The effect of visual information complexity on urban mobility intention and behavior

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Abstract. Encouraging soft mobility practices is a central issue for the ecological transition. Green information systems and more specifically self-tracking applications are tools that can be used to raise awareness and changing behavior. Based on the theoretical framework of visual complexity, this paper examines how the level of visual complexity of a mobile application influences users' urban mobility intentions and behaviors. We conducted two experimental studies. The first one investigated how the visual complexity of homepages affects mobility intentions with an application to measure one's carbon footprint in a situational setting. The first result of our research is that moderate information visual complexity positively influences the acceptability of a mobile application as well as mobility intentions. A second experimental research is divided into two parts, firstly, participants responded to our questionnaire, secondly, in a longitudinal approach, 51 subjects used the application over a 3-month period. The conceptual framework was tested using regression analyses. We find that intention to change behavior influences responsible urban mobility behavior. However, our experiment shows that the visual complexity of information does not have a significant influence on behavior. We then propose theoretical implications.

Keywords: Green Information System · responsible behavior · urban mobility · visual complexity · self-tracking.

1 Introduction

Despite a significant decrease in greenhouse gas emissions from transport, the latest IPCC report of 2022 warns that global warming in Europe will increase more than the world average [19]. The report also insists on the effectiveness of adopting gasoline-free urban mobility choices. Therefore, individuals need to be made aware of the environmental impact of their mobility so that they can, if necessary, change their behavior and reduce their impact on the environment. Despite the growing organizational and research efforts on transforming behavioral intentions into virtuous behaviors, much remains to be discovered about bridging this 'green gap' [37] that calls for work by researchers in sustainable behavior [14].

Information framing is an effective approach used in many research studies [24]. It considers that the way information is presented to the public influences the choices people make about how to process the information. In particular, the visual complexity of a piece of information impacts consumers' processing and final decisions [29]. The visual complexity of a stimulus refers to the amount of elements as well as the level of detail present. It can be defined as the diversity of visual elements [12]. Most research on this topic is based on Berlyne's theory of visual complexity [4] and the literature tells us that a visual stimulus of moderate visual complexity (as opposed to simple or complex) is more effective on purchase intentions [12, 42]. This is supported by several subsequent studies [11, 28].

Our research is particularly interested in the effect of technology use, adoption and visual complexity on behavior. We combine behavioral analysis from a computer science and a management science perspectives. The association of the two disciplines appeared to be an asset for the implementation of our experiments. We adopt a quantitative, experimental design combining a questionnaire and a longitudinal mobile app experiment with 189 participants over three months to test the potential impact of information complexity on people's behavior and intent. The first study presented is a situational setting with a questionnaire and the second is a two-stage study with the use of a mobile application on a longitudinal format with a questionnaire. The research presented here aims to provide empirical evidence of environmental awareness and behavior change through visual complexity.

Contributions:

- We observed that moderate visual complexity has a more significant effect on the intention of responsible transportation behavior than higher or lower visual complexity home pages.
- We find that moderate visual complexity does not have a more significant effect on responsible mobility behavior than higher or lower visual complexity home pages.

The theoretical aspects of behavior change incentives, self-monitoring, and the impact of visual complexity will be developed in section 2. We will then present our hypotheses and the protocol of the two studies in section 3. The results of impact of our application on people's intention and behavior will be exposed in section 4. Finally, we summarize our work and present future directions in section 5.

2 Materials and methods

2.1 A lever for behavioral change, the Green IS and self-tracking

To encourage sustainable behavior change, the use of Green Information Systems (IS) has emerged. The roles played by IS can be classified into three types: automate, inform (inform up and inform down) and transform, even if the majority of IS can only fulfill one of these three roles in practice [35]. Beyond the specific roles, it is the objectives of user-centered green IS that remain to be defined, as this area of research is still under-explored [6]. The most common application areas of these IS are oriented towards health and education. Studies are generally conducted with mobile devices (i.e., pervasive technologies) in these domains with feedback to lose weight or reduce alcohol consumption [26] or with the use of microlearning [7]. These studies show the effectiveness of these methods on user behavior.

In the context of our research - sustainable mobility applications - the most employed role is to inform [6] through the use of tools and/or feedback systems [15]. Self-tracking technologies allow people to access, monitor and analyze personal data in several areas [9] and for many individuals it is now a common practice to assess their performance, step count, diet, sleeping and more [21]. In the literature, studies about the adoption of self-tracking technology are mostly based on the unified theory of technology acceptance (UTAUT) [39]. The work of Ajana and al. [1] demonstrates that greater adoption of a self-tracking application for sports practices positively influences individuals' intentions. But, although these digital solutions are being developed to encourage responsible behavior, there is little research on their real impact. We know that tracking personal data can lead individuals to perform in a task 'for oneself' [27]. Still, the effect of information in changing and maintaining green mobility behavior raises many questions.

