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Managing users' Privacy, and Rights on Social Networking Sites

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ABSTRACT

The Information Systems literature highlights the asymmetric distribution of power between the users of online platforms and the organizations that collect and use their data. However, the problem of safeguarding users' privacy and rights on such platforms remains unresolved. To address that lacuna, we propose a conceptual design to overcome the challenges of storage, analysis, and integrity associated with stewardship of users' data. We take a *systemic* perspective, shifting from a user-provider relationship to a more *symbiotic* one in which i) users have control over their data, ii) organizations are relieved of the burden of maintaining the data, and iii) the data are not decoupled from information about their provenance and context of origin. We apply our conceptual design to online social networking platforms, to address problems of privacy and identity and pave the path to a richer set of possible applications. We discuss the significance and timeliness of our approach for the management of users' data, and the importance of our findings for future research, as well as for the design of online platforms.

INTRODUCTION

The networked context we live in is characterized by an escalation in the quantity, granularity, and the rate of generation and capture of data, which can reveal intimate information about users'[1], behaviors (such as sleeping or eating habits), preferences, and personality traits. The ability to manage and strategically leverage such data, increasingly becomes a critical determinant of competitive advantage. For the wider socio-economic context, such data is expected to give rise to opportunities for economic and societal value creation, enhance the

[1] Whilst we concur with recent voices within the IS literature supporting that the term 'users' needs to be abolished from our disciplinary ontology (e.g. Marjanovic & Cecez-Kecmanovic, 2017; Markus, 2017), we refer to social actors holding accounts on online platforms in the way they are commonly referred to—as 'users'—in order to align with the relevant literature (e.g. Abbasi *et al*., 2016; Chatterjee & Sarker, 2013).

economy, and create novel business models associated with data trading (Perera *et al*., 2017). Such opportunities entail addressing issues related to the integrity and security of data held, the breach of privacy, transparency of the purpose for which users' data is collected and the use to which it is put, and payments to users in exchange for personal data (Lu *et al*., 2018).

The Information Systems (IS) literature to date has focused on the data management problems of online platforms, viewing one side (the organizations) as 'owning' the problem and the solution, and the other side (the users) as data sources and beneficiaries of the outputs and outcomes of the organizational analysis (e.g. Baesens *et al*., 2016), highlighting the asymmetric distribution of power between the users and the organizations that collect and use their data. Less explored, however, is the problem of safeguarding users' privacy and rights on online platforms. We address that lacuna by articulating a conceptual design (Nunamaker *et al*., 1991), to overcome the challenges of stewardship of users' data, and to enable the development of privacy-focused systems and services. Our work is framed along the lines of established IS work (e.g. Conboy, 2009), and follows a design science approach (Arnott & Pervan, 2012; Chatterjee *et al*., 2009a; 2009b; Gregor & Hevner, 2013; Hevner *et al*., 2004; Mumford, 2003). It uses the principles of separation of concerns (SoC) (Hürsch & Lopes, 1995) and distributed computing (e.g. Crabtree *et al*., 2018) to overcome challenges associated with data storage, analysis, and integrity, whilst enabling users of online platforms to exercise more control over their data. We take a *systemic* perspective, and include both sides in our conceptual design, shifting from a user-provider relationship to a more *symbiotic* one, liberating organizations from maintaining costly infrastructures, and resolving tensions associated with leveraging user data.

We illustrate the utility of our conceptual design in the domain of social networking sites (SNS). We present the results of a survey that we conducted to identify user strategies for managing their privacy on SNS. In light of recent cases of alleged misuse of SNS users' data, we address problems of privacy and identity and open up online social networking to a much richer set of possible interactions and applications, with a finer granularity of user control over personal data.

Our contribution to the growing body of IS literature on Big Data privacy issues (Chatterjee & Sarker, 2013; Chatterjee *et al*., 2009a; 2009b) and systemic problems (Abbasi *et al*., 2016) lies in the motivation and implementation of a conceptual design addressing the challenges related to the handling of data volume, variety, currency, integrity and relevance, without compromising users' rights and privacy (Agarwal & Dhar, 2014; Baesens *et al*., 2016; Goes, 2014).

The rest of this paper is organized as follows: the next section delineates the distinctive features of Big Data, the associated analytical techniques, and the issues in leveraging its potential. This treatment suggests a need to develop an alternative to the centralized approaches to Big Data collection, storage, and analysis. In the following section, we propose a conceptual design to meet that need, and illustrate its merits by applying it in the domain of online social networking. We conclude the paper by discussing the limitations of our design, as well as its implications for organizations, users, and society at large in relation to changing public perceptions and new data protection regulations and reflect on opportunities for further research.

BACKGROUND AND PROBLEM STATEMENT

Users of online platforms are becoming increasingly sensitized to the ways in which their data are being used (Chatterjee & Sarker, 2013; Perera *et al*., 2017), as extending the harvesting of data across different aspects of peoples' daily lives can enable organizations to build an accurate picture articulating individuals' behavior, preferences, and identities (Agarwal & Dhar, 2014; Baesens *et al*., 2016; Goes, 2014). The collection of intimate information about users represents significant ethical challenges, the more wicked of which are concerned with:

- The provenance of data and the need to address the relevance of original contextual information when combining data from diverse sources (Montealegre *et al*., 2014),
- The complexity and contingent nature of socially situated *systems-in-use*, as well as the context-dependent relevance and immediacy of information required (Lycett, 2013),

- The behavioral inferences made, and the ethical and legal issues associated with the processing and use of personal data for purposes that its originators may not have envisaged, given permission for, or even been aware of (Abbasi *et al*., 2016).

Whilst the value proposition of Big Data may be attractive to organizations (Baesens *et al*., 2016; Chen *et al*., 2012), the significant associated ethical questions may fragment the public in troubling ways (Pariser, 2011; Perera *et al*., 2017). Novel models for incentivizing and engaging users, challenge conventional positions on issues such as privacy protection, and make use of gamification (Lowry *et al.*, 2015) as well as monetary or other incentives (Lu *et al*., 2018) to induce users to hand over their data. Organizations can, thus, obtain broad rights over the data they collect by using 'take it or leave it' terms of service (ToS). Consequently, users must agree to their data being used in certain ways by the organization and potentially by others contracting with it. Even when an organization is responsible and offers reasonable ToS, there is always a possibility that it could merge with another company less scrupulous about what it does with user data. The current system, thus, lacks legibility, agency, and negotiability (Mortier et al., 2017; Perera *et al*., 2017), since the users:

- cannot discern the multiple sources their data are collected from, the analysis that is performed on their data, and the consequences of that analysis,
- lack awareness regarding the ways that exist to affect data collection and analysis, and
- are trapped by the imposed features, facing binary accept/reject ToS mechanisms, difficulty of refining decisions, and of correcting data or inferences held about them.

Concurrently, the emergence of data regulations around the world (the prominent ones being Europe's GDPR[2], USA's HIPAA[3], NIST 800-171[4], GLBA[5], FISMA[6], Canada's PIPEDA[7], and Australia's APA[8]), have shifted the discussion and presented organizations that collect users' data with a new reality—one in which user data can become a liability. Consequently, many organizations that collect user data have become sensitive to the issue, especially organizations behind popular SNS, which have suffered from several user-data-related liabilities in the past.

PRIVACY AND RIGHTS ON SOCIAL NETWORKING SITES

The handling of user data raises privacy issues, and the risks of abuse of such data are difficult to quantify (Abbasi *et al*., 2016). The danger posed to users is critical, especially when the users do not understand what happens to their data. The work of Kramer *et al*. (2014), for instance, highlights a more insidious aspect of the acquisition and deployment of Big Data, demonstrating how users' data can be used to manipulate their emotions, and without them knowing that their data are used without their consent. More recently, the alleged misuse of Facebook users' data by Cambridge Analytica[9] illustrates the problem of transitivity of users' data: users trusted their data to Facebook for a specific set of reasons and benefits, but, without their consent or knowledge, their data were passed on to third parties, who allegedly committed the transgressions of exploiting these data for analysis, psychological profiling, targeting change of opinions, and tampering with democratic processes.

