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The psychological reassurance effect of mobile tracing app's in Covid-19 Era.

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1. Introduction

As COVID-19 has created a worldwide public health crisis (i.e., hospitalizations, deaths) and pushed society into social and cultural crises and financial insecurity (Beaunoyer et al., 2020; McKibbin & Fernando, 2020; Rajkumar, 2020; Vo-Thanh et al., 2020), the use of mobile devices is essential in fighting the virus and improve our lives (Brem et al., 2021; Guitton, 2020). Therefore, it is not surprising that various countries have decided to launch mobile apps to (1) identify people or contacts who may have encountered infected people and (2) trace the virus transmission chain by collecting data on people's movements and contacts (Rowe et al., 2020).

Today, no one can imagine using a smartphone that lacks mobile applications (apps); they are now regarded as inherent features of the technology. Mobile apps are not only easy to use but also provide ways to be informed (e.g., about health indicators such as heartbeat or number of steps taken) and entertained (Hackett et al., 2018). Most of the time people spend online is spent on mobile screens (e.g., 77% in the United States; ComScore, 2019) as smartphones allow people to access information anywhere, at any time.

Medical and epidemiological research show that implementing mobile tracing apps is a top-down government intervention (Ferretti et al., 2020; Pan et al., 2020) and crucial in epidemic crisis (Chan & Saqib, 2021). However, tracking technologies may raise acceptability issues (Georgieva et al., 2021) and more specifically privacy concerns that may influence the intention to use the mobile tracing app (Chan & Saqib, 2021). Moreover, there has been no research on the reassurance effect of mobile tracing apps in a pandemic context. Therefore, our aim is to (1) show how the antecedents (cost and benefits) of a mobile tracing app create value; (2) identify the consequences of value creation in terms of trust in government, the future, well-being, and word of mouth (WOM); and (3) determine how various moderators affect overall perceptions of value (see Figure 1).

Our results suggest that the success of mobile tracing apps depends on three factors: utility, status and risks perception. Beyond antecedents, we establish strong links between perceived value and trust in government, well-being, and trust in the future. Moreover, we highlight the effects of several moderators on the overall perception of the mobile app (e.g. social media usage, Covid-19 symptoms). Finally, our results show that the launch of a tracing app has a psychological reassurance effect on individuals, even if they have not installed it.

2. Theoretical framework

Our paper studies a central mediating construct that is perceived value (Kumar & Reinartz, 2016). According to Kumar and Reinartz (2016) the perceived value is a “customers’ net valuation of the perceived benefits accrued from an offering that is based on the costs they are willing to give up for the needs they are seeking to satisfy”. As a mediating construct, we use several antecedents (benefits and costs) and consequences (e.g., trust in the future) of perceived value to better measure the overall perception of mobile app value. It is now well established that people have the ability to perceive the benefits and undesirable consequences of a product/service (Gutman, 1982). With regard to the StopCovid mobile app, individuals can evaluate it because they are used to manipulate mobile apps frequently. Therefore, individuals can perceive the value of StopCovid even without installing it.

Insert Figure 1 about here

2.1. Cost/benefit impacts on value perception

Research on the acceptance of technology has identified pragmatic determinants, such as ease of use and utility (F. D. Davis, 1989). With regard to mobile apps, the technology acceptance model (TAM) has been used widely to determine usage intentions. Research focused on utility, or the extrinsic and cognitive benefits that enable task accomplishment (Cocosila & Trabelsi, 2016; H.-W. Kim et al., 2007), reveals that the perceived utility of mobile apps positively influences satisfaction and intentions to use (Cocosila & Trabelsi, 2016; B. Kim & Han, 2011; B. Kim & Oh, 2011). Researchers also have investigated the role of status for mobile app use—that is, the ability of apps to enhance the image users present to others (Holbrook, 2006). In the context of the COVID-19 pandemic, people may use apps such as the French StopCovid app to seek gratification from their social identity and social relationships for; according to Cocosila and Trabelsi (2016), the status value of mobile apps positively influences perceived value.

Although there are benefits to mobile app use, there also are costs. For example, because mobile apps collect data and send notifications to users (E.-S. Kim & Chung, 2021), they raise questions about risk, privacy, and intrusiveness. Research shows that privacy and intrusiveness concerns related to mobile apps negatively influence their perceived value (Cocosila & Trabelsi, 2016; Wottrich et al., 2018). Moreover, in mobile environments, users may feel more vulnerable to risks—which also may negatively affect mobile apps’ perceived value (Kleijnen et al., 2007; Sweeney et al., 1999). Accordingly, we propose:

H1. (a) Utility and (b) status benefits of the StopCovid app positively influence its perceived value.

H2. (a) Privacy, (b) intrusiveness, and (c) risk costs of the StopCovid app negatively influence its perceived value.

2.2. Effects of value perceptions on well-being, trust in the future, trust in government, and WOM

The three main consequences we investigate (i.e. *well-being, trust in the future, trust in government*) are related to psychological aspects and overall to the reassurance construct. Reassurance is a method, a process by which we provide information to a patient in order to remove fears or doubts and to comfort him (Linton et al., 2008). Reassurance is needed when the situation of an individual change in

such that it affects his psychological state and behavior. As the pandemic has increased anxiety, it has in the same time created an undesired context where people seek to be reassured. In such situations, reassurance can generate mechanisms such as seeking the presence of others in order to reduce anxiety (Spector & Sistrunk, 2010). Beyond the presence, a key factor to reassure people is the information provided by various actors (e.g. government, mass media). Because it has to fight the virus, information provided by the government have a great impact on the reassurance of people. Consequently, the sides of reassurance we measure in this paper deals with trust and well-being.

