Fall 12-14-2017

Integrating online-offline interactions to explain societal challenges

Christine Abdalla Mikhaeil

INTEGRATING ONLINE-OFFLINE INTERACTIONS TO EXPLAIN SOCIETAL CHALLENGES

BY

CHRISTINE ABDALLA MIKHAEIL

A Dissertation Submitted in Partial Fulfillment of the Requirements for the Degree

Of

Doctor of Philosophy

In the Robinson College of Business

Of

Georgia State University

GEORGIA STATE UNIVERSITY
ROBINSON COLLEGE OF BUSINESS
2017

ACCEPTANCE

This dissertation was prepared under the direction of the *Christine Abdalla Mikhaeil* Dissertation Committee. It has been approved and accepted by all members of that committee, and it has been accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy in Business Administration in the J. Mack Robinson College of Business of Georgia State University.

Richard Phillips, Dean

DISSERTATION COMMITTEE

Dr. Richard L. BASKERVILLE (GSU)
Chair

Dr. Christophe ELIE-DIT-COSAQUE (Paris-Dauphine – PSL Research University)
Co-Chair

Dr. Mark KEIL (GSU)
Member

Dr. Likoebe MARUPING (GSU)
Member

Dr. François-Xavier DE VAUJANY (Paris-Dauphine – PSL Research University)
Member

Dr. Jessie PALLUD (EM Strasbourg Business School)
External Member

Dr. Cécile GODE (Aix-Marseille University)
External Member

Dr. Carine DOMINGUEZ-PERY (University of Grenoble Alpes)
External Member

ABSTRACT

INTEGRATING ONLINE-OFFLINE INTERACTIONS TO EXPLAIN SOCIETAL CHALLENGES
BY

CHRISTINE ABDALLA MIKHAEIL
11/20/2017

Committee Chair: *Richard L. Baskerville & Christophe Elie-Dit-Cosaque*

Major Academic Unit: *Computer Information Systems*

Despite the wide literature on the consequences of Information and Communication Technologies (ICTs) use, the literature still lacks understanding about the societal consequences, positive or negative, intended or unintended. ICTs can yield the good and the bad. Consequences of technology usages on society are paradoxical. The paradoxical outcomes can be ta threat to the sustainability of society. Because interactions spread beyond the online space and its outcomes are paradoxical, societal challenges are complex problems. But not only complex problem, rather social complex problem. To harvest society, we need a better understanding of social complex problems. To do so, we adopted a multi-study dissertation model. To achieve that goal, the three studies of this doctoral work adopt a qualitative approach and a critical realist philosophy.

This dissertation focuses on the societal implications of online phenomena that spillover offline. We look at a first case: The Arab Spring and aim at understanding how an online community that started on Facebook materialized in urban space, changing the political landscape (Study 2). Addressing these kind of contemporaneous events does not come without analytical challenges. Therefore, we use and extend a semiotic analytical tool to face the representational complexity of the data collected (Study 1) with a discussion of the underlying philosophical assumptions. Finally, online communities can also have social costs by providing an echo chamber to socially undesirable behaviors. We aim at offering a conceptual explanation of how these online interactions turn into offline behaviors with negative spillovers (Study 3).

ACKNOWLEDGEMENTS

"Tell me and I forget. Teach me and I remember. Involve me and I learn."

Benjamin Franklin

The credit goes to those who taught and involved me; all mistakes are my own. I am grateful for the knowledge and skills you took the time to teach me. I am even more grateful for the time you took to pass on your passion for and dedication to research.

I would like to especially thank Christophe Elie-Dit-Cosaque and Richard Baskerville for being my teachers, my advisors and my mentors. They took on these three leading roles in my training such as it was easy to turn to them, invigorating to learn from them and fun to work with them. I owe them many thanks for believing in my ability to do research and complete a Ph.D.at Dauphine and GSU. It has been a wonderful experience.
Thank you for your support and for the opportunity to work with you!

I would like to express my gratitude to Dan Robey and his tireless commitment to students. Thank you for advising me throughout the Ph.D. program, engaging with me in theoretical conversations to expand my horizon and mentoring me on many more things.

I wish to thank my committee members - Dr. Dominguez-Péry, Dr. de Vaujany, Dr. Keil and Dr. Maruping for their precious input and time. I would like to thank the external members, Dr. Godé and Dr. Pallud, for agreeing on evaluating my doctoral work. I am grateful to the entire committee for creating a constructive, challenging and invigorating discussion, bringing me further than the doctoral work.

I have the unique chance to belong to two exceptional research organizations, who have lifted me up in so many occasions.

The seminars and courses taught by faculty of GSU have also been instrumental in my academic training. Thank you to Dr. Baskerville and Dr. Gallivan for teaching at Dauphine and making me discover GSU and the American tradition of research, when I was a master student. A big thank you to all the faculties of the Robinson College of Business whose classes were as challenging as inspiring.
GSU has a big and vibrant IS family who welcomed me warmly and was incredibly supportive in the milestones I have achieved among them. I must thank the vibrant faculty members who

seize every opportunity to show us how much fun research is. I thank Dr. Bala Ramesh, head of the IS department and Dr. Mark Keil, PhD program coordinator for welcoming me among them and for their seminars.
I would like to thank Dr. Likoebe Maruping for his seminar that was a turning point in my dissertation and his insightful feedback, that always took me one step farther. Dr. Arun Rai, Lars Mathiassen, J.J. Hsieh, Veda Storey, Duane Truex, Kurt Schimtz, Douglas Battleson, Shuguang Hong, who always took the time for stimulating exchange of ideas and precious help.

A Ph.D. program wouldn't be the same without my friends and colleagues Ph.D. students, with whom I share so many memories. A special thank you to the people I started the program with: Maheshwar (and his thoughtful wife Truanna), Kambiz, Xiaocong, Amber and Yanran who shared the very first moments in the program and so much more. I thank Amrita, Joshua, Tawfiq, Zirun, with whom I shared many seminars and who helped me through the program.
I need to thank my seniors in the program: Arun, Shane, Neetu, Youyou, Said, Alan, Vitali, Zhitao, Jessica, who were always ready to help and share their experience to get through the hardest parts of the programs.
I am so grateful I got to extend my stay as I got to meet Yukun, Pengcheng, Heesung, Hyounyung, Peiwei, Khaleed whose personalities and enthusiasm for research taught me a lot. My thank extend to all the Ph.D. students in the college of business with whom I have shared many memories. Your friendship and kindness were precious during this time abroad. I really enjoyed all the outings and activities we had together.

Dauphine was my starting point and as rich in interactions. I need to thank DRM-M&O team for providing logistical and developmental support. A special thanks to Anouck Adrot and Diana Santistevan for commenting my work. I would like to express my gratitude to Dr. De Vaujany, Pierre Laniray and Najma Saidani for the significant roles they played in bringing me to research.

I am grateful for the collegiality of faculties and Ph.D. of DRM, who were so supporting and helpful so Thank You Emilie, Pierre, Najma, Alexis, Oriane, Myriam, Melia, Laura, Sakura, Anthony, Mazoo, Hélène, Jean-Yves, Guillaume, Anouk, Yasmine, Marie, Claire, Elise, Aurore, Mounir, Vincent, Eliel, Amanda, Romain, Pierre.
I need to thank Julie and Matilda, who are on the same finish line. And despite sharing the same pressure and anxiety, they found time to listen and help. I would like to thank Najma, Myriam and Alexis for reading and revising chapters on short notice.

A BIG thank you to Florence Parent, Adenike Brewington and Kimberly Lawrence who made it so easy and enjoyable for me to navigate back and forth these two institutions.

Finally, I would like to thank my family and friends. A special appreciation to Marielle Beckett, who always encouraged me to pursue research and academia, when we were still writing our master dissertations, when I was applying for Ph.D. at Dauphine and at GSU, when I was abroad and when I was at the finish line.
I wish to thank my parents who unconditionally supported me and still do, whatever my next idea is.

Thank you all for this journey! You made it memorable.

ATTENTION: THE ENGLISH VERSION OF THE DISSERTATION STARTS P. 50

TABLE OF CONTENT

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1 - INTRODUCTION GENERALE (FRENCH)

Résumé :

Malgré une littérature abondante sur les conséquences des technologies de l'information et de la communication (TIC), cette littérature n'aborde que trop peu les conséquences sociétales, qu'elles soient positives ou négatives, intentionnelles ou non. Ces conséquences sur la société sont paradoxales. Ces résultats peuvent menacer la durabilité de la société. Parce que les interactions se propagent au-delà de l'espace en ligne et à cause de ces conséquences paradoxales, les défis sociétaux sont un problème complexe. Non seulement il s'agit d'un problème complexe, mais également d'un problème social complexe. Pour ces raisons, nous avons besoin d'une meilleure compréhension des problèmes sociaux complexes. Pour ce faire, nous avons adopté le modèle de la thèse sur travaux. Les trois études de ce travail de doctorat adoptent une approche qualitative et une positionnement réaliste critique.

Mots-clefs : en ligne/ hors-ligne, transdigitalization, défis sociétaux, retombées, complexité.

1.1. Contexte et Motivations de la recherche

« Je passe les étés dans un chalet à Cape Cod, et pendant des décennies, je me suis baladée sur les mêmes dunes que Thoreau a parcourues. Il n'y a pas si longtemps, les gens se promenaient têtes hautes, regardant l'eau, le ciel, le sable et les uns aux autres, en parlant. Maintenant, ils se promènent souvent la tête baissée, en tapant. Même lorsqu'ils sont avec des amis, partenaires, enfants, tout le monde est sur son propre appareil. Alors je dis, regardez, regardez-vous les uns les autres. ».[1]*(*Sherry Turkle 2012, dans le New York Times).

L'information numérique a infiltré notre vie quotidienne. Nos ordinateurs, les bourdonnements des sonneries et vibrations de nos tablettes ou téléphones, qui nous indiquent avoir reçu des messages, des photos, des vidéos, des tweets, des mises à jour de statut, de localisation, etc. ont envahi notre quotidien par l'ubiquité de nos appareils. Les réseaux sociaux captent toutes les informations qui circulent au sein de ces appareils. Des auteurs se sont penchés sur la question de la perte de *réelle* connexion. Parmi eux, Sherry Turkle partage une observation personnelle de cette déconnexion (citation d'ouverture) Cette observation peut sembler anecdotique, mais elle illustre l'irréconciliable dichotomie qui imprègne des discours simplificateurs.

Ce genre de récit a fait émerger un type de discours exclusif du « en ligne » ou « hors-ligne » où l'on s'alarme de la perte de prise du sujet sur le réel. A l'exception de quelques travaux (e.g., Butler 2001), le cyberespace est souvent décrit comme un contexte nouveau et différent de nos espaces d'interactions physiques. Ce fervent effort de distinction du « en ligne » de l'« hors-ligne » a mené à leur traitement dichotomique. Le déni de statut de réel pour virtuel est un postulat erroné. Le virtuel est une sphère réelle.

Un tel postulat a conduit à parler de « slacktivism » comme n'étant pas une vraie forme d'activisme, lorsque le cyber-activisme aurait dû être mis en perspective avec l'activisme dans le monde physique. Bien à l'opposé de cette distinction et de ce rejet, les sphères numériques et physiques s'enchevêtrent pour constituer le réel.

Les cas des soulèvements (2011/2012) qu'a connus le monde arabe est une illustration (que nous explorerons plus amplement dans cette thèse) de cette conjonction d'efforts et interactions en ligne et hors-ligne. Alors que les manifestations constituaient une action hors-ligne, le partage de l'information et la mobilisation prenaient place en ligne. Les deux sphères – en ligne

[1]Traduction personnelle; http://www.nytimes.com/2012/04/22/opinion/sunday/the-flight-from-conversation.html

et hors-ligne – constituent les deux faces d'une même réalité sociale. C'est la conjonction d'efforts en ligne et hors-ligne qui ont un impact tel que les soulèvements dans le monde arabe.

Notre thèse porte sur la dualité en ligne / hors-ligne ainsi que son utilité en vue d'illustrer, à travers l'étude de différents phénomènes, ses limites et son incapacité à expliquer et analyser les défis sociaux contemporains.

Cette dichotomie trop simpliste n'est pas la seule qui imprègne la littérature sur les communautés en ligne. D'autres distinctions ont été aussi utilisées. On peut citer par exemple : Gemeinshaft vs. Gesellshaft[2] (Tonnies et Loomis 1957), liens forts vs. faibles (Granovetter 1985; 1973).

En effet, les efforts de simplification, de classification, d'opposition et de dichotomies agissent comme un frein à l'exercice de la compréhension des phénomènes sociaux, en saisir le sens et en évaluer les conséquences en négligeant le potentiel qu'offre l'ensemble au lieu des entités séparées. En l'occurrence, la dichotomie en ligne / hors-ligne complique la tâche de tirer parti des communautés. Cette dernière, autrement appelée dichotomique *Weltanschauung* ou perception du monde, enferme nos réflexions dans le statut de 'l'étant' et non pas du 'devenant'. Cela veut dire que raisonner en termes de dichotomies nous situe obligatoirement comme 'étant' dans l'une ou l'autre sphère au détriment du 'devenant' qui se concentre sur la façon dont les choses changent, les actions se façonnent et leur transition d'une sphère à l'autre. Chesters et Welsh (2005) illustrent ce changement dans la réflexion conceptuelle avec l'étude de mouvements d'altermondialisation caractérisé par une contestation (politique et économique) débordante et itérative entre le local et le mondial représentée par les hacktivistes. Durant ces contestations, une action collective a résulté d'une synergie entre les actions menées en ligne et hors-ligne.

Comment dépasser cette dichotomie pour générer des nouvelles perspectives utiles ? Devons-nous garder cette séparation au moins sur le niveau analytique ? De nos jours, les phénomènes ayant des conséquences sociétales se propagent en ligne et hors-ligne de manière sans précédent. Il est donc légitime de chercher quels schémas d'interaction s'appliquent entre les dîtes sphères, comment s'influencent-elles mutuellement ?

[2] Traduction : Communauté vs. Société

En effet, nos interactions ou nos actions ne sont pas de simples translations d'une sphère à l'autre. Les individus qui naviguent entre leur cercle social virtuel et leur cercle social hors-ligne ne laissent pas l'un derrière eux pour rejoindre l'autre. Leurs interactions au sein d'un cercle social, en ligne ou hors-ligne, les façonnent et façonnent leurs interactions à venir. Manuel Castells écrit « Personne, qui est sur les réseaux sociaux tous les jours (et cela est vrai pour quelque 700 millions des 1 200 millions d'utilisateurs de réseaux sociaux) ne reste la même personne. Il est une interaction en ligne/hors ligne, pas un monde virtuel ésotérique. »[3].

Internet est devenu un espace -plus si nouveau- d'expression, loin des normes et catégories sociales, de la pression qui contraignent à se comporter d'une certaine manière et non d'une autre. Dans cet espace libre détaché de la société, de nouvelles opportunités de définition de soi sont offertes. Ce contexte conduit à de nouvelles interactions et communications qui définissent de nouvelles normes. Potentiellement, les individus peuvent se sentir plus en situation de pouvoir se comporter comme ils le souhaitent derrière un écran alors qu'hors-ligne où ils peuvent se sentir timides, gênés ou honteux, que ces comportements soient appropriés, souhaitables, légaux ou non.

Cependant, ce monde en ligne n'est pas détaché du reste de la société. Même si l'Internet peut apparaître comme une ardoise vierge, les individus, eux ne le sont pas : tous possèdent leurs expériences passées, leurs valeurs, leurs catégories sociales et leurs compréhensions du monde social. A l'inverse, il semble qu'il n'y ait pas d'échappatoire. L'utopie en ligne peut vite tourner au cauchemar. La recherche ciblée de certains types d'interactions en ligne peut aussi conduire au pire comme la propagation des maladies sexuellement transmissibles[4] ou des pactes de suicides[5]. Dans ces cas, les interactions en ligne entraînent des conséquences dangereuses voire mortelles.

Le défi est de faire face à cette contradiction sans la minimiser ou même la congédier. Les théories qui cherchent à expliquer les développements contemporains sans étudier pleinement l'expansion des interactions et de l'information et comment celles-ci sont comprises et utilisées ne permettent pas d'expliquer les phénomènes de grande envergure qui ont pris place depuis plusieurs décennies.

[3] Traduction propre : https://thesocietypages.org/cyborgology/2011/02/24/digital-dualism-versus-augmented-reality/
[4] https://www.dailydot.com/via/truvada-prep-hiv-stigma-craigslist/
[5] http://www.nytimes.com/2010/05/14/us/14suicide.html

En outre, la contextualisation des interactions sociales en ligne peut encore plus souffrir de la pression sociale et aggraver ainsi la dystopie. Le contexte d'Internet peut être aussi comparé à un panoptique : chaque interaction sociale est visible aux autres, ce qui conduit à des ajustements de comportements pour respecter les normes sociales. Les gens se joignent aux communautés en ligne avec leurs modèles mentaux pour donner un sens aux interactions qu'ils observent et interagissent selon les normes sociales. Les divisions socio-culturelles, telles que le racisme dans notre société hors-ligne, sont imprégnées dans le monde en ligne. Par conséquent, le contexte social des interactions persévère en ligne. Réciproquement, les activités en ligne se poursuivent hors-ligne. Jurgenson (2012) souligne que « les réseaux sociaux sont plus que quelque chose sur lesquels nous nous connectons ; c'est quelque chose que nous transportons en nous »[6], c'est-à-dire que se déconnecter signifie seulement quitter la plateforme, mais pas sa dimension sociale.

Pourtant, la question demeure : le monde en ligne est-il imprégné par le monde hors-ligne ou l'inverse ? Une des principales hypothèses de notre travail est la suivante : les deux sphères s'imprègnent l'une de l'autre. Les communautés et les personnes qui les forment débordent d'un monde vers l'autre en permanence, et les chercheurs devraient être amenés à en faire de même. Urry (2005a) décrit un réseau aussi complexe en parlant de fluides mondiaux (« *global fluids* ») : « Ces fluides résultent d'individus agissant sur la base d'informations et de relations locales, mais où ces actions locales ont ; par itération, capturées, déplacées, représentées, commercialisées et généralisées ; ont souvent des répercussions sur des lieux et des peuples très éloignés »[7] (p.246). La capacité d'auto-organisation de ces systèmes d'interactions conduit à des comportements bouleversants aux conséquences dramatiques.

Notre recherche

En étudiant les conséquences sociétales de l'utilisation d'Internet, nous affirmons que les dichotomies entre en ligne et hors-ligne, le virtuel et le réel, la communauté et la société sont plus entravantes qu'encourageantes pour développer une compréhension précise des problèmes que nous abordons.

La recherche se concentre sur les similitudes et les différences entre la sphère en ligne et la sphère hors-ligne. Il est nécessaire dans la littérature en systèmes d'information (SI) de

[6] https://thenewinquiry.com/the-irl-fetish/ et https://medium.com/@kaeleneburke/online-offline-dichotomy-9f87a13c726f

[7] Traduction propre

contextualiser le monde en ligne et de l'articuler avec leurs conséquences sociétales. En ligne et hors-ligne sont traités comme deux dispositifs conceptuels et deux modes expérientiels. Le concept de hors-ligne n'existe qu'en reflet du concept d'en ligne. Par conséquent, ces deux concepts sont inextricables l'un de l'autre.

Cette thèse vise à (1) fournir des modèles processuels pour les interactions en ligne/hors-ligne conduisant à des conséquences sociétales et (2) offrir une approche analytique aux données collectées sur les réseaux sociaux. Nous proposons deux modèles conceptuels processuels qui éclairent la transformation d'une communauté virtuelle en une manifestation physique conduisant à la chute d'un gouvernement (Étude 2) et la manière dont des interactions en ligne mènent à des retombées négatives (Étude 3). Nous expliquons comment une communauté en ligne devient une communauté hors-ligne dans un contexte politique et nous considérons des retombées négatives des comportements individuels suite aux interactions en ligne. Dans l'étude 2, nous avons examiné la mobilisation sur Facebook lors du printemps arabe égyptien. Dans l'étude 3, nous avons formulé notre modèle processuel sur la littérature informant sur les communautés polarisées ou stigmatisées telles que des communautés centrées sur les préférences politiques ou sexuelles.

Dans les deux études, nous nous sommes confrontés à des événements dramatiques dans le monde entier qui soulèvent des questions sur la dynamique qui conduit certaines entités à durer ou à s'effondrer. Les premiers événements locaux peuvent activer des transitions dramatiques à plus grande échelle, ce qui soulève la question fondamentale des processus. Les processus décrits et expliqués ici montrent comment les interactions de différents éléments peuvent produire des comportements émergents, non linéaires et surprenants qui sont représentés par des modèles processuels explicatifs, même si ces modèles ne peuvent pas servir à des fins prédictives.

Également dans l'étude 2, la nature des données collectées sur les réseaux sociaux a apporté de multiples défis, nous avons donc adopté et adapté une analyse de données sémiotique et formulé une boîte à outils pour atteindre nos objectifs de recherche (Étude 1). Nous illustrons cette technique avec des données empiriques. Par conséquent, notre recherche offre une approche complémentaire des défis à relever en fournissant des éléments de réponse conceptuels, empiriques et méthodologiques pour des recherches futures.

1.2. Problèmes complexes sociaux dans la recherche en SI

Les implications sociales des usages des technologies de l'information et de la communication (TIC) sont depuis longtemps une préoccupation pour les chercheurs en SI (Orlikowski et Robey 1991). Paradoxalement, nous semblons nous être éloigné de cet agenda lorsque l'Internet change et remet en cause les entreprises et la société en général. Les chercheurs en SI semblent en prendre conscience. Un agenda de recherche sur les conséquences sociétales des TIC semble donc être développé.

1.2.1. Développements récents

Les recherches répondant à cet appel, se sont intéressées à l'étude des processus socio-techniques dans différents contextes : d'urgence (Ling et al. 2015, Nan et Lu 2014) ou politique (Oh et al. 2015, Wattal et al. 2010), en particulier pour mobiliser le soutien ou créer tout un mouvement (Bennett et Segerberg 2012 ; Selander et Jarvenpaa 2016).
D'autres appels à définir et élargir les théories expliquant les défis sociétaux se font de plus en plus entendre. Le numéro spécial de MIS Quarterly de 2016 en témoigne (Majchrzak et al. 2016).

Dans certains cas, l'usage des TIC répondent aux défis auxquels font face les organisations. Andrade et Doolin (2016) ont étudié l'initiative du gouvernement en Nouvelle-Zélande *Computers in Home* et ont montré comment des ordinateurs remis à neufs avec accès à Internet ont permis à des réfugiés de reprendre le contrôle de leur vie, de se réinstaller dans une nouvelle société et de développer un sentiment d'appartenance culturelle. En s'appuyant sur l'impact positif déjà établi des TIC sur le PIB, Ganju et al. (2016) montrent l'existence d'une relation positive similaire avec le bien-être au niveau du pays, mais n'explique pas comment ni le pourquoi de cette relation. L'*empowerment* des femmes dans les sociétés traditionnelles est encore un défi sociétal auquel les TIC fournissent un espace de négociation des structures de pouvoir si elles sont intégrées avec des changements sociaux plus larges (Oreglia et Srinivasan 2016). Les TIC en tant que ressources peuvent être exploitées pour améliorer l'inclusion sociale et le bien-être.

Les TIC ne contribuent pas seulement au bien-être ou à l'autonomisation, mais entrent aussi dans des enjeux de vie et de mort. Venkatesh et al. (2016) montrent les atouts des TIC dans la lutte contre la mortalité infantile et surtout dans la complexité du contexte de l'Inde rurale. En

effet, ils ont montré l'influence sociétale sur l'utilisation des TIC dans le maintien des pratiques risquées : l'utilisation des kiosques de cybersanté pour accéder à de meilleures pratiques de soins infantiles a été fortement entravée par les mécanismes d'influence sociale.

Sur une note plus sombre, Chan et al. (2016) ont examiné des communautés idéologiquement polarisées qui diffusent des contenus incitant à la haine et à des crimes haineux hors-ligne. Cette étude soutient la thèse de la « cyber-balkanisation » (Van Alstyne et Brynjolfsson 2005), c'est-à-dire de la spécialisation des intérêts des groupes en ligne et ainsi peuvent mettre en danger l'égalité raciale et la « vie commune » en société. Ils ont également montré que ces communautés étaient motrices d'attaques de loups solitaires, mais ils ne fournissent pas les mécanismes expliquant comment ces comportements se développent à partir d'interactions en ligne. D'autres éléments de réponses renforcent l'hypothèse de la balkanisation d'Internet. L'étude de Greenwood et Agarwal (2016) sur Craigslist, plate-forme de petites-annonces, montre une propagation de la transmission du VIH. Bhuller et al. (2013) partagent des résultats similaires en étudiant la relation entre l'accès à Internet et les crimes sexuels.

Ces études sur les implications sociétales des usages des TIC illustrent un éventail d'effets paradoxaux où coexistent tensions et vivre ensemble.
En se concentrant sur les considérations éthiques des micro-tâches déléguées sur la plate-forme Amazon Mechanical Turk, Deng et al. (2016) ont identifié les affordances technologiques pour l'*empowerment* des travailleurs, mais aussi celles conduisant à la marginalisation des travailleurs. Cette dualité entre gains en autonomie et marginalisation met en évidence les transformations du travail permises par les TIC avec les problèmes classiques de salaire minimum, d'asymétrie de pouvoir ou de gouvernance dans un nouveau contexte. A ces problèmes dit « classiques » s'ajoutent des problèmes liés à la technologie, comme les mises à jour de la plate-forme. Cependant, en dehors du cadre de cette étude, les impacts sociétaux de cette main-d'œuvre marginalisée s'appuient sur Internet. De telles conclusions paradoxales s'étendent aux réseaux sociaux par Miranda et al. (2016), qui considèrent les affordances de ces réseaux sociaux comme hégémoniques ou émancipateurs du discours public autour d'une nouvelle législation - Stop Online Piracy Act (SOPA) - et, par conséquent, influencent l'ordre du jour législatif d'une manière ou d'une autre. Un autre exemple, lorsque l'accès à Internet permet aux patients d'être mieux informés, cela affecte également les relations médecin-patient : les patients peuvent s'inquiéter à excès pour des symptômes bénins les conduisant à devenir cyberchondriaques (White et Horvitz 2009). De même, lorsque la technologie est louée pour

des avantages tels que la flexibilité et l'autonomie, elle a également été blâmée pour l'accrue de stress qu'elle apporte aux individus (Ayyagari et al. 2011). En outre, les bienfaits du e-gouvernement a été montré pour réduire la corruption au sein des institutions et à l'échelle nationale, mais Srivastava et al. (2016) reconnaissent que la relation peut être bidirectionnelle. Cependant, sans éléments sur le contexte de leur collecte de données, aucun commencement d'explication de ces résultats contradictoires ne peut être apporté.

Par conséquent, les résultats paradoxaux de l'utilisation de la technologie dans toutes sortes d'activités sociales peuvent constituer une menace pour le développement durable de la société et au contraire peuvent servir à renforcer les divisions. Ces défis sociétaux doivent être abordés pour générer le bien commun et non le mal commun.

1.2.2. « La technologie est la société rendue durable »[8] (Latour 1990)

En raison des résultats paradoxaux, les utilisations des TIC peuvent se répercuter sur la société, la technologie peut ainsi constituer une menace pour la durabilité de la société. Une grande partie des recherches se concentre sur les divisions socioculturelles. La théorie de l'acteur-réseau a été utilisée pour examiner comment la technologie est socialement intégrée et construite. La citation de Latour porte sur la société et sa stabilité comme ensemble durable. Considérer les utilisateurs et l'artefact au même titre dans leur ancrage contextuel est nécessaire pour étudier les défis menaçant de diviser la société. Et la technologie permet la vitesse, la fluidité, un flux continu pour l'harmonie ainsi que pour la turbulence. Par conséquent, le social n'est ni une organisation ni une structure, mais une "entité circulante" (Latour 1999), c'est-à-dire que les deux produisent des événements locaux par leurs relations circulaires. Ces dynamiques non linéaires sont un trait commun de la complexité mondiale qui nous pousse à reconsidérer la fracture sociale traditionnelle. Le point clé des arguments de Latour est développé dans l'exploration du cas de Kodak. Latour dépasse le dualisme entre l'infrastructure technologique et les superstructures sociétales pour reconnaître que la complexité du social réside dans les tensions entre la société et la technologie.

Considérer la société et la technologie comme les « phases de la même action sociale » les lie ontologiquement. Nous devons donc considérer le chemin explicatif du changement où tous les acteurs co-évoluent, la société et la technologie incluses. Parce que ni la technologie, ni la

[8] Traduction propre

société ne peuvent être maintenues constantes, le changement social implique la transformation des groupes sociaux. Parce que rien ne peut être pris pour acquis, nous ne pouvons nous attendre à toujours récolter le bon côté de la technologie, et nous ne pouvons pas toujours empêcher les dérapages. Cette relation dynamique entre la société et la technologie crée parfois les conditions pour que la société bénéficie d'une infrastructure technologique. Toutefois, elle amplifie parfois les problèmes existants, si elle n'en crée pas de nouveau. Parce que les conséquences sont paradoxales, les prédictions sont plus difficiles à formuler, donc les défis sociétaux sont des problèmes complexes.

En tant que chercheur, le besoin de comprendre pour saisir le phénomène sous-jacent a conduit à réaliser seulement la moitié de notre objectif : « Le but de la science est de rechercher les explications les plus simples des faits complexes. Nous sommes susceptibles de tomber dans l'erreur de penser que les faits sont simples parce que la simplicité est l'objectif de notre quête. La devise directrice dans la vie de chaque philosophe naturel devrait être : "Cherchez la simplicité et s'en méfier. " » (Whitehead 1920, p.143, traduction propre). Nous ne respectons pas ces exigences en ne nous méfiant pas de la simplicité. De nombreux penseurs parmi lesquels Weaver (1948), Morin et Lemoigne (1999) décrivent les faiblesses d'une logique ancienne et rigide, les faiblesses de la simplicité de la science classique qui a réussi à répondre à des questions si nombreuses et faciles, tandis que les plus difficiles attendent encore.

Une implication méthodologique est l'alliance constante de la description et de l'explication : un manque d'explication souligne un manque de description. Latour attire notre attention sur le processus de mobilisation et d'engagement de la technologie dans les relations sociales. Cette perspective permet de voir les micro-changements dans les interactions et de les lier aux macro-changements observés dans la société.

1.2.3. Étudier les problèmes sociaux complexes

Ce qui a peut-être commencé avec des problèmes technologiques compliqués se mue en problèmes sociaux plutôt complexes : « un problème complexe comporte de nombreuses parties diverses qui s'adaptent et se transforment en nouvelles formes à toutes les tentatives au problème. Trouver une solution optimale à un problème complexe n'est pas possible ; les parties du problème interagissent les unes avec les autres de manière non-linéaire, s'auto-organisent et produisent des comportements émergents à un macro-niveau qui diffèrent en échelle et en nature des comportements à micro-niveaux des parties. » (Tanriverdi et al. 2010,

p.822-23, traduction propre). Internet a contribué à cette complexité en permettant aux parties mobiles de s'organiser constamment de manière nouvelle et plus rapide. Orlikowski et Robey (1991) soulignent le rôle constant de la technologie dans l'activation et l'inhibition de l'action sociale. Les TIC permettent et inhibent les conséquences sociales positives et négatives.

Par exemple, Jha et al. (2016) ont montré la complexité d'un écosystème visant à atténuer la pauvreté en Inde, telles que les différentes valeurs et intérêts des parties prenantes et l'attrition des nœuds centraux du réseau. Cela soulève des questions de durabilité et d'évolution de ces écosystèmes compatibles avec la technologie. Srivastava et ses collègues (2016) montrent le système complexe d'une nation telle que la corruption, qui s'appuie toujours sur des cadres exploratoires et les mécanismes explicatifs manquent toujours à l'appel. Un aspect commun qui émerge de toutes ces recherches est le besoin de contextualisation (Deng et al. 2016 ; Srivastava et al. 2016 ; Venkatesh et al. 2016) qui répond à un appel plus large de théorisation (Hong et al. 2013 ; Johns 2006). Par conséquent, nous sommes confrontés à la complexité dans des systèmes sociaux ouverts.

Les défis sociétaux ci-dessus qui ont attiré notre attention montrent comment les TIC imprègnent notre société et s'entrelacent dans toutes sortes de phénomènes sociaux. Internet a permis des réseaux dans lesquels l'information locale s'écoule plus rapidement et surpasse toutes frontières ou toutes limites. La mondialisation a contribué à un monde plus aplati dans lequel les interactions sociales sont interdépendantes, telles que les interactions locales répandent leurs effets secondaires loin de l'épicentre local (Urry 2005a). Le monde interconnecté a apporté des conséquences organisantes et désorganisantes (Kallinikos 2005), soulignant encore une fois les conséquences involontaires de la technologie (Kling 1996).
Ces études ont tissé les liens ou au moins reconnu les relations entre l'utilisation des TIC et les retombées sociétales, positives ou négatives. Les TIC contribuent à la complexité des défis sociétaux. Une telle hypothèse exige de répondre à la question processuelle : « Maintenant, nous avons vu que les descriptions des systèmes complexes peuvent prendre plusieurs formes. En particulier, nous pouvons avoir des descriptions d'état ou nous pouvons avoir des descriptions de processus ; plans ou recettes. » (Simon 1962, p.480, traduction propre). Le contraste entre les plans et les recettes vise à mettre en évidence les limites de la métaphore architecturale : les plans sont considérés comme donnés, ignorant les phénomènes tels que l'émergence ou l'improvisation.

Pour ce faire, nous adopterons une position réaliste critique. Pour récolter le meilleur du potentiel dans la société, nous devons étudier des problèmes sociaux complexes comme ils se déroulent parce que la complexité dans son étymologie latine signifie « ce qui est tissé ensemble ». Nous pouvons surmonter la dichotomie simpliste en ligne/hors-ligne en tissant entre l'en ligne et le hors-ligne, les propriétés des parties et les propriétés de l'ensemble, local et mondial, et même l'ordre et le désordre. En tissant ensemble ces dimensions nécessaires et inséparables, nous pouvons comprendre la réalité dans laquelle nous vivons et ses enjeux.

1.2.4. Entretenir le bien commun et empêcher le mal commun : Ethique sous-jacente

Platon, Spinoza, Locke, Hume sont quelques références clés lorsque nous interrogeons le bien fondé de nos actions. La question sous-jacente est celle de la justice sociale. La société idéale de Platon est celle où chacun vit harmonieusement sans se soucier de l'insuffisance matérielle. Dans cette définition, la justice concerne la spécialisation, c'est-à-dire que tout le monde contribue à la société. L'éthique de Platon ou l'éthique de la vertu est fondée sur l'agent moral plutôt que sur les conséquences. Ainsi, l'individu est motivé par la raison (i.e., les capacités de réflexion), l'esprit (i.e., la capacité émotionnelle) et l'appétit (i.e., les désirs) qui peuvent entrer en conflit. L'équilibre maintient le bonheur et la santé de l'individu, mais que faire si cela menace la société décrite comme hautement communautaire ?

Les conséquentialistes comme Mill ou Bentham[9] cherchent les meilleures conséquences générales. Cependant, si nous devons connaître les résultats pour juger de la moralité de l'action, nous sommes piégés dans l'attente, et ce peut-être pour le pire. De nos jours, nous sommes souvent confrontés à l'impossibilité de prévoir les conséquences. En outre, l'éthique utilitaire est plus susceptible de négliger les intérêts de la minorité pour décider d'un déroulement d'actions avec les meilleures conséquences globales. Néanmoins, nous ne pouvons supposer a priori que les composantes minoritaires de la dynamique sociétale ne seront pas à l'origine de conséquences plus importantes.

Ce sont quelques limites des approches philosophiques qui n'abordent que partiellement (1) l'étude des phénomènes complexes contemporains et (2) la nature des connaissances qui peuvent être produites de façon cohérente dans ce travail de doctorat.

[9] https://plato.stanford.edu/entries/consequentialism/

Par conséquent, la complexité dans notre monde conteste la droiture de l'ordre, du progrès et du sens. Selon Lemoigne (dans Morin et Lemoigne 1999), cette complexité irréductible exige un devoir de témoignage des événements qui nous posent problèmes aujourd'hui. Désormais, nous commençons par les conséquences perceptibles et observables sur les individus (e.g., maladie, deuil) et sur la société telles que les coûts pour les systèmes de soins de santé (Greenwood et Agarwal 2015), ou judiciaires et pénitentiaires (Chan et al. 2016). L'éthique de la complexité appelle à un engagement critique dans la nature de nos connaissances. Par conséquent, nous adoptons un point de vue complexe de l'éthique (Woermann et Cilliers 2012) :

"Il n'y a pas de science de la science, et même la science de la science serait insuffisante si elle ne comprenait pas les problèmes épistémologiques. La science est un site de construction tumultueux, la science est un processus qui ne pourrait être programmé à l'avance, car on ne peut jamais programmer ce que l'on trouvera, car la caractéristique d'une découverte est inattendue. Ce processus incontrôlé a conduit aujourd'hui au développement des potentialités de destruction et de manipulation, qui doit transformer l'introduction en science d'une double conscience : une conscience de soi et une conscience éthique " (Morin 2007, p.17, traduction propre).

A partir des conséquences, il est possible d'adopter une approche situationnelle pour tenir compte du contexte et des caractéristiques spécifiques de la société, car les approches prédictives ont atteint leurs limites. La complexité couvre donc les difficultés à décrire, à définir et à expliquer afin de pouvoir formuler des théories utiles qui peuvent aider les décideurs à trouver des solutions.

1.3. Fondements Philosophiques : Complexité et Réalisme Critique

Des résultats surprenants et paradoxaux proviennent des organisations sociales parce qu'elles se comportent de manière à rendre les prédictions plus ardues (Daft et Lewin 1990). Nos modèles et nos théories sont à plusieurs reprises assaillis par la myriade de crises à laquelle nous sommes confrontés, de sorte que les pratiques scientifiques et les postulats de la connaissance sont contestés.

Roy Bhaskar fournit une méta-théorie pour comprendre la réalité comme systémique et complexe (Bhaskar 1975 ; 1998 ; 2013). Les réalistes critiques comprennent que la réalité

sociale est complexe et ne peut pas être entièrement comprise en raison de l'inobservabilité de certains mécanismes. Le principe de Bhaskar sur les systèmes ouverts implique que tous les événements expérimentés sont causés par une combinaison spécifique d'éléments à un certain moment et à un certain endroit. C'est pourquoi, nous pouvons fournir des explications approfondies, mais aucune prédiction. L'objectif du Réalisme Critique (RC) est pertinent pour résoudre des problèmes sociaux complexes.

Nous avons adopté le réalisme critique parce que (1) le RC et la complexité répondent à un appel au renouvellement de la science, (2) il existe un bon nombre de postulats partagés entre RC et complexité sociale (CS) qui les rend compatibles et (3), il existe une valeur complémentaire lorsqu'une perspective de RC est appliquée à la CS car le RC offre une approche de la réalité par trois strates, et la CS est un processus de transition de stratum à stratum.

1.3.1. Un renouvellement paradigmatique

Le RC et la CS répondent aux faiblesses des hypothèses qui ont conduit la science. Le réalisme critique s'élève contre le positivisme et le constructivisme en préconisant la nécessité d'une ontologie explicite parallèlement à une épistémologie. Le RC offre un autre paradigme à la quête de formes d'explications suivant des lois universelles ou d'interprétations pures. Cette approche philosophique en fournissant un compte rendu éclairé de la science peut à son tour informer les études empiriques.

Une caractéristique du réalisme critique est la combinaison d'une perspective réaliste sur l'ontologie, une perspective relativiste sur l'épistémologie et une rationalité critique (Danermark et al. 2002). Le réalisme ontologique se réfère à l'existence stratifiée et objective du monde réel. Le relativisme épistémologique se rapporte à notre accès subjectif à la réalité et donc à la faillibilité de notre connaissance. Conformément à cette épistémologie, la méthodologie des *soft systems* (Checkland 2000) nous rappelle que nous n'avons pas accès au monde. Par conséquent, la pensée systémique est une épistémologie parce que nous décrivons le monde en tant que système. Ainsi, le rôle de l'observateur, le lieu et le moment de l'observation sont des paramètres de la subjectivité de la connaissance. Enfin, la rationalité du jugement « suggère qu'il existe des outils théoriques et méthodologiques que nous pouvons utiliser pour discriminer parmi les théories en regardant leur capacité à nous informer de la réalité externe » (Danermark et al. 2002, p. 10, traduction propre). Par conséquent, notre

connaissance est toujours médiatisée et, dans une certaine mesure, proche de la vérité. Être capable de comprendre les phénomènes sociaux en tant que chercheur implique le processus d'interprétation des sujets et des chercheurs impliqués dans la collecte et l'analyse des données. Dans les sciences sociales, les individus façonnent activement les structures sociales de leur propre univers social (Archer 1995 ; Danermark et al. 2002).

De l'autre côté, la pensée de la complexité a souffert du rejet absolu par la « science classique » (Morin 2014) fondée sur trois principes : le déterminisme universel, le réductionnisme et la disjonction.
Le déterminisme universel suppose que tout processus est réversible, ce qui rend les prédictions possibles. En supprimant le temps et en faisant de la nature un ordre impeccable, sont annihilées la confusion et les luttes de complexité de la gestion. Le deuxième principe de la thermodynamique fait trembler les principes fondamentaux de la science classique au XIX^{ème} siècle en introduisant l'irréversibilité. Le réductionnisme suppose que nous pouvons connaître l'ensemble en étudiant les éléments le composant. La disjonction est un principe d'investigation qui suppose l'isolement de l'objet étudié en éléments de base à étudier par des disciplines spécifiques, en supprimant chaque partie de son contexte systémique. L'isolement des pièces et leur étude par discipline nie la complexité en soi comme nous l'avons déjà mentionné, son étymologie (c'est-à-dire ce qui est tissé ensemble). Par conséquent, l'approche holistique prend le contre-pied d'étudier l'ensemble en étudiant seulement les parties et des études spécialisées ne prenant qu'une perspective disciplinaire.

Des idées qui couvrent l'imprévisibilité et le désordre comme le chaos (Thietart et Forgues 1995) ont rendu les piliers de la science classique vulnérables aux attaques. La systémie (Boulding 1956) et la cybernétique (Von Foerster 2003) ont rapidement ouvert la brèche. Les problèmes de « complexité organisée » (Weaver 1948) décrivent des systèmes complexes qui sont, par nature complexes et créent une complexité. La complexité fait alors une première apparition pour parler de systèmes complexes, mais est encore limitée, et sans reconsidérer la nature de la connaissance. L'étude de systèmes complexes a été une approche. Cependant, plutôt qu'une théorie unique, la complexité couvre une gamme de concepts qui constituent un cadre de recherche simplement couplé ou comme Nigel Thrift (1999) la décrit : « La théorie de la complexité est une économie de concepts » (p.34, traduction propre). La physique, l'informatique, les mathématiques, la biologie sont autant de disciplines qui ont contribué à la théorisation de la complexité et leur application dans la recherche organisationnelle a offert

encore plus d'interprétations. C'est pourquoi nous voyons de multiples approches de la complexité proliférer (Cilliers 2005). Plus particulièrement, une voie strictement mathématique dans une tradition positiviste exige une approche quantitative (c'est l'approche de l'Institut de Santa Fe) et une autre voie offrant une vision plus critique dans laquelle nous nous inscrivons : « Cette opinion soutient que la théorie de la complexité ne nous fournit pas exactement des outils pour résoudre nos problèmes complexes, mais nous montre (de manière rigoureuse) exactement pourquoi ces problèmes sont si difficiles » (Cilliers 2005, p.257, traduction propre). Cette seconde approche ouvre la voie à une approche qualitative. Au lieu de considérer la quantité d'éléments interagissant, cette approche s'intéresse à la nature de ces interactions (Human 2016).

Si tous ces éléments ne rendaient pas déjà le paysage de la complexité difficile à parcourir, la recherche en SI est une initiative multidisciplinaire. Donc, une variété d'approches, de perspectives et concepts sont mobilisés pour étudier ces réseaux d'éléments sociotechniques et leurs conséquences.

Tout cela est sans compter les multiples développements de la pensée complexe (Journé et al. 2012) à cause de défis questionnant l'état de nos connaissances de nos entités organisationnelles. Cohen (1999) décrit trois tendances contemporaines qui ont entretenu l'intérêt pour les systèmes complexes. Des changements spectaculaires tels que la mondialisation ont exercé des pressions sur les entités organisationnelles pour devenir plus adaptables et sensibles à ces changements. La révolution de l'information a permis par les avancées technologiques de recueillir et transmettre des données où que l'on soit de façon plus rapide pour apprendre à mieux s'adapter. Enfin, la nature instable des entités organisationnelles a conduit à la croissance des organisations temporaires et la fluidité de leurs frontières.

Des apparitions multiples de la complexité dans des numéros spéciaux ont certainement incités à accorder plus d'attention à la complexité qui nous entoure. *Organisation Science* (Anderson et al. 1999), *Theory, Culture and Society* (Urry 2005b), *Communications of the ACM* (Desai 2005), *Information Technology and People* (Jacucci et al. 2006) ont ouvert la voie et testé quelques idées pour aiguiser notre utilisation de la complexité pour répondre à de nouvelles questions. Certains auteurs (Morin 2014 ; Morin et Lemoigne 1999) ont plaidé en faveur d'un paradigme de la complexité comme celui sur lequel se tenait la science classique comme une nouvelle étape pour faire avancer la pensée complexe.

Face à la simplification constante des situations complexes, les auteurs appellent à des changements dans les stratégies de conceptualisation et de compréhension de la complexité. Nos trois études prennent le « tournant de la complexité » (Urry 2005b, traduction propre), à savoir adopter une approche « qui combine pensée systémique *et* processuelle » (p.3, traduction propre, italique dans l'original) pour enquêter sur les systèmes émergents et s'auto-organisant qui affectent profondément une séquence d'événements. La pensée de la complexité signifie penser à la fois en termes de la pensée systémique (c'est-à-dire qui implique des relations, des modèles et le contexte) et la pensée processuelle (c'est-à-dire qui implique le flux continu d'énergie et d'information) (Capra 2005). Ainsi, la complexité offre un réseau de relations entre les processus dans un contexte spécifique.

Le réalisme critique et la complexité fondées sur l'idée d'entités organisationnelles dynamiques, reconnaissent l'incertitude des conditions initiales et la possibilité d'atteindre un (quasi) équilibre. Les chercheurs ont ainsi voulu saisir la séquence des événements et découvrir les mécanismes génératifs pour expliquer comment les changements se produisent et affectent les systèmes organisationnels.

1.3.2. Postulats largement partagés

La complexité est souvent le premier qualificatif associé aux systèmes (Simon 1962 ; Morin 2014). Les systèmes sont considérés comme complexes parce qu'ils ont beaucoup d'éléments les composant, de connexions entre ces éléments et représentent encore tout un ensemble malgré la diversité de ses éléments. A ces dimensions de la complexité du système, Morin ajoute la complexité logique des systèmes : le système est à la fois plus et moins que la somme de ses éléments. A la suite du principe d'Aristote, « le tout est plus que la somme de ses parties » parce que certaines propriétés du système ne peuvent être trouvées dans ses parties. Cela illustre le principe d'émergence de la capacité organisatrice du système. En même temps, le système est moins que la somme de ses parties parce que le système exerce des contraintes sur le comportement de ses parties. Cela est particulièrement vrai dans le cas des systèmes sociaux où les règles sociales et les lois ainsi que les inhibitions sont en jeu.

Le RC intègre les valeurs systémiques et holistiques de la complexité de façon diffuse dans les premiers travaux de Bhaskar (Bhaskar 2013) de façon plus assumée dans son travail ultérieur (Bhaskar 2008). De plus, la complexité identifie directement les limites de nos connaissances, appelant le réductionnisme à rendre la réalité intelligible. Même si un système ne peut pas être

clairement distingué de son environnement en raison de son ouverture, les frontières sont une question de choix de l'observateur, et donc des produits de nos descriptions. Par conséquent, se référant à la nature interprétative de la connaissance, la complexité et le réalisme critique partagent la même épistémologie.

Nous résumons les postulats ontologiques et épistémologiques communs à la complexité et au réalisme critique :

- *Emergence* va de paire avec une ontologie stratifiée et une méthodologie rétroductive (Bhaskar 2013) et est donc une « caractéristique irréductible de notre monde ». « Le tout est plus que la somme des parties » résume que nous ne pouvons pas réduire les trajectoires des événements que nous observons à la nature des différents éléments qui les composent car ces événements manifestent des propriétés distinctes que les éléments qui les composent, seuls, ne possèdent pas. La complexité de la pensée systémique comme la pensée réaliste critique s'opposent ainsi à la pensée réductionniste. Le comportement d'émergence des éléments interagissant saisit l'impossibilité de formuler des prédictions à partir de nos connaissances des propriétés individuelles de ces éléments.

- *Ordre et Structure :* La pensée complexe suppose un certain degré (même très faible) d'ordre et de structure sous-jacent, sinon les événements se déroulent de façon aléatoire. En parallèle, le réalisme critique suppose l'existence de mécanismes générateurs durables (qui sont dans la strate du réel), qui peuvent être inobservables, car non perceptibles ou non activés, pourtant ces mécanismes existent bien. Ceci est un argument expliquant les limites atteintes par nos théories à visée prédictive. Ces mécanismes génèrent des événements dans le domaine empirique qui peuvent influencer le système (ou certaines de ses entités et structures), c'est pourquoi les processus ne doivent pas être pensés séparément : « l'étude de *processus* où la structure rencontre les événements ; c'est l'étude du mode de devenir, soutenir et traverser une structure ou une chose. (...) Un processus ne constitue pas une catégorie ontologique en dehors de la structure et l'événement » (Bhaskar 2009, p.145 italique dans l'original, traduction propre). L'ordre social est problématisé au travers de toutes les dimensions de la société, non en tant que processus clairement établis mais plutôt des processus qui permettent le maintien, l'adaptation et la résilience.

- *Contingence* va de paire avec la nature transitive de nos connaissances et de la nature intransitive des mécanismes que nous avons l'intention de spécifier. L'environnement d'un système social est composé d'autres systèmes sociaux, une meilleure description serait une imbrication des systèmes. Les systèmes sociaux sont paradoxalement considérés comme des systèmes d'auto-organisation (Von Foerster 2003) malgré leur besoin en énergie ou en information. Ce paradoxe décrit l'interaction des connaissances externes et internes. Alors que cette relation de dépendance semble contredire l'autonomie d'un système, il est plus approprié de comprendre ce paradoxe comme décrivant à la fois une complète autonomie opérationnelle et une ouverture interactionnelle (Luhmann 2012, Moeller 2006), constituant une propriété ontologique des systèmes complexes.

- *Les interactions non-linéaires :* La pensée complexe repose sur des dynamiques non-linéaires qui rendent toute prédiction impraticable. En parallèle, le réalisme critique préconise l'explication plutôt que la prédiction. Les systèmes sociaux dynamiques et leur mode d'organisation sont non-linéaires parce qu'ils sont informationnellement ouverts, loin d'un quelconque équilibre sans sombrer dans le chaos. L'explication réside dans le fait qu'en raison des flux continus de ressources, leur complète autonomie opérationnelle et leur nature autopoiétique (Capra 2005 ; Luhmann 2012). Les interactions non-linéaires rendent ainsi compte du déroulement des événements avec des résultats dramatiques ou disproportionnés : les causes qui nous semblent bénignes peuvent avoir d'importants effets et des causes qui nous semblent majeures peuvent avoir des conséquences bénignes.

- La *récursivité* va de paire avec le postulat de contingence. La pensée complexe implique un flux continu de changements, c'est-à-dire un processus récursif : si un élément évolue, il change ou renforce l'ensemble. Que cette rétroaction soit positive ou négative, elle implique une approche processuelle. La récursivité est également mobilisée dans notre quête pour une meilleure compréhension des systèmes complexes : notre connaissance est développée dans un contexte bien précis et de fait, limite notre connaissance du système complexe étudié.

1.3.3. Complémentarité vers notre objectif de recherche

Le réalisme critique a guidé notre approche des phénomènes sociaux, en particulier la stratification de la réalité. Le monde est défini par trois strates : les événements que l'on vit *(empirique)*, les événements tels qu'ils se produisent (ou non) (*l'actuel)* et les mécanismes menant aux événements *(le réel).* Par conséquent, la complexité causale peut être définie comme le processus permettant de passer de l'actuel au réel, où les tendances causales génèrent des effets perceptibles ou non. De même, le chevauchement entre l'actuel et l'empirique nécessite un processus de construction de sens pour expliquer comment nous vivons et ressentons ces événements (ou leur absence).

Sur la base de cette structure de la réalité et le manque de compréhension processuelle au travers de ces strates, nous offrons dans notre première étude des outils analytiques pour faire face à la complexité de nos données et naviguer d'une strate à une autre.

Les problèmes sociaux complexes sont des processus sensibles à la temporalité, les relations entre ses différents composants se développent au cours du temps. Le système ouvert proposé par Bertalanfly (1950) constitue un équilibre dynamique, décrit comme une importation et exportation continues des relations avec son environnement. Cette hypothèse a été soutenue par des penseurs de la systémie pour s'émanciper du fonctionnalisme de Parsons et se tourner vers une description processuelle des systèmes. C'est pourquoi, dans ce travail de thèse, nous nous concentrons sur l'approche processuelle. Nous développons trois réponses processuelles aux défis de la société en mettant l'accent sur le processus d'organisation sous-jacent des problèmes sociaux complexes en remettant en question notre propre construction sociale de la société.

Dans notre deuxième étude, nous explorons la conception de l'émergence de Bhaskar : « Avec l'émergence, en général, de nouveaux êtres (entités, structures, totalités, concepts) sont générés à partir d'un matériel préexistant dont ils n'auraient pu être ni induits ni déduits. (...) C'est une question autant créative qu'autopoïétique. » (Bhaskar 2008, p.46, traduction propre). Notre approche s'intéresse à l'émergence d'une communauté de la sphère en ligne à la sphère hors-ligne, ainsi que les conséquences sociétales associées. Dans ce travail, nous adoptons une philosophie réaliste critique que nous utilisons comme dispositif explicite ou implicite pour développer les arguments de nos études.

En adoptant la vision réaliste critique de la complexité sociale, nous sommes dans une position unique pour explorer de façon processuelle les différentes strates de la réalité.

1.4. Synthèse des trois études

La société est le système social le plus large et l'élément intégral de ce système est la coopération à mesure que les individus s'engagent en communiquant (Frank et Fahrbach 1999). Par conséquent, deux caractéristiques déterminantes des processus d'organisation sont les interactions et les comportements induits par ces interactions. La communication est alors le processus le plus critique qui maintient le système à flot et lui évite ainsi de sombrer dans le chaos. « La société est clairement un cas extrême dans le domaine que recouvre la notion de complexité. Extrême non parce qu'elle est plus complexe que d'autres systèmes (comme les cerveaux), mais parce que la nature de ses opérations élémentaires, à savoir les communications, y impose des contraintes considérables. Il est en effet étonnant de voir comment des systèmes très complexes peuvent être formés par des opérations de ce type. La communication est extrêmement étroite et doit reposer sur le séquençage pour l'interrelation. Cela nécessite donc beaucoup de temps, ce qui la menace toujours de la détérioration » (Luhmann 2012, p.81, traduction propre).

C'est pourquoi, pour remédier à cette complexité dans les phénomènes sociétaux, notre travail se déroule autour de trois axes d'action principaux en perpétuelle traversée entre les sphères de l'en ligne et du hors-ligne. Ces perpétuelles traversées sont des systèmes complexes en raison de leurs interconnexions. Une telle pensée de la complexité permet de mettre en évidence à quel point les phénomènes spatio-temporels inattendus et irréversibles sont rarement organisés en coprésence dans un contexte sociétal, mais plutôt par le « pouvoir informatif et médiatisé » (Urry 2002, traduction propre).

Tout d'abord, nous présentons dans les détails de la représentation de la complexité dans la construction de sens en décomposant notre analyse des communications. Les systèmes sociaux sont des systèmes interprétatifs (Weick 1995) : à partir de représentations internes de son environnement, le système interprète et émet la complexité dans son environnement. Les interactions au sein des systèmes sociaux sont principalement informatives (Boisot et Child 1999).

Deuxièmement, nous nous concentrons spécifiquement sur les communications comme activité du processus autopoiétique du système social. L'accent particulier sur les communications dans un contexte situé illustre les processus menant à une structure émergente.

Troisièmement, nous nous intéressons aux comportements résultant des interactions hors-ligne et en ligne conduisant à des retombées négatives. Ce travail lie les interactions locales avec des

implications profondes en considérant les progrès simultanés des interactions en ligne et hors-ligne.

Dans ce qui suit, nous résumons les trois études qui composent ce travail de thèse dans un tableau comparatif introductif (Tableau 1). Ensuite, nous développons une introduction pour chaque étude en présentant chaque élément structurant la recherche.

1.4.1. Tableau comparatif introductif

	Etude 1	Etude 2	Etude 3
Nature de l'étude	Méthodologique	Empirique	Conceptuelle
Situation problématique	Les phénomènes sociotechniques sont complexes et débordent hors-ligne avec leurs bienfaits et leurs conséquences terribles. La complexité du contenu, de la forme et de la signification ancrée dans les données des réseaux sociaux est un défi analytique pour exploiter ces données.	Les communautés en ligne dépassent leur dimension virtuelle dans les contextes politiques et d'urgence en s'appuyant sur les réseaux sociaux.	Les interactions en ligne produisent des conséquences hors-ligne et vice-versa. La plupart des études sont des modèles de variance établissant l'impact d'Internet sur la société. Ces idées sont trop déterministes et ne traitent pas de la complexité du phénomène, y compris de l'influence de la société sur les interactions en ligne.
Objectifs de recherche	Remédier à la complexité représentationnelle dans les réseaux	Expliquer comment une communauté en ligne ouverte qui se forme en ligne peu se manifester dans un espace urbain	Expliquer 1. Comment les interactions en ligne intensifient l'engagement à une identité stigmatisée dissimulée, 2. Comment ce processus mène à des retombées négatives.
Concepts	Sensemaking, abduction, rigueur, pertinence codes	Action collective, communauté en ligne ouverte, autopoiesis	Retombées négatives, identité stigmatisée et dissimulée, dissonance
Cadre conceptuel	Sémiotique	Théorie des systems sociaux (Luhmann)	Escalade d'engagement
Notre approche	Modèle processuel avec les étapes analytiques	Etude de cas et formulation d'un modèle processuel	Modèle processuel
Contextualisation de l'en ligne/ hors-ligne	Des traces comportementales des phénomènes hors-ligne peuvent être trouvées dans les communications en ligne. Nous pouvons parvenir à des explications plus complètes en intégrant les différents médias et le contenu, les chercheurs et les sujets dans nos analyse.	Ces communautés sont des systèmes autonomes qui autoproduisent (autopoiesis) les éléments et auto-sélectionnent (auto-organisation) des éléments et leurs relations pour maintenir et renouveler la communauté. Les fonctionnalités spécifiques de Facebook se prêtent à l'amplification des mouvements sociaux.	L'identité est une ressource et un moteur pour agir. La société en général favorise une crainte de pénalisation sociale à cause de certaines identités. La dissonance cognitive entraîne l'escalade de l'engagement.

Tableau 1: Tableau Introductif

1.4.2. Etude 1 – La Sémiotique pour analyser la complexité représentationnelle dans les réseaux sociaux

« nous pouvions produire les bouteilles mais nous ne pouvions comprendre le vin » (Stamper 1996, p.349, traduction propre)

Situation problématique : Cette première étude aborde un défi bien connu des adeptes de méthodes qualitatives, qui n'a été que renforcé par les progrès technologiques. Cependant, la richesse des données se caractérise par sa complexité. Paradoxalement, c'est aussi la force de la recherche qualitative (Miles et al. 2014 ; Myers 2013). Cela peut être aussi impressionnant qu'assommant. La littérature méthodologique se fait rare sur les défis spécifiques des chercheurs qualitatifs en SI. La plupart des chercheurs adaptent les méthodes développées dans d'autres disciplines. Toutefois, les réseaux sociaux jouent un rôle important dans l'ajout de complexité. La plupart des recherches utilisant des données sur les réseaux sociaux se fondent sur des analyses quantitatives qui, sans aucun doute, fournissent des éclairages pertinents, mais sont limitées dans la profondeur des explications théoriques, où la recherche qualitative porte habituellement ses fruits. Les données sur les réseaux sociaux offrent un énorme potentiel de recherche, mais aussi prometteuse cette voie soit-elle, ses fruits ne sont pas faciles à récolter. Les données sur les réseaux sociaux sont par nature multimédia : textes, photographies, vidéos, liens externes, etc. nous renvoient à plus de contenus. De plus, les réseaux sociaux captent les interactions sociales : les individus peuvent réagir, commenter, partager ces contenus de manière asynchrone ou synchrone, ce qui rend le contenu lui-même dynamique. Nous ne sommes pas confrontés à des données simples, s'il en est de telles, mais nous sommes plutôt confrontés à des communications et nous devons les analyser en tant que telles.