[2] https://gdpr-info.eu/

[3] https://www.hhs.gov/hipaa/for-professionals/security/laws-regulations/index.html

[4] http://nvlpubs.nist.gov/nistpubs/SpecialPublications/NIST.SP.800-171.pdf

[5] https://www.ftc.gov/tips-advice/business-center/privacy-and-security/gramm-leach-bliley-act

[6] https://www.congress.gov/bill/113th-congress/senate-bill/2521

[7] https://www.priv.gc.ca/en/privacy-topics/privacy-laws-in-canada/the-personal-information-protection-and-electronic-documents-act-pipeda/pipeda_brief/

[8] https://www.legislation.gov.au/Details/C2019C00025

[9] https://www.theguardian.com/news/series/cambridge-analytica-files

These cases bring to the fore the burden that responsible stewardship of user data imposes on organizations, highlighting the ethical, psychological, legal, economic, as well as political consequences that follow when stewardship of data is compromised, as well as accentuating the need for novel solutions that safeguard the privacy and rights of users on online platforms without stifling the ethical deployment of Big Data in business and society (Xu et al., 2011).

These considerations have led to greater public scrutiny of questionable practices regarding the sharing of users' data with third parties and prompted the organizations behind popular SNS to make promises regarding their safeguarding of users' privacy. Whilst such promises have failed to materialize, they have also failed to address the fact that users' data remain consolidated and stored on the organization side, creating in this way a 'honey-pot' for malicious entities. As a result, the continuous leak of sensitive user data by such entities remains a serious problem for the organizations behind popular SNS.

Concurrently, SNS users seem to have resorted to alternative solutions in order to self-manage their rights and privacy by using multiple identities through which they actively manage their online social interactions. The need of SNS users to incorporate multiple identities also emerges from the fact that they are actors in overlapping networks that extend both online and offline (Angelopoulos & Merali, 2015; 2017), to include their professional life, personal life, family life, or their hobbies and interests. In projecting their public social identity through their SNS interactivity, users present a limited number of their multiple identities at a time, based on the context in which they are situated (boyd, 2010), making these exposures context-dependent. The self-management of users' multiple context-dependent identities implies a process in which users control how others perceive them within a certain setting (Ellison *et al*., 2006; Schwämmlein & Wodzicki, 2012). SNS users may turn to the distinctive affordances and social norms of different SNS platforms to self-manage their identities, and craft contextually specific presentations of self. Consequently, users may choose whether to distribute certain content on certain SNS, possibly influenced by the SNS affordances and the ToS (Zhang & Leung, 2015).

PROPOSED CONCEPTUAL DESIGN

The considerations described in the previous sections provide the motivation for our proposed conceptual design (Figure 1), which embodies a paradigm shift in the way users' data are stored, accessed, and analyzed by organizations.

Data Storage and Access

Instead of storing personal data in costly-to-maintain corporate datacenters distributed around the world and subject to different legal systems, all user-data are stored on the user-side, giving the user full control over who has access to the data and for what purposes. Any type of personal data can be stored on the user-side, such as credit card transactions, medical records, supermarket and other loyalty-card data, as well as data related to their SNS accounts and communication. An organization wanting to conduct analytics over a particular set of attributes can locate those users that allow access to the required set, negotiate access to the specific data needed to conduct analytics directly on the privately held data, and receive back only the results of the required analysis: the data remain on the user-side throughout this chain of events. The advances in distributing computing and federation of personal networks enable the targeting of users that hold specific data for analysis, and such configurations have been successful with prominent examples those of SETI@HOME[10] and Folding@Home[11] projects.

The ownership and possession of data reside with the originators along with the discretion to choose whether to allow access to specific services. This entails a shift in power from the organizations and institutions that make use of that data to the originators of the data. Our proposed approach affords the ability to create multidimensional datasets of known provenance by retaining the originator information and context. It reduces the burden of centralized storage and management by deploying distributed, high granularity storage maintained by the originator.

[10] https://setiathome.berkeley.edu/

[11] https://foldingathome.org/

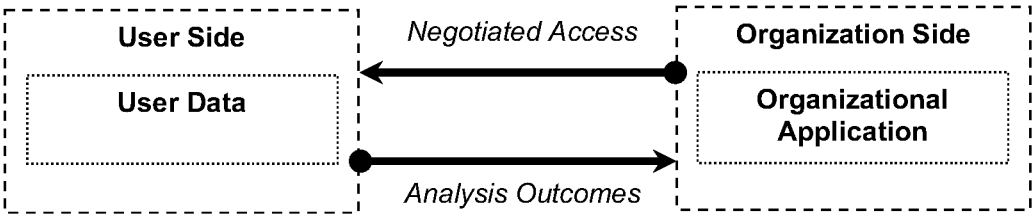

Figure 1: Data storage and access in the proposed conceptual design

Data Analytics

Our proposed conceptual design is fundamentally different to sampling from a population and the selection of representative data (see Figure 2), as it can target users: it can be applied to personalize a service based on the preferences of a user, or for analytics to a whole population. Traditionally, analysts sample data from a population and apply analytical techniques to derive results for the entire population. To deal with Big Data, analysts resort to techniques that enable them to apply computational approaches (Lin *et al.*, 2013). Such techniques entail batching the data in smaller sets based on their nature, or simulate the dataset using its features to create a more manageable one with similar properties, to run analytics on it, expecting results that would be close enough to the results one would have obtained by analyzing the original dataset. Big Data analytics, thus, address entire populations using samples (Junqué de Fortuny *et al.*, 2013).

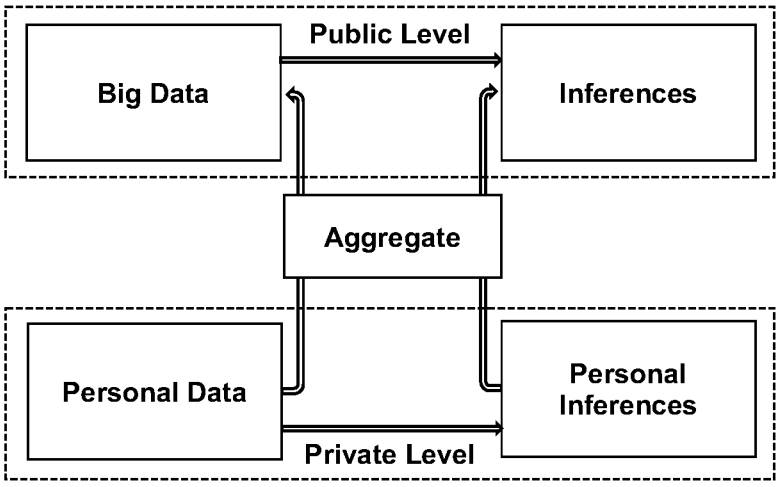

Figure 2: Data analytics in the proposed conceptual design

The fundamental shift has been from an *ontologically* driven paradigm to an *algorithmically* driven one (Chang *et al*., 2014; Kitchin *et al*., 2014): In the traditional approach, the sample selected for analysis is predicated on a frame derived from ontological assumptions about the structure of the world*,* while in the Big Data approach, the selection of representative sample is predicated on the intrinsic *structure of the data*, in an algorithmically determined way. Whilst, therefore, the wealth of a Big Data set is almost never actually used in practice, it carries along burdens related to the maintenance of costly infrastructures that retain it. The proposed design eliminates such a need and provide organizations with a way to target directly specific users.

Our design is predicated on the principle of the SoC, providing a connecting layer over existing services, to enable a common interface for flexible, scalable access to data across a heterogeneous user base. The principle of SoC refers to the delineation of system elements to achieve order and render the complexity of the system manageable, robust, and resilient. It rests on the idea that system elements should have exclusivity of purpose, and there should be no element that shares the responsibilities of another element. Realizing the SoC entails establishing logical or physical constraints delineating a given set of responsibilities such that the result is a system made up of elements of non-repeating sets of cohesive responsibilities. The goal is to establish a well-organized system where each part fulfills a meaningful role, maximizing the ability of the system to adapt to change, resulting in benefits for organizations and users since it reduces the overhead for managing the complexity of the system. In the next section we illustrate the utility of our conceptual design by describing its application on online social networking platforms, where we furnish a mechanism to address problems of privacy and identity and open up online social networking to a richer set of possible applications that can give rise to novel business models in relation to the use of the data, and their storage.

