Aug 10th, 12:00 AM

Societal acceptance of mobile contact tracing applications: the moderating effect of construal level

Félix Joly
HEC Montréal, felix.joly@hec.ca

Camille Grange
HEC Montreal, camille.grange@hec.ca

Societal acceptance of mobile contact tracing applications: the moderating effect of construal level

Emergent Research Forum (ERF) Papers

Félix Joly
HEC Montréal
Felix.joly@hec.ca

Camille Grange
HEC Montréal
Camille.grange@hec.ca

Introduction

Contact tracing, "the process of identifying, assessing, and managing people who have been exposed to someone who has been infected with a virus." (World Health Organization 2021), is a key component of pandemic management (Ferretti et al. 2020). During the most recent (COVID-19) pandemic, governments have deployed technologies to perform contact tracing more effectively (Riemer et al. 2020). Such technologies often take the form of mobile applications referred to as contact tracing apps (CTAs). *COVID Alert* (Canada), *TraceTogether* (Singapore), and *TousAntiCovid* (France) are examples of CTAs deployed to help reduce the coronavirus' spread (Urbaczewski et Lee 2020).

An important challenge with CTAs is that a large proportion of a population would need to use the application for it to be fully effective (Hinch et al. 2020). Yet, adoption rates have remained quite low (Lewis 2020), highlighting a classical public good dilemma. "In a public good dilemma, the whole group benefits if some members cooperate but individuals benefit from free riding if enough others cooperate" (Riemer et al. 2020). As CTAs illustrate, *digital* public goods can also generate public good dilemmas, but this is a relatively recent topic calling for more research. In the CTA context, what the extant literature tells us is that although the perceived societal utility of these technologies has a positive effect on their acceptance (Trang et al. 2020; Lin et al. 2021) an important barrier is linked to people's privacy concerns (Trang et al. 2020; Fox et al. 2021). In the present paper, we argue that such relationships deserve a more nuanced examination, which we propose to conduct through the lens of Construal Level Theory (CLT).

CLT states that the level of abstraction at which individuals interpret an object or event (that is, their "construal level (CL)") is related to two key factors: (i) temporal distance and (ii) evaluation arguments (Trope et Liberman 2003, 2010). The first assumption means that objects or events placed in a distant future (i.e., high temporal distance) tend to be interpreted in an abstract way (abstract CL), while those places in a near future tend to be interpreted concretely (concrete CL). The second assumption implies that the construal level has an impact on the nature of the arguments invoked when judging an object or an event. At an abstract construal level, an individual is likely to give more importance to abstract, superordinate evaluation arguments (e.g., arguments answering the question: why should I install an CTA?). In contrast, a concrete construal level is likely to lead an individual to give more importance to concrete, subordinate evaluation arguments (e.g., arguments answering the question: how can I install a CTA?) (Trope et Liberman 2003). A body of work has started to apply this theory in the context of information systems adoption (Ho et al. 2020; Schuetz et al. 2021). Overall, this emerging literature suggests that people's acceptance of CTAs is likely to be contingent on their CL.

In summary, the objectives of this research are to explore the factors leading to the societal acceptance of CTAs in a population, and to examine how their influence may vary depending on people's CL.

Background Literature:

Contact tracing and contact tracing technologies

There are three key approaches to implementing contact tracing, namely manual contact tracing, surveillance tracing, and proximity tracing. Manual contact tracing, which has been used during previous

pandemics, is effective but time-intensive and difficult to implement during rapid outbreaks. It involves asking someone who has been infected about their whereabouts and social activities prior to infection so that other individuals who may have been infected can be contacted and asked to isolate. Surveillance tracing uses a wide range of data collection tools (e.g., GPS and cell phone location data, data from social media platforms, CCTV camera and facial recognition data,) to reconstruct citizens' movement patterns and to contact those who have interacted with or frequented locations at the same time as the identified infected person. Finally, proximity tracing (the approach examined in this study) is most often enabled by Bluetooth based technology embedded in smartphone; it is effective only if a large portion of the population approves of it and uses it (Riemer et al. 2020).

The interest in better understanding the driving factors of people's attitude toward and adoption of CTAs has grown significantly since the beginning of the COVID-19 pandemic as a result of many countries attempting to implement such technology with disappointing results (Urbaczewski et Lee 2020). Framing CTA acceptance in terms of a situational privacy calculus leads to accounting for the role of two key factors described next, societal benefits and privacy concerns (Hassandoust et al. 2021; Fox et al. 2021).