Objectifs de recherche : Cette recherche vise à aborder la complexité représentationnelle des données accessibles sur les réseaux sociaux, c'est-à-dire le nature multimédia des données associée à plusieurs couches de significations. En s'appuyant sur notre expérience en matière de données sur les réseaux sociaux et en proposant un exemple au lecteur, nous avons élaboré des lignes directrices analytiques fondées sur la sémiotique (Chandler 2001 ; Eco 1976 ; Mingers et Willcocks 2017 ; Stamper 1991) et le réalisme critique.

Concepts et cadre conceptuel : Ce travail tente de construire une contribution mutuelle entre sémiotique et réalisme critique. Nous formulons un outil d'analyse et non une méthode. Notre approche des données est une expérience subjective par laquelle passe les sujets et le chercheur

par un processus de sensemaking. La sémiotique fournit un cadre prenant en compte les deux (i.e. sujet et chercheur) processus de sensemaking. Analytiquement, nous proposons un schéma de codage et décrivons le mode d'inférence (c'est-à-dire l'abduction). Cette étude espère aussi contribuer à la discussion sur les défis en recherche qualitative en SI pour faire avancer son développement et son impact.

Notre Approche : Pour ce faire, nous sommes retournés aux racines de notre discipline (Baskerville 2010 ; Grover et Lyytinen 2015) en utilisant la sémiotique. Cette dernière, l'étude des signes, présente un argumentaire convaincant pour répondre aux défis des interactions en ligne et hors-ligne. Tout d'abord, elle nous permet d'aborder le contenu des données, quelque soit sa nature au travers quatre dimensions : la sémantique, la pragmatique, la syntaxe et l'empirique. En second lieu, elle lie l'existence physique des communications (c'est-à-dire, l'expérience du vécu et ressenti des signes composant les communications) à leurs effets sociaux. De plus, le réalisme critique est compatible avec une telle approche sur deux dimensions. Tout d'abord, la nature stratifiée du monde réel est accessible par rétroduction ou abduction à partir du niveau empirique pour identifier les mécanismes sous-jacents des effets observés. En second lieu, épistémologiquement, le rôle de l'observateur est reconnu et intégré en fournissant des lignes directrices pour déchiffrer l'engagement analytique du chercheur. Cette boîte à outils peut être intégrée à différentes méthodologies (par exemple, étude de cas, ethnographie, etc.).

Contextualisation de l'en ligne/hors-ligne : Du fait du nombre croissant de recherches exploitant Internet, de plus en plus de directives méthodologiques émergent pour exploiter un tel potentiel. Nous avons vu la netnographie (Kozinets 2001), par exemple comme une approche culturelle du cyberespace. Cependant, le défi est dans l'interaction entre l'en ligne et le hors-ligne. Un autre défi pour la discipline des SI est l'étude des phénomènes sociaux qui enjambe la frontière conceptuelle entre l'en ligne/hors-ligne. L'Internet peut permettre aux communautés en ligne de rechercher le remède contre le cancer[10] ou permettre la propagation du VIH (Greenwood et Agarwal 2015), l'autonomisation des mouvements sociaux (Castells 2015) ou encore permettre à des communautés idéologiquement polarisées et aux loups-solitaires de commettre des crimes motivés par la haine raciale (Chan et al. 2016). Ces actions qui ont lieu hors-ligne laissent des traces en ligne. En tant que chercheurs, nous devons

[10] https://www.ncbi.nlm.nih.gov/pubmed/27442192

faire les liens pour formuler des contributions importantes et convaincantes pour la discipline et pour la société.

1.4.3. Étude 2 – Transdigital : Comment les communautés en ligne se transforment en communauté physique

« Nous utilisons Facebook pour planifier les manifestations, Twitter pour se coordonner et YouTube pour dire au monde. #egypt # Jan25 » (tweeté le 18/03/2011, traduction propre)

Situation problématique : Au lendemain du printemps arabe, les Cyber-utopiques ont érigé la « Révolution Facebook » ou la « révolution 2.0 », et les Cyber-sceptiques ont relégué les événements aux luttes économiques classiques et contre l'oppression. Donc, la question demeure : Les réseaux sociaux tels que Facebook (dans notre cas) ont-ils jouer un rôle ? Le cas échéant, lequel ?

Si la communauté SI convient que les TIC ont permis de nouvelles façons de penser et d'adopter une action collective, la plupart des recherches se sont concentrées sur la production de l'information telle un artefact dans les espaces de discussion. Ces études supposent que les biens et services produits apportent des changements, laissant de côté l'étude de ces communautés comme incarnant le changement lui-même. Ces communautés débordent de l'espace en ligne dans des contextes politiques et d'urgence en tirant parti des réseaux sociaux.

Objectif de recherche : Quand on fait un zoom dans la littérature sur les communautés en ligne ouvertes (*Open Online Communities, OOC*), leur fluidité et leur ouverture ont surtout mises en avant dans le partage des connaissances. La taille de la communauté et les communications ont été identifiées comme critique pour la durabilité de la communauté.

Quand on fait un zoom dans la littérature sur l'action collective, nous avons des explications binaires considérant soit les facteurs macro et externes, soit les facteurs micro et internes. Cette littérature évolue suite à une rupture dans l'adhésion de membres au sein des organisations traditionnelles et suite au constat des manifestations de masse qui fonctionnent grâce à des communications hautement personnalisées et une médiation technologique.

Par conséquent, nous observons la fluidité du cyberespace à l'espace urbain et des organisations conventionnelles aux processus d'organisation informels et émergents.

Cependant, « aucune révolution ne peut se faire sans faire participer la société à plus grande échelle. Même les efforts dans les cyberspaces sont stériles à moins qu'ils puissent être étendus

en véritables espaces sociaux, politiques et économiques » (Lim 2003, p.274, traduction propre). En effet, pour pouvoir incarner le changement social, une société plus large que la communauté en ligne doit être engagée en faveur de la cause.

Cadre conceptuel : Pour répondre à nos objectifs, nous nous tournons vers la pensée systémique allemande de Luhmann. Une approche systémique répond aux limites des explications binaires de la littérature sur l'action collective en regardant les stimuli externes et la dynamique interne du système. Nous nous appuyons sur trois principaux concepts des travaux de Luhmann (1986 ; 2012 ; 2013). Tout d'abord, de la biologie, l'« autopoiesis » décrit un processus d'autoproduction des éléments, des structures et des limites nécessaires pour maintenir ou renouveler le système (c'est-à-dire, les communications pour les systèmes sociaux). Dans ce processus, chaque composant participe à la production et la transformation des autres. En second lieu, l'auto-organisation implique l'auto-sélection des éléments et des relations entre eux. Troisièmement, le système est autonome : c'est un processus itératif entre autopoiesis et auto-organisation qui maintient ou renouvelle le système.

Notre Approche : Empiriquement, nous avons mené une étude de cas réaliste critique. Nous avons recueilli des données secondaires de Facebook pour deux principales raisons : d'une part, le premier appel à manifester a été trouvé sur Facebook qui était la source la plus commune d'information après la communication en face-à-face. Conformément aux travaux de Luhmann et au réalisme critique, nous avons traité les communications comme la couche émergente du social et nous avons procédé à une analyse des données sémiotiques (Stamper 1991) en appliquant notre technique présentée dans la première étude. Nous avons d'abord utilisé la stratégie de décomposition temporelle ou *bracketing* (Langley 1999) pour distinguer les périodes de structuration et d'analyser les processus de structuration et de sensemaking. La stratégie de la décomposition temporelle ou *bracketing* « permet l'examen explicite de la façon dont les actions sur une période conduit à des changements dans le contexte qui aura une incidence sur l'action dans les périodes ultérieures » (Langley 1999, p.703, traduction propre). Nous sommes partis des données avec des itérations entre les données et la théorie, puis nous avons fait appel à la triangulation avec la littérature, des articles de presse et des rapports.

Contextualisation de l'en ligne/hors-ligne : Nous nous sommes tout particulièrement intéressés au(x) rôle(s) des réseaux sociaux dans le processus qui transforme une communauté en ligne en une communauté physique (processus que nous appellons transdigitalisation). Les deux sphères ne sont pas seulement le reflet l'une de l'autre, mais également une extension

l'une de l'autre car elles créent, recréent et deviennent l'une et l'autre. Nous expliquons ce phénomène processuel par l'autopoiesis.

1.4.4. Étude 3 - Une escalade d'engagement à une identité menant à de retombées négatives

« Parce que l'Internet facilite la recherche de personnes partageant les mêmes idées, il peut faciliter la création et renforcer des communautés marginales qui ont une idéologie commune, mais sont géographiquement dispersées » (Van Alstyne et Brynjolfsson 2005, p.852, traduction propre)

Situation problématique : Internet a élargi la gamme d'interactions que nous pouvons avoir en dépassant les limitations géographiques. Cependant, les capacités de filtrage ont également permis un accès plus facile et plus large aux personnes partageant les mêmes idées et ont donc facilité l'accès et l'expansion des communautés idéologiquement polarisées (Van Alstyne et Brynjolfsson 2005). Les interactions numériques deviennent problématiques lorsqu'elles dépassent les espaces en ligne : la propagation du VIH (Greenwood et Agarwal 2015), les crimes haineux raciaux (Chan et al. 2016) ou les crimes sexuels (Bhuller et al. 2013) en sont des exemples. Ces études fournissent des théories en formulant des modèles de variance qui témoignent des aspects les plus sombres de la connectivité au sein de la société.

Objectif de recherche : Cette étude porte également sur les conséquences sociétales. Néanmoins, cette fois-ci, non pas par l'incarnation du changement social par une communauté, mais plutôt par des retombées négatives des interactions en ligne. Notre recherche vise à expliquer comment les interactions en ligne conduisent à des retombées négatives. Contrairement aux perspectives offertes jusqu'ici, nous nous intéressons non seulement à l'impact d'Internet sur la société, mais aussi à l'influence de la société sur certains types d'interactions en ligne**.**

Concepts : Les études sur lesquelles repose notre travail conceptuel, proposent des pistes pour expliquer le « comment », mais celles-ci sont habituellement hors de portée de l'étude et restent sous-développées. Nous suivons l'une de ces pistes et l'explorons pour proposer une explication provisoire de ces retombées négatives : la piste identitaire. Plus précisément, nous considérons l'identité stigmatisée et dissimulée (Goffman 1963), c'est-à-dire une identité dévalorisée qui n'est pas visible et peut ne pas faire face à une discrimination manifeste.

Toutefois, elle place l'individu dans une crainte constante de pénalisation sociale s'il s'avérait découvert. La société met certaines personnes en situation de dissonance cognitive en raison de la conformité forcée (Festinger 1957). Le contexte en ligne leur offre l'espace sécurisé pour explorer les aspects publiquement réprimés de soi et pour rechercher des personnes partageant les mêmes idées.

Cadre conceptuel : Un postulat qui régit notre travail est que la communauté en ligne fournit les mécanismes favorisant une escalade de l'engagement (Staw 1976) au lieu de réduire la dissonance cognitive, ce qui conduit à des comportements hors-ligne produisant des retombées négatives. Une affirmation clé dans la théorie de l'escalade est l'engagement des ressources. La littérature en SI a surtout porté ses efforts sur les ressources financières en tant que ressources engagées dans l'engagement croissant, en particulier dans la gestion de projet. Cependant, la formulation de la théorie (Brockner et al. 1986) comprend l'identité en tant que ressource engagée. D'une certaine manière, cet aspect reste inexploré. Dans cette étude, l'identité est la ressource clé engagée dans le processus d'escalade.

Notre Approche : Par conséquent, nous formulons un modèle processuel qui analyse l'influence de la société dans son ensemble en parallèle des interactions dans les communautés en ligne et la façon dont elles évoluent simultanément dans le temps.

Contextualisation de l'en ligne/hors-ligne : Nous considérons la société comme un groupe social plus large et sa co-influence avec des groupes sociaux en ligne plus restreints dans le processus menant les individus à certains comportements, tels que la société, subit des coûts sociaux et économiques des retombées négatives. Nous offrons une explication duale, où la société façonne les interactions en ligne et se retrouve façonnée par ces interactions.

1.5. References

Anderson, P., Meyer, A., Eisenhardt, K., Carley, K., and Pettigrew, A. 1999. "Introduction to the special issue: Applications of complexity theory to organization science," *Organization Science* (10:3), pp 233-236.

Andrade, A. D., and Doolin, B. 2016. "Information and communication technology and the social inclusion of refugees," *MIS Quarterly* (40:2), pp 405-416.

Archer, M. S. 1995. *Realist social theory: The morphogenetic approach*, Cambridge University Press: Cambridge.

Ayyagari, R., Grover, V., and Purvis, R. 2011. "Technostress: technological antecedents and implications," *MIS Quarterly* (35:4), pp 831-858.

Barley, S. R. 1983. "Semiotics and the Study of Occupational and Organizational Cultures," *Administrative Science Quarterly* (28:3), pp 393-413.

Baskerville, R. L. 2010. "Knowledge lost and found: A commentary on Allen Lee's 'retrospect and prospect'," *Journal of Information Technology* (25:4), pp 350-351.
Bennett, W. L., and Segerberg, A. 2011. "Digital media and the personalization of collective action: Social technology and the organization of protests against the global economic crisis," *Information, Communication & Society* (14:6), pp 770-799.
Bennett, W. L., and Segerberg, A. 2012. "The logic of connective action: Digital media and the personalization of contentious politics," *Information, Communication & Society* (15:5), pp 739-768.
Benson, J. K. 1977. "Organizations: A Dialectical View," *Administrative Science Quarterly* (22:1), pp. 1-21
Berger, A. A. 2004. "Semiotic analysis," in *Media analysis techniques*, Sage Publications Inc.: Thousand Oaks, United States.
Bhaskar, R. 2009. *Scientific realism and human emancipation*, (2nd ed.) Routledge: USA and Canada.
Bhaskar, R. 2013. *A realist theory of science*, (2nd ed.) Routledge Taylor and Francis Group: Lo(22:1), pp 1-21.
Bhaskar, R. 1975. "Forms of realism," *Philosophica* (15:1).
Bhaskar, R. 1998. *The possibility of naturalism: A philosophical critique of the contemporary human sciences*, (3rd ed.) Routledge: London and New York.
Bhaskar, R. 2008. *Dialectic: The pulse of freedom*, (2nd ed.) Routledge: London and New York.
Bhuller, M., Havnes, T., Leuven, E., and Mogstad, M. 2013. "Broadband Internet: An Information Superhighway to Sex Crime?," *The Review of Economic Studies* (80:4), pp 1237-1266.
Boisot, M., and Child, J. 1999. "Organizations as adaptive systems in complex environments: The case of China," *Organization Science* (10:3), pp 237-252.
Boulding, K. E. 1955. "Notes on the information concept," *Exploration* (6), pp 103-112.
Boulding, K. E. 1956. "General Systems Theory-The Skeleton of Science," *Management Science* (2:3), pp 197-208.
Braa, J., Hanseth, O., Heywood, A., Mohammed, W., and Shaw, V. 2007. "Developing health information systems in developing countries: the flexible standards strategy," *MIS Quarterly* (31:2), pp 381-402.
Brannen, M. Y. 2004. "When Mickey Loses Face: Recontextualization, Semantic Fit, and the Semiotics of Foreignness," *The Academy of Management Review* (29:4), pp 593-616.
Brockner, J., Houser, R., Birnbaum, G., Lloyd, K., Deitcher, J., Nathanson, S., and Rubin, J. Z. 1986. "Escalation of commitment to an ineffective course of action: The effect of feedback having negative implications for self-identity," *Administrative Science Quarterly* (31:1), pp 109-126.
Butler, B. S. 2001. "Membership size, communication activity, and sustainability: A resource-based model of online social structures," *Information Systems Research* (12:4), pp 346-362.
Capra, F. 2005. "Complexity and life," *Theory, Culture & Society* (22:5), pp 33-44.
Castells, M. 2011. *The rise of the network society: The information age: Economy, society, and culture*, (2nd ed.) John Wiley & Sons.
Castells, M. 2015. *Networks of outrage and hope: Social movements in the Internet age*, (2nd ed.) Polity Press: UK.
Cebrian, M., Rahwan, I., and Pentland, A. S. 2016. "Beyond viral," *Communications of the ACM* (59:4), pp 36-39.
Chan, J., and Ghose, A. 2014. "Internet's dirty secret: assessing the impact of online intermediaries on HIV transmission," *MIS Quarterly* (38:4), pp 955-976.

Chan, J., Ghose, A., and Seamans, R. 2016. "The Internet and Racial Hate Crime: Offline Spillovers from Online Access," *MIS Quarterly* (40:2), pp 381-403.
Chandler, D. 2001. *Semiotics: the basics*, (Routledge).
Checkland, P. 2000. "Soft systems methodology: a thirty year retrospective," *Systems Research and Behavioral Science* (17:1), pp 11-58.
Chesters, G., and Welsh, I. 2005. "Complexity and Social Movement(s)," *Theory, Culture & Society* (22:5), pp 187-211.
Cilliers, P. 2005. "Complexity, deconstruction and relativism," *Theory, Culture & Society* (22:5), pp 255-267.
Cohen, M. 1999. "Commentary on the Organization Science special issue on complexity," *Organization Science* (10:3), pp 373-376.
Daft, R. L., and Lewin, A. Y. 1990. "Can organization studies begin to break out of the normal science straitjacket? An editorial essay," *Organization Science* (1:1), pp 1-9.
Danermark, B., Ekstrom, M., and Jakobsen, L. 2002. *Explaining Society: an introduction to critical realism in the social sciences*, Routledge Taylor and Francis Group: London and New York.
De Vaujany, F.-X. 2008. "Capturing reflexivity modes in IS: A critical realist approach," *Information and Organization* (18:1), pp 51-72.
Deely, J. N. 1990. *Basics of semiotics*, Indiana University Press: Bloomington & Indianapolis.
Deng, X. N., Joshi, K. D., and Galliers, R. D. 2016. "The Duality of Empowerment and Marginalization in Microtask Crowdsourcing: Giving Voice to the Less Powerful Through Value Sensitive Design " *MIS Quarterly* (40:2), pp 279-302.
Desai, A. 2005. "Adaptive complex enterprises," *Communications of the ACM* (48:5).
Dewey, J. 1916. *Democracy and Education: An Introduction to Philosophy of Education*, (1st ed.) Macmillan: New York.
Doyle, A. C. 2013. *Sherlock Holmes: The complete novels and stories - Volume 1*, Barnes and Nobles Classics: New Yorks.
Dubai-School-of-Government 2011. "Civil Movements: The Impact of Facebook and Twitter," *Arab Social Media Report* (1:2), pp 1-30.
Dunn, A. 2011. "Unplugging a nation: State media strategy during Egypt's January 25 uprising," *Fletcher Forum of World Affairs* (35:2), pp 15-24.
Eco, U. 1976. *A theory of semiotics*, (1976 ed.) Indiana University Press: Bloomington.
Eco, U. 1979. *The role of the reader: Explorations in the semiotics of texts*, (1984 ed.) Indiana University Press: Bloomington.
Eco, U. 1983. "Horns, hooves, insteps: Some hypotheses on three types of abduction," in *The Sign of Three: Dupin, Holmes, Peirce*, U. Eco and T. A. Sebeok (eds.), Indiana University Press: Bloomington, pp. 198-220.
Eco, U., and Sebeok, T. A. 1983. *The Sign of Three: Dupin, Holmes, Peirce*, (Indiana University Press Bloomington.
Festinger, L. 1957. *A Theory of Cognitive Dissonance*, (1962 ed.) Row, Peterson & Co: New York.
Frank, K. A., and Fahrbach, K. 1999. "Organization culture as a complex system: Balance and information in models of influence and selection," *Organization Science* (10:3), pp 253-277.
Ganju, K. K., Pavlou, P. A., and Banker, R. D. 2016. "Does Information and Communication Technology Lead to the Well-Being of Nations? A Country-Level Empirical Investigation," *MIS Quarterly* (40:2), pp 417-430.
Ghonim, W. 2012. *Revolution 2.0: The Power of the People is Greater than the People in Power: A Memoir*, (1st ed.) Houghton Mifflin Harcourt.

Gladwell, M. 2010. "Small Change: Why the revolution will not be tweeted," *The New Yorker, available at https://www.newyorker.com/magazine/2010/10/04/small-change-malcolm-gladwell*

Glaser, J., Dixit, J., and Green, D. P. 2002. "Studying Hate Crime with the Internet: What Makes Racists Advocate Racial Violence?," *Journal of Social Issues* (58:1), pp 177-193.

Goffman, E. 1963. *Stigma: Notes on the Management of Spoiled Identity*, (1st ed.) Prentice-Hall, Inc.: Englewood Cliffs, N.J.

Granovetter, M. 1985. "Economic action and social structure: The problem of embeddedness," *American journal of sociology* (91:3), pp 481-510.

Granovetter, M. S. 1973. "The Strength of Weak Ties," *American Journal of Sociology* (78:6), pp 1360-1380.

Greenwood, B., and Agarwal, R. 2015. "Two Sided Platforms and HIV Incidence among the Digitally Disadvantaged," *Management Science* (62:8), pp 2281-2303.

Greenwood, B. N., and Agarwal, R. 2016. "Matching Platforms and HIV Incidence: An Empirical Investigation of Race, Gender, and Socioeconomic Status," *Management Science* (62:8), pp 2281 - 2303.

Grover, V., and Lyytinen, K. 2015. "New State of Play in Information Systems Research: The Push to the Edges," *MIS Quarterly* (39:2), pp 271-296.

Hackley, C. 2003. *Doing research projects in marketing, management and consumer research*, (1st ed.) Routledge: London and New York.

Halverson, J. R., Ruston, S. W., and Trethewey, A. 2013. "Mediated Martyrs of the Arab Spring: New Media, Civil Religion, and Narrative in Tunisia and Egypt," *Journal of Communication* (63:2), pp 312-332.

Hodge, R., and Kress, G. R. 1988. *Social semiotics*, (First ed.) Cornell University Press.

Hong, W., Chan, F. K., Thong, J. Y., Chasalow, L. C., and Dhillon, G. 2013. "A framework and guidelines for context-specific theorizing in information systems research," *Information Systems Research* (25:1), pp 111-136.

Human, O. 2016. "Complexity: E-Special Introduction," *Theory, Culture & Society* (33:7-8), pp 421-440.

Jacucci, E., Hanseth, O., and Lyytinen, K. 2006. "Introduction: Taking complexity seriously in IS research," *Information Technology & People* (19:1), pp 5-11.

Jha, S. K., Pinsonneault, A., and Dubé, L. 2016. "The Evolution of an ICT Platform-Enabled Ecosystem for Poverty Alleviation: The Case of eKutir," *MIS Quarterly* (40:2), pp 431-445.

Johns, G. 2006. "The essential impact of context on organizational behavior," *Academy of Management Review* (31:2), pp 386-408.

Journé, B., Grimand, A. & Garreau, L. 2012. "Face à la complexité. Illusions, audaces, humilité,". *Revue française de gestion*, (223:4), pp.15-25.

Kallinikos, J. 2005. "The order of technology: Complexity and control in a connected world," *Information and Organization* (15:3), pp 185-202.

Klein, H. K., and Myers, M. D. 1999. "A set of principles for conducting and evaluating interpretive field studies in information systems," *MIS Quarterly* (23:1), pp 67-93.

Kling, R. 1996. *Computerization and controversy: value conflicts and social choices*, Morgan Kaufmann.

Kozinets, R. V. 2001. "Utopian enterprise: Articulating the meanings of Star Trek's culture of consumption," *Journal of consumer research* (28:1), pp 67-88.

Langley, A. 1999. "Strategies for Theorizing from Process Data," *Academy of Management Review* (24:4), pp 691-710.

Latour, B. 1990. "Technology is society made durable," *The Sociological Review* (38:S1), pp 103-131.
Latour, B. 1999. "On recalling ANT," *The Sociological Review* (47:S1), pp 15-25.
Levy, S. J. 1959. "Symbols for sale," *Harvard business review* (37:4), pp 117-124.
Liebenau, J., and Backhouse, J. 1990. *Understanding Information: an Introduction*, (1st ed.) Palgrave Macmillan: Basingstoke and London.
Lim, M. 2003. "The Internet, social networks, and reform in Indonesia," in *Contesting Media Power: Towards a Global Comparative Perspective*, N. Couldry and J. Curran (eds.), Rowman & Littlefield Publishers: USA, pp. 273-288.
Ling, C. L. M., Pan, S. L., Ractham, P., and Kaewkitipong, L. 2015. "ICT-Enabled Community Empowerment in Crisis Response: Social Media in Thailand Flooding 2011," *Journal of the Association for Information Systems* (16:3), pp 174-212.
Locke, J. 1690/1959. *An Essay Concerning Human Understanding* (unabridged ed.) Dover: New York.
Lowry, P. B., Zhang, J., Wang, C., and Siponen, M. 2016. "Why Do Adults Engage in Cyberbullying on Social Media? An Integration of Online Disinhibition and Deindividuation Effects with the Social Structure and Social Learning Model," *Information Systems Research* (27:4), pp 962-986.
Luhmann, N. 1986. "The autopoiesis of social systems," in *Sociocybernetic paradoxes*, G. F. and v. d. Z. J. (eds.), Sage: London, pp. 172-192.
Luhmann, N. 1995. *Social Systems*, Stanford University Press: Stanford, California.
Luhmann, N. 2012. *Theory of Society, Volume 1*, Stanford University Press: Stanford, California.
Luhmann, N. 2013. *Introduction to Systems Theory*, (English ed.) Polity Press: Cambribge, United Kingdom.
Majchrzak, A., Markus, M. L., and Wareham, J. 2016. "Designing for Digital Transformation: Lessons for Information Systems Research from the Study Of ICT and Societal Challenges," *MIS Quarterly* (40:2), pp 267-277.
Maturana, H. R., and Varela, F. J. 1987. *The tree of knowledge: The biological roots of human understanding*, New Science Library/Shambhala Publications.
McCarthy, J. E. 1984. "Semiotic Idealism," *Transactions of the Charles S. Peirce Society* (20:4), pp 395-433.
Mick, D. G., and Oswald, L. R. 2006. "The semiotic paradigm on meaning in the marketplace," in *Handbook of qualitative research methods in marketing*, R. W. Belk (ed.), Edward Elgar Publishing Limited: Cheltenham, UK • Northampton, MA, USA, pp. 31-45.
Miles, M. B., Huberman, A. M., and Saldana, J. 2014. *Qualitative Data Analysis: A Methods Sourcebook*, (3rd ed.) SAGE Publications.
Milgram, P., and Kishino, F. 1994. "A taxonomy of mixed reality visual displays," *IEICE TRANSACTIONS on Information and Systems* (77:12), pp 1321-1329.
Mingers, J. 2001. "Combining IS research methods: towards a pluralist methodology," *Information Systems Research* (12:3), pp 240-259.
Mingers, J. 2004. "Real-izing information systems: critical realism as an underpinning philosophy for information systems," *Information and organization* (14:2), pp 87-103.
Mingers, J., Mutch, A., and Willcocks, L. 2013. "Introduction Special Issue: Critical realism in information systems research," *MIS Quarterly* (37:3), pp 795-802.
Mingers, J., and Willcocks, L. 2014. "An integrative semiotic framework for information systems: The social, personal and material worlds," *Information and Organization* (24:1), pp 48-70.

Mingers, J., and Willcocks, L. 2015. "Guidelines for Conducting Semiotic Research in Information Systems," in *14th European Conference on Research Methods (ECRM)* Valletta (Malta), pp. 290-298.
Mingers, J., and Willcocks, L. 2017. "An integrative semiotic methodology for IS research," *Information and Organization* (27:1), pp 17-36.
Miranda, S. M., Young, A., and Yetgin, E. 2016. "Are social media emancipatory or hegemonic? Societal effects of mass media digitization," *MIS Quarterly* (40:2), pp 303-329.
Moeller, H.-G. 2006. *Luhmann Explained: From Souls to Systems*, (1st ed.) Open Court Publishing: Chicago and La Salle, Illinois.
Morin, E. 2007. "Restricted complexity, general complexity," *Science and us: Philosophy and Complexity. Singapore: World Scientific*, pp 1-25.
Morin, E. 2014. "Complex thinking for a complex world–About reductionism, disjunction and systemism," *Systema: connecting matter, life, culture and technology* (2:1), pp 14-22.
Morin, E., and Lemoigne, J.-L. 1999. *L'intelligence de la complexité*, (1st ed.) L'Harmattan: Paris, Montreal.
Morris, C. 1938. "Foundations of the Theory of Signs," in *International Encyclopedia of Unified Science* O. Neurath (ed.), University of Chicago Press: Chicago.
Myers, M. D. 2013. *Qualitative Research in Business and Management*, (2nd ed.) Sage: Los Angeles I London I New Delhi I Singapore I Washington DC.
Nan, N., and Lu, Y. 2014. "Harnessing the Power of Self-Organization in an Online Community During Organizational Crisis," *MIS Quarterly* (38:4), pp 1135-1157.
Oh, O., Eom, C., and Rao, H. 2015. "Research Note—Role of Social Media in Social Change: An Analysis of Collective Sense Making During the 2011 Egypt Revolution," *Information Systems Research* (26:1), pp 210-223.
Oreglia, E., and Srinivasan, J. 2016. "ICT, Intermediaries, and the Transformation of Gendered Power Structures," *MIS Quarterly* (40:2), pp 501-510.
Orlikowski, W. J., and Robey, D. 1991. "Information technology and the structuring of organizations," *Information systems research* (2:2), pp 143-169.
Peirce, C. S. 1931-58. *The Collected Papers of C. S. Peirce*, (Cambridge: Harvard.
Ring, P. S., and Van de Ven, A. H. 1989. "Formal and informal dimensions of transactions," in *Research on the management of innovation: The Minnesota studies*, A. H. Van de Ven, H. L. Angle and M. S. Poole (eds.), Oxford University Press, pp. 171-192.
Saussure, F. d. 1959. *Course in General Linguistics*, (New York: Philosophical Library ed.).
Sebeok, T. A. 1985. *Contributions to the Doctrine of Signs*, University Press of America: Lanham,Md.
Selander, L., and Jarvenpaa, S. L. 2016. "Digital Action Repertoires and Transforming a Social Movement Organization," *MIS Quarterly* (40:2), pp 331-352.
Simon, H. A. 1962. "The Architecture of Complexity," *Proceedings of the American Philosophical Society* (106:6), pp 467-482.
Srivastava, S. C., Teo, T. S., and Devaraj, S. 2016. "You Can't Bribe a Computer: Dealing with the Societal Challenge of Corruption Through ICT," *MIS Quarterly* (40:2), pp 511-526.
Stamper, R. 1973. *Information in business and administrative systems*, Batsford: London.
Stamper, R. 1987. "Semantics," in *Critical issues in information systems research*, R. J. Boland and R. A. Hirschheim (eds.), John Wiley & Sons, Inc.: New York, NY.
Stamper, R. 1991. "The Semiotic Framework for Information Systems Research," in *Information Systems Research: Contemporary Approaches and Emergent Traditions*, Hans-Erik and H. K. a. R. H. Nissen (eds.): Amsterdam: North Holland.

Stamper, R. 1996. "Sign, Information Norms and Systems," in *Signs of Work: Semiosis and Informatiom Processing in Organisations,* B. Holmqvist, P. B. Andersen, H. Klein and R. Posner (eds.), Walter de Gruyter: Berlin.

Staw, B. M. 1976. "Knee-deep in the big muddy: A study of escalating commitment to a chosen course of action," *Organizational Behavior and Human Performance* (16:1), pp 27-44.

Strauss, A. L., and Corbin, J. 2008. *Basics of Qualitative Research: Grounded Theory Procedures and Techniques*, (3rd ed.) Sage Publications: Newbury Park, CA.

Tanriverdi, H., Rai, A., and Venkatraman, N. 2010. "Research commentary—reframing the dominant quests of information systems strategy research for complex adaptive business systems," *Information Systems Research* (21:4), pp 822-834.

Thietart, R.-A., and Forgues, B. 1995. "Chaos theory and organization," *Organization science* (6:1), pp 19-31.

Thrift, N. 1999. "The place of complexity," *Theory, Culture & Society* (16:3), pp 31-69.

Tiercelin, C. 1998. "Peirce's Objective Idealism: A Defense," *Transactions of the Charles S. Peirce Society* (34:1), pp 1-28.

Tilly, C. 1978. *From Mobilization to Revolution*, (Addison Wesley Publishing Co: New York.

Tonnies, F., and Loomis, C. P. 1957. *Community and society*, Courier Corporation.

Umiker-Sebeok, J. 1987. *Marketing and semiotics: New directions in the study of signs for sale*, Mouton de Gruyter: Berlin New York.

Urry, J. 2002. "The global complexities of September 11th," *Theory, Culture & Society* (19:4), pp 57-69.

Urry, J. 2005a. "The complexities of the global," *Theory, Culture & Society* (22:5), pp 235-254.

Urry, J. 2005b. "The Complexity Turn," *Theory, Culture & Society* (22:5), pp 1-14.

Van Alstyne, M., and Brynjolfsson, E. 2005. "Global village or cyber-balkans? Modeling and measuring the integration of electronic communities," *Management Science* (51:6), pp 851-868.

Venkatesh, V., Brown, S. A., and Bala, H. 2013. "Bridging the qualitative-quantitative divide: Guidelines for conducting mixed methods research in information systems," *MIS Quarterly* (37:1), pp 21-54.

Venkatesh, V., Rai, A., Sykes, T. A., and Aljafari, R. 2016. "Combating Infant Mortality in Rural India: Evidence from a Field Study of eHealth Kiosk Imlementations," *MIS Quarterly* (40:2), pp 353-380.

Volkoff, O., Strong, D. M., and Elmes, M. B. 2007. "Technological embeddedness and organizational change," *Organization Science* (18:5), pp 832-848.

Von Bertalanffy, L. 1950. "An outline of general system theory," *British Journal for the Philosophy of science* (1:2), pp 134-165.

Von Foerster, H. 2003. "On self-organizing systems and their environments," in *Understanding Understanding: Essays on Cybernetics and Cognition*, H. v. Foerster (ed.), Springer: USA, pp. 1-19.

Walsh, I., Holton, J. A., Bailyn, L., Fernandez, W., Levina, N., and Glaser, B. 2015. "What Grounded Theory Is…A Critically Reflective Conversation Among Scholars," *Organizational Research Methods* (18:4), pp 581-599.

Warschauer, M., and Grimes, D. 2007. "Audience, authorship, and artifact: The emergent semiotics of Web 2.0," *Annual Review of Applied Linguistics* (27), pp 1-23.

Wattal, S., Schuff, D., Mandviwalla, M., and Williams, C. B. 2010. "Web 2.0 and politics: the 2008 US presidential election and an e-politics research agenda," *MIS Quarterly (34:4*), pp 669-688.

Weaver, W. 1948. "Science and Complexity," *American scientist* (36), pp 536-567.

Weber, R. 2003. " Editor's comments - The Problem of the Problem," *MIS Quarterly* (27:2), pp iii–ix.
Weick, K. E. 1993. "The collapse of sensemaking in organizations: The Mann Gulch disaster," *Administrative Science Quarterly* (38:4), pp 628-652.
Weick, K. E. 1995. *Sensemaking in organizations*, (1st ed.) Sage Publications Inc.: Thousands Oaks: London: New Delhi.
White, R. W., and Horvitz, E. 2009. "Cyberchondria: studies of the escalation of medical concerns in web search," *ACM Transactions on Information Systems* (27:4), pp 1-37.
Whitehead, A. N. 1920. *The Concept of Nature*, (1st ed.) University Press: Cambridge.
Williams, C. K., and Karahanna, E. 2013. "Causal Explanation in the Coordinating Process: A Critical Realist Case Study of Federated IT Governance Structures," *Mis Quarterly* (37:3), pp 933-964.
Woermann, M., and Cilliers, P. 2012. "The ethics of complexity and the complexity of ethics," *South African Journal of Philosophy Suid-Afrikaanse Tydskrif vir Wysbegeerte* (31:2), pp 447-463.
Wynn, D. J., and Williams, C. K. 2012. "Principles for conducting critical realist case study research in information systems," *MIS quarterly* (36:3), pp 787-810.
York, J. C. 2011. "Not Twitter, Not Wikileaks: A Human Revolution. http://jilliancyork.com/2011/01/14/not-twitter-not-wikileaks-a-human-revolution/ ".
Zachariadis, M., Scott, S. V., and Barrett, M. I. 2013. "Methodological Implications of Critical Realism for Mixed-Methods Research," *MIS Quarterly* (37:3), pp 855-879.

CHAPTER 2 - GENERAL INTRODUCTION (ENGLISH)

Abstract

Despite the wide literature on the consequences of Information and Communication Technologies (ICTs) use, the literature still lacks understanding about the societal consequences, positive or negative, intended or unintended. ICTs can yield the good and the bad. Consequences of technology usages on society are paradoxical. The paradoxical outcomes can be threat to the sustainability of society. Because interactions spread beyond the online space and its outcomes are paradoxical, societal challenges are complex problems. But these are not just complex problems, rather these are social complex problems. To harvest society, we need a better understanding of social complex problems.

To do so, we adopted a multi-study dissertation model. Our research objective is contextualizing and conceptualizing the online-offline relationship. To achieve that goal, the three studies of this doctoral work adopt a qualitative approach and a critical realist philosophy.

Keywords: online-offline contextualization, spillover, transdigitalization, societal challenges, complexity.

2.1. Motivations

"*I spend the summers at a cottage on Cape Cod, and for decades I walked the same dunes that Thoreau once walked. Not too long ago, people walked with their heads up, looking at the water, the sky, the sand and at one another, talking. Now they often walk with their heads down, typing. Even when they are with friends, partners, children, everyone is on their own devices. So I say, look up, look at one another."*[11].

Digital information has infiltrated our everyday lives. Our computers, tablets or phones are buzzing or ringing signaling we received photos, videos, tweets, status updates, check-ins, news updates, messages, etc. The online space has colonized the offline world through ubiquitous devices. And social media capture all the information flowing into these devices. Authors have complained about the loss of *real* connectivity. Among them, the author of the introductory quote, Sherry Turkle shares her observation of this disconnection: This observation may sound anecdotal, yet it illustrates the irreconcilable dichotomy that pervades over-simplistic discourses.

This kind of account has led to create an either/or narrative, either online or offline and more importantly the spread of insights such as the loss of reality. The cyberspace has so many times been depicted as new and different - except for a few authors (e.g. Butler 2001) – such as online and offline are seen as two distinct realms. The denial of status of real to the online world is a damageable false assumption. Such assumption has led to talk about "slacktivism" as not real activism, when cyber-activism should have been put into perspective with physical world activism. Instead, digital and physical worlds are enmeshed to constitute the real. It is the conjunction of online and offline efforts that is impactful such as the uprisings in the Arab world.

The phenomena of interest in this dissertation question the utility of the online/offline dichotomy and illustrate its fallacy in contemporaneous societal challenges. This overly simplistic dichotomy is not the only one pervading the literature on online communities, other such as *Gemeinshaft vs. Gesellshaft*[12] (Tonnies and Loomis 1957), strong vs. weak ties (Granovetter 1985; 1973) pervade our thinking. Dichotomies and simplifications fail to capture the social phenomena at hands and their consequences. This approach neglects the potential of

[11] http://www.nytimes.com/2012/04/22/opinion/sunday/the-flight-from-conversation.html
[12] Translation: Community vs. Society

both online *and* offline together in leveraging communities. This either/or *Weltanschauung* (or world view) has also entrapped us to see things as *being* one or the other when contemporary phenomena have destabilized the idea of *being* to the benefit of *becoming*. Chesters and Welsh (2005) illustrate this conceptual thinking shift with alter-globalization movement (AGM) characterized by (political and economic) contestation overflowing and iterated between the local and the global represented by hacktivists: communications technologies are combined with a need of co-presence. Both forms of actions, iterative processes of organizations of contestation shaped synergistic collective action between online and offline.

How do we sort out those realms to generate helpful insights? Should we still study them as separate? Nowadays, phenomena with societal consequences spread through online and offline in unprecedented manners at an unprecedented pace. How much do online interactions influence our "offline" world and vice versa? Considering them as two different realms is disserving our understanding of those phenomena because Internet and technology in general is as substantive as pervasive in the questions we raise.

Furthermore, we do not simply carry interactions or actions from one realm to the other. Individuals navigating their online social world and their offline circles do not leave one behind to enter the other. Individuals do not come out unchanged of our interactions as stated by Manuel Castells: "Nobody who is on social networks everyday (and this is true for some 700 million of the 1,200 million social network users) is still the same person. It's an online/offline interaction, not an esoteric virtual world."[13]. The Internet has become a-not-so-new-anymore medium to express ourselves, away from social norms, categories and pressure that constrain to behave in a certain way and not in others. In this free space untied to the society, new opportunities to define the self are laid down. This context leads to new course of interactions and communications that set new norms. Potentially, people can feel more empowered behind a screen to behave in ways they would feel too shy in offline settings, whether they are appropriate, desirable, legal or not.

However, that online world is not that detached from the rest of society. Even though the Internet can appear as a blank slate, individuals do not join as blank slates: everybody comes with their past experiences, their values, social categories and understandings of the social world. Therefore, on the opposite, it seems there is no escape. The online utopia may turn out into a dystopia. The targeted search for certain kinds of online interactions can also lead to the

[13] https://thesocietypages.org/cyborgology/2011/02/24/digital-dualism-versus-augmented-reality/

worse such as spread of STDs[14] or suicide pacts [15]. In those cases, online interactions lead to negative spillovers. The challenge is dealing with this contradiction without dismissing it. Theories that seek to explain the contemporary developments without fully studying the expansion of interactions and information and how they are understood and used to set opportunities of courses of action fail to explain the far-reaching phenomena that have been taking places over several decades.

Moreover, the online contextualization of social interactions may suffer even more from social pressure and, thus heightens the dystopia. The Internet-based context can be compared to a panopticon: every social interaction is visible to others, which leads to behavior adjustments to meet social norms. People join online communities with their mental models to make sense of the interactions they observe and to interact according to social norms. Socio-cultural divides such as racism in our offline society pervade the online world. Consequently, the social context of interactions is carried on online. Reciprocally, online activities are carried on offline. Jurgenson (2012) stresses that "Social Media is more than something we log into; it is something we carry within us"[16], i.e. logging off only means leaving the media, but not its social dimension.

Still, the question remains: is the online world colored by the offline world or the offline world colored by the online? One core assumption of our work is both. Communities and people forming them overflow one world into the other constantly, and researchers should do so too. Urry (2005a) describes such complex network as global fluids: "Such fluids result from people acting upon the basis of local information and relationships, but where these local actions are, through iteration, captured, moved, represented, marketed and generalized, often impacting upon hugely distant places and peoples." (p.246). The self-organization ability of those interactional systems leads to overwhelming behaviors with dramatic consequences.

In studying the societal consequences of the use of Internet, we assert that the online vs. offline, the virtual vs. the real, the community vs. the society dichotomies are more hindering than enabling to have an accurate understand of the issues at hand.

[14] https://www.dailydot.com/via/truvada-prep-hiv-stigma-craigslist/
[15] http://www.nytimes.com/2010/05/14/us/14suicide.html
[16] https://thenewinquiry.com/the-irl-fetish/ et https://medium.com/@kaeleneburke/online-offline-dichotomy-9f87a13c726f

Ongoing academic research focuses on similarities and differences between the online and the offline world. There is a need in the IS literature to contextualize the online world and articulate it with societal consequences. Online and offline are treated as two conceptual devices and experiential modes. The concept of offline only exists in mirror of the online. Therefore, these two concepts are inextricable.

This dissertation aims at (1) providing process explanations for online-offline interactions leading to societal consequences and (2) offering an analytical approach to the data collected on social media. We provide such conceptual process explanations for the transformation of online community into a physical protest leading to the end of a government (Study 2) and online interactions leading to negative spillovers (Study 3). We look at how an online community becomes an offline community in a political context and at negative spillovers of individuals' behaviors following online interactions. In the former, we looked at the mobilization of Facebook in the Egyptian Arab Spring. In the latter, we based our process model on literature based on polarized or stigmatized communities such as communities centered around political or sexual preferences.

In both studies, we found ourselves confronted to dramatic developments worldwide that raise the questions of the dynamics leading to some entities to last and other to collapse. Early local events can activate dramatic transitions at a larger scale raising the fundamental question about processes. The processes described and explained here show how the interactions of different elements can produce emergent, non-linear and surprising behaviors that are represented through process models even though those models cannot serve predictive purposes.

Also in the former, we faced challenges considering the multimedia nature of data collected on social media and the multiple interactions creating multiple meaning, therefore, we adapted semiotic data analysis and formulated a toolkit to meet our research objectives (Study 1). We illustrate the first with empirical data analyzed with this analytical toolkit. Therefore, our research offers a complementary approach to challenges at stakes by providing conceptual, empirical and methodological elements of answer for future research.

2.2. Social Complex Problems in IS Research

Social implications of ICTs have been a concern of IS researchers (Orlikowski and Robey 1991) that we seem to have steered away paradoxically when Internet-enabled technologies

have changed and challenged business and society at large. The IS field is working its way back and has recently brought in the foreground the societal consequences of ICTs more extensively.

2.2.1. Recent Developments

Recent shifts have looked at the socio-technical process of digitalization in emergency context (Ling et al. 2015; Nan and Lu 2014) or political context (Oh et al. 2015; Wattal et al. 2010), specifically to mobilize support or create a whole movement (Bennett and Segerberg 2012; Selander and Jarvenpaa 2016). The 2016 *MIS Quarterly* Special Issue testifies of such emphasis (Majchrzak et al. 2016), and more importantly calls for expanded definition for theory to study societal challenges where IS contribute for better and for worse.

On the brighter side of technology, Andrade and Doolin (2016) studied the government initiative in New Zealand *Computers in Home* and showed how refurbished computer with Internet access and training enabled refugees to take back control over their lives, resettle in a new society and achieving a sense of cultural belonging. Building on the already established positive impact of ICTs on GDP, Ganju et al. (2016) show the existence of the relation with well-being at the country level, but does not explain how or why this proceeds. Empowerment of women in traditional societies is still a societal challenge to which ICTs provide a negotiation space of the power structures if they are part of broader social changes (Oreglia and Srinivasan 2016). ICT as a resource can be leveraged to improve social inclusion and well-being.

ICTs are not only involved in well-being or empowerment, but also life and death. Venkatesh et al. (2016) show the bright side of ICTs in combatting infant mortality as well as the complexity of the problem at hand in the context of rural India. On the opposite, they have shown the dark side of societal influence on the usage of ICTs and in maintaining risky practices: eHealth kiosks use to access information about better infant care practices was strongly hindered by social influence mechanisms. On the dark side of ICTs, Chan et al. (2016) looked at ideologically polarized communities diffusing hate-related content and offline hate crimes. Their study supports the "cyber-balkanization" (Van Alstyne and Brynjolfsson 2005) of the Internet, i.e. the specialization of interests of online groups endangering racial equality and "living-together" in society. They also showed that these communities empower lone-wolf

attacks, but do not provide the mechanisms to explain how such behaviors develop from online interactions. Other evidence comes to support the balkanization hypothesis. Greenwood and Agarwal's (2016) study of Craigslist as a matching platform shows a spread of HIV transmission. Bhuller et al. (2013) have shared similar results studying the relationship between Internet access and sex crimes.

Studying the social implications of ICTs usages have led to some paradoxical effects where positive and negative outcomes coexist. By focusing on ethical considerations of micro-tasks in the context of MTurk platform, Deng et al. (2016) identified technological affordances for workers' empowerment but also technological features leading to marginalization of workers. The empowerment-marginalization duality brings out work transformations enabled by ICTs with classical issues like minimum wage, power asymmetry or governance in a new context but also problems due to the technology such as platform updates. However, left outside of the scope of this study are the societal impacts of this marginalized workforce relying on Internet technology. Such paradoxical conclusions are shared about social media by Miranda et al. (2016), who look at the affordances of social media to be hegemonic or emancipatory of public discourse in the Stop Online Piracy Act (SOPA), and consequently influences legislative agenda one way or the other. Furthermore, when Internet access enables patients to be better informed, it also impacts the physician-patient relationships negatively: patients can become overly concerned by benign symptoms leading to cyberchondria (White and Horvitz 2009). Similarly, when technology is praised for benefits such as flexibility and autonomy, it has also been found to create and heighten stress for individuals (Ayyagari et al. 2011). Furthermore, e-government has been shown to reduce institution and nation-wide corruption but Srivastava and colleagues acknowledge that the relation can be bidirectional. However, they do not provide contextualization of their data collection to begin to explain such conflicting findings. Consequently, paradoxical outcomes of technology usage in all kind of social activities can be a threat to the sustainability society and reinforce divides. Those societal challenges need to be addressed to be able to harvest *the Good* and prevent *the Bad*.

2.2.2. "Technology is society made durable" (Latour 1990)

Because of the paradoxical outcomes, ICTs usages can yield in society a threat to the sustainability of society. Much of the research focus is on socio-cultural divides. Actor-network theory has been used to look at how technology is socially embedded and constructed. Latour's

opening statement is about keeping society as a durable whole. His empirical approach is to consider technology as non-human actants. Considering the Internet users and the artifact to access it are anchored in a context that is carried online is necessary to study the challenges threatening to divide society. And technology is powering velocity, fluidity, continuous flow enabling harmony as well turbulence. Therefore, the social is neither purely agency nor structure but a "circulating entity" (Latour 1999), i.e. both produce local events by their circular relations. Those non-linear dynamics are a common trait of global complexity pushing us to reconsider traditional social divide. The key points of Latour's arguments are developed in the socio-technical exploration of the Kodak camera research. Further than that, Latour moves beyond the dualism between technological infrastructure and societal superstructures to acknowledge the complexity of the social lies in the tensions between society and technology.

Considering society and technology as "phases of the same social action" makes them ontologically related. We thus need to consider explanatory path of change where all the actors co-evolve, society and technology included. Because nor the technology, nor the society can be held constant, social change implies the transformation of social groups. Because nothing can be taken for granted, we cannot expect to always harvest the bright side of technology, nor can we always prevent the bad and ugly to happen. This dynamic relationship between society and technology creates sometimes the conditions for society to benefit from technological infrastructure and sometimes amplifies existing problems if not creating new ones. Because the consequences are paradoxical, predictions are harder to formulate, thus societal challenges are complex problems.

As scientists, the need for our understanding to grasp the underlying phenomenon, has led to fulfill only half of our aim: "The aim of science is to seek the simplest explanations of complex facts. We are apt to fall into the error of thinking that the facts are simple because simplicity is the goal of our quest. The guiding motto in the life of every natural philosopher should be, "Seek simplicity and distrust it." (Whitehead 1920, p.143). We fall short of requirements by failing to distrust simplicity. Numerous thinkers among which Weaver (1948) and Morin and Lemoigne (1999) describe the shortcomings of an old and rigid logic, the shortcomings of simplicity of classical science that has succeeded in answering so plentiful easy questions, while the hardest ones still await.

A methodological implication is the constant alliance of description and explanation: a gap in explanation points out to a lack of description Latour calls for our attention to process of mobilization and engagement of technology in social relationships. This perspective enables

one to see the micro changes in interactions and to tie them up to macro changes observed in society.

2.2.3. Studying Social Complex Problems

What may have started as complicated technological problems reveal themselves to be rather complex social problems: “a complex problem has many diverse parts that adapt and morph into new forms with every attempt to the problem. Finding an optimal solution to a complex problem is not feasible; the parts of the problem interact with each other in nonlinear ways, self-organize, and produce emergent macrolevel behaviors that differ in scale and kind from the microlevel behaviors of the parts.” (Tanriverdi et al. 2010, p.822-23). The Internet has contributed to that complexity by allowing the moving parts to constantly self-organize in new and faster ways. Orlikowski and Robey (1991) highlight the constant role of technology in enabling and inhibiting social action. ICTs enable and inhibit positive and negative social consequences.

For example, Jha et al. (2016) have shown the complexity that an ecosystem aiming at alleviating poverty in India encounters such as the different values and interests of stakeholders and attrition of key nodes of the network. This raises the questions of sustainability and scalability of such technological-enabled ecosystems. Srivastava and colleagues’ (2016) work show the complex nation-wide system of corruption, and the field failing to study it as such, is still relying on exploratory frameworks and missing explanatory mechanisms of the observed consequences. A commonality that emerges from the papers is the need for contextualization (Deng et al. 2016; Srivastava et al. 2016; Venkatesh et al. 2016) that answers a broader call in theorizing (Hong et al. 2013; Johns 2006). Consequently, we face complexity in open social systems.

The societal challenges above that have drawn our attention show how ICTs are pervading our society and interlocked in all kind of social phenomena. Internet has enabled networks in which local information flows faster across boundaries and borders. Globalization has contributed to a flatter world in which social interactions are interdependent such as local interactions spread side-effects far away from the local epicenter (Urry 2005a). The interconnected world has brought organizing as well as disorganizing consequences (Kallinikos 2005), stressing once again the unintended consequences of technology (Kling 1996).

These studies have drawn the connections or at least acknowledged the relations between ICTs usage and societal spillovers, positive or negative. ICTs contribute to the complexity of societal challenges. Such assumption requires answering the process question: "Now we have seen that the descriptions of complex systems can take many forms. In particular, we can have state descriptions or we can have process descriptions: blueprints or recipes." (Simon 1962, p.480). The contrast between blueprints and recipes aims at highlighting the limits of the architectural metaphor: blueprints are considered as given, ignoring phenomena such emergence or improvisation.

To do so, we will adopt a critical realist stance. To harvest the best of the potential in society, we need to study complex social problems as they unfold because complexity in its Latin etymology means to entwine together. We can overcome the over-simplistic online-offline dichotomy by weaving between online and offline, the properties of the parts and the properties of the whole, local and global, even order and disorder. In weaving those necessary and inseparable dimensions, we can understand the one reality we live in.

2.2.4. Harvest *the Good* and prevent *the Bad*: Underlying Ethics

Plato, Spinoza, Locke, Hume are a few references that come to mind when we question the righteous of our actions. The underlying question is the one of societal justice. Plato's ideal society is one where everyone lives harmoniously without worrying about material sufficiency. In this definition, justice is about specialization, i.e. everybody contributes to society. Plato's ethics or Virtue ethics is based on the moral agent rather than consequences. Accordingly, the individual is driven by reason (i.e. thinking abilities), spirit (i.e. emotional ability) and appetite (i.e. desires) that may be in conflict. The balance maintains happiness and healthiness for the individual, but what if it threatens the society described as highly communitarian?

Consequentialists like Mill or Bentham[17] search for the best overall consequences. However, if we must know the outcomes to judge the morality of the action, we are left locked-up waiting, maybe for the worst. Nowadays, we often face the impossibility to predict the consequences. Additionally, utilitarian ethics is more likely to neglect the interests of minority to decide of the course of action with the best overall consequences. Nevertheless, we cannot suppose a priori that smaller components of societal dynamics do not bear larger consequences.

[17] https://plato.stanford.edu/entries/consequentialism/

Those are few limits of philosophical approaches that only partially (1) cover the study of contemporaneous challenging phenomena and (2) address the nature of knowledge that consistently can be produced in this doctoral work.

Consequently, complexity in our world challenges the righteousness of order, progress and meanings. According to Lemoigne (in Morin and Lemoigne 1999), this irreducible complexity calls for a duty of testimony of the events that raise issues for us today. Henceforth, we start from the perceivable and observable consequences on individuals (e.g. disease, loss) *and* society such as costs for the health care systems (Greenwood and Agarwal 2015), or judicial and penitentiary (Chan et al. 2016). The *ethics of complexity* calls for a critical engagement with the nature of our knowledge. Therefore, we adopt a *complex view of ethics* (Woermann and Cilliers 2012):

"There is no science of science, and even the science of science would be insufficient if it did not include epistemological problems. Science is a tumultuous building site, science is a process that could not be programmed in advance, because one can never program what one will find, since the characteristic of a discovery is in its unexpectedness. This uncontrolled process has led today to the development of potentialities of destruction and manipulation, which must bring the introduction into science of a double conscience: a conscience of itself and an ethical conscience" (Morin 2007, p.17).

Starting from consequences enables us to further adopt a situational approach to account for context and specific features of society because predictive approaches have reached their limits. Complexity, thus, covers the hardship in describing, defining and explaining so that we can formulate useful theories that can help policy makers derive solutions.

2.3. Philosophical Underpinnings: Complexity and Critical Realism

Surprising and paradoxical outcomes arise from social organizations because they behave in ways that make predictions tougher (Daft and Lewin 1990). Our models and theories are repeatedly assaulted by the myriad of crises we face, so that scientific practices and assumptions of knowledge are challenged.

Roy Bhaskar provides a meta-framework to understand reality as systemic and complex (Bhaskar 1975; 1998; 2013). Critical realists understand that social reality is complex, and

cannot be fully understood because of the unobservability of certain mechanisms. Bhaskar's premise of open systems implies that any experienced events are caused by a specific combination of elements at a certain time and place. That's why we can provide in-depth explanation but no prediction. The Critical Realist (CR) lens is relevant to address complex social problems.

We adopted Critical Realism because (1) both CR and complexity answers a call for renewal of science, (2) there is a broad shared assumption space between CR & social complexity (SC) that make them compatible, and (3) there is complementary value when a CR perspective is applied to SC because CR offers a 3-strata view of reality, and SC is a process to transition from stratum to stratum.

2.3.1. A paradigmatic renewal

Both CR and SC are responses to shortcomings of the assumptions that have driven science. Critical realism rises against positivism and constructivism by advocating the need for an explicit ontology alongside an epistemology. CR offers an alternative paradigm to the quest of law-like forms of explanations or pure interpretations. This philosophical stance by providing an informed account of science can in turn inform empirical studies.

On the one side, a hallmark of critical realism is the combination of a realist perspective on ontology, a relativist perspective on epistemology and a judgmental rationality (Danermark et al. 2002). Ontological realism refers to stratified and objective existence of the real world. Epistemological relativism relates to our subjective access to reality and therefore, the fallibility of our knowledge. Aligned with this epistemology, soft systems methodology (Checkland 2000) reminds us that we have no access to the world. Therefore, systems thinking is an epistemology because we describe the world as a system. Thus, the role of the observer, the place and time of observation are concurrent parameters of the subjectivity of knowledge. Finally, judgmental rationality "suggests, there are some theoretical and methodological tools we can use in order to discriminate among theories regarding their ability to inform us about external reality." (Danermark et al. 2002, p. 10). Consequently, our knowledge is always conceptually mediated and to some degree close to the truth. Being able to understand social phenomena as researcher involves the interpretation process of subjects and researchers

involved in data collection and analysis. In social sciences, individuals actively shape and are shaped by the social structures of their own social world (Archer 1995; Danermark et al. 2002).

On the other side, complexity thinking suffered from absolute reject from "classical science" (Morin 2014) based on three principles: universal determinism, reductionism and disjunction. Universal determinism assumes that any process is reversible making predictions possible. Removing time and making nature a spotless order removes the confusion and struggles of handling complexity. The second thermodynamic principle rattles grounding principles of classical science in the 19th century by introducing irreversibility. Reductionism assumes that you can know the whole by studying its parts. Disjunction is an investigation principle that assumes the isolation of the object under study into basic parts to be studied by specific disciplines, removing each part from its systemic context. Isolating parts and the study of them by discipline denies complexity *per se* as we previously discussed its etymology (i.e. woven together). Consequently, the holistic approach argues against studying the whole by only studying the parts and specialized studies taking one discipline perspective.

Ideas that cover unpredictability and disorder like chaos (Thietart and Forgues 1995) make the pillars of classical science vulnerable to attacks. Systems science (Boulding 1956) and cybernetics (Von Foerster 2003) quickly open up the breach. The problems of "organized complexity" (Weaver 1948) describe complex systems that are made of complexity and produce complexity. Complexity makes then a first appearance to talk about complex systems, but is still limited, not reconsidering the nature of knowledge. Looking at complex systems has been an approach. However, rather than a single theory, complexity covers a range of concepts that constitute a loosely-coupled research framework or as Nigel Thrift (1999) put it "Complexity theory is an economy of concepts" (p.34). Physics, computer science, mathematics, biology are fields that contributed to the theorization of complexity and their application in organizational research has offered many more interpretations. That's why we see different views of complexity proliferating (Cilliers 2005). Mostly, one path strictly mathematical in a positivist tradition calls for quantitative approach (That is the approach of the Santa Fe Institute) and another path offering a more critical view that we follow: "This view argues that complexity theory does not provide us with exact tools to solve our complex problems, but shows us (in a rigorous way) exactly why these problems are so difficult" (Cilliers 2005, p.257). This second view considers qualitative approach. Instead of considering the number of parts interacting, this view looks at the nature of interactions (Human 2016).

To add to the struggle of navigating complexity, IS research is an interdisciplinary endeavor. Therefore, a variety of approaches, perspectives and concepts are mobilized to study the web of socio-technical elements and their consequences.

