

Design fiction and Green IT: Impact of foresight scenarios on behavioral intention

Julie Rochat (julie.rochat@b-com.com)

IRT b-com, 1219 Av. des Champs Blancs, 35510 Cesson-Sévigné

Jean-Marc Josset (jean-marc.josset@b-com.com)

IRT b-com, 75005, Paris France
Sense Lab, Orange labs, Châtillon, 92320, France

Martin Ragot (martin.ragot@b-com.com)

IRT b-com, 1219 Av. des Champs Blancs, 35510 Cesson-Sévigné, France

Julien Tauvel (julien@imprudence.fr)

91 Av. de la République, 75011 Paris, France

Mathieu Griffoul (mathieu@imprudence.fr)

91 Av. de la République, 75011 Paris, France

Abstract

The Green IT approach questions the environmental, social and economic impact of digital technology. Design fiction is a discipline that can guide behaviors in favor of Green IT by building new imaginaries. However, to our knowledge, few studies assess the impact of narratives of possible future on behavioral intentions. To answer this question, we conducted a study with 388 participants, examining the impact of 14 different scenarios of possible digital futures on individual perceptions. The results showed that, for individuals with already a high level of Green IT practices, the fear dimension of scenarios has a preeminent impact on their intention to further increase these behaviors, whereas people with little practice of Green IT are more sensitive to confidence and the presence of solutions. These results pave the way for the integration of specific technological narratives within the construction of future public policies in favor of Green IT.

Keywords: Design fiction; Green IT; Attitude; Behavioral intention; Narratives.

Introduction

In regards to the environmental crisis, digital technologies have multiple and complex impacts. On the one hand, its environmental and social impact is not negligible (Kallinikos, Aaltonen, & Marton, 2013). On the other, digital technological innovations could help address some environmental issues, as proposed by the "IT (information technology) for Green" concept (e.g., Molla, Cooper, and Pittayachawan, 2011), or social issues (see Schneider, 2019, for examples of digital technologies benefits on society). Indeed, despite efforts to optimize its consumption and recycling, the computing industry global greenhouse emissions amount to 2.1 to 3.9 percents, and these are expected to increase further in the coming years (e.g., Freitag et al., 2021). The same ambivalence applies to social aspects : while connecting billions of people together, a digitalized world can still generate inequalities (see Lutz, 2019, for examples), as some people could be excluded from this ultra-connected society. Social media applications have been praised for their ability to inform and help protest movements in authoritarian countries (Diamond, 2010), before being accused of disseminating conspiracy theories and enabling mass manipulation (Morozov, 2012).

Related work

Green IT and behavioral interventions

Hence, digital technology is a complex sector, widely integrated into all aspects of society: at individual, organisational and governmental levels. In the light of its contradictory effects, it now seems necessary for ecological and societal transition plans to seriously consider the place of digital technology in our society, and ask the question of how to encourage individuals to adopt more responsible digital practices. The Green IT approach has emerged to address the social and environmental challenges posed to society by digital technologies. This approach aims to examine the environmental, social and economic impact of digital technology (Murugesan, 2008). It has been defined as "an integrated and cooperating set of people, processes, and computing resources (Watson et al. 2010) that aim at pollution prevention, product stewardship or sustainable development, Chen et al. 2009; Molla et al. 2009a) for the purpose of enhancing environmental and economic performance (Melville 2010)" (Tan, Pan, and Zuo, 2011, p.3).

The Green IT approach implies the adoption of specific behaviors by governments, organizations and individuals, such as the appropriate recycling of technological tools. As far as individuals are concerned, relatively few studies have been carried out to define the factors involved in adopting behaviors associated with Green IT (see Theis and Schreiber (2021) for an overview). Some of the studies identified possible intervention factors, such as social norms (e.g., Yoon, 2018), motivation (e.g., Wati and Koo, 2012) or perceived knowledge (e.g., Ahmad and Nordin, 2014; Leung, Lau, Shamsub, and Lau, 2018; Rochat and Ragot, 2022). For example, Rochat and Ragot (2022) showed that the more knowledge individuals thought they had about Green IT, the better their attitude and intention to adopt Green IT behaviours. However, to our knowledge, very few of these studies have tested the application of such interventions (see Loock, Staake, and Thiesse, 2013 for an example), particularly in behavioral in-

terventions. The vast majority of them do not propose any causal links. Additionally, other behavioral interventions have been identified in the context of pro-environmental practices (see Khanna et al. (2021) or Nisa, Bélanger, Schumpe, and Faller (2019), for examples of meta-analysis or literature reviews), as the implementation of financial incentives or awareness-raising interventions. However, the literature has not always shown the effects of this type of these interventions (see Nisa et al. 2019, for examples).