Compared to self-tracking applications with an essentially individual dimension, Gabrielli et al. explored the impact of a mobile application offering different transport options [17]. They show a slight increase in sustainable transport choices over a one-month period. Tulusan and al. provide a mobile application based on eco-feedback to reduce employees fuel consumption during driving [38]. The impact of the feedback is evaluated and revealed that drivers using the app save 3.23% of fuel. While this impact may seem minimal for the 25 participants of the study, it would make a notable difference on a larger population. Still with the objective of more responsible mobility, the measurement of the impact on individual mobility of a more environmentally friendly transport offer is also interesting [16]. The results of this early-stage study on 13 volunteers show the engagement in the application but not a change of behavior.

According to [1], individuals, who grant a higher acceptability of the application, should be more inclined to have stronger behavioral intentions towards the application's goal. In this paper, we predict that app acceptability mediates the effect of information complexity on more responsible behavioral intentions.

It may be noted that in the context of urban mobility, the results of some studies based on feedback are mixed. We can therefore legitimately ask the question of the impact of the information transmitted to the user. Here, we add the criterion of visual complexity of a digital tool to understand whether or not it can impact sustainable mobility intentions and behaviors. To our knowledge, no research has investigated visual complexity in an environmental setup.

2.2 The effects of visual complexity of information on individuals.

Berlyne is a pioneer in the research field of the perception and the behavior in response to the stimuli, with his book "Conflict, arousal, and curiosity" [4]. He defines four tools into stimuli selection namely Novelty, Uncertainty, Conflict and Complexity. He considers that complexity is "the most impalpable of the four elusive concepts" and he enumerates some properties of complexity. First, the number of elements that increases the complexity. Second, complexity can be reduced by having identical elements with specific conditions, such as locations, or even with a common property. The complexity varies inversely with the degree of response to multiple elements as a unit. Indeed, the closer the elements are to each other, the more an individual will consider these close elements as a whole (i.e., a unit), the less complexity he perceives.

To determine whether a stimulus is efficient, it is important to define the features that focus attention. This is the goal of Treisman and Gelade in 1980, who proposed the theory of feature integration [36]. This theory defines color, orientation, spatial frequency, brightness and direction of motion as attractors. Other works in the field of visual attention research has led to a better understanding of the mechanisms of perception and attention. Computational models have made it possible to determine the salience of a scene from the various elementary feature maps by extracting the activity level of each element that composes it [23]. This prediction allows to know where the attention is focused. Subsequently, discriminative properties such as contrast, color, edge orientation and movement have been defined to increase the visual salience of a scene [20].

Work on visual complexity illustrates negative effects of high visual complexity on consumers' emotional reactions [12], on information processing fluency showing that individuals with limited acquisition capacity are more sensitive to low visual complexity information [29]. In website design, low visual complexity leads to experience higher levels of trust and more positive judgments of website aesthetics [42]. Conversely, some studies have shown that consumer satisfaction is higher when the visual complexity of a web page is high [31]. Other researchers found that advertising with high visual complexity increases consumers' attention to the communication and generates a positive attitude [32]. A significant body of research, based on Berlyne's theory, concludes that moderate visual complexity has a more significant effect on purchase intentions [12, 40]. According to the work of Geissler et al. [18], web pages with moderate visual complexity provoke a more favorable response in the user, what has been confirmed by other studies [12, 41].

2.3 Experiments and hypothesis

In an attempt to determine the impact of the information provided on mobility intentions and behaviors, we propose two experiments measuring the effects of the visual complexity of CO_2 information. To achieve this goal we have created our own application to measure this variable on intentions and behaviors. More precisely, we conducted two complementary experimental studies, the first study is a situational setting experiment exploring the effect of visual complexity on behavioral intentions and the second study is in real condition experiment through a mobile application. For each setting we formulate several closely related hypothesis.

Situational setting experiment:

HS1: An application with moderate visual complexity will have greater acceptability than one with low or high complexity. All of the abovementioned literature leads us to consider that the level of complexity could determine the impact of information on the acceptability of a self-tracking application and then on behavior.

HS2: An application with moderate visual complexity elicits more responsible behavior intentions. In addition to the effectiveness of moderate complexity on the acceptability of a technology, we assume that this level of complexity will also elicit more favorable behavioral intentions depending on the purpose of the application. In our case, this is the intention to use means of transport that emits less CO_2 than the car.

HS3: High acceptability of the application has a positive effect on intentions for more responsible behavior. If information visual complexity produces this effect, acceptability should in turn influence behavioral intentions towards more responsibility. This hypothesis is supported in particular by research examining the effectiveness of self-tracking tools on attitudes and behavioral intentions.

Real condition experiment:

HR1: An application with moderate visual complexity leads to more responsible behavior. Our theoretical framework allows us to assume that a level of visual complexity on a digital device influences urban mobility behavior. We then assume that an application with moderate complexity generates less CO_2 emitting urban mobility behaviors.