Furthermore, complexity thinking went through further developments (Journé et al. 2012) due to environmental challenges questioning the state of our knowledge of organizational entities. Cohen (1999) describes three contemporary trends sustaining the interest in complex systems. Dramatic changes such as globalization have put pressures on organizational entities to become more adaptable and responsive to these changes. The information revolution enabled by technological advances has led to collect and transmit data from anywhere faster to learn to better adapt. Finally, the unstable nature of organizational entities has led to the growth of temporary organizations and the fluidity of its boundaries.

Multiple appearances of complexity in special issues have certainly given incentives to pay more attention to the complexity surrounding us. *Organization Science* (Anderson et al. 1999), *Theory, Culture and Society* (Urry 2005b), *Communications of the ACM* (Desai 2005), *Information Technology and People* (Jacucci et al. 2006) have opened the conversation and tested some ideas to sharpen our use of complexity in answering new questions. Authors like Morin (Morin 2014; Morin and Lemoigne 1999) have advocated for a complexity paradigm as the one on which stood classical science as another step to advance complexity thinking.
Facing constant simplification of complex situations, authors call for change in strategies to conceptualize and understand complexity. Our three studies take "The Complexity Turn" (Urry 2005b), i.e. embrace an approach "that combines system *and* process thinking" (p.3, original emphasis) to investigate emergent and self-organizing systems that profoundly affect the outcomes of a sequence of events. Complexity thinking means thinking in terms of both because systemic thinking implies relationships, patterns and context and process thinking implies the continuous flow of energy and information (Capra 2005). Thus, complexity offers a network of relationships between processes in a specific context.

Both critical realism and complexity embrace the view of organizational entities as dynamic, acknowledging the uncertainty of initial conditions and the possibility to reach a (quasi)equilibrium. Researchers have thus aimed at capturing the sequence of events and uncovering the generative mechanisms to explain how changes happen and affect organizational systems.

2.3.2. Broadly shared assumption space

Complexity is often the first quality associated with systems (Simon 1962 ; Morin 2014). Systems are considered complex because they have many parts and many connections between parts and still represent a whole ensemble despite the diversity of its parts. To these dimensions of system complexity, Morin adds the logical complexity of systems: a system is **both** *more* and *less* the sum of its parts. Following Aristotle's principle," the whole is more than the sum of its parts" because some properties of the system cannot be found in its parts. That illustrates the principle of emergence in the organizing capability of the system. Simultaneously, the system is less than the sum of its parts because the system exerts constraints on the behavior of its parts. This is especially true in the case of social systems where social rules and laws are at play as well as inhibitions.

CR incorporates systemic and holistic values of complexity implicitly in the early work of Bhaskar (Bhaskar 2013) or more explicitly in its later work (Bhaskar 2008). Moreover, complexity directly pinpoints to the limits of our knowledge, calling for reductionism to make reality intelligible. Even though a system cannot be precisely identified from its environment because of its openness, the boundaries are a matter of choice of the observer, and thus products of our descriptions. Consequently, referring to the interpretative nature of knowledge, complexity and critical realism share the same epistemology.

We summarize common ontological and epistemological assumptions between complexity and critical realism:

- *Emergence* goes along with a stratified ontology and retroductive methodology (Bhaskar 2013) and thus is an "irreducible feature of our world". "The whole is more than the sum of the parts" i.e. we cannot reduce the behaviors of events to the nature of its parts such as the system has distinct properties from their parts. Both complexity developed in systems thinking and critical realism stand against reductionism in science. The emergent behavior of components interacting components capture the impossibility to predict from our knowledge of individual components.
- *Order and Structure:* Complexity theory assumes some degree (even very weak) order and underlying structure, otherwise events unfold from randomness. In parallel, critical realism assumes the existence of enduring generative mechanisms (which are the Real) that might be unobservable, unexperienced because not perceptible or not activated but

they do exist. That's one reason also why prediction is not a fruitful avenue. Those mechanisms generate events in the empirical realm that may change the system (or entities and structures) that is why process should not be thought apart: "the study of *process* where structure meets events; that is in the study of the mode of becoming, bestaying and begoing of a structure or thing. (…) Process is not an ontological category apart from structure and event" (Bhaskar 2009, p.145 original emphasis). Social order is problematized through all layer of society, not as clear-cut processes, but rather processes that enable maintenance, adaptation and resilience.

- *Contingency* goes along with the transitive nature of our knowledge of things and intransitive nature of mechanisms we intend to uncover. The environment of a considered social system is composed of other social systems, better described as a nesting of systems. Social systems are paradoxically considered as self-organizing systems (Von Foerster 2003), despite their need for energy or information. This paradox describes the interplay of external and internal knowledge: how the environment is organized to organize the self. While it can be understood as dependence relationship contradicting the autonomy of a system, it can rather be understood as operational closure and interactional openness (Luhmann 2012; Moeller 2006), ontological property of complex systems.
- *Non-linear interactions:* Complexity theory assumes non-linear dynamic systems which makes prediction not practical. In parallel, critical realism advocates explanation rather than prediction. Social systems dynamics and pattern of organization are non-linear because they are informationally open, are far from equilibrium but do not fall into chaos because of the continuous flow of resources, are operationally close and autopoietic (Capra 2005; Luhmann 2012). Non-linear interactions thus describe the unfolding of events with dramatic or disproportionate outcomes: small causes can have great effects and great causes can have small effects.
- *Recursivity* goes along with the contingency assumption. Complexity implies a continuous flow of changes i.e., a recursive process: if one element evolves, it changes or strengthens the whole. Whether the feedback is positive or negative, it implies a process approach. Recursivity applies also in our inquiry for knowledge of complex systems: our knowledge is context-dependent and thus we cannot know completely a complex system.

2.3.3. Complementarity towards our goal

Critical Realism guided our approach to social phenomena, especially the stratification of reality. The world is defined by three strata: events as experienced *(the empirical)*, events as they happen (or not) (*the actual)* and mechanisms leading to the events *(the real)*. Therefore, causal complexity can be defined as the process enabling to move from the real to the actual, where causal tendencies generate perceivable effects or not. Similarly, the overlap between the actual and the empirical requires sensemaking process to explain how we experience (or not) events.

Based on this structure of reality and the lack of processual understanding across the strata, we delve deeper into the strata in our first study to provide analytical guidance to face complexity in our data.

Complex social problems are time-sensitive processes; the relations between its constituents develop over time. Open system as proposed by Bertalanfly (1950) constitute a dynamic equilibrium, described as continuous importing and exporting relations with its environment. This assumption was sustained by systems thinkers like to move away from Parsons' functionalism and transition towards a processual description of systems. That's why, in the following doctoral work, we solely focus on processual approach. We develop three processual answers to societal challenges by focusing on the process of organizing underlying observed social complex problems and by questioning our own social construction of society.

In our second study, we explore Bhaskar's later conceptualization of emergence: "In emergence, generally, new beings (entities, structures, totalities, concepts) are generated out of preexisting material from which they could have been neither induced nor deduced. (…) This is matter as creative, autopoietic." (Bhaskar 2008, p.46). Our approach looks at community emergence from online to offline as well as associated societal consequences. In this doctoral work, we adopt a critical realist philosophy that we use as explicit or implicit device to develop the arguments of our studies.

By adopting CR view of SC, we are in a unique position to explore processually the different strata of reality.

2.4. Overview of the three studies

Society is the largest social system and the integral element is cooperation as individuals engage in communications (Frank and Fahrbach 1999). Consequently, two defining characteristics of organizing processes are interactions and behaviors induced by those

interactions. Communications is then the most critical process maintaining the system and avoiding chaos. "**Society is clearly an extreme case in the field covered by the concept of complexity**. It is extreme not because it is more complex than other systems (such as brains), but because the nature of its elementary operations, namely, communications, places considerable constraints on it. It is indeed astonishing that and how highly complex systems can be formed through operations of this type. For communication is extremely narrow-gauged and must rely on sequencing for interconnection. It hence requires a great deal of time, which always threatens it with deterioration" (Luhmann 2012, p.81 emphasis added).

That's why, to address this complexity in societal phenomena, our work proceeds along three main lines of action constantly criss-crossing between online and offline realms. Those criss-crossing realms are complex systems due to their interconnections. Such complexity thinking enables to bring out how unexpected and irreversible spatio-temporal phenomena are rarely organized in co-presence in one societal context but rather by "informational and mediated power" (Urry 2002).

First, we get into the details of the representation of complexity in meaning by decomposing our analysis of communications. Social systems are interpretative systems (Weick 1995): from internal representations of its environment, the system interprets and enacts the complexity in its environment. The interactions within the social systems are primarily informational (Boisot and Child 1999).

Second, we focus specifically on communications as the operation to organize a social system autopoietic process. This process develops its structural complexity. The specific focus on communications in a situated context illustrates the processes leading to an emergent structure.

Third, we aim specific attention at the behaviors resulting from offline and online interactions leading to negative spillovers. This work ties up local interactions with far-reaching implications by considering the concurrent progress of online and offline interactions.

In the following, we summarize the three studies composing this dissertation work into an introductory comparative table (Table 2). Then, we develop an introduction to each study by presenting each element structuring the research.

2.4.1. Introductory Table

	Study 1	Study 2	Study 3
Nature of the Study	Methodological	Empirical	Conceptual
Problematic Situation	Socio-technical phenomena are complex and overflow offline with their wonders and dreadful consequences. Content, form and meaning complexity nested in social media data are a struggle to unleash the potential of qualitative data in deriving meaningful insights.	Online communities overflow out of the online space in political and emergency contexts by leveraging social media. There is a pressing need for understanding because business and society are challenged.	Online interactions produce offline consequences and vice-versa. Most studies are variance models stablishing the impact of Internet on Society. Those insights are too deterministic and do not address the complexity of the phenomenon, including the influence of society on online interactions.
Research Objectives	Address representational complexity in social media	Explain how an Open Online Community (OOC) that started online can materialize itself in a physical setting	Explain: - How online interactions escalate commitment to a concealable stigmatized identity - How this escalation process produces negative spillovers
Concepts	Sensemaking, coding, abduction, rigor-relevance	Collective action, open online community, autopoiesis	Negative spillovers, concealable stigmatized identity, dissonance
Conceptual Framework	Semiotics	Luhmann Systems Theory	Escalation of commitment to a costly course of action
Approach	Process Model with semiotic analytical guidelines	In-depth single Case study Process Model theorizing	Process Model
Online-offline contextualization	Behavioral traces of offline phenomena can be found in online communications. We can achieve deeper explanations only by integrating media and content, researcher and subjects in our analysis	OOC are autonomous systems that self-produce (autopoiesis) the elements and self-select (self-organization) the elements and their relationships to maintain and renew the community. Specific features of Facebook lent themselves to scaling up social movements.	Identity is a resource and a driver of behavior. Mainstream society creates fear of social penalty about one's identity. Cognitive dissonance drives the commitment escalation.

Table 2: Introductory Table

2.4.2. Study 1 – Using Semiotics to analyze representational complexity in social media

"we could produce bottles but we could not understand the wine" (Stamper 1996, p.349)

Problematic situation: This first Study addresses a well-known challenge from qualitative researchers that has only been heightened by technological advances. Paradoxically, it is also the strength of qualitative research (Miles et al. 2014; Myers 2013). However, the richness of data is characterized by its complexity. It can be as overwhelming as disruptive. And the methodological literature remains silent on the specific challenges of IS qualitative researchers. Most researchers adapt methods we already use to another context. Social media play an important role in adding complexity. Most of the research using social media data use quantitative analyses, which undoubtedly derive useful insights but is limited in the depth of theoretical explanations, where qualitative research usually jumps in. Social media data offer a tremendous potential for research, but as fruitful this avenue seems, the benefits are not easy to harvest. Social media data are multimedia: texts, photographs, videos, external links that refer you to more contents. Moreover, social media capture social interactions: people can react, comment, share any of those contents asynchronously or synchronously, making the content itself dynamic. We are not facing simple data, if there any simple. Rather, we are facing communications and we need to analyze them as such.

Research objectives: This research aims at addressing the *representational complexity* of social media data, i.e. the multimedia media nature of data coupled with multiple layers of meanings. Building on our experience with social media data and providing the reader with an example, we developed analytical guidelines based on semiotics (Chandler 2001; Eco 1976; Mingers and Willcocks 2017; Stamper 1991) and critical realism.

Concepts and Conceptual Framework: This work attempts to build a mutual contribution between semiotics and critical realism. We formulate an analytical tool and not a method. The experience of data is a subjective experience and both subjects and researcher go through a sensemaking process. Semiotics provides a framework to account for both sensemaking processes. We address it methodologically by offering a coding scheme and by describing the inference mode (i.e. abductions). This study hopes also to contribute to the discussion about challenges in IS qualitative research to advance its development and impact.

Approach: To do so, we turned back to the roots of our field (Baskerville 2010; Grover and Lyytinen 2015) by leveraging semiotics. Semiotics, the study of signs presents to compelling argument to address the online-offline interplay. First, it enables us to address the content of data no matter its nature through four dimensions: pragmatics, semantics, syntactics and empirics. Second, it ties up the physical existence of communications (i.e. experience of signs composing the communications) to its social effects. Furthermore, the critical realism is consistent with such approach on two dimensions. First, the stratified nature of the real world is accessible through retroduction or abductions starting from the empirical level to derive the generative mechanisms underlying observed effects. Second, epistemologically, the role of the observer is acknowledged and integrated in our guideline by providing guidelines to decipher subjects' researcher's analytical commitment. This toolkit can be "plugged in" different methodologies (e.g. case study, ethnography, etc.).

Online-offline contextualization: The growing Internet-based studies have seen methodological guidelines emerge to harness the power of the internet. We have seen netnography (Kozinets 2001), for example as an approach to the cultures of cyberspace. However, the challenge is in the interplay between online and offline. Another challenge for the IS field is the study of social phenomena that spans the conceptual online/offline boundary. The Internet can enable online communities that open-source the cure for cancer[18] or spread HIV (Greenwood and Agarwal 2015), empower social movements (Castells 2015) or empower polarized communities and lone wolves to commit racial hate crimes (Chan et al. 2016). Those offline behaviors leave behaviorial traces online. As researchers, we need to connect the dots to provide important and compelling contributions to IS and society.

2.4.3. Study 2 – Transdigital: How online communities transform from online to physical

"We use Facebook to schedule the protests, Twitter to coordinate, and YouTube to tell the world. #egypt #jan25" (Tweeted on 18/03/2011)

Problematic Situation: In the aftermath of the Arab Spring, we have heard Cyber-utopian explanations erecting the "Facebook Revolution" or the "Revolution 2.0" as well as Cyber-

[18] https://www.ncbi.nlm.nih.gov/pubmed/27442192

skeptics strongly advocating for external factors explanations, reminding us the duress and economic struggles people live under. So, the question remains: Did social media -and Facebook for this study- play a role, if any?

If the IS community agrees that ICTs have enabled new ways to think and enact collective action, most of the research has focused on the production of the information artifact in discussion spaces. These studies assume that produced goods and services bring changes, leaving out opportunities to study communities as embodying change itself. These communities overflow out of the online space in political and emergency contexts by leveraging social media. There is a pressing need for understanding because business and society are challenged.

Research Objective: When we zoom in the Open Online Communities (OOC) literature, the fluidity and openness has mostly focused on knowledge sharing. Size of the community and communication have been shown critical for the community sustainability.

When we zoom in the Collective Action literature, we found either/or explanations: either macro and external factors or micro and internal dynamics explanations. We see the literature transitioning by observing membership breakdown in conventional organizations (like Social Movement Organizations - SMOs) and observing mass protests that operate through highly personalized and technologically-mediated communications.

Therefore, we observe fluidity from the cyberspace to the urban space and from conventional organizations to informal and emergent organizing processes.

However, "no revolution can happen without involving society on a wider scale. Even efforts within cyberspaces are fruitless unless they can be extended into real social political and economic spaces" (Lim 2003, p.274). Moreover, to be able to incarnate social change, a wider society than the online community needs to engage in the cause.

Therefore, our research question: *How an Open Online Communities (OOC) that started online can manifest itself in a physical setting?*

Conceptual Framework: To address that question, we turn to the Germans for answers and in particular Luhmann System Theory (LST). A systemic approach addresses the one-sided explanation of collective action literature by looking at both external stimuli and internal dynamics of the system to explain social phenomena. From Luhmann's work (1986; 2012; 2013), we rely on three core concepts. First, from biology "autopoiesis" entails a process of self-production of elements, structures and boundaries needed to maintain or renew the system

(i.e. communications for social systems). In this process, each component participates in the production and transformation of others. Second, self-organization entails the self-selection of elements and relations between them. Thirdly, the system is autonomous: it is an iterative process between autopoiesis and self-organization that maintains or renews the system.

Approach: Empirically, we conducted an in-depth critical realist case study. We collected secondary data from Facebook for two reasons: the first call for protest was found on Facebook and Facebook was the most common source of information after face-to-face communication. Consistent with LST and critical realism, we treated communications as the emergent layer of social world and proceeded to a semiotic data analysis (Stamper 1991) applying the toolkit developed in the first Study. We first used temporal bracketing strategy (Langley 1999) to distinguish structuring period and analyze structuring and sensemaking processes. Bracketing "enables the explicit examination of how actions of one period lead to changes in the context that will affect action in subsequent periods" (Langley 1999, p.703). We started from the data with iterations between data and theory and triangulation with literature, news articles and reports.

Online-offline contextualization: We looked specifically at the role of social media in the process transforming an online community to a physical one (we will call it transdigitalization process). Both spheres are not only a reflection of each other but also an extension as they create, recreate and become each other. We explain that by the autopoietic process.

2.4.4. Study 3 – An Identity-driven escalation of commitment to negative spillovers

"*Because the Internet makes it easier to find like-minded individuals, it can facilitate the creation and strength of fringe communities that have a common ideology but are dispersed geographically"* (Van Alstyne and Brynjolfsson 2005, p.852)

Problematic Situation: The Internet has expanded the range of interactions that we can have by overcoming geographic boundaries. However, filtering capabilities has also enabled easier and larger access to like-minded people and thus, facilitated access to polarized communities (Van Alstyne and Brynjolfsson 2005). The digital interactions become problematic when they overflow out of the online spaces: spread of HIV (Greenwood and Agarwal 2015), racial hate crimes (Chan et al. 2016) or sex crimes (Bhuller et al. 2013) are some example. These studies

provide variance explanations and supporting evidence for the darker aspects of connectivity on society.

Research Objective: The third Study in this doctoral work looks also at societal consequences. Nevertheless, this time not by physical embodiment of social change by a community but rather, negative spillovers of online interactions. Our research aims at explaining how online interactions lead to negative spillovers. We take a reversed stance by looking at not only the impact of Internet in society but also the role society plays in favoring certain kinds of online interactions.

Concepts: The studies we based our conceptual work on, offer hints at "how" explanation but those are usually out of the scope of the study and remain underdeveloped. We follow one of these hints and explore it to offer a tentative explanation of negative spillovers: identity. Specifically, we look at concealable stigmatized identity (Goffman 1963), i.e. devalued identity that are not visible and may not face overt discrimination but fear social penalty if it comes to light. Society puts them in cognitive dissonance due to forced compliance (Festinger 1957). The online context offers them the safe space to explore the publicly repressed aspects of self and to look for like-minded individuals.

Conceptual Framework: A core assumption in our work is that the online community provide the mechanisms of escalation of commitment (Staw 1976) instead of reducing the cognitive dissonance, which leads to offline behaviors with negative spillovers. One key statement in escalation theory is the commitment of resources. IS literature has mostly focused on money as a resource committed in escalating commitment, especially in project management. However, early formulation of the theory (Brockner et al. 1986) includes identity as a resource committed. Somehow, this aspect remains unexplored. In this Study, identity is the key resource committed to the escalation process.

Approach: Therefore, we formulate a process model that looks at the influence of the wider-society in parallel of interactions in online communities and how they evolve concurrently over time.

Online-Offline Contextualization: We look at society as a wider social group and its co-influence with narrower online social groups in the process leading individuals to behave such

as society suffers social and economic costs of negative spillovers. We offer a dual explanation, where society shapes online interactions and is shaped by it.

2.5. References

Anderson, P., Meyer, A., Eisenhardt, K., Carley, K., and Pettigrew, A. 1999. "Introduction to the special issue: Applications of complexity theory to organization science," *Organization Science* (10:3), pp 233-236.

Andrade, A. D., and Doolin, B. 2016. "Information and communication technology and the social inclusion of refugees," *MIS Quarterly* (40:2), pp 405-416.

Archer, M. S. 1995. *Realist social theory: The morphogenetic approach*, Cambridge University Press: Cambridge.

Ayyagari, R., Grover, V., and Purvis, R. 2011. "Technostress: technological antecedents and implications," *MIS Quarterly* (35:4), pp 831-858.

Barley, S. R. 1983. "Semiotics and the Study of Occupational and Organizational Cultures," *Administrative Science Quarterly* (28:3), pp 393-413.

Baskerville, R. L. 2010. "Knowledge lost and found: A commentary on Allen Lee's 'retrospect and prospect'," *Journal of Information Technology* (25:4), pp 350-351.

Bennett, W. L., and Segerberg, A. 2011. "Digital media and the personalization of collective action: Social technology and the organization of protests against the global economic crisis," *Information, Communication & Society* (14:6), pp 770-799.

Bennett, W. L., and Segerberg, A. 2012. "The logic of connective action: Digital media and the personalization of contentious politics," *Information, Communication & Society* (15:5), pp 739-768.

Benson, J. K. 1977. "Organizations: A Dialectical View," *Administrative Science Quarterly* (22:1), pp. 1-21

Berger, A. A. 2004. "Semiotic analysis," in *Media analysis techniques*, Sage Publications Inc.: Thousand Oaks, United States.

Bhaskar, R. 2009. *Scientific realism and human emancipation*, (2nd ed.) Routledge: USA and Canada.

Bhaskar, R. 2013. *A realist theory of science*, (2nd ed.) Routledge Taylor and Francis Group: Lo(22:1), pp 1-21.

Bhaskar, R. 1975. "Forms of realism," *Philosophica* (15:1).

Bhaskar, R. 1998. *The possibility of naturalism: A philosophical critique of the contemporary human sciences*, (3rd ed.) Routledge: London and New York.

Bhaskar, R. 2008. *Dialectic: The pulse of freedom*, (2nd ed.) Routledge: London and New York.

Bhuller, M., Havnes, T., Leuven, E., and Mogstad, M. 2013. "Broadband Internet: An Information Superhighway to Sex Crime?," *The Review of Economic Studies* (80:4), pp 1237-1266.

Boisot, M., and Child, J. 1999. "Organizations as adaptive systems in complex environments: The case of China," *Organization Science* (10:3), pp 237-252.

Boulding, K. E. 1955. "Notes on the information concept," *Exploration* (6), pp 103-112.

Boulding, K. E. 1956. "General Systems Theory-The Skeleton of Science," *Management Science* (2:3), pp 197-208.

Braa, J., Hanseth, O., Heywood, A., Mohammed, W., and Shaw, V. 2007. "Developing health information systems in developing countries: the flexible standards strategy," *MIS Quarterly* (31:2), pp 381-402.

Brannen, M. Y. 2004. "When Mickey Loses Face: Recontextualization, Semantic Fit, and the Semiotics of Foreignness," *The Academy of Management Review* (29:4), pp 593-616.
Brockner, J., Houser, R., Birnbaum, G., Lloyd, K., Deitcher, J., Nathanson, S., and Rubin, J. Z. 1986. "Escalation of commitment to an ineffective course of action: The effect of feedback having negative implications for self-identity," *Administrative Science Quarterly* (31:1), pp 109-126.
Butler, B. S. 2001. "Membership size, communication activity, and sustainability: A resource-based model of online social structures," *Information Systems Research* (12:4), pp 346-362.
Capra, F. 2005. "Complexity and life," *Theory, Culture & Society* (22:5), pp 33-44.
Castells, M. 2011. *The rise of the network society: The information age: Economy, society, and culture*, (2nd ed.) John Wiley & Sons.
Castells, M. 2015. *Networks of outrage and hope: Social movements in the Internet age*, (2nd ed.) Polity Press: UK.
Cebrian, M., Rahwan, I., and Pentland, A. S. 2016. "Beyond viral," *Communications of the ACM* (59:4), pp 36-39.
Chan, J., and Ghose, A. 2014. "Internet's dirty secret: assessing the impact of online intermediaries on HIV transmission," *MIS Quarterly* (38:4), pp 955-976.
Chan, J., Ghose, A., and Seamans, R. 2016. "The Internet and Racial Hate Crime: Offline Spillovers from Online Access," *MIS Quarterly* (40:2), pp 381-403.
Chandler, D. 2001. *Semiotics: the basics*, (Routledge).
Checkland, P. 2000. "Soft systems methodology: a thirty year retrospective," *Systems Research and Behavioral Science* (17:1), pp 11-58.
Chesters, G., and Welsh, I. 2005. "Complexity and Social Movement(s)," *Theory, Culture & Society* (22:5), pp 187-211.
Cilliers, P. 2005. "Complexity, deconstruction and relativism," *Theory, Culture & Society* (22:5), pp 255-267.
Cohen, M. 1999. "Commentary on the Organization Science special issue on complexity," *Organization Science* (10:3), pp 373-376.
Daft, R. L., and Lewin, A. Y. 1990. "Can organization studies begin to break out of the normal science straitjacket? An editorial essay," *Organization Science* (1:1), pp 1-9.
Danermark, B., Ekstrom, M., and Jakobsen, L. 2002. *Explaining Society: an introduction to critical realism in the social sciences*, Routledge Taylor and Francis Group: London and New York.
De Vaujany, F.-X. 2008. "Capturing reflexivity modes in IS: A critical realist approach," *Information and Organization* (18:1), pp 51-72.
Deely, J. N. 1990. *Basics of semiotics*, Indiana University Press: Bloomington & Indianapolis.
Deng, X. N., Joshi, K. D., and Galliers, R. D. 2016. "The Duality of Empowerment and Marginalization in Microtask Crowdsourcing: Giving Voice to the Less Powerful Through Value Sensitive Design " *MIS Quarterly* (40:2), pp 279-302.
Desai, A. 2005. "Adaptive complex enterprises," *Communications of the ACM* (48:5).
Dewey, J. 1916. *Democracy and Education: An Introduction to Philosophy of Education*, (1st ed.) Macmillan: New York.
Doyle, A. C. 2013. *Sherlock Holmes: The complete novels and stories - Volume 1*, Barnes and Nobles Classics: New Yorks.
Dubai-School-of-Government 2011. "Civil Movements: The Impact of Facebook and Twitter," *Arab Social Media Report* (1:2), pp 1-30.
Dunn, A. 2011. "Unplugging a nation: State media strategy during Egypt's January 25 uprising," *Fletcher Forum of World Affairs* (35:2), pp 15-24.
Eco, U. 1976. *A theory of semiotics*, (1976 ed.) Indiana University Press: Bloomington.

Eco, U. 1979. *The role of the reader: Explorations in the semiotics of texts*, (1984 ed.) Indiana University Press: Bloomington.
Eco, U. 1983. "Horns, hooves, insteps: Some hypotheses on three types of abduction," in *The Sign of Three: Dupin, Holmes, Peirce*, U. Eco and T. A. Sebeok (eds.), Indiana University Press: Bloomington, pp. 198-220.
Eco, U., and Sebeok, T. A. 1983. *The Sign of Three: Dupin, Holmes, Peirce*, (Indiana University Press Bloomington.
Festinger, L. 1957. *A Theory of Cognitive Dissonance*, (1962 ed.) Row, Peterson & Co: New York.
Frank, K. A., and Fahrbach, K. 1999. "Organization culture as a complex system: Balance and information in models of influence and selection," *Organization Science* (10:3), pp 253-277.
Ganju, K. K., Pavlou, P. A., and Banker, R. D. 2016. "Does Information and Communication Technology Lead to the Well-Being of Nations? A Country-Level Empirical Investigation," *MIS Quarterly* (40:2), pp 417-430.
Ghonim, W. 2012. *Revolution 2.0: The Power of the People is Greater than the People in Power: A Memoir*, (1st ed.) Houghton Mifflin Harcourt.
Gladwell, M. 2010. "Small Change: Why the revolution will not be tweeted," *The New Yorker, available at https://www.newyorker.com/magazine/2010/10/04/small-change-malcolm-gladwell*
Glaser, J., Dixit, J., and Green, D. P. 2002. "Studying Hate Crime with the Internet: What Makes Racists Advocate Racial Violence?," *Journal of Social Issues* (58:1), pp 177-193.
Goffman, E. 1963. *Stigma: Notes on the Management of Spoiled Identity*, (1st ed.) Prentice-Hall, Inc.: Englewood Cliffs, N.J.
Granovetter, M. 1985. "Economic action and social structure: The problem of embeddedness," *American journal of sociology* (91:3), pp 481-510.
Granovetter, M. S. 1973. "The Strength of Weak Ties," *American Journal of Sociology* (78:6), pp 1360-1380.
Greenwood, B., and Agarwal, R. 2015. "Two Sided Platforms and HIV Incidence among the Digitally Disadvantaged," *Management Science* (62:8), pp 2281-2303.
Greenwood, B. N., and Agarwal, R. 2016. "Matching Platforms and HIV Incidence: An Empirical Investigation of Race, Gender, and Socioeconomic Status," *Management Science* (62:8), pp 2281 - 2303.
Grover, V., and Lyytinen, K. 2015. "New State of Play in Information Systems Research: The Push to the Edges," *MIS Quarterly* (39:2), pp 271-296.
Hackley, C. 2003. *Doing research projects in marketing, management and consumer research*, (1st ed.) Routledge: London and New York.
Halverson, J. R., Ruston, S. W., and Trethewey, A. 2013. "Mediated Martyrs of the Arab Spring: New Media, Civil Religion, and Narrative in Tunisia and Egypt," *Journal of Communication* (63:2), pp 312-332.
Hodge, R., and Kress, G. R. 1988. *Social semiotics*, (First ed.) Cornell University Press.
Hong, W., Chan, F. K., Thong, J. Y., Chasalow, L. C., and Dhillon, G. 2013. "A framework and guidelines for context-specific theorizing in information systems research," *Information Systems Research* (25:1), pp 111-136.
Human, O. 2016. "Complexity: E-Special Introduction," *Theory, Culture & Society* (33:7-8), pp 421-440.
Jacucci, E., Hanseth, O., and Lyytinen, K. 2006. "Introduction: Taking complexity seriously in IS research," *Information Technology & People* (19:1), pp 5-11.

Jha, S. K., Pinsonneault, A., and Dubé, L. 2016. "The Evolution of an ICT Platform-Enabled Ecosystem for Poverty Alleviation: The Case of eKutir," *MIS Quarterly* (40:2), pp 431-445.
Johns, G. 2006. "The essential impact of context on organizational behavior," *Academy of Management Review* (31:2), pp 386-408.
Journé, B., Grimand, A. & Garreau, L. 2012. "Face à la complexité. Illusions, audaces, humilité,". *Revue française de gestion*, (223:4), pp.15-25.
Kallinikos, J. 2005. "The order of technology: Complexity and control in a connected world," *Information and Organization* (15:3), pp 185-202.
Klein, H. K., and Myers, M. D. 1999. "A set of principles for conducting and evaluating interpretive field studies in information systems," *MIS Quarterly* (23:1), pp 67-93.
Kling, R. 1996. *Computerization and controversy: value conflicts and social choices*, Morgan Kaufmann.
Kozinets, R. V. 2001. "Utopian enterprise: Articulating the meanings of Star Trek's culture of consumption," *Journal of consumer research* (28:1), pp 67-88.
Langley, A. 1999. "Strategies for Theorizing from Process Data," *Academy of Management Review* (24:4), pp 691-710.
Latour, B. 1990. "Technology is society made durable," *The Sociological Review* (38:S1), pp 103-131.
Latour, B. 1999. "On recalling ANT," *The Sociological Review* (47:S1), pp 15-25.
Levy, S. J. 1959. "Symbols for sale," *Harvard business review* (37:4), pp 117-124.
Liebenau, J., and Backhouse, J. 1990. *Understanding Information: an Introduction*, (1st ed.) Palgrave Macmillan: Basingstoke and London.
Lim, M. 2003. "The Internet, social networks, and reform in Indonesia," in *Contesting Media Power: Towards a Global Comparative Perspective*, N. Couldry and J. Curran (eds.), Rowman & Littlefield Publishers: USA, pp. 273-288.
Ling, C. L. M., Pan, S. L., Ractham, P., and Kaewkitipong, L. 2015. "ICT-Enabled Community Empowerment in Crisis Response: Social Media in Thailand Flooding 2011," *Journal of the Association for Information Systems* (16:3), pp 174-212.
Locke, J. 1690/1959. *An Essay Concerning Human Understanding* (unabridged ed.) Dover: New York.
Lowry, P. B., Zhang, J., Wang, C., and Siponen, M. 2016. "Why Do Adults Engage in Cyberbullying on Social Media? An Integration of Online Disinhibition and Deindividuation Effects with the Social Structure and Social Learning Model," *Information Systems Research* (27:4), pp 962-986.
Luhmann, N. 1986. "The autopoiesis of social systems," in *Sociocybernetic paradoxes*, G. F. and v. d. Z. J. (eds.), Sage: London, pp. 172-192.
Luhmann, N. 1995. *Social Systems*, Stanford University Press: Stanford, California.
Luhmann, N. 2012. *Theory of Society, Volume 1*, Stanford University Press: Stanford, California.
Luhmann, N. 2013. *Introduction to Systems Theory*, (English ed.) Polity Press: Cambribge, United Kingdom.
Majchrzak, A., Markus, M. L., and Wareham, J. 2016. "Designing for Digital Transformation: Lessons for Information Systems Research from the Study Of ICT and Societal Challenges," *MIS Quarterly* (40:2), pp 267-277.
Maturana, H. R., and Varela, F. J. 1987. *The tree of knowledge: The biological roots of human understanding*, New Science Library/Shambhala Publications.
McCarthy, J. E. 1984. "Semiotic Idealism," *Transactions of the Charles S. Peirce Society* (20:4), pp 395-433.

Mick, D. G., and Oswald, L. R. 2006. "The semiotic paradigm on meaning in the marketplace," in *Handbook of qualitative research methods in marketing*, R. W. Belk (ed.), Edward Elgar Publishing Limited: Cheltenham, UK • Northampton, MA, USA, pp. 31-45.
Miles, M. B., Huberman, A. M., and Saldana, J. 2014. *Qualitative Data Analysis: A Methods Sourcebook*, (3rd ed.) SAGE Publications.
Milgram, P., and Kishino, F. 1994. "A taxonomy of mixed reality visual displays," *IEICE TRANSACTIONS on Information and Systems* (77:12), pp 1321-1329.
Mingers, J. 2001. "Combining IS research methods: towards a pluralist methodology," *Information Systems Research* (12:3), pp 240-259.
Mingers, J. 2004. "Real-izing information systems: critical realism as an underpinning philosophy for information systems," *Information and organization* (14:2), pp 87-103.
Mingers, J., Mutch, A., and Willcocks, L. 2013. "Introduction Special Issue: Critical realism in information systems research," *MIS Quarterly* (37:3), pp 795-802.
Mingers, J., and Willcocks, L. 2014. "An integrative semiotic framework for information systems: The social, personal and material worlds," *Information and Organization* (24:1), pp 48-70.
Mingers, J., and Willcocks, L. 2015. "Guidelines for Conducting Semiotic Research in Information Systems," in *14th European Conference on Research Methods (ECRM)* Valletta (Malta), pp. 290-298.
Mingers, J., and Willcocks, L. 2017. "An integrative semiotic methodology for IS research," *Information and Organization* (27:1), pp 17-36.
Miranda, S. M., Young, A., and Yetgin, E. 2016. "Are social media emancipatory or hegemonic? Societal effects of mass media digitization," *MIS Quarterly* (40:2), pp 303-329.
Moeller, H.-G. 2006. *Luhmann Explained: From Souls to Systems*, (1st ed.) Open Court Publishing: Chicago and La Salle, Illinois.
Morin, E. 2007. "Restricted complexity, general complexity," *Science and us: Philosophy and Complexity. Singapore: World Scientific*, pp 1-25.
Morin, E. 2014. "Complex thinking for a complex world–About reductionism, disjunction and systemism," *Systema: connecting matter, life, culture and technology* (2:1), pp 14-22.
Morin, E., and Lemoigne, J.-L. 1999. *L'intelligence de la complexité*, (1st ed.) L'Harmattan: Paris, Montreal.
Morris, C. 1938. "Foundations of the Theory of Signs," in *International Encyclopedia of Unified Science* O. Neurath (ed.), University of Chicago Press: Chicago.
Myers, M. D. 2013. *Qualitative Research in Business and Management*, (2nd ed.) Sage: Los Angeles I London I New Delhi I Singapore I Washington DC.
Nan, N., and Lu, Y. 2014. "Harnessing the Power of Self-Organization in an Online Community During Organizational Crisis," *MIS Quarterly* (38:4), pp 1135-1157.
Oh, O., Eom, C., and Rao, H. 2015. "Research Note—Role of Social Media in Social Change: An Analysis of Collective Sense Making During the 2011 Egypt Revolution," *Information Systems Research* (26:1), pp 210-223.
Oreglia, E., and Srinivasan, J. 2016. "ICT, Intermediaries, and the Transformation of Gendered Power Structures," *MIS Quarterly* (40:2), pp 501-510.
Orlikowski, W. J., and Robey, D. 1991. "Information technology and the structuring of organizations," *Information systems research* (2:2), pp 143-169.
Peirce, C. S. 1931-58. *The Collected Papers of C. S. Peirce*, (Cambridge: Harvard.
Ring, P. S., and Van de Ven, A. H. 1989. "Formal and informal dimensions of transactions," in *Research on the management of innovation: The Minnesota studies*, A. H. Van de Ven, H. L. Angle and M. S. Poole (eds.), Oxford University Press, pp. 171-192.
Saussure, F. d. 1959. *Course in General Linguistics*, (New York: Philosophical Library ed.).

Sebeok, T. A. 1985. *Contributions to the Doctrine of Signs*, University Press of America: Lanham,Md.
Selander, L., and Jarvenpaa, S. L. 2016. "Digital Action Repertoires and Transforming a Social Movement Organization," *MIS Quarterly* (40:2), pp 331-352.
Simon, H. A. 1962. "The Architecture of Complexity," *Proceedings of the American Philosophical Society* (106:6), pp 467-482.
Srivastava, S. C., Teo, T. S., and Devaraj, S. 2016. "You Can't Bribe a Computer: Dealing with the Societal Challenge of Corruption Through ICT," *MIS Quarterly* (40:2), pp 511-526.
Stamper, R. 1973. *Information in business and administrative systems*, Batsford: London.
Stamper, R. 1987. "Semantics," in *Critical issues in information systems research*, R. J. Boland and R. A. Hirschheim (eds.), John Wiley & Sons, Inc.: New York, NY.
Stamper, R. 1991. "The Semiotic Framework for Information Systems Research," in *Information Systems Research: Contemporary Approaches and Emergent Traditions*, Hans-Erik and H. K. a. R. H. Nissen (eds.): Amsterdam: North Holland.
Stamper, R. 1996. "Sign, Information Norms and Systems," in *Signs of Work: Semiosis and Informatiom Processing in Organisations*, B. Holmqvist, P. B. Andersen, H. Klein and R. Posner (eds.), Walter de Gruyter: Berlin.
Staw, B. M. 1976. "Knee-deep in the big muddy: A study of escalating commitment to a chosen course of action," *Organizational Behavior and Human Performance* (16:1), pp 27-44.
Strauss, A. L., and Corbin, J. 2008. *Basics of Qualitative Research: Grounded Theory Procedures and Techniques*, (3rd ed.) Sage Publications: Newbury Park, CA.
Tanriverdi, H., Rai, A., and Venkatraman, N. 2010. "Research commentary—reframing the dominant quests of information systems strategy research for complex adaptive business systems," *Information Systems Research* (21:4), pp 822-834.
Thietart, R.-A., and Forgues, B. 1995. "Chaos theory and organization," *Organization science* (6:1), pp 19-31.
Thrift, N. 1999. "The place of complexity," *Theory, Culture & Society* (16:3), pp 31-69.
Tiercelin, C. 1998. "Peirce's Objective Idealism: A Defense," *Transactions of the Charles S. Peirce Society* (34:1), pp 1-28.
Tilly, C. 1978. *From Mobilization to Revolution*, (Addison Wesley Publishing Co: New York.
Tonnies, F., and Loomis, C. P. 1957. *Community and society*, Courier Corporation.
Umiker-Sebeok, J. 1987. *Marketing and semiotics: New directions in the study of signs for sale*, Mouton de Gruyter: Berlin New York.
Urry, J. 2002. "The global complexities of September 11th," *Theory, Culture & Society* (19:4), pp 57-69.
Urry, J. 2005a. "The complexities of the global," *Theory, Culture & Society* (22:5), pp 235-254.
Urry, J. 2005b. "The Complexity Turn," *Theory, Culture & Society* (22:5), pp 1-14.
Van Alstyne, M., and Brynjolfsson, E. 2005. "Global village or cyber-balkans? Modeling and measuring the integration of electronic communities," *Management Science* (51:6), pp 851-868.
Venkatesh, V., Brown, S. A., and Bala, H. 2013. "Bridging the qualitative-quantitative divide: Guidelines for conducting mixed methods research in information systems," *MIS Quarterly* (37:1), pp 21-54.
Venkatesh, V., Rai, A., Sykes, T. A., and Aljafari, R. 2016. "Combating Infant Mortality in Rural India: Evidence from a Field Study of eHealth Kiosk Imlementations," *MIS Quarterly* (40:2), pp 353-380.
Volkoff, O., Strong, D. M., and Elmes, M. B. 2007. "Technological embeddedness and organizational change," *Organization Science* (18:5), pp 832-848.

Von Bertalanffy, L. 1950. "An outline of general system theory," *British Journal for the Philosophy of science* (1:2), pp 134-165.
Von Foerster, H. 2003. "On self-organizing systems and their environments," in *Understanding Understanding: Essays on Cybernetics and Cognition*, H. v. Foerster (ed.), Springer: USA, pp. 1-19.
Walsh, I., Holton, J. A., Bailyn, L., Fernandez, W., Levina, N., and Glaser, B. 2015. "What Grounded Theory Is…A Critically Reflective Conversation Among Scholars," *Organizational Research Methods* (18:4), pp 581-599.
Warschauer, M., and Grimes, D. 2007. "Audience, authorship, and artifact: The emergent semiotics of Web 2.0," *Annual Review of Applied Linguistics* (27), pp 1-23.
Wattal, S., Schuff, D., Mandviwalla, M., and Williams, C. B. 2010. "Web 2.0 and politics: the 2008 US presidential election and an e-politics research agenda," *MIS Quarterly (34:4*), pp 669-688.
Weaver, W. 1948. "Science and Complexity," *American scientist* (36), pp 536-567.
Weber, R. 2003. " Editor's comments - The Problem of the Problem," *MIS Quarterly* (27:2), pp iii–ix.
Weick, K. E. 1993. "The collapse of sensemaking in organizations: The Mann Gulch disaster," *Administrative Science Quarterly* (38:4), pp 628-652.
Weick, K. E. 1995. *Sensemaking in organizations*, (1st ed.) Sage Publications Inc.: Thousands Oaks: London: New Delhi.
White, R. W., and Horvitz, E. 2009. "Cyberchondria: studies of the escalation of medical concerns in web search," *ACM Transactions on Information Systems* (27:4), pp 1-37.
Whitehead, A. N. 1920. *The Concept of Nature*, (1st ed.) University Press: Cambridge.
Williams, C. K., and Karahanna, E. 2013. "Causal Explanation in the Coordinating Process: A Critical Realist Case Study of Federated IT Governance Structures," *Mis Quarterly* (37:3), pp 933-964.
Woermann, M., and Cilliers, P. 2012. "The ethics of complexity and the complexity of ethics," *South African Journal of Philosophy Suid-Afrikaanse Tydskrif vir Wysbegeerte* (31:2), pp 447-463.
Wynn, D. J., and Williams, C. K. 2012. "Principles for conducting critical realist case study research in information systems," *MIS quarterly* (36:3), pp 787-810.
York, J. C. 2011. "Not Twitter, Not Wikileaks: A Human Revolution. http://jilliancyork.com/2011/01/14/not-twitter-not-wikileaks-a-human-revolution/ ".
Zachariadis, M., Scott, S. V., and Barrett, M. I. 2013. "Methodological Implications of Critical Realism for Mixed-Methods Research," *MIS Quarterly* (37:3), pp 855-879.

CHAPTER 3 - USING SEMIOTICS TO ANALYZE REPRESENTATIONAL COMPLEXITY IN SOCIAL MEDIA

Abstract

Data from social media offer us multimedia data brimming with multiple layers of meanings. Social media enable rapid-fire digital communications. These communications are incredibly complex in content, form and meaning. This representational complexity is a stumbling block in data analysis that stands in the way of deeper explanations. These unstructured data rich in social meanings are as complex as the phenomena they represent. While it is possible to formulate an entire research methodology around semiotics, it is not always necessary. We can adapt semiotic analysis within existing methodologies. This paper offers and illustrates an analytical technique to address representational complexity that can be used in conjunction with other methodologies such as case study, ethnography, etc. This analytical technique espouses a critical realist philosophy to develop much needed, deeper explanations from qualitative data.

Keywords: semiotics, critical realism, qualitative research, data analysis, representational complexity

3.1. Introduction

Data from social media is often assumed to be similar to other qualitative data such as interviews or documentation. However, such an assumption neglects important social and technological distinctions. Instead of texts from few known sources, social media data are characterized by *representational complexity*: multimedia data (e.g. photos, texts, videos, external links, etc.) brimming with multiple layers of meanings. Because data from social media are representationally complex communications, such data should be analyzed accordingly.

One solution would be to adopt an entire semiotic methodology (Mingers and Willcocks 2017). However, this is not always necessary. This paper offers a semiotic analytical technique that can be adopted to study representationally complex data within a broader framework of other methodologies such as case studies, grounded theory, ethnography, etc.

The Internet has become a powerful technological tool that is increasingly central in our society. It is capable of delivering both the wonderful (Bennett and Segerberg 2011; Benson 1977; Braa et al. 2007; Castells 2011; Deng et al. 2016) and the terrible (Bhuller et al. 2013; Chan and Ghose 2014; Chan et al. 2016; Greenwood and Agarwal 2016; Lowry et al. 2016). But how do we tell the difference? For example, the Internet has revolutionized our travel habits, but this helps spread disease. It has delivered worldwide, online communities for us, but this has also scaled up the planning of hate crimes. It has fomented a wealth of big data, but this is destroying our privacy. This rapid-fire digital communication can be incredibly complex in content, in form, and in meaning. The proliferation of rich, Internet-borne multimedia technologies burrows meanings under a myriad of representations.

We should expect that IS researchers would be highly expert at the discovery of meanings in the Internet communications. Our theoretical and practical contributions should at least explain the contrasting meanings delivered when hyper-connectivity spreads across all industries and every layer of society. It couldn't be more important. These complex sociotechnical systems are now essential to our political, economic and even entertainment behaviors. Individuals, organizations, and institutions use this digital world to manage their complexity and stability. At the societal level, for example, protests have leveraged social media to create a supersizing impact. IS researchers are in a unique position to help society make sense of this sea of

communication. But do we really have the tools we need to confront the complex, ubiquitous and versatile nature of the information and data pervading everyday life?

Representational complexity is a stumbling block in data analysis. Online social networks give access to unstructured, rich social meanings in data. It can be overwhelming not only because we can access data faster than we can process and analyze it, but also due to its rich, multimedia nature. Qualitative researchers take this richness of data as their strength and their challenge (Miles et al. 2014; Myers 2013). But the rigor in their techniques has been largely oriented to texts. This rigor is threatened by the increasing representational complexity in our data.
Representational complexity is a challenge for deeper explanations. The represented phenomena are complex anyway. These phenomena are political *and* economic *and* entertainment, etc. There are layers of representations of phenomena that have layers of meanings. The current state of the field offers accurate models to predict the online spread of ideas, but fails "to predict the behavior change produced by this very same campaign" (Cebrian et al. 2016, p.37). We lack focus on "the underlying incentive structures—the hidden network of interpersonal motivations that provide the engine for collective decision making and action." (Cebrian et al. 2016, p.37). We need explanation rather than prediction. If we focus only on the media (the representations) we lose touch with the content (Halverson et al. 2013). A shallow approach would single out the interactive and multimedia nature of communication from the study of change. A shallow approach treats information as an objectified content and deprives us from understanding its dynamic role in the sociology of knowledge (Boulding 1955).

In this paper, we propose and illustrate a data analysis technique to address representational complexity. This approach integrates semiotics (to deal with representational complexity) and critical realism (to deal with layers of meaning). Semiotics regards theories of signs and symbols (Stamper 1973). Critical realism offers an epistemology of explaining rather than predicting (Bhaskar 1975; Wynn and Williams 2012). In a critical realist approach to semiotic analysis, the process of interpreting the meaning of signs considers the interrelatedness of signs within a context. Such an approach guides us in the realms of the social world, the personal world and the material world (Mingers 2001; Mingers and Willcocks 2014; 2015; 2017). It also pursues empirical work by adopting a critical realist stance (De Vaujany 2008; Volkoff et al. 2007; Williams and Karahanna 2013; Wynn and Williams 2012; Zachariadis et al. 2013)
Our approach is an analytical technique that can be integrated into more comprehensive research methodologies such as case studies or ethnography. It is neither a new philosophical

stance nor a new research method. As such it might be viewed as a substitute for the data coding techniques frequently adapted in qualitative studies such as those found in Strauss and Corbin (2008). It is particularly suitable in Information Systems (IS) because any IS is a semiotic system (Baskerville 2010; Grover and Lyytinen 2015). Semiotics is a valuable foundation to help establish and advance the qualitative identity of the field (Weber 2003). The structured aspect of semiotics is also very valuable as a means to ensure rigor in our analytical work. In the past IS has generally used semiotics to study the information flowing through our systems (Liebenau and Backhouse 1990). More recently, entire IS research methodologies have developed that are centered on semiotics principles (Mingers and Willcocks 2017). We apply semiotics for the purpose of analysis of IS research data.

This paper is organized as follows. Before introducing a short history of semiotics, we will position this research and its contributions in the qualitative research process. Thirdly, we position semiotics from a critical realist standpoint. Then, building on previous formulations of guidelines, we offer an analytical device: The *Double Semiotic Helix*, before discussing its implications and concluding. As semiotics authorities have done in the past, we illustrate key concepts of semiotic analysis with their applications found in detective stories about criminal investigation (Eco and Sebeok 1983). In particular, we clarify some of these concepts by drawing on the fiction of Sir Arthur Conan Doyle's famous character, Sherlock Holmes.

3.2. Positioning in Qualitative Research

Qualitative research merits lie in understanding what people say and do in context (Myers 2013). While Myers insists that talking to people is the best way to understand them, advances in information and communications technologies have enabled to access mounts of conversations. Those talks are cultural and social phenomena at the tips of our fingers. Those conversations benefit also from technological advances by integrating all kind of media other than texts (e.g. photos, videos, hyperlinks, etc.) increasing the richness of data for the researcher. Facing lots of data, an analytical strategy is required to know how to look at them.

The choice of a data analysis approach is driven by the underlying epistemology of the researcher and the choice of a strategy of enquiry to find evidence (Figure 1). While data analysis comes after data collection, they can be simultaneous. The research objectives guide these choices. Data collection techniques can be combined and are not exclusive of one method.

Similarly, for data analysis approaches, the research question guides the choice of an approach. This research contributes to analyzing qualitative data.

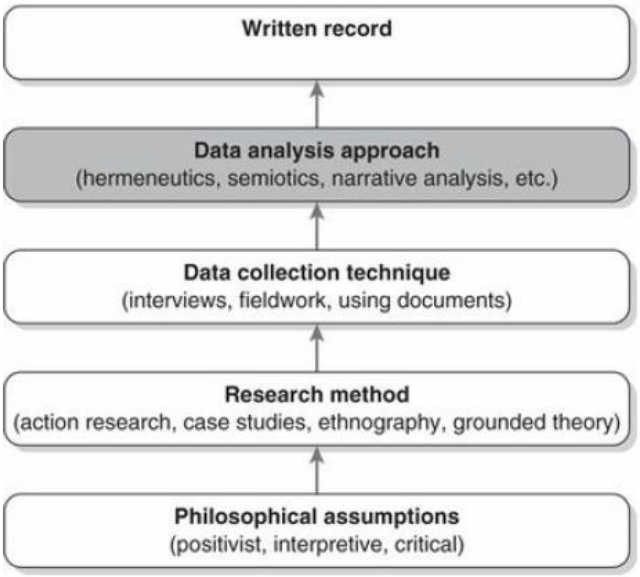


Figure 1: Research Process (Myers 2013, p.163)

If a dozen of data analysis approaches exist, hermeneutics, semiotics and narrative analysis are the most common in business and management research (Myers 2013). Despite its peculiar relevance for IS research, semiotics is still scarce in the field (Mingers & Wilcocks 2017). Mingers and Wilcocks (2017) have erected semiotics as an entire methodology. However, raising semiotics as a methodology rather than an analytical technique undermines the understanding of the data and the role of the medium in other methodologies.

As a fundamental analytical approach, semiotic focuses on representations and their effects in social life. When Walter Fernandez (Walsh et al. 2015) reminds us of the grounded theory motto "All is data", he also judiciously highlights the need to understand the data: "it doesn't really matter what type of data you are using, but you do need to understand that the data are gathered for a reason—that is, to allow the process of theoretical sampling to occur." (p.586). The conversational nature of the data considered involves the production, transmission, interpretation of meaning (Mingers & Wilcocks 2017), making a clear call for semiotics. Furthermore, the role of the medium cannot be neglected.

That's why we argue that semiotics can be a choice of data analysis technique. We will argue further in this direction following Myers's (2013) recommendations. To do so, after introducing the long semiotics tradition, we argue for a critical realist philosophy to unleash

the benefits of semiotics at their greater potential. We illustrate the analytical technique with data extracted from a case study, fully presented in the next chapter.

3.3. Semiotics: Overview and Shortcomings

3.3.1. Purpose and Motivations

What general linguistics has offered to the analysis of human speech (Saussure 1959) will no longer suffice to account for seeking, making and using information in online interactions because such communications rely on several media. Continual engagement with communication technologies generates information encoded and transported in signs (e.g. images, texts, videos, etc.) from local to more distant societies. Online interactions can offer insights that explain pervasive social phenomena. These phenomena exist "*in* transmission, in communication …. There is more than a verbal tie between the words common, community, and communication" (Dewey 1916, p.5 original emphasis). Social media stress the process of sharing (sending, interpreting, reacting to) self-generated content. Screens, increasingly present around us, reflect this reality whether we choose to be passive observer or to actively engage with the content. This ubiquity of technology has put us in a situation where we can make the information technologies yet not understand the information contained in those technologies: "we could produce bottles but we could not understand the wine" (Stamper 1996, p.349).

Technology as *material culture* gave rise to a networked society (Castells 2011). In this society information processing bridges the gap between data and knowledge. It is at the heart of social consequences we observe in the physical world. Networks proliferate and engage in a wide array of unprecedented behaviors. Online networks are less bounded, less constrained; thus, making it more difficult for us to grasp. The Internet, and especially social media, provides a huge available information base, leaving us facing a torrent of relevant and irrelevant data. This torrent increases the complexity inherent in studying social relations, even when taking a system thinking viewpoint. Luhmann's concept of society sees the emergence of interconnected subsystems as a prerequisite to modern society. Actors capable of communications face complexity through the implosion of meanings. They attempt to reduce it by drawing meaning from their observations. They select signs from along a horizon of observations to ensure continuity and renewal of society. Thus, "[o]bservation is the basic operation of understanding" (Luhmann 1995, p.65), which aligns with a critical realists' mission. But this task challenges our sensemaking capabilities. To maintain our sensemaking

capabilities, we need to break down the perceived signals into their constituent parts. A semiotics approach, i.e. an approach of how meaning is engendered and conveyed, is ideal. While researchers in IS have used sensemaking to understand the interpretative process of their subjects, they have not applied a sensemaking approach to their own data analysis (i.e., how they make sense of their subjects' sensemaking process). The researcher's sensemaking culminates in an *analytical commitment*: the projection of the researcher's own interpretative orientation onto the entirety of a communication. The lack of an account for this analytical commitment of an individual investigator has been previously highlighted (Mingers 2001). Exploring semiotics raises our awareness of the role of the signs systems and our own roles in constructing our understanding of the reality. Information cannot be contained and meaning cannot be transmitted as is (Chandler 2001) but we can actively draw meanings from the signs we experience. Thus, we need to account for subjects' and researcher's sensemaking process.

3.3.2. Overview of Semiotics Traditions

Semiotics does not have a unified tradition. As the theory of signs pervades history, the first explicit reference arises in the work of John Locke (1690/1959). He describes *semiotike* or "the doctrine of signs" as one of the three kinds of knowledge including physics and ethics. However, it is not before the 20th century that semiotics work has been developed through the European tradition of Ferdinand de Saussure and the American tradition of Charles Sanders Peirce. Semiotics is the study of textual and non-textual meaning-producing events: "the exchange of any messages whatever and of the systems of signs which underlie them" (Sebeok 1985, p.1). Semiotics has been used in a structuralist (or Saussurean) tradition by focusing mostly on formal, explicit and visible structures sign systems (e.g. language). These approaches aim at finding linear and exact patterns between signs and meanings. These have also been mobilized in an interpretive manner by looking at the transformative and dynamic processes of sign systems. Such approaches include social semiotics. They see the dynamic process of meaning creation as emergent from its social context (Mingers and Willcocks 2017).

Swiss linguist Saussure (1857-1913) argued that language was the most important system: "*A science that studies the life of signs within society* is conceivable; (…); I shall call it semiology (from Greek *semeion* 'sign'). Semiology would show what constitutes signs, what laws govern them."[19] (Saussure 1959, p.16, original emphasis). Saussure decomposed the sign into a

[19] We will solely use the "semiotics" as it became the most dominant usage in the literature for the study of signs.

signified and a signifier. The latter refers to the mental image that its written or spoken form generates and the former bears the meaning of the latter. The relationship between the two is either arbitrary or governed by social relations. The arbitrariness of signs implies the autonomy of language. Saussure argued that all kinds of social practices could be studied through semiology. Saussure adopted a relational perspective of the sign (Figure 3). This focuses on *what* builds the basis for the structuralist (and most often European) tradition. Such a stance provides a universal grammar that enables an understanding of language beyond its historical and cultural context. Saussure's *Course in General Linguistics* is evidence of this approach. His teachings did not focus on the use of language, but rather on its underlying structure. Critics of his ahistorical approach opened the way to a post-structuralist view that included both historical and cultural dimensions of language.

Peirce's American tradition of semiotics (1839-1914) defines a sign as "something which stands to somebody for something in some respect or capacity". Signs include words, images, sounds, gestures and objects. This set expands nicely to encompass the kinds of content than can be generated on social media like Facebook nowadays. Peirce adopts a triadic and not dyadic definition of the sign (Figure 4). The *interpretant* – without designating the interpreter – refers to some form of meaning drawn from the *sign* or *representamen.* The *object* commits Peirce to some realism (Mingers and Willcocks 2014). Consistent with Saussure, Peirce introduced the relativity of arbitrariness by offering a typology of signs. However, Peirce's definition misses the dimension of the community. Building on Peirce, Morris (1938) further decomposed the structure of semiotics in terms of *pragmatics, semantics and syntactics* to cover the intentional use of signs, their meaning, and the relationships between signs.

Ronald Stamper's approach (1991; 1996) unified these previous works by including human and technological information functions (Figure 2). Stamper (1996) expands Peirce's definition to include the social dimension: "something which stands to somebody for something in some respect or capacity, in some community or social context". Signs have physical forms available to our investigation. The technical features of information systems do not depend on humans. Therefore, he adopts a narrower definition of information as "precisely defined properties of signs, all of them capable of empirical investigation". Stamper's ladder of semiotics (Figure 2) extends Morris' framework by adding *empirics* as a semiotic layer of information. It ties the physical existence of a sign (*physical world*) to its social consequences (*social world*). Empirics and syntactics are essential to information systems development to convey signs, while

semantics and pragmatics are keys in drawing meaning from signs: “Meanings express personal views of reality. When there is a firmly established consensus, and only then, we can pretend that meanings are independent of people. Many semantic problems cannot be solved until one has established who is responsible for the meanings expressed.” (Stamper 1987). As Deely (1990) observes, “at the heart of semiotics is the realization that the whole of human experience, without exception, is an interpretive structure mediated and sustained by signs” (p. 5). This approach considers then semiotics as accessing one specific view on the world. Therefore, semiotics is not “the reality” but limits our knowledge to our experience of the world: the social construction of reality (Chandler 2001). Consequently, our mode of inquiry into the world is dependent on our past experiences. Human beings are drawing understanding from previous human experiences and not just from the object under study. This mode accounts for the development of analytical commitment.