Narratives and Foresight

Among the range of behavioral interventions, it appears that narrative could be a relevant option to encourage certain types of behaviors. In fact, narratives are part of persuasive interventions, as opposed to argumentative strategies (Bilandzic & Busselle, 2013). Narratives are here defined as *"a cohesive, causally linked sequence of events that takes place in a dynamic world subject to conflict, transformation, and resolution through non-habitual, purposeful actions performed by characters"* (Braddock and Dillard, 2016, p.2). In a 2016 meta-analysis, 74 articles were identified examining the impact of narratives on intentions, beliefs, attitudes and behaviors (Braddock & Dillard, 2016). The latter showed positive effects of narratives, particularly on attitudes, intentions and behaviors. Moreover, according to Yang (2013), storytelling has a strong persuasive power, whereas quantitative statements and information are less persuasive. So that, in the environmental crisis situation, narratives could be powerful tools to help societal change by making sociotechnical projects desirable and likely for a variety of social groups (Ruhrt, 2023). In this sense, a study has examined the effects of projecting participants to 2050, according to different factors, on their attitudes and political intentions, particularly in relation to climate change (Bain, Hornsey, Bongiorno, Kashima, & Crimston, 2013). They showed that a projection linked to future benevolence influenced current attitudinal attitudes and intentions.

To elaborate foresight narratives, various forecasting methodologies can be used, such as scenario planning (see Gürdür Broo et al. (2021) or Xhelili et al. (2020), for concrete examples of the application of this methodology). In relation to this topic, some studies have examined individual perceptions of possible futures, via their perceived desirability or their perceived probability (e.g., Cuhls, Dragomir, Gheorghiu, Rosa, and Curaj, 2022). Others have studied the effects of reading forward-looking scenarios on participants' willingness (e.g., Johnson, Bell, and Teisl, 2016). For example, Johnson et al. (2016) showed that participants who had read scenarios with more or less distant time dimensions were more likely to report wanting to take part in land use planning. This latest study shows that narratives presenting possible futures can have an effect on individual intentions. In parallel, other methods of speculative foresight are also used, such as design fiction. This discipline is defined as *"a way of exploring different approaches to making things, probing the material conclusions of your imagination, removing*

the usual constraints when designing for a massive market... This is a different genre of design that is forward-looking, beyond incremental, and makes an effort to explore new kinds of social interaction rituals. Design fiction is about creative provocation, raising questions, innovation, and exploration." (Bleecker, 2022, p.7). Design fiction differentiates itself from other foresight methods by allowing individuals to be more immersed in possible futures (Burnam-Fink, 2015), making them more accessible. What's more, they make these futures more likely (*"Le design fiction: Une méthode pour explorer les futurs et construire l'avenir ?"*, n.d.). Design ultimately builds more engaging, debatable, emotionally immersive scenarios. This methodology has been used in various fields to speculate on possible futures, such as the field of artificial intelligence in the educational context (e.g., Cox, 2021) or sustainable mobilities (see *"The Landscape of Envisioning and Speculative Design Methods for Sustainable Mobility Futures"*, (2020), for an example of some studies). Moreover, some have looked more specifically at design fiction and pro-environmental practices (e.g., Schippl, 2016; Wakkary, Desjardins, Hauser, and Maestri, 2013). However, to our knowledge, no study of design fiction has been carried out on Green IT in a wide way. More specifically, no study has examined individual perceptions of these scenarios and their effects on the adoption of practices associated with Green IT.

Objectives

Yet these questions are both relevant and necessary. Indeed, as mentioned above, societal and environmental situations cause us to consider the impact of digital technology, particularly in the future, and the behavioral intervention to be put in place to guide behavior. The literature has shown an interest in studying the effects of narratives, particularly prospective ones with design fiction, as a behavioral intervention, via the individual perceptions they induce. It appears that design fiction could act as a behavioural intervention, encouraging individuals to adopt behaviours associated with Green IT, through the presentation of future Green IT in 2040. Hence, the objectives of this observational study were twofold: 1) to study individual perceptions of scenarios derived from design fiction and; 2) to study the effects of perceptions induced by the scenarios on attitudes and behavioral intentions towards Green IT.

Method

Participants and Experimental Design

A total of 389 participants ($M_{age} = 37.40$; $S.D. = 11.80$; $min-max = 19.00-70.00$)¹, including 94% participants living in the United States of America, 3,60% living in India, and the others lived in Brazil, Italy or others. The sample consisted of 187 women and 197 men². They have participated in this

¹27 participants did not correctly indicate their date of birth, so this average age was calculated on a sample of 362 participants.

²Two participants did not wish to reply and three did not reply to the item.

online study on a voluntary basis. They did the survey via the Amazon Mechanical Turk (AMT) platform and were paid 1.50\$. They were randomly assigned to one of the 14 study conditions, each presenting a different design fiction scenario on Green IT (28 people per group on average, *S.D.* = 3.14).

Measures

All items were measured on a 5-point Likert scale with 1 = "Strongly disagree", 2 = "Disagree", 3 = "Neutral", 4 = "Agree" and 5 = "Strongly agree".

Control variables. Attractiveness towards technology was measured by three items³ derived from the Agarwal and Prasad (1998) scale (e.g., "*I like to experiment with new digital technologies*"). The analyses showed a bad reliability for this scale, $\alpha = .61$.

