A systems approach to understanding the effect of Facebook use on the quality of interpersonal communication

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Abstract

Social networking platforms such as Facebook have become integrated into the milieu of modern-day social interactions. Facebook, one of the most prominent social networking platforms globally, is widely used as a primary medium for communicating and networking for personal, professional and recreational purposes. This paper attempts to grapple with an identified problem in the tension between the use of Facebook and the quality of interpersonal communication. Using qualitative systems dynamics modelling, the paper explores the effects of Facebook on the quality of interpersonal communication from the perspective of a potential Facebook user. Given that one of the co-authors is an active Facebook user, the paper employs this case study area with the purpose of understanding and illustrating it, primarily, from a subjective, individual point of view. In this way, a personal experience of Facebook and its impact on the nature of interpersonal communication provides the intuitive starting point for the inquiry.

1   Introduction

Facebook is one of the most prolific online social networks of the contemporary era and the first of its kind in history. Created in 2004 by Mark Zuckerberg and a group of fellow Harvard University students, it reached 50 million users by October 2007 and an astonishing 1 billion monthly active users on 14th September 2012 from across the globe (Facebook, 2013). Although the platform has its origins in the United States of America, at the time Facebook reached 1 billion, the median age of the active users was 22 years and the top five countries where people were connected were Brazil, India, Indonesia, Mexico and the United States (Facebook, 2013).

Facebook enables users to create visible profiles with basic personal information; users are able to make available a wide range of personal details thereafter. The platform boasts a host of features facilitating virtual interaction. These then have the potential to be extended to offline environments. Some of these features include the friends list, the wall, status, events, messages, video, photos, pokes, chat, groups and like; explained below by Nadkarni and Hofman (2012).

> "The *friends* list is a crucial component of Facebook, because it allows the end user to create a public display of links to connections which viewers can in turn click through, to traverse the network. The *wall* is a term given to the Facebook feature that functions as a bulletin board and allows other users to post personal messages directed toward the end user. The *pokes* function allows users to offer initial greetings to other users. *Status* allows users to inform their friends of their whereabouts and thoughts. The *events* feature enables users to plan meetings or events that they can extend invitations for. *Photos* and *videos* allow users to upload albums, photos and videos which other users can comment on. Communication with friends is accomplished through *messages,* which are public or private, but also through a chat feature. The *groups* feature allows users to create and join interest groups. The *like* functionality allows users to give positive feedback about preferred content."

Facebook's mission is to give people the power to share and make the world more open and connected (Facebook, 2013). These technical features shed light on the myriad of opportunities for engagement and sharing that Facebook makes possible in the virtual social networking space. In social network theory, a network is understood as a set of relationships

(Kadushin, 2004). The Facebook platform succeeds in incorporating a vast array of features which culminate in a rich set of network interactions and relationships. However, the networks established on Facebook are anchored in offline, real life networks, relationships and connections; although the possibility of connecting with people outside of established networks is a distinguishing feature of the platform. Essentially, offline social networks are extending onto a virtual platform in such a way that codifies, externalises and collates an individual's family, friends, acquaintances and wider connections. "Facebook represents a means for individuals to continue (and extend) their offline relationships and conversations in an online medium" (Hollenbeck and Kaikati, 2012). Arnaboldi et al. (2013) similarly affirms that the properties of offline social networks are true for Facebook as well. "Facebook users are primarily communicating with people who are already part of their extended social network" (Boyd and Ellison, 2007). As in offline contexts, Facebook users are closely connected to a smaller group of people and loosely connected to a larger group of people; however it is acknowledged that Facebook makes it possible to connect, or be 'friends' with considerably more people, as reflected in the friends list feature. Nonetheless, the number of relationships that an individual can actively sustain, even on Facebook, is somewhere around the same as in real life—Dunbar's number sets this at 150 individuals (Arnaboldi et al., 2013).

This paper presents an exploration of the tension between the use of Facebook and the quality of interpersonal communication surfacing from the active engagement with the platform by one of the co-authors, a regular Facebook user. Qualitative systems dynamics modelling is employed in an attempt to unpack the relationship between the use of Facebook and its impact on the quality of interpersonal communication. Given the highly subjective and qualitative nature of this investigation, this method of systems dynamics modelling is deemed most appropriate and succeeds in engendering a richer understanding of the identified problem.

2 The dynamics of Facebook

This section unpacks the motivations for why people make use of Facebook which accounts for the social networking platform's commendable success and continuous proliferation. With technology increasingly shaping and being shaped by our lifestyles, it is imperative to shed light on the fundamental psychological and social drivers for the use of Facebook.

Coupled to this is an explanation of the underlying logic of how Facebook works; how it propagates networks of relationships and connections in such a way that bolsters the platform's mission to make the world a more open and connected place.

2.1   Why do people use Facebook?

According to Facebook, people use the site to stay connected with friends and family, to discover what's going on in the world, and to share and express what matters to them (Facebook, 2013). Numerous studies have investigated the psychological factors contributing to Facebook use (e.g. Boyd and Ellison, 2007, Ellison et al., 2007, Bonds-Raacke and Raacke, 2010, Boyd and Hargittai, 2010, Sheldon et al., 2011)

Nadkarni and Hofmann (2012) reviews array of studies and proposes a dual-factor model of Facebook use. In line with this model, Facebook use is primarily motivated by two basic social needs: the need to belong and the need for self-presentation. Even though humans are highly dependent on the social support of others (Nadkarni and Hofmann, 2012) and Facebook provides a very concrete, accessible and traceable platform through which to foster this, the relationship between Facebook and social connection is complex. Nonetheless, the need to belong—connected to self-worth, self-esteem and so on—is acknowledged as a fundamental driver for the use of Facebook.

The need for self-presentation is a closely connected motivation. Users are invited to create a personal profile through which they establish a presence on Facebook. Comprehensive research has been conducted on the role that social networking sites play in identity construction (e.g. Tong et al., 2008, Wang et al., 2010, Back et al., 2010). Like other social networking sites, Facebook "leaves itself open to the possibility its users display their idealised, rather than accurate, selves through their profiles" (Nadkarni and Hofmann, 2012). Moreover, Facebook "has a number of characteristics (e.g. its ubiquitous nature, high visibility, direct connection to a sizeable and heterogeneous network of known individuals) that provide unique and interesting conditions for investigating the interaction of multiple selves...in self-expression" (Hollenbeck and Kaikati, 2012). Crucial findings by Back et al. (2010) and Zhao et al (2008) reveal that, unlike other anonymous online environments, Facebook users express and communicate their real personality rather than promoting idealised versions of themselves. This is due to the fact that information about a user's reputation or personality is difficult to control (e.g. wall posts posted by other users) as well

as the fact that friends provide accountability and subtle feedback on the self as presented through the Facebook profile (Back et al., 2010).