Drivers of CTA acceptance

The first part of the privacy calculus concerns the expected benefits that encourage acceptance. The CTA literature suggests that societal benefits appeal and reciprocal benefits are particularly salient drivers of individuals' intention to install a CTA. Societal benefits appeal refers to the calls to action that provide reasons to engage in certain individual behaviors for the benefit of society as a whole (e.g., "By using the app, you make an important contribution to the health of the population"; Trang et al. 2020). Reciprocal benefits, corresponds to "an individual's perception of the reciprocal benefits everyone will experience from using the application" (Hamari et Koivisto 2015 cited in Fox et al. 2021). The psychological rationale behind such effects is that if a CTA is used effectively, it would allow a pandemic to be managed with less of a need for strict social distancing measures such as curfews or lockdowns (Ferretti et al. 2020).

Drivers of CTA reluctance

The second part of the privacy calculus concerns factors that deter acceptance. The literature has provided evidence that privacy concerns are prominent in the context of digital goods. We know that individuals' general disposition toward the provision of personal information to external entities (Malhotra et al. 2004) is likely to be negatively related to CTA adoption (Trang et al. 2020; Lin et al. 2021). Another particularly relevant insights from the literature on information collection laden goods, is that technologies that collect potentially sensitive consumer information well beyond the initial transaction (such as CTAs) make it difficult for potential adopters to assess the extent to which their privacy is safeguarded, thereby negatively influencing their adoption intentions (Al-Natour et al. 2020).

Research Model and Hypotheses Development

The proposed research model, informed by the extant literature and the construal level theory lens, is presented in Figure 1.

CTA Acceptance

We conceptualize CTA acceptance through two constructs: attitude toward using a CTA and intention to adopt (i.e., install) a CTA. The attitude toward using a CTA corresponds to an *individual's overall affective reaction to using a CTA* (Venkatesh et al. 2003). This construct has never been employed in the context of CTA acceptance but is commonly used in the literature that studies acceptance (Venkatesh et al., 2003). We decided to include it in our model because we believe that the effect of CL may differ between attitude and adoption (Arts et al. 2011). Moreover, other studies use this construct in an acceptance context because it is well suited to the voluntary use situation (Ho et al. 2020)

The intention to adopt a CTA is commonly used in the literature to study technology acceptance (Venkatesh et al., 2003) and is also employed in the CTA acceptance context (Trang et al. 2020; Lin et al. 2021; Fox et al. 2021) to capture *an individual's self-assessed likelihood of adopting a CTA* (Hassandoust et al. 2021).

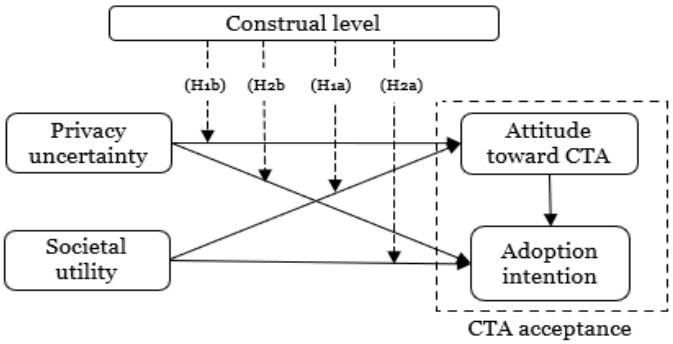

Figure 1 Proposed Research Model

Privacy Uncertainty and Societal Utility

Based on the extant literature, we define two drivers of CTA acceptance. First, Societal Utility (SU) combines elements of both societal benefits appeal (Trang et al. 2020) and reciprocal benefits (Fox et al. 2021) to capture *the extent to which an individual values the collective benefits offered by a CTA*. Societal utility should have a positive effect on CTA acceptance because it highlights the reasons why using this technology allows the population to protect oneself while protecting others and to be able to live normally in times of pandemic (i.e., avoid any form of strict social distancing (curfew, lockdown), access their hobbies and be able to gather at any time).

The construct we define to capture privacy concerns is Privacy Uncertainty (PU). PU corresponds to *the extent of difficulty an individual experiences when assessing the privacy of the information they entrust to the CTA developer* (Al-Natour et al. 2020). PU has a negative effect on CTA acceptance because depending on the design of the application, different types of personal information are collected and used by the technology - and by extension, by the government health agency that developed it - to make it work (Trang et al. 2020). Therefore, the more uncertain users are about the data collected and used by the app, the more negative their attitude towards the app will be and the less likely they will adopt the CTA.