APPLICATION TO SNS

We extend our conceptual design to address online social networking, and more specifically the aforementioned need of SNS users to preserve their privacy and rights. To better understand

these needs, we conducted an online survey, exploring how users behave on the various SNS, how they self-manage their multiple context-dependent identities, how much and what they reveal about their lives on those SNS, and how they overall manage their social networks.

We constructed a questionnaire consisting of 27 items based on the relevant literature (Dholakia *et al*., 2004; Karl & Peluchette, 2011; Kodjamanis & Angelopoulos, 2013; Koh & Kim, 2003; Kuh & McPartland, 1954; Peluchette *et al*., 2013; Wasko & Faraj, 2005; Zhang & Leung, 2015), and by grouping the related questions, we created distinctive attitudinal measures (Appendix II). To maximize validity and minimize bias, a pilot phase preceded the data collection, which included *n=60* participants. The findings of our pilot study show that users tend to use different SNS to address different interests as well as to separate their personal and professional lives, and they tend to use multiple accounts on the same SNS for the same reasons. They tend, however, to use the same account on a specific SNS to contact a specific user, and they also use the same email account to communicate with a specific user. The users tend to post the same information on their accounts on the various SNS, and overall, they are satisfied with the use of multiple accounts on the various SNS to self-manage their multiple context-dependent identities.

The data collection lasted ten days, and overall 324 SNS users participated. All the participants were native English speakers. Out of these participants, 51 did not complete all the questions and were excluded from our analysis. From the remaining 273 participants, 4 refused the privacy statement and were also excluded, leaving a total of 269 participants. Demographic information was collected relating to age group, gender and the highest level of education of the participants. The survey was conducted online and naturally addressed an international audience. As our work is following a design science approach to address a wider need of SNS users, a cross sectional analysis related to the nationality of the participants is beyond the scope of this paper. In Table 1, we present the demographic descriptive statistics of the participants in our survey.

Table 1: Survey participants' demographics

Age Group	N (%)
18-21 years	3 (1.1)
22-25 years	41 (15.2)
26-30 years	70 (26.0)
31-40 years	108 (40.1)
41-50 years	32 (11.9)
51-60 years	14 (5.2)
61-70 years	1 (0.4)
Gender	**N (%)**
Female	97 (36.1)
Male	172 (63.9)
Highest Level of Education	**N (%)**
High school or equivalent	9 (3.3)
Vocational school (2 year)	11 (4.1)
Some college	45 (16.7)
Bachelor's degree	59 (21.9)
Master's degree	94 (34.9)
Doctoral degree	43 (16.0)
Professional degree	6 (2.2)
Other	2 (0.7)

Out of the 269 participants in our study, 251 (93%) report having a Facebook account, 151 (56%) a Twitter account, 177 (65%) a LinkedIn account, and 81 (30%) an account on other SNS. Facebook, Twitter, and LinkedIn are the most prominent SNS, which was also supported by the results of our pilot study. In terms of multiple account holders, 49 participants (18%) report having multiple Facebook accounts, 33 multiple Twitter accounts (12%), 2 multiple LinkedIn accounts (less than 1%), and 10 (approximately 4%) multiple accounts in other SNS, whilst 189 participants (70%) report not having multiple accounts in any SNS. To ascertain the overall effect between the various SNS and the use of multiple accounts, these differences are explored using a 2*5 chi-squared, followed by a *post hoc* examination of standardized adjusted residuals to identify areas which made a significant contribution to the chi-squared results. We use a binary logistic regression between the use of SNS and our attitudinal measures to explore their relation. A chi-squared test reveals differences between the use of single and multiple accounts with specific SNS in this context to be significant ($chil^2=43.53, df=4, p=8.028*10^{-9}$).

Table 2: Spread of multiple account use across SNS and standardized chi2 residuals.

	One Account		Multiple Accounts	
SNS	**n**	**Residual**	**n**	**Residual**
Facebook	202	-1.07	**50**	**2.70***
Twitter	119	-1.08	**33**	**2.72***
LinkedIn	175	1.78	**2**	**-4.49***
Other	14	0.55	0	-1.37

**major contributors to* chi^2 *(absolute value > 2) highlighted in bold*

The results of the analysis of chi-squared standardized residuals reveals that the use of multiple accounts within the same SNS is more common amongst Facebook and Twitter users, and considerably less common amongst the users of other SNS (Table 2).

Table 3: Binary Logistic Regression Analysis of Use of Multiple SNS Accounts

	B	S.E.	Exp(B)	95% C.I. for EXP(B)	
				Lower	Upper
Total number of SNS used	0.39***	0.15	1.47	1.10	1.97
Offline Communication across SNS	0.03	0.05	1.03	0.93	1.13
Breath of use across SNS	0.09*	0.04	1.09	1.01	1.19
Sense of community across SNS	-0.02	0.06	0.98	0.88	1.09
Revelation across SNS	0.04	0.11	1.04	0.84	1.28
Tendency to manage audiences outside of SNS	0.24*	0.12	1.26	1.00	1.60
Tendency to manage audiences inside of SNS	0.01	0.05	1.01	0.91	1.13
General engagement with SNS	0.04	0.06	1.04	0.93	1.16
General satisfaction with SNS	-0.24	0.18	0.79	0.55	1.12
Constant	-3.98	1.05			
Model X2			23.17**		
Nagelkerke R2			0.13		
-2LL			266.96		

Our findings show that participants who tend to use more SNS (Exp[β]=1.47, CI 1.10-1.97), use them for a wider variety of purposes (Exp[β]=1.01, CI 1.01-1.02), and they tend to engage in a higher level of offline audience management (Exp[β]=1.27, CI 1.00-1.60). Our results demonstrate that the total number of accounts on SNS is the strongest predictor of the multiple use of SNS (Table 3), which means that the more SNS a user has at least one account on, the more likely it is for this user to have more than one account on at least one of those SNS.

Table 4: Users of Multiple Accounts (UMA) and Users of Single Accounts (USA)

Dependent Variable	UMA mean	USA mean	Std. Error	Df	F	Sig.	Observed Power
Total number of SNS used	**3.476**	**3.015**	**0.172**	**1 / 262**	**7.175**	**.008***	-
Average Offline Communication across SNS	7.131	6.263	0.508	1 / 262	2.922	.089	.399
Average Breath of Use across SNS	**11.335**	**9.913**	**0.650**	**1 / 262**	**4.789**	**.030***	-
Average Sense of Community across SNS	9.624	9.9624	0.468	1 / 262	0.058	.811	.057
Average Revelation across SNS	**4.254**	**3.802**	**0.226**	**1 / 262**	**3.979**	**.047***	-
Tendency to manage audiences outside of SNS	**9.905**	**9.299**	**0.195**	**1 / 262**	**6.688**	**.010***	-
Tendency to manage audiences inside of SNS	9.905	9.299	0.442	1 / 262	1.880	.172	.277
General engagement with SNS	9.688	8.967	0.487	1 / 262	2.188	.140	.314
General satisfaction with SNS	3.818	3.720	0.134	1 / 262	0.539	.463	.113
Satisfaction with interaction with contacts in SNS	3.800	3.865	0.141	1 / 262	0.210	.647	.074

**Significant effects at p<0.05 highlighted in bold*

Our analysis reveals some differences regarding the information sharing patterns of users on the various SNS. In terms of the total information revelation, a repeated measure MANOVA using Wilks' Lambda reveals significant and large effect amongst the various SNS *(F=32.009, Hyp df=3, Error df=83, p=1.76*10^{-13}, Eta^2=0.536*). Moreover, we identify that there is considerable variation in the type of information shared by users on each SNS (Table 2). A chi-squared analysis demonstrates that these differences are statistically significant (chi^2=330.12, df=27, p=6.87*10-54), and an examination of the standardized residuals reveals those effects that have contributed considerably to the chi-square results. To explore the differences in attitudes between the users holding multiple accounts and single accounts, we performed an independent subject MANOVA including the type of SNS user as the independent variable and the attitudinal measures as the dependent variables. The multivariate test was significant (λ=0.913, F=2.415, Hyp df=10, Error df=253, sig=0.009), and *post hoc* testing using Sidak correction for multiple tests shows that the participants in our study holding multiple accounts within the same SNS tend to have accounts on more SNS, which they also tend to use for a wider breadth of activities, they reveal more information about themselves, and they are more likely to engage in audience management activities when not using online SNS (Table 4).