Participants' current adoption of Green IT behaviors was measured using two items inspired by the Chow and Chen (2009) scale (e.g., "*I often practice Green IT*"). Analyses revealed good reliability for this scale, $\alpha = .76$.

A manipulation check item was created, in the form of a single-choice question on the theme of the text they had just read. This item was used to check that the study had been completed seriously ("*What was the major theme of the scenario you read?*"). All participants who got it wrong were rejected from the study.

Explanatory variables. Participants' desirability of the scenario was measured by four items (e.g., "*This scenario is desirable*") and their probability of acceptance was measured by four items (e.g., "*This scenario is probable*"). The analyses revealed medium reliability for desirability scale, $\alpha = .58$, and probability scale, $\alpha = .59$.

Perceived problems and solutions within the scenarios were measured with two items (e.g., "*This scenario provides solutions*").

The share of digital technology and Green IT perceived in each scenario was measured by using one item each (e.g., "*This scenario incorporates Green IT*").

Participants' distrust of the future presented in the scenario was measured by five items (e.g., "*I will be wary of this future*"). Perceived trust in the presented future was measured using six items (e.g., "*I can trust this future*").⁴ The analyses revealed good reliability for distrust scale, $\alpha = .77$, and trust scale, $\alpha = .83$.

Dependant variables. The participants' attitude towards Green IT was measured with five items adapted from the Chow and Chen (2009) scale (e.g., "*For me, practicing Green IT is pleasant one*"). Analyses revealed good reliability for this scale, $\alpha = .74$.

Behavioral intention to adopt Green IT behaviors was measured using three items taken from the study by Rochat and

Ragot (2022), who had adapted them from the study by Chow and Chen (2009) (e.g., "*I will intend to practice Green IT*"). The analyses revealed good reliability for this scale, $\alpha = .68$. Change of intention ratio. Finally, a behavior change ratio score was calculated by subtracting the scores for current adoption of behaviours associated with Green IT from the scores for intention to change behaviours associated with Green IT. These scores were then converted into absolute values.

Material

Green IT was presented to all participants with a text of 60 words. It succinctly defined this approach and presented four associated behaviors (e.g., "*Avoiding buying new digital devices*").

In total, 14 foresight scenarios on Green IT by 2040 were constructed through design fiction methodology. The 14 scenarios were relatively homogeneous in terms of length, averaging 499.21 words (*S.D.* = 30.63, *mdn* = 502, *min-max* = 430-546).

Design fiction is a methodology to creating forward-looking scenarios. In this study, scenarios were designed in both an analytical and a creative way. In the first stage, structural drivers, like demographic dynamics, social and societal shifts, and game-changing technologies were combined. In this plausible and feasible decor, weak signals and disruptive innovations on the whole digital value chain have been explored, to identify new and radical solutions that help go off the beaten tracks. The next step was more creative with an understanding of the tensions that structure the futures of what's digital to create stakes, choosing the desirable approaches and then let the writers, designers and futurists work together to play with all the future-building components they have to envision desirable, engaging and inspiring futures. In this way, these futures have been constructed and designed to be neither utopian nor dystotypical, but possibly desirable and plausible.

Procedure

First, participants were informed that they would be conducting a study about their perceptions of a possible future and that their data would be treated confidentially and anonymously for scientific purposes. Secondly, they were asked to respond to randomly assigned items of attractiveness towards technology. Afterwards, the presentation of Green IT was read, and then the participants answered the two randomly presented items of current adoption of Green IT. In a third step, they were given instructions about the text they were going to read and were informed that they would be asked a memory test with specific questions about it at the end of the study. In the fourth step, depending on their random assignment, the participants read one of the 14 scenarios. Then, they answered the perceived desirability and probability scales, the perceived share of digital and Green IT in the scenario read scales, their confidence and distrust in the future scale, intention to adopt Green IT behaviors scale and attitude towards Green IT scale. All of these items were presented randomly

³It was initially measured with four items, but the inverted item of the scale was removed from the analyses as it made the scale unreliable, $\alpha = .29$

⁴Initially, trust was measured by seven items. However, due to an error in the nomination of the last item, it was not taken into account in the calculation of trust in the scenarios presented.

to the participants. Finally, participants indicated their gender and date of birth. They then answered a manipulation check item. In total, the study lasted about 10 minutes.

Results

Analyses are performed with STATA software (V15.0) and jamovi 1.6 (jamovi project, n.d.). The distribution into 14 groups was carried out randomly, ensuring an even distribution between women and men, and age. Variance analyses showed that the averages values for attractiveness towards technology ($F = 1.04, p = .409$) and Green IT practices ($F = 1.07, p = .389$) do not vary significantly between the groups. As a reminder, all participants rated the scenario they had just read according to eight criteria (desirability, probability, trustworthiness, distrust, problems, solution, technology and Green IT presence). A factorization (MCA) was performed to study the associations between these criteria by representing them in a 2-dimensional Euclidean space. The first two dimensions have a cumulative inertia of 64.10%.

- "Solution based trust". The first dimension (31.9% inertia) of our representation has as its main contributing variables: solution (0.18), presence of digital technology (0.13), presence of green IT (0.13) and trust (0.20).