Because the StopCovid app was launched by the French government (on June 2, 2020), trust in government is an important variable to consider (Ye & Lyu, 2020). From the perspective of public health policy, if people do not trust the government, their intentions to use a tracing app may be affected, even if the perceived value of the app is high. Trust in government is strongly associated with adherence to health guidelines (Sibley et al., 2020) and is vital for implementing social policies that require people to take action (M. Davis et al., 2011). Moreover, in a crisis context, trust in government leads to cooperative, responsible, altruistic behaviors and a tendency to follow government recommendations (e.g., lockdown rules) (Chanley et al., 2000; Hetherington, 1998). By addressing actions by the government to develop this app, we propose:

H3. High levels of perceived value of the StopCovid app positively influence trust in government.

Disasters (e.g., war, hurricanes, virus) cause harm to mental and physical health (Huang & Zhao, 2020; Zhang & Ma, 2020). In such contexts, people may have negative feelings because their well-being is affected. Sibley et al. (2020) note that healthiness includes the presence of positive well-being. In the context of the StopCovid app, the perceived value of the app, due to utility and status benefits, may have a positive influence on the well-being of the population. Therefore, we propose:

H4. High levels of perceived value of the StopCovid app positively influence well-being.

Sibley et al. (2020) note that one dimension of well-being relates to trust in the future, which links to feelings of security and satisfaction with one's standard of living (i.e., not having to wear masks outside, going to restaurants). Accordingly, we propose:

H5. High levels of perceived value of the StopCovid app positively influence trust in the future.

For many years, researchers have studied the word-of-mouth (WOM) concept, especially with regard to mobile apps. They suggest that entertainment, subjective norms, and satisfaction are the key antecedents of positive WOM for mobile apps (San-Martín et al., 2015; Verkijika & De Wet, 2019). To date, there has been no study of the connections between WOM and trust in the future, trust in the government, well-being, and perceived value. We propose, in the context of the COVID-19 pandemic and its associated level of anxiety, that with regard to mobile tracing apps, these four concepts positively influence WOM:

H6. High levels of (a) perceived value, (b) trust in government, (c) well-being, and (d) trust in the future positively influence WOM.

2.3. Pandemic moderators

Perception of a product's value depends on the context in which it is used. A mobile app used in one context can generate more value than in another context (Kleijnen et al., 2007; Wang et al., 2013)—that is, it has conditional value (Sheth et al., 1991; Woodruff, 1997). Perceptions of the costs and benefits of the StopCovid mobile app may vary significantly in the context of COVID-19. During the pandemic and especially lockdowns, people have been exposed to daily media information, government announcements, and health concerns for themselves and their families. In this study, we identify key moderators that affect overall perception of the mobile app: age and technology factors, trust in media, trust in government, and health factors.

First, we consider the moderating effects of general factors such as gender and age. There is a significant difference between men and women in terms of deaths from COVID-19; in both the United States and France, for example, the gender breakdown of deaths is 54% male and 46% female (CDC, 2020; Santé Publique France, 2021). Even though men seem to more vulnerable to the virus, no research evidence exists to support hypotheses about the difference. In contrast, for age, research has shown clearly, and the media has communicated widely, that older people are far more vulnerable to the disease (e.g., in the United States, from march 2019 to January 2021, 20.8% of COVID-19 patients are in the 65–74 year age group vs. 0.5% in the 5–17 year age group) (CDC, 2020). However, with regard to technology factors as moderators, there may be differences in terms of value perceptions between users and non-users of the StopCovid app. Although users might have a more positive perception of the app's value, because they have the opportunity to test it in real time, there is no evidence that leads us to formulate any hypotheses in terms negative or positive effects for the entire model. Rather, we postulate only:

H7. Compared with those younger than 55 years of age, those 55 years of age and older perceive the value of the StopCovid app as greater.

Second, we investigate the moderating effect of trust in media by noting differences in the perceived value of the mobile app between groups: high vs. low trust in government media, high vs. low trust in mass media, and high vs. low trust in alternative media. During a crisis, people obtain information from television, the Internet, and social networks (Garfin et al., 2020). Media context plays an essential role in shaping institutional trust and attitudes toward nations and governments. However, parts of populations may disbelieve government and mass media information. In France, only 23% of the population trusts the news media (Statista, 2020). Moreover, trust in government can decline over time, even if it is initially high, because perceptions of risk increase over time, and conspiracy theories develop (e.g., “anti-mask” movement). The COVID-19 pandemic has provided alternative channels (e.g., YouTube influencers, Twitter users) opportunities to expand their visibility by communicating (dis)information that differs from and opposes to official information (i.e., mass and government media). Because in pandemic situations, people seek accurate information to protect themselves and their families, those who trust mass and government media may be more likely than others to perceive the StopCovid app as valuable. Conversely, those who trust alternative media (more than they trust official information channels) and express defiance toward decisions by governments may be less likely to perceive the StopCovid app as valuable:

H8. Compared with those who trust alternative media more than government and mass media, those who trust government and mass media more than alternative media perceive the value of the StopCovid app as greater.

Third, we evaluate the moderating effect of trust in government and how it moderates the other model effects. As previously mentioned, with regard to COVID-19, trust in government can decline over time (Sibley et al., 2020), especially following the imposition of government actions to fight the virus (e.g., mask mandates, confinement). People judge the effectiveness of government actions, or at least form opinions about those actions, according to the actions implemented by the government and the numbers of deaths or infections. Similar to other countries, France has set up a scientific council to fight the virus. Yet some medical scientists hold opposing views on the pandemic situation and promote alternative treatments (e.g., hydroxychloroquine). This situation led to the formation of two sides, which mass media refers to as the “reassuring” (*rassuriste*) side and the “alarmist” side, generating even more confusion in the population (Mansour & Maad, 2020). Therefore, we hypothesize:

H9. Compared with those who evaluate the government’s actions negatively and trust the government council less (i.e., “reassuring” side), those who evaluate the actions of the government positively and trust the government council (i.e., “alarmist” side) perceive the value of the StopCovid app as greater.