Thus it can be seen how the reasons underpinning the use of Facebook are intricately connected with complex psychological processes and patterns. Nonetheless, for the purpose of this paper, a simplistic understanding of the two overriding motivations is sufficient.

2.2   Facebook: the strength of weak ties

As it has been illustrated, Facebook replicates and extends the vast, varied and interlinking social networks that exist in real life; those constituting the rich social fabric of diverse societies. Similarly, many of the principles underpinning the offline social networks are true also for online social networks. One of these principles is the strength of weak ties and the nature of information dissemination (Gilbert and Karahalios, 2009, Xiang et al., 2010, Bakshy and Rosenn, 2012, Arnaboldi et al., 2013). Granovetter (1973) seminal text, *The Strength of Weak Ties* depicted the strategic functionality of weak ties in large scale social networks as small groups aggregate to form large-scale network patterns. Weak ties are indispensable to an individual's opportunities and their integration into communities as well as for the dissemination of ideas, influence and information between diverse individuals and communities (Granovetter, 1973). The article also outlines the nature of strong ties that constitute dense networks.

"The strength of a tie is a (probably linear) combination of the amount of time, the emotional intensity, the intimacy (mutual confiding) and the reciprocal services which characterise the tie" (Granovetter, 1973). Additionally, "the more frequently persons interact with one another, the stronger the sentiments of friendship for one another are apt to be" (Homan in Granovetter, 1973). In a network, "whatever is diffused can reach a larger number of people and traverse greater social distance when passed through weak ties rather than strong" (Granovetter, 1973). Additionally, in terms of organisation of communities and societies, "weak ties play a role in effecting social cohesion" (Granovetter, 1973). It becomes apparent that strong ties are not conducive to the widespread sharing of information. Facebook understands the power of weak ties as those responsible for the majority of information spread on their platform (Bakshy and Rosenn, 2012). Facebook's success as an online social network can thus be understood and attributed to its ability to target fundamental social needs (belonging and self-presentation) using a platform which leverages the strength of weak ties.

5

Reflecting on Facebook's purpose as giving people the power to share information through a host of functionalities, and making the world more open and connected, it becomes apparent that fostering loose, weak ties is the most fruitful way of spreading information whilst ensuring that people feel connected to their virtual communities. Since more people can be connected through weak ties, it makes logical sense for Facebook to cultivate online social network structures that are less dense and which constitute a richness of loose ties, over and above the strong ties in networks people identify with in both real and virtual life.

Against the above understanding of the functionality, purpose and nature of Facebook as an online social networking site, a specific problem is identified in the relationship between the use of Facebook and the quality of interpersonal communication. This is built upon the central notion that Facebook tends towards the cultivation of weak ties and loose connections, as opposed to the facilitation and support of strong ties. It is understood that strong ties, or strong interpersonal relationships, require considerable time and emotional investments as well as elements of mutual confiding and reciprocal services (Granovetter 1973). Seen together, the assertion that the use of Facebook impacts the quality of interpersonal communication finds justification. This paper thus asserts that *the use of Facebook negatively impacts the quality of interpersonal communication*, and utilises qualitative system dynamics modelling to explore the problem.

3   Qualitative system dynamics analysis

3.1   *System dynamics: a brief overview*

System dynamics is a useful tool in creating feedback theories. It is based on feedback control theory and was developed by Forrester in the 1960's in order to understand the behaviour of problems within a system (Forrester, 1961, Sterman, 2000). System dynamics not only guide in understanding of the structures of systems and their dynamics, but also provide vigorous approaches to building simulation models.

Several studies have developed guidelines for system dynamics modelling process (Randers, 1980, Richardson and Pugh, 1981, Roberts et al., 1983, Wolstenholme, 1990, Sterman, 2000),(Forrester and Senge, 1980, Sterman, 2000). While the guidelines provided range from three to eight steps, all include similar iterative activities that involve both qualitative modelling and quantitative modelling. Qualitative modelling entails problem identification

and conceptualisation, where, the issue being investigated is mapped out using qualitative tools such as causal loop diagrams and influence diagrams.

Qualitative modelling is a crucial component of the system dynamics modelling process given that qualitative data is usually the main source of information (Forrester 1975a) that constitutes the starting point for the modelling process. Mainstream authors in the system dynamics field (Randers, 1980, Richardson and Pugh, 1981, Roberts et al., 1983, Wolstenholme, 1990, Sterman, 2000) also share the view that qualitative modelling is a necessary aspect of system dynamics modelling. Though many systems dynamics practitioners place emphasis on the importance of qualitative modelling, others stress the importance of quantitative modelling in pursuit of robust knowledge (e.g. Sterman, 2000, Pruyt, 2013). Proponents of quantitative modelling advocate this approach to problem conceptualisation, since it utilises mental models and structural elements of problems; specifies and integrates both soft and hard variables; simulates dynamic behaviour of the problem under investigation; and results in greater problem understanding as well as the enhanced ability to explain and manage dynamic real world issues. Nonetheless, quantitative modelling faces a considerable challenge in the formulation and quantification of soft variables. Some experts argue that simulation from such analysis could be misleading given the uncertainty associated with quantifying soft variables (Coyle, 2000). For this reason, others conclude that an emphasis should rather be placed on qualitative systems dynamics practice (Wolstenholme, 1990). Although the authors do not fully agree with Wolstenholme, (1990) and Coyle (2000) in only advocating qualitative dynamics practice, it is considered sensible to use qualitative system dynamics in some situations where the quantification of soft variables is challenging and often unattainable. It becomes clear that employing qualitative systems modelling relates well to the issue under investigation in this paper, which is about understanding the effect of the use of Facebook on the quality of interpersonal communication.