Based on the findings of our survey, we can conclude that the existing SNS platforms are limited in their capacity to deal with the complex users' needs for two reasons: i) they are use-specific and have been designed for a limited scope, and ii) the ToS prohibit the use of multiple accounts, and so, to express multiple identities, users have to create accounts on multiple SNS.

Consequently, the inherent weakness of the dominant SNS is that they try to impose a one-size-fits-all approach on social interactivity to satisfy some of the needs of many users. Users, however, can have multiple identities through which they actively manage their social interactions. Often such identities are pseudonymous, and users could suffer embarrassment or worse if these identities were publicly linked. The importance of controlling privacy and the ability to choose distinct levels of exposure for different combinations of data, social contexts, and SNS platform properties is reflected in the strategies deployed by our participants. The reasons why users choose to manage the overlap of their social networks, even keeping some networks completely distinct from others, are completely normal and not in the least clandestine. Attempts to support this richness via access-control mechanisms have been proved largely inadequate, as our findings support. Whilst users understand how these mechanisms work, the cognitive effort required can result in their mis- or non-use. Furthermore, collating one's social interactions and data into a single service gives rise to security risks such as identity theft.

ARCHITECTURE FOR APPLICATION ON SNS

Based on the findings of our survey and the proposed design, we architect a structure that enables SNS users to interact in a timeline style, while providing cues for effective automated processing. Our approach (Figure 3) is based on the SoC and is built on three independent layers: a shim, a storage, and a processing layer. With interoperability in mind, our design works in the same way an email client would do on any device and operating system and aggregates the users' SNS activity on a single interface through the secure use of communication protocols.

The approach is presented schematically in Figure 3, where 'Data Source' represents the various SNS from which the application reads/writes updates to the 'Shim Layer' that ensures

compatibility of the ongoing updating of the various SNS application programming interfaces (API). Then the data are stored in the 'Storage Layer', which is responsible for the redundancy of the system and resides on the users' side as predicated by our conceptual design (Figure 1). The 'Processors' are responsible for the *intelligence* of the application and transform the data with small, agent-like applications before the information arrives at the user through the client.

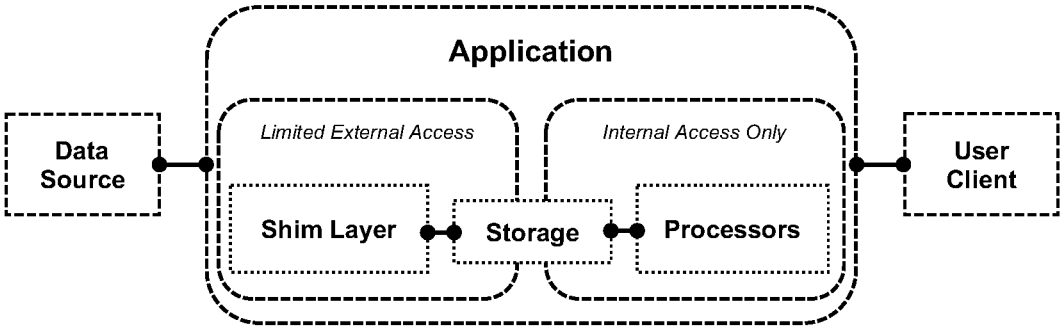

Figure 3. Architecture for application on SNS

Shim Layer: Following the principles of SoC in our architecture, we incorporate a shim layer to provide code extensibility and prevent code duplication, which can result to lower deployment costs and less maintenance. The shim layer in our architecture acts as a compatibility layer that resolves issues that may arise during the development of newer versions of applications or to execute applications on software platforms for which they were not originally designed. The shim layer is responsible for connecting with the existing SNS to read and write data. In principal, this means aggregating data from multiple SNS into a common storage format and acting as a distribution channel for their transmission. Moreover, the shim layer is responsible for the collection of special data, such as the ToS of each SNS, to be used by the processing layers. The Shim layer, thus, in our architecture as is responsible for the communication with the SNS, and the translation of all data in a unified way to be used by the other two layers.

Storage Layer: Storage of the data and its redundancy through replication is a significant element of the system since everything is stored and replicated on the user side, as dictated by our design. Data replication involves the sharing of information to ensure consistency between redundant resources, to improve the reliability and fault-tolerance of the system, as well as data

accessibility. The storage layer is a distributed repository for data collected by the shim layer and acts as an intermediary for client applications to communicate with, obviating the need for clients to communicate directly with SNS. Such a combination enhances the overall resilience of the system by providing a layer that transparently ensures the redundancy and efficacy of the overall system use. The storage layer enables it to operate both in real-time, getting data from the Shim layer and feeding them to the processing layer, as well as by storing data for future use, based on the user preferences. Special data, thus, can be saved and be updated when needed instead of being retrieved on every communication. Moreover, data regarding past communication can be stored for use by the processing layers to optimize communication.

Processing Layer: The processing layer is an input and output pipe: data flowing through this layer is scanned and optionally transformed by *processors*, which are small, agent-like applications. The processing layer in our architecture is pluggable with published APIs, enabling third-party developers to extend and experiment with the platform. The proposed processors represent the element of *intelligence* in our design, enabling greater control over the appearance and presentation of content to specific users and on specific SNS.

Processors: Based on the findings of our survey, our proposed architecture has two processors. The first processor is an adaptive filter for message reception. It is common for people to have accounts on different SNS, and to have overlapping groups of contacts on them. It is also common to send the same message through different SNS. Typically, this means that a user can receive the same message multiple times. An adaptive filter detects duplicate messages from diverse sources and filters them out so that the receiver gets the message once. Similarly, if a user sends a message targeted at a specific user or group of users, an adaptive filter could potentially send the message through the SNS in which the recipient is most likely to respond on. The processor can conduct real-time social network analytics based on past communication at the user-level and use the results to identify the optimal channel that a message should be sent through to the recipient in order to be seen and be responded to faster.

The second processor protects users from the consequences of posting copyrightable content onto the various SNS. To do this, the ToS of the SNS specify that the user must transfer some rights of the media file used to the service. Whilst this may be acceptable for a lot of users, there are also a lot of situations under which transferring some rights to the service may not be acceptable. To address this, we propose an intermediate processor through which users can specify which rights they are happy to share, and which they do not wish to share with the SNS; the intermediate processor identifies instances in which collisions occur and warns the users.

The application of our proposed architecture on SNS can be enhanced by more pluggable processors in the processing layer based on specific user needs, providing in this way the element of intelligence in our architecture, and enabling third-party developers to extend and experiment with the proposed platform, as it is built on open standards for this purpose.

Communication between the proposed architecture and the existing SNS

For the communication of the architecture with the current and future SNS, we propose the use of existing secure communication protocols for email exchange. Similar to the self-management of multiple context-dependent online identities, users commonly make use of multiple email addresses to distinguish personal and professional communication, and in many cases, this is imposed on them. For instance, users might have their personal email address that provides them with ease of use as well as longevity, and their corporate or university email address for their professional communication. The point at which these identities exist together should be within the user-clients in the private context of user mobile devices and personal computers.

Mail servers make use of two sets of protocols for sending and receiving email messages over the Internet. For sending messages, most email software uses the simple mail transfer protocol (SMTP), which is a set of communication guidelines that allow applications to send emails. There are two protocols that are used for retrieving and storing email: the post office protocol 3 (POP3) and the Internet message access protocol (IMAP), which enables users to synchronize emails across multiple devices, a feature extremely important today, when most people use at

least two devices to access emails. While proprietary email systems and cloud-based webmail providers use their own non-standard protocols, they all use SMTP and IMAP when sending or receiving emails from outside their systems. The distribution and access protocols of SMTP and IMAP allow us to use existing services for the transmission and storage of information. Concurrently, the multi-purpose Internet mail extensions (MIME) allows the exchange of almost any type of data along with metadata relating to addressing and provenance, and is understood by a wide range of clients, allowing us to experiment with the storage of SNS message types as MIME while reusing existing software for the display of SNS content. Using MIME as a storage mechanism allows the display of messages without requiring changes to the underlying format, enabling us to support multi-party encryption of content across a range of SNS.