Fourth, we investigate the moderating effect of health and, specifically, how people’s health situations and the situations of those around them moderate the model effects. The COVID-19 crisis has generated feelings of stress, depression, fear, and loneliness (Jungmann & Witthöft, 2020; Liu et al., 2020). During a viral epidemic, most people develop health anxiety (Zhang & Ma, 2020), including unwarranted fears of the perceived health threat (Abramowitz & Braddock, 2008), on a continuum that ranges from an absence of health awareness to pathologic anxiety (Abramowitz & Braddock, 2008). When anxiety arises, people often develop safety behaviors, such as checking (for symptoms, fever, signs of illness), avoiding risky activities, seeking confirmation of good health, and reading information on the crisis (Brown et al., 2020). Those who perceive themselves to be in poor health suffer greater anxiety. A survey in China showed that more than half of the respondents had concerns about COVID-19 or potential infections of their families (Zhang and Ma, 2020). Those affected by quarantine (i.e., themselves or someone they know) suffer from greater anxiety (Jungmann and Witthöft, 2020); their perceptions change when they (or their families/friends) have had the virus or were identified as contact cases. Finally, the constant flow of COVID-19 information uses emotional language to capture people’s attention (Garfin et al., 2020), such that their brains, discussions, and thoughts become focused on the pandemic. This excessive absorption (Jungmann et al., 2020) and hyper-consumption of news can lead people to develop “cyberchondria” (i.e., obsession with self-health auto-evaluation), which correlates positively with anxiety (Jungmann and Witthöft, 2020). Therefore, in line with research on conditional value and the psychological and health effects of COVID-19, we hypothesize:

H10. Compared with those who have not personally experienced COVID-19 symptoms, whose friends/families have not experienced COVID-19 symptoms, and who have not felt anxious during the pandemic, those who personally have experienced COVID-19 symptoms, whose families/friends have experienced COVID-19 symptoms, and who have felt anxious during the pandemic perceive the value of the StopCovid app as greater.

3. Method

3.1 Data collection and sample

We conducted our study in the context of the Covid-19 pandemic. We designed a questionnaire consisting of 82 items, with a time duration of 10 minutes. At the beginning of the survey, we introduced a brief description of the StopCovid mobile app launched by the French government. We informed all respondents of the presence of sensitive questions and asked them to accept the conditions, in line with the European Union's General Data Protection Regulation (GDPR) rules. The survey started online one week before the launch of the app and end one week after the launch. A survey agency administered the questionnaire online. Respondents were selected rigorously and received gifts rather than payment. Our data collection represents the ratio of the actual use of the mobile app (i.e. the ratio of 10% having installed the StopCovid mobile application versus 90% not having installed it). A total of 832 mobile app users, representative of the French population, responded to our questionnaire; we discarded 12 respondents because they failed answered a verification question introduced in the middle of the questionnaire. Table 1 presents the main characteristics of our sample.

Insert Table 1 about here

3.2 Measurements

We began by using partial least squares structural equation modeling (PLS-SEM) to test our hypotheses in Smart PLS 3.3.2 (Ringle et al., 2015). We used the path scheme (Henseler, 2010) with the consistent PLS algorithm, which can correct reflective constructs' correlations and to ensure the results are consistent with a factor model (Dijkstra & Henseler, 2015). Next, to test the significance of the relationships between variables and estimate predictive validity (Q^2 values), we used bootstrapping and blindfolding procedures (Stone, 1974; Geisser, 1975). Finally, we ran a multigroup analysis (MGA) to determine whether the data groups (e.g., installation of app vs. non-installation of app) exhibited significant differences in their group-specific parameter estimates (e.g., outer weights, outer loadings, path coefficients). We first tested the overall model without differentiating between the data groups, then ran the MGA to test for differences between the data groups.

To check the reliabilities and validities of the constructs, we used Cronbach's alpha (α), composite reliability (CR), and average variance extracted (AVE) indicators. For all measures, the α value was greater than .70 (Hair et al., 2016; Nunnally & Bernstein, 1994), the CR was above .70 (Fornell and Larcker, 1981; Hair et al., 2016), and the AVE exceeded .50 (Bagozzi and Yi, 1988; Barclay et al., 1995; Fornell and Larcker, 1981; Hair et al., 2016) (see Table 2). We also assessed the loadings of the measures of each item with their respective constructs, and all loadings were greater than .70

(Hulland, 1999). We used the heterotrait-monotrait ratio (HTMT) method to assess and confirm the discriminant validity of the measures, as an alternative to the Fornell-Larcker criterion (Henseler et al., 2015). Finally, we evaluated R-square, Q-square, and model fit using the standardized root mean square residual (SRMR) and normed fit index (NFI) indicators. Perceived value showed a high predictive value ($R^2 = .790$; $Q^2 = .622$), as did trust in government ($R^2 = .754$; $Q^2 = .572$), well-being ($R^2 = .620$; $Q^2 = .519$), trust in the future ($R^2 = .749$; $Q^2 = .616$), and WOM ($R^2 = .873$; $Q^2 = .78$). The SRMR values are below .08 (.056), and the NFI (.917) also confirms good fit (Hu & Bentler, 1998).