Construal Level

Construal Level (CL) corresponds to an individual's degree of concreteness or abstraction when representing (or interpreting) an object. CLT poses two key assumptions. First, it highlights the relationship between CL and psychological distance, and proposes that the more psychologically distant (close) an object is from an individual, the more likely it is to be represented in an abstract (concrete) fashion (Trope & Liberman, 2003; Trope and Liberman 2010). The theory identifies different types of psychological distances (temporal, spatial, social, hypothetical) (Trope & Liberman, 2003). Temporal distance refers to the distance between an individual and an object over time. The greater the duration, the more likely an object will be interpreted in an abstract way. In contrast, the shorter the duration, the more likely an object will be interpreted in a concrete way (Trope & Liberman, 2003). For example, thinking about a CTA developed in the context of a *future* pandemic is more likely to lead to an abstract representation than thinking about it for the purpose of the *current* COVID-19 pandemic.

Second, it proposes the so-called "desirability/feasibility hypothesis", another key aspect related to CL. This assumption implies that an abstract CL leads individuals to represent an object "in terms of abstract, superordinate, and decontextualized features that convey the general core information" (Ho et al, 2020), and that as a result, they will put greater weight on *desirability* features (*why* aspect). (Trope and Liberman 2003). In contrast, a concrete CL, which drives individuals to represent an object "in terms of concrete, subordinate, and contextualized features that convey specific details" (Ho et al. 2020), leads to a greater weight being put on *feasibility* features (*how* aspect) (Trope and Liberman 2003).

Hypotheses

The SU construct emphasizes desirability arguments. Indeed, it highlights the reasons *why* using a CTA would bring personal and societal benefits. On the other hand, the PU construct emphasizes feasibility

arguments. Indeed, it is the concrete features of *how* the app manages privacy that will influence the difficulty of the app user in assessing the privacy of the information they entrust to the CTA developer.

The CLT's desirability/feasibility hypothesis suggests that desirability features will be weighted more strongly in an abstract CL and, conversely, that feasibility features will be weighted more strongly in a concrete CL. We therefore propose that SU will become more salient when a CTA is evaluated in abstract terms while PU will become more salient when CTA is interpreted in concrete terms. This leads us to propose the following hypotheses:

H1: Abstract CL strengthens the positive effect of SU on individuals' attitude toward CTA (H1a), and it weakens the negative effect of PU on individuals' attitude toward CTA (H1b)

H2: Abstract CL strengthens the positive effect of SU on individuals' intention to adopt a CTA (H2a), and it weakens the negative effect of PU on individuals' intention to adopt a CTA (H2b)

Methodology/study plan

Our plan is to conduct an experiment in which we will manipulate participants' construal level (abstract vs. concrete) as well as design elements (related to privacy features and communication of usage benefits) of a (fictitious) CTA to generate variance in PU and SU. Data will be collected from Canadians during the COVID-19 pandemic, when the COVID Alert application is almost no longer used by the population.

Participants will be randomly assigned to one of two CL conditions (abstract vs concrete). Following the work of Ho et al. (2020) and Schuetz & al. (2021), we will induce participants' construal level by acting on two dimensions: temporal psychological distance (distal vs. proximate) and evaluation arguments (desirability vs. feasibility). Regarding temporal psychological distance: participants placed in the abstract CL condition will be asked to evaluate a CTA developed for the purpose of a *future* pandemic while participants placed in a concrete CL condition will have to evaluate a CTA developed in the context of a new variant of the *current* COVID-19 pandemic. Regarding evaluation arguments: after reading the instructions, participants placed in the abstract CL condition will be asked to think about *why* they would use the new CTA in the context of a future pandemic, and report at least three reasons why they would use the app's key features (self-declaration of COVID infection and close contact notification). Participants placed in the concrete CL condition will be asked to think about *how* they would use the CTA in the context of a new COVID-19 variant, and report at least three ways by which they would avoid transmitting the virus to people around them and prevent an infected person from transmitting the virus to them.

To test the effectiveness of the construal level manipulation, we will rely on Ho et al.'s (2020) method and calculate the relative construal level score of each participant. This score is calculated by subtracting the mean of the concrete construal level items from the mean of the abstract CL items. A positive score indicates a relatively abstract CL, whereas a negative score indicates a relatively concrete CL.

After being exposed to the construal level manipulation, participants will be shown with mock-ups of the fictitious contact tracing application and will be asked to fill out a survey including questions pertaining to construal level (for manipulation check purpose), PU, SU, attitude toward using the new app and adoption intention.

Potential implications for research and practice

We expect this research to have both scientific and practical benefits.