- "From worrying to reassuring". The second dimension (28.80%) has the following main contributing variables: desirability of the scenario's occurrence (0.28), distrust (-0.21) and probability of the scenario's occurrence (0.18).

The 14 scenarios were placed as supplementary variables in the resulting map, and grouped in four classes by doing a hierarchical classification (using Ward's clustering method). Then, these scenarios were grouped with Ward's clustering method to cross-tabulate the scenarios with the averages obtained for the eight construction variables (see Figure 1).

By choosing four groups (using Duda-Hart stopping rule), a description of these four classes can be done, using their position on the MCA base map and their characteristics:

- 1. An optimistic transition (presenting scarce solutions, but rather reassuring): Not much digital technological novelties in these scenarios, which are more about individual and societal adaptation (six scenarios ; $n = 171$).

- 2. Controversial technological solutions (presenting solutions but considered a little worrying): Located to the right, but rather downwards. Some solutions exist, but they are a little worrying (mass surveillance and control) (four scenarios ; $n = 106$).

- 3. A better and harmonious future (presenting solutions and judged reassuring): Located in the upper right-hand dial. This cluster is made up of just one scenario, presenting a very positive solution oriented future (one scenario ; $n = 23$).

- 4. A stunned world : This cluster of scenarios is situated at the bottom left (presenting scarce solutions, and considered as worrying) : The scenarios in this group focus more on crises than on their resolution (three scenarios ; $n = 89$).

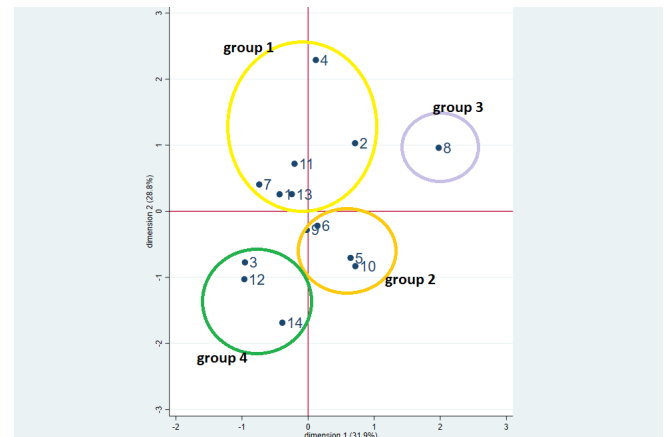


Figure 1: MCA representation of scenario groups according to their "distrust" and "solution" perceptions

Effects of clusters of scenarios

In order to statistically verify the link between the four clusters of scenarios identified and the attitude and adoption intention associated with Green IT, non-parametric Kruskal-Wallis analyses were carried out, followed by Mann-Whitney U tests when they proved significant. Non-parametric analyses were carried out because of the imbalance in the number of participants in each of the scenario clusters (one of the clusters consisted of only one scenario, with 23 participants) (see Figure 2 for descriptive analyses).

Preliminary analyses were carried out to check the homogeneity between control measures. They showed no significant differences between clusters for attractiveness towards technology, $Kruskal-Wallis(3) = 3.25, p = .355$, and current Green IT practices, $Kruskal-Wallis(3) = 3.77, p = .287$.

The analyses revealed a significant effect of the four types of scenario on the attitude associated with Green IT, $Kruskal-Wallis(3) = 8.62, p = .035$, and the intention to adopt behaviours associated with Green IT, $Kruskal-Wallis(3) = 9.95, p = .019$. However, no significant link was shown for the calculation of the change of intention ratio, $Kruskal-Wallis(3) = 4.82, p = .185$.

For attitude, participants who read scenarios classified as "An optimistic transition" reported a lower attitude towards Green IT than those confronted with the scenario classified as "A better and harmonious future", $U = 1356, p = .015$. Similarly, participants in the "A better and harmonious future" scenarios reported having a better attitude than those in the "A stunned world" scenarios, $U = 675.00, p = .011$. No other differences were revealed by the analyses, $p > .099$.

Concerning intention to adopt Green IT behaviours, results showed that participants in the "An optimistic transition" scenarios have reported having less intention of adopting Green IT-related behaviours than those who had read "Controversial technological solutions" scenarios, $U = 7472.00, p = .012$. Similarly, participants in the "Controversial technological solutions" scenarios reported having more intention of adopt-

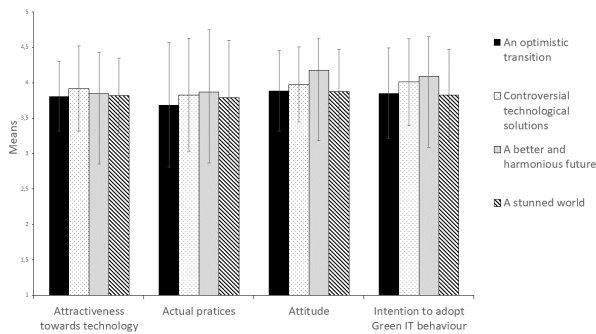


Figure 2: Means and standards deviation associated with measures according to group scenarios

ing Green IT-related behaviours than those who had read "A stunned world" scenarios, $U = 3727.00$, $p = .010$. Analyses showed no other significant differences, $allp > .092$.