3.2   *An application of qualitative systems dynamics*

Qualitative system dynamics is essentially the first attempt in structuring the essential elements or components of the problem within the system being studied. This can be done using various qualitative system dynamics diagrams such as causal loop diagrams, stock and flow diagrams, sector diagrams, bull's eye diagram, influence diagrams, and archetype diagrams (Pruyt, 2013). Clearly, the objective of developing system dynamics diagrams is to

map the overall relationships of factors or elements of a system. As earlier indicated, this may be a sufficient level of analysis given the inherent complexity of the issue being investigated, particularly where data is mostly qualitative in nature. However, in some situations where there is more information, knowledge, or experience about the different factors or elements, it may be possible to go beyond qualitative analysis to quantitative modelling.

Causal loop diagramming is the most commonly utilised tool for qualitative system dynamics analysis. Casual loop diagrams reveal the causal interrelationships among sets of variables pertinent to the problem. This is done for the purpose of generating greater understanding of the nature of a problem with a view to enabling greater insight into potential interventions or problem solutions. The building blocks of causal loop diagrams are (Wolstenholme, 1999):

(i) *Variables* – this is a condition, situation, action or decision that *can influence*, and *can be influenced* by other variables. A variable can be quantitative or qualitative since causal loop diagrams have the ability to incorporate both of these variables.

(ii) *Links / Arrows* – which show the relationship and the direction of influence or causation between variables.

(iii) The *direction of influence* – which is represented by S's (+), meaning 'same direction' of O's (-), meaning 'opposite direction'. These arrows indicate the way one variable moves or changes in relation to another.

(iv) *Type of feedback loop* – there are two types of feedback loops: balancing feedback loops that seeks equilibrium and are represented by 'B'; and reinforcing feedback loops that amplify changes and are represented by 'R'.

Based on the above understanding of the strengths and applications of this form of qualitative systems dynamics, the investigation of the relationship between the use of Facebook and the quality of interpersonal communication employs causal loop diagramming to map the pertinent qualitative causal relations. This form of qualitative systems modelling is further supported by the fact that causal loop diagrams demand confronting mental models. In this case, surfacing assumptions and beliefs about the manner in which people interact, connect and communicate with other people in person, on communication platforms and virtually, is necessary in order to depict the causal relation between the use of Facebook and the quality of interpersonal communication. This also demands addressing personal opinions and perceptions of Facebook and the importance placed on of interpersonal communication. Thus, the causal loop diagram is reflective of subjective, personally held beliefs and values

about what it means to be close to another person, connected to networks of people and the nature of contemporary communication methods.

The process employed in this investigation emulates the phases described in qualitative system dynamics analysis (Sterman, 2000) which include: problem formulation, variable identification, and causal loop construction and analysis. Having introduced the tension between the use of Facebook and the quality of interpersonal community, it is evident how the problem structuring phase of systems thinking requires clearly demarcating the system boundaries and the scope of investigation. Given the myriad of opportunities for investigation around issues of modern communication and the impact of social networking platforms, stringently outlining the scope of investigation is crucial. In this way the causal loop exploration is guided by an established and clear boundary in line with the identified problem. The basis for this problem statement is primarily an assertion from personal experience subsequently grounded in supportive supplementary literature. In order to construct the causal loop diagram, initial key variables springing from the problem statement lead to the identification of the host of pertinent variables linked to the use of Facebook and the quality of interpersonal relationships. Using these preliminary variables, a series of causal loop diagrams were constructed, surfacing other significant variables in an attempt to illustrate the causal relationship within the specified problem. This iterative process culminates in the causal loop diagram featured in this investigation.

3.2.1 Problem formulation and conceptualisation

The causal loop diagram explores the interconnection between the use of Facebook and the quality of interpersonal communication. The essence of the problem is captured here: "Our omniscient new technologies lure us towards increasingly superficial connections at exactly the same moment they make avoiding the mess of human interaction easy" (Marche, 2012). Herein lies the fundamental tension between the use of Facebook relative to the use of interpersonal communication. Facebook appeals to fundamental human social needs and both facilitates and encourages loose connections for the purpose of creating a more connected world where people share more with the people in their networks. Facebook is criticised for its deleterious impact on the quality of interpersonal communication (Marche, 2012); these kinds of negative sentiments are widely held (Warrell, 2013). More significantly, this problem is personally experienced and intuitively known by one of the co-authors. It is for this reason that a causal loop diagram, as a tool for sense making is employed in an attempt to

further understand this problem. The causal loop diagram explores this by delineating the causal relations leading to a decrease in the quality of interpersonal communication. However, in order to properly investigate the problem, a clear understanding of the study's fundamental principles and key assumptions is necessary.

The use of Facebook is presented as the active and engagement with the multiplicity of public-oriented Facebook functionalities; thus excluding the private messaging function (which would be categorised as interpersonal communication). It is assumed that the use of Facebook equates to the engagement with public communication platforms on the online social network. Interpersonal communication is framed as the two way communication or sharing that takes place between individuals where specifically tailored messages find relevance in the unique interpersonal relationship that exists between them. Although it is not limited to reciprocal communication between two people, it is assumed that the intended audience is known and constituting a small number of individuals only. In an era where a vast array of technological devices and platforms enable this kind of communication, the concept of interpersonal communication is not being limited to face-to-face interaction. The quality of interpersonal communication is grounded in the understanding of a strong interpersonal tie as outlined by Granovetter (1973). Here a "combination of the amount of time, the emotional intensity, the intimacy (mutual confiding) and the reciprocal services which characterise the tie" are what constitute a valuable interpersonal relationship, made possible by the array of communication tools as well as conventional face-to-face interaction (Granovetter 1973: 1370).

The first assumption in this study concerns the definition of interpersonal communication. Since it groups an array of direct communication mediums together with face-to-face interaction, it becomes evident that this variable equates the value of real life interaction with that of interpersonal communication on a technological platform. This assumption is problematic in light the attention given to the negative impact of social media, in general, on real life human interaction (Warrell, 2013). Nonetheless, this assumption is important to understand the manner in which the use of the public-oriented functionalities of Facebook detracts from the input into direct interpersonal communication, whether in person or over one of the conventional interpersonal communication methods, and thus also the quality thereof. Related to this is the fact that the study employs generalities concerning the use of conventional interpersonal communication methods for the purpose of illustrating the

aforementioned point. Specifically, it is acknowledged that the use of a conventional interpersonal communication method does not necessarily result in a higher quality of communication, rather, the potential for more time and emotional investment along with mutual confiding and reciprocal services is greater.