First, we hope to contribute to the body of knowledge examining the societal acceptability of sensitive information technologies. Concretely, this will be achieved by leveraging construal level theory to develop a better understanding of the drivers of CTA's societal acceptance. In doing so, we also hope to contribute to the emerging literature that uses the CLT in the context of studying IT adoption in general.

From a practical standpoint, we anticipate that this research will help provide specific recommendations to public health institutions about which design practices can be used to promote more effectively societal, mass acceptance of CTAs. This is an important effort because more effective contact tracing, via the responsible use of information technology, will have a significant role in our dealings with future pandemics, especially when vaccines and treatments are not yet available (Baumgartner & Rainey 2020).

REFERENCES

Al-Natour, S., Cavusoglu, H., Benbasat, I., and Aleem, U. (2020). An Empirical Investigation of the Antecedents and Consequences of Privacy Uncertainty in the Context of Mobile Apps. Information Systems Research, 31(4), 1037–1063.

Arts, J. W. C., Frambach, R. T., and Bijmolt, T. H. A. (2011). Generalizations on consumer innovation adoption: A meta-analysis on drivers of intention and behavior. International Journal of Research in Marketing, 28(2), 134–144.

Baumgaertner, E., and Rainey, J. (2020, April 2). Trump administration ended pandemic early-warning program to detect coronaviruses. Los Angeles Times. https://www.latimes.com/science/story/2020-04-02/coronavirus-trump-pandemic-program-viruses-detection

Ferretti, L., Wymant, C., Kendall, M., Zhao, L., Nurtay, A., Abeler-Dörner, L., Parker, M., Bonsall, D., and Fraser, C. (2020). Quantifying SARS-CoV-2 transmission suggests epidemic control with digital contact tracing. Science (New York, N.y.), 368(6491), eabb6936.

Fox, G., Clohessy, T., van der Werff, L., Rosati, P., and Lynn, T. (2021). Exploring the competing influences of privacy concerns and positive beliefs on citizen acceptance of contact tracing mobile applications. Computers in Human Behavior, 121, 106806.

Hassandoust, F., Akhlaghpour, S., and Johnston, A. C. (2021). Individuals' privacy concerns and adoption of contact tracing mobile applications in a pandemic: A situational privacy calculus perspective. Journal of the American Medical Informatics Association, 28(3), 463–471.

Hinch, R., Probert, W., Nurtay, A., Kendall, M., Wymant, C., Hall, M., … and Fraser, C. (2020). Effective configurations of a digital contact tracing app: a report to NHSX. Retrieved July, 23, 2020.

Ho, C. K.Y., Ke, W., and Liu, H. (2015). Choice decision of e-learning system: Implications from construal level theory. Information and Management, 52(2), 160–169.

Lewis, D. (2020). Why many countries failed at COVID contact-tracing—But some got it right. Nature, 588(7838), 384–387.

Lin, J., Carter, L., and Liu, D. (2021). Privacy concerns and digital government: Exploring citizen willingness to adopt the COVIDSafe app. European Journal of Information Systems, 30(4), 389–402.

Riemer, K., Ciriello, R., Peter, S., and Schlagwein, D. (2020). Digital contact-tracing adoption in the COVID-19 pandemic: IT governance for collective action at the societal level. European Journal of Information Systems, 29(6), 731–745.

Schuetz, S. W., Lowry, P. B., Pienta, D. A., and Thatcher, J. B. (2021). Improving the Design of Information Security Messages by Leveraging the Effects of Temporal Distance and Argument Nature. Journal of the Association for Information Systems, 22(5), 1376–1428.

Trang, S., Trenz, M., Weiger, W. H., Tarafdar, M., and Cheung, C. M. K. (2020). One app to trace them all? Examining app specifications for mass acceptance of contact-tracing apps. European Journal of Information Systems, 29(4), 415–428.

Trope, Y., and Liberman, N. (2010). Construal-Level Theory of Psychological Distance. Psychological Review, 117(2), 440–463

Trope, Y., and Liberman, N. (2003). Temporal construal. Psychological Review, 110(3), 403.

Urbaczewski, A., and Lee, Y. J. (2020). Information Technology and the pandemic: A preliminary multinational analysis of the impact of mobile tracking technology on the COVID-19 contagion control. European Journal of Information Systems, 29(4), 405–414.

Venkatesh, V., Morris, M. G., Davis, G. B., and Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. Mis Quarterly, 27(3), 425–478.

World Health Organization. (2021). Coronavirus disease (COVID-19): Contact tracing. https://www.who.int/news-room/questions-and-answers/item/coronavirus-disease-covid-19-contact-tracing