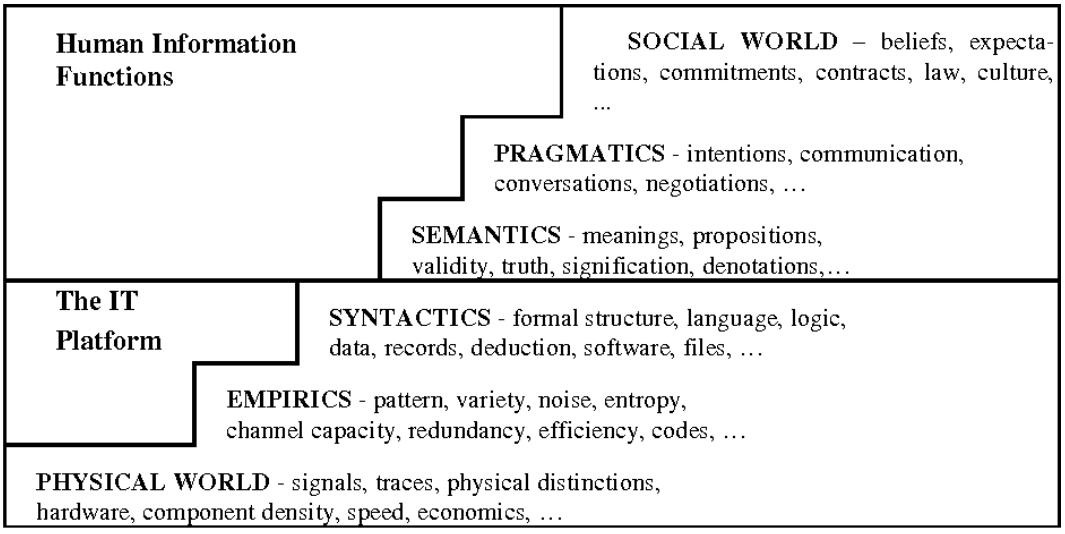


Figure 2: Stamper's Semiotic Framework

3.3.3. Use and Limitations

Research using semiotics for data analysis is scant; IS has not embraced it yet, despite its roots in semiotics (Baskerville 2010; Grover and Lyytinen 2015). Instead, the management and marketing fields have drawn more vibrantly on semiotics. For example, management research has relied upon semiotics to investigate meanings in occupational context (Barley 1983). Brannen (2004) showed how Disney Company faced important losses because they downplayed the meaning of cultural signs in Europe. Brannen brings compelling evidence of the utility of semiotics in understanding a market. Advertising and consumer research has drawn heavily on semiotics as a method (Hackley 2003; Levy 1959; Mick and Oswald 2006; Umiker-Sebeok 1987). Their main reasoning revolves around consumer’s process of

sensemaking in marketing communications: “how culture and collective understanding is formed and sustained” (Hackley 2003, p.165). Semiotics provides an understanding of cultural values in the communication process, and offers an alternative to the economic rationality approach to consumer behavior. Hackley adopts an interpretive stance: “semiotics can be a useful approach in empirical research studies that seek insights into the constructed, arbitrary and culturally mediated character of human understanding” (Hackley 2003, p.171).

Semiotics arrives to us today from along two different paths: Saussure’s was sowed with realism; Stamper’s sowed with idealism. These paths embody a dualism that cannot fully account for the world we live in as we live in it. The former cannot account for cognitive and social processes. The later cannot account for overarching structures. The perspective of realism is no less adequate than the perspective of idealism. Maturana and Varela (1987) summarize the dichotomy:

> “In fact, on the one hand there is the trap of assuming that the nervous system operates with representations of the world. And it is a trap, because it blinds us to the possibility of realizing how the nervous system functions from moment to moment as a definite system with operational closure ... On the other hand, there is the other trap: denying the surrounding environment on the assumption that the nervous system functions completely in a vacuum, where everything is valid and everything is possible. This is the other extreme: absolute cognitive solitude or solipsism, the classic philosophic tradition which held that only one's interior life exists. And it is a trap because it does not allow us to explain how there is a due proportion or commensurability between the operation of the organism and its world.” (p. 133).

This duality has evolved, though it has not been fully addressed. Somewhere in between stands Peirce with “objective idealism” (McCarthy 1984; Tiercelin 1998). We find that the study of signs is presently at a crossroads. We counter forms of imperatives that have driven research either to search for regularities or to solely rely on interpretation of meaning. Such imperatives have reduced social sciences to alternative narrow paths, each of which is unable to account for both human and technological information functions.

3.3.4. Online and Social Media Context

In an ever increasingly computerized environment, interactions have moved from the desktop to surround us everywhere and in multiple creative forms. It is all at our fingertips reach. The continuous presence of information devices and platforms means we must account for their characteristics in use, especially in the process of drawing meaning from these interactions. Solely by their existence, these signs trigger the meaning-making process. They engender further interactions in online or offline spaces with undoubted social effects. Culturally, individuals rely heavily on technologies. They are socially networked. Technology mediates their interactions. As individuals' experiences of the world migrate from one space to the other, individuals themselves become inherently semiotic.

Various combinations of the virtual and the physical give rise to different sets of interactions. Advanced technologies and virtual worlds extend our modes of representation: "emergent semiotics refers to the way that the meaning of a particular page or site may only emerge through automated filtering and synthesis of the input of many people. … determined not by the conscious editorial decisions of an individual or group, but rather by the clicks of thousands of people around the world." (Warschauer and Grimes 2007, p.14). Computer Mediated Communications (CMC) introduce increased ambiguity in social interactions due to deprivation of important visual and aural cues. Milgram and Kishino (1994) represented the continuum from a physical world to a virtual world as a spectrum of reality. But as technological advances seek to deliver more 'objective' (more 'real') contexts for online social interactions, the recipient's mindset (e.g. their own cultural context, assumptions, goals) begins to play a greater part in how the recipient draws meaning from these online communications (interpretation and understanding).

Semiotics is an increasingly relevant framework to develop an understanding of how people make sense of their online interactions. It helps explain how they behave in and through both the physical and digital worlds. Semiotics, by deriving meaning from the relation between the sign and the object it represents, bridges these physical and digital spheres. A semiotics approach builds meaning by integrating both physical and social structures respective to both spheres. Consequently, semiotics is a promising tool in the emergence of new ways of meaning-making (e.g. social networks, wikis, blogs). It addresses the tangible material objects in which interactions are anchored, while also accounting for the processes and outcomes of both spheres.

3.4. A Critical Realist (CR) Approach to Semiotics

Because it accommodates both the realism and the idealism that presently confound semiotics, concepts from critical realism offer a promising means for reconciling these issues. The communications at the base of semiotics usually spans both the social and the physical. Critical realism reconciles them on a philosophical basis. This section discusses the critical realist theory of meaning and its relevance for IS research semiotics. Addressing these objectives implies identifying the mechanisms of semiotics. Bhaskar's (1975; 2013) critical realist view of the world offers a philosophy to analyze and understand the complexity in social and physical research settings.

3.4.1. Critical Realists' Tenets in IS field

IS researchers have argued for a critical realist approach or methodology as offering a consensus between empiricism and social construction (Mingers 2004; Mingers et al. 2013; Zachariadis et al. 2013). IS researchers have drawn on critical realism principles to develop methodological guidelines for case study and mixed methods research (Venkatesh et al. 2013; Wynn and Williams 2012). Our approach extends this work to the analytical stage of research (hereby semiotic analysis). Semiotics is embedded in the material world; but not only in the affordances and the liabilities of the material world, but also the character of the social or conceptual aspects inherent in that material world.

Bhaskar (1975; 2013) defines reality as stratified, complex and dynamic. The stratified ontology of reality is denoted as the real, the actual, and the empirical (Table 3). The *real* refers to causal powers or tendencies or structures powering causal effects in society. A subset of the real is the *actual* and includes the events that do or do not happen when (all or some) structures are actualized. The *empirical* includes the actual observable and experienced events as a subset of the actual. Therefore, the empirical is the material for semiotic analysis. Researchers explain social phenomena through *retroduction or abduction*[20], i.e., through access to the empirical, researchers propose and describe causal mechanisms that explain the activation (or not) of reality. It is an iterative creative process that identifies and empirically corroborates the

[20] Retroduction and Abduction are considered as essentially the same by Mingers, J., Mutch, A., and Willcocks, L. 2013. "Introduction Special Issue: Critical realism in information systems research," *MIS Quarterly* (37:3), pp 795-802. and Wynn, D. J., and Williams, C. K. 2012. "Principles for conducting critical realist case study research in information systems," *MIS quarterly* (36:3), pp 787-810., . We will use abduction in the rest of the paper.

mechanisms at play (Wynn and Williams 2012). This process aims at answering: "What properties must exist for [the phenomenon of interest] to exist and to be what [it] is? Or…more briefly: What makes [the phenomenon of interest] possible?" (Danermark et al. 2002, p. 97). Empirical corroboration aims at ensuring causal depth and a superior explanatory power than other alternatives: "[It] is the job of substantive science to discover which [mechanisms] actually do [exist]" (Bhaskar 2013, p.136). Table 3 includes examples of mechanisms that IS researchers have examined in each strata of reality.

Strata of Reality (CR)	Main aspects	Examples in IS Research
Real	Causal mechanisms and structures coproducing events (objects)	Technological artifact, language and culture (Wynn and Williams 2012), Affordances (Volkoff and Strong 2013), coordination governance mechanisms (Williams and Karahanna 2013).
Actual	Events or Outcomes (e.g. human action, historical events)	Concrete outcomes actors experienced or expected to (Volkoff and Strong 2013), events in coordinating efforts as specific changes in the structure (Williams and Karahanna 2013).
Empirical	Experiences (e.g. observations, documents)	Observations, Interviews (Volkoff and Strong 2013) and archival data (Williams and Karahanna 2013).

Table 3: Strata of Reality in IS CR research

Semiotics can guide such a "substantive science", especially with an analytical tool based on Stamper's operationalization of semiotics. Critical realism posits that there is a real objective world but departs from realism by incorporating perception and interpretation of observed events. In doing so, critical realism offers an epistemological avenue to bridge the separation between nominalists and (post-) structuralists. Critical realism is transcendental because it not only accepts the intransitive nature of the world, but also the transitive nature of our knowledge of it. CR is itself not a methodology but rather a philosophy of science that has implications for methodology: "[a]n ontology without a methodology is deaf and dumb, a methodology without an ontology is blind" (Archer 1995, p.27). Only a few studies (Mingers and Willcocks 2014; 2015; 2017) have drawn the mutual benefits of critical realism and semiotics from an IS perspective. In CR, causal explanations are developed under "empirical scrutiny" (Bhaskar 1975) but are still subject to meaning-making from the data. Semiotics offers an approach to achieve this empirical scrutiny by deciphering meaning behind interwoven signs.

For CR, reality is not only stratified but also complex and dynamic. Bhaskar (2008; 2013) draws on social systems as open systems because, unlike natural sciences research, the phenomena under study cannot be isolated from their contextual environment. The complexity of social phenomena lies in the continuous enactment of the causal powers reproducing and transforming the structures. Structures are ever-present and are continuously (re)produced or transformed. The structures of semiotics always preexist the actor(s) and therefore, have gained certain autonomy even if they depend on actors for reproduction and transformation. Socio-technical systems are no exceptions to this: "As the world is open, and agency is real, and as society is only materially present in intentional human action, it follows that social phenomena only ever manifest themselves in open systems." (Bhaskar 1998, p.125).

Such described ontology can slip from the research process because researcher's work is not intransitive reality. That's why, the researcher looks for validations in the transitive epistemology of theory and methods at hand. By developing a semiotic analytical technique that is available to other methodologies, we extend the current critical realist approach of semiotics in IS research (Mingers and Willcocks 2017). Semiotics is the study of the process of meaning-making from material representations to its social effects. A semiotic analytical technique is much needed at the empirical level to uncover the enduring structures and mechanisms (*real)*. Thus, semiotics is a theory of how meaning is generated taking into account the forms of representations and its effects. We develop in the next sub-section the different approaches to decipher intended and unintended meanings that are in communications.

3.4.2. A Theory of Meaning

Multiple definitions of a sign exist and thus, lead to different approaches to semiotics. Bhaskar reformulates the concept sign in an approach closer to Peirce than Saussure. Consistent with both Bhaskar and Peirce, Stamper (1996) defined a *sign* as: "something which stands to somebody for something in some respect or capacity, in some community or social context". (This extension of Peirce's definition will suit our purpose here.)

Previous conceptions of a sign were limited even though "the centerpiece of any adequate theory of meanings must be the semiotic triangle" (Bhaskar 2008, p.208). As we described above, early work of Saussure focused on the structure of the sign as signifier/signified dyad in a synchronic context of interpretation. This relation between the signifier and the signified is purely defined by social conventions. But Saussure's signifier/signified dyadic relationship

(Figure 3) omits the object or referent. Peirce's triadic use of sign (described earlier) designates both the whole and one of its parts as the sign (the representamen), along with the interpetant and the object (Figure 4). Bhaskar's triangle (Figure 5) is similar to Peirce's; Bhaskar's referent mapping to Peirce's object, Bhaskar's signified mapping to Peirce's interpretant, and Bhaskar's signifier mapping to Peirce's sign/representamen. Bhaskar's triangle reconciles the signified (elided by the nominalists), and the referent (elided by the (post-)structuralist or Saussurean). We accompany these theories of meaning with Table 4 to compare the different concepts and definitions around the sign.

$$Sign = \frac{\text{Signifier}}{\text{Signified}}$$

Figure 3: Saussure's dyadic relationship

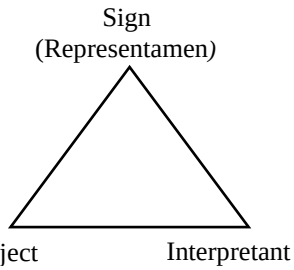


Figure 4: Peirce's Semiotic Triangle

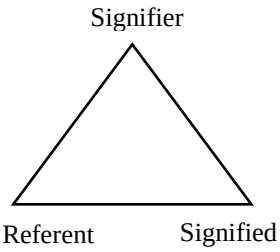


Figure 5: Bhaskar's Semiotic Triangle (2008)

	Saussure	Peirce	Bhaskar
Sign	The (arbitrary) unity of a signifier and a signified	Anything determined by something else (object) and determines an effect (interpretant) on someone = the signifier	What knowledge is made of
Signifier	A sound-image (sensory)		The locutionary force
Signified	A concept (abstract)		A concept (abstract)
Representamen		The sign-vehicle	
Object		The signified	
Interpretant		The understanding of the sign-object relation	
Referent			The object

Table 4: "Sign" Definition by tradition

A critical realist definition of sign includes the reality of things we cannot perceive. The signified incorporates an epistemic relativity: all our knowledge is human dependent. The referent addresses an intransitive domain: the objects of our knowledge have a physical objective existence. Accordingly, the critical realist view of the world is characterized by the duality between intransitive objects which have their own existence outside of human

experience (realism) but can only be known if there is a human to experience it (social construction):

> "Any adequate philosophy of science must find a way of grappling with this central paradox of science: that men in their social activity produce knowledge which is a social product much like any other, which is no more independent of its production and the men who produce it than motor cars, armchairs or books, which has its own craftsmen, technicians, publicists, standards and skills and which is no less subject to change than any other commodity. This is one side of 'knowledge'. The other is that knowledge is '*of*' things which are not produced by men at all: the specific gravity of mercury, the process of electrolysis, the mechanism of light propagation. None of these 'objects of knowledge' depend upon human activity. If men ceased to exist sound would continue to travel and heavy bodies fall to the earth in exactly the same way, though *ex hypothesi* there would be no-one to know it." (Bhaskar 2008, p.11).

Both CR and semiotics can draw on each other to articulate a rich and deep view of the world. Most streams of semiotics would agree that much if not all our knowledge of the world is indirect, i.e. from our experiences as they are represented to us and carried by media such ICTs (Chandler 2001). Semiotics is at the empirical level but the study of signs gives us access to other strata of reality. It grants us access to patterns of objects as (real) manifestations and/or critical interpretations. Such access depends on a context that presents us with the real despite its somewhat elusive existence. The study of signs highlights the importance of not taking representations for granted and analyzing them to discover the reality they represent. Human inquiry, despite its fallibility and biases, enables us to access aspects of the real. Signs are mediators that enable an interpretive understanding of the world. When we decipher signs, we can understand any action or communication. Such understanding arises because signs are purposeful and meaningful. Our integrative analytical framework aims at holding "the promise of a systematic, comprehensive and coherent study of communications phenomena as a whole, not just instances of it" (Hodge and Kress 1988, p.1).

3.5. A Semiotic Analytical Coding Technique

> *"Most people, if you describe a train of events to them, will tell you what the result would be. They can put those events together in their minds, and argue from them that something will come to pass. There are few people, however,*

> *who, if you told them the result, would be able to evolve from their own inner consciousness what the steps were which led up to that result. This power is what I mean when I talk of* ***reasoning backward****"*[21].

This section details an analytical coding technique and its underlying assumptions. The technique is intended for use by other more comprehensive methodologies. We developed this analytical approach for (offline) social phenomena that leave detailed behavioral traces of what individuals think and do online. For example, social media is a specific platform where such interactions can take place. Work in this arena has studied online-offline spillovers, communications leading to mass protests (e.g. Castells 2015; Halverson et al. 2013), and the role of polarized political discussion groups in encouraging hate crimes (e.g. Chan et al. 2016; Glaser et al. 2002). These studies are powerful inquiries enabled by the highly granular level of data available, but currently lack ideal data analysis approaches that are better suited for the rich and multimedia nature of this granular data.

In such studies, researchers work retrospectively (Figure 6). Those generating the communications construct signs in a timeline shown from left to right. In a semiotic analysis, researchers must interpret those signs in a reverse timeline, working backward through the signs from right to left.

Figure 6: Production and Interpretation of Meaning

Building on Stamper's semiotics ladder and Liebenau and Backhouse's (1990) popularization of Stamper's work, we offer a double-helix model (Figure 6) to account for (1) the generation of communications by subjects that unfold over time (left-to-right in our figure) and (2) investigator's interpretation process (a reversed right-to-left in our figure). As well, we offer

[21] Arthur Conan Doyle, *A Study in Scarlet* (emphasis added)

coding framework based on abduction. To do so, we use an interrogative framing (asking questions) as an analytical device (Table 5).

Semioticians have noticed that such semiotic analysis resembles a detective endeavor that explains what happened in the social world by following and analyzing physical signs (Berger 2004; Eco and Sebeok 1983). The social phenomenon observed in the social offline world is, following this analogy, our crime scene. A worthy detective derives explanation from clues to solve crimes. Thus, observation is an inferential process. Only by *reasoning backwards*, we can expand our knowledge of the world. Social media leave behind a trail of valuable evidence. In the next section, we will apply this analytical device to data collected from Facebook. As we reason backwards *or abductively*, we let a *first class semiotician* – namely the fictional character Sherlock Holmes -(Berger 2004; Eco and Sebeok 1983) introduce the precise reasoning of semiotics:

"*Data!Data!Data!" he cried impatiently. "I can't make bricks without clay*."[22]

As when Holmes called for his clay, we collect data to meticulously associate explanations with the phenomena under study. In our case, social media offers access to rich and various data. All the clues are out there. The investigator abduces from signs available in data to identify clues. Any theory that may arise, must cover data extensively. Theories help explain the events retrospectively.

As we stated previously, knowledge comes abductively from a system of signs. We work backwards through the mechanisms which led to the observed facts (phenomena) and how these phenomena acquire meaning by having become signs.

Eco (1983) identifies three kind of abductions that apply to a detective solving a crime: *overcoded abduction, undercoded abduction* and *creative abduction.* For Eco, abduction is principally a matter of following the clues. We draw on Sherlock Holmes' experiences to develop inferences while doing a semiotic analysis.

[22] Arthur Conan Doyle, *The Adventure of the Copper Beeches*

Watson: Holmes, you are a very knowledgeable man.

Holmes: Of course. All knowledge comes useful to the detective.

Watson: What about, say, the belief that Earth orbits the Sun?

Holmes: That would be an exception.

Watson: So would be any knowledge of classical literature, classical languages, politics—

Holmes: All exceptions, Watson. Useless things clutter the mind.[23]

Overcoded abduction focuses on knowing as inferring, i.e. relies on rules that govern interpretation, rules that are already known by the detective. This quasi-automatic kind of reasoning does not require much effort because the investigator shares some proximity with the context, or because of similarity of the phenomenon under observation with previous cases. All forms of knowing are tied to or mediated by signs. Prior knowledge and experiences serve as a basis of the sensemaking process. A clue leads the investigator to things (s)he already knows. Abduction aims at eliciting that knowledge. No sign has inherent meaning. Instead, interpretation lies with the detective. Furthermore, no inherent meaning can be assumed because of the multimedia nature of signs: communications are open to interpretation, subjected to one's interpretative baggage. Therefore, it requires understanding of how perception and cognition processes interact to produce working hypotheses and identify prejudices. Eco suggests *undercoding* to unveil them.

"*Pon my word, Watson, you are coming along wonderfully. You have really done very well indeed. It is true that you have missed everything of importance, but you have hit upon the method, and you have a quick eye for colour. Never trust to general impressions, my boy, but concentrate yourself upon details.*"[24]

Undercoded abduction requires examining the data for clues. Since the mind is an "attic"[25], it can be messy or orderly depending on the number and variety of furniture. Thus, we offer a semiotic approach to a forensic science detective toolkit (Figure 7 and Table 5). Semiotics as an analytical technique goes much closer to meaning and use of information by focusing on key elements. Moreover, semiotics is independent of the technology.

[23] Arthur Conan Doyle, *A Study in Scarlet*
[24] Arthur Conan Doyle, *A Case of Identity*
[25] Arthur Conan Doyle, *A Study in Scarlet*

The semiotic ladder offers relevant sensitizing devices. However, applying it in a stepwise manner does not efficiently address the issues of the nature of the content (i.e. representational complexity), its dynamic context and deeply intertwined interpretations of many-to-many communications. We turn the semiotic ladder into a smart briefcase for the investigator. Figure 7 highlights the personal journey that the investigator undertakes to identify clues and analyze them through four dimensions sharing logical but not sequential relation in the iterative analysis.

We assume that the author of the communications has loaded the communications following the semiotics ladder: The message is first loaded with pragmatics (framing the author's intentions within the context). Second, the author loads the semantics (the meaning and truth-of-the-matter). Third, the author loads the syntax (structuring the communication). Finally, the author produces the message (the empirical signal). This communication loading process moves left-to-right in the figure. While we realize this assumption has a nice, structural appeal for the analyst, the actual process of loading the message is likely to be much messier and less sequential.

The semiotic analytical coding operates in a reverse order. The empirical message is coded first, perhaps codes dealing with signaling (such as statistical relations between signs or strings of signs). The syntactical aspect is coded next, perhaps codes dealing with structuring (relations and rules between signs). The semantic aspect is then coded, perhaps as explanations (the relations between the signs and behavior). Finally, the pragmatics is coded, perhaps as descriptions (the relation between agents and social environment). This semiotic analysis takes the form of a disassembly of the signs, and proceeds from right-to-left in the figure. Like the loading process, it is unlikely the coding approach will be so pure. The process must be iterative because, for example, knowledge from the semantic aspect might suggest recoding of the syntactical aspect. Also, knowledge from subsequent communications might demand recoding previous communications. This iterative aspect is discussed further below.

Thus, a semiotic analysis begins by coding each semiotic layer in a first message. Facing complexity or ambiguity, we parse communications into signs. Anything can be a sign if it is perceived and interpreted. The coding reflects the investigator's critical interpretation of the layered-meaning in each message. The coding is repeated for each subsequent message. Each

message adding to the analysis, the investigator returns to previous message(s) and revises the meaning if new messages question previous conclusions.

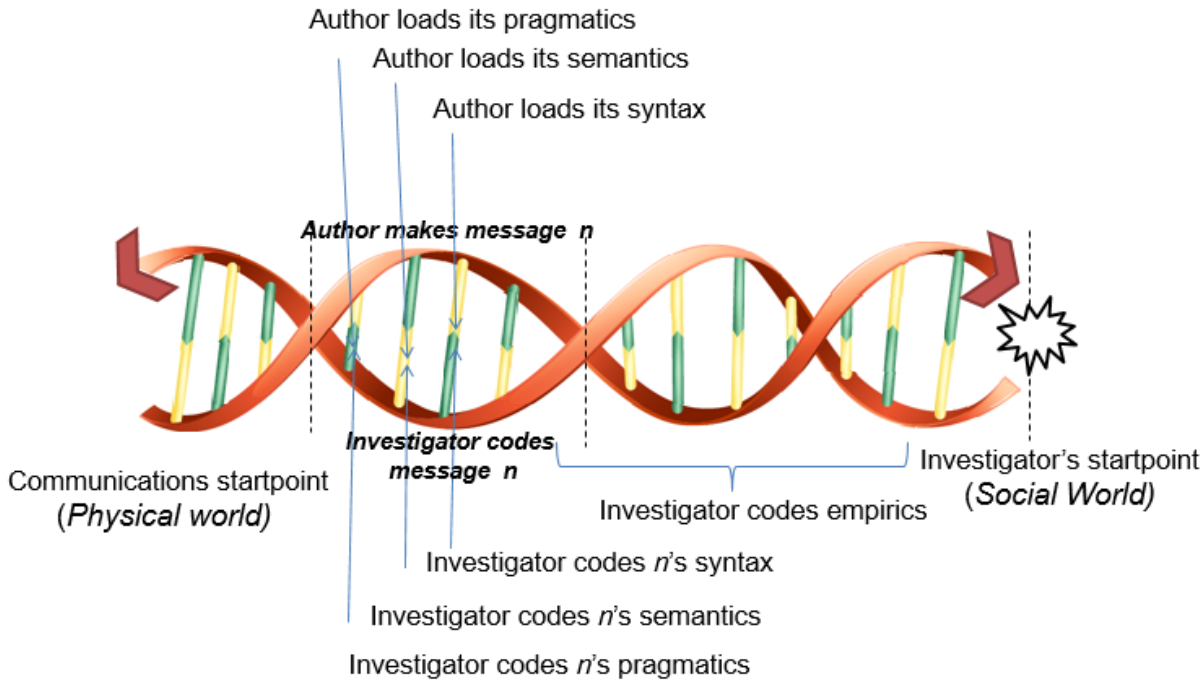


Figure 7: The Investigator's Semiotics Coding Process

The investigator abduces an interpretation of signs to formulate plausible intentional explanations. The double-helix shape (Figure 6 and Figure 7) illustrates how the investigator's *analytical commitment* is intertwined with other sensemaking processes. The investigator's commitment to uncover the "real" mechanisms explaining the observed social phenomenon requires deciphering his/her analytical commitment. This objective-subjective combination is intertwined in the investigator analytical commitment. The analytical commitment arises once the investigator has deciphered the intended meaning in the communications that led to actions, and thus projected his/her own sensemaking process in this interpretation of the signs. In this way, the investigator is a research instrument, whose sensemaking process is an attentional process (Weick 1995). In other words, the data analysts pay attention to their own analytical commitments. This critical attention includes an awareness of how the investigator's own position within the analytical social setting may have affected the analysis. An analytical commitment is a commitment to his/her analysis of the entirety of the communication (Table 5). It accounts for how the investigator has loaded his/her own interpretation into the explanation of the communication.

In this process, we operationalize the four semiotic dimensions of Stamper's ladder (Table 5). Pragmatics is essential because it relies on shared values, beliefs and assumptions that determine patterns of behaviors and enable coordination. Liebenau and Backhouse (1990) argue that empirics have only interest once the other semiotic dimensions have been analyzed. However, that may not always be true considering the *chunk* of data that can be retrieved from online sources such as social media. On the contrary, empirics can help to identify where to look for signaling communications that have been (properly) transmitted and identify the ones that have been transparent. Empirics refers to the technical characteristics – affordances and constraints - that can affect the quality of the message on any screen display. Digitally-enabled environments, afford messages (i.e. string of signs) to access a network of other messages or comments. For the investigator, Facebook affords the display of multiple interaction variables: Likes, shares and comments for each post. As signs, they have meaning but they also have effects by providing opportunities to change meanings. Therefore, there is an active relation of meaning between a user and a message. No sign is fully understandable on its own because signs are intertwined with each other (*syntactics*) and because of culture and time (*pragmatics*) in making sense (*semantics)*. Therefore, following the ladder in a stepwise manner would not account for these interdependencies to such a degree that a definitive analysis is not achievable (*iterative process*).

		Analytical Commitment	
	Author Loads Intended Meaning	*Key Questions as The Investigator Codes Communication in vivo*	**Investigator Codes Investigator's Loadings**
Pragmatics *Describing:* Relation between agents and social environment	**The author loads the communications with their context** Values, beliefs, assumptions shared by a community Formal and informal rules **The author loads the communications with the author's intentions** - mental model - conditions of satisfactions - may cause things	***(Context of use)*** *What are the conditions of (effective?) interactions?* ***(Intentionality)*** *What are the intentions of the stakeholders? Do contextual factors favor the use of this technology?*	***(Context of interpretation)*** *How cultural distant is the investigator from the context of use?* *Does it impede understanding?* *Does proximity make signs transparent to the investigator?* ***(Intentionality)*** *Why choose these data to inform a specific social phenomenon? How does that relate to one's own assumptions and values systems?*
Semantics *Explaining:* Relation between use of signs and behaviors	***The author loads understanding of past communications and/or events***	***(Meaning Making Process)*** *What are the connections drawn between used signs? How are they drawn? What is the outcome of the sensemaking process?* - Appropriate Response - Polysemy - Breakdown	***(Meaning Making Process)*** *What are the continuous decisions made to analyze data?* *What are the frameworks in which the stimuli are analyzed? How to derive benefits from data?*
Syntactics *Structuring:* Relations and Rules between signs	***The author loads the formalization of communications according to rules that govern them.***	***(Construction of meaning)*** *How is the message constructed? How does the structure influence meaning?* - Language, Grammar, Vocabulary, Syntax, Combination of media, Stylistic devices (metaphors, metonymies, etc.)	***(Construction of meaning)*** *How does it capture values, beliefs and assumptions? What is the representation of reality portrayed? What are the semantic values of the construction of meaning?* - **Syntagmatic analysis**: Relation between elements - **Paradigmatic analysis**: Opposition and contrasts between elements

Empirics *Signaling:* Statistical relations between signs or strings of signs	**The author loads technical characteristics by transmitting and receiving communications.**		***(Technical characteristics)*** *Why are they used for or not used for? What does that signal? What is the semantic or emotional value associated with used features in the message?* ***(Traffic/Frequency)*** *Do we observe "abnormal" behavior? Does infrequent message provide more information?* ***(Accuracy)*** *What is transmitted or lost? Is the communication perceived as noise? Can intentions be mistaken? Was the technology appropriate for the context of interpretation?*

Table 5: Questioning Guiding Coding Process

Abduction in its most creative form or ***creative abduction*** requires observations of signs from different world views that at least oppose conventional interpretations or theories. This creative effort implies adjustments or change in our current body of knowledge. Creating such novel perspectives can be done by using semiotics concepts for transparent or absent signs. This kind of abduction involves re-description of previously drawn meanings and relations. When Holmes dismissed Watson's inferences and came up with a new hypothesis, everybody attributed it to brilliant guesswork. In fact, it was actually creative abduction. It was not guesswork at all. The new hypothesis arose from a chain of reasoning and was supported by evidence. Each time a new hypothesis is formulated, a new cycle of analysis starts going through over- and undercoded abduction to support, refine or revise the hypothesis or formulate new ones. Abduction also helps organizing clues into a sensible whole. Abduction rather than observation alone is required to untie social agreements and theoretical constructions. In this way, the iterative process involved in semiotic analysis is not just analytical, but also logical and critical.

3.6. Use example: Semiotic Analysis of Arab Spring Communications

This section illustrates the semiotics analysis as used within a case study. In this case study, we were interested in explaining the role of technology as the tide of mass protests. We observed the offline and social consequences of these events (*social world*). Communications play an important role in such phenomena. Conversations often preceded such events and communications technologies carry trails of evidence leading to protests and narratives of the events beyond borders.

3.6.1. Semiotic Coding of Online Data

In the case of the Arab Uprisings, communication (*physical world*) via social media (e.g., Facebook) specifically kickstarted the mobilization. In the 2011 Arab Spring protests (*social world),* ICTs and social media played an important mobilizing role in the overthrow of President Hosni Mubarak's authoritarian regime. The users – mostly young, urban and educated individuals - turned to social media like Facebook to organize protests and disseminate information nationally and internationally (Dubai-School-of-Government 2011).

There are two common interpretations of the events used previously to explain them. First, a technological analysis celebrates the emancipatory powers of social media (like Facebook and Twitter) an their use by the young to defeat a stable autocratic regime (Ghonim 2012; Oh et al. 2015). A second interpretation is contextual; Egyptians were afflicted by unemployment, soaring commodity prices, corruption and oppression (Gladwell 2010; York 2011). These explanations are rooted in two influential streams of collective action literature: resource-mobilization theory (Tilly 1978) and Marxist theories where a collective consciousness is built around grievances. We started with these frameworks in mind (*overcoded abduction).*

Semiotics analysis was used for data from the English Facebook page "We Are All Khaled Said" from June 2010 until February 11th 2011, the day Mubarak stepped down. For our illustration in this paper, we focus on the data of four days of protests January 25-28. From January 25, protesters took over Tahrir Square in Cairo for the 18 days prior to Mubarak's resignation. We analyzed the data in 2016, five years after the events took place; knowing the outcomes and the current situation (*overcoded abduction).* We explicitly coded pictures and texts according to semiotics approach developed in the previous section (*undercoded*

abduction). Detailed examples of this coding, including author loaded images and text are shown in Table 6 and Table 7.

This four-day episode not only included the Tahrir (i.e. "Liberation") Square occupation, but protests across Egypt and the world (Table 6). On January 27th, in an effort to quell the protests, the government ordered the shut down the Internet. The following day, the cellular mobile telephone service was also shut down (Table 7). The moves were seen as a repressive and propaganda treatment of social media. After prayers on January 28, protests were dubbed as a "Day of Anger".

	Analytical Commitment		
Author Loadings	*The Investigator Codes Communication*	**Investigator Codes Investigator's Loadings**	
 ***(1) Post#3 January 25***	***(Context of use)*** *10 days after the first call for protests, 11 days after Ben Ali fled Tunisia, National Holiday celebrating the Police* ***(Intentionality)*** (mental model) Break down from culture of silence *(Cause things)* Assemble isolated groups (+ triangulation with demographics studies)	***(Context of interpretation)*** *Retrospective study five years after the events* ***(Intentionality)*** *Question of the role of social media in the Arab Spring still heated discussion. Episode of the Internet shutdown did not stop the uprising and thus, weakens the "Facebook Revolution" argument.*	**Pragmatics**
 ***(2) Post#7 January 25***	***(Meaning Making Process)*** *Invitation to join the crowd by the pictures aiming at breaking the culture of fear.* *Showing people they are not alone.*	***(Meaning Making Process)***	**Semantics**

 ***(3) January 29***	***(Construction of meaning)*** *(1) (Structure)* Opposition of a crowd on their knees in front of police standing *(Stylistic Device)* (2) *(Stylistic device)* Metaphor of wave taking over Tahrir Square	***(Construction of meaning)*** (1) Irony is in the opposition of *(Polysemy)* a praying crowd / a crowd bowing in front of police standing and depicted as oppressive and abusive *(3) (Combinations)* 1st crowd picture since Internet shutdown. A lot of texts so far to inform of the shutdown, call out for help and report violence.	**Syntactics**
		(Technical characteristics) (*Affordances)* Sharing pictures of crowds all day on January 25th. ***(Traffic/Frequency)*** *(Frequency & Energy)* Period of January 25-27: high, then silent on Arabic Facebook Page (*abnormal behavior)*, and 116 posts on English page on the 28th, more than 10 ***(Accuracy)*** *Void between 27th and 29th. And then fewer messages. Need to rely on other media.*	**Empirics**

Table 6: Semiotic Analysis of Pictures

	Analytical Commitment		
Author Loadings	*The Investigator Codes Communication*	**Investigator Codes Investigator's Loadings**	
Many reports that the internet and the mobile network will be switched off tomorrow to stop the communication between protesters and try to stop all protests. ***01/27/2011 11:36PM*** *BREAKING NEWS: URGENT - Internet has been completely switched off in Egypt by the Egyptian government 10 minutes after AP published this video of the killing of an Egyptian protester by Egyptian police snipper.* *http://apne.ws/eEC1I5* ***01/28/2011 2:04AM*** *I received tens of confirmation from people in Egypt that Internet is completely cut. Police is withdrawing from all main squares and centers and tens of government hired thugs / criminals and convicts are pouring petrol on cars and setting them on fire. This will be the execuse Egypt will use to show that Police had to interfere violent to save people's lives.* *http://apne.ws/eEC1I5* ***01/28/2011 2:12AM*** *Please contact your government officials and representatives. Egyptians will be slaughtered tomorrow morning. Call the Egyptian embassy in your country. Protest. TALK TO THE MEDIA. Your actions whatever they are WILL SAVE LIVES. Your actions will save lives. Take an action now please.* ***01/28/2011 2:20AM***	***(Context of use)*** 4th day of protests on January 28 Friday, day of prayer Social media still low penetration rate (5.5% of the population) but cellular networks, pervasive in everyday use (SMS) *(triangulation of data with reports)* Police violence and abuse ***(Intentionality)*** (mental model) Break down from culture of silence *(Cause things)* cellular networks wider reach of the Egyptian population	***(Context of interpretation)*** Retrospective study five years after the events ***(Intentionality)*** Question of the breakdown of communications in weakening the protests. Role played of the Internet shutdown episode in the following events.	**Pragmatics**
	(Meaning Making Process) *(Polysemy)* containment strategy from the government / more violence will happen without a window on the outside *(Breakdown)* Real fear from the protests, Found the "switch off" for Internet *(Context of use)* informs *(sensemaking)* *(Improvisation)* Reactions and hiding it, not to be shut down again.	***(Meaning Making Process)*** Theories in collective action: Resource Mobilization (Tilly, 1978), Frame Analysis, Political processes, New social movement theory at different cycles of analysis	**Semantics**

It's now 3 am in the morning in Egypt. Hundreds of political activists are being arrested from their homes at this moment in a very large scale operation. Almost all leaders of Muslim brotherhood are confirmed arrested. More reports that Police agents are pouring petrol in the streets of main squares to set them on fire during protest. Please act. *Government is planning war crimes tomorrow. Please contact the media, governments, leaders and everyone you can. Coverage and Awareness could help save lives in Friday protests.* ***01/28/2011 3:01AM*** *Aljazeera confirms: In several low-income parts of Cairo and Alexandria, government-hired thugs were seen to be splashing petroleum over parked cars. This to prepare for protests in which they'll light vehicles on fire when the time is right for them. They will charge through the streets with swords and caustic acid to splash on protesters placing blame of violence on protesters* ***01/28/2011 5:09AM*** *Internet is down in Egypt. There is one or two ways left to connect to the World. I won't disclose what they are in case Egyptian government finds out. Landlines are back working now in Egypt. Techie Activists are looking at broadcasting long wave radio broadcasts out of Egypt to update the world.* ***01/28/2011 11:34AM***	***(Construction of meaning)*** *(Language)* Shouting capitals (*Stylistic Device)* Irony is in the opposition of Egyptians and crime-related vocabulary to refer to government *(Personification)* Someone screaming/begging for help. Call out international community for help (*Combinations)* No pictures. Plain text, some links to external sources. Emergency or rush: need to inform people before there is no mean to do so.	***(Construction of meaning)*** Contrast with pictures of protests that were positively engaging toward change, when those posts suggest a violent step back. Seriousness of the posts (texts in traditional news format "Breaking news", external links and reference to other sources)	**Syntactics**
		(Technical characteristics) (*Affordances)* Unlimited "editorial decision" to post until no access ***(Traffic/Frequency)*** *(Frequency & Energy)* Period of January 25-27: high, then silent on Arabic Facebook Page (*abnormal behavior)*, and 116 posts on English page on the 28th, more than 10 ***(Accuracy)*** (*Accuracy)* signals transmitted outside of Egypt. Friday, day of prayer: offline networks take over	**Empirics**

Table 7: Semiotic analysis of Facebook Posts

3.6.2. Overall Analytical Commitments

The semiotic analysis of this episode increases awareness of important elements that were overlooked in contemporary interpretations. Such an oversight also arises when studies privilege the media over its content. Posts on the Arabic page warn about the Internet shutdown and possibly the cellular network too, and calls on the international community, the Egyptian diaspora, to help. Then, the page goes silent on the eve of the protests until the 30th. However, by considering the content of both the Arabic and the English Facebook pages, we can associate the absence of signals on one side (Arabic) with the continuation of signals (English) on the other side (*revealed by semiotic coding of the empirics).* The signals and the absence of signals indicate where data are to be found, such as in this case. Evidence missing in the Arabic page may be found in the English page.

Our initial overall analytical commitment might be described as a *Broken Telephone Explanation*. It was named after *telephone,* a cumulative error game in which players whisper a message from player to player until the distorted outcome is announced to the group and compared with the original.[26] With the media curtailment, we initially interpreted the messages as distorted and not properly executed. Communications became sparse and included a struggle to counter censorship. The absence of perceptible events on Facebook signaled abnormal behavior, similar to a broken telephone game.

But the absence of semiotics data on the Arabic Facebook page drives more consideration of other online media: the English Facebook page, news media, etc. Despite the shutdown of communications media, people were still rallying at the protest sites. An extended conversation had emerged on Facebook. It transcended the Egyptian Internet/cellular shutdown because it spanned borders, and created a virtual ecology: a global society across various media. The international community could take over through the international (English language) Facebook page. Egyptians used landlines to call friends and family (in the Egyptian diaspora) to provide updates that they could then spread online. Diasporas were funneling out information that could return to Egypt via landline. The online global social media no longer simply represented simple reflections of the social context in Egypt; it became an extension of that local social context.

[26] Also known as Chinese whispers, Russian scandal, whisper down the lane, operator, grapevine, gossip, don't drink the milk, secret message, the messenger game, and pass the message. See https://en.wikipedia.org/wiki/Chinese_whispers

An analysis of this additional data dissolved the analytical commitment to the broken telephone explanation. Instead, creative abduction leads to an overall analytical commitment to an explanation based on a frame analysis (Benford & Snow 2000; Goffman 1974), political processes (Tarrow 2011) and new social movements theory (Castells 2015). We might describe this as the *Boomerang Explanation*. The Egyptian Internet shutdown did not quell the protests. On the contrary, reports in press show that it likely increased the number of people in the streets and intensified the movement. Because of the shutdown of cellular services many Egyptian people experienced the first government-imposed limitation on their ability to communicate freely. Unexpectedly, this shutdown affected a considerable number of previously apolitical segments of the population (Dunn 2011). The government had, in effect, achieved the opposite of their intended effect. It boomeranged. They had mobilized almost the entirety of the country in support of the protests. Their shutdown backfired.

3.7. Four Principles for a Critical Realist Study of Signs: *The Sign of Four*[27]

In this section, we formulate and articulate a set of principles (see Table 8 and Figure 8 for a summary) underlying a semiotic analysis in accordance with epistemic relativity and realist ontology (see Figure 8). We offer four principles to conduct a critical realist analysis of signs and articulate them with the elements of definition of a sign.

Our analytical approach means to leverage semiotics as a procedure for sensemaking within other overall methodologies. It offers a systematic application of semiotics in studying data available online, represented on our screens (Mingers and Willcocks 2014; 2015; 2017), processed by individuals somewhere, and of which the investigator needs to make sense. Such a sensemaking approach shifts the focus from decision making to meaning (Weick 1993).

3.7.1. The Semiotic Principle of Unlimited Semiosis

Unlimited semiosis designates the continual process of interpreting and making signs. Coined by Eco to describe the unstable relationship between signifier and signified, *unlimited semiosis* refers to the essential role of the reader in the process of making meaning: "Semiosis explains

[27] It is the title of the second Sherlock Holmes' novel written by Sir Arthur Conan Doyle, A. C. 2013. *Sherlock Holmes: The complete novels and stories - Volume 1*, (Barnes and Nobles Classics: New Yorks..

itself by itself: this continual circularity is the normal condition of signification and even allows communicational processes to use signs in order to mention things and states of the world" (Eco 1979, p.198). Peirce refers to meaning as the translation into another system of signs: "The interpretant of a sign becomes in turn a sign, and so on *ad infinitum"* (Peirce 1931-58, p.35-6).

Deciphering the analytical commitment assures that the text (or text-analog) has not disappeared under the interpretation (Nietzsche 1886). When the interpretation actually suppresses the data, it can create misunderstandings of the past. A retrospective study of a phenomenon requires analysts to (re)consider the signs and semiotic judgements of the investigator. In this continuous analytical process, the signifier becomes the signified and vice-versa. Such a reversal may be needed wherever the investigator's interpretation plays an active part in the analysis. The iterative process allows an initial understanding to be gradually revised, refined and enriched through experiences with the data. This iterative process forms a dialogue with the data that fill in the gaps of our understanding. It develops a more authentic analysis and guarantees consideration for local and historical context.

3.7.2. The Epistemological Principle of an Evidence Check

The purpose of an evidence check is to ensure proper use of the trail of behavioral evidence left online. As a philosophical paradigm, CR upholds the access to independent reality through subjective knowledge (Bhaskar 1975; Bhaskar 1998). The investigator draws meaning from the knowledge claims in the data and their relation to reality. The investigator aims at understanding the author's subjective meanings (Klein and Myers 1999; Wynn and Williams 2012) and uses his/her own system of belief to decipher it. One premise in social sciences is that both the investigator and his/her object can make interpretations when they engage (Klein and Myers, 1999). The investigator's understanding and analysis are theory-laden and concept-dependent. It can make knowledge about reality fallible (Bhaskar 1998). To reduce this effect, CR aims at formulating a detailed, empirically-based, causal explanation of how and why a specific phenomenon occurred (Bhaskar 1998).

In an evidence check, the different layers covered by the semiotics coding scheme aim at explicating both the authors' and the investigators' interpretations. An evidence check includes in the analysis both of their contexts and systems of belief. It is important because signs can be

understood synchronically or diachronically with reference to their context of production. Signs evolve over time. On the one hand, the cultural distance between investigator and authors can hinder the formulation of plausible explanations and the identification of the best explanation. On the other hand, no distance (cultural or otherwise) between contexts of production and interpretation can make signs so transparent that investigators miss clues. An evidence check makes such influences more transparent.

3.7.3. The Ontological Principle of a Reality Check

A reality check is consistent with a stratified view of reality. Most of the time, the mechanisms that could explain the observed empirical facts are themselves unobservable. But even if we cannot observe such a causal mechanism directly, we can observe its effects (Bhaskar 1975). Thus, our inferences about the existence of these mechanisms rely solely on our observations of what we believe to be their manifest effects.

A reality check increases the number, variety and depth of our perceptions and experiences and henceforth, increases our confidence that these causal mechanisms do exist (Wynn and Williams 2012). A stratified conception of reality is central to this ontology. At the empirical level, a reality check aims at corroborating the inferred mechanisms. Through the triangulation of data from different sources, we achieve "empirical corroboration" (Wynn and Williams 2012) or "empirical scrutiny" (Bhaskar 1975).

3.7.4. The Inference Principle of Abductions (or Retroductions)

Abductions, as decomposed by Eco (1983), grant access to the real from the empirical. Stamper's semiotics ladder provides sensitizing devices to alleviate *overcoding*, by *undercoding* and thereby generate *creative abduction*. Wynn and Williams (2012) offer methodological guidelines for critical realist case studies that Mingers and Wilcocks (2017) have mobilized in their 4A's semiotic methodology. In their methodology's *Analyze* stage, they suggest investigating semiotics as framed by the personal, material, and social worlds. They also specifically investigate the interactions of these worlds. To fit more generally into other methodologies, our analytical approach operates from a different level of abstraction. Our coding approach exploits Stamper's (1991) more structured semiotic ladder (empirics, syntactics, semantics and pragmatics) but still within the context of CR. Articulated with abductions in a logical and iterative fashion rather than sequential, our analytical device enables

an investigator to move from the empirical to the actual to the real. Hence, sensemaking is both analytical and synthetic.

The Semiotic Principle of "Unlimited Semiosis" This principle requires an active and iterative experience of signs and created interpretations (i.e. new strings of signs). Signs or string of signs are open and interpretable. Signs are interwoven with other signs and are experienced through culture and time. Any interpretation can itself be interpreted and re-interpreted. Signs can rarely be fully captured and understood. Iteration is fundamental in drawing meaning from communications. This iteration includes iteration between signs and strings of signs; it includes iteration between signs and different interpretations.
The Epistemological Principle of Evidence Check Epistemic relativity means "Knowledge is always local and historical" (Mingers et al. 2013). An evidence check ensures that signs are used properly and purposefully in addressing research goals. This principle requires detailed empirically-based description of actors' and investigators' interpretations.
The Ontological Principle of Reality Check This principle answers the question "what is *really* going on out there*?".* A reality check requires revising perceptions of the world we live in and readjusting our grasp of reality. "Empirical corroboration" (Wynn and Williams 2012) or "empirical scrutiny" (Bhaskar 1975) aims at assessing the existence and then the explanatory power of the inferred causal mechanisms. Triangulation of data sources enables investigators to alleviate the limiting effects of their perceptions and understandings.
The Inference Principle of Abductions (or Retroductions) This principle reflects an emphasis on explanation (epistemology) and emergence (ontology) (Wynn & Williams 2012). Drawing meaning from data requires moving from the detailed description of context, actions and outcomes to the identification of potential causal mechanisms. Eco's (1983) definitions of overcoded, undercoded and creative abductions are operationalized in a systematic manner. Abduction applied in unlimited semiosis requires the elaboration and recording of all plausible explanations before choosing the *best explanation.*

Table 8: Principles Underlying Semiotics Data Analysis

These four principles are interdependent, and relate closely to Bhaskar's definition of sign (see Figure 5). The semiotic principle of unlimited semiosis is the overarching principle of semiotics data analysis technique, creating a "whole" explanation of the observed phenomenon. The

investigator needs to become aware of use of available data (*evidence check)*, which aspects of reality are represented or not (*reality check),* and how to formulate explanatory mechanisms (*abductions).*

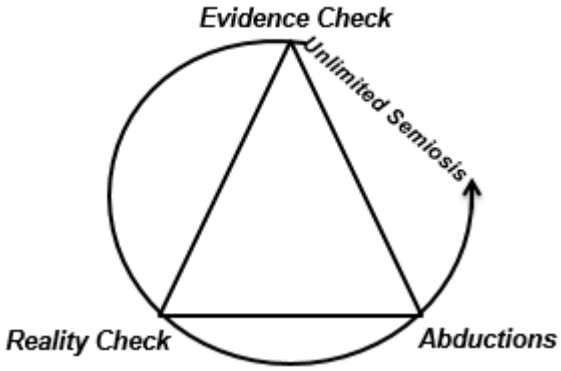


Figure 8: Principles circling the Semiotic Triangle

3.8. Contributions

The semiotic analytical technique described in this paper addresses the problem of representational complexity: the multimedia nature of data that represent phenomena with different layers of meaning. It leverages semiotics as an empirical science to provide a basis for an analytical technique that can be adopted within other methodologies. This analytical technique contrasts with those found in existing semiotics methodologies, such as Mingers and Willcocks (2017). It is a more structured technique that is more easily adapted to more general research methodology such as case studies, grounded theory, ethnography, etc. We propose a set of four principles for conducting semiotics data analysis. Furthermore, the articulation of principles guidelines is consistent with the critical realist definition of a sign (Bhaskar 2008). This research also extends the efforts of previous empirical research that adopts a critical realist approach (De Vaujany 2008; Volkoff et al. 2007; Williams and Karahanna 2013; Wynn and Williams 2012; Zachariadis et al. 2013).

CR is a viable philosophical stance to investigate complex socio-technical phenomena. This research extends previous developments for studying the depth of complex interactions (e.g. Mingers and Willcocks 2017; Wynn and Williams 2012). The philosophy underlying this analytical technique provides a means for formulating explanations rather than predictions. By taking a stratified view of reality, CR is a departure from the dualism of constructivism and positivism. It reconciles previously opposing semiotic arguments. This stratified view of reality

distinguishes *being* itself from our *knowledge of being*. Reality is concept-dependent but not concept-exhaustive. Drawing on this philosophy, semiotic data analysis can offer practical guidelines to investigate the empirical layer with its representational complexity intact.

Furthermore, CR supports certain sensemaking process assumptions about individuals who are acting to warrant their assumptions of realism (Weick 1995): "The process of understanding emerges from the need of individuals to construct an external factual order 'out there' or to recognize that there is an external reality in their social relationships" (Ring and Van de Ven 1989, p.181). Plausibility in the sensemaking process aligns with the search for the *best explanation.* Both focus on "the filters people invoke, why they invoke them, and what these filters include and exclude" (Weick 1995, p.57). We extend this work by operationalizing *analytical commitment* within our semiotic analytic technique. Analytical commitment accounts for the "habits of the mind" (Mingers 2001), clarity of underlying values, social environment (Weick 1995) and intellectual history. We also extend work in sensemaking by formulating a process through which we can derive novel understandings in our research.

The analytical toolkit above also supports further work in the rigor-relevance discussion. Relevance arises by linking a social phenomenon and its social consequences. The technique sets opportunities for IS researchers to conduct powerful inquiries by following threads of online human behavior. These online phenomena illustrate the bright side (Bennett and Segerberg 2011; Benson 1977; Braa et al. 2007; Castells 2011; Deng et al. 2016) as well as the dark side (Bhuller et al. 2013; Chan and Ghose 2014; Chan et al. 2016; Greenwood and Agarwal 2016; Lowry et al. 2016) of socio-technical phenomena. Using semiotic analysis, future research can investigate the perlocutionary effects of representationally complex communications, especially when these effects have societal consequences.

Rigor arises by bringing structure into the analysis of unstructured, rich social meanings in representationally complex data and by making explicit the inference mode (i.e. abductions). This rigor is extended by explicating the investigator's *analytical commitment* in making interpretations. Researchers can better demonstrate the trustworthiness of their conclusions by applying our semiotics toolkit to their perceptions and understandings of observed phenomena.

The semiotics toolkit above helps improve qualitative research methodologies in several aspects. First, by advocating for a semiotic analytical approach, we embrace the information core of the IS field. It improves our understanding and application of semiotics. Second, the

practical guidelines, and their illustration in a current case study, aim at advancing the impact of qualitative inquiries.

Semiotics and critical realism have a more extensive contribution to each other than previously demonstrated. The toolkit above should further stimulate constructive critics and debates that advance our modes of inquiry. Such advancements will hopefully rise in the face of novel challenges, such as representational complexity, as technology and society continue their interlocking emergence.

3.9. Concluding thoughts on qualitative research

3.9.1. Reflections on existing analytical approaches

Regardless of the methodology, tying data and theories is a critical effort towards theory building for researchers that calls for some creativity (Pozzebon et al 2011). Among fundamental methods for qualitative data analysis, semiotics in the example used here show how deeper explanation can be developed. As well, semiotics combined with critical realist assumptions is useful for theory development (see next chapter). The ongoing analysis sustained the development of rival hypotheses keeping our conclusions temporary. As such, our framework accommodates "healthy corrective for built-in blind spots" (Miles et al. 2014). Coding is a heuristic. From its Greek etymology, heuristic means to discover. Our analytical approach offers semiotic codes as a backbone for any research considering the creation, transmission and interpretation of meanings: semiotics ties their representation and their effects. A simultaneous coding process specific to the research topic emerges to inform the phenomenon.

Regarding coding, principles of grounded theory have been adopted separately as data analysis approach. Multiple coding principles have been followed depending on the tradition (Table 9). We raised semiotics coding principles to compete with those. Instead of being solely focused on the data materials, our framework integrates explicitly a sensitivity to context (*pragmatics*) and a sensitivity to the medium *(empirics)*. The operationalization of the semiotics ladder offers guidance to let the data speak. Furthermore, its application to the investigator's analytical commitment integrates systematically *jottings* to strengthen the coding process itself. Miles and colleagues (2014) define jottings as one way to improve mindfulness during data analysis by capturing researcher's ideas, feelings, comments, struggles, etc.

Grounded Theory			Miles et al. 2014
Glaser & Strauss	**Strauss & Corbin**	**Charmaz**	
Open	Open	Initial	First Cycle *(25 different approaches among which Descriptive, In Vivo, Process, etc.)*
Selective	Axial	Focused	Second Cycle: Pattern Coding
	Selective		
Theoretical	Coding for Process	Theoretical	

Table 9: Coding Steps in different traditions

3.9.2. New horizon with Big Data?

The complementarity between insights driven from big data analytics and insights from semiotics is still a vacant area. Big data covers a range of analytical techniques to study large datasets, but the semiotics investigates the interpretation. Big Data deals with volume but data do not talk by themselves. Besides, big data remains silent on how data relate to each other. The limits of datasets and the questions you can ask your datasets with applied mathematics do not call for richer data but for richer analyses.

These limitations open the path for mixed-method research and embrace pluralism to deliver richer insights (Mingers 2001). Anderson (2008) wrote "Out with every theory of human behavior, from linguistics to sociology. Forget taxonomy, ontology, and psychology. Who knows why people do what they do? The point is they do it, and we can track and measure it with unprecedented fidelity. With enough data, the numbers speak for themselves."[28]All researchers are interpreters, their design decisions stem from their knowledge and lead to interpretations. Numerous opportunities lie ahead of us with the visualization power of analytics (De Moya et al. 2017) and deeper analyses of communication patterns and strategies. This research formulates a framework that considers the mechanisms of meaning.

3.10. Conclusion

This paper aims at addressing the specific struggles of IS qualitative researchers and namely the *representational complexity*. of data collected on social media to explain broader phenomena. One of the objective of this article was to illustrate the potential of semiotics as a

[28] https://www.wired.com/2008/06/pb-theory/

data analytical technique for deeper explanations and theory building (see next chapter for the case study illustration). We have developed a semiotic analytical technique and demonstrated how to use it. We also bring into discussion and into explicit empirical work, the individual commitment of the researcher to address rigor.

3.11. References

Archer, M. S. 1995. *Realist social theory: The morphogenetic approach*, Cambridge University Press: Cambridge.

Barley, S. R. 1983. "Semiotics and the Study of Occupational and Organizational Cultures," *Administrative Science Quarterly* (28:3), pp 393-413.

Baskerville, R. L. 2010. "Knowledge lost and found: A commentary on Allen Lee's 'retrospect and prospect'," *Journal of Information Technology* (25:4), pp 350-351.

Bennett, W. L., and Segerberg, A. 2011. "Digital media and the personalization of collective action: Social technology and the organization of protests against the global economic crisis," *Information, Communication & Society* (14:6), pp 770-799.

Benson, J. K. 1977. "Organizations: A Dialectical View," *Administrative Science Quarterly* (22:1), pp 1-21.

Berger, A. A. 2004. "Semiotic analysis," in *Media analysis techniques*, Sage Publications Inc.: Thousand Oaks, United States.

Bhaskar, R. 1975. "Forms of realism," *Philosophica* (15:1).

Bhaskar, R. 1998. *The possibility of naturalism: A philosophical critique of the contemporary human sciences*, (3rd ed.) Routledge: London and New York.

Bhaskar, R. 2008. *Dialectic: The pulse of freedom*, (2nd ed.) Routledge: London and New York.

Bhaskar, R. 2013. *A realist theory of science*, (2nd ed.) Routledge Taylor and Francis Group: London and New York.

Bhuller, M., Havnes, T., Leuven, E., and Mogstad, M. 2013. "Broadband Internet: An Information Superhighway to Sex Crime?," *The Review of Economic Studies* (80:4), pp 1237-1266.

Boulding, K. E. 1955. "Notes on the information concept," *Exploration* (6), pp 103-112.

Braa, J., Hanseth, O., Heywood, A., Mohammed, W., and Shaw, V. 2007. "Developing health information systems in developing countries: the flexible standards strategy," *MIS Quarterly* (31:2), pp 381-402.

Brannen, M. Y. 2004. "When Mickey Loses Face: Recontextualization, Semantic Fit, and the Semiotics of Foreignness," *The Academy of Management Review* (29:4), pp 593-616.

Castells, M. 2011. *The rise of the network society: The information age: Economy, society, and culture*, (2nd ed.) John Wiley & Sons.

Castells, M. 2015. *Networks of outrage and hope: Social movements in the Internet age*, (2nd ed.) Polity Press: UK.

Cebrian, M., Rahwan, I., and Pentland, A. S. 2016. "Beyond viral," *Communications of the ACM* (59:4), pp 36-39.

Chan, J., and Ghose, A. 2014. "Internet's dirty secret: assessing the impact of online intermediaries on HIV transmission," *MIS Quarterly* (38:4), pp 955-976.

Chan, J., Ghose, A., and Seamans, R. 2016. "The Internet and Racial Hate Crime: Offline Spillovers from Online Access," *MIS Quarterly* (40:2), pp 381-403.

Chandler, D. 2001. *Semiotics: the basics*, Routledge.

Danermark, B., Ekstrom, M., and Jakobsen, L. 2002. *Explaining Society: an introduction to critical realism in the social sciences*, Routledge Taylor and Francis Group: London and New York.