4. Results

4.1 Overall results

With regard to H1, related to the effects of benefits on perceived value, we find significant effects of the benefits of utility ($\gamma = .360$, $t = 7.475$, $p < .000$) and status ($\gamma = .227$, $t = 5.142$, $p < .000$), in support of H1a and H1b. That is, both benefits have significant effects on perceived value, though the utility effect is greater. We also observe significant negative effects of privacy ($\gamma = -.096$, $t = 2.590$, $p < .05$), intrusiveness ($\gamma = -.107$, $t = 2.689$, $p < .05$), and risk ($\gamma = -.276$, $t = 4.958$, $p < .000$), in support of H2a–c. Risk has the most significant negative effect on perceived value. The second part of the model shows significant effects of perceived value on trust in government ($\beta = .868$, $t = 59.399$, $p < .000$), well-being ($\beta = .787$, $t = 43.481$, $p < .000$), and trust in the future ($\beta = .865$, $t = 59.919$, $p < .000$), in support of H3–H5. Then in the third part of the model, we tested the relationships of four variables (i.e., perceived value, trust in government, well-being, and trust in the future) with WOM. The relationship between trust in government and WOM is not significant ($\beta = .089$, $t = 1.231$, $p > .05$), so we must reject H6b. However, we find a significant effect of perceived value ($\beta = .400$, $t = 5.541$, $p < .000$), well-being ($\beta = .355$, $t = 6.059$, $p < .000$), and trust in the future ($\beta = .149$, $t = 1.904$, $p < .05$) on WOM, as predicted by H4a, H4c, and H4d (see Table 3).

4.2 MGA results

We ran several MGAs to test the moderating effects of various factors related to the pandemic situation. Our first MGA analysis consisted of testing the moderating effects of gender and age (see Table 4). With regard to gender, we observe two differences: Privacy concerns have a greater effect on perceived value for men (γ diff = .151, $p < .05$), and perceived value has a greater effect on WOM for women (β diff = .243, $p < .05$). We find four differences with regard to age: The status effect on perceived value is greater for those aged 18 to 54 years (γ diff = .146, $p < .05$); the effects of perceived value on trust in the future (β diff = -.63, $p < .05$) and well-being (β diff = -.72, $p < .05$) are greater for those older than 55 years; and the effect of trust in government on WOM also is greater among this older category (β diff = -.363, $p < .05$).

Regarding the moderating effect of mobile app installation, we find that those who installed and used the mobile app indicate greater effects of perceived value on WOM (β diff = .370, $p < .05$), of trust in the future on WOM (β diff = -.779, $p < .05$), and of well-being on WOM (β diff = .297, $p < .05$). The effect of perceived value on well-being is greater for the group that did not install the app (β diff = -.292, $p < .000$).

The second part of the MGA, related to media trust, shows one difference with regard to trust in government media, two differences with regard to trust in mass media, and three differences with regard to trust in alternative media (see Table 4). First, only the effect of perceived value effect on well-being is greater for those with low levels of trust in government media (β diff = $-.150, p < .05$). In this group, we find a greater effect of perceived value on well-being (β diff = $-.135, p < .05$) and a weaker effect of trust in government media on WOM (β diff = $.264, p < .05$). Second, the group with high levels of trust in alternative media shows a greater effect of intrusiveness on perceived value (γ diff = $-.241, p < .05$) and of perceived value on well-being (β diff = $.072, p < .05$). However, for the group with low levels of trust, we observe a greater effect of privacy on perceived value (γ diff = $.126, p < .05$).

With regard to social media behavior as moderators, such as YouTube use, we observe a difference, such that low levels of use relate to the effect of risk on perceived value (γ diff = $.290, p < .05$). For those with low levels of social media use, we find greater effects of perceived value on trust in the future (β diff = $-.077, p < .05$), of trust in the government on WOM (β diff = $-.181, p < .05$), and of trust in the future on WOM (β diff = $-.371, p < .05$). Those with high levels of social media use show greater effects of perceived value on WOM (β diff = $.368, p < .05$) and of well-being on WOM (β diff = $.189, p < .05$).

With regard to trust, we tested the moderating effects of (1) efficiency of government action against COVID-19, (2) trust in the government council, and (3) trust in heterodox (non-conforming) scientists (see Table 4). We find few differences with regard to trust in the government council and trust in heterodox scientists; only the moderator of low level of trust in the government council shows a greater effect of perceived value on well-being (β diff = $-.069, p < .05$), whereas high level of trust in heterodox scientists shows greater effects of intrusiveness on perceived value (γ diff = $-.167, p < .05$) and of perceived value on trust in the future (β diff = $.069, p < .05$). In addition, the group that evaluates the French government's action against COVID-19 as efficient notes greater effects of status on perceived value (γ diff = $-.085, p < .05$) and of perceived value on trust in government (β diff = $-.196, p < .05$). Conversely, those who evaluate the French government's actions as inefficient indicate greater effects of perceived value on well-being (β diff = $-.102, p < .05$) and of trust in the future on WOM (β diff = $.304, p < .05$).

The fourth part of our MGA focused on health factors. We tested the moderating effect of having experienced COVID-19 symptoms oneself, of having friends/family experience COVID-19 symptoms, and of feelings experienced during the pandemic. We find no effects for the moderator "having experienced Covid-19 symptoms" and two differences for the moderator "feelings experienced during the pandemic." Feeling good during the pandemic leads to a greater negative effect of privacy on perceived value (γ diff = $-.190, p < .05$), whereas feeling bad during the pandemic indicates a greater negative effect of risk on perceived value (γ diff = $.186, p < .05$). The moderator of whether friends/family have experienced COVID-19 symptoms shows greater effects for the "non-experience of symptoms" group, including the effects of risk on perceived value (γ diff = $.214, p < .05$), of perceived value on well-being (β diff = $-.121, p < .05$), and of perceived value on WOM (β diff = $-.402, p < .05$). However, for the "experienced symptoms" group, we observe greater effects of utility on perceived

value (γ diff = .298, $p < .001$) and of trust in government on WOM (β diff = .469, $p < .05$). Therefore, all the effects are at least partially validated (Table 4).

Insert Tables 2–4 about here

5. Discussion

5.1 Theoretical contributions

In a pandemic context, the utility of the mobile tracing app is an important benefit, and risk is an important cost. These results are in line with previous research (Cocosila & Trabelsi, 2016; Kleijnen et al., 2007). However, it should be noted that people are concerned about the risk that their personal information will be used for non-pandemic purposes; in the pandemic, privacy costs have a very low effect on perceived value. They are more willing to provide personal data to help fight the virus than they would be to disclose them in traditional contexts, such as to private companies (Wottrich et al., 2018). We establish strong links between perceived value and trust in government, well-being, and trust in the future. Theoretically, this completely new finding shows how a tool such a mobile app can significantly reassure people.