A second assumption to confront is that the nature and value of connection via Facebook or conventional interpersonal methods is not equated. This investigation recognises that people desire and to varying extents, require both (virtual) public and (virtual and real life) interpersonal interaction. Given the fact that people have a limited propensity to communicate and connect, it becomes evident that the tension is then where these capabilities and energies are directed and the consequences of these choices made. The causal loop diagrams endeavour to unpack this dynamic interplay between the use of Facebook and the quality of interpersonal communication.

In terms of the use of Facebook, a distinction is made between the relationships and connections that can be established. Facebook replicates and extends existing real life social networks whilst also enabling and propagating abundant online connections. As in real life, there remains a relatively stable number of individuals can maintain *relationships* with on Facebook (Arnaboldi et al., 2013) as opposed to the countless *connections* which that user can establish.

3.3   *Identifying variables for causal loop diagram*

Having made clear the grounding principles and assumptions, the next step was to identify the variables that would be endogenous, exogenous, excluded variables (Table 1). Endogenous variables are those influenced by the causal linkages constituting the core problem addressed in causal loop diagram. The causal loop diagram attempts to capture the tension in focus by introducing a central variable depicting the time and effort investment made into the use of Facebook relative to interpersonal communication. The remainder of the endogenous variables find relevance in how they relate to the ratio of time and effort invested into either the use of Facebook or interpersonal communication. It is acknowledged that this variable does not equate the nature or value of communicating interpersonally or via Facebook but rather illustrates the tension individuals experience given the allure of Facebook and the messiness of interpersonal communication (Marche, 2011).

Table 1: Identified variables for causal loop diagram

Endogenous variables	Exogenous variables	Excluded variables
Use of Facebook relative to interpersonal communication	Organisational communication	Face-to-face interaction
Use of Facebook	Cultural sharing	Facebook identity
Information dissemination	Personal expression	Real identity
Network communication	Need to belong	Amount of time
Global awareness	Need for self-presentation	Emotional intensity
Perception of network connection	Perception of Facebook	Mutual confiding
Derived value / utility from Facebook	Expected utility / derived value from Facebook	Reciprocal services
Desire to connect through Facebook	Interpersonal communication threshold	Quantity of Facebook connections
Investment in Facebook identity	Information intake threshold	
Conventional interpersonal communication methods	Network communication threshold	
Quality of interpersonal communication		
Derived value / utility from interpersonal communication		
Desire to connect interpersonally		
Quantity of interpersonal communication		
Information intake		
Quantity of Facebook relationships		

On the other hand, exogenous variables fall outside of the boundary of the causal loop diagram and are determined by factors outside of the system. In section 1.1, two motives for the use of Facebook were explained—the need to belong and the need for self-presentation. These, along with the three types of information dissemination and the interpersonal communication, information intake and network communication thresholds, were considered exogenous variables since they operate as constant variables. The perception of Facebook and the expected derived value / utility from Facebook are parameters which influence initial conditions for the use of Facebook and the investment in Facebook identity and are thus also exogenous. Endogenous and exogenous variables are referenced and elaborated on further in section 4, where the dynamic analysis of the causal loop diagram is explained.

The excluded variables are those which are pertinent to the qualitative investigation but omitted from the causal loop diagram as they were outside the scope of current analysis, as well as the need to ensure brevity and simplicity. Face-to-face interaction is considered an important component of interpersonal communication but given the investigation's focus on modern communication technologies enabling interpersonal and network communication, this variable was excluded. The relationship between the Facebook identity and real identity

was also excluded. Even though the dynamics and tensions are of integral importance to the presentation of the self on Facebook and thus also the investment in Facebook identity, research has indicated that there is significant congruence between the real and virtual identities of Facebook users (Back et al., 2010, Zhao et al., 2008). It is for this reason that these variables were excluded. Amount of time, emotional intensity, mutual confiding and reciprocal services are related to the strength of interpersonal relationship ties and thus relevant to the quality of interpersonal communication. However, these variables were excluded so as to focus on the aggregate nature of the quality of interpersonal communication. The quantity of Facebook connections is excluded given that this aspect of the use of Facebook is beyond the scope of the study.

4   Results from causal loop analysis

The causal loop diagram was been broken down into six interlinked feedback loops which are discussed in the sub-sections that follows.

4.1   *The use of Facebook and the need to belong: R1, R2, R3*

There are three reinforcing loops that are associated with the use of facebook and need to belong, R1, R2 and R3 (see Figure 1). The use of Facebook is motivated by a fundamental human social need, the need to belong. As an online social network, Facebook provides people the opportunity to engage with an array of networks, organisations, movements and interest groups. The use of Facebook can also be attributed to the perceptions that users have about the platform and their related positive, negative or ambivalent opinions thereof. Fundamental drivers and perceptions are closely connected to the expectations of users. Facebook users engage with Facebook with certain expectations about the value and utility that can be derived for their personal and professional lives from using the online social network. Having elaborated on the exogenous variables influencing the use of Facebook by potential and active users, the three reinforcing loops concerning the use of Facebook because of a need to belong, is explained below.
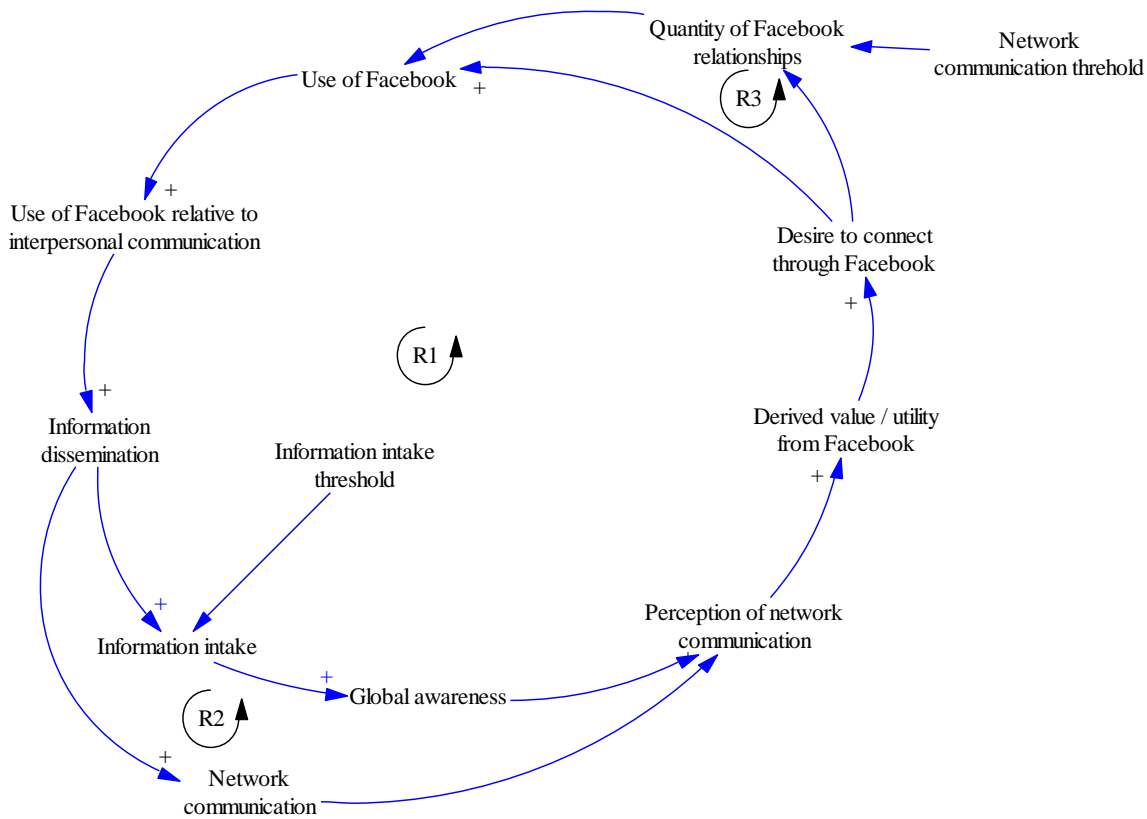
Figure 1: The use of Facebook and the need to belong causal loop diagrams