Effects of participant characteristics

We use the participants' initial responses : gender, age and declared use of Green IT to form eight combinations. A projection of these combinations as supplementary variables on the previous MCA, shows two groups, mainly based on the declared usage of Green IT : whatever age and gender, (1) people with higher usage of Green IT expressed more anxiety and more solutions orientation, while (2) people who declared a lesser usage, expressed less solution, and more reassuring. To test this categorization on the final answers of the questionnaire (after reading the scenarios and judging them), we do a regression of: 1) the intention of practicing Green IT and; 2) the attitude Verso Green IT by the different criteria used in our factorization for each of the groups (see Table 1). Whether the intention is to adopt Green IT or the associated attitude, for the group with higher practitioners of Green IT, analyses showed that distrust is the more significant and important coefficient with probability of occurrence. For the group with lesser practitioners of Green IT, the trust parameter is the most important, as well as for intention to adopt Green IT-behaviours and for attitude. Individuals who strongly practise behaviours associated with Green IT are more sensitive to scenarios that present a future that we should be wary of. On the other hand, individuals with a low level of Green IT behaviour are more sensitive to scenarios presenting a future in which they can be confident.

Discussion

This study had the objectives 1) to study the perceptions of foresight narratives, constructed using the design fiction approach, on individual perceptions and 2) to examine the impact of these perceptions on intention to practice Green IT behaviors and attitudes towards Green IT.

Firstly, the results showed that four clusters of scenarios could be differentiated on the basis of the perception measures

collected (desirability, probability, trustworthiness, distrust, problems, solution, technology presence end Green IT presence). Some of these criteria are more influential than others: (1) the trust (or fear) and (2) the presence of solutions to the problems.

Second, results showed that these perceptions influence the attitudes and behavioral intentions associated with Green IT. Our results showed that individuals who were confronted with scenarios judged to lead to positive solutions for the future reported a more positive attitude towards Green IT than individuals confronted with scenarios judged to be (1) the most worrying, with no solutions, or (2) less technological, presenting societal and individual adaptations. Moreover, participants who had read scenarios considered to be solution-oriented and a little worrying, were more likely to adopt behaviours associated with Green IT than those confronted with worrying scenarios, and presenting no solutions, or presenting few solutions with more societal or individual adaptations. These results suggest that prospective scenarios derived from design fiction can have a framing effect, thanks to the perceptions they convey. The framing effect (Tversky & Kahneman, 1981) shows that decisions depend on the way (positive or negative) in which the problem is described (in a risky situation, it is easier to choose the option that is positively presented). It has been verified empirically by numerous studies (Khberger, 1998), in many fields, such as artificial intelligence (e.g., Ragot et al., 2020).

Our results seem to indicate that these effects are conditioned by the perceptions induced by the future scenarios presented. It is possible that these perceptions induced different emotions in the participants. According to the literature, these emotions or affects are strong predictors in the context of climate change (see Brosch, 2021, for a recent meta-analysis). It is all the more interesting to note that our results suggest differences in the effects of perception on attitude and intention to adopt behaviour. Indeed, it turns out that, to increase a more positive attitude towards Green IT, proposing scenarios with positive solutions seems the most effective. This suggests that potentially positive affects conveyed by future scenarios improve attitudes towards Green IT. This result may be consistent with the findings of Bain et al. (2013). These researchers had shown that the positive (benevolent in their study) nature of projections does indeed seem to positively influence attitudes, particularly in the context of climate change. Conversely, and contrary to Bain et al. (2013)'s results, scenarios perceived as more worrying, and therefore likely to generate more negative emotions, increase the intention to adopt Green IT. This is in line with certain results from the literature, which have shown that messages with negative emotional content influence adaptation intentions, for example in the context of climate change (Hine et al., 2016). In this sense, it is possible that a form of threat have been perceived by the participants, a threat that has effects on evocations of fear (Carey, McDermott, & Sarma, 2013). According to some studies on pro-environmental be-

Table 1: Regression analysis

	Intention to adopt Green IT-behaviours		Attitude associated with Green IT	
	Higher practitioners	Lesser practitioners	Higher practitioners	Lesser practitioners
Desirability	-0.139 (.215)	0.063 (.484)	0.050 (.330)	-3.580 (.996)
Probability	0.248 (.017)*	-0.001 (.989)	0.050 (.045)*	5.582 (.357)
Presence of IT	0.056 (.518)	0.145 (.021)*	0.103 (.006)**	8.492 (.058)
Presence of Green IT	-0.127 (.177)	0.051 (.419)	0.036 (.288)	2.252 (.601)
Distrust	0.404 (.000)***	0.028 (.706)	0.116 (.025)**	1.863 (.978)
Trust	0.165 (.141)	0.262 (.001)***	0.086 (.129)	3.260 (.001)***
Solutions	0.064 (.512)	0.124 (.076)	0.062 (.128)	1.641 (.006)**
Problem	-0.181 (.079)	0.068 (.282)	-0.006 (.842)	5.411 (.181)