De Moya, J.F., Pallud, J., Merdinger-Rumpler, C., & Schneider, F. 2017. "Approche de la communication sur Twitter par l'analytique : le cas de quatre hôpitaux européens," *Management & Data Science*, (1:1).

De Vaujany, F.-X. 2008. "Capturing reflexivity modes in IS: A critical realist approach," *Information and Organization* (18:1), pp 51-72.

Deely, J. N. 1990. *Basics of semiotics*, (Indiana University Press: Bloomington & Indianapolis.

Deng, X. N., Joshi, K. D., and Galliers, R. D. 2016. "The Duality of Empowerment and Marginalization in Microtask Crowdsourcing: Giving Voice to the Less Powerful Through Value Sensitive Design " *MIS Quarterly* (40:2), pp 279-302.

Dewey, J. 1916. *Democracy and Education: An Introduction to Philosophy of Education*, (1st ed.) Macmillan: New York.

Doyle, A. C. 2013. *Sherlock Holmes: The complete novels and stories - Volume 1*, (Barnes and Nobles Classics: New Yorks.

Dubai-School-of-Government 2011. "Civil Movements: The Impact of Facebook and Twitter," *Arab Social Media Report* (1:2), pp 1-30.

Dunn, A. 2011. "Unplugging a nation: State media strategy during Egypt's January 25 uprising," *Fletcher Forum of World Affairs* (35:2), pp 15-24.

Eco, U. 1979. *The role of the reader: Explorations in the semiotics of texts*, (1984 ed.) Indiana University Press: Bloomington.

Eco, U. 1983. "Horns, hooves, insteps: Some hypotheses on three types of abduction," in *The Sign of Three: Dupin, Holmes, Peirce*, U. Eco and T. A. Sebeok (eds.), Indiana University Press: Bloomington, pp. 198-220.

Eco, U., and Sebeok, T. A. 1983. *The Sign of Three: Dupin, Holmes, Peirce*, (Indiana University Press Bloomington.

Ghonim, W. 2012. *Revolution 2.0: The Power of the People is Greater than the People in Power: A Memoir*, (1st ed.) Houghton Mifflin Harcourt.

Gladwell, M. 2010. "Small Change: Why the revolution will not be tweeted,"

Glaser, J., Dixit, J., and Green, D. P. 2002. "Studying Hate Crime with the Internet: What Makes Racists Advocate Racial Violence?," *Journal of Social Issues* (58:1), pp 177-193.

Greenwood, B. N., and Agarwal, R. 2016. "Matching Platforms and HIV Incidence: An Empirical Investigation of Race, Gender, and Socioeconomic Status," *Management Science* (62:8), pp 2281 - 2303.

Grover, V., and Lyytinen, K. 2015. "New State of Play in Information Systems Research: The Push to the Edges," *MIS Quarterly* (39:2), pp 271-296.

Hackley, C. 2003. *Doing research projects in marketing, management and consumer research*, (1st ed.) Routledge: London and New York.

Halverson, J. R., Ruston, S. W., and Trethewey, A. 2013. "Mediated Martyrs of the Arab Spring: New Media, Civil Religion, and Narrative in Tunisia and Egypt," *Journal of Communication* (63:2), pp 312-332.

Hodge, R., and Kress, G. R. 1988. *Social semiotics*, (First ed.) Cornell University Press.

Klein, H. K., and Myers, M. D. 1999. "A set of principles for conducting and evaluating interpretive field studies in information systems," *MIS Quarterly* (23:1), pp 67-93.

Levy, S. J. 1959. "Symbols for sale," *Harvard business review* (37:4), pp 117-124.

Liebenau, J., and Backhouse, J. 1990. *Understanding Information: an Introduction*, (1st ed.) Palgrave Macmillan: Basingstoke and London.

Locke, J. 1690/1959. *An Essay Concerning Human Understanding* (unabridged ed.) Dover: New York.

Lowry, P. B., Zhang, J., Wang, C., and Siponen, M. 2016. "Why Do Adults Engage in Cyberbullying on Social Media? An Integration of Online Disinhibition and Deindividuation Effects with the Social Structure and Social Learning Model," *Information Systems Research* (27:4), pp 962-986.

Luhmann, N. 1995. *Social Systems*, (Stanford University Press: Stanford, California.

Maturana, H. R., and Varela, F. J. 1987. *The tree of knowledge: The biological roots of human understanding*, New Science Library/Shambhala Publications.

McCarthy, J. E. 1984. "Semiotic Idealism," *Transactions of the Charles S. Peirce Society* (20:4), pp 395-433.

Mick, D. G., and Oswald, L. R. 2006. "The semiotic paradigm on meaning in the marketplace," in *Handbook of qualitative research methods in marketing*, R. W. Belk (ed.), Edward Elgar Publishing Limited: Cheltenham, UK • Northampton, MA, USA, pp. 31-45.

Miles, M. B., Huberman, A. M., and Saldana, J. 2014. *Qualitative Data Analysis: A Methods Sourcebook*, (3rd ed.) SAGE Publications.

Milgram, P., and Kishino, F. 1994. "A taxonomy of mixed reality visual displays," *IEICE TRANSACTIONS on Information and Systems* (77:12), pp 1321-1329.

Mingers, J. 2001. "Combining IS research methods: towards a pluralist methodology," *Information systems research* (12:3), pp 240-259.

Mingers, J. 2004. "Real-izing information systems: critical realism as an underpinning philosophy for information systems," *Information and organization* (14:2), pp 87-103.

Mingers, J., Mutch, A., and Willcocks, L. 2013. "Introduction Special Issue: Critical realism in information systems research," *MIS Quarterly* (37:3), pp 795-802.

Mingers, J., and Willcocks, L. 2014. "An integrative semiotic framework for information systems: The social, personal and material worlds," *Information and Organization* (24:1), pp 48-70.

Mingers, J., and Willcocks, L. 2015. "Guidelines for Conducting Semiotic Research in Information Systems," in *14th European Conference on Research Methods (ECRM)* Valletta (Malta), pp. 290-298.

Mingers, J., and Willcocks, L. 2017. "An integrative semiotic methodology for IS research," *Information and Organization* (27:1), pp 17-36.

Morris, C. 1938. "Foundations of the Theory of Signs," in *International Encyclopedia of Unified Science* O. Neurath (ed.), University of Chicago Press: Chicago.

Myers, M. D. 2013. *Qualitative Research in Business and Management*, (2nd ed.) Sage: Los Angeles I London I New Delhi I Singapore I Washington DC.

Oh, O., Eom, C., and Rao, H. 2015. "Research Note—Role of Social Media in Social Change: An Analysis of Collective Sense Making During the 2011 Egypt Revolution," *Information Systems Research* (26:1), pp 210-223.

Peirce, C. S. 1931-58. *The Collected Papers of C. S. Peirce*, Cambridge: Harvard.

Pozzebon, M., Petrini, M., de Mello, R. B., and Garreau, L. 2011. "Unpacking researchers' creativity and imagination in grounded theorizing: An exemplar from IS research," *Information and Organization* (21:4), pp 177-193

Ring, P. S., and Van de Ven, A. H. 1989. "Formal and informal dimensions of transactions," in *Research on the management of innovation: The Minnesota studies*, A. H. Van de Ven, H. L. Angle and M. S. Poole (eds.), Oxford University Press, pp. 171-192.

Saussure, F. d. 1959. *Course in General Linguistics*, (New York: Philosophical Library ed.).

Sebeok, T. A. 1985. *Contributions to the Doctrine of Signs*, University Press of America: Lanham,Md.

Stamper, R. 1973. *Information in business and administrative systems*, Batsford: London.

Stamper, R. 1987. "Semantics," in *Critical issues in information systems research,* R. J. Boland and R. A. Hirschheim (eds.), John Wiley & Sons, Inc.: New York, NY.
Stamper, R. 1991. "The Semiotic Framework for Information Systems Research," in *Information Systems Research: Contemporary Approaches and Emergent Traditions,* Hans-Erik and H. K. a. R. H. Nissen (eds.): Amsterdam: North Holland.
Stamper, R. 1996. "Sign, Information Norms and Systems," in *Signs of Work: Semiosis and Informatiom Processing in Organisations,* B. Holmqvist, P. B. Andersen, H. Klein and R. Posner (eds.), Walter de Gruyter: Berlin.
Strauss, A. L., and Corbin, J. 2008. *Basics of Qualitative Research: Grounded Theory Procedures and Techniques*, (3rd ed.) Sage Publications: Newbury Park, CA.
Tiercelin, C. 1998. "Peirce's Objective Idealism: A Defense," *Transactions of the Charles S. Peirce Society* (34:1), pp 1-28.
Tilly, C. 1978. *From Mobilization to Revolution*, Addison Wesley Publishing Co: New York.
Umiker-Sebeok, J. 1987. *Marketing and semiotics: New directions in the study of signs for sale*, Mouton de Gruyter: Berlin New York.
Venkatesh, V., Brown, S. A., and Bala, H. 2013. "Bridging the qualitative-quantitative divide: Guidelines for conducting mixed methods research in information systems," *MIS Quarterly* (37:1), pp 21-54.
Volkoff, O., Strong, D. M., and Elmes, M. B. 2007. "Technological embeddedness and organizational change," *Organization Science* (18:5), pp 832-848.
Walsh, I., Holton, J. A., Bailyn, L., Fernandez, W., Levina, N., and Glaser, B. 2015. "What Grounded Theory Is…A Critically Reflective Conversation Among Scholars," *Organizational Research Methods* (18:4), pp 581-599.
Warschauer, M., and Grimes, D. 2007. "Audience, authorship, and artifact: The emergent semiotics of Web 2.0," *Annual Review of Applied Linguistics* (27), pp 1-23.
Weber, R. 2003. " Editor's comments - The Problem of the Problem," *MIS Quarterly* (27:2), pp iii–ix.
Weick, K. E. 1993. "The collapse of sensemaking in organizations: The Mann Gulch disaster," *Administrative Science Quarterly* (38:4), pp 628-652.
Weick, K. E. 1995. *Sensemaking in organizations*, (1st ed.) Sage Publications Inc.: Thousands Oaks: London: New Delhi.
Williams, C. K., and Karahanna, E. 2013. "Causal Explanation in the Coordinating Process: A Critical Realist Case Study of Federated IT Governance Structures," *MIS Quarterly* (37:3), pp 933-964.
Wynn, D. J., and Williams, C. K. 2012. "Principles for conducting critical realist case study research in information systems," *MIS quarterly* (36:3), pp 787-810.
York, J. C. 2011. "Not Twitter, Not Wikileaks: A Human Revolution. http://jilliancyork.com/2011/01/14/not-twitter-not-wikileaks-a-human-revolution/ ".
Zachariadis, M., Scott, S. V., and Barrett, M. I. 2013. "Methodological Implications of Critical Realism for Mixed-Methods Research," *MIS Quarterly* (37:3), pp 855-879.

SYNTHESIS 1

Internet-enabled technologies are pervading our economic, political and social life such as attention turns toward the IS field on two dimensions.

On the one hand, we are expected to explain a variety of phenomena from the role of ICTs in contestation movements, the spread of diseases, hate speech and crimes, to cite a few examples.

On the other hand, IS researchers are expected to provide guidelines on the treatment of the data from the digital world. Widespread are the research practice of collecting online data and building predicting models *a posteriori*. However, their predictive capability falls short to be accurate by neglecting the treatment of the content.

Therefore, we have been put in a unique position to help society make sense of these complex, versatile, and ubiquitous challenges. Our doctoral work addresses both expectations.

In this chapter, we addressed the latter expectation by addressing the qualitative treatment of data by addressing their representational complexity (i.e. multimedia data brimming with multiple layers of meanings). We provided a coding example from the rapid-fire digital communications behind the 2011 Arab Spring in Egypt to demonstrate the technique.

We provide an analytical framework that analyzes data and interpretations of data with 4 iterative coding dimensions, we specified the inference process and evaluation criteria. In this chapter, we provided frameworks to structure coding (Table 5), evaluation criteria (Table 8). We summarize our approach in the Figure 9.

The next two chapters address the first expectation towards the field by studying two social phenomena that overflow the online realm.

First, to follow on that chapter, we provide the entire case study of how an online community that started online transform into a supersizing protest to put an end to a regime. The sample of data coded as a tutorial in this chapter comes from the data collected for this single extreme case study. This chapter also shows how a semiotic analytical technique is compatible with a case study.

Second, because not all online communities become a physical community, we looked for spillovers from offline to online back to offline. This work looks at the influence of interactions in offline and online communities on individuals to behave in the other sphere as (s)he sees faithful to her/his identity. We consider three types of behaviors that produce negative spillovers for society.

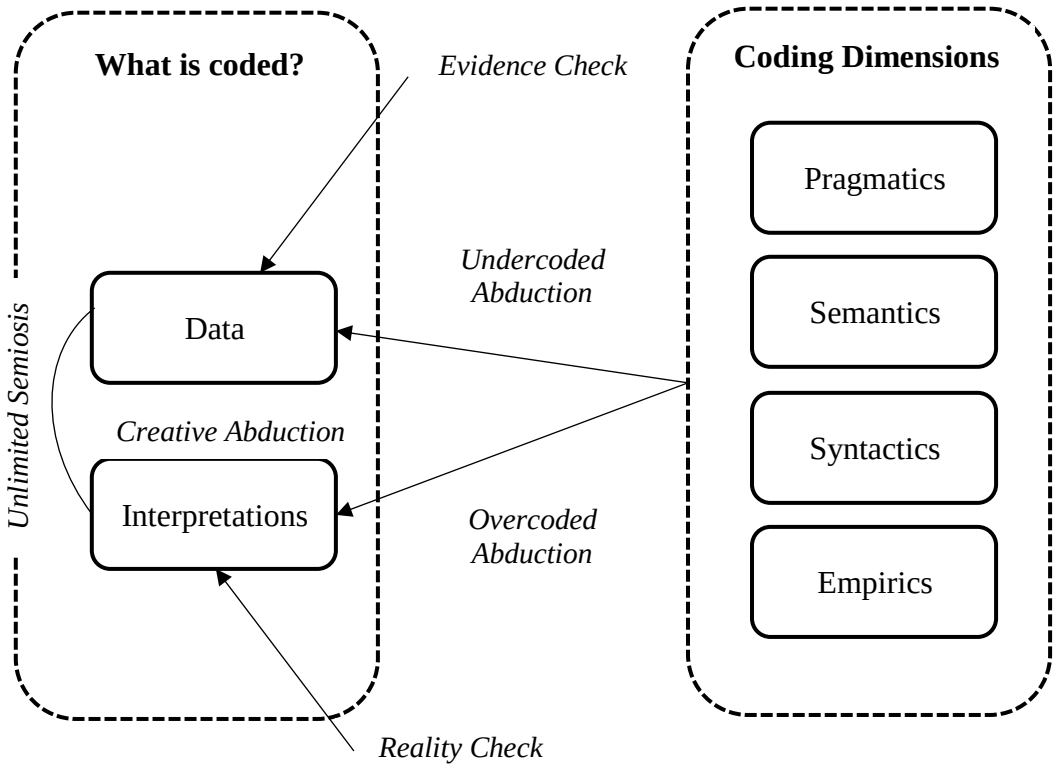


Figure 9: A Semiotic Analytical Framework

CHAPTER 4 - TRANSDIGITAL: HOW COMMUNITIES TRANSFORM FROM ONLINE TO PHYSICAL[29]

Abstract:

Occupy Wall Street, Indignados, Arab Spring are online collective actions that have scaled up into large crowds protesting offline. Furthermore, some of them relied very little on the organizing experience of dissentious actions of traditional actors such as social movement organizations (SMOs). The role of social media in such phenomena has been fiercely debated, quickly dismissed or praised. Absent, however, are any theoretical explanations.

Our framework is based on Luhmann's System Theory, and employs a semiotic analysis to illuminate the role of communications in the autopoiesis of such Open Online Community (OOC). The 2011 Egyptian Arab Spring illustrates an in-depth extreme case study. We show that Facebook features lend themselves to the transdigitalization of an online community or to become an Open Transdigital Community (OTC). The framework is important because collective action limited to the cyberspace, not reaching the wider society, yields weak chances to create social change. This Theory of Online Autopoietic Process (TOAP) involves four discrete and identifiable stages: autogenesis, proto-autopoiesis, transdigitalization, and quiescence.

Keywords: autopoiesis, collective action, open online communities, semiotics, transdigitalization.

[29] An early conceptual version of this paper has been presented to EGOS 2016.

4.1. Introduction

To effectively achieve social change, online communities must engage enough members to participate in offline collective action and involve civil society at large (Lim 2003; Van Laer and Van Aelst 2010). The capability of social movements to engage a critical mass online and offline is critical to successfully act for or against a cause.

Occupy Wall Street, Indignados, Arab Spring are online collective actions that have scaled up into large crowds protesting offline. Furthermore, some of them relied very little on the organizing experience of dissentious actions of traditional actors such as social movement organizations (SMOs). Foredoomed not to happen (Gladwell 2010) because their members were seen as too shortly and temporary mobilized (only hours or days) and mostly in non-conflict zones against the everyday hardships of conflict zones, these collective actions have shaken the last decade beyond their national anchor. Contrarily to SMOs with official membership, digitally-enabled community reached higher-level of worthiness, unity, numbers, commitment (WUNC) (Bennett and Segerberg 2012; Tilly 1978).

The Arab Spring has successfully conveyed its political and social cause and appealed to a broader audience beyond (SMOs') branding and (social and geographical) boundaries by using social media such as Facebook, Twitter and YouTube (Bennett and Segerberg 2012; Halverson et al. 2013; Oh et al. 2015; Tufekci and Wilson 2012). The role of social media in such phenomena has been fiercely debated, quickly dismissed or praised. Absent, however, are any theoretical explanations.

Those collective actions are based on open online communities (OOCs) (Faraj et al. 2011), open and fluid in contents (i.e. people make the "editorial line") and membership (i.e. people follow multiple causes and decide when and to what they participate). These OOCs leverage social media as alternative to mainstream (e.g. newspapers, TV) journalism (often state-controlled) and self-organize their digitally-networked collective action. Studies have mostly highlighted the large-scale movements and the role of communications in shaping and organizing these protests. Size of the community and communications are two characteristics that find support in the larger literature on online communities (Butler 2001). Yet, too often focused on the produced information artifact, the literature leaves out the change embodied by these communities. Still, a movement is not born until outrage rises and is taken into actions.

Our research objective is to explain how an OOC that started online can materialize itself in a physical setting and consequently become an *Open Transdigital Community*, present both online and offline. Thus, we are interested in understanding how online communications have scaled up an OOC offline to achieve social change.

We examine this question in the context of the 2011 Egyptian Arab Spring as an extreme case study. In the 18 days of protest from January 25th 2011 to February 11th a "condition for individual experiences to link up and form a movement is the existence of a communication process that propagates the events and the emotions attached to it." (Castells 2015, p.15). Previous studies have focused on collective sensemaking on Twitter (Oh et al. 2015), we focus on Facebook communications because the first call for protests has been found on Facebook and it was the second source of information after face-to-face. Our research contributes to two current conversations. First, the role of social media in the Arab Spring is still controversial. On one hand, *Cyber-Utopians* (Cohen 2011; Ghonim 2012; Oh et al. 2015) adopt a technologically deterministic stance: the "Facebook Revolution" overthrowing a tyrant where offline activists could not. On the other hand, the *Cyber-Skeptics* (Gladwell 2010; Rich 2011; York 2011), guided by an environmental perspective and eager to dismiss Internet, focus on oppressive social conditions to explain the breakdown of the Egyptian regime. However, reality is a combination of courageous collective action, conditions of duress (Quinn and Worline 2008) and specific features of media at hand.

Second, political and social collective action are complex adaptive social system, with many interacting parts in non-linear manners, self-creating and self-organizing the means to adapt, and producing macrolevel social consequences (Tanriverdi et al. 2010). They can be in constant change (Brown and Eisenhardt 1997) and such extreme case can extend our complexity thinking.

Luhmann' system theory (LST) is useful because it provides a way of transcending those two (i.e. Utopians vs. Skeptics) approaches that scholars have mainly adopted. It is useful in one sense, because Luhmann conceptualized communications as internal process and the structural coupling between the system and the environment. Drawing on Luhmann's work (1986; 2012; 2013), we explore complexity of the autopoietic (i.e. self-creation) and self-organizing process. By understanding the observable and experienced elements (Bhaskar 2013) i.e. communications, we shift our focus from the complexity of the system to processual complexity of communications that kept the OOC from chaos: a small change in the online or offline led to important changes in the other making predictions impossible (Bhaskar 2013).

Beyond the communicative reach of Facebook Posts, Likes, Comments as texts, pictures or videos etc. are representations created, sent, received and interpreted to be acted upon by individuals. Facing the analytical complexity of multimedia data available on Facebook, we turned to semiotic data analysis (Stamper 1973; 1991; 1996) to analyze communications.

The current research reconsiders the impact of SMOs in some conflict zones (Selander and Jarvenpaa 2016). We contribute to the ongoing conversation of the role of social media in (political) collective action (Selander and Jarvenpaa 2016; Tufekci and Wilson 2012). We show that specific Facebook features lent itself to the transdigitalization of an online community. Facebook enables a larger scale of connectivity in diffusing information encompassed in posts associated with currency of attention (e.g. Likes), affording "*ambient awareness"* (Leonardi 2015), *awareness-of-sense-of-community*, *awareness-of-scale* and *scale-of-awareness* for the OOC to successfully materialize social change. Furthermore, we contribute to the OOC literature by theorizing OOCs that have the potential to materialize social change or said differently, become *Open Transdigital Community* (OTC).

The rest of the paper is organized as follows. First, we will introduce the theoretical background. Before explaining our data analysis, we present our research context and approach. Then, we present our conceptual development that has arisen inductively as a theory of online autopoietic process (TOAP). Finally, before concluding, we will discuss our findings.

4.2. Theoretical Background

ICTs have enabled new ways to think and enact collective action, most of the research has focused on the production of the information artifact in discussion spaces. These studies assume that produced goods and services bring changes, leaving out opportunities to study communities as embodying change itself. These communities overflow out of the online space in political and emergency contexts by leveraging social media. There is a pressing need for understanding because business and society are challenged. To address this challenge, this research is grounded in two related lines of research. We address their shortcomings by integrating these streams with a complexity lens.

When we zoom in the OOC literature, the fluidity and openness of membership and content has mostly focused on knowledge sharing. When we zoom in the collective action literature,

we found either/or explanations: either macro and external factors or micro and internal dynamics explanations. We see the literature shifting by acknowledging membership breakdown in conventional organizations (like SMOs) and observing mass protests that operate through highly personalized and technologically-mediated communications outside of SMOs.

4.2.1. Open Online Communities (OOC)

Regardless of platform choice, widespread use of information and communication technologies (ICTs) has enabled unencumbered collaboration and collective intelligence (e.g. Faraj et al. 2011; Faraj et al. 2015; Gu et al. 2007; Han et al. 2012; Johnson et al. 2014) by gathering individuals sharing common interests in virtual spaces, regardless of organizational and geographical boundaries (O'Mahony and Lakhani 2011). Through the communication process, individuals create benefits for themselves and the community (Butler 2001; Wang et al. 2013; Zhang et al. 2013). However, the coproduction capability of these communities is challenged by their openness. Boundaries of these communities are fluid (Dobusch and Schoeneborn 2015), permeable (Wang et al. 2013) and open to the public (Kane et al. 2014), implying constant morphing.

Previous research has highlighted the impact of these discussion communities mostly in knowledge collaboration (Choi et al. 2010; Faraj et al. 2015; Wang et al. 2013). These OOCs are widely studied as discussion spaces where their outcome lies in the coproduction of an information artifact (Faraj et al. 2011; Faraj et al. 2015; Fleming and Waguespack 2007; Ren et al. 2012; Zhang et al. 2013). Considering these communities for their production of information (Butler 2001), cultural goods (Han et al. 2012) or goods and services like the production and enhancement of software (Roberts et al. 2006), these studies rely on the main assumption that OOCs have triggered change by the production of something, mostly the information artifact. This assumption leaves out the capability of the OOC itself to embody the change by becoming something material. However, online communities do not stay within the boundaries of the virtual world anymore without societal consequences. Some may influence attitudes and decisions in the offline world like virtual investment-related communities (VIC) (Gu et al. 2007). Some are reactive and trigger online mechanisms for offline response such as emergency responses (Lee et al. 2015; Nan and Lu 2014; Oh et al. 2013) or in case of social and political movements (Oh et al. 2015; Wattal et al. 2010) or cyclical and passion driven such as fans conventions (Kozinets 2001; 2002). In all these situations, OOCs exhibit self-organization properties: members self-select the communities they want to join and make

deliberate decisions on how and when to contribute to satisfy individuals and collective goals. Studies have mainly focused on individuals' motives and behaviors (Moon and Sproull 2008). Some have considered internal dynamics (Faraj et al. 2011; Johnson et al. 2014). The size of community and communications have a significant impact on retaining and attracting members (Butler 2001). Few have focused on the environment (Gu et al. 2007; Wang et al. 2013).

4.2.2. (Online) Collective Action

A specific form of OOC is social movements and the collective action they undertake across online and offline spaces. Collective actions are "taken by two or more people in pursuit of the same collective good" (Marwell and Oliver 1993, p.4), typically resulting in a shared outcome. Social movements are concerned with social change and alteration of power relations as their goal. Social movements among others have been prompt to leverage mass communication power and the ubiquity of participation of the Internet. Globalization and personalized ICTs have made membership flexible and made room for non-organizational actors to reframe social issues and political dissent (Bennett and Segerberg 2011). Traditional organizations such as SMOs have leveraged them for their campaigns (Selander and Jarvenpaa 2016). Yet, social media has also provided resources for grassroots movements (Bennett and Segerberg 2011; 2012; Oh et al. 2013; 2015; Selander and Jarvenpaa 2016; Tufekci and Wilson 2012).

So far, approaches to study these social phenomena have given supremacy to either external factors or internal dynamics. Yet, those explanations fail to capture the complexity introduced by globalization, technological advances and in the scale of collective actions and its effects. For example, only rarely has research considered the fluidity of OOCs between cyberspace and urban space (Selander and Jarvenpaa 2016) and the self-organizing process leading to physical embodiment of the community with its large-scale impacts (Figure 10).

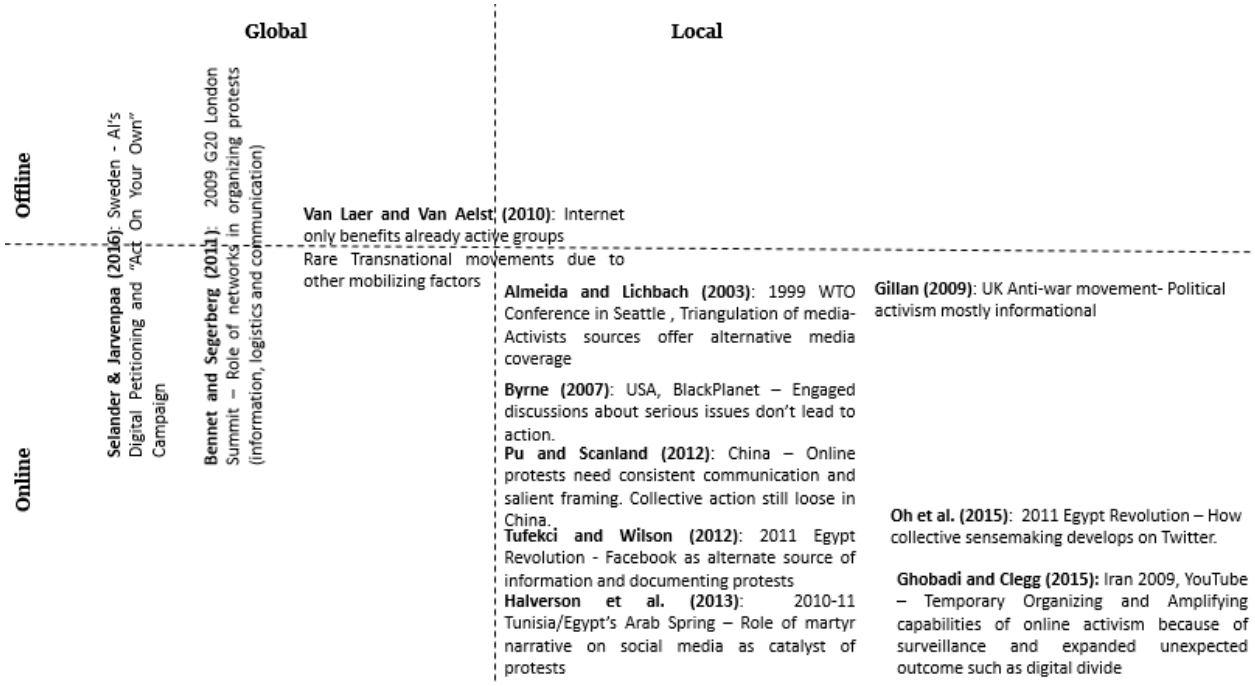


Figure 10: Mapping of the literature (Sample)

Four theoretical lenses have been mainly mobilized (Hara and Huang 2011). Resource Mobilization Theory (Selander and Jarvenpaa 2016; Tilly 1978) focuses on internal dynamics of resources such as money, expertise, means of communication, social ties, etc. ICTs can be integrated to this stream of research as a resource by itself or a mean to develop these resources. Frame analysis (Benford and Snow 2000; Goffman 1974) has been widely applied in sociology. Collective action frames focus on the processual reality construction through the production of meanings, beliefs, values. ICTs enable to build up and diffuse a sense of community and an awareness of this sense of community. Political process theory (Tarrow 2011) adopts an opposite focus by looking at external aspects of the movements in terms of opportunities and challenges. ICTs offer opportunities to take part in action outside of government's control, lowering the cost of participation. New social movement theory (Castells 2010) puts an emphasis on the interactive process of collective identity construction. ICTs' features can provide opportunities to participate and foster a collective identity.

Online social movements have harnessed aspects of the presented theoretical frameworks through the Internet by mobilizing sizable numbers of people in action (Hara and Huang 2011). Even though the literature on social movements and political action is widespread in different fields, in general, studies have tended to focus on narrow issue. For example, the focus has been on individual-level studies to link social media use and participation to protests (e.g.

Tufekci and Wilson 2012), instead of the capability of social media to access a larger pool of individuals through offline networks. Bennet and Segerberg (2011; 2012) suggest that ubiquity of the Internet encourages the rise of self-organized *connective actions* where individuals do not know each other and learn about the time and place through their personal social networks (Tilly 1978), describing a shift from centralized formal group engagement to personalized participation. Similarly to more broad OOC, people resist membership, they follow multiple causes but are selective in actions they decide to participate (Bennett and Segerberg 2011; Bimber et al. 2005). This last point is not a trivial aspect, since governments have little control over the Internet and cut-off is a common response from authoritarian regime. These networks ensure the maintenance of communications and not sliding into chaos by enabling an "ongoing conversation" (Tilly 1998) and coordination.

Social media, specifically, has been considered either as central for social change and online activism (Ghobadi and Clegg 2015; Selander and Jarvenpaa 2016) and for empowerment (Ling et al. 2015) or has been dismissed as inconsequential (Cebrian et al. 2016). As shown in previous studies, mainstream media is often pro-regime (Oh et al. 2015; Tufekci and Wilson 2012). Many scholars (Edwards 2014; Halverson et al. 2013; Lim 2003; Oh et al. 2015; Tufekci and Wilson 2012) have focused on the role of social media in the Arab Spring and highlighted their central role. Research has highlighted how groups have self-organized and improvised thanks to social media "they enable immediate connections among previously disconnected groups of people" (Oh et al. 2015, p.212). However, "no revolution can happen without involving society on a wider scale. Even efforts within cyberspaces are fruitless unless they can be extended into real social, political and economic spaces" (Lim 2003, p.274; see also Van Laer and Van Aelst 2010), so the question of how untraditional actors have mobilized beyond critical mass from online to offline - being boundaryless -remains unanswered.

While we do not support technologically deterministic explanations of the Arab Spring, we rather support the idea of complex collective action (Tufekci and Wilson 2012), to which social media was a salient feature (Halverson et al. 2013). We argue that social media as non-political platforms afford opportunities for political dissent leading to materialization of change by combining different aspects of social movements. The use of Facebook, through information encompassed in posts shared to personal networks associated with currency of attention (e.g. Likes) was a facilitator of social change and alteration of power relations.

4.2.3. Luhmann and Complexity

Social movements are self-producing and self-organizing systems: a social movement is coupled to the rest of society, and still autonomous with its own internal logic. Henceforth, it cannot be reduced to a singular cause that lead systematically to protest, neither external nor internal factors, it is transforming the opposition to society within society into action according to Luhmann. Social movements have complex causes and unfold in complex and non-linear interactions with society. Self-producing and self-selecting an interpretation of a problematic situation, their identity, goal and actions in an iterative self-referential process, they are complex dynamic social systems.

Luhmann (1995; 2012; 2013) draws upon concepts from diverse fields to formulate his theory of social system. Concepts such as autopoiesis (Varela et al. 1974) (i.e. self-production), self-organization (i.e. self-selection of elements and relationships) and self-reference in relation to meaning are central to our understanding of complexity. Communications are the infinite process that enables the further production and reproduction of social world. The nature of communications in social movements recursively calls for mobilization to maintain the social system. Therefore, OOCs formed around social change are self-referential communications system, operating against society within society.

Luhmann's work implies a high degree of abstraction to theorize social systems, our interpretations led to empirical implications for this study. Empirically, Luhmann defines complexity as the impracticability of completely observing a social phenomenon and thus, connecting all the elements. Elements of the system can be understood in terms of communications as observations of complexity in the social world. The system is structurally coupled to the environment (i.e. OOC to the civil society). The explanatory power of coupling can be translated within the social system to describe the interdependency of the communication process. We develop key elements of Luhmann's systemic thoughts for the purpose of our research.

4.2.3.1. Theory of observing systems

Luhmann's work follows and furthers previous attempts to generalize systems theoretical approaches such as Bertalanffy, Boulding and others by offering a "theory of observing systems" (Luhmann 2013, p.27). Luhmann acknowledges complexity by rejecting closed systems assumption and acknowledging living, psychic and social systems to be found in the world. Yet, his principal interest revolved around society and thus, his focus on social systems (Luhmann 1997). He turned to biology and sociology to look at open systems, where openness integrates in the theory exchanges between the system and the environment (Seidl and Becker 2006). Without fully accepting the assumption of open systems. He was interested in the conceptualization of these exchanges. In the case of social systems defined as communication systems, he looked at information exchanges. Luhmann's work aims at explaining how environmental stimuli lead the system to change: the environment is said to irritate the system leading to a stable (or unstable) structural change. The environment is actually composed of other systems that might become relevant to the considered system. The environment constitutes the external context or background of the social system but is also constitutive of the system. The system draws its own boundaries through operational closure, i.e. through the internal synthetic logic of communication. The system draws its own boundaries from the environment:

"The system operates in a selective way, as much in the plane of the structures as in that of the processes: there are always other possibilities that can be selected when one pursuits an order. It is precisely because the system selects an order, that it becomes complex, since it is forced to make a selection of the relation between its elements" (Luhmann 1995, p.137). Therefore, system boundaries cannot be taken as given nor for granted, they are components of the system (Luhmann 1990).

Nevertheless, Luhmann conceptualized interactions between system and environment such as the latter "irritates" the former for change without the system being able to affect the environment. Operational closure is the starting point to understand autopoiesis and self-organization.

4.2.3.2. Self-organization and Autopoietic Process

Luhmann draws a clear distinction between these two concepts (Luhmann 2013). On the one hand, self-organization refers to the arrangement of the elements produced by the system itself. The activity of a system presupposes structures. On the other hand, autopoiesis refers to the actualization of the structure-making capability inherent in each system state. Thus, each system state is a potential point of departure of the actual structure. The work of Chilean biologists Humberto Maturana and Francisco Varela (e.g. Varela et al. 1974) brought the Greek term of autopoiesis, i.e. self-production or self-creation as well as self-renewal to systems theorizing. Autopoiesis implies the autonomy of the system by producing its own structures, operations and boundaries i.e. without importing anything, the system generates itself. Therefore, there is a circular process between self-organization and autopoiesis. As an example, language is the condition for speaking, but at the same time cannot be forgotten because it is spoken, i.e. because of communications.

4.2.3.3. Reformulating coupling as autopoietic mechanism

All social systems are dependent on communications, even more so autopoietic systems: "social systems use communications as their particular mode of autopoietic reproduction. Their elements are communications which are recursively produced and reproduced by a network of communications and which cannot exist outside of such a network." (Luhmann 1986, p.174). Communications are the only means of system self-renewal. This means that only a system can transform itself.

To understand how the transformation takes place, we need to turn to structural coupling, i.e. the linkage between system and environment. The coupling insures that the system processes information initiated by the environment (irritation or stimulus). So, information processing only occurs within the system creating a capacity of possibilities still within the system. The degree of irritability can therefore be understood as structural coupling to describe the interdependence between the system and the environment (itself composed of other systems). The explanatory power of coupling can be translated within the considered social system, when talking about communications as the autopoietic mechanism. Communications are interdependent to different degrees, or loosely to tightly coupled. Perrow (1984) offers coupling characteristics that are convenient to describe communications coupling. On the one

hand, loosely coupled messages embody partial or infrequent answers to initial ones and delays within a conversation. On the other hand, tight coupling implies quasi instantaneous responses that delivers efficient interactions. More tightly coupled communications act as the glue of the system (Weick 1976).

In the context of OOCs, messages can convey one or more coupling signals, signs and symbols that indicate the degree of coupling present in the OOC. Loosely coupled messages will allow more independency of the members and the OOC can adapt easily to change in the environment. Moreover, drawing on Weick (1976), we can explain why messages in OOCs can be partially loosely coupled and partially tightly coupled.

Coupling is a mechanism that indicates the way in which messages are driving the autopoietic process. Each message behaves as an event. As communications continue, further messages (events) connect to previous ones and prepare for upcoming ones. This behavior describes the connectivity property of messages. Messages reflect two abilities of social systems: self-reference i.e. "the ability of systems to refer to themselves and their constituent components" and other-reference, i.e. "relating and referring to their environment" (Lee and Demetis 2016, p.5079).

Coupling signals within messages indicate the connectivity property as well as the interdependence between the system and the environment. Therefore, coupling signals provide an indication of the state of autopoiesis in an OOC. We assume that, as the proportion of self-reference increases in each message in comparison to other-reference, it signals that the coupling to the OOC is increasing, and consequently, the autopoietic process is advancing.

4.2.3.4. Reentry

The paradox of reentry is the appropriation by the system of what it has distinguished itself (i.e. its environment). The confrontation between system and environment can be observed within the system. Reentry marks the transition from one autopoietic episode to another. It describes a relation between self-reference and other-reference and defines a tighter degree of coupling. Meaning is operationalized by reentry.

So far, OOCs share similarities with Luhmann's conception of systems. They have an interactional openness with their environment (i.e. outside of the community). They negotiate their boundaries. Their agenda of collective actions can be stimulated or irritated by exogenous

events. These events lead to self-organization of their internal resources. They adapt through response and autopoiesis. These recursive processes can be observed and described through online conscious communications that technical systems (such as social media) can track and capture. The potential of autopoiesis has been eclipsed (Demetis and Lee 2016) and underestimated in describing the state of departure from a given situation. This potential has also been overlooked in explaining OOC development over time.

4.3. Research Context and Method

We engaged in an inductive and in-depth extreme qualitative case study from which we formulate a process model.

4.3.1. Rationale for an extreme single-case study

The inductive approach is relevant to the study of phenomena that are deeply contextualized and lack explanations in the literature (Edmondson and McManus 2007). To engage deeply with the context and the data, we adopted a single case study.

A single-case study design has been advocated for different research endeavors (e.g. Yin 2014). Among them is the extreme single-case study (Gerring 2007; Yin 2014 ; Godé-Sanchez 2008 ; Bouty et al. 2011). Extreme cases are those that exhibit characteristics that do not occur every day. They are called extreme because they are "paradigmatic of some phenomenon of interest" (Gerring 2007, p.101). Extreme cases are useful for generating new theoretical insights, as they offer unique opportunity to document, analyze and inform more common processes.

The Egyptian Arab Spring offers an excellent opportunity to study rapid scaling of a community for social change. This case offers potential for discovery of general mechanisms by which a community resets its own context by crossing the threshold from the relative comfort of online, low-level-of-risk-taking actions to the relative danger of offline, high-level-of-risk-taking actions.

4.3.2. Research context

We structured the description of the following events by leveraging the "descriptive utility" of temporal bracketing. The tenet of the bracketing strategy is the "decomposition of data into

successive adjacent periods enables the explicit examination of how actions of one period lead to changes in the context that will affect action in subsequent periods" (Langley 1999, p.703). Langley gives the example of a flow chart to visually represent periods. We choose below a timeline (Figure 11). We identify a point of departure that decomposes our timeline in four periods.

We trace these four periods in the communications as marked by specific events. Those events are "action-reaction" types of relationships between society-at-large and a sub-set of that society (i.e. OOC), whose temporal progressions enrich our understanding of the ontology of the social (Langley et al. 2013). This study embraces the study of process "in which things are reifications of processes" (Langley et al. 2013, p.4; see also Tsoukas and Chia 2002). The OOC, as a sub-set of a larger society, is in a constant state of bringing reality together (Tsoukas and Chia 2002).

The first event is the death of Khaled Said, a young man from Alexandria beaten up by the police. Social media erected him as a martyr and as *the face of a cause* by creating a Facebook page for his martyrdom ("We Are All Khaled Said"). In this way, an event that happened in the Egyptian society-at-large triggered a reaction that created an online community. The second event is different because the lag time increases and the online community begins to anticipate the behavior of society. With the prospect of corrupted elections, the Facebook page calls for support and protest on the two days before the election. The third event illustrates the triggers created when the physical, large-scale protests culminated with Tunisian President fleeing his country. The online community called for protests in Egypt. This call for protests is answered locally and globally with protests that are no longer just online. The last event involves the local society, by reacting to the physical actions of the community, obtains the resignation of Egyptian President Hosni Mubarak.

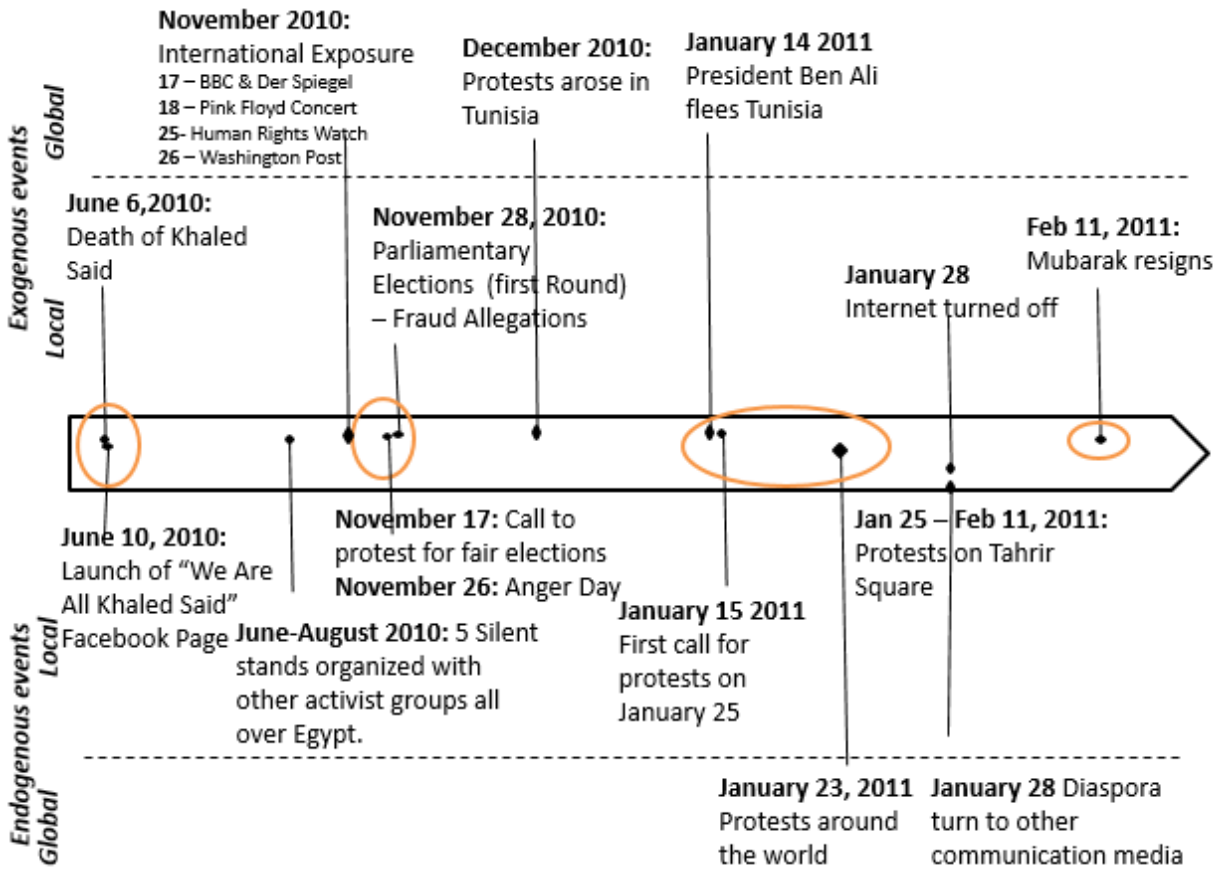


Figure 11: Timeline

4.3.3. Case study database

Data can be eclectic (Langley 1999) and we used different sources to build a narrative of the events around the evidence.

From our review of academic literature, we found evidence that social media was leveraged in the Arab Spring. Facebook played an early role in those momentous events. Our focus is on Facebook data because studies have shown that Facebook was the second – after face-to-face communications – most common source of information (Tufekci and Wilson 2012). Facebook was where the first call for protest (on January 25th, 2011) was found.

Facebook is a social networking platform that allows individuals to 1) create a profile on which 2) they can share pictures, texts, videos, etc. and 3) network through a "friendship" system. Facebook is a system constituted by numerous and various subsystems, i.e. communities gathered in a common interest, and more practically, around a page like "We Are All Khaled Said". It is a complex and dynamic system: complex, because we cannot be fully aware of all

the interactions happening; and dynamic, because it is permanently reproduced through communications. Communication is a dominant function of Facebook.

We focus on the English Facebook page to further account for mobilization and, in our case specifically, transdigitalization of collective action. The English page reflects activities in conflict and in non-conflict zones because it became a major focal point for both domestic and overseas demonstrations. While the English and Arabic pages generally mirror each other, we complemented our English data collection with some translated posts from the Arabic Facebook Page, especially for iconic posts like the very first posts.

Aware of the limitations of our main data source focus, we triangulated our findings with alternative accounts of the events such as books, diaries, news articles and essays (Table 10).

Data Source	Data collected	Use in the Analysis
Facebook	2042 Posts till 05/01/2016 1033 till 02/12/1011 Comments and Likes for each post	To gather data at the level of interaction. To identify processes of leading to a transition from online to offline collective action.
General Press/Blogs Articles	15	To gather representations of offline events. To triangulate different accounts with our findings and constitute a log of events (Appendix D).
Research articles	17	
Books/Diaries	5	

Table 10: Case Study Database

4.3.4. Analytical technique

A methodological implication of LST is the focus on communications as the internal and autonomous autopoietic process of a social system's development, maintenance and renewal. Communications are available to all on social media and are part of the emergent and accessible layer of reality. Interactional openness, as conceptualized by Luhmann, makes the system sensitive to environmental stimuli. Even though Luhmann never referred to himself as a critical realist, authors like Mingers (1994; 2003) regard his work as such.

We turned to semiotic data analysis for two main reasons. First, Luhmann defines the social as made of communications and communication as the autopoietic process of society as the largest system it can be, yet does not offer guidance on how to look at communications. Second, data collected from Facebook are multimedia in form and complex in content.

Semiotics is the study of signs, where anything, i.e. text, picture, video, sound, etc. can be a sign to be interpreted. We picked Stamper's ladder of semiotics (Figure 2) because Stamper (1973; 1991; 1996) starts from the physical existence of communications (*physical world)* which are analyzed through four dimensions of the ladder (*empirics, syntactics, semantics, pragmatics)* to explain the social consequences of these communications (*social world).* We rely on Liebenau and Backhouse's (1990) introduction to the different dimensions of the semiotics ladder (Table 11)

Pragmatics	**Semantics**
"the consideration of the context of activity, and those characteristics of people, organizations and acts of communication which affect information" (p.20), which includes the social irritation to semiotics	"the meaning of acts of communication" (p.37)
Context provides boundaries to develop meaning (e.g. physical and cultural) **Intentionality** - Community of thoughts share a view of the world - Conditions of satisfaction are defined - May lead to actions	**Meaning** i.e. how to make sense of data up to the point of the results of interpretation (e.g. actions) **Semantic problems** No inherent meaning. The more culturally distant are the parties involved in communications, the more likely is confusion to emerge. **Semantic Analysis** Identify agents, entities and their relations.
Syntactics	**Empirics**
"the means of formalizing the way in which we represent information" (p.55), which includes the self-organization of communications	"the role of the physical and engineering aspects of information" (p.67), which includes the irritations from the physical environment.
Vocabulary and Grammar Elements of discourse **Syntax** Positioning and Combinations **Usages** Link communications to actions	**Modulation of signals** - *Sensitivity*: receiver's capability to discern - *Range of sensitivity: what can be perceived* - *Resolution of output:* Precision Logical measure of information (e.g. frequency)

Table 11: Stamper's Semiotics Framework. Table adapted from Liebenau and Backhouse (1990)

This approach is consistent with a critical realist philosophical stance taken in our case study. The complexity view described by Luhmann implies a sense of knowing dependent of the observer. Therefore, questions about the nature of the real arise. Facing complex situations, observations are dependent of many contingencies. Critical realism (CR) (Bhaskar 2013; Fairclough et al. 2004; Hartwig 2015; Mingers 2001) assumes a subjective knowledge of an

objective reality. Stamper's ladder builds on four aspects of communications to draw interpretations and identify generative mechanisms explaining observed social phenomenon. Systems-theorizing (Demetis and Lee 2016) and CR-based research for systems-oriented theorizing (Lee 2004) have been advocated for developing in-depth explanations of complex interactions (Grover et al. 2008).

4.4. Data Analysis and Findings

What happened in Egypt in early 2011 did not start in 2011 or 2010; it started long before in people's lives. Internet (and social media) users and non-users were sharing a context of oppression and economic struggles (Sadiki 2014). We use a narrative technique (Pratt 2009) to present our data analysis and findings from individual voices of participants and witnesses of the events. By using an engaging, second-person narrative, we avoid the less-accessible recitation of the detailed semiotic analysis. Nevertheless, this is not a tale of the emancipatory power of social media. The main insights that arise from the analysis are provided below. We illustrate the use of a semiotics analytical technique with "power quotes" and complete our storyline by quoting "proof quotes" (Pratt 2008; 2009).

As Facebook will be our starting point, picture yourself in the middle of your "Friends" circle, it is literally there every time you log in to your Facebook account. All the people in your circle can follow your updates on their news feeds. You update your status, post, comment, *Like* contents or share them; you make new Friends and you block other people. This is your own space.

4.4.1. The Death of Khaled Said

One day, you find out about this young man with an innocent face who was beaten to death outside of a cybercafé by the police in Alexandria. You can identify with him (Sadiki 2014), he is from the middle class, an educated Egyptian who died at 28: "*My first reaction was denial. I could not believe that anyone could actually inflict such brutality on someone else. The victim was a twenty-eight-year-old from Alexandria. According to eyewitnesses, some dispute had erupted between him and the two officers, leading to their physical assault on him, which claimed the young man's life. I felt miserable, frustrated, and outraged*."(Ghonim 2012, p.58-9).

And shortly afterwards, you learn about the Facebook page "We Are All Khaled Said", which is named after this young man. Like Adel, you engage: "*Like thousands of other Egyptians, I had joined the "We are all Khaled Said" Facebook page, set up in mid-2010 after the police murdered a young man in cold blood in Alexandria*" (Al-Saleh 2015, p.55). The Facebook page is anonymously administrated under the pseudonym "El Shaheed" ("The Martyr"). It opens with a picture of Khaled's bludgeoned face taken at the morgue by a family member. The police assert that he was involved in drug dealing and he tried to escape his arrest by swallowing a bag of drugs. But online, you find a different story (Table 12, Appendix A).

Post #1 June 10, 2010 9:01PM	Analysis	Concepts
Oh you inhuman: we will claim Khaled Said's Right. I'm Egyptian. I will never accept Khaled's murder by torture, by heartless people with no mercy. These people were confident they could get away with murder because they're from the police. I'm Egyptian. I will not let the blood of this young man be wasted. I'm Egyptian like Khaled, I didn't stand by him. Tomorrow they will come to kill me and you won't stand by me. The person that killed Khaled and soiled his hands with Khaled's blood shouldn't see the light of day anymore. People like this do not deserve to live. They do not deserve to live in Egypt among us.	"I'm Egyptian" vs. "they", inhuman and murderers guilty for the torture, the blood, reproduce the authoritarian regime. But also, all the people who did not do anything to change the situation: "stand by him", "stand by me", provoke/galvanize the crowds to take action towards change to hit the pride, anger of the audience. So, that the message ends on a collective, unifying "us" Set the cultural and political context to develop a shared mental model.	*Autopoietic Element Of Martyr narrative* Identity *Community of thoughts* *Sense of community* **PRAGMATICS** Alterity *Cultural Context: institutionalized practice* Discontinuity *Intentionality* **ENVIRONMENT** ***Other-reference vs. I: no self-reference*** *Culture of silence* *Accountability* Continuity *Maintenance of an order* *Culture of fear* *Fear-oriented communication* Weak ***self-reference***: defined against the institutionalized order

Table 12: Semiotic Analysis of First Post - See Appendix A for further Analysis

The shock of the pictures and the story reach beyond the national borders. The page quickly becomes popular and is populated by more cases of people like Khaled. In association with other activists, the Facebook page calls for Silent Stands starting with Alexandria, Khaled's hometown: five over the summer.

The living and smiling face of Khaled becomes the iconic face standing against injustice and corrupted authorities. He personifies both. Juxtaposing pictures of the ruined face of Khaled and the smiling face of Khaled strikes you, intensifying your emotions. He is a martyr of the Emergency Law, and a witness of the oppression (Halverson et al. 2013; Herrera 2014). Culturally and religiously, a narrative of martyrdom resonates with you whether you are Muslim or Christian.

As you keep following updates on the Facebook page, you become aware of more police brutality, missing cases and injustice (that we do not wish to reproduce here considering the violence of the content). Those victims, those martyrs, are systematically reported so that everybody witnesses the wrongdoings of the regime. People produce and share these stories of oppression. The content is not "clean" or professional but it reinforces the inclusiveness of the community.

You read other people's comments that translate the shared resentment, the need for the truth and a sense of hope and courage:

"*The Most Important Thng we Must Tell The world about , That police and Prosecution and Judiciary and Autopsy General Managers are in collusion together to cover The crime so As not to Expose Their Affairs .. Particularly This Fake autopsy report By Al- sebae about khalid's death lets send a message says there is a chaos all the time cause of the corrupt Government"* (07/20/2010)

"*The Egyptian government neither represent the people nor act in their favor. The government is supporting the apparatus of terror to protect the corruption that has reached its hight during the reign of Mubarak the despot of Egypt. We shall bring down the Despot, the apparatus of terror, and the slave solders.*

The people have spoken and the uprising has begun!!!" (07/23/2010)

*"What on earth can anyone do to deserve this treatment?" (*07/27/2010*)*

*"It's a long and hard road, are you with us?" (*08/15/2010*)*

You witness the community getting stronger, you read voices of dissent that you could not hear anywhere else, and you realize that you are not alone. You feel this sense of community, while before you were feeling isolated. Multiple voices are represented, since members generate content. Multiple sources are cited, such as newspapers or Amnesty International. These sources reinforce the authenticity of the page and the credibility of the emerging space of hostility against society.

Insights: We label this period *autogenesis* to describe the self-creation of a community. We have highlighted how the organizing process was triggered by the environmental stimuli: a

sense of community growing around an emotional narrative and an exposure to others' messages affording an "ambient awareness" (Leonardi 2015). These have been built through the features of the media.

4.4.2. Emboldened by Global Society Acknowledgement, the OOC Gets Ahead of the Local Society

The Facebook page and Khaled start drawing attention beyond Egypt, not only from the international press (see Figure 11: Timeline), but also from worldwide artists (Figure 12) who are taking a stance against what has been happening in Egypt:

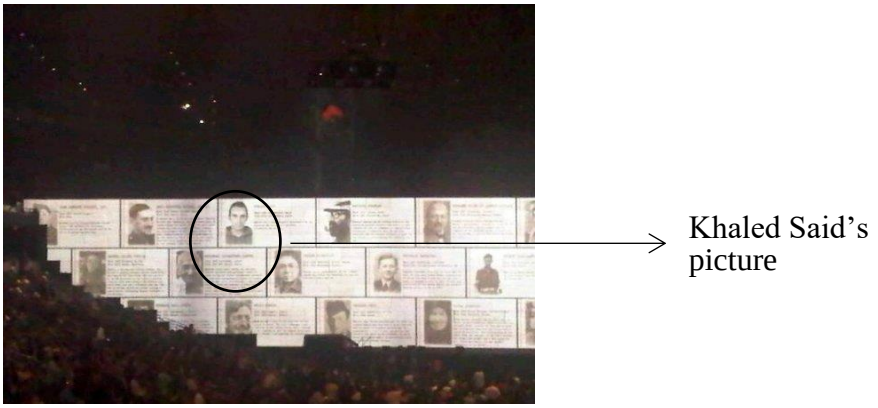


Figure 12: Pink Floyd's concert in Florida displaying pictures of people becoming symbols of injustice

Those initiatives from an international civil society provide exposure in mainstream media. The rest of the world is looking at us.

"It feels great when you know that the whole world has started to listen to us Egyptians and support our fair cause. A torture-free and just Egypt for all." (Text accompanying picture in Figure 12, 11/18/2010).

You did not expect such exposure, such engagement around the cause, such engagement beyond our reach. It seems especially truthful considering that the national press distorts facts. It was not planned. Yet, those external representations of what you have been following these past months not only raise awareness worldwide, but also raise your own awareness about your sense of community. Egyptian or not, you stand up against torture, you stand up for Khaled. You become aware of this sense of community.

You see the *Likes* increasing again, getting some enthusiasm back after a month, which strengthens some loyalty to the cause, maybe it's a revolution. Authors like Gladwell (2010)

do not believe that it's a revolution, we are too dispersed, our links are too loose to create a movement, we won't go protest. But this is a different kind of participation, where you do not need to be from Alexandria to know about Khaled Said, you do not need to be in Egypt to show your support. It is a different form of participation; the cost is lower and it breaks slowly with the culture of fear and silence. We did it, we made small changes in the mainstream news landscape.

You see the Facebook page growing in numbers and quickly reaching 100,000 members in a period of five days. It reaches five million by November 2010 (Herrera 2014), when the parliamentary elections are held. The movement is scaling up fast and this is reassuring in a Police State. Hence, when the Facebook page calls for us to protest before the Parliamentary elections, to go demand unrigged elections, some of us go but some of us still obey our fear.

The Tunisians have started in December, they had their own martyr and they did it. Now President Ben Ali fled the country.
Tunisia did it. Then we can do it too. Or maybe, we can't. Sara believes so: "Egypt is not Tunisia and Tunisia is not Egypt." (Al-Saleh 2015, p.67). But the Facebook page posted a call to protest on January, 25th: *"Although it took no more than a few keyboard strokes and a single mouse click to change the event's name to "January 25: Revolution Against Torture, Poverty, Corruption, and Unemployment," my mindset changed drastically immediately after I did so. I felt an adrenaline rush, only this time it wasn't fight or flight, it was fight or fight. After posting the event's new name, I was ready to face any and all consequences"* (Ghonim 2012, p.136) (Figure 13- For further analysis of texts see Appendix B)

Figure 13: Pictures of January 15th (on the left) and 17th (on the right) posts

It is a Tuesday but also a national holiday to show our pride in the police. Sara is skeptical, she adds "*How can you organize a revolution and give it a date?! A revolution just bursts out with no date. Giving it a date will make the police and the regime ready to crush it.*" (Al-Saleh 2015, p.67). Once again, but what do we have to lose? (Sadiki 2014)

May this conjunction of outrage, oppression, poverty and hope (Castells 2015) leads to something?

Insights: We label this period *proto-autopoiesis* to describe the community becoming an environmental stimulus for the rest of society. We observe, and highlight, a reversed dynamic. Media features allowed the display of membership and signs of worldwide acknowledgement over and above the information actually provided. Such displays and signs created an awareness of this sense of community and bring "ambient awareness" (Leonardi 2015) worldwide.