Such an approach can provide transport-independent and flexible—but standardized—support for asymmetric encryption for per-service, per-user authentication and privacy, while addressing format standardization. The linking of users' multiple identities is performed on the user-side and relies on information received out-of-band to indicate that the different identities belong to the same user. In cases where identities refer to multiple distinct pods, they could be completely opaque, having semantic meaning for those who already know how to resolve them. This enables asymmetric communication through simple key management APIs, and services might also support authentication of message exchange, with trusted clients able to interpret incoming messages, becoming trusted through out-of-band mechanisms or face-to-face interaction.

DISCUSSION

The proposed conceptual design redresses the extant asymmetries in the balance of power between users and service providers, by being configured to be *open,* and self-hosted on the user-side. It thus enables service providers to have lightweight and agile applications, tailored to be relevant to real-time individual contexts, able to run on the user-side, and only return the results of the analysis (Figure 1). Each application installed on the user-side for a service provider also generates data in the form of analysis results that can be stored and used as input

by the applications of other providers, and thus, the consumption of data on the user-side leads to the production of new data about the user, which always remain stored on the user-side.

As shown by our survey participants, the limitations of online platforms have compelled users to develop complicated and cumbersome strategies in order to manage their identities and privacy. In the literature and popular media, the discussion about users' privacy and rights is becoming increasingly relevant and heated, due to the consequences that follow when stewardship of users' data is compromised, and there have been many attempts to provide solutions to this problem (Perera *et al*., 2017). To date, however, most of such proposed solutions are software-based and cloud-hosted, leading to another set of problems related to the security, performance, and interactivity of the data (Mortier *et al*., 2016). However, that said, such software-based solutions can run as processors in the proposed conceptual design we describe here, minimizing in this way the limitations they present for users' privacy and rights.

Implications

Our work is timely and important in contributing towards resolving the privacy and provenance issues highlighted in the recent IS research agenda on Big Data (Abbasi *et al*., 2016; Chatterjee & Sarker, 2013; Chatterjee *et al*., 2009a; 2009b). The proposal that data are stored on the user-side enables control over who has access to the data and for what purposes, allowing users to regain privacy and rights over both their data and their lives. The proposed design enables organizations to provide applications relevant to real-time individual contexts, enabling novel business practices associated with the strategies for storage and use of the data, and spawning business models leveraging the affordances of the user-based server. For instance, the option to use the results of analysis from the application of a service provider as input for the application of another, can give rise to communities of developers that will be able to provide context for the input of their applications, with the user always able to define the level of access that such applications would have to their data. A change in the paradigm of the "instrumental" ways that

users' data are stored and accessed (Chang *et al*., 2014; Kitchin *et al*., 2014) may act as a catalyst to "change the entire social theory that goes with them" (Latour, 2009, p. 155).

Our design provides integrated filtering of communication so that each message that is distributed through the various SNS is received once by an end user. At present, it is common to receive the same status update from the same person through multiple channels as many users choose to link their various SNS accounts for convenience and post the same content on all of them, and because a recipient may choose to "follow" a message sender through multiple channels. The standardization across alternate transport-layer names and content metadata that a social inter-network layer provides makes it far easier to create clients that can intelligently manage content presented across multiple transports, and to filter based on content or on transport, or on a combination of these two. Moreover, our design can provide intelligent sharing lists, as it is common for users to distribute content to multiple recipients, and different transports provide different mechanisms for doing so. Given the frailty of human memory, it can be difficult to recall exactly which contacts a given piece of content would be relevant to. There are many cases, however, where exercising control in this regard is extremely valuable: family members may not be interested in seeing updates concerning hobbies; it can become embarrassing to share family-specific photos with work colleagues, and it may be career limiting to allow one's manager to see what they did last weekend. Our approach enables an intelligent design, aware of the distribution properties of the various SNS while coalescing the multiple identities that users have. This allows for suggestions concerning who should receive a message, based on its content and the inferred interests of users, as well as the properties of the transports available to reach the recipient, and inferred knowledge about which contacts should not receive it.

Implications can also be distilled from the results of our survey. The findings of our survey demonstrate that it is necessary to revisit the way that we design SNS, to provide users with better ways to self-manage their multiple context-dependent online identities. This would enable greater flexibility, creativity, and utility in the exploitation of users' social networks and provide them with control over such exploitation. The self-management of multiple context-dependent online identities is still an issue to be pursued by both academia and the industry, and there is

a profound need for better tools to be implemented either by the SNS or by third-parties that will take up the challenge of implementing new tools tailored to the identified needs of SNS users, since the tools that are already available and provided by the SNS for the self-management of multiple context-dependent online identities are insufficient and often neglected by the users.

Limitations and future research

Our design is faced with limitations arising from real-world difficulties, concerning SNS users as well as service providers. The main limitation is that it requires users to take responsibility for their data. This is an optimistic endeavor since users tend to resist changes of this nature (Brown *et al*., 2002; Lapointe & Rivard, 2005; Sykes *et al*., 2014; Venkatesh *et al.*, 2003). Such a limitation, however, can give rise to novel business opportunities that will provide user-side data storage, and redundancy solutions. Moreover, such a need can inspire the open source community to come up with innovative, secure, reliable, and cost-effective related applications. Future research should investigate the possibilities for adoption of such a design by users and explore their willingness to take responsibility for their data in order to regain their privacy.

A second limitation arises from within the application of our design on SNS. The central focus of SNS is the message (e.g. text, picture, video), that is, some data conveyed by the network from the originating user to a defined list of users. Each SNS uses different message structures: in some cases, a message might be plain text or an image; in others, a message might have a rich structure, with extensive metadata in addition to the raw content. A critical part of the proposed approach, thus, is to implement the mapping of the SNS message structures. Whilst this is part of the design of our approach to ensure interoperability, it does represent a limitation. There is, however, an underlying flexibility to our approach which is valuable: if the initially chosen mapping proves to be unsuitable in some way, it is a simple matter for those concerned to create another mapping, and even for multiple mappings to be operational in parallel. The flexibility engendered by avoiding “locking in” the system to a single ontology that attempts to describe all formats and uses of data allows the system to be flexible and to respond to changes

in context and demand, enabling it to be continually updated and extended to support new uses. To this end, we encourage future research to extend the proposed conceptual design by mapping existing SNS message structures and evaluate its usability (e.g. Lowry *et al*., 2009).

A third limitation arises from the ease of adoption by the existing SNS, which tend to generate revenue through targeted advertising based on users' data. Our design could be perceived as a barrier, as it could negate the provision of user data to the SNS, and thus, the generation of revenue. However, there is growing advocacy and public pressure for users' privacy and rights to be protected, and our approach addresses such concerns. Whilst our proposed design might not be explicitly implemented by organizations for the above reasons, it can inspire novel business endeavors using the various APIs for implementation from third-parties. In this study, we follow a design science approach and propose a conceptual design, however, future research could incorporate a canonical action research (Davison *et al*., 2004; 2012) perspective, or an action design research (Sein *et al*., 2011) perspective to investigate the topic within an SNS organization and implement a design that could overcome such a limitation.

CONCLUSIONS

We focus on the challenges and issues associated with Big Data and propose a conceptual design that uses the principles of SoC and Distributed Computing to overcome many of the challenges associated with storage, analysis, and integrity that are directly linked to users' privacy and rights. We address the issue of asymmetrical distribution of power between the originators of data and the organizations that make use of that data, by taking a systemic perspective to include both sides in our design, shifting from a user-provider relationship to a more symbiotic one in which control over access to user data resides with the user. The benefits of our design for organizations using the data include being liberated from the burden of maintaining and updating large centralized data stores and having access to relevant high granularity data from the entire distributed population of user-held data, which are not decoupled from their context of origin. We also illustrate the affordances of the proposed design by

describing its application in the domain of SNS, where we furnish a mechanism to address problems of privacy, and identity and create the potential to open up online social networking to a much richer set of possible applications, referring also to the limitations that it presents.

Our study is timely and important for both IS research and practice and contributes to the broader IS literature as a design study that leads to the development of a novel architecture. Going forward, there are two directions for future research emerging from our study. The first is to evaluate the conceptual design we propose and compare it to the existing models in use by most service providers that exploit user data. The second is to apply our conceptual design to domains other than SNS and to see applications in more conventional domains such as healthcare, banking, commerce, energy use, and governance. The approach we propose enables greater flexibility, creativity, and utility in the exploitation of online social networks while providing users with greater control over such exploitation. We believe that by doing so, we can open up online social networking to richer application development and enables the same kind of explosion in the use of user data that the Internet sparked with computer networking.