The more an individual uses Facebook, the more time and effort they invest into communication via this social network as opposed to interpersonal communication. Thus it is asserted that the more an individual uses Facebook, the less time and effort they put into interpersonal communication given their limited propensity to communicate. Given Facebook's primary function of making the world a more open and connected place, dissemination of information is the overarching outcome of the use of Facebook. The more a person uses Facebook, the more information can be, and is, shared. Primarily, this information can take the form of organisational communication, cultural sharing or personal expression. These three account for the majority of information shared in the public Facebook domain and are illustrated in Figure 4. Organisational communication refers to the information shared so as to organise virtual and real life gatherings, such as events, rallies or celebrations. Cultural sharing refers to the interesting content that people share ranging from current affairs, politics, art, humour and the like. Personal expression refers to the information pertinent to the thoughts, beliefs and happenings relevant to an individual. These three types of information dissemination make use the wide array of both active and passive, and direct and indirect, Facebook functionalities. Facebook makes it increasingly easier to share these kinds of information, making it an attractive and hassle free manner through which to share personal preferences, plans or sentiments with a wide group of people.

Sharing these same pieces of information using conventional interpersonal communication methods is made to look relatively cumbersome and effortful; Facebook takes the hassle out of connecting with the people around you. This provides the foundation for R1, R2 and R3.

The more information dissemination that takes place on the Facebook platform, the greater a user's awareness of global events, trends and affairs is, since the more information they are able to take in, as depicted in R2. However, there is only so much an individual can come to know about what's taking place around the world and given the expanse of information shared on Facebook, only so much that that individual can access and see. Encapsulating this tension, this information intake threshold is a relative variable however unpacking it is beyond the scope of this investigation.

Similarly, as seen in R2, the more information is shared, the more network communication takes place, that is the more conversing and interaction that takes place in the various networks accessible on Facebook. Public sharing enriches the communication within networks. The more this global awareness (R1) and network communication (R2) is, the greater the perception of network connection. Users feel more aware of what is happening in the world and thus they perceive a greater connection to a global society. The more information is shared, the more network communication takes place and the greater the sense of global awareness which in turn induces an enhanced perception of connection and belonging to these virtual networks. A greater desire to connect through Facebook results from this enhanced perception of connection and belonging since people derived greater value from engagement with the social network. The perception of network connection is positively related to the derived value and utility from Facebook. That is, the more people feel connected to other people, the more (we think) we know about what is going on in their lives. In this way, Facebook is both useful and valuable, providing useful (practical reminders about birthdays for example) and edifying (notifications about engagements, births etc) information. The more value is derived, the more users desire to connect through Facebook which in turns boosts the use of Facebook. The ease of information sharing and thus the greater desire to connect through Facebook might also cause a desire to connect with a greater number of people in the network of relationships a user has established on Facebook. However, as it has been indicated, there is a limit to how many networked relationships a Facebook user can sustain, and thus the network communication threshold keeps a check on the quantity of Facebook relations. The distinction between networked relationships and

Facebook connections is pertinent here. Though Facebook enables a countless number of connections, research has shown there is a limit to the number of networked relationships that can be sustained (Arnaboldi et al., 2013). In this way, Facebook provides a seamless, integrated and hassle free opportunity to communicate virtually with extended real life networks.

The reinforcing loops R1, R2 and R3 illustrate how Facebook successfully facilitates and encourages ease of communication and connection within networks of people through the public dissemination of information, tapping into a fundamental human need to belong. Conversely though, these reinforcing loops, when framed and explained differently also illustrate the alienation that a poor perception of network connection fosters under conditions of less information dissemination and reduced derived value / utility. The popular discourse around Facebook corroborates this finding; much is written about how Facebook makes people sad or lonely (Warrell, 2013).