Other contributions derived from our work relate to the moderators we test: Several of them show significant effects. First, those who have installed the mobile app express stronger links with regard to WOM. In this group, perceived value, trust in the future, and well-being strongly affect WOM, such that people who use the StopCovid app are more likely to encourage their friends and families to use it. Second—and not surprisingly—those who rate the government’s virus-fighting efficiency as high show stronger effects of status on perceived value and, in turn, of perceived value on trust in government. In contrast, those who give the government a low efficiency rating show stronger effects of perceived value on well-being, and of trust in the future on WOM. That is, for the former group, the StopCovid app reinforces status and trust in government, whereas for the latter group, it fosters well-being and WOM. Third, our study shows that those whose friends/families have experienced COVID-19 symptoms show a greater effect of utility on perceived value and of trust in government on WOM, whereas those whose friends/families have not experienced COVID-19 symptoms are more oriented to well-being and more concerned by the risks of using the StopCovid app. Finally, the originality of this study consists in showing the reassurance effect of a mobile app in a pandemic context. Indeed, even the majority of people does not have installed the StopCovid app, results show that they are greatly reassured by the launch of the mobile app. The indirect information given by the government to the people is that “we are doing something to fight the pandemic”. This information seems to be enough in reassuring people.

5.2 Practical contributions

The StopCovid app, launched after the first wave of the virus, was considered less appealing than its second version, TousAntiCovid¹ (2.5 downloads of StopCovid vs. 10 million downloads of TousAntiCovid). However, even the second version of the app has met with limited success. According to our results, we argue that the success of this type of mobile app depends on its usefulness and risks.

¹ English translation: “All Against Covid.”

Therefore, governments should demonstrate the app's usefulness more clearly and reassure people about any risks. Furthermore, we suggest that one way to increase number of downloads is to communicate how the app will help people fight the virus and look forward to a better future. Finally, this study highlights the fact that it is crucial, in a pandemic context, to reassure people by concrete actions like the launch of the StopCovid app. Indeed, people will not first keep in mind the efficiency of the mobile app but the information that the government is doing the best to stop the pandemic.

5.3 Limitations and implications for research

We conducted this study during the first wave of the COVID-19 pandemic, when the virus was not as well-known as it was at the beginning of 2021. We did not consider people's levels of fear, because we were not comparing two periods. Therefore, our results reflect a sample in which a large number of people had not yet installed the app, such that its perceived value could be specific to that period. Further research should investigate whether the evolution of the virus has moderated perceptions of the app's value and more specifically whether it can still positively affect trust in the future, trust in the government, and well-being. Our work shows that in health contexts, people are less concerned with privacy; it would be interesting to know whether it is the context, or the government source of the app, better explains this lack of concern.

6. Conclusion

Our study investigates the role of a government-issued, mobile tracing app in a pandemic context. It shows that this kind of tool can help reassure people by giving them hope, building their trust in the government, and making them feel the government is doing its best to end the pandemic. In a context in which some groups have lost faith in government, our results show that mobile apps such as StopCovid can help people regain their trust in government and the future. We offer our work as a novel view on the role of mobile tracing apps in a pandemic context.

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Table 1.

Characteristics of the sample

Gender	Female: 47.58%
	Male: 52.42%
Age	18 to 34: 30.75%
	35 to 54: 34.26%
	55 to 64: 14.89%
	65+: 20.10%
Education	Other: 1%
	BTEC: 13.43%
	A level: 20.94%
	Undergraduate
	- BTEC higher national diploma: 24.81%
	- Bachelor: 17.19%
	Graduate
	- Master's: 16.34%
	- Doctorate: 6.05%
Installation of StopCovid mobile app	Yes: 13.19%
	No: 86.81%

Table 2.

Measurement model

Items	Loadings	α	rhoA	CR	AVE
Utility		.92	.93	.92	.73
Using the StopCovid application would allow me to easily report if I have been in contact with the virus.	.70				
The use of the StopCovid application would be convenient.	.88				
Using the StopCovid application would help me to communicate important information.	.83				
I think the StopCovid application would be helpful.	.99				
Status/Social		.91	.92	.91	.72
Using the StopCovid application would make a good impression on those around me.	.90				
Using the StopCovid application would reassure my family and friends.	.91				
Not using the StopCovid application would question the people around me.	.71				
Using the StopCovid application would improve the way I am perceived by those around me (personal and professional).	.85				
Privacy		.92	.93	.92	.86
Use of the StopCovid application would weaken the respect for privacy.	.88				
Registering and using the StopCovid application would compromise my privacy as my personal information could be used without my consent.	.97				
Intrusiveness		.89	.90	.90	.69
I think the notifications from the StopCovid application will be: Low Disturbing - High Disturbing.	.75				

Least invasive -Very invasive.	.88				
Not very indiscreet - Very indiscreet.	.78				
Little intrusive - Very intrusive.	.90				
Risk		.90	.91	.91	.83
I believe that the information I would communicate via the StopCovid application will not be manipulated for any other purpose than that of Covid 19.	.86				
I believe that the information that I would communicate via the StopCovid application will not be exposed / disclosed.	.96				
Perceived Value		.93	.93	.93	.82
Despite its drawbacks (e.g., disclosure of personal data), the use of this StopCovid application is worthwhile.	.91				
Overall, I consider the costs of using the StopCovid application to be worth the effort.	.90				
Compared to the risks I have to take, I think that using the StopCovid application helps to stop the epidemic.	.91				
Trust in Government		.93	.93	.93	.82
This application shows that the government is honest with its citizens.	.90				
By proposing an application, the government is responding to my concerns about Covid-19.	.93				
By proposing this application, it increases my confidence in the government.	.89				
Well-being		.95	.95	.95	.90
I think this StopCovid application will help me feel good again.	.96				
I think this StopCovid app will help me get my joy back.	.94				
Trust in the Future		.94	.94	.94	.89
Thanks to this application, I think we'll be able to return to a normal life.	.94				
This application will help us get out of this epidemic crisis.	.94				
Word of Mouth		.91	.91	.91	.83
I'd be proud to tell my friends and family that I use the StopCovid application...	.93				
I would say mostly positive things about the StopCovid application to those around me.	.90				

Notes: α = Cronbach's Alpha ; CR = Composite Reliability ; AVE= Average Variance Extracted

Table 3.