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APPENDIX I

QUESTIONNAIRE

1. In which Social Networking Sites (SNS) do you have an account?

	Facebook	Twitter	LinkedIn	Other	None
I have an account on:	❑	❑	❑	❑	❑

2. In which SNS do you have multiple accounts?

	Facebook	Twitter	LinkedIn	Other	None
I have multiple accounts on:	❑	❑	❑	❑	❑

3. To what extent has the use of multiple accounts met your expectations on the reasons that led you to create more than one account?

	Far short of expectations	Short of expectations	Equals expectations	Exceeds expectations	Far exceeds expectations
Facebook	❍	❍	❍	❍	❍
Twitter	❍	❍	❍	❍	❍
LinkedIn	❍	❍	❍	❍	❍
Other	❍	❍	❍	❍	❍

4. How do you use your accounts on the various SNS? (The question refers to the use of individual accounts on the various SNS)

	Never	Rarely	Sometimes	Often	All the time
I use different SNS to address different interests	❍	❍	❍	❍	❍
I use different SNS to separate personal / professional life	❍	❍	❍	❍	❍
I communicate with the same contacts using the same SNS	❍	❍	❍	❍	❍
I post the same information on all my SNS	❍	❍	❍	❍	❍
I have created categories of friends on Facebook	❍	❍	❍	❍	❍
I have created list of people I follow on Twitter	❍	❍	❍	❍	❍

5. In the case that you have more than one account in at least one SNS, how do you use your accounts
(The question refers to the use of multiple accounts on the same SNS)

	Never	Rarely	Sometimes	Often	All the time
I use different accounts to address different interests	❍	❍	❍	❍	❍
I use different accounts to separate personal / professional life	❍	❍	❍	❍	❍
I use a single account to communicate with my contacts from a certain SNS	❍	❍	❍	❍	❍
I post the same information on all my different accounts on an SNS	❍	❍	❍	❍	❍

6. How much information do you provide on your [SNS Name] profile(s)? (repeat question for every SNS the participant has an account on)

	Yes	No
Do you allow everyone to view your profile(s)?	❍	❍
Do you include a picture of yourself on your profile(s)?	❍	❍
Do you include your e-mail address on your profile(s)?	❍	❍
Do you include your instant messenger address(es) on your profiles(s)?	❍	❍
Do you include your phone number(s) on your profile(s)?	❍	❍
Do you include your home address on your profile(s)?	❍	❍
Do you include information about your interests on your profile(s)?	❍	❍
Do you include information about your personality on your profile(s)?	❍	❍
Do you spend time personalizing your profile page(s)?	❍	❍
Do you use your real name on your profile page(s)?	❍	❍

7. How often do you use [SNS Name] to satisfy the following needs? (repeat question for every SNS the participant has an account on)

	Never	Rarely	Sometimes	Often	All the time
To stay in touch with friends / family	❍	❍	❍	❍	❍
To stay in touch with colleagues	❍	❍	❍	❍	❍
To contribute / get information	❍	❍	❍	❍	❍
To impress friends / family	❍	❍	❍	❍	❍
To impress colleagues	❍	❍	❍	❍	❍
To search for jobs	❍	❍	❍	❍	❍
To share pictures	❍	❍	❍	❍	❍
To play / relax	❍	❍	❍	❍	❍

8. I am pleased with my experience on:

	Very Displeased	Displeased	Somewhat Displeased	Neutral	Somewhat Pleased	Pleased	Very Pleased
Facebook	❍	❍	❍	❍	❍	❍	❍
Twitter	❍	❍	❍	❍	❍	❍	❍
LinkedIn	❍	❍	❍	❍	❍	❍	❍
Other	❍	❍	❍	❍	❍	❍	❍

9. I am pleased to interact with my contacts on:

	Very Displeased	Displeased	Somewhat Displeased	Neutral	Somewhat Pleased	Pleased	Very Pleased
Facebook	❍	❍	❍	❍	❍	❍	❍
Twitter	❍	❍	❍	❍	❍	❍	❍
LinkedIn	❍	❍	❍	❍	❍	❍	❍
Other	❍	❍	❍	❍	❍	❍	❍

10. I participate actively on:

	Never	Rarely	Sometimes	Most of the time	Always
Facebook	❍	❍	❍	❍	❍
Twitter	❍	❍	❍	❍	❍
LinkedIn	❍	❍	❍	❍	❍
Other	❍	❍	❍	❍	❍

11. I reply to my contacts who need help on:

	Never	Rarely	Sometimes	Most of the time	Always
Facebook	❍	❍	❍	❍	❍
Twitter	❍	❍	❍	❍	❍
LinkedIn	❍	❍	❍	❍	❍
Other	❍	❍	❍	❍	❍

12. Think about your interactions with your contacts in each SNS, and indicate whether your contacts know how you define yourself

	Very Unlikely	Unlikely	Undecided	Likely	Very Likely
Facebook	❍	❍	❍	❍	❍
Twitter	❍	❍	❍	❍	❍
LinkedIn	❍	❍	❍	❍	❍
Other	❍	❍	❍	❍	❍

13. Do you pay attention to the online/offline status of your contacts?

	Never	Rarely	Sometimes	Often	All the time
I am usually aware of who are logged on online	❍	❍	❍	❍	❍
I pay attention to my contacts' online/offline status	❍	❍	❍	❍	❍

14. How much do you agree with the following statements regarding [SNS Name]? (repeat question for every SNS the participant has an account on)

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
There is a sense of human contact	❍	❍	❍	❍	❍
There is a sense of personalness	❍	❍	❍	❍	❍
There is a sense of sociability	❍	❍	❍	❍	❍
There is a sense of human warmth	❍	❍	❍	❍	❍
There is a sense of human sensitivity	❍	❍	❍	❍	❍

15. Do you chat with your contacts?

	Never	Rarely	Sometimes	Often	All the time
I use Google Hangout to chat with my contacts	❍	❍	❍	❍	❍
I use Facebook messenger to chat with my contacts	❍	❍	❍	❍	❍
I use whatsapp to chat with my contacts	❍	❍	❍	❍	❍
I use another application to chat with my contacts	❍	❍	❍	❍	❍

16. Do you call your contacts from this SNS on the phone?

	Never	Rarely	Sometimes	Often	All the time
Facebook	❍	❍	❍	❍	❍
Twitter	❍	❍	❍	❍	❍
LinkedIn	❍	❍	❍	❍	❍
Other	❍	❍	❍	❍	❍

17. Do you meet your contacts from this SNS in offline settings?

	Never	Rarely	Sometimes	Often	All the time
Facebook	❍	❍	❍	❍	❍
Twitter	❍	❍	❍	❍	❍
LinkedIn	❍	❍	❍	❍	❍
Other	❍	❍	❍	❍	❍

18. Do you exchange SMS messages with your contacts from this SNS?

	Never	Rarely	Sometimes	Often	All the time
Facebook	❍	❍	❍	❍	❍
Twitter	❍	❍	❍	❍	❍
LinkedIn	❍	❍	❍	❍	❍
Other	❍	❍	❍	❍	❍

19. Do you exchange e-mails with your contacts from this SNS?

	Never	Rarely	Sometimes	Often	All the time
Facebook	❍	❍	❍	❍	❍
Twitter	❍	❍	❍	❍	❍
LinkedIn	❍	❍	❍	❍	❍
Other	❍	❍	❍	❍	❍

20. Do you use Skype (or any other VoIP service) to communicate with your contacts from this SNS?

	Never	Rarely	Sometimes	Often	All the time
Facebook	❍	❍	❍	❍	❍
Twitter	❍	❍	❍	❍	❍
LinkedIn	❍	❍	❍	❍	❍
Other	❍	❍	❍	❍	❍

21. How do you use your email and phone to communicate with your contacts?

	Yes	No
I have more than one email account	❍	❍
I use different email accounts to address different interests	❍	❍
I always use the same email account to communicate with certain contacts	❍	❍
I have more than one phone number	❍	❍
I use different phone numbers to address different interests	❍	❍
I always use the same phone number to communicate with certain contacts	❍	❍