4.2   The use of Facebook and the need for self-presentation: R4, R5

Building on the explanation of R1, R2 and R3 presented above, the reinforcing loops R4 and R5 (Figure 2) illustrate how the use of Facebook relates to the other fundamental driver: the need for self-presentation. The more an individual uses Facebook, relative to interpersonal communication, the more information is shared and absorbed, and in turn the greater their perception of connection because of enhanced global awareness (R4) and network communication (R5). And so, the more one uses Facebook, the more value can be derived from Facebook which motivates an investment in the Facebook identity. Interactions on Facebook are anchored by the personal profile and so in order to derive greater value from the platform, users invest more time and effort into crafting a rich and engaging Facebook profile grounded in their actual identity. The more a user invests in their Facebook identity, the more they then use Facebook.
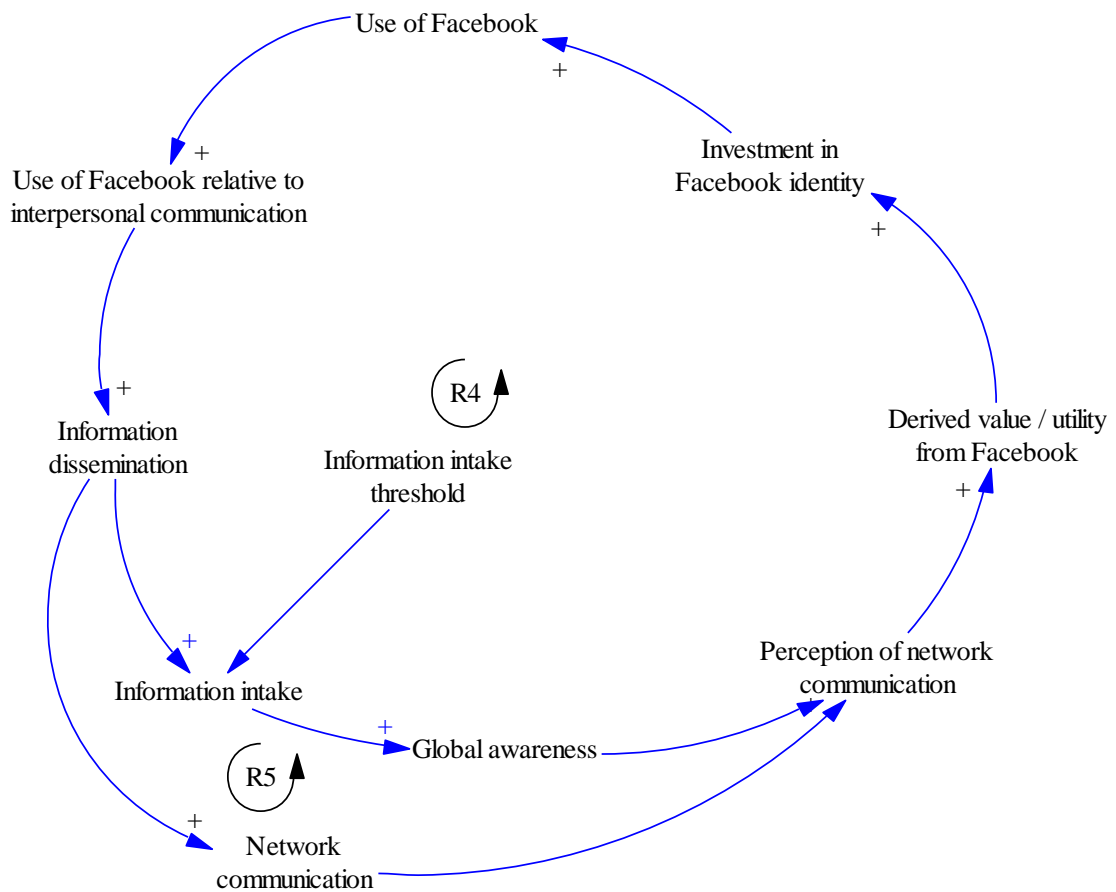
Figure 2: The use of Facebook and the need for self-presentation

This section concludes that the use of Facebook, motivated by fundamental human needs, can either foster a greater sense of connection and belonging to the groups and networks that extend from their real lives into the virtual world, or reduce an individual's perception about their connection to these same networks, and the world at large.

4.3 The use of conventional interpersonal communication methods and the quality of interpersonal communication: R6, B1

Distinctive to the reinforcing loops connected to the use of Facebook, R6 and B1 depict how the quality of interpersonal communication is related to the use of conventional interpersonal communication methods (see Figure 3). These communication tools are understood to be those that make possible direct communication between either two people or amongst a small group of individuals. They include instant messaging tools such as Whatsapp, WeChat, BBM, Skype, private Facebook messages, traditional mail, email, phone calls, text and face-to-face interaction. These kinds of communication platforms allow for clearly directed, specific (in some cases, both verbal and non-verbal) messages from one individual to another. The

excluded variables relating to the strength of an interpersonal relationship are relevant here since conventional interpersonal communication methods require a degree of effort and investment, more than the public declarations that constitute public information dissemination on Facebook. Therefore, it is asserted that the more conventional interpersonal communication methods are used, the greater the potential quality of these interpersonal interactions, though this is not necessarily the case. Quality of interpersonal communication exhibits a level of time investment, emotional intensity, mutual confiding and reciprocal services that allow for strong interpersonal connections.
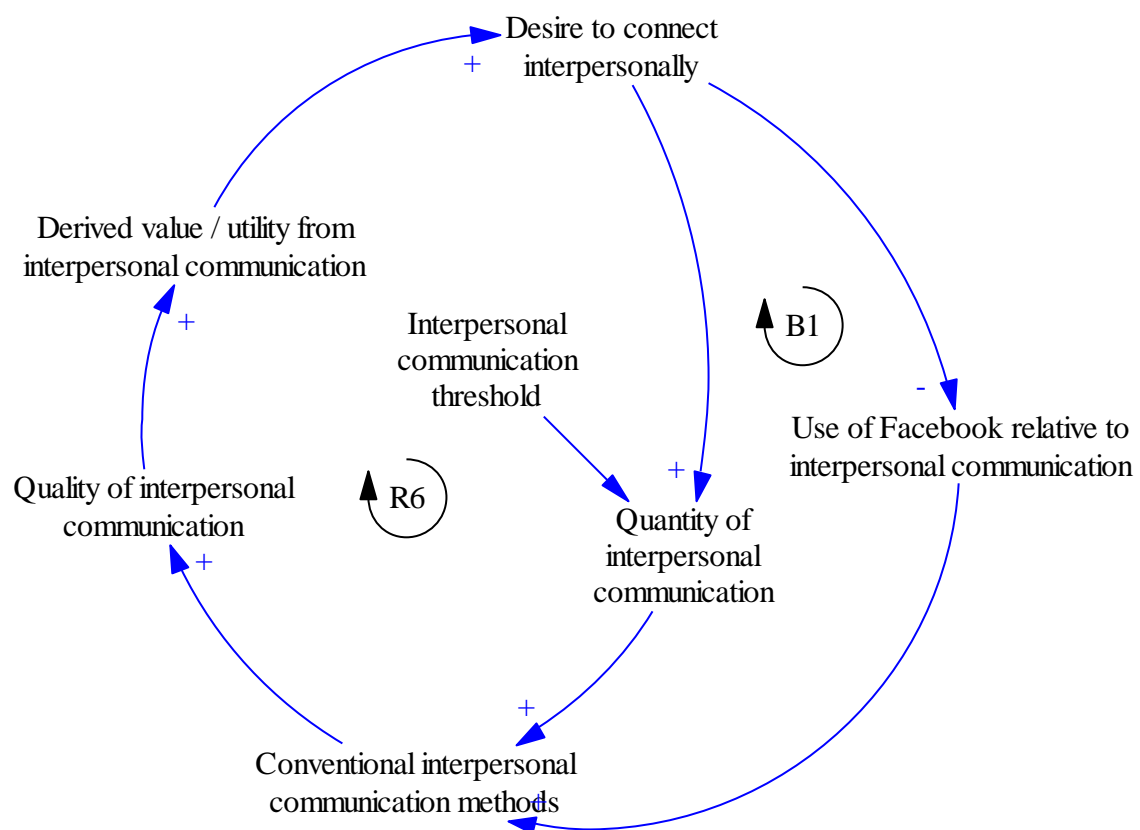