Standardized beta coefficients; p-values in parentheses. * $p < .05$, ** $p < .01$, *** $p < .001$

haviour intentions, threat appeals have contradictory effects (see Kothe et al., 2019, for an example). Our study seems to indicate that the effects linked to the perception of a threat can be differentiated according to the type of content proposed: the presence of technologies, the absence of solutions, and so on. Moreover, the futures presented are concrete stories, not abstract ones, and messages that appeal to fear in a concrete way would be more effective than more abstract ones (Schuetz, Benjamin Lowry, Pienta, & Bennett Thatcher, 2020). These results confirm the metanalysis of Bechtoldt, Götman, Moslener, and Pauw (2021) which show that people's belief in their ability to change and engage in adaptive actions, as well as their emotional reaction are the strongest predictors of behavior change. However, all these explanations are only speculative, as we do not measure affects or emotions in this study. It would be interesting, in future studies, to record the emotions induced by the presentation of prospective scenarios in order to verify this hypothesis.

Finally, the results of this study showed that the perceptions linked to the scenarios had a different influence on the intention to adopt behaviour and attitude, depending on the profile of the individuals. In fact, this study showed that people who already practiced a great deal of behavior associated with Green IT were more influenced in terms of adoption intention by scenarios judged to be somewhat distrustful. Conversely, people with few Green IT-related behaviours were more influenced by scenarios judged to present a confident future. This shows that design fiction must present possible futures adapted to the characteristics of the populations concerned. Taken together, these results show that design fiction can indeed influence individuals, as narratives of possible futures, through the perceptions it can convey. This is ultimately in line with the results of Braddock and Dillard (2016)'s meta-analysis, which showed that narratives have an influence on attitudes and behaviour.

This study presents several limitations. First, the reliability analyses of the desirability and probability measures proved to be relatively average. Second, the analyses revealed a strong disparity in terms of the number of participants in the clustering of scenarios into four categories. It would be interesting to conduct a similar study with groups that are more

equivalent in terms of number of people. Thirdly, attitudes towards Green IT were not measured until after the scenarios had been presented. It would be interesting, in future studies, to investigate a possible effect of attitude change through the presentation of design fiction scenarios. Fourthly, other perceptual measurements of the scenarios presented could have been carried out. For example, the quality of script writing, perceived meaning, etc., could be studied to examine their effects on attitudes and behavioural intentions. This should be investigated in future studies. Finally, only behavioural intentions were measured, not actual changes in behaviour. Indeed, there are different conditions that may not lead to adoption action (Dubuisson-Quellier, 2018, for examples). Therefore, in future studies, it would seem appropriate to measure this adoption of behaviour via a longitudinal study. In this study, it is suggested that design fiction, via the perceptions it induces, could be considered as a behavioural intervention for Green IT behaviors. It would be interesting, in future studies, to compare or to complete its effects with other forms of intervention for other behaviours.

Conclusion

Based on the results of this study, people who are already aware and active will be more sensitive to the trust solution, whereas for people who are not convinced, the need to be reassured first is predominant in the proposed story. In addition, the results of this study suggest different effects depending on the connotations of the scenarios presented. They seem to show that to improve people's attitude towards Green IT, it is preferable to expose them to future solutions. On the other hand, to encourage them to think about adopting behaviours associated with Green IT, scenarios considered more worrying are more effective. These promising results pave the way for new foresight studies on the influence of future narratives on the orientation of individual behaviors. This could be an important guideline for more effective storytelling, through design, to promote responsible and ethical behavior in relation to digital technologies.

Acknowledgements

Our study was carried out within b-com, an institute of research and technology dedicated to digital technologies. It received support from the Future Investments program of the French National Research Agency (grant no. ANR-07-A0-AIRT).