Bootstrapping path coefficients

	M	SD	t-value	p-value	H	Sig.
Utility -> Perceived Value	.360	.048	7.475	.000	H1a	***
Status -> Perceived Value	.227	.044	5.142	.000	H1b	***
Privacy -> Perceived Value	-.096	.037	2.590	.005	H2a	*
Intrusiveness -> Perceived Value	-.107	.040	2.689	.004	H2b	*
Risk -> Perceived Value	-.276	.056	4.958	.000	H2c	***
Perceived Value -> Trust in Government	.868	.015	59.399	.000	H3	***
Perceived Value -> Well-being	.787	.018	43.481	.000	H4	***

Perceived Value -> Trust in the Future	.865	.014	59.919	.000	H5	***
Perceived Value -> Word of Mouth	.400	.072	5.541	.000	H6a	***
Trust in Government -> Word of Mouth	.089	.073	1.231	.109	H6b	ns
Well-being -> Word of Mouth	.355	.059	6.059	.000	H6c	***
Trust in the Future -> Word of Mouth	.149	.078	1.904	.028	H6d	*

Notes: M = mean; H = hypothesis; SD = standard deviation.

*Significant at .05. ** Significant at .01. *** Significant at .001.

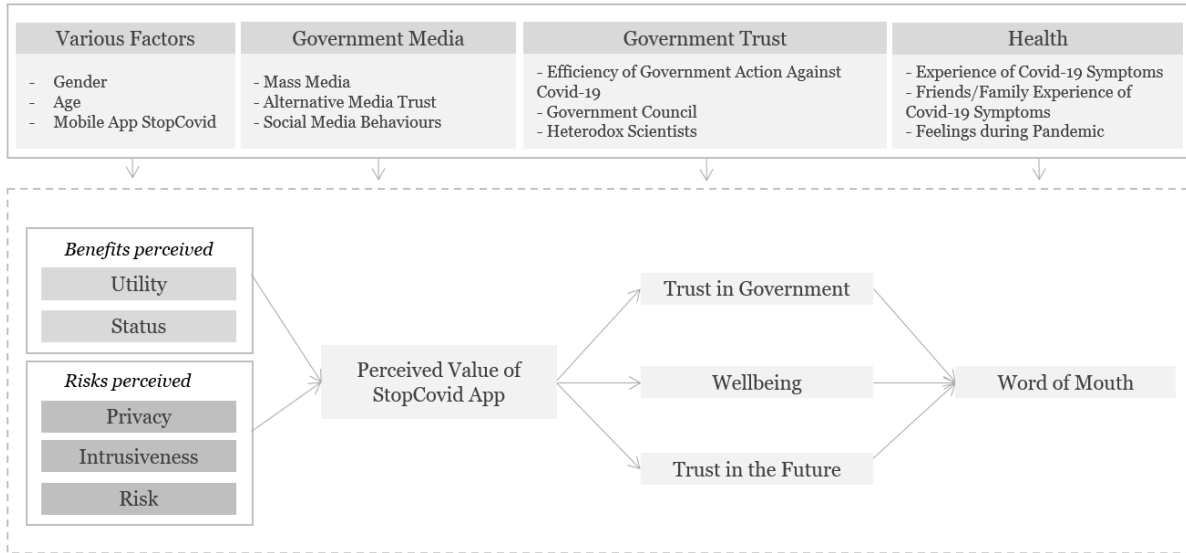


Fig. 1. Theoretical model

Table 4.

Multi-group comparison test results

	Various Moderators			Trust in Media				Trust in Government			Health			
	Gender	Age	Mobile App	Gov.	Mass Media	Alternative	Social Media	YouTube	Gov. Efficiency	Gov. Council	Heterodox scientists	Personal Covid-19 Symptoms	Friend/Family Covid-19 Symptoms	Feelings during Covid
Intrusiveness -> Perceived Value	ns.	ns.	ns.	ns.	ns.	sig.	ns.	ns.	ns.	ns.	sig.	ns.	ns.	ns.
Perceived Value -> Trust in Government	ns.	ns.	ns.	ns.	ns.	ns.	ns.	ns.	sig.	ns.	ns.	ns.	ns.	ns.
Perceived Value -> Trust in the Future	ns.	sig.	ns.	ns.	ns.	ns.	sig.	ns.	ns.	ns.	sig.	ns.	ns.	ns.
Perceived Value -> Well-being	ns.	sig.	sig.	sig.	sig.	sig.	sig.	ns.	sig.	sig.	ns.	ns.	sig.	ns.
Perceived Value -> Word of Mouth	sig.	ns.	sig.	ns.	ns.	ns.	sig.	ns.	ns.	ns.	ns.	ns.	sig.	ns.
Privacy -> Perceived Value	sig.	ns.	ns.	ns.	ns.	sig.	ns.	ns.	ns.	ns.	ns.	ns.	ns.	sig.
Risk -> Perceived Value	ns.	ns.	ns.	ns.	ns.	ns.	ns.	sig.	ns.	ns.	ns.	ns.	sig.	sig.
Status -> Perceived Value	ns.	sig.	ns.	ns.	ns.	ns.	ns.	ns.	sig.	ns.	ns.	ns.	ns.	ns.
Trust in Government -> Word of Mouth	ns.	sig.	ns.	ns.	sig.	ns.	sig.	ns.	ns.	ns.	ns.	ns.	sig.	ns.
Trust in the Future -> Word of Mouth	ns.	ns.	sig.	ns.	ns.	ns.	sig.	ns.	sig.	ns.	ns.	ns.	ns.	ns.
Utility -> Perceived Value	ns.	ns.	ns.	ns.	ns.	ns.	ns.	ns.	ns.	ns.	ns.	ns.	sig.	ns.
Well-being -> Word of Mouth	ns.	ns.	sig.	ns.	ns.	ns.	sig.	ns.	ns.	ns.	ns.	ns.	ns.	ns.