Figure 3: The use of conventional interpersonal communication methods and the quality of interpersonal communication methods

The more an individual employs conventional interpersonal communication methods the greater the quality and the greater the derived value and utility from interpersonal communication; this in turn prompts a greater desire to connect interpersonally as opposed to over Facebook as seen in B1. The more an individual finds interpersonal communication valuable and useful, the less they will use Facebook. R6 shows that an individual who desires

to connect interpersonally will make an effort to do so and thus the quantity of interpersonal connections will be greater. This is monitored or checked by the interpersonal relationship threshold, a range around Dunbar's number of 150 people (Arnaboldi et al., 2013). The quantity of interpersonal communication is positively related to a use of conventional interpersonal communication methods.

4.4 *The use of Facebook relative to interpersonal communication*

Having explored the two main components of the CLD in turn, Figure 4 illustrates their dynamic interaction revolving around the central tension between the use of Facebook and the quality of interpersonal communication. It has been explained how the use of Facebook results in a greater perception of network connection. The more a user feels connected to a network through the use and engagement with Facebook, the less they make use of conventional interpersonal communication methods. The abundance of loose connections fostered by Facebook which enable the increased sharing of information, opinion and influence, negatively impacts the quality of strong interpersonal communication made possible through conventional communication methods.
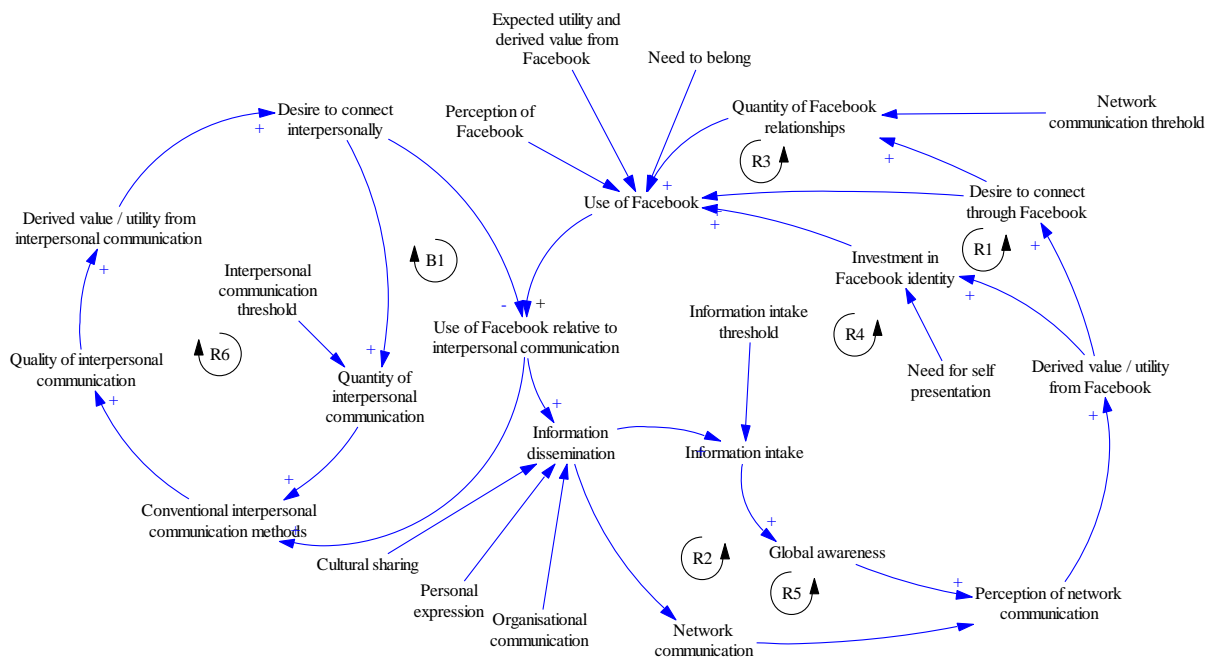

Figure 4: The use of Facebook relative to interpersonal communication

Essentially, Facebook's attraction and the sense of belonging that it brings, reduces the effort people put into interpersonal relationships given their perception of connection informed by the abundance of information shared on Facebook. The users already feel connected to people

so they make less effort to engage in interpersonal communication, which can often be unpredictable and messy as much as it might be rewarding and fruitful. The less people use conventional interpersonal communication methods, the less the quality of their (limited) interactions and the value derived from them. In turn, people feel less of a desire to connect interpersonally if they gain little from these interactions which then prompts more use of Facebook as a means of fulfilling the essential human desire to belong and connect with one another.

The attempt to unpack the causal relationship between the use of Facebook and the quality of interpersonal communication in this paper has illuminated the dynamic process where the more an individual uses Facebook relative to interpersonal communication methods and feels more connected to people across an array of groups and networks, the less they connect directly with people on an interpersonal basis, forfeiting valuable reciprocal intimacy from a (potentially) strong interpersonal relationships. And thus, they turn once again to Facebook as a means of gaining access to groups of people with whom they have loose associations, where they can attain a sense of belonging and connection.