4.4.3. Global Society Provides the Extra-Mile to Trigger Self-Organization of Offline Protests

We arrive at January 23rd and people are protesting across the world in front of Egyptian embassies. They proudly boast flags and signs announcing January 25 (Figure 14). Egyptians all over the world are taking pictures of their actions and are sharing these pictures on Facebook. We are everywhere and people are looking at us: "*When the young ultras arrived at the square, they began launching fireworks into the sky. One unified chant burst from thousands of lungs. One central, overarching, radical demand had captured the attention of every member of that critical mass in Tahrir: to rid our nation of Hosni Mubarak. We all yelled, "EL SHA'AB YUREED ISQAAT AN-NIZAAM!" (The people want to topple the regime!)"* (Ghonim 2012, p.184).

a) January 23rd Post b) January 25th "Tahrir Square NOW"

Figure 14: Transdigitalization

We are here on the 25th and people are in the street, walking, calling for other people to join them whether they are strolling nearby or watching from their windows (Table 13 and Appendix C for further analysis). "*People were afraid of both the regime and the consequences of joining a demonstration*" (Al-Saleh 2015).

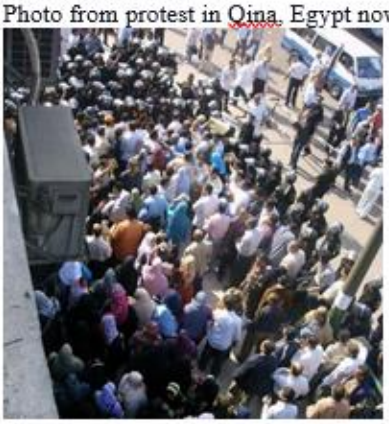
Post#1 January 25	Analysis	Concept
Photo from protest in Qina, Egypt now. 	The revolution (change?) is on its way everywhere (here Qina). And attracting more people like observers. (call to Join). ***Autopoietic process spilling over into urban space. Start of transdigital OOC: present simultaneously in cyberspace and urban space*** The picture creates an awareness of scale of what is going to happen.	*Lead to action* **PRAGMATIC** ***Growing self-reference***: people joining and crowd moving, coming from meaning drawn from posts and context. **SEMANTICS**
Post#2 January 25		
Protesters are giving flowers to Policemen in Egypt now. 	Internalization of the opposition made till here protesters vs. cops (depicted as corrupt and brutal) cops. Set Expectations to solve it peacefully. End state to reach.	**Zoom in** **Reentry** **SYNTACTICS** **Aspired Poiesis** **PRAGMATIC**

Table 13: Semiotic Analysis - People joining protests

People like Sara take the time to share pictures and comments "I *posted the photo on Facebook and commented, "The day the Egyptians said NO." A Spanish friend of mine wrote, "Go . . . Go . . . Go. . . ." I thought to myself, "This is big. . . . It's happening and the world is watching.""* (Al-Saleh 2015), and more and more people like and comment on Facebook (Figure 15). It is happening.

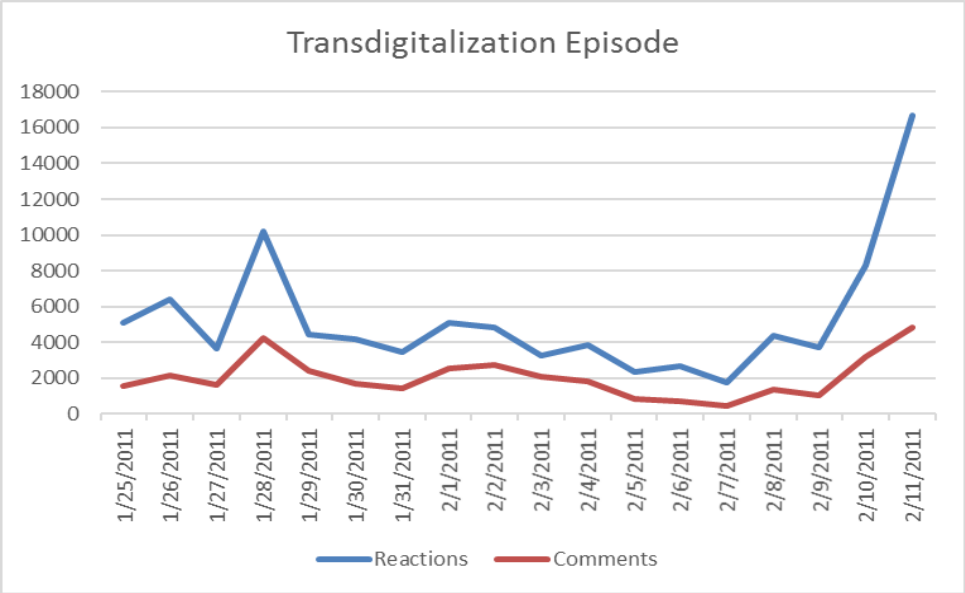


Figure 15: Illustration of Empirics

People know it is happening, become aware of how big we are, how big we are growing: *"Within two days, the tens of thousands of people in Tahrir Square morphed—by some estimates—into a million people demonstrating across seven of Egypt's twenty-nine governorates. The crowd in Tahrir grew tenfold while in Alexandria—Egypt's second-largest city—the Corniche along the Mediterranean was packed with tens of thousands of demonstrators. Meanwhile in Suez, the army was called in to try to pacify a city that some journalists described as a war zone*."(Cook 2011, p. 284).

The police are getting violent and suddenly, late in the night of January 27th, no more Internet: "*An Egyptian friend living in England sent me his number so that if the Internet was shut down, I could text him the news and he would post it on Facebook. On this Friday event, the government did turn off all communication networks, including mobile services, so I could not send any news to anybody."* (Al-Saleh 2015). Later that day, they also cut the cell network so Maha could not reach her friends. But landlines are still active, and others reached their families and friends who immigrated abroad and passed them the baton, telling them what they saw and

asking them what is happening. The Arabic page "We Are All Khaled Said" went silent but the diaspora kept the English page alive (Figure 16).

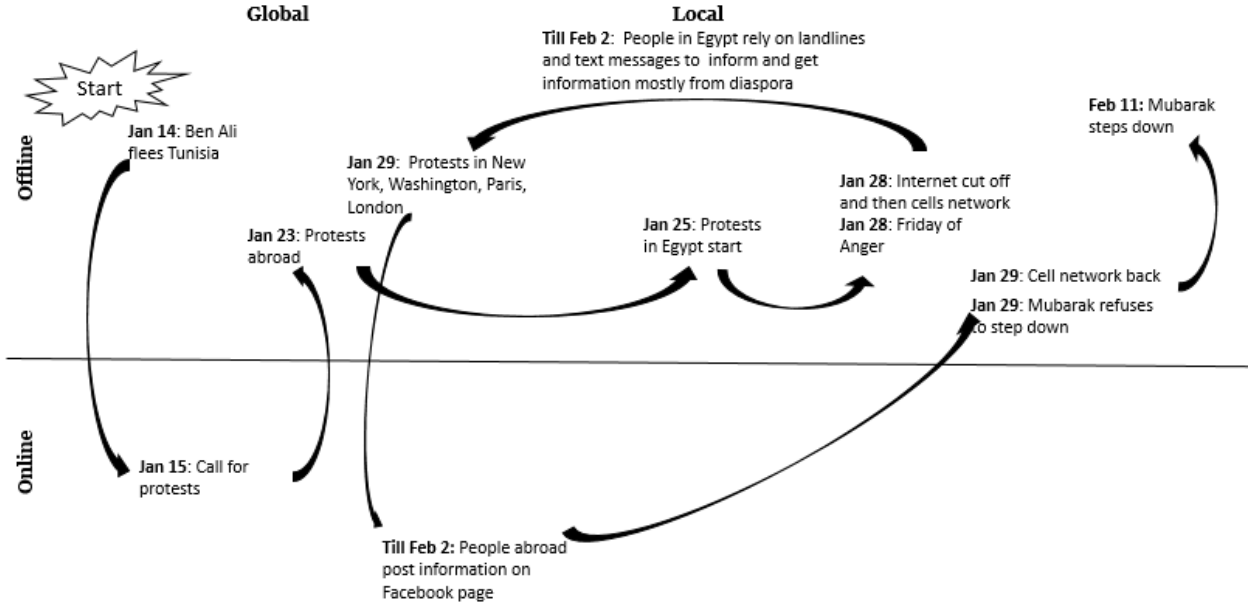


Figure 16: Online-Offline interactions during around Internet cut-off episode (Snapshot January 14-February 11)

It is not only in Egypt, not only Egyptians who are making these days happen. We have crossed lines, they tried to stop us, but the movement is wider than they thought. They have underestimated us, fueling our rage and our hope. By their act of despair, they reinforce the movement. When they see the government trembling, more people will join us.

Insights: We label this period *transdigitalization* to describe the physical embodiment of the OOC, even though it simultaneously remains alive online. We have highlighted how the communications internalizes outside representations of the transdigital community and its conflictual interactions with the rest of society. This allows a reciprocal relationship between awareness of scale, encouraging people to participate, and scaling up the awareness and the protests.

4.4.4. Local Offline Community Shapes Local Society

February 11th, Mubarak steps down. He quit. He got on a flight with his family and retreats to the resort town of Sharm El-Sheikh.

People are celebrating and then it is time to clean up Tahrir Square. What happens next? After the joy, the singing, the dancing, even the tears, what will happen? The Facebook page echoes the same questioning: "*What next? What does this page should focus on in the coming weeks & months?*" (2/12/2011). Adel cannot stop thinking, "*But the Egyptian revolution continues. We took down the head of the regime; the body remains. Every day there is a struggle against a different, smaller Mubarak: in offices, in universities, in government departments, in schools, in factories, and on farms*."

On the 13th, protesters started to clean Tahrir Square, started to build a new era. The page sends mostly updates, not only on what is happening now in Egypt but also in North African and middle-eastern countries. Libya seems to be next: "*Libyan's day of rage has started in Libya.*" (02/16/2011). Some people are eager to support Libya, to see the event in Tunisia and Egypt repeat itself in the region:

"*We need to trend this on Twitter the way we did #Jan25 so the world can take notice. What is the hashtag for Lybia's on twitter?*" (02/15/2011)

"*Ghaddafi must fall. See the link and join - https://www.facebook.com/group.php?gid=131181310225447*" (02/16/2011).

Others are preoccupied with the possibility that Mubarak will escape with the fortune he hoarded over the years. Some just want to get into debate:

"*What can you do with Mubarak's $70 billions ?*

To give you an idea about what you can do with $70 billions, imagine this;

If you buy $70 billions worth of 30 years US Treasury bonds (one of the safest, most conservative, investments in the world), yielding 4.2% per year, this is what you get:

1. Every day: you receive $8 millions in interest. YES, everyday, you have $8 millions (40-50 millions Egyptian pounds per day) to spend !! [(70000000000 x 0.042) / 365]

2. At the end of 30 years, you still have your $70 billions !" (02/16/2011)

"*To those of you debating above: Yes, there are people in the West who are very cynical and pessimistic about the Middle East, but you know what - any time demonstrations for Freedom take place, we SHOULD offer moral support to the Protesters. These brave Freedom Fighters in Iran, Tunisia, Egypt, Libya and elsewhere are risking it ALL and fighting the greatest fight of them all ... they deserve our attention, acknowledgement and respect*." (02/16/2011)

Insights: We label this period *quiescence* to describe the "calm out of chaos" following the protests and the fulfillment of demand. We have highlighted how the conjunction of joy and doubts, in contrast with autogenesis, jeopardize the sense of community uniting them.

4.5. Theory Development

Along with a summary of theoretical outcome of the analysis, we conceptualize the four phases that this open online community went through to materialize social change in urban space. Our conceptual work results in a process model (Figure 17) of the Theory of Online Autopoietic Process (TOAP).

4.5.1. Autogenesis

An autogenetic phase captures a process perspective to explain how the community emerges or arises (Drazin and Sandelands 1992; Zeleny 1981). The first period shows the combination of multiple emotions labeled emotional complexity, i.e. "the simultaneous or sequential experience of at least two different emotional states during the same emotional episode" (Rothman and Melwani 2017, p.259) like grief, anger and fear to be the next victim. Individuals, political and apolitical citizens felt grief, anger, resentment but also national pride. These emotions are channeled in a narrative of martyrdom, anchored in the cultural context. The communications opportunities enabled by Facebook sparked an idea of revolution by constructing a narrative and creating accountability around a shared mental model. This spark triggered culturally resonant elements of a common heritage. It empowered the social network to express voices of dissent; it embodied the social change. This narrative strategy reinforces identification to a cause personified by Khaled Said.

It is an online community that generates this narrative through online communications.

Because it is an online community, it can feel separate or partitioned from broader society. As a result, communications can be built around hostility towards society at large and its political apparatus. The partition emerges from a disconnect between society and those individuals who are not geographically or socially close. Those individuals form into a sub-group. Social networking them to be exposed to each other messages and actions allowing *ambient awareness* (Leonardi 2015*)*, which make them realize they share the same anger, fears and hopes Consequently, a sense of community emerges as the generative social rule that governs communications.

4.5.2. Proto-Autopoiesis

A proto-autopoietic phase captures a "low form of autopoietic (proto-autopoiesis) dynamic that establishes physical stability." (Liang 2011, p.199). Emotional posts and streams of news build and reinforce the online presence by attracting offline exposure. There is a conjunction of features on Facebook: the number of *Likes*, the nature of comments and multimedia contents. This conjunction, this exposure, enables members to become aware of their sense of community. This awareness can fluctuate, especially because the OOC does not have control over the source and the form of the offline exposure. Therefore, it is still a low intensity autopoietic form. As it begins organizing the dissention activities, the OCC marks the beginning of its takeover of its offline exposure. Facebook was used to link geographically and socially dispersed around a discourse/narrative space and a globalized value of justice. Users identified as the oppressed as "we", the oppressor as "they" and people who are still passive, scared or unaware as "you". We argue that without the Internet to share information across boundaries, it would have been impossible to create the awareness of this sense of "we".

4.5.3. Transdigitalization

Transdigitalization entails the development of a physical embodiment of the community. *Transdigital* refers to a digital entity (e.g. online community) that spawns its own physical/offline entity (e.g. protests). The online community continues to exist, but now it inhabits coexisting online and offline forms. This dualism may also be called an *Open Transdigital Community (OTC)*. This embodiment also materializes an opposition between society and the OTC. The *awareness-of-scale* afforded the OTC to scale up supported by user-generated content, scaling up the OTC and creating an escalation relationship between *awareness-of-scale* and *scale-of-awareness* leading to *scaling up*.

4.5.4. Quiescence

The quiescent phase captures the attainment of goal, i.e., change in civil society by breaking with culture of fear and silence. Communications have reduced and multiple paths appear that divide rather than unite. The sense of community that drove the autogenetic stage is at stake; it can lead to renewal of the community or the end of it.

4.5.5. Two classifying dimensions

We have observed that these four phases evolve across two important dimensions: outcome and communications coupling.

First, there are two types of outcome of each period. Either the community internalizes its goal or it produces something outside of the community, i.e. *praxis* or *poiesis*. The autogenesis phase embodies *praxis*, in which the community collects evidences of police abuses and brutality to raise awareness. The proto-autopoiesis phase embodies *poiesis*, because the OOC has produced reactions in international press or by worldwide artists.

Second, there are two types of communications coupling in each period. Either the communications are self-referencing or other-referencing. *Self-reference* is the capacity of the OOC to refer to itself. *Other-reference*, i.e. the capacity of the system to refer to its environment. The coupling looks at the relation between the two. While both concepts were defined by Luhmann, he never operationalized them. The autogenesis phase displays mostly *other-reference* because the OOC is opposing and parting with the rest of society. The proto-autopoiesis phase displays mostly *self-reference* because beyond the sense of community, it is the awareness of itself that drives communications. The transdigitalization phase displays a peculiar relationship between *self-reference* and *other-reference* called *re-entry*. Re-entry entails the internalization of those communications that embody the opposition between the OOC and the rest of society. For example, the other-reference, "we are *in* opposition" becomes the self-reference "we are *the* opposition". Therefore, we observe reconfiguration of communications as moving and interacting parts around different features of the media.

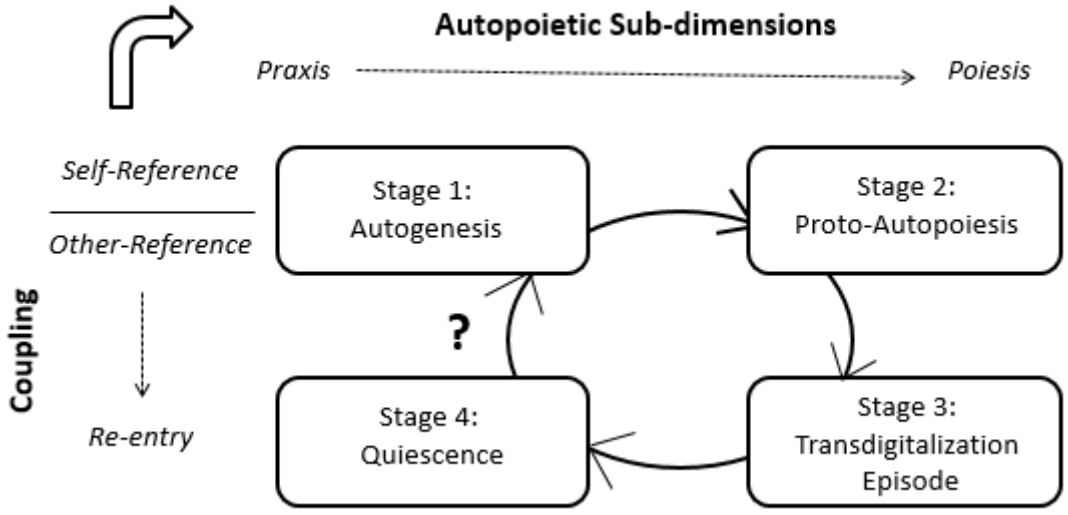


Figure 17: Process Model

4.5.6. Awareness through the stages

Furthermore, thorough the four stages, we have identified different affordances of social networking technology. Social media enable to see other people's communications and to be exposed to their views (Leonardi 2015; Leonardi and Vaast 2017).

"A*mbient awareness"* (Leonardi 2015) is defined as awareness of communications occurring in one's environment and plays a key role on the development of metaknowledge. We bring supporting evidence and show its role in building a sense of community. We also found other kind of technology-enabled awareness specific to social media that are supported by Facebook features.

Awareness-of-sense-of-community assumes the need to become aware of shared thought, fears and hopes among a society by observing communications to act together. *Awareness-of-scale* and *Scale-of-awareness* assume respectively to become aware of the size of the community (either online or offline) and the extent to which the cause of the community is well-perceived and understood. They are intertwined in a mutual relationship: as awareness scales up (i.e. *Scale-of-awareness)* more people join the community and the display of membership, support, visual content enabled by Facebook (i.e. *Awareness-of-scale)* encourages more people to join.

We synthesized in Table 14 pieces of evidence supporting different kinds of awareness afforded by Facebook at each stage.

	Autogenesis	Proto-Autopoiesis	Transdigitalization	Quiescence
Ambient Awareness	"Like thousands of other Egyptians, I had joined the "We are all Khaled Said" Facebook page."			
Awareness-of-sense-of-community		"we all were in pursuit of our freedom and dignity."		
Awareness-of-scale	Display of membership and support (e.g. Likes)	Display of growth in membership and support	Photos of crowded places like Tahrir Square: "I posted the photo on Facebook (…) A Spanish friend of mine wrote, "Go . . . Go . . . Go. . . ." I thought to myself, "This is big. . . . (…) and the world is watching.""	
Scale-of-awareness		External links of International coverage (November 2010 in Figure 11)	Pictures of moving crowds (Table 13 and Figure 14)	Posts and Comments about other countries like Libya

Table 14: Awareness afforded by stage

4.6. Discussion

This research article investigates the question of how an OOC that started online can manifest itself in a physical setting and occupy both spaces, i.e. becomes an OTC.

Our work answers two calls from the literature. First, the nature of this phenomenon spanned beyond its online space or its national territory. It had root causes that are hard to untangle. We face a unique complex situation that deals with many adaptable moving parts that interact with each other. These parts self-organize through communications. Further, this complex situation produces a societal outcome (Tanriverdi et al. 2010). Second, the literature in (online) collective action has neglected the relationship between collective action in cyberspace and collective action in urban space (e.g. Selander and Jarvenpaa 2016; Tufekci and Wilson 2012). Much attention has been devoted to online protests and media affordances available to a cause (Halverson et al. 2013; Selander and Jarvenpaa 2016). However, how online activities can influence and generate actions in urban space remains relatively unexplored.

Our focus has been on Facebook features that lend themselves to a larger scale of connectivity beyond the conflict space. The fluidity of boundaries of OOCs in different settings has already attracted attention in the IS literature (Faraj et al. 2011; Fleming and Waguespack 2007; Han et al. 2012). But too little attention has been paid to this fluidity in relation to the OOCs societal challenges (e.g. Selander and Jarvenpaa 2016). These open communities are increasingly easier to create. They can quickly execute known action repertories as well as develop novel ones.

4.6.1. Contributions to Complexity

4.6.1.1. A processual complexity

Our contribution sits at the confluence of IS and complexity with its conceptualization of *transdigitalization.* We position the concept of complexity in relation to the process of *becoming*, but not (yet) *being* a system. The parallel between Figure 10 and Figure 16 shows how we have studied these new kinds of social movements so far and how they unfold over time and (geographical and online) spaces. They grow by drawing on media and social media to reach a *scale-of-awareness* and a scale faster. In our case, this *complexity of becoming* is a flow of interactions between myriad of events that can lead an OOC to overflow out of its online world and become a physical community. In our case, these events also lead the OOC to overtake the role of conventional organizations, even across borders. In our case, networks of individuals and communities destabilize established order and further trigger social and global complexity. These effects arise because of their internal (and micro-level) dynamics and their societal (and macro-level) outcomes. Facebook created a network of networks, which is a key feature because it enabled the OOC to maintain its communications despite an Internet shutdown. In this way, it avoided a collapse into chaos. Interactions in networks with globalizing patterns have led to collective action by not conventional actors such as SMOs. Thus, the complexity in these globalizing effects arises from the mobility and reconfiguration of images and meanings as well as people. It amplifies a complex open system once, but no longer, limited to national boundaries.

Therefore, our above study of process complexity is hampered by the struggle with recoverability (Checkland 2000) of the process that has led to the observed events. It makes it difficult to recover the triggers of the Arab Spring. We improved our understanding using post-hoc analyses of the events that account for the temporal progression in the making of society.

The online and offline communities are not only a reflection of each other, but also an extension of the society-at-large: Society shapes an online society that in turn recreates and becomes society. We conceptualize this duality as a transdigital autopoietic process where both the online and the offline society create and shape each other. They both enable and constrain each other. The online and offline community overlap as an *Open Transdigital Community* (OTC), existing simultaneously online and offline. We contribute to a better understanding of this complexity by teasing out the autopoietic process in a critical realist tradition, where the community (and society at large) transforms itself in itself. It is an autopoietic mechanism that explains the process of societal (re)production (Hartwig 2015). The iteration between the online and offline is an iteration between the existing range of potentialities (online) and the realization of a single potentiality (offline). These iterations of structuring and sensemaking recreate society across realms. The ongoing process between the OOC and the OTC changes the community physically and digitally as well as changing the meanings within its existence. Consistent with critical realism, the duality of transdigitalization requires not only the fluidity of an open community, but also a fluidity of perspectives. That is, the community spawns itself in one realm (on line) and the other (off line) in a way that each and both reflect the whole.

This complexity stems from the interplay of social and material forces, where the virtual offers a range of potentialities. Within one timeline, two (online and offline) spaces offer different action repertories (Selander and Jarvenpaa 2016; Tilly 1978). This interplay shows potential for unanticipated and large-scale outcomes.

4.6.1.2. An analytical complexity

In our case, we arrive at the complexity of becoming through the *complex ontology of signs***.** These signs are multi-modal. Their meaning flexes across time and space, their representations interacting in a non-linear way that enables a multiplicity in sensemaking (Weick 1995). Human interactions at large involve complexity in the communication of meaning when signs are multi-modal. The presence of computer-mediated interactions also invokes the aesthetics in the system's self-communicative events. The importance of the aesthetics of these multi-modal signs increase the complexity of connectivity between actors. Furthermore, the interaction of this ontology and the aesthetics have both intended and unintended effects on the local context. There are also unintended consequences for the established social order. This is why semiotics (Morris 1938; Peirce 1931-58; Saussure 1959) and specifically the semiotic

ladder (Stamper 1973; 1991; 1996) provide a fruitful avenue to empirically deal with the complexity arising from the signs that embody communications. We offer an operationalization of the four semiotic dimensions to address (1) issues of analysis and interpretation for researchers and (2) relations between micro-events (i.e. communications) and macro-effects (i.e. political change).

For the first, semiotics proves useful in processing multiple signals formed by participants in their own context as observers. Participants form these signals in ways that are affected by their own pre-existing knowledge and assumptions. In the latter, communication manifests the mechanism that shapes collective behavior (through components such as tone and rhythm). Emblematic of complexity, the micro-level of these communicative events inspires, but does not embody, the amplitude of the macro-effects that follow.

For qualitative research, complexity arises in the way that contingent and emergent social outcomes do not proceed from set causal roots. Processual complexity arises from the multiple accounts of the events. We built a narrative from those different experiences to convey to the readers the uprising experience. The narrative provides detailed descriptions while avoiding misleading simplification.

4.6.2. Contributions to Collective Action

The potential of social media in creating political change has been widely and fiercely discussed. The press was eager, on the one hand, to erect and applaud the notion of Revolution 2.0 (Rich 2011), while on the other hand, to tear it down (Gladwell 2010). Skeptics and pessimists have criticized cyberactivism as a lazy form of participation. They believe the focus on media (e.g. Oh et al. 2015) has undermined the role of content (Halverson et al. 2013). They suggest it does not achieve any real change in society (Kristofferson et al. 2014). They conclude that Internet activism is reduced to raising awareness, changing pictures, or digital petitioning (Selander and Jarvenpaa 2016). Our study contributes to this discussion. More generally, our research develops an understanding of the process that leads an organization to add offline actions to their online actions. More importantly, we help explain how actions transition from lower levels of risk-taking to higher levels of risk-taking.

Our contribution reveals the systemic consequences of self-organized communities that stand behind collective action. These consequences are larger than just raising awareness about a

cause, these are larger than just getting the attention of potential protesters, larger than making this cause, their cause. Along the way of "*ambient awareness"* (Leonardi 2015), we have identified three other kind of technology enabled awareness: *awareness-of-sense-community, awareness-of-*scale and *scale-of-awareness* (Table 14). These consequences are larger than just media usage (Oh et al. 2015) or its undermining of the role of content (Halverson et al. 2013). These consequences are about the emergence of an online community that is subsequently driven to materialize and act in the physical world.

4.6.3. Limitations & Future Research

Our study has several limitations that offer opportunities for further research. We analyzed data from June 2010 to February 2011 to cover the origins of the community, the eighteen days of protests and Mubarak's resignation. Moreover, we focused our study to events leading up to, and including, the 18-day Tahrir Square protest. Subsequent to the Quiescence stage identified in our research, news reports and Facebook data indicate there was an iterative return to Autogenesis. There were subsequent calls for protests (Figure 18) that suggest Proto-Autopoiesis. There were subsequent protests on Tahrir Square happened (Figure 19) that may indicate Transdigitalization. However, to confirm the identified process further detailed analysis of the communications need to be pursued. Henceforth, we assume an iterative process model (Figure 17). Researchers can investigate if the TOAP model applies to other kind of transdigital communities such as fan clubs or user groups. Other opportunities lie in investigating the phenomenon of transdigital communities that start offline and turn to online. Does the TOAP model operate in such a reverse situation?

Figure 18: Comparison of Posters of Call for Protest (January 25th and September 9th)

Figure 19: Transdigitalization (July, 8th; September, 9th; November, 18th)

Selander and Jarvenpaa (2016) argue that SMOs are critical to the sustainability of a cause. On the one hand, that might explain why the Arab Spring did not totally end up in its desired utopia. On the other hand, SMOs have neither attracted such enthusiasm nor born such consequential outcomes. Further research is needed to explore the synergies that both forms (SMO and OTC) might develop to enhance a cause. Our study offers insights to help SMO managers to leverage new forms of organizing. For example, our work with OTCs is consistent with the studies of SMOs (Selander and Jarvenpaa 2016). Such a SMO might in some circumstances be, or entail, an OTC. These SMO forms of OTC might address broad social issues and leverage social media toward their envisioned social state. In this way, such organizations can succeed in obtaining exposure in mainstream media. Therefore, when SMOs and OTCs have developed independently, it may be in their mutual interests to combine their efforts. This combination can be especially important when an OTC enters the quiescence stage because the SMO may endure more persistently and continue to prosecute the aims of the SMO-OTC combine.

Another research opportunity involves leveraging semiotic analysis through multiple avenues of communication, not only Facebook. The consequences of the Arab Spring are the result of layers of mainstream and alternative media of communication. We have studied the expansion and the capability of an online community that gathered on Facebook to rally more people to its cause. It would be important in future to build the full picture of similar events to compare and contrast the perspectives found in data across multiple social media (e.g. Twitter and YouTube). In addition, insights from people who were brought to the square through different communications channels could illuminate other dynamics not observable on social media.

Finally, the role of affect and specifically emotional complexity (Rothman and Melwani 2017) in bottom-up social change offers opportunities for future development, especially using the multimedia nature of social media.

4.7. Conclusion

Building on 2011 events, this paper is an inquiry into the path that leads an OOC (Open Online Community) to an OTC (Open Transdigital Communities). This transformation process is critical to achieve social change. Yet, the assumption that cyberactivism cannot draw a critical mass is undermined by our study. Communications on social media do not become facilitator of social change in a vacuum but are coupled to their environment. Our model offers a novel advance toward explaining this process with a semiotic study of communications using social media.

4.8. References

Al-Saleh, A. 2015. *Voices of the Arab Spring - Personal Stories from the Arab Revolutions*, (1st ed.) Columbia University Press: New York.

Anderson, P., Meyer, A., Eisenhardt, K., Carley, K., and Pettigrew, A. 1999. "Introduction to the special issue: Applications of complexity theory to organization science," *Organization Science* (10:3), pp 233-236.

Andrade, A. D., and Doolin, B. 2016. "Information and communication technology and the social inclusion of refugees," *MIS Quarterly* (40:2), pp 405-416.

Archer, M. S. 1995. *Realist social theory: The morphogenetic approach*, Cambridge University Press: Cambridge.

Ayyagari, R., Grover, V., and Purvis, R. 2011. "Technostress: technological antecedents and implications," *MIS Quarterly* (35:4), pp 831-858.

Barley, S. R. 1983. "Semiotics and the Study of Occupational and Organizational Cultures," *Administrative Science Quarterly* (28:3), pp 393-413.

Baskerville, R. L. 2010. "Knowledge lost and found: A commentary on Allen Lee's 'retrospect and prospect'," *Journal of Information Technology* (25:4), pp 350-351.

Benford, R. D., and Snow, D. A. 2000. "Framing processes and social movements: An overview and assessment," *Annual review of sociology* (26), pp 611-639.

Bennett, W. L., and Segerberg, A. 2011. "Digital media and the personalization of collective action: Social technology and the organization of protests against the global economic crisis," *Information, Communication & Society* (14:6), pp 770-799.

Bennett, W. L., and Segerberg, A. 2012. "The logic of connective action: Digital media and the personalization of contentious politics," *Information, Communication & Society* (15:5), pp 739-768.

Benson, J. K. 1977. "Organizations: A Dialectical View," *Administrative Science Quarterly* (22:1), pp 1-21.

Berger, A. A. 2004. "Semiotic analysis," in *Media analysis techniques*, Sage Publications Inc.: Thousand Oaks, United States.

Bhaskar, R. 1975. "Forms of realism," *Philosophica* (15:1).

Bhaskar, R. 1998. *The possibility of naturalism: A philosophical critique of the contemporary human sciences*, (3rd ed.) Routledge: London and New York.

Bhaskar, R. 2008. *Dialectic: The pulse of freedom*, (2nd ed.) Routledge: London and New York.

Bhaskar, R. 2009. *Scientific realism and human emancipation*, (2nd ed.) Routledge: USA and Canada.

Bhaskar, R. 2013. *A realist theory of science*, (2nd ed.) Routledge Taylor and Francis Group: London and New York.

Bhuller, M., Havnes, T., Leuven, E., and Mogstad, M. 2013. "Broadband Internet: An Information Superhighway to Sex Crime?," *The Review of Economic Studies* (80:4), pp 1237-1266.

Bimber, B., Flanagin, A. J., and Stohl, C. 2005. "Reconceptualizing collective action in the contemporary media environment," *Communication Theory* (15:4), pp 365-388.

Boisot, M., and Child, J. 1999. "Organizations as adaptive systems in complex environments: The case of China," *Organization Science* (10:3), pp 237-252.

Boulding, K. E. 1955. "Notes on the information concept," *Exploration* (6), pp 103-112.

Boulding, K. E. 1956. "General Systems Theory-The Skeleton of Science," *Management Science* (2:3), pp 197-208.

Bouty, I., Drucker-Godard, C., Godé, C., Lièvre, P., Nizet, J. & Pichault, F. 2011. "Les pratiques de coordination en situation extrême," *Management & Avenir*, (41:1), pp. 387-393.
Braa, J., Hanseth, O., Heywood, A., Mohammed, W., and Shaw, V. 2007. "Developing health information systems in developing countries: the flexible standards strategy," *MIS Quarterly* (31:2), pp 381-402.
Brannen, M. Y. 2004. "When Mickey Loses Face: Recontextualization, Semantic Fit, and the Semiotics of Foreignness," *The Academy of Management Review* (29:4), pp 593-616.
Brockner, J., Houser, R., Birnbaum, G., Lloyd, K., Deitcher, J., Nathanson, S., and Rubin, J. Z. 1986. "Escalation of commitment to an ineffective course of action: The effect of feedback having negative implications for self-identity," *Administrative Science Quarterly* (31:1), pp 109-126.
Brown, S. L., and Eisenhardt, K. M. 1997. "The Art of continuous change: Linking complexity theory and time-paced evolution in relentlessly shifting organizations," *Administrative Science Quarterly* (42:1), pp 1-34.
Butler, B. S. 2001. "Membership size, communication activity, and sustainability: A resource-based model of online social structures," *Information Systems Research* (12:4), pp 346-362.
Capra, F. 2005. "Complexity and life," *Theory, Culture & Society* (22:5), pp 33-44.
Castells, M. 2010. *The power of identity: The information age: Economy, society, and culture*, (2nd ed.) John Wiley & Sons: UK.
Castells, M. 2011. *The rise of the network society: The information age: Economy, society, and culture*, (2nd ed.) John Wiley & Sons.
Castells, M. 2015. *Networks of outrage and hope: Social movements in the Internet age*, (2nd ed.) Polity Press: UK.
Cebrian, M., Rahwan, I., and Pentland, A. S. 2016. "Beyond viral," *Communications of the ACM* (59:4), pp 36-39.
Chan, J., and Ghose, A. 2014. "Internet's dirty secret: assessing the impact of online intermediaries on HIV transmission," *MIS Quarterly* (38:4), pp 955-976.
Chan, J., Ghose, A., and Seamans, R. 2016. "The Internet and Racial Hate Crime: Offline Spillovers from Online Access," *MIS Quarterly* (40:2), pp 381-403.
Chandler, D. 2001. *Semiotics: the basics*, Routledge.
Checkland, P. 2000. "Soft systems methodology: a thirty year retrospective," *Systems Research and Behavioral Science* (17:1), pp 11-58.
Chesters, G., and Welsh, I. 2005. "Complexity and Social Movement(s)," *Theory, Culture & Society* (22:5), pp 187-211.
Choi, S. Y., Lee, H., and Yoo, Y. 2010. "The impact of information technology and transactive memory systems on knowledge sharing, application, and team performance: a field study," *MIS quarterly* (34:4), pp 855-870.
Cilliers, P. 2005. "Complexity, deconstruction and relativism," *Theory, Culture & Society* (22:5), pp 255-267.
Cohen, M. 1999. "Commentary on the Organization Science special issue on complexity," *Organization Science* (10:3), pp 373-376.
Cohen, R. 2011. "Facebook and Arab Dignity," The New York Times. http://www.nytimes.com/2011/01/25/opinion/25iht-edcohen25.html
Cook, S. A. 2011. *The Struggle for Egypt: From Nasser to Tahrir Square*, (Oxford University Press.
Daft, R. L., and Lewin, A. Y. 1990. "Can organization studies begin to break out of the normal science straitjacket? An editorial essay," *Organization Science* (1:1), pp 1-9.

Danermark, B., Ekstrom, M., and Jakobsen, L. 2002. *Explaining Society: an introduction to critical realism in the social sciences*, Routledge Taylor and Francis Group: London and New York.
De Vaujany, F.-X. 2008. "Capturing reflexivity modes in IS: A critical realist approach," *Information and Organization* (18:1), pp 51-72.
Deely, J. N. 1990. *Basics of semiotics*, (Indiana University Press: Bloomington & Indianapolis.
Demetis, D. S., and Lee, A. S. 2016. "Crafting theory to satisfy the requirements of systems science," *Information and Organization* (26:4), pp 116-126.
Deng, X. N., Joshi, K. D., and Galliers, R. D. 2016. "The Duality of Empowerment and Marginalization in Microtask Crowdsourcing: Giving Voice to the Less Powerful Through Value Sensitive Design " *MIS Quarterly* (40:2), pp 279-302.
Desai, A. 2005. "Adaptive complex enterprises," *Communications of the ACM* (48:5).
Dewey, J. 1916. *Democracy and Education: An Introduction to Philosophy of Education*, (1st ed.) Macmillan: New York.
Dobusch, L., and Schoeneborn, D. 2015. "Fluidity, identity, and organizationality: The communicative constitution of Anonymous," *Journal of Management Studies* (52:8), pp 1005-1035.
Doyle, A. C. 2013. *Sherlock Holmes: The complete novels and stories - Volume 1*, (Barnes and Nobles Classics: New Yorks.
Drazin, R., and Sandelands, L. 1992. "Autogenesis: A perspective on the process of organizing," *Organization Science* (3:2), pp 230-249.
Dubai-School-of-Government 2011. "Civil Movements: The Impact of Facebook and Twitter," *Arab Social Media Report* (1:2), pp 1-30.
Dunn, A. 2011. "Unplugging a nation: State media strategy during Egypt's January 25 uprising," *Fletcher Forum of World Affairs* (35:2), pp 15-24.
Eco, U. 1976. *A theory of semiotics*, (1976 ed.) Indiana University Press: Bloomington.
Eco, U. 1979. *The role of the reader: Explorations in the semiotics of texts*, (1984 ed.) Indiana University Press: Bloomington.
Eco, U. 1983. "Horns, hooves, insteps: Some hypotheses on three types of abduction," in *The Sign of Three: Dupin, Holmes, Peirce*, U. Eco and T. A. Sebeok (eds.), Indiana University Press: Bloomington, pp. 198-220.
Eco, U., and Sebeok, T. A. 1983. *The Sign of Three: Dupin, Holmes, Peirce*, (Indiana University Press Bloomington.
Edmondson, A. C., and McManus, S. E. 2007. "Methodological fit in management field research," *Academy of management review* (32:4), pp 1246-1264.
Edwards, G. 2014. *Social Movements and Protest*, (Cambridge University Press: New York.
Fairclough, N., Jessop, B., and Sayer, A. 2004. "Critical realism and semiosis," in *Realism discourse and deconstruction*, J. Joseph and J. M. Roberts (eds.), Routledge: London, pp. 24-42.
Faraj, S., Jarvenpaa, S. L., and Majchrzak, A. 2011. "Knowledge collaboration in online communities," *Organization science* (22:5), pp 1224-1239.
Faraj, S., Kudaravalli, S., and Wasko, M. 2015. "Leading Collaboration in Online Communities," *MIS Quarterly* (39:2), pp 393-412.
Festinger, L. 1957. *A Theory of Cognitive Dissonance*, (1962 ed.) Row, Peterson & Co: New York.
Fleming, L., and Waguespack, D. M. 2007. "Brokerage, boundary spanning, and leadership in open innovation communities," *Organization science* (18:2), pp 165-180.
Frank, K. A., and Fahrbach, K. 1999. "Organization culture as a complex system: Balance and information in models of influence and selection," *Organization Science* (10:3), pp 253-277.

Ganju, K. K., Pavlou, P. A., and Banker, R. D. 2016. "Does Information and Communication Technology Lead to the Well-Being of Nations? A Country-Level Empirical Investigation," *MIS Quarterly* (40:2), pp 417-430.
Gerring, J. 2007. *Case Study Research: Principles and Practices*, (2nd ed.) Cambridge University Press.
Ghobadi, S., and Clegg, S. 2015. "“These days will never be forgotten…”: A critical mass approach to online activism," *Information and Organization* (25:1), pp 52-71.
Ghonim, W. 2012. *Revolution 2.0: The Power of the People is Greater than the People in Power: A Memoir*, (1st ed.) Houghton Mifflin Harcourt.
Gladwell, M. 2010. "Small Change: Why the revolution will not be tweeted,"
Glaser, J., Dixit, J., and Green, D. P. 2002. "Studying Hate Crime with the Internet: What Makes Racists Advocate Racial Violence?," *Journal of Social Issues* (58:1), pp 177-193.
Godé-Sanchez, C. 2008. "Les TIC comme leviers du changement organisationnel : une analyse du cas des Armées américaines en Afghanistan," *Systèmes d'information & management*, (13:1), pp.7-30.
Goffman, E. 1963. *Stigma: Notes on the Management of Spoiled Identity*, (1st ed.) Prentice-Hall, Inc.: Englewood Cliffs, N.J.
Goffman, E. 1974. *Frame analysis: An essay on the organization of experience*, (Harvard University Press.
Granovetter, M. 1985. "Economic action and social structure: The problem of embeddedness," *American journal of sociology* (91:3), pp 481-510.
Granovetter, M. S. 1973. "The Strength of Weak Ties," *American Journal of Sociology* (78:6), pp 1360-1380.
Greenwood, B., and Agarwal, R. 2015. "Two Sided Platforms and HIV Incidence among the Digitally Disadvantaged," *Management Science* (62:8), pp 2281-2303.
Greenwood, B. N., and Agarwal, R. 2016. "Matching Platforms and HIV Incidence: An Empirical Investigation of Race, Gender, and Socioeconomic Status," *Management Science* (62:8), pp 2281 - 2303.
Grover, V., and Lyytinen, K. 2015. "New State of Play in Information Systems Research: The Push to the Edges," *MIS Quarterly* (39:2), pp 271-296.
Grover, V., Lyytinen, K., Srinivasan, A., and Tan, B. C. 2008. "Contributing to rigorous and forward thinking explanatory theory," *Journal of the Association for Information Systems* (9:2), pp 40-47.
Gu, B., Konana, P., Rajagopalan, B., and Chen, H.-W. M. 2007. "Competition among virtual communities and user valuation: The case of investing-related communities," *Information Systems Research* (18:1), pp 68-85.
Hackley, C. 2003. *Doing research projects in marketing, management and consumer research*, (1st ed.) Routledge: London and New York.
Halverson, J. R., Ruston, S. W., and Trethewey, A. 2013. "Mediated Martyrs of the Arab Spring: New Media, Civil Religion, and Narrative in Tunisia and Egypt," *Journal of Communication* (63:2), pp 312-332.
Han, K., Oh, W., Im, K. S., Chang, R. M., Oh, H., and Pinsonneault, A. 2012. "Value cocreation and wealth spillover in open innovation alliances," *MIS Quarterly* (36:1), pp 291-325.
Hara, N., and Huang, B. Y. 2011. "Online social movements," *Annual review of information science and technology* (45:1), pp 489-522.
Hartwig, M. 2015. *Dictionary of critical realism*, Routledge.
Herrera, L. 2014. *Revolution in the age of social media: The Egyptian popular insurrection and the internet*, Verso Books.
Hodge, R., and Kress, G. R. 1988. *Social semiotics*, (First ed.) Cornell University Press.

Hong, W., Chan, F. K., Thong, J. Y., Chasalow, L. C., and Dhillon, G. 2013. "A framework and guidelines for context-specific theorizing in information systems research," *Information Systems Research* (25:1), pp 111-136.
Human, O. 2016. "Complexity: E-Special Introduction," *Theory, Culture & Society* (33:7-8), pp 421-440.
Jacucci, E., Hanseth, O., and Lyytinen, K. 2006. "Introduction: Taking complexity seriously in IS research," *Information Technology & People* (19:1), pp 5-11.
Jha, S. K., Pinsonneault, A., and Dubé, L. 2016. "The Evolution of an ICT Platform-Enabled Ecosystem for Poverty Alleviation: The Case of eKutir," *MIS Quarterly* (40:2), pp 431-445.
Johns, G. 2006. "The essential impact of context on organizational behavior," *Academy of Management Review* (31:2), pp 386-408.
Johnson, S. L., Faraj, S., and Kudaravalli, S. 2014. "Emergence of Power Laws in Online Communities: The Role of Social Mechanisms and Preferential Attachment," *MIS Quarterly* (38:3), pp 795-808.
Kallinikos, J. 2005. "The order of technology: Complexity and control in a connected world," *Information and Organization* (15:3), pp 185-202.
Kane, G. C., Alavi, M., Labianca, G. J., and Borgatti, S. 2014. "What's different about social media networks? A framework and research agenda," *MIS Quarterly* (38:1), pp 275-304.
Klein, H. K., and Myers, M. D. 1999. "A set of principles for conducting and evaluating interpretive field studies in information systems," *MIS Quarterly* (23:1), pp 67-93.
Kling, R. 1996. *Computerization and controversy: value conflicts and social choices*, (Morgan Kaufmann.
Kozinets, R. V. 2001. "Utopian enterprise: Articulating the meanings of Star Trek's culture of consumption," *Journal of consumer research* (28:1), pp 67-88.
Kozinets, R. V. 2002. "The field behind the screen: Using netnography for marketing research in online communities," *Journal of marketing research* (39:1), pp 61-72.
Kristofferson, K., White, K., and Peloza, J. 2014. "The nature of slacktivism: How the social observability of an initial act of token support affects subsequent prosocial action," *Journal of Consumer Research* (40:6), pp 1149-1166.
Langley, A. 1999. "Strategies for Theorizing from Process Data," *Academy of Management Review* (24:4), pp 691-710.
Langley, A., Smallman, C., Tsoukas, H., and Van de Ven, A. H. 2013. "Process studies of change in organization and management: unveiling temporality, activity, and flow," *Academy of Management Journal* (56:1), pp 1-13.
Latour, B. 1990. "Technology is society made durable," *The Sociological Review* (38:S1), pp 103-131.
Latour, B. 1999. "On recalling ANT," *The Sociological Review* (47:S1), pp 15-25.
Lee, A. S. 2004. "Thinking about social theory and philosophy for information systems," in *Social theory and philosophy for information systems*, L. Wilcocks and J. Mingers (eds.), John Wiley and Sons UK.
Lee, A. S., and Demetis, D. S. 2016. "Crafting Theory to Satisfy the Requirements of Systems Science," in *49th Hawaii International Conference on System Sciences (HICSS)*, IEEE, pp. 5075-5084.
Lee, J., Agrawal, M., and Rao, H. R. 2015. "Message diffusion through social network service: The case of rumor and non-rumor related tweets during Boston bombing 2013," *Information Systems Frontiers* (17:5), pp 997-1005.

Leonardi, P. M. 2015. "Ambient Awareness and Knowledge Acquisition: Using Social Media to Learn" Who Knows What" and" Who Knows Whom"," *MIS Quarterly* (39:4), pp 747-762.
Leonardi, P. M., and Vaast, E. 2017. "Social Media and Their Affordances for Organizing: A Review and Agenda for Research," *Academy of Management Annals* (11:1), pp 150-188.
Levy, S. J. 1959. "Symbols for sale," *Harvard business review* (37:4), pp 117-124.
Liang, T. Y. 2011. "Emergence and the new intelligence leadership," *International Journal of Complexity in Leadership and Management* (1:2), pp 192-207.
Liebenau, J., and Backhouse, J. 1990. *Understanding Information: an Introduction*, (1st ed.) Palgrave Macmillan: Basingstoke and London.
Lim, M. 2003. "The Internet, social networks, and reform in Indonesia," in *Contesting Media Power: Towards a Global Comparative Perspective*, N. Couldry and J. Curran (eds.), Rowman & Littlefield Publishers: USA, pp. 273-288.
Ling, C. L. M., Pan, S. L., Ractham, P., and Kaewkitipong, L. 2015. "ICT-Enabled Community Empowerment in Crisis Response: Social Media in Thailand Flooding 2011," *Journal of the Association for Information Systems* (16:3), p 174.
Locke, J. 1690/1959. *An Essay Concerning Human Understanding* (unabridged ed.) Dover: New York.
Lowry, P. B., Zhang, J., Wang, C., and Siponen, M. 2016. "Why Do Adults Engage in Cyberbullying on Social Media? An Integration of Online Disinhibition and Deindividuation Effects with the Social Structure and Social Learning Model," *Information Systems Research* (27:4), pp 962-986.
Luhmann, N. 1986. "The autopoiesis of social systems," in *Sociocybernetic paradoxes*, G. F. and v. d. Z. J. (eds.), Sage: London, pp. 172-192.
Luhmann, N. 1990. *Essays on self-reference*, Columbia University Press: New York.
Luhmann, N. 1995. *Social Systems*, Stanford University Press: Stanford, California.
Luhmann, N. 2012. *Theory of Society, Volume 1*, Stanford University Press: Stanford, California.
Luhmann, N. 2013. *Introduction to Systems Theory*, (English ed.) Polity Press: Cambribge, United Kingdom.
Majchrzak, A., Markus, M. L., and Wareham, J. 2016. "Designing for Digital Transformation: Lessons for Information Systems Research from the Study Of ICT and Societal Challenges," *MIS Quarterly* (40:2), pp 267-277.
Marwell, G., and Oliver, P. 1993. *The critical mass in collective action*, Cambridge University Press.
Maturana, H. R., and Varela, F. J. 1987. *The tree of knowledge: The biological roots of human understanding*, New Science Library/Shambhala Publications.
McCarthy, J. E. 1984. "Semiotic Idealism," *Transactions of the Charles S. Peirce Society* (20:4), pp 395-433.
Mick, D. G., and Oswald, L. R. 2006. "The semiotic paradigm on meaning in the marketplace," in *Handbook of qualitative research methods in marketing*, R. W. Belk (ed.), Edward Elgar Publishing Limited: Cheltenham, UK • Northampton, MA, USA, pp. 31-45.
Miles, M. B., Huberman, A. M., and Saldana, J. 2014. *Qualitative Data Analysis: A Methods Sourcebook*, (3rd ed.) SAGE Publications.
Milgram, P., and Kishino, F. 1994. "A taxonomy of mixed reality visual displays," *IEICE TRANSACTIONS on Information and Systems* (77:12), pp 1321-1329.
Mingers, J. 1994. *Self-producing systems: Implications and applications of autopoiesis*, Springer Science & Business Media.

Mingers, J. 2001. "Combining IS research methods: towards a pluralist methodology," *Information systems research* (12:3), pp 240-259.
Mingers, J. 2003. "Observing organizations: An evaluation of Luhmann's organization theory," *Tore Bakken and Tor Hernes, Autopoietic Organization Theory: Drawing on Niklas Luhmanns Social Systems Perspective. Olso: Abstrakt Forlag*), pp 103-122.
Mingers, J. 2004. "Real-izing information systems: critical realism as an underpinning philosophy for information systems," *Information and organization* (14:2), pp 87-103.
Mingers, J., Mutch, A., and Willcocks, L. 2013. "Introduction Special Issue: Critical realism in information systems research," *MIS Quarterly* (37:3), pp 795-802.
Mingers, J., and Willcocks, L. 2014. "An integrative semiotic framework for information systems: The social, personal and material worlds," *Information and Organization* (24:1), pp 48-70.
Mingers, J., and Willcocks, L. 2015. "Guidelines for Conducting Semiotic Research in Information Systems," in *14th European Conference on Research Methods (ECRM)* Valletta (Malta), pp. 290-298.
Mingers, J., and Willcocks, L. 2017. "An integrative semiotic methodology for IS research," *Information and Organization* (27:1), pp 17-36.
Miranda, S. M., Young, A., and Yetgin, E. 2016. "Are social media emancipatory or hegemonic? Societal effects of mass media digitization," *MIS Quarterly* (40:2), pp 303-329.
Moeller, H.-G. 2006. *Luhmann Explained: From Souls to Systems*, (1st ed.) Open Court Publishing: Chicago and La Salle, Illinois.
Moon, J. Y., and Sproull, L. S. 2008. "The role of feedback in managing the Internet-based volunteer work force," *Information Systems Research* (19:4), pp 494-515.
Morin, E. 2007. "Restricted complexity, general complexity," *Science and us: Philosophy and Complexity. Singapore: World Scientific*, pp 1-25.
Morin, E. 2014. "Complex thinking for a complex world–About reductionism, disjunction and systemism," *Systema: connecting matter, life, culture and technology* (2:1), pp 14-22.
Morin, E., and Lemoigne, J.-L. 1999. *L'intelligence de la complexité*, (1st ed.) L'Harmattan: Paris, Montreal.
Morris, C. 1938. "Foundations of the Theory of Signs," in *International Encyclopedia of Unified Science* O. Neurath (ed.), University of Chicago Press: Chicago.
Myers, M. D. 2013. *Qualitative Research in Business and Management*, (2nd ed.) Sage: Los Angeles I London I New Delhi I Singapore I Washington DC.
Nan, N., and Lu, Y. 2014. "Harnessing the Power of Self-Organization in an Online Community During Organizational Crisis," *MIS Quarterly* (38:4), pp 1135-1157.
O'Mahony, S., and Lakhani, K. R. 2011. "Organizations in the shadow of communities," in *Communities and organizations*, Emerald Group Publishing Limited, pp. 3-36.
Oh, O., Agrawal, M., and Rao, H. R. 2013. "Community intelligence and social media services: A rumor theoretic analysis of tweets during social crises," *MIS Quarterly* (37:2), pp 407-426.
Oh, O., Eom, C., and Rao, H. 2015. "Research Note—Role of Social Media in Social Change: An Analysis of Collective Sense Making During the 2011 Egypt Revolution," *Information Systems Research* (26:1), pp 210-223.
Oreglia, E., and Srinivasan, J. 2016. "ICT, Intermediaries, and the Transformation of Gendered Power Structures," *MIS Quarterly* (40:2), pp 501-510.
Orlikowski, W. J., and Robey, D. 1991. "Information technology and the structuring of organizations," *Information systems research* (2:2), pp 143-169.
Peirce, C. S. 1931-58. *The Collected Papers of C. S. Peirce*, Cambridge: Harvard.
Perrow, C. 1984. "Normal accidents: Living with high risk systems," New York: Basic Books.

Pratt, M. G. 2008. "Fitting Oval Pegs Into Round Holes," *Organizational Research Methods* (11:3), pp 481-509.
Pratt, M. G. 2009. "From the editors: For the lack of a boilerplate: Tips on writing up (and reviewing) qualitative research," *Academy of Management Journal* (52:5), pp 856-862.
Quinn, R. W., and Worline, M. C. 2008. "Enabling courageous collective action: Conversations from United Airlines flight 93," *Organization Science* (19:4), pp 497-516.
Ren, Y., Harper, F. M., Drenner, S., Terveen, L. G., Kiesler, S. B., Riedl, J., and Kraut, R. E. 2012. "Building member attachment in online communities: Applying theories of group identity and interpersonal bonds," *MIS Quarterly* (36:3), pp 841-864.
Rich, F. 2011. "Wallflowers at the Revolution," The New York Times http://www.nytimes.com/2011/02/06/opinion/06rich.html
Ring, P. S., and Van de Ven, A. H. 1989. "Formal and informal dimensions of transactions," in *Research on the management of innovation: The Minnesota studies*, A. H. Van de Ven, H. L. Angle and M. S. Poole (eds.), Oxford University Press, pp. 171-192.
Roberts, J. A., Hann, I.-H., and Slaughter, S. A. 2006. "Understanding the motivations, participation, and performance of open source software developers: A longitudinal study of the Apache projects," *Management Science* (52:7), pp 984-999.
Rothman, N. B., and Melwani, S. 2017. "Feeling mixed, ambivalent, and in flux: The social functions of emotional complexity for leaders," *Academy of Management Review* (42:2), pp 259-282.
Sadiki, L. 2014. *Routledge Handbook of the Arab Spring: Rethinking Democratization*, (Routledge.
Saussure, F. d. 1959. *Course in General Linguistics*, (New York: Philosophical Library ed.).
Sebeok, T. A. 1985. *Contributions to the Doctrine of Signs*, University Press of America: Lanham,Md.
Seidl, D., and Becker, K. H. 2006. "Organizations as Distinction Generating and Processing Systems: Niklas Luhmann's Contribution to Organization Studies," *Organization* (13:1) January 1, 2006, pp 9-35.
Selander, L., and Jarvenpaa, S. L. 2016. "Digital Action Repertoires and Transforming a Social Movement Organization," *MIS Quarterly* (40:2), pp 331-352.
Simon, H. A. 1962. "The Architecture of Complexity," *Proceedings of the American Philosophical Society* (106:6), pp 467-482.
Srivastava, S. C., Teo, T. S., and Devaraj, S. 2016. "You Can't Bribe a Computer: Dealing with the Societal Challenge of Corruption Through ICT," *MIS Quarterly* (40:2), pp 511-526.
Stamper, R. 1973. *Information in business and administrative systems*, (Batsford: London.
Stamper, R. 1987. "Semantics," in *Critical issues in information systems research*, R. J. Boland and R. A. Hirschheim (eds.), John Wiley & Sons, Inc.: New York, NY.
Stamper, R. 1991. "The Semiotic Framework for Information Systems Research," in *Information Systems Research: Contemporary Approaches and Emergent Traditions*, Hans-Erik and H. K. a. R. H. Nissen (eds.): Amsterdam: North Holland.
Stamper, R. 1996. "Sign, Information Norms and Systems," in *Signs of Work: Semiosis and Informatiom Processing in Organisations*, B. Holmqvist, P. B. Andersen, H. Klein and R. Posner (eds.), Walter de Gruyter: Berlin.
Staw, B. M. 1976. "Knee-deep in the big muddy: A study of escalating commitment to a chosen course of action," *Organizational Behavior and Human Performance* (16:1), pp 27-44.
Strauss, A. L., and Corbin, J. 2008. *Basics of Qualitative Research: Grounded Theory Procedures and Techniques*, (3rd ed.) Sage Publications: Newbury Park, CA.
Tanriverdi, H., Rai, A., and Venkatraman, N. 2010. "Research commentary—reframing the dominant quests of information systems strategy research for complex adaptive business systems," *Information Systems Research* (21:4), pp 822-834.

Tarrow, S. G. 2011. *Power in movement: Social movements and contentious politics*, Cambridge University Press: Cambridge.
Thietart, R.-A., and Forgues, B. 1995. "Chaos theory and organization," *Organization science* (6:1), pp 19-31.
Thrift, N. 1999. "The place of complexity," *Theory, Culture & Society* (16:3), pp 31-69.
Tiercelin, C. 1998. "Peirce's Objective Idealism: A Defense," *Transactions of the Charles S. Peirce Society* (34:1), pp 1-28.
Tilly, C. 1978. *From Mobilization to Revolution*, Addison Wesley Publishing Co: New York.
Tilly, C. 1998. "Contentious conversation," *Social Research* (65:3), pp 491-510.
Tonnies, F., and Loomis, C. P. 1957. *Community and society*, Courier Corporation.
Tsoukas, H., and Chia, R. 2002. "On organizational becoming: Rethinking organizational change," *Organization science* (13:5), pp 567-582.
Tufekci, Z., and Wilson, C. 2012. "Social media and the decision to participate in political protest: Observations from Tahrir Square," *Journal of Communication* (62:2), pp 363-379.
Umiker-Sebeok, J. 1987. *Marketing and semiotics: New directions in the study of signs for sale*, Mouton de Gruyter: Berlin New York.
Urry, J. 2002. "The global complexities of September 11th," *Theory, Culture & Society* (19:4), pp 57-69.
Urry, J. 2005a. "The complexities of the global," *Theory, Culture & Society* (22:5), pp 235-254.
Urry, J. 2005b. "The Complexity Turn," *Theory, Culture & Society* (22:5), pp 1-14.
Van Alstyne, M., and Brynjolfsson, E. 2005. "Global village or cyber-balkans? Modeling and measuring the integration of electronic communities," *Management Science* (51:6), pp 851-868.
Van Laer, J., and Van Aelst, P. 2010. "Internet and social movement action repertoires: Opportunities and limitations," *Information, Communication & Society* (13:8), pp 1146-1171.
Varela, F. G., Maturana, H. R., and Uribe, R. 1974. "Autopoiesis: the organization of living systems, its characterization and a model," *Biosystems* (5:4), pp 187-196.
Venkatesh, V., Brown, S. A., and Bala, H. 2013. "Bridging the qualitative-quantitative divide: Guidelines for conducting mixed methods research in information systems," *MIS Quarterly* (37:1), pp 21-54.
Venkatesh, V., Rai, A., Sykes, T. A., and Aljafari, R. 2016. "Combating Infant Mortality in Rural India: Evidence from a Field Study of eHealth Kiosk Imlementations," *MIS Quarterly* (40:2), pp 353-380.
Volkoff, O., Strong, D. M., and Elmes, M. B. 2007. "Technological embeddedness and organizational change," *Organization Science* (18:5), pp 832-848.
Von Bertalanffy, L. 1950. "An outline of general system theory," *British Journal for the Philosophy of science* (1:2), pp 134-165.
Von Foerster, H. 2003. "On self-organizing systems and their environments," in *Understanding Understanding: Essays on Cybernetics and Cognition*, H. v. Foerster (ed.), Springer: USA, pp. 1-19.
Walsh, I., Holton, J. A., Bailyn, L., Fernandez, W., Levina, N., and Glaser, B. 2015. "What Grounded Theory Is…A Critically Reflective Conversation Among Scholars," *Organizational Research Methods* (18:4), pp 581-599.
Wang, X., Butler, B. S., and Ren, Y. 2013. "The impact of membership overlap on growth: An ecological competition view of online groups," *Organization Science* (24:2), pp 414-431.