Appendix 1.

Multi-group comparison test results (general factors)

	General Factors									
	Gender (Female vs. Male)					Age (18/54 vs. 55+)				
	β Female	β Male	β diff	<i>p</i> -value diff	<i>Sig</i>	β 18/54	β 55+	B diff	<i>p</i> -value diff	<i>Sig</i>
Intrusiveness -> Perceived Value	-.162	-.079	-.083	.156	No	-.106	-.098	-.007	.461	No
Perceived Value -> Trust in Government	.866	.872	-.006	.415	No	.869	.864	.005	.437	No
Perceived Value -> Trust in the Future	.848	.880	-.032	.134	No	.840	.903	-.063	.007	Yes
Perceived Value -> Well-being	.759	.815	-.056	.057	No	.759	.831	-.072	.020	Yes
Perceived Value -> Word of Mouth	.518	.275	.243	.049	Yes	.485	.276	.209	.076	No
Privacy -> Perceived Value	-.007	-.158	.151	.031	Yes	-.123	-.032	-.091	.128	No
Risk -> Perceived Value	-.273	-.281	.008	.463	No	-.222	-.409	.187	.061	No
Status -> Perceived Value	.219	.235	-.017	.411	No	.268	.122	.146	.049	Yes
Trust in Government -> Word of Mouth	.046	.123	-.077	.305	No	-.062	.301	-.363	.005	Yes
Trust in the Future -> Word of Mouth	.151	.128	.023	.453	No	.183	.098	.086	.310	No
Utility -> Perceived Value	.396	.314	.082	.197	No	.360	.383	-.023	.407	No
Well-being -> Word of Mouth	.281	.467	-.186	.063	No	.378	.343	.034	.380	No

Appendix 2.

Multi-group comparison test results (media trust)

	Trust in Media														
	Government Media					Mass Media					Alternative Media				
	β High	β Low	β diff	<i>p</i> -value diff	<i>Sig</i>	β High	β Low	β diff	<i>p</i> -value diff	<i>Sig</i>	β High	β Low	β diff	<i>p</i> -value diff	<i>Sig</i>
Intrusiveness -> Perceived Value	-.125	-.101	-.025	.384	No	-.086	-.115	.029	.351	No	-.272	-.031	-.241	.008	Yes
Perceived Value -> Trust in Government	.844	.832	.013	.353	No	.834	.854	-.020	.324	No	.893	.855	.039	.094	No
Perceived Value -> Trust in the Future	.822	.842	-.019	.294	No	.813	.864	-.051	.078	No	.874	.859	.015	.310	No
Perceived Value -> Well-being	.658	.809	-.150	.001	Yes	.674	.809	-.135	.002	Yes	.836	.764	.072	.022	Yes
Perceived Value -> Word of Mouth	.473	.374	.099	.256	No	.306	.439	-.133	.176	No	.382	.399	-.016	.441	No
Privacy -> Perceived Value	-.153	-.073	-.080	.162	No	-.109	-.087	-.022	.404	No	-.013	-.138	.126	.032	Yes
Risk -> Perceived Value	-.190	-.292	.102	.210	No	-.368	-.236	-.131	.137	No	-.252	-.274	.022	.448	No
Status -> Perceived Value	.256	.209	.047	.325	No	.216	.233	-.017	.431	No	.264	.213	.050	.301	No
Trust in Government -> Word of Mouth	.040	.030	.011	.473	No	.247	-.017	.264	.035	Yes	.254	.036	.218	.089	No
Trust in the Future -> Word of Mouth	.074	.191	-.117	.237	No	.169	.112	.056	.348	No	.058	.197	-.139	.183	No
Utility -> Perceived Value	.363	.385	-.022	.409	No	.275	.398	-.124	.115	No	.249	.412	-.163	.084	No
Well-being -> Word of Mouth	.432	.371	.061	.323	No	.297	.439	-.142	.109	No	.310	.354	-.043	.372	No

Appendix 3.

Multi-group comparison test results (Health)

	Health														
	Personal Experience of Covid-19					Friends/Family Experience of Covid-19					Feelings during Pandemic				
	β Yes	β No	β diff	<i>p</i> -value diff	<i>Sig</i>	β Yes	β No	β diff	<i>p</i> -value diff	<i>Sig</i>	β Good	β Bad	β diff	<i>p</i> -value diff	<i>Sig</i>
Intrusiveness -> Perceived Value	-.234	-.105	-.129	.209	No	.019	-.136	.155	.065	No	-.083	-.132	.048	.269	No
Perceived Value -> Trust in Government	.897	.865	.032	.271	No	.832	.879	-.048	.115	No	.863	.878	-.015	.296	No
Perceived Value -> Trust in the Future	.823	.871	-.048	.263	No	.823	.876	-.053	.091	No	.873	.857	.015	.303	No
Perceived Value -> Well-being	.781	.788	-.007	.468	No	.695	.816	-.121	.006	Yes	.766	.817	-.051	.064	No
Perceived Value -> Word of Mouth	.259	.412	-.153	.269	No	.129	.531	-.402	.004	Yes	.413	.381	.033	.414	No
Privacy -> Perceived Value	-.225	-.080	-.146	.165	No	-.165	-.078	-.087	.199	No	-.197	-.008	-.190	.007	Yes
Risk -> Perceived Value	-.129	-.287	.159	.203	No	-.126	-.339	.214	.049	Yes	-.180	-.365	.186	.049	Yes
Status -> Perceived Value	.146	.234	-.088	.289	No	.200	.239	-.039	.340	No	.276	.184	.091	.151	No
Trust in Government -> Word of Mouth	.206	.080	.126	.399	No	.423	-.046	.469	.007	Yes	.069	.110	-.041	.379	No
Trust in the Future -> Word of Mouth	.159	.150	.009	.476	No	.118	.135	-.017	.433	No	.189	.059	.130	.211	No