The analysed problem in Figure 4 where, Facebook use competes for time (effort) resources with interpersonal communication can thus be generally represented by success to successful systems archetype (see Figure 5). The success to successful archetype '*relates to situations in which two parties or activities compete for the same limited resources and an even a small advantage results in more resources being allocated to the most successful party or activity, which reinforces the competition*' (Pruyt, 2013).
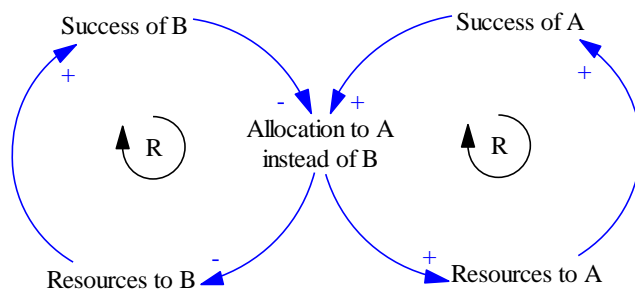

Figure 5: Success to the successful systems archetype

In this case, it is observed that the two activities (Facebook use and interpersonal communication) compete for the same and limited resource of time (effort) that an individual can allocate to these. As observed in the causal loop analysis, derived value (utility) from one of these activity results in more time resource being allocated to the activity that is perceived to yield more value (utility), in the case of our analysis, Facebook use. In this way, the reinforcing loops related to the use of Facebook are dominant. The resulting dynamic behaviour of the two activities and resources allocated to each is sketched in behaviour over time graph presented in Figure 6.
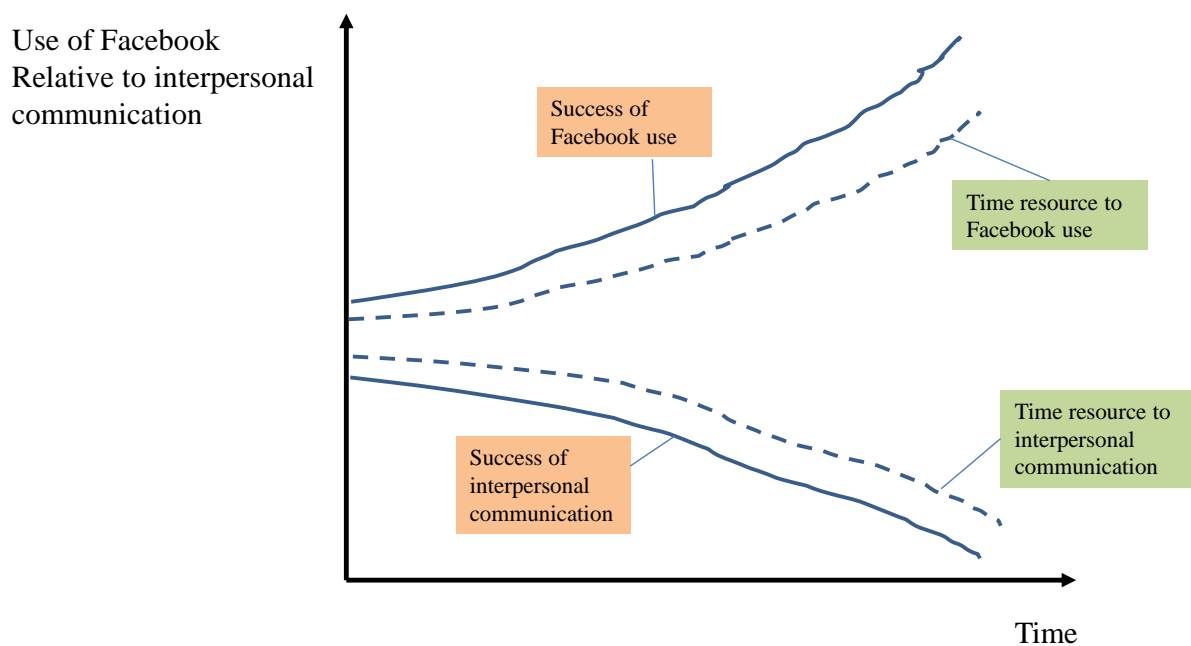

Figure 6: The use of Facebook relative to interpersonal communication

The trap that the success to successful archetype presents is the possibility to displace the weaker activity or individual by possibly allocating all the resources to the successful activity / individual (Meadows, 2008). This raises the question as to whether interpersonal communication will no longer be in existence at one point in time, and if so, what interventions can be made now to address this?

Based on the success to the successeful system archetype, the success or failure of one of the two activities may be due to initial conditions rather than the intrinsic benefits. Some suggested ways of overcoming the system trap include identifying potential success traps that can be kept under control, and identifying goals and objectives that define success. One of the

identified success trap was the network communication threshold and information intake threshold. Hence, even if a Facebook user decides to allocate all the time on Facebook use, there is so much of information that one can absorb, as well as a limited network communication. Facebook users should thus make an effort not to allocate more time on Facebook that will obviously compromise on the conventional interpersonal communication.

Identifying the goals and objectives of the two activities in relation to time resource allocated is more subjective and possibly not within this paper scope, and warrants further investigation. It is however argued that individuals' propensity to communicate should inevitably be shared between engagement on Facebook and interpersonally using conventional interpersonal methods.

5   Conclusions

This paper uses qualitative system dynamics to provide an understanding on the dynamics of Facebook use and quality of interpersonal communication. Using causal loop diagrams, six feedback loops were identified as endogenous in the problem, of which, five are reinforcing loops and one is balancing loop. As a tool for making sense of this particular problem, the causal loop diagrams have shed important insights on how Facebook emerges as a substitute for the connection people lack in their interpersonal relationships. Dealing with this problem, Facebook users are encouraged to not see interactions as tradeoffs, but rather as complementary where the value of respective communication platforms and mediums are recognised. The causal loop diagrams have illustrated the value of Facebook in developing networks of strategic and useful loose connections whilst also the importance of strong interpersonal relationships for personal development and fulfilment. The analysed problem can generally be represented by the success to the successful system archetype. In this case, Facebook users are seen to allocate more time resource in Facebook use hence, compromising the time available for interpersonal communication. Facebook users should make more of an effort to communicate with people using conventional communication methods so as to nurture the emotional intimacy valued in these strong interpersonal relationships. Broadcasting and sharing on Facebook is not a sufficient substitute and has been illustrated to degrade the quality of interpersonal relationships.

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