References

- Agarwal, R., & Prasad, J. (1998, June). A conceptual and operational definition of personal innovativeness in the domain of information technology. *Information Systems Research, 9*(2), 204–215. (Publisher: INFORMS) doi: 10.1287/isre.9.2.204
- Ahmad, T. S. T., & Nordin, M. (2014). University students' subjective knowledge of green computing and pro-environmental behavior. doi: 10.5539/IES.V7N2P64
- Bain, P. G., Hornsey, M. J., Bongiorno, R., Kashima, Y., & Crimston, D. (2013, April). Collective futures: how projections about the future of society are related to actions and attitudes supporting social change. *Personality & Social Psychology Bulletin, 39*(4), 523–539. doi: 10.1177/0146167213478200
- Bechtoldt, M. N., Götmann, A., Moslener, U., & Pauw, W. P. (2021, February). Addressing the climate change adaptation puzzle: a psychological science perspective. *Climate Policy, 21*(2), 186–202. doi: 10.1080/14693062.2020.1807897
- Bilandzic, H., & Busselle, R. (2013). Narrative persuasion. In *The SAGE handbook of persuasion: Developments in theory and practice, 2nd ed* (pp. 200–219). Thousand Oaks, CA, US: Sage Publications, Inc.
- Blecker, J. (2022). Design Fiction. In *Machine Learning and the City*. John Wiley & Sons, Ltd. (Section: 24) doi: 10.1002/9781119815075.ch47
- Braddock, K., & Dillard, J. P. (2016). Meta-analytic evidence for the persuasive effect of narratives on beliefs, attitudes, intentions, and behaviors. *Communication Monographs, 83*(4), 446–467. (Place: United Kingdom Publisher: Taylor & Francis) doi: 10.1080/03637751.2015.1128555
- Brosch, T. (2021, December). Affect and emotions as drivers of climate change perception and action: a review. *Current Opinion in Behavioral Sciences, 42*, 15–21. doi: 10.1016/j.cobeha.2021.02.001
- Burnam-Fink, M. (2015, June). Creating narrative scenarios: Science fiction prototyping at Emerge. *Futures, 70*, 48–55. doi: 10.1016/j.futures.2014.12.005
- Carey, R. N., McDermott, D. T., & Sarma, K. M. (2013, May). The Impact of Threat Appeals on Fear Arousal and Driver Behavior: A Meta-Analysis of Experimental Research 19902011. *PLoS ONE, 8*(5), e62821. doi: 10.1371/journal.pone.0062821
- Chow, W. S., & Chen, Y. (2009, December). Intended belief and actual behavior in green computing in hong kong. *Journal of Computer Information Systems, 50*(2). (Publisher: Taylor & Francis) doi: 10.1080/08874417.2009.11645392
- Cox, A. M. (2021, January). Exploring the impact of Artificial Intelligence and robots on higher education through literature-based design fictions. *International Journal of Educational Technology in Higher Education, 18*(1), 3. doi: 10.1186/s41239-020-00237-8
- Cuhls, K., Dragomir, B., Gheorghiu, R., Rosa, A., & Curaj, A. (2022, April). Probability and desirability of future developments: Results of a large-scale Argumentative Delphi in support of Horizon Europe preparation. *Futures, 138*, 102918. doi: 10.1016/j.futures.2022.102918
- Diamond, L. (2010). Liberation technology. *J. Democracy, 21*, 69. (Publisher: HeinOnline)
- Dubuisson-Quellier, S. (2018). *La consommation engage*. Presses de la Fondation nationale des sciences politiques.
- Freitag, C., Berners-Lee, M., Widdicks, K., Knowles, B., Blair, G. S., & Friday, A. (2021, September). The real climate and transformative impact of ICT: A critique of estimates, trends, and regulations. *Patterns (New York, N.Y.), 2*(9), 100340. doi: 10.1016/j.patter.2021.100340
- Gürdür Broo, D., Lamb, K., Ehwi, R. J., Pärn, E., Koronaki, A., Makri, C., & Zomer, T. (2021, February). Built environment of Britain in 2040: Scenarios and strategies. *Sustainable Cities and Society, 65*, 102645. doi: 10.1016/j.scs.2020.102645
- Hine, D. W., Phillips, W. J., Cooksey, R., Reser, J. P., Nunn, P., Marks, A. D. G., ... Watt, S. E. (2016). Preaching to different choirs: How to motivate dismissive, uncommitted, and alarmed audiences to adapt to climate change? *Global Environmental Change, 36*, 1.
- jamovi project, T. (n.d.). *jamovi*. Retrieved from <https://www.jamovi.org>.
- Johnson, M. L., Bell, K. P., & Teisl, M. F. (2016, November). Does reading scenarios of future land use changes affect willingness to participate in land use planning? *Land Use Policy, 57*, 44–52. doi: 10.1016/j.landusepol.2016.05.007
- Kallinikos, J., Aaltonen, A., & Marton, A. (2013). The ambivalent ontology of digital artifacts. *Mis Quarterly, 357–370*. (Publisher: JSTOR)
- Khanna, T. M., Baiocchi, G., Callaghan, M., Creutzig, F., Guías, H., Haddaway, N. R., ... Minx, J. C. (2021, September). A multi-country meta-analysis on the role of behavioural change in reducing energy consumption and CO2 emissions in residential buildings. *Nature Energy, 6*(9), 925–932. doi: 10.1038/s41560-021-00866-x
- Kothe, E. J., Ling, M., North, M., Klas, A., Mullan, B. A., & Novorodovskaya, L. (2019, December). Protection motivation theory and proenvironmental behaviour: A systematic mapping review. *Australian Journal of Psychology, 71*(4), 411–432. (Publisher: Routledge eprint: <https://doi.org/10.1111/ajpy.12271>) doi: 10.1111/ajpy.12271
- Khberger, A. (1998, July). The Influence of Framing on Risky Decisions: A Meta-analysis. *Organizational Behavior*