Warschauer, M., and Grimes, D. 2007. "Audience, authorship, and artifact: The emergent semiotics of Web 2.0," *Annual Review of Applied Linguistics* (27), pp 1-23.
Wattal, S., Schuff, D., Mandviwalla, M., and Williams, C. B. 2010. "Web 2.0 and politics: the 2008 US presidential election and an e-politics research agenda," *MIS Quarterly* (34:4), pp 669-688.
Weaver, W. 1948. "Science and Complexity," *American scientist* (36), pp 536-567.
Weber, R. 2003. " Editor's comments - The Problem of the Problem," *MIS Quarterly* (27:2), pp iii–ix.
Weick, K. E. 1976. "Educational organizations as loosely coupled systems," *Administrative science quarterly*), pp 1-19.
Weick, K. E. 1993. "The collapse of sensemaking in organizations: The Mann Gulch disaster," *Administrative Science Quarterly* (38:4), pp 628-652.
Weick, K. E. 1995. *Sensemaking in organizations*, (1st ed.) Sage Publications Inc.: Thousands Oaks: London: New Delhi.
White, R. W., and Horvitz, E. 2009. "Cyberchondria: studies of the escalation of medical concerns in web search," *ACM Transactions on Information Systems* (27:4), pp 1-37.
Whitehead, A. N. 1920. *The Concept of Nature*, (1st ed.) University Press: Cambridge.
Williams, C. K., and Karahanna, E. 2013. "Causal Explanation in the Coordinating Process: A Critical Realist Case Study of Federated IT Governance Structures," *MIS Quarterly* (37:3), pp 933-964.
Woermann, M., and Cilliers, P. 2012. "The ethics of complexity and the complexity of ethics," *South African Journal of Philosophy Suid-Afrikaanse Tydskrif vir Wysbegeerte* (31:2), pp 447-463.
Wynn, D. J., and Williams, C. K. 2012. "Principles for conducting critical realist case study research in information systems," *MIS quarterly* (36:3), pp 787-810.
Yin, R. K. 2014. *Case Study Research: Design and Methods*, (5th ed.) Sage Publications.
York, J. C. 2011. "Not Twitter, Not Wikileaks: A Human Revolution. http://jilliancyork.com/2011/01/14/not-twitter-not-wikileaks-a-human-revolution/ ".
Zachariadis, M., Scott, S. V., and Barrett, M. I. 2013. "Methodological Implications of Critical Realism for Mixed-Methods Research," *MIS Quarterly* (37:3), pp 855-879.
Zeleny, M. 1981. "Autogenesis: On the self-organization of life," in *Autopoiesis: A theory of living organization*, M. Zeleny (ed.), Elsevier North Holland: New York NY, pp. 91-115.
Zhang, C., Hahn, J., and De, P. 2013. "Research note—continued participation in online innovation communities: does community response matter equally for everyone?," *Information Systems Research* (24:4), pp 1112-1130.

Appendix A: Illustration of Coupling for the Autogenesis Stage

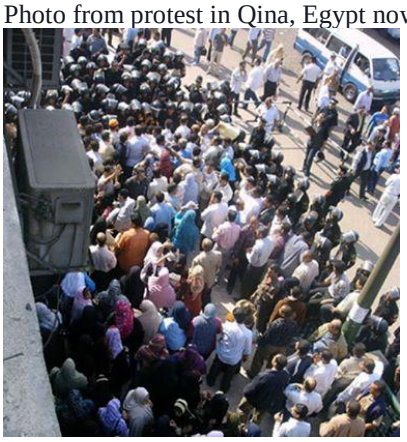
Post #1 June 10, 2010 9:01PM	Analysis	Concepts
Oh you inhuman: we will claim Khaled Said's Right. I'm Egyptian. I will never accept Khaled's murder by torture, by heartless people with no mercy. These people were confident they could get away with murder because they're from the police. I'm Egyptian. I will not let the blood of this young man be wasted. I'm Egyptian like Khaled, I didn't stand by him. Tomorrow they will come to kill me and you won't stand by me. The person that killed Khaled and soiled his hands with Khaled's blood shouldn't see the light of day anymore. People like this do not deserve to live. They do not deserve to live in Egypt among us.	"I'm Egyptian" vs. "they", inhuman and murderers guilty for the torture, the blood, reproduce the authoritarian regime. But also, all the people who did not do anything to change the situation: "stand by him", "stand by me", provoke/galvanize the crowds to take action towards change to hit the pride, anger of the audience. So, that the message ends on a collective, unifying "us" Set the cultural and political context to develop a shared mental model.	*Autopoietic Element Of Martyr narrative* Identity *Community of thoughts* *Sense of community* **PRAGMATICS** Alterity *Cultural Context: institutionalized practice* Discontinuity *Intentionality* **ENVIRONMENT** ***Other-reference vs. I: no self-reference*** *Culture of silence* *Accountability* Continuity *Maintenance of an order* *Culture of fear* *Fear-oriented communication* Weak ***self-reference***: defined against the institutionalized order
Post #2 June 10, 2010 9:02PM		
It's our right and we won't give it up.	Resonates with the first sentence of the 1st post. Reinforces the quest for justice (right), the anger (won't give up) and the collective rhythms both parts of the sentence (our, we).	Weak ***self-reference*** *Weak Sense of community* Partitioning of initial post + **SYNTACTICS** Elements of discourse to action *Rise against culture of fear*
Post #3 June 10, 2010 9:09PM		
[5 photographs of Khaled Said, before and after being beat up]	Emotional component. Violence of the picture. Channel emotions/anger to a cause.	Elements of narrative **SYNTACTICS** Combinations of Dead vs. Alive

Post #4 June 10, 2010 9:15PM		
The day they went and killed Khaled, I didn't stand by him. Tomorrow they will come to kill me and you won't stand by me.	Single out and Repeat a part of the (melo)dramatic opening speech to provoke Egyptians in their pride as the situation has been around for too long.	They vs. I You vs. I *Other-reference* **SYNTACTICS** Denounce culture of fear **PRAGMATICS**
Post #5 June 10, 2010 9:19PM		
Hey everyone, we are now 300 after a couple of minutes. We want to be 100,000. We have to unite so that we can make a clear stand against the ones who oppress us and think they own our life.	Motivating the crowd, by reporting achievement and creating trust environment as he is not alone. Encourages people to extend the reach of their message and Like or Share this page.	*Condition of satisfaction* **PRAXIS** *Goal-Seeking* **PRAGMATICS** *May lead to actions* Drift from Storyline shows the *meaning* drawn to the resulting action (i.e. joining). **SEMANTICS**
Post #6 June 10, 2010 9:42PM		
My blood is in your necks, oh Egyptians	Focusing on living Khaled than dead by giving him a voice, the picture of his dead body won't reappear. But his picture, alive and representing the face of an ordinary Egyptian from a middle-class background	Choices in combination of elements of discourse *Accountability of users/members* *Usages* **SYNTACTICS**

Appendix B: Illustration of Coupling for the Proto-Autopoiesis Stage

Post January 15, 2011	Analysis	Concepts
Activists from all over Egypt have now agreed to make the 25th January, the day to start Egyptians' peaceful uprising against torture, poverty, corruption and unemployment in Egypt. Stand up for your rights Egyptians. To our International friends: Support us please in every possible way to make this day a success. 25th January is the official Egyptian Police day (in which they celebrate torturing us). Do you want to be part of change in Egypt? & help creating it?	Organization of dissention action by promoting a sense of community ("Egyptians") around a common cause ("against torture… in Egypt"). Dissemination information through different nodes of network	**Semantic Analysis** *Core group of agents* **SEMANTICS** Peripheric node *Intentionality* *Symbol* **PRAGMATICS** **SYNTACTICS** ***Poiesis***: aiming at producing effects beyond itself
Post January 17, 2011		
To All our supporters living outside Egypt: Would you be able to do a protest in front of the Egyptian embassy in your country on Sunday 23rd January or Tuesday 25th? Would our members in UK and USA and other countries try to arrange such a protest and email: alshaheeed@gmail.com with details to co-ordinate please? We urgently need your support at this stage.	Resonate with second half of previous posts. Coordinating and Assembling in one united collective by connecting different social spaces. Removing spatial distance by connecting every node on January 25th.	***Poiesis***: aiming at producing effects beyond itself Building **self-reference** **STRUCTURAL COUPLING:** Intentional and planned irritations of the sociopolitical system in last 2 posts

Appendix C: Illustration of coupling for the Transdigitalization Episode

Post#1 January 25	Analysis	Concept
Photo from protest in Qina, Egypt now. 	The revolution (change?) is on its way everywhere (here Qina). And attracting more people like observers. (call to Join). ***Autopoietic process spilling over into urban space. Start of transdigital OOC: present simultaneously in cyberspace and urban space*** The picture creates an awareness of scale of what is going to happen.	*Lead to action* **PRAGMATIC** ***Growing self-reference***: people joining and crowd moving, coming from meaning drawn from posts and context. **SEMANTICS**
Post#2 January 25		
Protesters are giving flowers to Policemen in Egypt now. 	Internalization of the opposition made till here protesters vs. cops (depicted as corrupt and brutal) cops. Set Expectations to solve it peacefully. End state to reach.	**Zoom in** **Reentry** **SYNTACTICS** **Aspired Poiesis** **PRAGMATIC**
Post#3 January 25		
Protesters take a break to pray. 	Internalization of the opposition citizens VS. policemen, foreground/background, on knees/standings. Praying = peaceful activity	**Reentry** *System vs. environment* **SYNTACTICS**

Post#4 January 25		
Confirmed: Tahrir Square is now COMPLETELY ours. Egyptian Police now is only worried about protecting their head quarters: Ministry of interior. 	Gathering in an open space where millions can come to sympathize with the OOC.	*Self-reference* *« ours »* **SYNTACTICS**
Post#5 January 25		
After years of dictatorship, protesters in Tunisia managed to do their prayers after the dictator was ousted. Today Egyptian protesters took break to pray before carrying on protesting for their rights. 	OOC follows similar path than other systems of collective actions. And set further Expectations: On January 14th, President Ben Ali flew Tunisia. Praying = peaceful protest Speculative positioning.	Self-reference and other-reference parallelism **SYNTACTICS** *Intentionality: Conditions of satisfaction* **PRAGMATIC**
Post#6 January 25		
Alexandria. I guess the message is clear. Isn't it? 	Half Picture of Mubarak (current state of the environment) torn apart (change brought by the system). Set Expectations. Speculative picture and tag question.	***Reentry*** **SYNTACTICS** *Intentionality: Conditions of satisfaction* **PRAGMATIC**
Post#7 January 25		
Tahrir Square NOW 	Peaceful and massive gathering that has grown over the day. Open and boundaryless. The pictures on that day creates an awareness of sense-of-community and awareness of scale that breaks the culture of fear and encourage people to join	Self-reference **SYNTACTICS** *Intentionality: Lead to actions.* **PRAGMATIC**

Appendix D: Log of events (Sample of one account from Al-Saleh 2015)

Date	Maha
Before January 25th	On one night, long before January 25, I saw pictures of Khaled Said on Facebook— I could not sleep at all that night. I joined his support group "We are all Khaled Said" on Facebook. The group started organizing events for which we dressed in black and faced the Nile or the sea for an hour (and in silence) from wherever we were standing. I loved the idea because it allowed me to demonstrate my anger at and condemnation of Khaled's murder in a very civilized way. I could also express my fear of becoming the next victim of the Egyptian police force. I attended several silent protests, one with my mother and younger sister in my hometown, and another alone here in Cairo where I live and work.
January 25th	On January 25, 2011, the "We are all Khaled Said" Facebook page started promoting the march, which was very well planned in terms of where to meet, what to chant, what to carry and what not to carry, and acceptable types of shoes. The page had all kinds of information, with one exception: the direction and end point of the march. Before the morning of January 25, I had never voted in any elections or taken part in any protests, because I always thought both were dangerous in Egypt. I always associated protests with harassment and very violent police reactions. I recall so many pictures of men and women being dragged through the street, and I wanted to avoid becoming one of them—and yet somehow I trusted the Facebook page.
January 26-27th	
January 28th	After the success of "We are all Khaled Said" Day on January 25, Facebook and Twitter groups posted that January 28 would be "Jum'at al-Ghadab" (Friday of Anger). Because it was blocked, I accessed Facebook through Opera Mini, the software that connected us to proxy servers. We were worried when we heard that the regime was planning to cut off the Internet completely and maybe cell-phone networks, too. An Egyptian friend living in England sent me his number so that if the Internet was shut down, I could text him the news and he would post it on Facebook. On this Friday event, the government did turn off all communication networks, including mobile services, so I could not send any news to anybody. But we eventually made our voice heard by the entire world. Personally, this day gave me the best memories, which I will never forget. It activated a part of me that had been dormant for the thirty-seven years I have been Egyptian.

SYNTHESIS 2

This three-essay dissertation focuses on the societal implications of online phenomena that spillover offline. In this chapter, we looked at a first case: The Arab Spring and aim at understanding how an online community that started on Facebook materialized in urban space, changing the political landscape. Addressing these kind of contemporaneous events does not come without analytical challenges. Therefore, we use the semiotic analytical tool developed in the previous chapter in a single extreme case study.

We have shown the complexity to study such collective actions that overflow the online realm but also their local dimension. We have formulated a four-stage process model (Figure 17) explaining how an OOC can become an OTC. By focusing our study on one medium – Facebook – we have been able to specify the different types of awareness afforded by, and critical in, the unfolding of the process model. We found supporting evidence for *ambient awareness*, and brought into light *awareness-of-sense-of-community*, *awareness-of-scale*, *scale-of-awareness* (Table 14).

However, not all online communities will *transdigitalize*. Furthermore, online communities can also have social costs by providing an echo chamber to socially undesirable behaviors. Some highly specialized online communities heighten some socially stigmatized identities and empower individuals to act on their own. We aim at offering a conceptual explanation of how these online interactions turn into offline behaviors with negative spillovers (next chapter).

CHAPTER 5 - AN IDENTITY-DRIVEN ESCALATION OF COMMITMENT TO NEGATIVE SPILLOVERS[30]

Abstract

The technological advances of the World Wide Web led it to become a highly interactive medium on which billions of individuals share not only their information but also their thoughts and beliefs. While it is an ideal tool to bring people together and expand horizons by connecting remote communities, sadly it is also dangerously effective in spreading diseases or hate crime. Such poor awareness on how such paradoxical outcomes arise is a societal challenge. This conceptual paper focuses on concealable stigmatized identities; i.e., culturally devalued identities that are not visible to others. When acted upon they produce socially questionable activities that incur social penalties and generate (tangible and intangible) societal costs. We explain how cognitive dissonance about one's identity refines our current understanding of the relationship between (increased) Internet access and (increased) societal negative spillovers. We offer a process model explaining how online escalation-of-commitment leads to offline negative spillovers.

Keywords: Spillovers, online-offline interactions, escalation of commitment, process theory

[30] A previous version of this paper has been accepted to ICIS 2017.

5.1. Introduction

The Internet has brought many benefits such as knowledge collaboration (Butler 2001; Faraj et al. 2011), social empowerment (Leong et al. 2016) and value co-creation (Han et al. 2012) (to cite only a few). But widespread Internet access also creates new problems (Deng et al. 2016).

Paradoxically, the same discussion space – The Internet – reduces and heightens distance between individuals. On the one hand, networked communications have reduced geographical distance allowing improved coordination and better information sharing (Butler 2001; Wang et al. 2013). On the other hand, the electronic infrastructure provides the tools for a preference-based separation (Van Alstyne and Brynjolfsson 2005) that entraps rather than empowers the human condition. The same global infrastructures that can help refugees' social integration (Andrade and Doolin 2016), improve well-being nationwide (Ganju et al. 2016), reduce infant mortality in remote areas (Venkatesh et al. 2016) but also fragment and polarize interactions based on ideologies (Chan et al. 2016), and offer new venues to spread diseases (Chan and Ghose 2014; Greenwood and Agarwal 2015).

In societal terms, the widespread use of Information and Communication Technology (ICT) acts like a catalyst for some kinds of social interactions. The Internet offers to a wide range of people the capability to self-generate content that becomes accessible to larger social groups (Agarwal et al. 2008; Chan et al. 2016; Van Alstyne and Brynjolfsson 2005). These heightened interactions raise societal challenges (Bhuller et al. 2013; Chan et al. 2016; Greenwood and Agarwal 2016; Whyte 1986). Researchers have explored the fluid membership boundaries of online communities. These fluid membership boundaries create a larger space for individual processes through the selective viewing of content (Chan et al. 2016) and specialization of interests (Van Alstyne and Brynjolfsson 2005). However, this conceptualization of fluid boundaries is no longer sufficient in scope. Today, the boundaries of these digital platforms are not only fluid in membership but are also highly fluid across the boundaries between online and offline worlds. Online communicative events have offline consequences and vice-versa. Those challenges emerge as spillovers from online interactions into offline interactions. *Spillovers* regard the effects and consequences of online interactions that overflow the online space to affect the offline society. Furthermore, there can be negative spillovers because their effects translate into social costs (e.g. health costs) and personal pain (e.g. injuries, loss).

Consistently with Van Alstyne and Brynjolfsson (2005), we do not argue that improved communication access and filtering capabilities will systematically lead to these negative spillovers. However, we do argue that the IS field is still mainly biased toward studying the use of technological infrastructure in providing better products and services, building better organizations and making better societies. This focus has left unexplained a number of phenomena (see vignettes in the next section for concrete examples) with less noble, but nevertheless dramatic, impact on our societies.

The previous studies cited above have acknowledged the online role of individual identity, but this level of analysis needs further exploration for the purposes of spillovers between online and offline behavior. These studies have assumed the role of Internet in identity construction, maintenance and amplification. The online interactions of interest are socially dubious and can lead to risky and costly offline (sometimes illegal) behaviors. For example, how searching romantic matching platforms for casual sex partners can connect offline to higher HIV incidence rates (Chan and Ghose 2014; Greenwood and Agarwal 2016); or how participation in ideology-laden communities can connect offline to racial hate crimes (Chan et al. 2016). These negative spillovers are online interactions that spread beyond the online space. In this paper, we narrow down such identities to focus on concealable stigmatized identities i.e. identities that are not visible to others and culturally devalued (Goffman 1963; McKenna and Bargh 1998). Given that identity is a driver of behavior (Stets and Biga 2003), we apply concepts from escalation of commitment (Staw 1981) to build a tentative explanation of why certain forms of costly social behavior arise.

The opportunities to broaden the scope of current theories about online social behaviors are becoming apparent in three prominent areas. First, the main emphasis of theorizing has been on the impact of the *Internet on society* (Bhuller et al. 2013; Chan and Ghose 2014; Chan et al. 2016). This emphasis has marginalized the impact of *society on the Internet*, i.e., it limits our understanding of how socially dubious behaviors unfold and interact between online and offline social spaces. Second, the narrower scope of application of extant theories has encouraged researchers to concentrate on factor-based research approaches. A broader scope of application, one that includes online and offline spillovers, begs for process studies that explain the sequence of events leading to such spillovers. Third, the multilevel aspects of the interaction of human behaviors across online and offline spaces are, at least in the current era, of growing importance. Behavior at the individual level, as well as the group level, is important.

For example, individuals can more easily gain an online social prominence that can spillover offline.

A better understanding of negative spillovers also has several important implications for public policy in regard to addressing the social costs and online content governance. For example, the Center for Disease Control and Prevention (CDC) reported the highest number of reported STDs (Sexually Transmitted Diseases) in 2015[31] for an estimated cost of $16 billion each year for the American healthcare system. This report attributed this trend mainly to Americans between 15 and 24 years old who were men who having sex with men (MSM). Another example is the online radicalization of the Boston bombers which cost $333 million to compensate for the losses to the city and the victims[32]. In both cases, the pain of the victims and their families are not just individual, but social consequences of diseases or crimes.

The purposes of this study are twofold: to explain (1) how online interactions escalate commitment to a concealable stigmatized identity, and (2) how this escalation process produces negative spillovers.

The paper is organized as follows. First, we introduce the information systems (IS) literature on offline spillovers. Second, we develop vignettes to give concrete examples of negative spillovers. Third, we provide an analysis of the mechanisms related to the escalation of commitment to a concealable stigmatized identity that yields negative spillovers. Fourth, we develop a process model to explain Internet-driven socially dubious behaviors. Before concluding, we discuss the theoretical and practical implications of the model.

5.2. What are Negative Spillovers?

Before we discuss the process leading to negative spillovers, we present three vignettes to illustrate the nature of negative spillovers before theorizing it. The vignettes come from the news media and popular press. They relate true stories. We use the names as reported in the press articles. They are summarized here for length consideration and annotated to give a broader picture.

[31] http://www.cdc.gov/nchhstp/newsroom/2016/std-surveillance-report-2015-press-release.html
[32] http://usnews.nbcnews.com/_news/2013/04/30/17975443-adding-up-the-financial-costs-of-the-boston-bombings

The three vignettes revolve around individuals who turn to online communities for different purposes yet share common reasons such as social support. We develop each vignette and their societal consequences.

5.2.1. Vignette 1: Online Interactions Leading to Sexually Risky Behaviors

Brandon, 23 and Travis, 29 are *bug chasing* online. It means they are looking for a *gift-giver*, i.e. a HIV-positive man who wants to have unprotected sex and does not mind transmitting the disease (Blanchard 2013). Bug chasing is not a typical conversation in society or in the LGBT community. Each joined an online community to facilitate his bug chase. Each wanted to avoid the confrontation with judgmentalism. Each wanted to fulfill a need for belonging. Each was searching for an identity. This online space offers a non-judgmental arena where they can talk plainly about what they want and what they do not want. Travis attended a *conversion party*, a sex party where bug chasers go to have sex with gift-givers in hopes of getting infected. Three weeks later, Travis tested positive for HIV and was thankful to his gift-giver. Brandon is excited about attending such a party because he believes that contracting HIV will make his sex life better. Therefore, after having a great time in his conversion party, he reacted with disappointment when his subsequent HIV-test came back negative. The negative result did not make him think further, he is determined in his chase and planning to go to another party.

The negative spillover in this vignette regards the negative impact on societal healthcare costs. Surveys in the San Francisco area show that old and young men, HIV-negative or -positive are already involved in high-risk sexual behaviors (Goode 2001). Such behaviors substantially increase the burden of healthcare cost on society(Choi et al. 2016). This particular online community builds its shared values in opposition to HIV-stigma and serophobia (the fear of people who are HIV positive). Many would argue that the diminishment of such stigmatizations and irrational phobias would improve offline society. However, this community extends this opposition into a belief that bug chasing and gift giving is an intimate connection that combines vulnerability and thrill into a life event (Dean 2013). Regardless of how attractive this may be for the participants, enabling folks to spread the virus has a negative spillover by increasing the health care costs in society.

5.2.2. Vignette 2: Empowered Patients or Cyberchondriacs?

When she felt twitching in her muscles, Catherine turned to “Dr. Google” (online information and advice). Her worries turned to panic when Google’s first page of results listed multiple deadly and incurable diseases (Usborne 2009). Among them, Catherine found two brain diseases. When she turned to her doctor, he quickly dismissed every serious disease she discovered in her online search. Instead, her doctor diagnosed her with a benign disease. However, Catherine did not completely feel at rest after seeing her doctor. She once again Googled her diagnostic and once again found the worst results possible. Overwhelmed, she joined an online community to share her fear of imminent death. She started to experience speech problems.

The negative spillover in this vignette also regards the negative impact on societal healthcare costs. Catherine became a *cyberchondriac*, a patient who researches their symptoms online and develops serious anxieties when they find a disease, illness or condition that is consistent with their self-evaluation.

The Internet is now an important source of health information and online health search activity is widespread. While it can empower some individuals, it may harm others by creating anxiety and distress. Cyberchondriacs overlook doctors’ diagnostics and lock themselves into a reinforcing spirals where their health-information-seeking reinforces their health anxiety (White and Horvitz 2009). In extreme cases, the imagined illness manifests as physical symptoms (Gummow 2013). Cyberchondria is a negative spillover onto society because health anxiety costs 16% of the annual medical costs, has negative effects on social relationships (e.g. married couples) and increases the loss of trust in the patient-doctor relationship (Gummow 2013).

5.2.3. Vignette 3: Racial Hate Crime

At different times, Frazier, Michael and Anders joined an online white supremacist community (Liston 2014). This community described itself as "the voice of the new, embattled White minority". As a minority, they feel apart from the rest of the society and most importantly, they do not share the same values. Frazier was known to espouse anti-Semitic views and widely expressed his hate for Jewish people. He was very active on online hate groups where he posted

more than 12,000 racist messages and communicated with other individuals sharing the same ideology. After a shooting at a Jewish Community Center in Kansas, Frazier was convicted of capital murder and sentenced to death. During a shooting at a Sikh temple in Wisconsin, Michael fatally shot six people, and then died from a self-inflicted gunshot. In Norway, Anders was convicted of murdering 77 people in bombing and shooting incidents.

The negative spillover in this vignette regards violence that is promoted by online communities focused on hatred toward other races, religions, politics, etc. The dreadful events above align with previous research showing the relationship between increased broadband availability and the incidence of racial hate crimes, particularly among lone-wolf perpetrators (Chan et al. 2016). Online communities can promote the efficiency of the spread of extremist ideology and spur like-minded individuals to carry out attacks. The negative spillover is not focused on the formation of offline hate groups as a result of online hate groups. Instead, the negative spillover regards the role of online communities in raising the social cost of hate group violence: loss-of-life, injuries, ruined families, homes and businesses, law-enforcement, incarceration, etc.

5.3. Theorizing the Negative Spillovers

Previous studies focus specifically on behaviors shared by a subgroup to which societies[33] frequently assign negative connotations (e.g. racism or casual sex). Such shared behaviors are known to lead to outcomes with negative consequences for the whole society. For example, Chan et al. (2016) investigated the relationship between widespread Internet access and racial hate crimes. Bhuller et al. (2013) have looked at Internet pornography use linked to sex crimes as an offline negative spillover. Chan and Ghose (2014) as well as Greenwood and Agarwal (2016) researched the relationship between the introduction of dating platforms (e.g. Craigslist), and the HIV incidence rate. Such studies focus specifically on behaviors to which societies frequently assign negative connotations (e.g. racism or casual sex) and that lead to outcomes with negative consequences borne by society. These studies premise that (increased) Internet broadband access or "digital connectivity" (Greenwood and Agarwal 2016) explains the observation of these negative behaviors and have added moderators like levels of segregation (Chan et al. 2016), or race, gender and socioeconomic status(Greenwood and Agarwal 2016).

[33] We will consider Western society as most of the studies so far identified have been conducted in the U.S.

These studies do establish digital connectivity as a necessary condition for such negative spillovers, however, we propose this is not a sufficient explanation. These studies also show that online interactions lead participants into self-presentation by engaging in "construction and affirmation of racial identities" (Chan et al. 2016) and online anonymity encourages online interactions because such anonymity reduces or even eliminates the fear of "social penalty of engagement in risky activity" (Greenwood & Agarwal 2016, p.3). Based on the existing literature, it appears any sufficient explanation of behaviors negatively perceived by the society must include identity formulation and appraisal. Core features of online platforms offer the possibility to self-select the content that enables specialization of interest (Van Alstyne and Brynjolfsson 2005). In other words, social networking platforms enable people to find link-minded individuals who exactly align with behaviors that may be negatively received by the broader society or opposing social groups. They enable the *socially odious* to find kindred spirits. By supporting anonymity and subsequent online anonymous social interaction, these platforms also free their users from the weight of offline social norms and the fear of social penalty.

In this way, individuals search for online social interactions aligned with their preferences. When successful, this search gives rise to highly specialized and homogeneous communities. These communities can have significant consequences as users interact with other social groups of the society: "Because the Internet makes it easier to find like-minded individuals, it can facilitate the creation and strength of fringe communities that have a common ideology but are dispersed geographically" (Van Alstyne and Brynjolfsson 2005, p.852). Increased connectivity and improved filtering technologies are important antecedents in fragmenting interaction and threatening integration. ICT acts as a "lubricant" for the satisfaction of preferences that precipitate specialization. While intrinsic or external rewards may drive such specialization, it may fundamentally endanger the welfare of the overarching society. Overspecialization of subgroups can create tension between such voluntary fragmentation and the integration of the society as a whole (Van Alstyne and Brynjolfsson 2005). Much of the research to date suggests that the consequences of misalignment between specialized interactions and society's interactions can lead to direct social and economic costs such as medical expenses, legal costs, property damage, human suffering, etc.

Current explanations of online-to-offline spillovers are rather deterministic. Simply associating increased Internet access with negative spillovers does not provide sufficient detail about the individual cognitive processes that leads to these negative spillovers. This elaboration is especially compelled by the evidence showing how, on average, the relationship holds. For example, Chan and colleagues (2016) have shown that widespread Internet has favored those racial hate crimes that are undertaken by lone-wolves (as opposed to groups). More complete explanations for such spillovers (e.g. identity based) need more development.

5.4. Unpacking the Processes at Play

5.4.1. Concealable Stigmatized Social Identity

5.4.1.1. Process of identification

Identity is the answer to the question, "Who are we?" It is as personal as it is social (Carter and Grover 2015). An individual holds one self-concept which encompasses the view of self, i.e. the set of meanings of who we are. However, the overall self has multiple parts, i.e. multiple identities (Stets and Burke 2005).

Tajfel's work in psychology offers insights into how identity manifests in social groups. Early work (Tajfel and Turner 1979) has highlighted the importance of social identification for self-esteem. Tajfel (1978) defines social identity as "that part of an individual's self-concept which derives from his knowledge of his membership of a social group (or groups) together with the value and emotional significance attached to that membership." (p. 63). Three components contribute to this definition. First, a *cognitive component*: through self-categorization, an individual is aware of his/her group membership. Identification is a central cognitive process to understand why individuals do what they do (Ashforth et al. 2008): they define themselves and maneuver accordingly because humans are meaning-seekers (Weick 1995). Accordingly, the degree of identification to and involvement with identity social group embodies an individual's commitment to set in motion or inhibit certain behaviors. Second, an *evaluative component*: through self-esteem, an individual values his/her membership. Third, *an emotional component* which is the affective commitment to the group. Commitment is key because the degree to which someone identifies with a social group will determine his/her tendency to behave according to his/her group membership. The effects of this commitment will hold even when it contradicts with other memberships such as the natural belongingness to an overarching society.

Tajfel (1982) further stresses that internal and external criteria define group identification. Tajfel focusses on internal criteria, such as the cognitive and evaluative components, but disregards the emotional component. While two out of three components are necessary, they are not sufficient. There must be an external consensus that such a group exists. This external criterion means that outsiders attribute certain behaviors to a certain group. However, this external criterion is itself not sufficient until individuals become aware of, and value, their group membership. While research on social identification has neglected its emotional dimension (Johnson et al. 2012), it has not been entirely ignored. Albert (1998) compares identity to an onion: as you peel away layers, tears come to your eyes. Tears are the emotions indicating the importance of identification. The *process* of identification is not merely cognitive. Cognitive identification is a pre-condition for emotional identification to follow in the identification process (Carmeli et al. 2006). Research such as that on motivated cognition (Chen et al. 1996) or affect-as-information-model (Clore et al. 2001) are also process-oriented; it studies the role of emotions in individuals' search and their processing of information.

As a process, social identification as the perception of oneness of an individual with a group (Ashforth and Mael 1989) continues to drive individuals' commitment as they tend to expend more efforts on the behalf of the group with which they identify. Continued membership is maintained by the ability of the group to enhance the self-esteem of its members. Others motivational factors have been identified such as reduction of uncertainty or the basic need to belong (Brewer 1991; Hogg and Abrams 1990; 1993). However, the latter can be frustrated by being too different to belong to the mainstream society.

In our vignettes, individuals are drawn to online community to find social connections among like-minded people who share the same sexual practices (vignette 1), the same health concerns or distrust in the medical system (vignette 2) or the same ideology (vignette 3).

5.4.1.2. Stigma: Labelling and Setting Apart

Members of mainstream society have internalized cultural conceptions. According to these shared interpretations, they value some and devalue other identities (e.g. a non-mainstream sexual or political orientation). Being placed in a certain social category that is culturally frowned-upon or *stigmatized* results in various negative outcomes from loss of self-esteem to

hindering professional success or impacting social functioning. Originally defined by Erving Goffman (1963), societal stigma can be portrayed from socially undesirable to dangerous:
"*The term stigma and its synonyms conceal a double perspective: does the stigmatized individual assume his differentness is known about already or is evident on the spot, or does he assume it is neither known about by those present nor immediately perceivable by them?*" (Goffman 1963, p.4).
The kind of stigma we are interested in according to Goffman's typology are "*blemishes of individual character"* and matter because, as explained above, the individual can suffer from being *discredited* or at least being *discreditable.*

Spoiled identities can suffer from concealable or conspicuous (e.g. physical traits) stigma (McKenna & Bargh 1998). We are focusing on *concealable stigmatized (or marginalized) identity*. Comparatively, individuals with concealable stigma have no visible signs a) that enable them to find others who are similar and, b) may be in a position to hear more negative feedback about their concealed identity because their close circles do not identify them as such, which can increase their feeling of "uniqueness" and isolation. Consequently, while individuals with conspicuous stigma face overt discrimination, those with concealable stigma fear real or imagined identity threats.

Since Goffman, research on stigma has shown the negative consequences of stigmatizing processes like discrimination. It also shows that these consequences can occur in less overt ways in other types of stigma such as mental illness, sexual preferences, disability or unemployment (Link and Phelan 2001; Lyons et al. 2017).
In less overt ways, people with a stigmatized identity not only fear social rejection, they expect it. The socialization process taught them how people behave around people who have the same stigma. They also expect devaluation and they feel devaluation, discrimination and rejection personally. The fear, the threat and the everyday challenge pervade one's world view. The social threat pushes individuals with stigmatized identity to keep their identity concealed. Such concealment may unintentionally reinforce the commitment to it. Individuals with stigmatized identity feel constantly under threat. Because of the concealable character of their identity, the need to keep it concealed bears constantly on therein mind. This cognitive state may lead them to be strained in their social interactions or to restrict their social circle. The social weight of the stigma is vicious in its effects because it does not need direct interactions, or the experience

of devaluation, or discrimination, or rejection. It alone is enough to eat away self-esteem. It lies in the world view that the individual has built about a stigma.

People can be passive and reinforce certain conceptions about stigmatized identity; or they can resist and challenge the labelling and stereotyping to protect their self-esteem.
In our vignettes, individuals experienced or anticipated social rejection because of their sexual practices (vignette 1), or their lack of medical training (vignette 2) or their extreme social viewpoints (vignette 3).

5.4.2. Cognitive Dissonance due to Forced Compliance

An individual is put in an uncomfortable situation when they have a commitment to a potential behavior that risks a social penalty. This commitment arises when the person's private beliefs do not align with social behavioral norms. Festinger's work on dissonance is rooted in the study of such phenomena.
Cognitive dissonance (Festinger 1957) refers to situation in which individuals are involved in conflicting behaviors creating tension and discomfort. Festinger's theory assumes that individuals are driven to hold their behaviors in consonance.

Cognitive dissonance is an intra-individual process describing a situation in which a person acts in contradiction to her personal belief (Festinger 1957; Festinger et al. 1956). Under forced (also called public or overt) compliance, individuals adopt a counter-attitudinal behavior publicly to avoid punishment (e.g. social penalty) or to obtain a reward, but will hold on to their belief privately (Festinger 1957). The social pressure is only partially successful or being diverted. The absence of alignment between the public behavior and the private belief creates the cognitive dissonance. Further work on forced-compliance-driven cognitive dissonance (Kiesler and De Salvo 1967; Tedeschi et al. 1971) shows that, in such settings, individuals do not actually change their private values, beliefs, or attitudes. Instead they only change their publicly expressed self-description. Moreover, any public change in declared attitude is not earnest but only an effort to restore a spoiled identity (Gaes et al. 1978).

Cognitive dissonance due to such forced compliance engenders not only conflicting feelings and discomfort, but also means that the individual feels different from the group to which (s)he naturally belongs. This feeling of difference is critical because (s)he values this membership (i.e., society). This experimental critical feeling may imply that if the dissonance cannot be

eliminated then some facets of self-concept need to be hidden in order to maintain membership in a group. The stigmatized individual has assimilated the standards of the wider society well-enough to gain a feeling of belonging and sharing the identity of this natural group. Therefore, the social and moral character (which makes cognitive elements subjective and thus, harder to resolve the dissonance) and the continuous feedback received from the wider society through social interactions nurtures iteratively the magnitude of the cognitive dissonance.

Social support plays an important role in reducing or promoting the dissonance. Stroebe and Diehl (1981; 1988) show how the behaviors of an immediate social circle can gradually reduce the experienced dissonance. In this circle, one may learn about their friends' past "bad" behavior. Such knowledge offers a kind of social support for justifying dissonant behavior or acts as a marker of desirable behavior. It acts as a social reward that is equivalent to the financial reward given to participants by Festinger and Carlsmith (1959).

These previous studies assume the Internet is a provider of consonant relations that support and amplify the dissonant behavior. It overlooks the possibility that the online context can instead provide a venue to express and explore a certain identity that has been socially disapproved. Online communities harness the Internet in a unique way to advance their negatively stigmatized agenda.

In our vignettes, individuals experienced dissonance due to forced conformity. Their social conformity is forced because their identity goes against mainstream society. Instead of changing their beliefs, they search for social support online. Here they find comfort in their beliefs and encouragement in their behaviors.

5.5. Online Contextual Features

The growth of computer-mediated-communication (CMC) has raised researchers' concerns with the reduction of *social cues* that communicate social information about correspondents in online messages (Kiesler et al. 1984). Early work has shown relative anonymity to favour task-oriented exchanges at the expense of socioemotional interaction. Sproull and Kiesler's (1986) work goes on to show that the absence of social cues reinforces the feeling of anonymity, producing *deindividuation* leading to less regulated behaviors. Later work (e.g. McKenna and Bargh 1998) has shown that anonymity can actually strengthen social influence. Postmes and colleagues (2001) found that visual anonymity strengthens group's identification and this in

turn positively affected social influence. Deindividuation is the concomitance of loss of awareness of one's own identity and disinhibited, anti-normative behaviors. These factors are collectively triggered by online immersion and the anonymity enabled by online media. However, the research to date has privileged the general society norms but failed to consider the (online) situational norms (Postmes et al. 1998). Paradoxically, deindividuation effects are antinormative for the mainstream society and normative to the online community.

Through anonymity and invisibility gained online, individuals "loosen up, feel less restrained, and express themselves more openly" (Suler 2004, p. 321). The "*online disinhibition effect*" (Suler 2004) enabled by CMC is at play in the explanation of the pervasive phenomenon leading to behaviors that would not happen in face-to-face communications. Suler discusses uninhibited behaviors in the cyberspace through altruist online behaviors as well as legal and illegal behaviors on the dark side of Internet (e.g. pornography, crime). Online disinhibition is part of the self-development to solve interpersonal conflicts (arising from experienced dissonance) as well as to explore some facet of one's identity (Turkle 1995). Moreover, *anonymity* enables to separate their online from their offline behaviors and identities. They can act out online without being compromised offline. Related to the dissociative anonymity, i.e. absence of clues on one's identity, *invisibility* relieves an individual from worrying how he looks or sounds. Moreover, individuals do not have to interact in real time; *asynchronous communications* enable individuals to more reflectively process initial reactions and formulate a more considered reply. DiMaggio et al. (2001) point out that the Internet is a breakthrough combining the technical advances of telegraph, telephone, radio and television to make it "unprecedentedly malleable. This malleability raises the stakes for actors who wish to shape its evolution" (p.327). Technological advances have changed the contextual conditions of information exchange such as new mechanisms of interactions and coordination have emerged (Godé-Sanchez 2008).

In this context, individuals can search for online social interactions aligned with their preferences. When successful, this search gives rise to highly specialized and homogeneous communities. These communities can have significant consequences as users interact with other social groups of the society: "Because the Internet makes it easier to find like-minded individuals, it can facilitate the creation and strength of fringe communities that have a common ideology but are dispersed geographically" (Van Alstyne & Brynjolfsson 2005, p.852). Increased connectivity and improved filtering technologies are important antecedents to the

fragmentation of online interaction and thereby threaten integration. ICT acts as a "lubricant" for the satisfaction of preferences that precipitate specialization. While intrinsic or external rewards may drive such specialization, it may fundamentally endanger the welfare of the overarching society. Overspecialization of subgroups can create tension between such voluntary fragmentation and the integration of the society as a whole (Van Alstyne & Brynjolfsson 2005). Much of the research to date suggests that the consequences of misalignment between specialized interactions and society's interactions can lead to direct social and economic costs such as medical expenses, legal costs, property damage, human suffering, etc.

5.6. Online Escalation of Commitment

Commitment is a key concept in cognitive dissonance theory as well as in social identity theories. In the former theory, commitment to the belief involves action. In the latter theories, commitment in relation to identity enables the production of stable self-meanings which in turn lead to consistent courses of action. The dissonance is stressful and ego-threatening (Brockner et al. 1986) and thus commands resolution. Individuals tend to trivialize if not ignore information they regard as not credible or aberrant (Simon et al. 1995). This filtering process encourages the reinforcement and defensive bolstering of commitment to a course of action to which one has been predisposed (Staw 1981).

Escalation of commitment to a certain course of action becomes aberrant in situations when individuals, groups or organizations keep engaging in a *failing* course of action despite the presence of negative feedback (Staw 1976). Several explanations have been leveraged to describe how the mechanism unfolds: self-justification theory (Staw 1976), the avoidance approach (Rubin and Brockner 1975), prospect theory (Whyte 1986), agency theory (Harrison and Harrell 1993), and real options (Tiwana et al. 2006). These explanations indicate that the key characteristics of escalation include the concomitance of negative information and a continued commitment.

5.6.1. Cognitive Dissonance as Escalating Commitment Driver

As Staw noticed from his own observations, "many of the most injurious personal decisions and most glaring policy disasters can come in the shape of sequential and escalating

commitment" (Staw 1981, p.578). Staw initially talked about escalation of commitment to a costly course of action. We borrow this notion to explain how a similar process of escalating commitment drives an attempt to reduce cognitive dissonance by spilling negatively stigmatized social behavior over from online to offline.

In the setting at hand, cognitive dissonance is the motivation for such an escalation process. Escalation of commitment theory is a plausible path unfolding from negative feedback introducing an identity threat.

This cognitive dissonance is rooted in the misfit between (1) an individual's preferences and beliefs about "states of the world" (Akerlof and Dickens 1982, p.307) and (2) those preferences and beliefs of his/her immediate offline social circles. The former explains that the commitment escalates because individuals identify with outcomes in order to preserve their self-esteem (Brockner et al. 1986). Furthermore, Festinger (1957) concluded that, "A person may not be able to find the social support needed to change a cognitive element, or he may not be able to find new elements which reduce the total dissonance. *In fact, it is quite conceivable that in the process of trying to reduce dissonance, it might even be increased*. **This will depend upon what the person encounters while attempting to reduce the dissonance.**" (p.23-24, emphasis added). Building on this quote (Figure 20), we argue that, in cases of concealed, negatively stigmatized beliefs, an individual may employ online social cues to build consonance among a new social group while at the same time (s)he will increase the dissonance with their offline social group. In the online context of socialization, the individual is escalating his commitment to the concealed aspect of his/her self-concept.

Said differently, offline, the unsettling feeling of being singled out or being ostracized leads to a change in a *behavioral* cognitive element. However, the dissonance remains even if its effects are not socially present anymore. Therefore, the individual will search for, and create, a new safe environment online, but do so without changing the driving *environmental* cognitive elements. Figure 20 shows that following dissonance, the negative feedback does not disappear without uncontestable evidence because the convictions are deeply-rooted. Otherwise, as long as social support is found the belief is held and even reinforced leading to proselytism.

Forced compliance leads individuals to publicly change their overt behavior while still holding to their private beliefs because of the threat of the punishment for noncompliance (Festinger 1957). Online and privately, individuals reduce forced compliance by increasing the number of consonant relations.

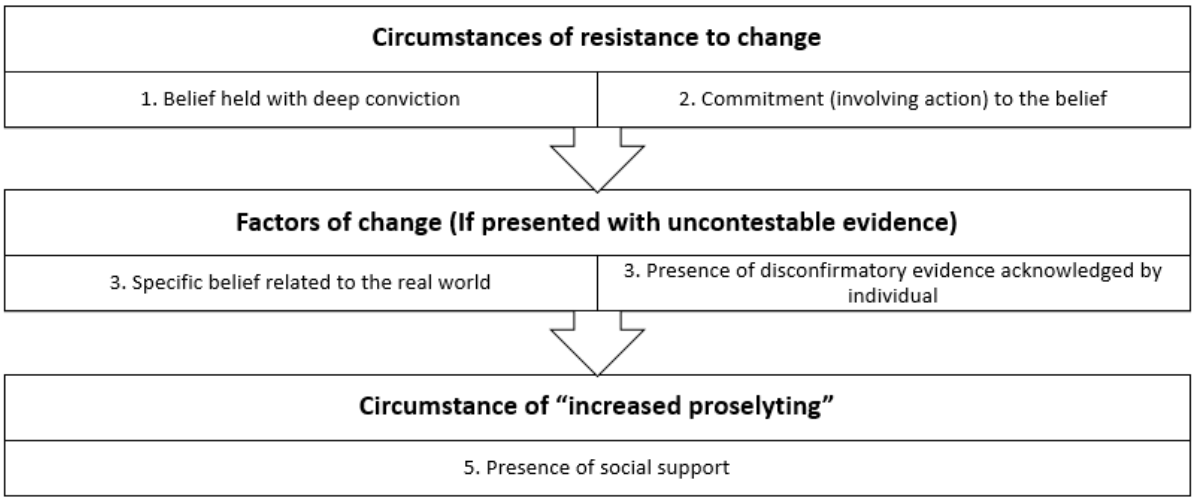


Figure 20: Conditions of "increased fervor" following dissonance (from Festinger et al. 1957)

5.6.2. Resources Allocation: Me, Myself and I

When individuals decide not to cease a questionable course of action, they also commit more effort and resources to it. Resource allocation is among the core features of escalation of commitment, which is not just restricted to money but also include time and intangible resources like individual's self-concept (Brockner 1992; Brockner et al. 1986). Escalation of commitment or entrapment theorists have solely considered the continuous monetary investment to a failing course of action regarding decision makers as individuals who "**have** too much invested to quit" (Brockner 1992; Brockner et al. 1981). However, decision makers can **be** too much invested to quit. Early work (e.g. Staw 1982; Brockner et al. 1986) explored the implications on identity by considering the *perceived consequences of the behavior* resulting from the escalation process. The focus shifts from the actual behavior to the individual's identification with the foreseeable outcome. This shift entails two dimensions: the breadth of the outcome being perceived (revealing a broad range of self-concept) and depth of this outcome (how central those aspects are to the individual).

Identity work is essential to the understanding of organizing (Brown 2015). Self-presentational motives are an important phenomenon that can explain the trend to escalate commitment to a damaging course of action (Brockner and Rubin 1985). Identity represents a motivational resource mobilized to ensure integrity between the self and behaviors over time.

Sometimes, identity can be problematic (Alvesson and Willmott 2002). The thought of having misbehaved can be threatening to one's self-image. Self-presentation is a cognitive effort that

can be difficult and strenuous (Vohs et al. 2005). The threat of isolation can silence the expression of an invisible identity creating a spiral development dynamic (Bowen and Blackmon 2003; Noelle-Neumann 1974). Self-presentation efforts consume self-regulatory resources to keep a positive image such as individuals' cognitive resources to present themselves in a socially desirable manner are depleted (Vohs et al. 2005).

Because online information is largely free, the monetary search costs to acquire information is trivial or non-existent. However, individuals do commit other kinds of new resources online to counterbalance the offline social setbacks. For example, their time and energy (external costs) "opportunity costs of time in foregone activities", as well as cognitive efforts (internal costs) to engage with, sort and integrate information (Smith et al. 1999, p.286). In particular, individuals may allocate their self-concept or some parts of it (i.e. identities) by allocating time and efforts in information search and even online interactions to maintain positive desirable self-presentation. The self is a resource considered early in the formulation of the theory but not thoroughly investigated. Social psychologists have studied commitment to identity because the production of stable self-meanings leads to the production of consistent lines of action. Strenuous self-presentation consumes cognitive resources over time, depleting the self from its resources (e.g. attention, energy, strength) and making individuals less efficient in other cognitive tasks like solving problems (Baumeister et al. 1998; Baumeister and Heatherton 1996).

Individuals escalate their commitment to their identity because hiding it and keeping it as a secret from their close circles requires vigilance. The vigilance only makes it more salient as individuals work not to reveal it (Wegner 1994; Wegner and Erber 1992). According to ego depletion theory (Baumeister et al. 1998; Baumeister and Heatherton 1996), depletion of resources makes it harder for people to control and quell behaviors. Experienced dissonance depletes the self from attentional and cognitive resources because people need to spend more resources to understand the situation, control their behavior and deal with their discomfort (Rosen et al. 2016). Thus, taboo or frowned-upon topics become more salient. Online interactions with like-minded people re-establishe consonance, which enhances self-esteem and the feeling of belonging. Individuals with concealable stigma who suffer from the negative self-esteem generated by general society feedback are more likely to search for positive appraisals supporting their stigma. Individuals in such online communities may also rationalize the (potential or effective) social rejection. Consequently, an individual's confidence in the

importance of a certain aspect of the self is confirmed such as (s)he is ready to self-disclose it or act upon it offline.

5.7. Spillover Double-Loop Process Model

The following process model (Figure 21) assumes two kinds of contextual conditions as antecedents from the theoretical development above. First, the internal condition is the experience of cognitive dissonance by individuals. This dissonance arises from their distinctive behavior, tied to a concealable stigmatized identity, being subject to a social penalty. The individuals proceed to look for resolution online and, upon resolving the dissonance online, act upon it offline. Second, we assume individuals have access to Internet or means to seek access as external conditions. The story of the process model starts offline, unfolds online and ends back again offline. This escalation model explains how very specific behaviors unfold and lead to societal negative externality (e.g. the consequences of risky or violent behaviors). While the focal phenomenon of this model is mainly limited to fringe sub-cultures within a society, its potential impact on broader society (in terms of risky and violent behaviors) is significant. We offer a "process model as a development event sequence" (Van de Ven 2007), i.e. we focus in the sequence of incidents and activities that unfold over time. Our main focus is on progressions of online and offline activities that converge towards spillovers. Our teleological process model relies on agency driven by the need to reduce the dissonance. Our process model (Figure 21) is followed by a table that summarizes the definitions (Table 15).

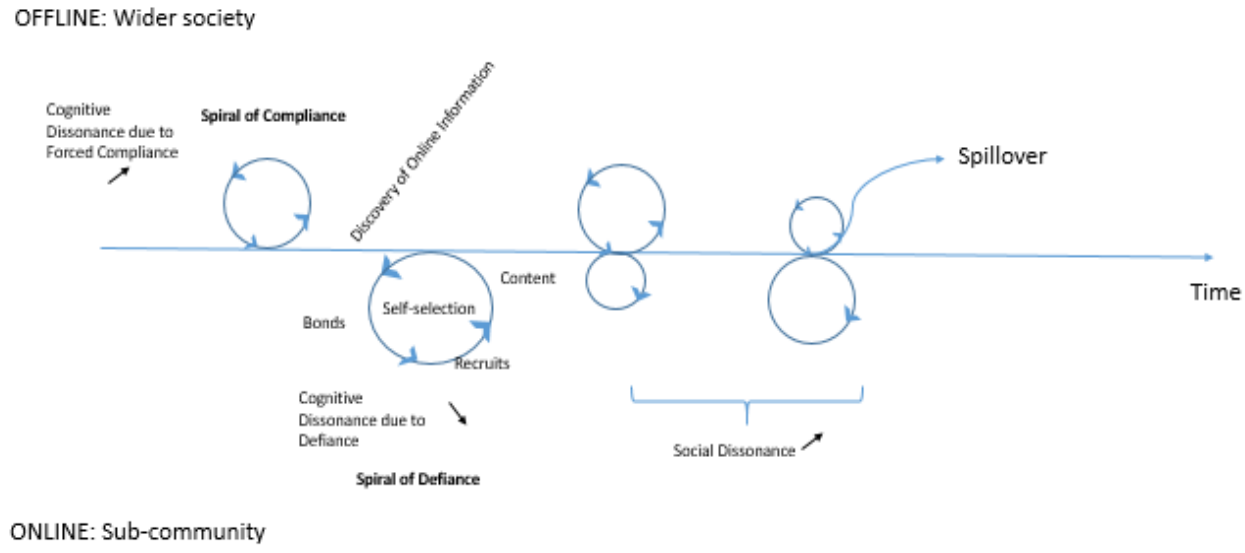


Figure 21: Spillover Double-Loop Process Model

5.7.1. Offline Spiral of Compliance

The general timeline in Figure 21 flows from left to right. It begins with a conflict between what an individual learns from the social group and what (s)he holds as his/her own belief. This conflict creates and reinforces the cognitive dissonance. Close circles may also express judgements that make one less comfortable with voicing a different stance. The individual is caught in an offline "*spiral of silence"* (Noelle-Neumann 1974). The spiral nurtures the fear of discrimination, shame, or animosity. Because individuals among a social group tend to share some standards, it can hurt to stand out. Therefore, the subjectivity of such elements nurtures the magnitude of the dissonance. The subjectivity is harder to reconcile than objective cognitive elements. Individuals change and conform their overt behavior because they are afraid to be overtly marginalized.

One way to know if the private, internal behavior has actually changed (and not only public, external behavior) is to observe one's behavior outside of the social pressure context. What cognitive dissonance and spiral of silence did not address is how a media (here below, the Internet) can level the playing field: online, an isolated opinion may not be marginalized anymore. An online community can offer a place free of fears to voice privately-held beliefs. We argue that online social cues can subdue the pressure-to-conform from the wider society. The Internet and its specialized online communities enable social exchange that can reduce the dissonance from forced compliance by increasing the number of consonant relations: "Processes of social communication and social influence are, hence inextricably interwoven with processes of creation and reduction of dissonance" (Festinger 1957, p.177).

Concept	Definition
Cognitive Dissonance	Intra-individual process describing a situation in which a person acts in contradiction to his/her personal beliefs
(Offline) Spiral of Compliance	Individual's behavior aligned with mainstream society values against his/her own values by fear of social penalty
(Online) Spiral of Defiance	Individual's commitment to the online community's values and behaviors against mainstream society's
Self-selection	Individuals search and retention of online information, like-minded people and new recruits
Social Dissonance	Societal divide between online sub-community and mainstream community on what is socially accepted
(Negative) Spillover	Effects and consequences of online interactions that overflow the online space to affect the offline society.

Table 15: Concepts and Definitions

5.7.2. Online Spiral of Defiance

McKenna and Bargh (1998) have shown that, for stigmatized individuals (e.g. homosexual, individuals holding marginalized political beliefs), the Internet is the only venue to discuss their identities. As such, membership in such communities is held with great importance (and social influence over behaviors is stronger) because of the scarcity of such an environment that is safe from the wider society.

Joining the sub-community can be part of a developmental process: cognitive dissonance results in a break down in the identity-construction process. The individual needs to reconcile his/her sense of self with the society's view. We acknowledge that there might be different reasons to join the sub-community, yet, we are interested in the effects of the unfolding cognitive dissonance along the path. Individuals join the online sub-community because it offers them the protection through anonymity.

Successful modes of survival require continuous identification and integration in the sub-community. Marginalization from the society as a whole (mainstream community) and concomitantly being considered as a threat to society is a burden that commands relief. One effect of experiencing such conflict is "defiant individualism" (Sanchez-Jankowski 1991), i.e. individuals commit to the sub-community defying the mainstream social community. In our case, the online (private) behavior continuously defies the mainstream community by confronting it and resisting any changes.

5.7.2.1. Sub-processes of Escalating Commitment: Self-selecting as key driver

Online, individuals feel free to self-select information sources and connect with others (a cognitive component) without social anxiety. Bargh and McKenna (2004) stress that the variety of online groups available covers "everything from Indian cooking to dinosaurs to raincoat fetishes" (p.582) to more socially frowned-upon practices such as pornography and recreational drug use. Through advanced technological capabilities (e.g. filtering capabilities) and increased connectivity, the Internet makes it easier for anyone to satisfy his/her preferences and to find like-minded individuals despite geographic distance (Van Alstyne and Brynjolfsson 2005).

Individuals can find online specialized communities that empathize with their frustration and conflicting needs. These communities reassure them that they belong to the "*normals*" (in Goffman's use of the word) and provide some relief from their social burden. The self-selected nature of their group membership strengthens their involvement (affective component). Community support provides the basis for social bonding. The combination of anonymity and invisibility offers a safe social environment for confiding online and protection from the risk of social penalty from one's close circles (e.g. colleagues, friends and family). It encourages self-disclosure, especially if some facets are negatively connoted or taboos. As relationships form online, they allow participants to share unexpressed facets of one's self. McKenna et al. (2002) have shown that distinctive features of the Internet enable faster development of relationships than offline settings. For example, the Internet makes the core of human activity, i.e. communications between individuals, ubiquitous and pervasive.

Once members, individuals become gatekeepers of the online community by participating in the recruitment strategy. They have a vested interest to ensure the expansion of the community because it is aligned with their social identity, and its expansion protects and enhances their self-esteem (evaluative component). But at its heart, the online process is self-selection: self-selection of information sources, group membership, and new recruits through the specialization of interests that is enabled by the Internet.

5.7.3. Double Spirals of Societal Divide

Of course, "virtual communities do not have to be opposed to physical communities" (Castells 2010, p. 387). But the arguments above show how individuals slip away from the mainstream community – weakening its overall cohesion. They slip into a specialized online sub-

community strengthened by its attraction. Such online escalation can lead to costly offline behavior not only for individuals, but also for society as a whole. This escalation unfolds in several ways. In the search of decreasing cognitive dissonance, escalating commitment to a concealable stigmatized identity creates and strengthens social dissonance, i.e. a societal divide between online sub-community and mainstream community on what is socially accepted.

For example, racism is socially stigmatized especially when it comes to extreme views such as white supremacists or Nazis (Ezekiel 1995). The prevalence of online hate groups could be seen as a way to let off the steam and consequently, not lead to the increase (if not reduction) of hate crimes. Research has shown that online groups (increasingly) advocate hate crimes (Glaser et al. 2002). Another example is the case of attacks perpetrated by *lone wolves* (Brynielsson et al. 2013) to whom online communities provide support and reinforcement of what is acceptable to a point it promotes individual actions.

Self-selection in online communities, as related to the promotion of shared interests, is often non-geographic. One consequence of this factor is the reinforcement of fringe communities or "greater balkanization" (Van Alstyne and Brynjolfsson 2005) and group polarization through controversial to heated conversation (Sia et al. 2002). It means technological advances, in some contexts, can lead to societal divides instead of uniting us through specialization of interests as "a lubricant that enables the satisfaction of preferences" (Van Alstyne and Brynjolfsson 2005, p.852) strengthening differences rather than offering common grounds.

The online community, as a subset of the wider offline society, itself holds conflicting values. When the online community drifts away from the mainstream society, that wider society may ostracize the stigmatized subsets. The effect of this stigmatization and ostracization can loosen the commitment to the mainstream and even increase the cohesion within the specialized online communities. The online escalation of commitment process loosens up the whole society and threatens social stability and cohesion. When social dissonance arises between a society and its constituent parts, it can have a social cost borne by the entire society (including the subsets). Such online escalation leads to costly offline behavior not only for individuals but also for society as a whole in several ways. In the search of decreasing cognitive dissonance, escalating commitment to a concealable stigmatized identity creates and strengthen social dissonance, i.e. the societal divide (between the online sub-community and the mainstream community) over what is socially acceptable.

5.8. Discussion

The foregoing research is a conceptual argument and aims at theory development. While its reasoning is grounded on existing thought, its main limitation is the need for further empirical research to bolster the theory and the model with more evidence. This need for further empirical evidence is the central direction for future research. Nevertheless, the conceptual development alone offers substantial contributions to theory and practice.