22. What is your gender?
- ❍ Male
- ❍ Female
- ❍ Other
- ❍ Prefer not to say

23. What is your age group?
- ❍ 18-21
- ❍ 22-25
- ❍ 26-30
- ❍ 31-40
- ❍ 41-50
- ❍ 51-60
- ❍ 61-70
- ❍ 71+

24. What is the highest level of education you have completed?
- ❍ Less than High School
- ❍ High school or equivalent
- ❍ Vocational/technical school (2 year)
- ❍ Some college
- ❍ Bachelor's degree
- ❍ Master's degree
- ❍ Doctoral degree
- ❍ Professional degree (MD, JD, etc.)
- ❍ Other

25. What is your type of employment?
- ❍ Full Time
- ❍ Part Time
- ❍ Self Employed
- ❍ Student
- ❍ Unemployed

26. The organization you work for is in which of the following:
- ❍ Public sector
- ❍ Private sector
- ❍ Not-for-profit
- ❍ Education
- ❍ Don't know
- ❍ Other

27. Which of the following best describes your role in the industry?
- ❍ Upper management
- ❍ Middle management
- ❍ Junior management
- ❍ Administrative staff
- ❍ Support staff
- ❍ Student
- ❍ Trained professional
- ❍ Skilled laborer
- ❍ Consultant
- ❍ Temporary employee
- ❍ Researcher
- ❍ Self-employed
- ❍ Other

APPENDIX II

ATTITUDINAL MEASURES

Table 5: Attitudinal measures and questions from the questionnaire

Attitudinal Measure	Questions
Offline Communication across SNS (Koh & Kim, 2003)	Do you chat with your contacts? Do you call your contacts from this SNS on the phone? Do you meet your contacts from this SNS in offline settings? Do you exchange SMS messages with your contacts from this SNS? Do you exchange e-mails with your contacts from this SNS? Do you use VoIP to communicate with your contacts from this SNS?
Breath of use across SNS (Dholakia *et al*. 2004, Kodjamanis & Angelopoulos, 2013)	How often do you use (SNS list) to satisfy the following needs? o To contribute / get information o To stay in touch with friends / family o To stay in touch with colleagues o To impress friends / family o To impress colleagues o To play / relax o To search for jobs o To share pictures
Sense of community across SNS (Gefen & Straub, 2004)	There is a sense of human contact (SNS list) There is a sense of personalness (SNS list) There is a sense of sociability (SNS list) There is a sense of human warmth (SNS list) There is a sense of human sensitivity (SNS list)
Revelation across SNS (Duffy & Shaw, 2000)	Do you include your phone number(s) on your profile(s)? Do you include your home address on your profile(s)? Do you include information about your interests on your profile(s)? Do you include information about your personality on your profile(s)? Do you spend time personalizing your profile page(s)? Do you use your real name on your profile page(s)? Do you allow everyone to view your profile(s)?
Tendency to manage audiences outside of SNS (Koh & Kim, 2003)	I have more than one email account I use different email accounts to address different interests I use the same email account to communicate with certain contacts I have more than one phone number I use different phone numbers to address different interests I use the same phone number to communicate with certain contacts
Tendency to manage audiences inside of SNS (Koh & Kim, 2003)	I use different accounts to address different interests I use different accounts to separate personal / professional I use a single account to communicate with contacts from a certain SNS I post the same information on all my different accounts on an SNS
General engagement with SNS (Koh & Kim, 2003, Wasko & Faraj, 2005)	I participate actively on (SNS list) I reply to my contacts who need help on (SNS list) I am pleased to interact with my contacts on (SNS list)
General satisfaction with SNS (Duffy *et al*., 2000)	I am pleased with my experience on (SNS list)

Response Table

Referral	Comment	Response
R 1.1	The author(s) appear to have had multiple ideas in mind. I recommend that they stand back from the present draft and ask themselves what they're really trying to do, then narrow their focus to a specific topic. One way to start this would be to strip the Introduction back to the bare essentials by removing the multiple repetitions.	We thank R1 for this comment, which was one of the most valuable of this review process, as it sparked the reshaping of the whole paper. As advised by R1 in this comment, we did strip the introduction back to the bare essentials and we believe that it is now appropriately focused and refined, while the paper's aim is now focused on proposing a conceptual design to overcome the challenges of storage, analysis, and integrity associated with stewardship of users' data on SNS.
R 1.2	The work would benefit from explicit discussion of appropriate research methods for fulfilling the authors' purpose.	This comment was also very helpful as it identified a missing opportunity for our paper, and we would like to thank R1 for this. Our work is framed along the lines of established IS work (e.g. Conboy, 2009), and follows a design science approach (Arnott & Pervan, 2012; Chatterjee *et al*., 2009a; 2009b; Gregor & Hevner, 2013; Hevner *et al*., 2004; Mumford, 2003), which as R2 notices, is appropriately chosen and conducted. This comment, however, allowed us to reshape the suggestions for future research in our conclusions section, which will hopefully open up the topic in the IS field for researchers who would like to take up the challenge of incorporating a canonical action research (Davison *et al*., 2004; 2012) perspective, or an action design research (Sein *et al*., 2011) perspective to investigate the topic within SNS organizations.

R 1.3	The Background and Problem Statement on pp.3-6 would benefit from proper consideration of privacy literature, both in IS and in policy journals. The motivation to address consumers' interest as well as those of business enterprises is good, but it needs depth of insight that has to date been missing from the IS literature. At the end of that section, it remains unclear what practices the authors consider are and are not ethical and are not legal. It seems to me to be problematical not to contrast the permissive regulatory context in the USA with the more balanced context in Europe - particularly since the GDPR came into force earlier this year - and to omit consideration of whether the GDPR will have significant impacts on existing SNS, both within Europe and beyond it. The paper would also benefit from consideration of prior attempts in the same space. There have been multiple attempts to establish consumer-oriented social media, using alternative business models and alternative architectures.	This comment provided us with the opportunity to make clearer the aim of our work, and for this we thank R1. Privacy issues are the implication of the mass collection and exploitation of users' data, and we specifically deal with the root of the problem in this paper, which also extends in providing implications for the better management of users' privacy and rights. We did find particularly useful the idea to refer in our Background and Problem Statement section to the emergence of data regulations around the world, which provided a solid motivation for our work, since they have shifted the discussion and presented organizations that collect users' data with a new reality—one in which user data can become a liability. When it comes to prior attempts to establish consumer-oriented social media, using alternative business models and alternative architectures, our design is meant to address the issues in the existing SNS and not to be used for the implementation of a new one like diaspora or mastodon. Given the reshaping of the whole paper based on the comments of both reviewers we felt that such an addition would be out of topic in the current version, however if the reviewers think that such a discussion needs to be included in the paper, we are happy to do so in the next revision, given the opportunity.
R 1.4	The Proposed Conceptual Design on pp.6-10 is problematical in several ways. Firstly, with the substantial shift in consumer computing away from software products and data on consumers' own devices, to cloud-based services, it is far from clear that data can be readily migrated back again. Secondly, the scheme doesn't deny SNS providers access to consumers' data. It merely creates an additional channel whereby third parties can gain	We would like to thank R1 for providing us with the opportunity to explain further the proposed conceptual design and deal with any misinterpretations. As we explain in the limitations section, the implementation of the proposed conceptual design does rely on the willingness of the existing SNS to adopt it. Indeed, the scheme does not deny SNS providers to access to users' data, and that is the purpose of the design: enable users' to have control over their data, while permitting SNS providers granular access to these data for analysis, but receiving back