Utility -> Perceived Value	.308	.360	-.052	.368	No	.577	.279	.298	.001	Yes	.352	.355	-.002	.498	No
Well-being -> Word of Mouth	.367	.350	.017	.416	No	.331	.369	-.038	.409	No	.335	.428	-.093	.249	No

Appendix 4.

Multi-group comparison test results (Government Trust)

	Trust in Government														
	Efficiency of Government Action Against COVID-19					Government Council					Heterodox Scientists				
	β Low	β High	β diff	<i>p</i> -value diff	<i>Sig</i>	β High	β Low	β diff	<i>p</i> -value diff	<i>Sig</i>	β High	β Low	β diff	<i>p</i> -value diff	<i>Sig</i>
Intrusiveness -> Perceived Value	-.135	-.066	-.069	.193	No	-.108	-.089	-.018	.416	No	-.199	-.032	-.167	.018	Yes
Perceived Value -> Trust in Government	.808	.894	-.085	.004	Yes	.858	.824	.034	.177	No	.869	.868	.000	.495	No
Perceived Value -> Trust in the Future	.845	.832	.012	.369	No	.859	.820	.039	.133	No	.904	.835	.069	.008	Yes
Perceived Value -> Well-being	.801	.698	.102	.008	Yes	.727	.797	-.069	.049	Yes	.817	.773	.043	.113	No
Perceived Value -> Word of Mouth	.365	.421	-.057	.366	No	.461	.376	.084	.284	No	.416	.383	.033	.426	No
Privacy -> Perceived Value	-.098	-.134	.036	.320	No	-.142	-.078	-.064	.215	No	-.030	-.138	.108	.071	No
Risk -> Perceived Value	-.272	-.242	-.031	.404	No	-.222	-.304	.082	.231	No	-.256	-.285	.029	.402	No
Status -> Perceived Value	.133	.329	-.196	.017	Yes	.262	.187	.075	.221	No	.288	.182	.106	.121	No
Trust in Government -> Word of Mouth	-.039	.194	-.233	.100	No	.109	-.077	.185	.111	No	.064	.123	-.059	.353	No
Trust in the Future -> Word of Mouth	.288	-.017	.304	.026	Yes	.054	.212	-.158	.170	No	.184	.114	.070	.335	No
Utility -> Perceived Value	.423	.322	.101	.154	No	.364	.380	-.016	.434	No	.284	.421	-.138	.085	No
Well-being -> Word of Mouth	.344	.426	-.082	.284	No	.381	.454	-.072	.293	No	.324	.373	-.048	.350	No

Appendix 5.

Multi-group comparison test results (Social Media Behaviors)

	Social Media Behaviors														
	Installation of StopCovid Mobile App					Social Media Usage					YouTube Usage				
	β Yes	β No	β diff	<i>p</i> -value diff	<i>Sig</i>	β High	β Low	β diff	<i>p</i> -value diff	<i>Sig</i>	β High	β Low	β diff	<i>p</i> -value diff	<i>Sig</i>
Intrusiveness -> Perceived Value	-.011	-.115	.103	.196	No	-.118	.008	-.126	.136	No	-.128	-.040	-.088	.173	No
Perceived Value -> Trust in Government	.816	.853	-.037	.240	No	.861	.899	-.038	.134	No	.887	.869	.018	.274	No
Perceived Value -> Trust in the Future	.740	.855	-.115	.091	No	.853	.930	-.077	.017	Yes	.860	.860	.001	.494	No
Perceived Value -> Well-being	.494	.786	-.292	.000	Yes	.784	.794	-.010	.386	No	.812	.766	.047	.139	No
Perceived Value -> Word of Mouth	.714	.344	.370	.038	Yes	.442	.074	.368	.003	Yes	.430	.359	.071	.343	No

Privacy -> Perceived Value	-.277	-.069	-.208	.082	<i>No</i>	-.091	-.207	.116	.107	<i>No</i>	-.109	-.044	-.065	.238	<i>No</i>
Risk -> Perceived Value	-.183	-.290	.107	.283	<i>No</i>	-.250	-.384	.134	.154	<i>No</i>	-.190	-.480	.290	.012	Yes
Status -> Perceived Value	.313	.211	.102	.300	<i>No</i>	.244	.271	-.027	.408	<i>No</i>	.260	.151	.109	.125	<i>No</i>
Trust in Government -> Word of Mouth	.177	.078	.099	.433	<i>No</i>	.052	.233	-.181	.003	Yes	.050	.072	-.022	.450	<i>No</i>
Trust in the Future -> Word of Mouth	-.540	.239	-.779	.007	Yes	.117	.488	-.371	.003	Yes	.082	.210	-.128	.255	<i>No</i>
Utility -> Perceived Value	.434	.367	.067	.439	<i>No</i>	.361	.244	.116	.181	<i>No</i>	.386	.320	.066	.251	<i>No</i>
	.632	.335	.297	.028	Yes	.384	.196	.189	.003	Yes	.423	.359	.064	.307	<i>No</i>
Well-being -> Word of Mouth															