5.8.1. Theoretical Contributions

The most important theoretical contributions are threefold. First, our research is embedded in IS literature, particularly that dealing with the role of ICT in societal challenges (Majchrzak et al. 2016). We are exploring the risk environment that the Internet represents. We elaborate current work in the IS field by further developing our understanding of the relationship between (increased) Internet access and (increased) societal negative spillovers (e.g. sex or hate crimes, STD transmission). In line with the papers published in an *MISQ* special issue (2016), we conceptually highlighted the role of the Internet in creating, reinforcing or offering new avenues for current social issues to unfold (Chan et al. 2016). Previous work (Ayyagari et al. 2011; Bhuller et al. 2013; Chan and Ghose 2014; Chan et al. 2016) has established strong variance models that support the role played by technological advances in challenging our social models. That research has merit in shedding light on these phenomena, but leaves us in the dark about how the Internet *goes bad*. In reaction to these variance models, we offer a process model to explain how the power of technological advances can be harnessed to serve undesirable, dangerous and costly behaviors, not only for an individual or a community but for the whole society. In doing so, we built on ideas briefly raised by the preceding work: the role of identity in leading to socially undesirable behaviors. We further develop the role of online communities in catalyzing concealable stigmatized identities and affirm the importance of identity in relation to ICT (Carter and Grover 2015). For example, we need future research into this model to further our current understanding of the role of the Internet in the process of radicalization; a notion frequently used to translate terrorists into victims. Future studies can also test this model by studying the drivers and process leading individuals to engage in risky sexual practices.

Second, our work draws together two previously distinct lines of research: escalation-of-commitment (Brockner 1992; Brockner et al. 1986; Staw 1981) and cognitive dissonance (Festinger 1957; Festinger and Carlsmith 1959; Festinger et al. 1956). These works align to support a powerful model that helps explain the psychological and social processes that drive negative spillovers. Escalation-of-commitment researchers have previously drawn from forced compliance literature; we move to the next level by explaining how cognitive dissonance drives the escalation of commitment. In line with previous work, the self-justification processes that underlie dissonance are consistent with escalating behaviors. But in our model of escalation of commitment, money is not the actual resource being allocated to the escalating commitment. Instead it is an individual's time. More importantly, it is one's aspects of self (i.e. one's identity). These aspects were highlighted in an early elaboration of the escalation-of-commitment theory (Brockner et al. 1986) but primacy was given to monetary resources as the indicator of escalation in decision making. Future research on escalation of commitment can improve our understanding of this phenomenon by studying the allocation of identities instead of the waste ("throwing good money after bad"). We already know that identity verification is a motor of behavior (Ma and Agarwal 2007). Our research opens possibilities to investigate identity driven escalation of commitment in such impactful behaviors as sexual practices or ideology-laden violence.

In the same vein, we outlined how perceived outcomes of a behavior (or possible behavior), and how deeply and broadly an individual identifies with these outcomes, affect the escalation process. Besides, in line with Staw's work (1976; 1981), we identified internal and external justification processes of online escalation. We elaborate online sub-processes specific to online context: self-selection of information source, self-selection of group membership and self-selection of new members. We need further research to expand on the multilevel mechanisms at play in order to improve our understanding of the societal consequences. We also need further research to address the mechanisms of bounded rationality in an online context where individuals willingly ignore unsettling information and instead seek out confirming information.

Third, this research builds forward from the established work in cognitive dissonance (Festinger 1957; Festinger et al. 1956). The same processes are at play online and offline. In line with Festinger, we are accounting for the complexity of the dissonance phenomenon that unfolds in two related social contexts. In the first context, we elaborate previous work by considering how offline dissonance interacts simultaneously with the search for online

consonance. The online search for dissonance reduction offline can lead to an offline dissonance increase which can have disastrous consequences. In the second context, we reaffirm the explanatory power of Festinger's theory regarding social issues. Our work does open new boundaries for future research into the effects of cognitive dissonance toward driving individuals to online specialized communities.

These affirmatory effects aside, we also contribute an elaboration of Festinger's seminal work. Previous work conflates both cognitive and social processes by blending cognitive processes with social influences. Festinger acknowledges the necessary influence of social support in either reducing or supporting the dissonance. Where there is social support for dissonant behavior, the individual is encouraged to follow the path of "fervent proselytism". However, this line of research has heretofore not yet considered the social processes to the same degree as cognitive processes. In our research, we tease apart these two processes. To the (offline) forced compliance environment theorized by Festinger, we add the (online) defiance environment that may yield excessive dissonance. We contribute to this line of work by elaborating the concept of social dissonance to account for the dissonance *between* social groups that drift away. In line with previous work, we still consider cognitive dissonance as a state that drives actions. But the distinction between social and cognitive dissonance is necessary to understand how societal challenges arise. This distinction repositions dissonance as a social-cognitive phenomenon in which both social and cognitive processes are at play. As noted earlier, further research is now needed to investigate both the magnitude of cognitive dissonance driving individuals to join a specialized community together with the magnitude of social dissonance necessary to drive negative spillovers.

Based on social psychology literature (e.g. McKenna and Bargh 1998), we have explained how the absence of like-minded individuals in offline settings leads to online spillovers in ever-more specialized communities. The recreation of supporting social interactions online leads to the amplification of some aspects of self to dangerous behaviors. Therefore, the current focus on *the impact of Internet on Society* (Bhuller et al. 2013; Chan and Ghose 2014; Chan et al. 2016) overlooks *impact of society on the Internet.* This oversight has so far limited our understanding of online and offline interactions. As challenging as can longitudinal studies are, this last theoretical contribution calls for longitudinal studies that follow individuals from one sphere to the other. We especially need to study how we undermine anonymity and favor social

desirability bias. We need to test and refine the drivers that spill online to offline and vice-versa.

5.8.2. Practical Implications

This conceptual research has several implications for policy makers and regulators. This model calls for policy makers to pay more attention to online interactions in specialized communities that incite violent behavior. Future research can build on our process model to formulate guidelines for policy makers in reducing the influence of those online communities or any online initiative aiming at preventing these negative social effects. This study focuses on the *dark side* of the Internet. Further studies can investigate how *to bring this darkness back into light*.

Policy makers have thus far delivered reactive measures rather than preventive measures. For example, beginning October 2017, Germany has reinforced its already stringent stance on hate speech by forcing Facebook, Google, Twitter and similar companies to delete illegal content (racist, sexist, etc.) within 24 hours after notification. Failure to do so will result in fines up to $57 million[34]. As of June 2017, Facebook was the leading performer, making reviews of 58% of flagged content[35]. After such dramatic efforts to blunt the potential for the Internet to spread violence, and as authorities call for ever stronger measures, our study helps us to understand what this hate speech is expressing. A better understanding of these dynamics will inform more innovative measures to prevent hate speech from becoming hate crime. Furthermore, policy makers need to encourage more such studies to investigate why such discourses proliferate and how these unfold further in violence.

Such societal challenges command a collective response. These online communities stretch across borders and their online dimension creates a much more complex problem than could any single actor. States, Internet actors, or social activists cannot handle the problem on their own. But these stakeholders can collaborate to improve their responsiveness to such phenomena.

This process model shows the importance of identity processes in leading to undesirable behavior and the need to counter communities' polarization. The Internet is inherently

[34] https://www.nytimes.com/2017/06/30/business/germany-facebook-google-twitter.html
[35] https://www.theverge.com/2017/6/2/15728268/facebook-twitter-youtube-hate-speech-europe-removal

responsibility in these negative spillovers. The Internet lowers the costs and increases the ease of communication for like-minded people while concealing their identity. It has lowers the threshold of sanctions for engaging in a certain range of behavior from *risky or violent* to *socially embarrassing*. The hardship in tackling such problem is the conversational nature of the Internet in comparison to traditional media and the incredible capability of user-generated online materials. Tackling the negative consequences of spillovers is only treating the symptoms of a wider phenomenon. The main social actors need to play on the same ground, the Internet, to counter offline negative spillovers. Society needs to be provide an online alternative to reduce the share of attention received by polarized communities.

Moreover, such phenomena call into question the characteristics of technological platforms used to support those online communities. We expect research such as ours to have implications for the future design of online community platforms. At this stage, we can compare architectures of different platforms in relation to negative spillovers. Considering social media for example, Facebook and Twitter have different architectures. Facebook generates conversations around pages, groups and posts with different lifespans that do not overwhelm each other. In contrast, the use of hashtags on Twitter offers explosive alerts on a "hot" topic that can go viral, until a "hotter" topic explodes to steal away its limelight. Each platform has features that can enable or reduce the proliferation of socially risky messages. For this reason, further empirical work needs to study the characteristics of technological platforms to discover capabilities to minimize negative spillovers.

5.8.3. Future Research

This paper is limited to the conceptual development of a theory and a model. Future research is needed to test the proposed Spillover Double-Loop Process Model. An empirical investigation of the model will add value to the contributions. Our work is also limited by its focus on negative spillovers. Further research is needed to develop the theory and the model for use with neutral or positive spillovers. Moreover, we encourage future research to address the empirical issues that such work entails. There are problems in collecting data about the kind of online socially sensitive communities that lead to negative spillovers: our examples included hate-groups, marginalized sexual practices, and medical anxiety. While we depended on the news media in developing actual vignettes, collecting data directly from human subjects will regard highly confidential and private information.

This conceptual research raises relevant issue for society. Researching such a theory raises several ethical challenges in its operationalization because it falls into a socially sensitive research category, i.e. "studies in which there are potential social consequences or implications either directly for the participants in research or the class of individuals represented by the research" (Sieber and Stanley 1988). Our research question is motivated by the negative consequences of Internet-enabled interactions leading to offline behaviors with societal costs. Previous studies have focused on the study of such behaviors in a naturalistic context. But the study of ICT enabled casual sex, sex crimes or racial hate crimes poses ethical dilemmas for researcher. These dilemmas are not only for the protection of participants but also the groups associated with the participant. Moreover, the findings of such studies might themselves be applied in dubious ways.

5.9. Conclusion

The Spillover Double-Loop Process Model explains societal challenges that burden society and individuals. This research aims to explain how a committed sub-community becomes engaged in risky or violent behaviors. An escalating process of commitment to a concealable stigmatized identity (through online and offline spaces) explains the negative effects of polarized online communities. These effects rage on society and trigger a reverse polarizing effect of society on the online community. Through an application of Staw's theory and an elaboration of the concept of dissonance, the process model explains the underlying mechanisms that lead to the negative spillovers already identified in the literature.

The Spillover Double-Loop Process Model embodies a theory to help us understand the interactions between offline and online social spheres. This model relies on three theoretical assumptions: (1) cognitive dissonance as a powerful driver, (2) self-concept that is a resource committed fully or partially (i.e. identities) to escalating behaviors, and (3) such process can result in costly societal divide.

This improved understanding of the spillovers mechanisms from offline to online to offline will help us to recognize and evaluate the roots of the problem and not only its negative outcomes. This model can be useful to explain online radicalization leading to violent actions, as well as risky sexual behaviors leading to the spread of STD. The escalation of commitment is a powerful theoretical lens and teases out the sub-processes that unfold online. Indeed, we

need to better explain how online communities have transformed the Internet: its wonders in booking a trip or searching for a partner; and its terrors in planning hate crimes or spreading disease. This research suggests directions for further empirical work testing and refining models such as ours.

5.10. References

Agarwal, R., Gupta, A. K., and Kraut, R. 2008. "Editorial overview-The interplay between digital and social networks," *Information Systems Research* (19:3), pp 243-252.

Akerlof, G. A., and Dickens, W. T. 1982. "The Economic Consequences of Cognitive Dissonance," *The American Economic Review* (72:3), pp 307-319.

Albert, S. 1998. "The definition and metadefinition of identity," in *Identity in Organizations: Building Theory Through Conversations*, D. A. Whetten and P. C. Godfrey (eds.), SAGE Publications, Inc.: Thousand Oaks, California, pp. 1–14.

Alvesson, M., and Willmott, H. 2002. "Identity regulation as organizational control: Producing the appropriate individual," *Journal of management studies* (39:5), pp 619-644.

Andrade, A. D., and Doolin, B. 2016. "Information and communication technology and the social inclusion of refugees," *MIS Quarterly* (40:2), pp 405-416.

Ashforth, B. E., Harrison, S. H., and Corley, K. G. 2008. "Identification in organizations: An examination of four fundamental questions," *Journal of management* (34:3), pp 325-374.

Ashforth, B. E., and Mael, F. 1989. "Social identity theory and the organization," *Academy of Management Review* (14:1), pp 20-39.

Ayyagari, R., Grover, V., and Purvis, R. 2011. "Technostress: technological antecedents and implications," *MIS Quarterly* (35:4), pp 831-858.

Bargh, J. A., and McKenna, K. Y. 2004. "The Internet and social life," *Annu. Rev. Psychol.* (55), pp 573-590.

Baumeister, R. F., Bratslavsky, E., Muraven, M., and Tice, D. M. 1998. "Ego depletion: Is the active self a limited resource?," *Journal of personality and social psychology* (74:5), p 1252.

Baumeister, R. F., and Heatherton, T. F. 1996. "Self-regulation failure: An overview," *Psychological inquiry* (7:1), pp 1-15.

Bhuller, M., Havnes, T., Leuven, E., and Mogstad, M. 2013. "Broadband Internet: An Information Superhighway to Sex Crime?," *The Review of Economic Studies* (80:4), pp 1237-1266.

Blanchard, S. 2013. "To 'achieve' a positive HIV status, some gay men proudly practice risky behaviors," November 20, 2013 (available at http://www.watermarkonline.com/2013/11/20/to-achieve-a-positive-hiv-status-some-gay-men-proudly-practice-risky-behaviors/) 5 May 2017.

Bowen, F., and Blackmon, K. 2003. "Spirals of silence: The dynamic effects of diversity on organizational voice," *Journal of management Studies* (40:6), pp 1393-1417.

Brewer, M. B. 1991. "The social self: On being the same and different at the same time," *Personality and social psychology bulletin* (17:5), pp 475-482.

Brockner, J. 1992. "The Escalation of Commitment to a Failing Course of Action: Toward Theoretical Progress," *Academy of Management Review* (17:1), pp 39-61.

Brockner, J., Houser, R., Birnbaum, G., Lloyd, K., Deitcher, J., Nathanson, S., and Rubin, J. Z. 1986. "Escalation of commitment to an ineffective course of action: The effect of

feedback having negative implications for self-identity," *Administrative Science Quarterly* (31:1), pp 109-126.
Brockner, J., and Rubin, J. Z. 1985. *Entrapment in escalating conflicts: A social psychological analysis*, (1st ed.) Springer-Verlag New York Inc.
Brockner, J., Rubin, J. Z., and Lang, E. 1981. "Face-saving and entrapment," *Journal of Experimental Social Psychology* (17:1), pp 68-79.
Brown, A. D. 2015. "Identities and identity work in organizations," *International Journal of Management Reviews* (17:1), pp 20-40.
Brynielsson, J., Horndahl, A., Johansson, F., Kaati, L., Mårtenson, C., and Svenson, P. 2013. "Harvesting and analysis of weak signals for detecting lone wolf terrorists," *Security Informatics* (2:11), pp 1-15.
Butler, B. S. 2001. "Membership size, communication activity, and sustainability: A resource-based model of online social structures," *Information Systems Research* (12:4), pp 346-362.
Carmeli, A., Gilat, G., and Weisberg, J. 2006. "Perceived external prestige, organizational identification and affective commitment: A stakeholder approach," *Corporate Reputation Review* (9:2), pp 92-104.
Carter, M., and Grover, V. 2015. "Me, Myself, and I(T): Cconceptualizing Information Technology Identity and its Implications," *MIS Quarterly* (39:4), pp 931-957.
Castells, M. 2010. *The rise of the network society: The information age: Economy, society, and culture*, (2nd ed.) Wiley-Blackwell: UK.
Chan, J., and Ghose, A. 2014. "Internet's dirty secret: assessing the impact of online intermediaries on HIV transmission," *MIS Quarterly* (38:4), pp 955-976.
Chan, J., Ghose, A., and Seamans, R. 2016. "The Internet and Racial Hate Crime: Offline Spillovers from Online Access," *MIS Quarterly* (40:2), pp 381-403.
Chen, S., Shechter, D., and Chaiken, S. 1996. "Getting at the truth or getting along: Accuracy-versus impression-motivated heuristic and systematic processing," *Journal of Personality and Social Psychology* (71:2), pp 262-275.
Choi, S. K., Holtgrave, D. R., Bacon, J., Kennedy, R., Lush, J., McGee, F., Tomlinson, G. A., and Rourke, S. B. 2016. "Economic evaluation of community-based HIV prevention programs in Ontario: evidence of effectiveness in reducing HIV infections and health care costs," *AIDS and Behavior* (20:6), pp 1143-1156.
Clore, G. L., Gasper, K., and Garvin, E. 2001. "Affect as information," in *Handbook of affect and social cognition*, J. P. Forgas (ed.), Lawrence Erlbaum Associates Publishers: Mahwah, NJ, pp. 121-144.
Dean, T. 2013. "In Barebacking Culture, H.I.V. Is Embraced, Not Avoided," (available at https://www.nytimes.com/roomfordebate/2013/11/28/how-will-aids-be-eradicated/in-barebacking-culture-hiv-is-embraced-not-avoided) 05/05/2017.
Deng, X. N., Joshi, K. D., and Galliers, R. D. 2016. "The Duality of Empowerment and Marginalization in Microtask Crowdsourcing: Giving Voice to the Less Powerful Through Value Sensitive Design " *MIS Quarterly* (40:2), pp 279-302.
DiMaggio, P., Hargittai, E., Neuman, W. R., and Robinson, J. P. 2001. "Social implications of the Internet," *Annual Review of Sociology* (27:1), pp 307-336.
Ezekiel, R. S. 1995. *The racist mind: Portraits of American neo-Nazis and Klansmen*, New York.
Faraj, S., Jarvenpaa, S. L., and Majchrzak, A. 2011. "Knowledge collaboration in online communities," *Organization science* (22:5), pp 1224-1239.
Festinger, L. 1957. *A Theory of Cognitive Dissonance*, (1962 ed.) Row, Peterson & Co: New York.

Festinger, L., and Carlsmith, J. M. 1959. "Cognitive consequences of forced compliance," *The Journal of Abnormal and Social Psychology* (58:2), pp 203-210.
Festinger, L., Riecken, H. W., and Schachter, S. 1956. *When Prophecy Fails*, (1st ed.) University of Minnesota Press: Mineapolis.
Gaes, G. G., Kalle, R. J., and Tedeschi, J. T. 1978. "Impression management in the forced compliance situation," *Journal of Experimental Social Psychology* (14:5) 1978/09/01/, pp 493-510.
Ganju, K. K., Pavlou, P. A., and Banker, R. D. 2016. "Does Information and Communication Technology Lead to the Well-Being of Nations? A Country-Level Empirical Investigation," *MIS Quarterly* (40:2), pp 417-430.
Glaser, J., Dixit, J., and Green, D. P. 2002. "Studying Hate Crime with the Internet: What Makes Racists Advocate Racial Violence?," *Journal of Social Issues* (58:1), pp 177-193.
Godé-Sanchez, C. 2008. "Les TIC comme leviers du changement organisationnel : une analyse du cas des Armées américaines en Afghanistan," *Systèmes d'information & management*, (13:1), pp.7-30.
Goffman, E. 1963. *Stigma: Notes on the Management of Spoiled Identity*, (1st ed.) Prentice-Hall, Inc.: Englewood Cliffs, N.J.
Goode, E. 2001. "With Fears Fading, More Gays Spurn Old Preventive Message," (available at http://www.nytimes.com/2001/08/19/us/with-fears-fading-more-gays-spurn-old-preventive-message.html) 05/05/2017.
Greenwood, B., and Agarwal, R. 2015. "Two Sided Platforms and HIV Incidence among the Digitally Disadvantaged," *Management Science* (62:8), pp 2281-2303.
Greenwood, B. N., and Agarwal, R. 2016. "Matching Platforms and HIV Incidence: An Empirical Investigation of Race, Gender, and Socioeconomic Status," *Management Science* (62:8), pp 2281 - 2303.
Gummow, J. 2013. "Hypochondriacs Cost Our Healthcare Industry Billions," (available at http://www.alternet.org/personal-health/hypochondriacs-cost-our-healthcare-industry-billions) 05/05/2017.
Han, K., Oh, W., Im, K. S., Chang, R. M., Oh, H., and Pinsonneault, A. 2012. "Value cocreation and wealth spillover in open innovation alliances," *MIS Quarterly* (36:1), pp 291-325.
Harrison, P. D., and Harrell, A. 1993. "Impact of "adverse selection" on managers' project evaluation decisions," *Academy of Management Journal* (36:3), pp 635-643.
Hogg, M. A., and Abrams, D. 1990. "Social motivation, self-esteem and social identity," in *Social identity theory: Constructive and critical advances*, D. A. M. A. Hogg (ed.), Springer-Verlag: New York, pp. 28-47.
Hogg, M. A., and Abrams, D. E. 1993. "Towards a single-process uncertainty-reduction model of social motivation in groups," in *Group motivation: Social psychological perspectives*, n. M. A. H. D. Abrams (ed.), Harvester Wheatsheaf: London, pp. 173-190.
Johnson, M. D., Morgeson, F. P., and Hekman, D. R. 2012. "Cognitive and affective identification: Exploring the links between different forms of social identification and personality with work attitudes and behavior," *Journal of Organizational Behavior* (33:8), pp 1142-1167.
Kiesler, C. A., and De Salvo, J. 1967. "The group as an influencing agent in a forced compliance paradigm," *Journal of Experimental Social Psychology* (3:2), pp 160-171.
Kiesler, S., Siegel, J., and McGuire, T. W. 1984. "Social psychological aspects of computer-mediated communication," *American psychologist* (39:10), pp 1123-1134.

Leong, M., Pan, S., and Newell, S. 2016. "The emergence of self-organizing e-commerce ecosystem in remote villages of china: a tale of digital empowerment for rural development," *MIS Quarterly* (40:2), pp 475-484.
Link, B. G., and Phelan, J. C. 2001. "Conceptualizing Stigma," *Annual Review of Sociology* (27:1), pp 363-385.
Liston, B. 2014. "Racist online forums linked to deadly U.S. hate crimes: rights group," (available at http://www.reuters.com/article/us-usa-crime-hatecrime-idUSBREA3H04T20140418) 05/05/2017.
Lyons, B., Pek, S., and Wessel, J. 2017. "Towards a" sunlit path": Stigma identity management as a source of localized social change through interaction," *Academy of Management Review* (Forthcoming).
Ma, M., and Agarwal, R. 2007. "Through a glass darkly: Information technology design, identity verification, and knowledge contribution in online communities," *Information Systems Research* (18:1), pp 42-67.
Majchrzak, A., Markus, M. L., and Wareham, J. 2016. "Designing for Digital Transformation: Lessons for Information Systems Research from the Study Of ICT and Societal Challenges," *MIS Quarterly* (40:2), pp 267-277.
McKenna, K. Y. A., and Bargh, J. A. 1998. "Coming out in the age of the Internet: Identity" demarginalization" through virtual group participation," *Journal of personality and social psychology* (75:3), pp 681-694.
McKenna, K. Y. A., Green, A. S., and Gleason, M. E. J. 2002. "Relationship Formation on the Internet: What's the Big Attraction?," *Journal of Social Issues* (58:1), pp 9-31.
Noelle-Neumann, E. 1974. "The spiral of silence a theory of public opinion," *Journal of communication* (24:2), pp 43-51.
Postmes, T., Spears, R., and Lea, M. 1998. "Breaching or building social boundaries? SIDE-effects of computer-mediated communication," *Communication research* (25:6), pp 689-715.
Postmes, T., Spears, R., Sakhel, K., and De Groot, D. 2001. "Social influence in computer-mediated communication: The effects of anonymity on group behavior," *Personality and Social Psychology Bulletin* (27:10), pp 1243-1254.
Rosen, C. C., Koopman, J., Gabriel, A. S., and Johnson, R. E. 2016. "Who strikes back? A daily investigation of when and why incivility begets incivility," *Journal of Applied Psychology* (101:11), pp 1620–1634.
Rubin, J. Z., and Brockner, J. 1975. "Factors affecting entrapment in waiting situations: The Rosencrantz and Guildenstern effect," *Journal of Personality and Social Psychology* (31:6), p 1054-1063.
Sanchez-Jankowski, M. 1991. *Islands in the Street: Gangs and American Urban Society*, University of California Press: Berkeley, Calif.
Sia, C.-L., Tan, B. C., and Wei, K.-K. 2002. "Group polarization and computer-mediated communication: Effects of communication cues, social presence, and anonymity," *Information Systems Research* (13:1), pp 70-90.
Sieber, J. E., and Stanley, B. 1988. "Ethical and professional dimensions of socially sensitive research," *American Psychologist* (43:1), p 49-55.
Simon, L., Greenberg, J., and Brehm, J. 1995. "Trivialization: the forgotten mode of dissonance reduction," *Journal of Personality and Social Psychology* (68:2), pp 247-260.
Smith, G. E., Venkatraman, M. P., and Dholakia, R. R. 1999. "Diagnosing the search cost effect: Waiting time and the moderating impact of prior category knowledge," *Journal of Economic Psychology* (20:3) 6, pp 285-314.
Sproull, L., and Kiesler, S. 1986. "Reducing social context cues: Electronic mail in organizational communication," *Management science* (32:11), pp 1492-1512.

Staw, B. M. 1976. "Knee-deep in the big muddy: A study of escalating commitment to a chosen course of action," *Organizational Behavior and Human Performance* (16:1), pp 27-44.
Staw, B. M. 1981. "The escalation of commitment to a course of action," *Academy of management Review* (6:4), pp 577-587.
Stets, J. E., and Biga, C. F. 2003. "Bringing identity theory into environmental sociology," *Sociological Theory* (21:4), pp 398-423.
Stets, J. E., and Burke, P. J. 2005. "A sociological approach to self and identity," in *Handbook of self and identity*, pp. 128-152.
Stroebe, W., and Diehl, M. 1981. "Conformity and Counterattitudinal Behavior: The Effect of Social Support on Attitude Change," *Journal of Personality and Social Psychology* (41:5), pp 876-889.
Stroebe, W., and Diehl, M. 1988. "When Social Support Fails Supporter Characteristics in Compliance-Induced Attitude Change," *Personality and Social Psychology Bulletin* (14:1), pp 136-144.
Suler, J. 2004. "The online disinhibition effect," *Cyberpsychology & behavior* (7:3), pp 321-326.
Tajfel, H. 1982. "Social psychology of intergroup relations," *Annual review of psychology* (33:1), pp 1-39.
Tajfel, H. E. 1978. *Differentiation between social groups: Studies in the social psychology of intergroup relations*, Academic Press.
Tajfel, H. E., and Turner, J. C. 1979. "An integrative theory of intergroup conflict," in *The Social Psychology of Intergroup Relations.*, W. G. A. S. Worchel (ed.), Brooks-Cole: Monterey, CA, pp. 33-47.
Tedeschi, J. T., Schlenker, B. R., and Bonoma, T. V. 1971. "Cognitive dissonance: Private ratiocination or public spectacle?," *American Psychologist* (26:8), p 685.
Tiwana, A., Keil, M., and Fichman, R. G. 2006. "Information systems project continuation in escalation situations: A real options model," *Decision Sciences* (37:3), pp 357-391.
Turkle, S. 1995. *Life on the Screen: Identity in the Age of the Internet*, (Simon & Schuster New York.
Usborne, S. 2009. "Cyberchondria: The Perils of Internet Self-Diagnosis," February 17 2009 (available at http://www.independent.co.uk/life-style/health-and-families/features/cyberchondria-the-perils-of-internet-self-diagnosis-1623649.html) 5 May 2017
Van Alstyne, M., and Brynjolfsson, E. 2005. "Global village or cyber-balkans? Modeling and measuring the integration of electronic communities," *Management Science* (51:6), pp 851-868.
Van de Ven, A. H. 2007. *Engaged scholarship: A guide for organizational and social research*, (1st ed.) Oxford University Press Inc.: New York.
Venkatesh, V., Rai, A., Sykes, T. A., and Aljafari, R. 2016. "Combating Infant Mortality in Rural India: Evidence from a Field Study of eHealth Kiosk Imlementations," *MIS Quarterly* (40:2), pp 353-380.
Vohs, K. D., Baumeister, R. F., and Ciarocco, N. J. 2005. "Self-regulation and self-presentation: regulatory resource depletion impairs impression management and effortful self-presentation depletes regulatory resources," *Journal of personality and social psychology* (88:4), p 632-657.
Wang, X., Butler, B. S., and Ren, Y. 2013. "The impact of membership overlap on growth: An ecological competition view of online groups," *Organization Science* (24:2), pp 414-431.
Wegner, D. M. 1994. "Ironic processes of mental control," *Psychological review* (101:1), pp 34-52.

Wegner, D. M., and Erber, R. 1992. "The hyperaccessibility of suppressed thoughts," *Journal of personality and social psychology* (63:6), pp 903-912.
Weick, K. E. 1995. *Sensemaking in organizations*, (1st ed.) Sage Publications Inc.: Thousands Oaks: London: New Delhi.
White, R. W., and Horvitz, E. 2009. "Cyberchondria: studies of the escalation of medical concerns in web search," *ACM Transactions on Information Systems* (27:4), pp 1-37.
Whyte, G. 1986. "Escalating commitment to a course of action: A reinterpretation," *Academy of Management Review* (11:2), pp 311-321.

CHAPTER 6- GENERAL DISCUSSION

Abstract

We conclude our doctoral work by summarizing our work and reflecting on the online-offline conceptualization across studies. We attempted to give a grasp on the complexity of the interactions between the online and the offline world. We offer process explanations that integrate both realms as dual forces in the same phenomenon leading to social change. We intended to address the issue methodologically, conceptually and empirically. Our critical realist philosophical stance aimed at formulating deeper explanations rather than predictions. We formulated explanations that integrated a complexity lens by accounting for the effects of internal dynamics in online communities (i.e. the effects of the Internet on Society) but also the exogeneous stimuli (i.e. the effects of Society on the Internet), showing the co-creation of societal challenges. We outline the limitations of our work and avenues for future research.

Keywords: online-offline contextualization, spillover, transdigitalization, societal challenges, complexity, duality.

6.1. Summary of our studies

Our doctoral work aims at addressing and integrating the online-offline relationships methodologically, empirically and conceptually. The three studies composing the dissertation are complementary. This work constitutes a step toward deeper explanations rather than predictions providing theoretical explanations, methodological guidance and empirical evidence. More specifically, we uncovered the analytical processes to study social phenomena expanding beyond the online sphere, studied a case where the online community becomes the social change by duplicating offline and finally developed conceptual argument to explain indirect spillovers from online communities' interactions on society.

Our three studies highlight the challenges faced by IS researchers but also the wonderful and terrific road ahead. Contemporary events involve mobile technology, networks, data and information that destabilize organizations, society and global order.

Henceforth, we have developed studies addressing researchers', policy makers' and online actors' concerns. Each study offers a take on the complexity of social phenomena. We summarize those three studies in the following paragraphs.

IS researchers frequently turn to online data as primary or secondary sources to study phenomena that unfold at least partially online. Online platforms have evolved so that they bring their mixed fortunes to researchers. This study acknowledges the tremendous potential of online data by addressing some of its challenges. On the analytical processes, we leverage semiotic data analysis to approach the representational complexity embedded in social media. Representational complexity covers multimedia data (e.g. photos, texts, videos, external links, etc.) brimming with multiple layers of meanings. We offer a structured technique and describe the inference process along the analysis. Deeply rooted in critical realism, our approach aims at developing in depth explanation of complex interactions. As such, we showed how to make sense of qualitative data to formulate conceptual explanations. Our toolkit provides researchers with guidance to approach the nature of data, the subjects' sensemaking process as well as his/her own. The analytical tool was motivated by relevance concerned and we concluded that chapter by addressing rigor concerns. This work shows the need for a dual contextualization: we cannot limit the contextualization to one sphere only since online and offline overflow into each other. Furthermore, we contributed to advance the impact of qualitative research by our application of the method to data from the Arab Spring. With samples of data extracted from

the case study presented in this document, we detailed our coding of the data, our analytical commitment and our abductive reasoning to formulate an explanation.

Extending that effort, we leveraged Luhmann's Systems theory to explain how an open online community relying a priori on Facebook materialized on Tahrir Square (Cairo, Egypt) for 18 days but also all over the world. In this study, we addressed our research question by using semiotic data analysis to identify the specific features of Facebook that lent itself to such collective action. Doing so, we gave a complete example of how semiotic data analysis can be integrated in a research methodology, hereby a case study. By using a narrative style, our results restitute the voices confined in our data. Letting the data speak was a necessary choice so that the reader can grasp the *emotional complexity* that pervades our data.

The literature in IS have extensively raised the fluidity and openness of online communities (Dobusch and Schoeneborn 2015; Faraj et al. 2011; Feller et al. 2008; Shaikh and Vaast 2016) looking at membership, size or content. However, the fluidity between the online and offline had not been addressed. We studied such collective action and contributed to conceptualize *Open Transdigital Communities.* Those *transdigital* communities overflow geographic borders and virtual boundaries blurring boundaries of the study. This illustration of our analytical technique leverages communications to identify generative mechanisms. We informed the sensemaking process transitioning from the empirical to the actual and the structuring process between the actual and the real. We offer a process model specifying the autopoietic sub-processes of online communities prone to manifest themselves offline.

While, not all the online communities will *transdigitalize*, the role of online communities should not be downplayed in societal challenges. Online communities can be echo chamber where own's beliefs and behaviors can be reinforced. Those echo chambers can encourage the social support for behaviors that are socially risky or even illegal. We gave the example of sexual risky practices leading to the increase of HIV incidence rate. Online communications have also reinforced hateful behaviors based on ideologies leading to violence. We integrated cognitive dissonance (Festinger and Carlsmith 1959; Festinger et al. 1956) in online and offline context, reasserting its explanatory power and extend it by identifying social dissonance at the collective level. Cognitive dissonance between one's own beliefs or values and what is socially desirable acts as a trigger to join an online echo chamber. The escalation of commitment lens (Brockner 1992; Brockner et al. 1986; Staw 1976; Staw 1981) enables to explore identity as a resource committed towards a socially costly and undesirable course of action. This conceptual

work explains the role of online communities in negative spillovers creating societal challenges (Majchrzak et al. 2016). This study shows the need for conceptual cross-fertilization to understand the bi-directional relationship between society and the Internet. The implications of our research are multiple considering recent newspaper headlines. From joint efforts from Internet companies and government to stop hate speech, to online community design to identify situations at risk passing by health prevention services, individuals turn to online communities for a variety of small behaviors that translate in dramatic consequences for society.

We synthesize the objectives and contributions of our three studies in the following Table 16.

	Study 1	Study 2	Study 3
Research Objectives	Address representational complexity in social media	Explain how an OOC that started online can materialize itself in a physical setting	Explain (1) how online interactions escalate commitment to a concealable stigmatized identity, (2) how this escalation process produces negative spillovers
Conceptualization	Double Semiotic Helix Semiotic Triangle Principles	Theory of Online Autopoietic Process (TOAP) Open Transdigital Community	Spillover Double-Loop Process Model Social Dissonance
Contributions to the extant literature	Data Analysis technique - Address representational complexity - Guidelines - Include researcher's analytical commitment - Principles overarching the technique	Collective Action: - Process Model for concurrent development online and offline Luhmann System Theory: - Operationalization of coupling - Simultaneous study of internal autonomous mechanisms and environment irritations Role of ICT's - Identified Facebook affordances - Leveraged the content and not only the media Extensive illustration of semiotic data analysis	Cognitive Dissonance: - Complexity of the phenomenon across online/offline. - Social dissonance. Escalation of commitment: - Social and Psychological subprocesses of negative spillovers. - Aspects of self (i.e. identity) as resource committed. ICTs and Societal Challenges: - Process explanation of why individuals "join the dark side" and what happens on the dark side - Reciprocal relationships: Impact of the Internet on Society and Impact of Society in shaping Internet usage.
Future Research	Extensive application to develop and refine the toolkit Mixed Methods: Big Data Analytics & Semiotics	Synergies between SMOs and OOC/OTCs Multiple media study Other types of OOCs that can turn into OTCs	Empirical work "De-escalation" process: "how to *bring the darkness into light"*

Table 16: Summary Table

6.2. Conceptual Issues raised by our work

This doctoral work raised a certain number of issues to which our studies bring different elements of answer. First, our studies reframe the discussion about the online-offline dichotomy which has reached the limits of its simple conceptualization to provide theories. Second, our work questions the nature and degree of community in this context.

6.2.1. Online-Offline Dichotomy: Process Explanations

We offer two process models to explain social phenomena that overflow the online sphere and local boundaries to become societal challenges. On the one hand, we looked at the phenomenon of transdigitalization of social movements (Study 2). On the other hand, we looked at online community interactions encouraging some undesirable and damageable behaviors for the individuals themselves and society at large (Study 3).

The core focus of these studies is the online/offline interactions. In our study of transdigitalization, exogenous stimuli create an online community itself self-organizing the materialization of a whole community in the urban space. Both communities create and transform each other: they reflect each other but they do not entirely overlap. The transdigitalization process is a dual process which creates an offline community which simultaneously recreates the online community. In our study of negative spillovers, society by stigmatizing process and creating threatening environment "pushes" individuals online who gather around a stigma in the shadow of the wider society. Then, online sub-community and mainstream society co-evolve in opposition till society pays the price of the divide (i.e. negative spillovers). The common conclusion of these two studies is the processual duality: society creates an online society which recreates society.

This duality has been theorized in different fashion. Latour (1999) has wrote about the social as a "circulating entity": "there is no zoom going from macro structure to micro interactions . . . [since] both micro and macro are local effects of hooking up to circulating entities' "(p. 19). In a similar fashion of the structuration theory (Giddens 1984), the transdigitalization process and the commitment escalation process describe the duality of transformation of the interactions system.

Both studies describe the interconnection of a variety of elements as the self-organizing process of emergent and dissipative systems destabilizing the current social order to reshape it such as their process of *becoming* shakes the concept of *being* (Chesters and Welsh 2005). Their non-linear dynamics do not only overflow borders but also levels of analysis from local causes to global effects. Increasing complexity in society results in the constant flight of social issues out from the hands of conventional, stratified, and bounded organizations.

In both studies, process approach comes to the foreground to tie together the synchronic and diachronic actions taken online and offline, locally and globally to explain the dramatic consequences at the micro and macro levels.

The Spillover Double-Loop process model (Study 3) shows visually the simultaneous growth of offline cognitive dissonance and reduction of online cognitive dissonance creating such social dissonance that an individual is ready to act on his reinforced values offline causing negative spillovers.

Our analysis of the collective actions leading to the end of Mubarak regime (Study 2) studies both diachronic calls for actions and offline protests as well synchronic online pictures posting and protests on Tahrir Square, constituting a positive feedback loop reinforcing the movement. These processes of iteration between online communications and offline actions constantly update the field of possibilities (online) and the extent to which the possible becomes real.

Thinking complexity with an innovative engagement combining systemic thinking and process thinking has been adopted to forge new theories with their ecology of concepts.

6.2.2. Conceptualization of (Online) Communities and the Role of Technology

The complexity turn taking place from local to global also changes concepts such as collective identity, core feature defining what constitutes a community. Early sociological treatment of community looked at neighbourhoods. However, a community is better defined as a network that provides social support, information and resources.

Technology-mediated communities have overthrown spatial aspects to emphasize interactions. "Community without propinquity" (Webber 1999 [1963]) is hardly a new idea. Online communities have also overflown digital boundaries and geographical borders. These two *movements* have given rise to *fluid phenomena of organizing*.

Yet, the creation of online communities has been shown to contribute to much of political, social and economic changes. The promise of a harmonious world seems partially fulfilled. The same platforms bring people together and divide people in groups by accentuating differences in beliefs and values. The *global village* has its own *cyber-balkans*. Either considering waves of protests, the spread of diseases or the spread of hate speech, the community is the center of socio-economic changes.

Our work describes how a sub-scene, either a sub-culture (Study 2) or a sub-community (Study 3), come to the foreground by crafting an alternative space within a dominant scene. These communities cannot be denied the qualifier of *real*: they are real communities considering their strike force drawn from deep online roots.

Membership is an aspect that needs to be revisited in these contexts. We face committed and disruptive online communities. They are loose communities centered around issues. They are highly specialized such as it is easy to join: the immediate ethos (i.e. beliefs and values) are clearly displayed. These communities are organized in response to latent threats. Though, the community is precarious, constantly open to negotiation. Anonymity plays an important role in generating audience rather than membership. These communities are actually self-centered and generate empathy with other people only because of individual experiences.

Technology is used to reduce distance in general (social and geographical) but also to amplify it. This sub-scene is a graphically rich environment. Communications cues nourish divisiveness and unity. Our work brings further evidence of the role of social media in successfully raising awareness. We expand this finding by delving deeper into the different types of awareness afforded by *showing*.

Bottom-up text-analog materials contribute to building a sense of community, but most importantly *awareness* in multiple aspects (Study 2). Photos and videos have been shown to be key social currencies in the online sphere because people can *Like* them, comment on them, share them. This awareness enables to channel these loose communities centred around issues and to lower the bar for offline and risky actions. This criss-crossing of realms also shows that social media has only played one part in the member engagement equation.

In both uniting and dividing, we face member-oriented communities, where peer support is a key aspect. Individuals look for empathy *and* solutions, relations *and* action. Both need to be delivered: it is a dyadic relation. The technological features heighten the individualization of the community. Members look for a comfortable place to share their feelings and opinions

because they read similar accounts but they also look for actionable assets. Because either they suffer under duress or they feel oppressed in expressing themselves, they need to do something about it to feel better.

6.3. Contributions to Complexity Conversation

The complexity is overwhelming for the individuals experiencing the phenomena under study as much as for the researchers attempting to conceptualize and study it.

Building *awareness of complexity* is teasing out the what is at play and how to address it. Being aware of the complexity surrounding us is specific to humans because we are consequently aware also "of the possibility of selecting their environment" (Luhman 1979, p.6). More than just awareness of complexity, it is also about *awareness of world's contingency*. It is not only about knowing that the world we inhabit could have been different *but* can be made different and thus, need to be seen differently. This *awareness of complexity* is our starting point. Identifying potential threats and opportunities calls for a response. These studies reflect the "complexity turn" (Urry 2005) that requires combining systemic thinking and process thinking. This turn is much needed for any theory that aspires to explain contemporary phenomena that have led to dramatic effects for decades now.

Therefore, we have addressed the problem of complexity by refusing to follow the explanatory principles of classical science (Morin 2014). Morin (2007) calls for a strategy of general complexity:

"In opposition to reduction, complexity requires that one tries to comprehend the relations between the whole and the parts. The principle of disjunction, of separation (between objects, between disciplines, between notions, between subject and object of knowledge) should be substituted by a principle that maintains the distinction, but that tries to establish the relation." (p.10–11).

To determinism, we have engaged with deeper explanations, rather than predictions that fall short of expectations. To reductionism, we have traded a deep knowledge of the components of society to study emergent properties of social systems which have dramatic potentialities. Finally, to disjunction, we have traded hermetically sealed disciplined to the mobilization of socio-psychological theories. Simplification principles do not enable a deep engagement with problems at hand.

The world we live in has become more complicated but especially more complex. So are the phenomena we study. A complicated situation has many moving parts and number of possible paths. A complex situation must deal with many adaptable moving parts interacting with each other and self-organizing and most importantly in our case produce societal outcomes (Tanriverdi et al. 2010). By increasing connectivity, Internet has contributed to the complexity. The Internet is a complex adaptive system (CAS) of humans and devices: "Humanity as a whole is not yet very well organized, but it already functions to a considerable extent as a complex adaptive system" (Gell-Mann 1995, p.19). Through new channels of communications and interactions, the Internet has irrevocably challenged our understanding of the world we live in. Understanding what it is and what it may become is necessary to make sense of possible societal consequences.

The complexity lens of our work is found in the following components (Johnson 2002; Lewin 1992):

- *Emergence:* "The whole is greater than the sum of the parts" is a principle of systems science (Demetis and Lee 2016). We showed that lower-level interactions focusing on communications produces individual or collective actions with consequences at the societal level. Methodologically, it has been translated by a closer look to communications to explain far-reaching social effects (Study 1), either offline protests changing social order and regime (Study 2) or online interactions in echo chambers can motivate behaviors destabilizing health and police services (Study 3). Our analytical approach has also shown the production explanations as a combination of individuals (subjects and researcher) sensemaking processes (Study 1).

- *Contingency:*
    - *Autopoiesis and Self-organization* builds on emergence: "we stopped analyzing emergence and started creating it" (Johnson 2002, p.23). Individuals' decisions to act together towards a common goal create a higher-level order. We go further with developing the autopoietic process (Study 2) showing how a self-organizing system can create itself. Study 3 focuses on self-organizing online communities facing social stigma and how they engage in positive reinforcing loop despite negative feedback from wider society.
    - *Operative Closure and Interactional Openness*. As both concepts may seem in contradiction, it implies that the system is autonomous in its internal processes

and open to its environment. The integration of both shows the necessity to look at responsiveness of the system to environmental stimuli, how flexible the system is and how it adapts. Those two principles are clearly at play in self-organizing processes. Study 1 focuses on the analysis of the communications around the Internet shutdown, showing that the system is not open to the point of loss of autonomy. Still, it interacts with and receives information from its environment. The autopoietic sub-processes (Study 2) are still at play. Similarly, there is escalation to commitment to a concealable stigmatized identity (Study 3) despite social interactions indicating its undesirability.

- *Order and Structure:* We have shown that social context matters because it "irritates" communications and can influence reactions. Order appears as a very fragile and temporary thing. Rather, following the establishment and development of relations (Morin 2007) seems to be a more appropriate approach. We have followed relations by studying the dynamics of conversations and relating their different components (Study 1). Signs and conversations (i.e. string of signs) have structure and relations between their different elements. Individuals look around them but the Internet has enabled them to look further than their own neighborhoods. Online, they figure out what is happening and connect with like-minded people for support. These new neighborhoods create the global village, as duplicating protests around the world (Study 2) or can contribute to cyber-balkanization (Study 3) and respectively empower or diminish society.

- *Non-Linear interactions*: The relationships between interactions in the online and offline space are interdependent in patterns from local causes to global effects and can have dramatic consequences. Both online and offline co-evolve in parallel and not in opposition making a whole. They are mutually interdependent. We have described networks of rich interactions evolving over time. Therefore, our research illustrates two dimensions of non-linearity: the quality (and not only quantity) of interactions and the cause-effect relationship.

- *Recursivity*. As information about the environment and its interactions with it are collected and circulates across the system, the perceptions of the problematic situation changes and influences behaviors from individuals and collective either as reinforcing or changing previous behaviors. We showed that communications are constantly feeding communities making individuals reevaluate their mental models. In Study 1,

we showed that it was not so much the Internet shutdown but the cells network that drove the growth of the movement. In Study 2, we showed also that exogeneous events (i.e. President Ben Ali fleeing Tunisia) triggered self-organizing processes leading to the transdigitalization episode. In the third study, we showed that information from online and offline social contexts feeds perceptions of one's identities.

6.4. Contributions to Methodological Conversation

The nature of our work is conceptual in foundation to provide explanations of already identified relationships but limited to variance model. As Simon (1996) wrote "The goal of science is to make the wonderful and complex understandable and simple—but not less wonderful" (p. x). Gell-Mann (1995) defines simplicity as the laws of nature such as the law of gravity, when complexity characterized the evolution of society. CAS retrieve information about their environment and about its own interactions with its environment to build a mental model and act on it. The resulting action happens in the offline world and influences the perception of the existing mental model, changing the system itself and its environment. Therefore, the study of CAS is about the information flow and therefore, follows what happens to information. The complexity of the system under study relies on its connectivity. We face complex pattern of communications and content which are context-dependent and subjective.

The methodological challenge is to grasp the rich fabric of the world which keeps eluding a clear analytical approach. Collecting and analyzing online communications content combined with offline information in a systematic manner directly raise methodological challenges. Such challenges call for an encompassing approach to study transdigital phenomena and spill-overs effects. The online world contains behavioral traces of the offline world. Thus, online-offline boundaries get blurred, offering a blended reality. Facing analytical challenges, this doctoral work has led to the formulation of a semiotic analytical technique when others (Mingers and Willcocks 2017) have erected as a standalone methodology. Our work has also led to a demonstration of its purposes and benefits to encourage others to engage with it.

Methodologically, we propose to study social media content that consists of numerous and multimedia online communications. We have showed that online communication is not a reflection of societal problems but an extension of society. Online communications show the effort of certain groups to be visible and heard. Online communications are an important channel to spread a message to the world. Moreover, the impact of those communications is

only realized when taken to the offline world: these online networks bring change from the screen to society. The interplay between online communications and offline societal consequences frame the nature of the spillover issue.

Our methodological contribution does not treat context as a transparent background but embeds phenomena in society because they are context-sensitive phenomena. Hence, social conditions are fully integrated to be framed as the problematic situation under study. Our study shows also that individualized forms of online communications are always embedded in larger structures; from online communities that arise around the issues to society at large that plays a role in framing the problem and suffers from the consequences.

We offer a conceptualization of society as a continuum between individuals, communities, technologies in a cultural context. Integrating "global village" aspects and cyber-balkanization (Van Alstyne and Brynjolfsson 2005), we offer a full picture of the bright and dark role of computer-mediated communications in societal matters.

6.5. Practical Implications

Currently, over 88% of people in America, 77% in Europe and 49.6% of people worldwide have access to Internet[36] (Internet World Stats 2017). Nowadays, the spread of Internet access is ubiquitous. Everyone has integrated Internet in their lives: government, corporations, individuals, elites, terrorists, etc. The degree of connectivity of individuals has led to change in way of life but these connected individuals also affect the lives of many people out of reach before. The nature and impacts of the Internet on society takes us far from its original design reserved for military and academics (Leiner et al. 2009). Phenomena that were endemic have become pandemic issues.

Internet as any ICTs creates negative and positive spillovers in the overall society. If the "Facebook Revolution" is good advertising in western countries, extremist and racist contents is also enabled on social media and can be costly for corporations[37] and challenging for States. This dissertation work raises the role of society in favoring certain types of community. Therefore, this work recognises a joint effort between Internet players, governments and regulators across borders.

[36] http://www.internetworldstats.com/stats.htm
[37] https://www.theguardian.com/technology/2017/mar/25/google-youtube-advertising-extremist-content-att-verizon

Because our work shows the pervasiveness of social problems at different layers of society, problems that have been around for decades now without proper response, our work generates explanations based on available evidence that challenge current assumptions. Our employed technique serves the purposes of detecting and dismantling preconceptions to answer the call of the intelligence community to provide "'alternative analysis' to address transnational threats"[38]. As a matter of fact, the Central Intelligence Agency (CIA) has organized unclassified interdisciplinary workshops to encourage "alternative sense-making" and mindfulness, i.e. "continuous wariness of analytic failure" in order to better inform policy makers (ibid.). Our methodological contributions participate in an effort to generate *mindful alternative analyses*.

The Internet is the technological infrastructure to society today. Our work shows the importance of scholarly research to understand the depth of change felt by individuals, companies, governments and institutions (Castells 2014). The Internet is not new but the unforeseen interactions and social impacts have left us in a harmful ignorance.

Our work also has implications for Internet companies powering online platforms like Facebook or Twitter. Study 2 shows how Facebook features have enabled to build *awareness* to empower digitally-enabled collective action. These insights are also useful for conventional organizations as it may help them to reposition their contributions to debates and contestations. Moreover, Study 3 hints at design of features of online community that favour the expression of certain identities and features that impulse conversational dynamics. Most importantly, this is a call to other actors in society to reclaim that space and make their voice heard and listened. Society at large has lost ground to these echo chambers; whose members need to hear other echoes.

6.6. Limitations and Avenues for Future Research

Our work represents a first effort to shed light on the complexity of societal challenges that arise from social phenomena overflowing all the boundaries that we have erected and all the dichotomies we used as heuristics. We have already highlighted the limitations of each single study. All of them call for further empirical work for different purposes. Our semiotic analytical technique (Study 1) calls for further applications to bring evidence of its relevance for IS

[38] https://www.cia.gov/library/kent-center-occasional-papers/vol3no2.htm

research and to demonstrate the rigor in its use. Those studies will also enable to develop and refine the technique to better serve qualitative researchers. We developed two process models too. The TOAP model calls for further empirical support (Study 2) and the Spillover Double-Loop Process Model is in need of empirical support (Study 3).

Furthermore, they are as many opportunities for future research considering the recent news headlines. The role of technology in empowering society and the overall responsibility for researchers to also study drifted usages makes it an exciting time for IS research.

For example, social movements and collective action have gained a renewal interests considering the use of technology advances for the means and the ends of contestation without the conventional actors. Talking about technology-enabled collective action and organizing are preferred to groups, associations or organizations. The roles of technologies in such movements still await its theorization.

Another crucial social problem is the online radicalization. The Charlottesville riots have shown how on the Internet white nationalists are shaped by extremism the same way as Islamists[39]. The motivations are not the same but both use the Internet to spread their ideology, recruit and organize their offline collective actions. Governments and Internet companies have been overwhelmed with how to handle online hate contents. Deleting contents and supressing online space have been actions undertaken by IT companies voluntarily or by law (in Germany). However, the reactive measures do not convince everybody[40]. We face social problems whose current answers are not satisfactory. That's why further research can provide deeper explanations in order to design better measures.

Those contemporary phenomena are as many phenomena that reiterate the importance of IS contributions to mainstream discussions.

Still considering recent news headlines, society constantly redefines what behavior are socially desirable and legal. Therefore, concealable identities that are nowadays stigmatized and put individuals in distress because of the dissonance felt might not be the identities to which our Double-Loop Spillover Model applies to in years, decades or centuries. As an example, we have seen the President of the United States Donald Trump pardons former Sheriff Arpaio. The

[39] https://www.nytimes.com/2017/08/23/technology/a-hunt-for-ways-to-disrupt-the-work-of-online-radicalization.html?mcubz=1

[40] https://www.washingtonpost.com/news/the-switch/wp/2017/08/18/banning-neo-nazis-online-may-be-slippery-slope-tech-group-warns-silicon-valley/

man the president describes as a patriot just doing his job[41] was criminally convicted for racial profiling to arrest and turn Latinos to immigration authorities. This drift between what is right or wrong in the legal discourse and the political discourse can – especially if reinforced by other cases – redraw the lines of the legal and illegal, providing incentives for certain behaviors to proliferate in broad light.

Besides, we highlight two methodological opportunities that arise from integrating those three studies: multilevel perspective and mixed method.

First, we think that one step towards a better understanding of transdigitalization or spillovers is to integrate the phenomenon in a multilevel perspective from micro-level interactions to macro-level outcomes, from individual to society. That is also one challenge of addressing complexity. Multilevel studies are a first step to approach societal challenges related to ICTs use *in simplicity*. Bottom-up approaches, for example, can help shedding the lights on how individual actions lead to dramatic consequences for a collective. However, a harder step is moving away from this reasoning to fully account for the complexity in the social. As Latour (1999) cited earlier talked about "circulating entity", there is no zooming in micro-context and zooming out to macro-context but many "complex mobile interconnections" (Urry 2002). There are many trajectories that do not follow bottom-up or top-down approaches. The multilevel perspective may be a too linear grasp the extent and pervasiveness of complex societies.

Second, another opportunity of research would be to explore methodological pluralism. Our work has solely considered qualitative approach to analyse communications. We have previously highlighted potential complementarities between big data analytics and semiotics. The combination of qualitative and quantitative methods has been previously discussed. For example, Mingers (2001) argues for a strong pluralism because any research situation is inherently multidimensional and complex. Mingers identified five designs in the literature: sequential, parallel, dominant, multimethodology and multilevel. The latter could address at the same time our first lead for future research by using different methods at different levels. New challenging phenomena can also identify new forms of pluralist methodology and offers new theoretical frameworks with appropriate practical guidance.

[41] https://www.nytimes.com/2017/08/25/us/politics/joe-arpaio-trump-pardon-sheriff-arizona.html?mcubz=1

6.7. References

Brockner, J. 1992. "The Escalation of Commitment to a Failing Course of Action: Toward Theoretical Progress," *Academy of Management Review* (17:1), pp 39-61.

Brockner, J., Houser, R., Birnbaum, G., Lloyd, K., Deitcher, J., Nathanson, S., and Rubin, J. Z. 1986. "Escalation of commitment to an ineffective course of action: The effect of feedback having negative implications for self-identity," *Administrative Science Quarterly* (31:1), pp 109-126.

Castells, M. 2014. "The impact of the internet on society: a global perspective," *Change: 19 key essays on how internet is changing our lives*.

Chesters, G., and Welsh, I. 2005. "Complexity and Social Movement(s)," *Theory, Culture & Society* (22:5), pp 187-211.

Demetis, D. S., and Lee, A. S. 2016. "Crafting theory to satisfy the requirements of systems science," *Information and Organization* (26:4), pp 116-126.

Dobusch, L., and Schoeneborn, D. 2015. "Fluidity, identity, and organizationality: The communicative constitution of Anonymous," *Journal of Management Studies* (52:8), pp 1005-1035.

Faraj, S., Jarvenpaa, S. L., and Majchrzak, A. 2011. "Knowledge collaboration in online communities," *Organization science* (22:5), pp 1224-1239.

Feller, J., Finnegan, P., Fitzgerald, B., and Hayes, J. 2008. "From peer production to productization: A study of socially enabled business exchanges in open source service networks," *Information Systems Research* (19:4), pp 475-493.

Festinger, L., and Carlsmith, J. M. 1959. "Cognitive consequences of forced compliance," *The Journal of Abnormal and Social Psychology* (58:2), pp 203-210.

Festinger, L., Riecken, H. W., and Schachter, S. 1956. *When Prophecy Fails*, (1st ed.) University of Minnesota Press: Mineapolis.

Gell-Mann, M. 1995. *The Quark and the Jaguar: Adventures in the Simple and the Complex*, (Macmillan.

Giddens, A. 1984. *The constitution of society: Outline of the theory of structuration*, (1st ed.) Univ of California Press.

Johnson, S. 2002. *Emergence: The connected lives of ants, brains, cities, and software*, Simon and Schuster.

Latour, B. 1999. "On recalling ANT," *The Sociological Review* (47:S1), pp 15-25.

Leiner, B. M., Cerf, V. G., Clark, D. D., Kahn, R. E., Kleinrock, L., Lynch, D. C., Postel, J., Roberts, L. G., and Wolff, S. 2009. "A brief history of the Internet," *ACM SIGCOMM Computer Communication Review* (39:5), pp 22-31.

Lewin, R. 1992. *Complexity: Life at the edge of chaos*, (2nd ed.) MacMillan Publishing Company: New York, Toronto.

Luhman, N. 1979. "Trust and power: two works by Niklas Luhmann," Chichester, UK: Wiley.

Majchrzak, A., Markus, M. L., and Wareham, J. 2016. "Designing for Digital Transformation: Lessons for Information Systems Research from the Study Of ICT and Societal Challenges," *MIS Quarterly* (40:2), pp 267-277.

Mingers, J. 2001. "Combining IS research methods: towards a pluralist methodology," *Information systems research* (12:3), pp 240-259.

Mingers, J., and Willcocks, L. 2017. "An integrative semiotic methodology for IS research," *Information and Organization* (27:1), pp 17-36.

Morin, E. 2007. "Restricted complexity, general complexity," *Science and us: Philosophy and Complexity. Singapore: World Scientific*), pp 1-25.

Morin, E. 2014. "Complex thinking for a complex world–About reductionism, disjunction and systemism," *Systema: connecting matter, life, culture and technology* (2:1), pp 14-22.

Shaikh, M., and Vaast, E. 2016. "Folding and unfolding: balancing openness and transparency in open source communities," *Information Systems Research* (27:4), pp 813-833.

Simon, H. A. 1996. *The sciences of the artificial*, MIT press.

Staw, B. M. 1976. "Knee-deep in the big muddy: A study of escalating commitment to a chosen course of action," *Organizational Behavior and Human Performance* (16:1), pp 27-44.

Staw, B. M. 1981. "The escalation of commitment to a course of action," *Academy of management Review* (6:4), pp 577-587.

Tanriverdi, H., Rai, A., and Venkatraman, N. 2010. "Research commentary—reframing the dominant quests of information systems strategy research for complex adaptive business systems," *Information Systems Research* (21:4), pp 822-834.

Urry, J. 2002. "The global complexities of September 11th," *Theory, Culture & Society* (19:4), pp 57-69.

Urry, J. 2005. "The Complexity Turn," *Theory, Culture & Society* (22:5), pp 1-14.

Van Alstyne, M., and Brynjolfsson, E. 2005. "Global village or cyber-balkans? Modeling and measuring the integration of electronic communities," *Management Science* (51:6), pp 851-868.

Webber, M. 1999 [1963]. "Order in diversity: community without propinquity," in *The American cities and technology reader: wilderness to wired city*.