- ior and Human Decision Processes*, 75(1), 23–55. doi: 10.1006/obhd.1998.2781
- The Landscape of Envisioning and Speculative Design Methods for Sustainable Mobility Futures. (n.d.), 12.
- Le design fiction: Une méthode pour explorer les futurs et construire l'avenir ? (n.d.), N 421.
- Leung, N. K. Y., Lau, S., Shamsub, H., & Lau, S. Y. (2018, September). A study of perception factors that affect green it behavior completed research..
- Loock, C.-M., Staake, T., & Thiesse, F. (2013, December). Motivating energy-efficient behavior with green is: an investigation of goal setting and the role of defaults. *MIS Quarterly*, 37. doi: 10.25300/MISQ/2013/37.4.15
- Lutz, C. (2019, April). Digital inequalities in the age of artificial intelligence and big data. *Human Behavior and Emerging Technologies*, 1(2), 141–148. doi: 10.1002/hbe2.140
- Molla, A., Cooper, V., & Pittayachawan, S. (2011, August). The Green IT Readiness (G-Readiness) of Organizations: An Exploratory Analysis of a Construct and Instrument. *Communications of the Association for Information Systems*, 29(1). doi: 10.17705/1CAIS.02904
- Morozov, E. (2012). *Net Delusion* (Reprint dition ed.). New York: PublicAffairs.
- Murugesan, S. (2008). Harnessing Green IT: Principles and Practices. *IT Professional*, 10(1), 24–33. doi: 10.1109/MITP.2008.10
- Nisa, C. F., Bélanger, J. J., Schumpe, B. M., & Faller, D. G. (2019, December). Meta-analysis of randomised controlled trials testing behavioural interventions to promote household action on climate change. *Nature Communications*, 10(1), 4545. doi: 10.1038/s41467-019-12457-2
- Rochat, J., & Ragot, M. (2022, September). Adoption of green it behaviours: a perceived knowledge effect on responsible digital practices? In *MobileHCI '22 Adjunct*. Vancouver, Canada.
- Ruhrort, L. (2023, January). Can a rapid mobility transition appear both desirable and achievable? Reflections on the role of competing narratives for socio-technical change and suggestions for a research agenda. *Innovation: The European Journal of Social Science Research*, 36(1), 123–140. (Publisher: Routledge eprint: <https://doi.org/10.1080/13511610.2022.2057935>) doi: 10.1080/13511610.2022.2057935
- Schippel, J. (2016, January). Assessing the desirability and feasibility of scenarios on eco-efficient transport: a heuristic for efficient stakeholder involvement during foresight processes. *Foresight*, 18(1), 41–58. (Publisher: Emerald Group Publishing Limited) doi: 10.1108/FS-05-2014-0034
- Schneider, S. (2019). The Impacts of Digital Technologies on Innovating for Sustainability. In N. Bocken, P. Ritola, L. Albareda, & R. Verburg (Eds.), *Innovation for Sustainability: Business Transformations Towards a Better World* (pp. 415–433). Cham: Springer International Publishing. doi: 10.1007/978-3-319-97385-2_2
- Schuetz, S. W., Benjamin Lowry, P., Pienta, D. A., & Bennett Thatcher, J. (2020, July). The Effectiveness of Abstract Versus Concrete Fear Appeals in Information Security. *Journal of Management Information Systems*, 37(3), 723–757. doi: 10.1080/07421222.2020.1790187
- Tan, B., Pan, S. L., & Zuo, M. (2011, December). Attaining and Enacting Green Leadership: Insights from the Green IT Initiatives of China Mobile. In *ICIS 2011 Proceedings*.
- Theis, V., & Schreiber, D. (2021). State-of-the-art of scientific production about green information technology. *Gesto & Produo*, 28(4), e5557. doi: 10.1590/1806-9649-2021v28e5557
- Tversky, A., & Kahneman, D. (1981, January). The Framing of Decisions and the Psychology of Choice. *Science*, 211(4481), 453–458. (Publisher: American Association for the Advancement of Science) doi: 10.1126/science.7455683
- Wakkary, R., Desjardins, A., Hauser, S., & Maestri, L. (2013, September). A sustainable design fiction: Green practices. *ACM Transactions on Computer-Human Interaction*, 20(4), 23:1–23:34. doi: 10.1145/2494265
- Wati, Y., & Koo, C. (2012, January). Toward green is adoption behaviors: a self-determination perspective. In *2012 45th Hawaii International Conference on System Sciences* (pp. 1207–1216). (ISSN: 1530-1605) doi: 10.1109/HICSS.2012.598
- Xhelili, A., Strube, R., Grossi, F., Zvinov, I., Taylor, T., Martinez-Juarez, P., ... Gjorgjević, D. (2020, January). A Technological Scenario for a Healthier, More Equitable and Sustainable Europe in 2040: Citizen Perceptions and Policy Implications. *International Journal of Environmental Research and Public Health*, 17(1), 231. (Number: 1 Publisher: Multidisciplinary Digital Publishing Institute) doi: 10.3390/ijerph17010231
- Yang, C. C. (2013, June). Telling Tales at Work: An Evolutionary Explanation. *Business Communication Quarterly*, 76(2), 132–154. (Publisher: SAGE Publications) doi: 10.1177/1080569913480023
- Yoon, C. (2018, June). Extending the TAM for Green IT: A normative perspective. *Computers in Human Behavior*, 83, 129–139. doi: 10.1016/j.chb.2018.01.032