	access to consumers' data. Even if it worked, it wouldn't affect the abuses of that data by SNS providers. Thirdly, it's unclear how, in the 2nd para. on p.8, the analyst would know which privately-held data-sets to negotiate access to, in order to assemble the desired sample.	only the result of analysis, forbidding in this way abuse by SNS providers. Such granular access also enables the user to give the providers' applications access to specific data for specific purposes, as we explain in the data storage and access section of the paper. In refocusing the paper after the first round of reviews we believe we now explain this clearly, however, if the reviewers think that this is necessary, we can provide an example case in the next revision, given the opportunity.
R 1.5	In relation to the survey reported on pp.10-16, no information is provided in relation to the population, sampling frame, sampling technique, sample, relationship between sample and population characteristics, questionnaire and questions. It appears that it may be a convenience / online / snowball sample, in which case it can have absolutely no external validity, i.e. inferences drawn can apply only to that particular sample. Judging by the results reported, it may also be highly localised, e.g. within the USA only. SNS market-shares are highly varied across languages and countries. JAIS is an international journal, and some reflection on cultural differences is essential. One interesting result is that close to 20% of the sample claimed and/or admitted to having multiple Facebook accounts (which would presumably be in breach of Facebook's Terms), ditto c.12% re Twitter. It seems to me that a decently-designed survey directed at such questions could be a useful contribution to the literature.	This comment prompted us to provide further details about the survey, making it indeed more concrete, and for this we would like to thank R1. The comment is addressed in the 'application to SNS' section within its first three paragraphs. More specifically, the data collection lasted ten days, and demographic information was collected relating to age group, gender and the highest level of education of the participants. The survey was conducted online and naturally addressed an international audience. As our work is following a design science approach to address a wider need of SNS users, a cross sectional analysis related to the nationality of the participants was deemed as beyond the scope of this paper. We are excited to see that R1 picked up on our interesting findings, and our survey was designed for that specific purpose, while the application of our design to SNS addresses specifically such findings, and we explicitly report these to the implications of our study explaining that the affordances of the current SNS platforms do not address the needs of users, making the need for a design such as the one we propose an important contribution to the IS literature.
R 1.6	An example of how the privacy analysis lacks depth is the brief mention of anonymity late on p.15. The	We thank R1 for this comment, as it spotted an inaccuracy with the use of the word "anonymous": we indeed wanted to refer to

	appropriate word in the context in question is 'pseudonymous', because a username has to be provided, and it has to pass the SNS provider's tests, and it has a declared profile associated with it, and it accumulates a behavioural profile. The questions are whether it can be linked to a real-world identity, and whether it can be linked to other SNS identities. There are so many tools available to SNS providers (cookies, browser signatures, etc.) that identity linkage may be a quite simple matter.	the retention of anonymity, and, as R1 accurately noted for the case we refer to, this is preserved with the use of "pseudonymous" accounts, and not "anonymous". As we also explain in our response to R1.3, privacy issues are the implication of the mass collection and exploitation of users' data, and we specifically deal with the root of the problem in this paper, which also extends in providing implications for the better management of users' privacy and rights. To this end, our design provides a treatment to the problem of linking pseudonymous accounts to a real-world identity.
R 1.7	The Architecture section on pp.16-20 is unclear and unconvincing. There is almost nothing in the way of a requirements statement or design criteria. Moreover, the text is at best only modestly related back to the earlier sections. The text at the bottom of p.17 has 'Processors' connecting the 'Shim' 'Layer' with the Storage' 'Layer', whereas the Figure depicts the relationship quite differently. At the bottom of p.19, the text blunders into the area of privacy policy processing, which is the subject of a substantial literature and many prior experiments (all of which have essentially been failures).	We would like to thank R1 for this final and important comment which spotted a mistake on our figure, we have now corrected this in the current version of the paper. Following the guidance of R1 in this comment, the section also follows the new streamlined approach inspired by R1, as we explain in R1.1, as the work is now focused on proposing a conceptual design to overcome the challenges of storage, analysis, and integrity associated with stewardship of users' data on SNS.
R 2.1	Conceptual design: the authors' interpretation of the concepts of "Big data" and "small data" as used to inform their conceptual design (Figure 1) are somewhat inconsistent with the relevant literature. For example, for a phenomenon to be classified as 'big data" it is necessary to have the three Vs – volume, variety (e.g. structured and unstructured data) and velocity (real time or ready time data). The last V	We thank R2 for this comment, which was one of the most valuable of this review process, as it also sparked the reshaping of the whole paper. In line with the advice of R2 in this comment, we removed the discussion on the divide between "Big Data" and "Small Data", and now these sections are appropriately focused and refined, while the paper's aim is now focused on proposing a conceptual design to overcome

	(velocity) is neglected. Consequently, using a sample (subset) of data to create "small data" is highly questionable. To make the matters even more confusing, many authors use the term "Small data" to describe organisational (operational) data that do not meet the criteria for big data – mostly variety and velocity (real-time). Interpreted in this way even "small data" could be very large in size. In reality they are and becoming larger and larger. In essence – the size of Big data (Volume) is not a determining factor for a phenomenon to be classified as such. Consequently, reducing the volume into "small data" so that can be analysed (as depicted by Figure 1) introduces an even greater conceptual confusion.	the challenges of storage, analysis, and integrity associated with stewardship of users' data on SNS.
R 2.2	I would also like to make the authors aware of the recent conversations about the notion of "users" and why this concept has to be questioned in the age of big data. I this to be very relevant for their work. Markus (2017) in her JSIS paper says: "To refer to the 'users' of today's complex systems is to invite intellectual errors either by focusing on one category of actors and neglecting the others or by assuming incorrectly that all actors involved with the same technology have similar purposes and practices or experience the same consequences. ... IS datification researchers need to chart the entire constellation of participating stakeholders, regardless of their status as systems users" (p.237).	This comment prompted us to think hard about our use of the word "users" in the paper, and for the inspiring discussions it sparked during the revision period both amongst the co-authors as well as with prominent figures of the IS community we consulted, we would like to thank R2. We indeed came up with several terms we could use, none of which were able to encapsulate the notion of social actors that hold accounts on SNS. To address this comment, we provide a footnote asserting: "Whilst we concur with recent voices within the IS literature supporting that the term 'users' needs to be abolished from our disciplinary ontology (e.g. Marjanovic & Cecez-Kecmanovic, 2017; Markus, 2017), we refer to social actors holding accounts on online platforms in the way they are commonly referred to—as 'users'—in order to align with the relevant literature (e.g. Abbasi et al., 2016; Chatterjee & Sarker, 2013)." However, we remain open to the suggestions

		of R2 for alternative terms that we will be happy to incorporate in the next revision, given the opportunity.
R 2.3	By replacing “users” with “stakeholders” we also open up another “can of worms” that is “datafication”. The authors assume a boundary of the privacy problem around users who interact with the system (i.e. users of the system such as Social networking site). Yet they neglect that subsequent ongoing datafication (propagation, reuse, recombination of Facebook data) that creates many more stakeholders. Consequently, datafication constantly expands the boundary of the problem they investigate. Please see Marjanovic and Cezec-Kecmanovic (2017) – reference provided below. At the same time, it is also important to acknowledge that the users of the networking sites also “tick the box” in exchange of free service and inevitably open opportunities for subsequent datafication. After all, this is Facebook’s business model. From the legal perspective this permission makes the “storage and replication layer” of the proposed design science solution somewhat questionable.	We would like to thank R2 for providing us with the opportunity to explain further the proposed conceptual design and deal with any misinterpretations. Firstly, we do deal with the problem of data transitivity, that is: users trusting their data to an SNS for a specific set of reasons and benefits, but, without their consent or knowledge, their data are passed on to third parties. By keeping the data on the user-side with granular access control to both the data as well as the analysis results, the problem of data transitivity is dealt with. Moreover, regarding the legal issues that R2 describes, our “storage and replication layer” resides in the user-side and is aligned with all data regulations. In refocusing the paper after the first round of reviews we believe we now explain this clearly, however, if the reviewers think that this is necessary, we can provide an example case in the next revision, given the opportunity.
R 2.4	Finally, the authors may like to reconsider their assumptions about the system. While they talk about the complexity of the system, "the main residual benefits" applied when designing a system (as stated on pg. 9) communicate an engineering view of both systems: - the system being investigated (SN) and the system being designed (as depicted by Figure 2). Using analogies from mechanical engineering as	We would like to thank R2 for this final and important comment which provides us with the opportunity to explain further the use of the term ‘Shim’ in our design. A shim layer acts as a compatibility layer that resolves issues that may arise during the development of newer versions of applications or to execute applications on software platforms for which they were not originally designed. The name of the term comes indeed from the field of mechanical engineering and has been adopted

	inspiration for design of "Shim Layer" implicitly communicates the same mechanical view of the system. The above-mentioned paper by Marjanovic and Cecez-Kecmanovic (2017) may be also helpful when rethinking the nature of the 'system' as well as the boundaries of the problem space.	by the developers' communities; it is not a term or an analogy that we came up with for the needs of the paper, rather we adopted it as an industry standard. Whilst this is indeed a shim layer, if the term can be considered as confusing, we remain open to suggestions for alternative terms that we will be happy to incorporate in the next revision, given the opportunity.

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