HR2: Intentions to behave more responsibly generate more responsible behavior. Although the literature has addressed this problem between behavioral intention and actual behavior, the gap persists [2]. Our hypothesis assumes that intentions to emit less CO_2, are transformed into more responsible behavior, thanks to the application.

3 Experiment

3.1 Protocol

Our hypotheses were tested in two experiments with a mobile application with three levels of complexity by varying the characteristics, quantity and arrangement of elements. More specifically, three homepages (see Figure 1) have been created by taking into account the criteria described by Wang et al. [41], namely quantity of elements, variety of elements, asymmetry of elements, irregularity of elements. These elements are also shared in the visual attention community as intensity (or intensity contrast, or luminance contrast), color, and orientation [5]. After developing the different stimuli, we checked the validity of the manipulation. Our concern was to check the perception of the level of visual complexity prior to conducting our experiments. We pre-tested the perceived visual complexity of the stimuli by asking 74 participants to rate the quantity, variety and irregularity of the stimuli on 9-items using a 7-point scale (1 = "Strongly disagree", 7= "Strongly agree"), adapted from Lee, Hwangbo and Ji [25]. A descriptive analysis and ANOVA were conducted. The results of this pretest confirm significant differences (F = 28.959, p = 0.000) between the three complexity levels. The high complexity homepage is well perceived as more complex (mean = 4.359, SD = 0.6675) than the moderate complexity homepage (mean = 3.340, SD = 0.7398) and the low complexity homepage (mean = 2.270, SD = 1.0123), thus confirming the validity of the manipulation.

3.2 Situational setting experiment methodology

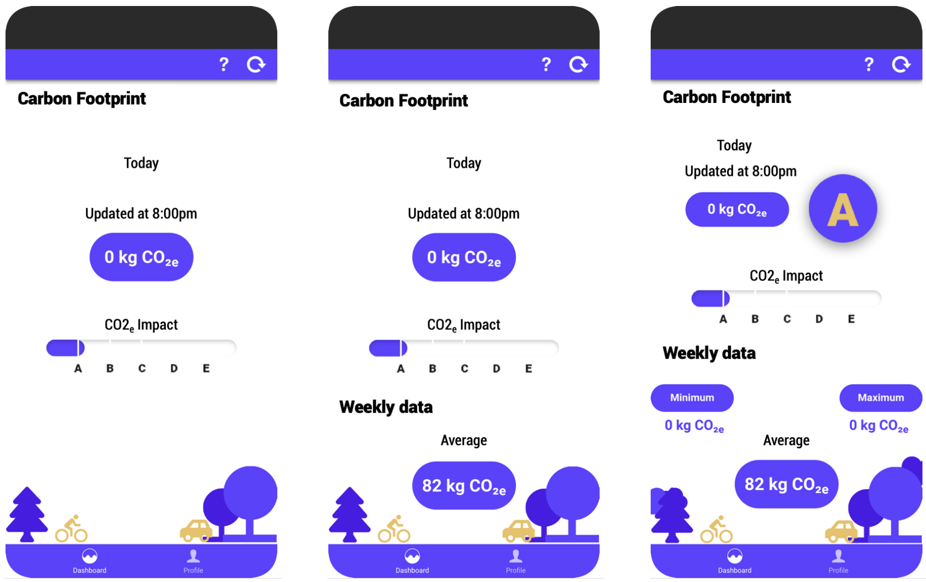
For the first experiment, 362 people (39% between 15 and 20 years old, 46% between 21 and 25 years old, 15% between 26 and 35 years old, 49.5% of women), recruited in several French cities, took part in this study. Recruitment was carried out using the snowball method on a voluntary basis.

After randomly viewing one of the three versions (i.e., homescreens), participants responded to a questionnaire in order to rate their acceptability of the application as a function of the complexity of the stimulus using 21 items and 7 dimensions based on the UTAUT model (Perceived Usefulness, Perceived Ease of Use, Social Influence, Facilitating Conditions, Hedonic Motivations, Habit, Intention to Use) using a 7-point scale (1 = "Strongly Disagree", 7 = "Strongly Agree") [39], averaged in a single measure.

They also rated their intention to use transport that emits less CO_2 than the car on a 4-item, 7-point scale (1 = "Strongly disagree", 7 = "Strongly agree") [8], averaged into one measure. We told subjects that they had to answer the questions by taking into account the visual (with one of the three levels of complexity) before each construct.

3.3 Real condition experiment methodology

The second experiment follows a two-stage design. First, participants were asked to fill in a questionnaire before installing the "Eco-Mobility" application. Vol-



(a) Low complexity (b) Medium complexity (c) High complexity

Fig. 1: Homepage with three different levels of complexity (low, medium and high for left to right). *The visuals have been translated into English for comprehension purposes even though the application has been designed in French.*

unteers were then randomly assigned to three groups of visual complexity when they registered on the application.

Front end of Eco-Mobility: The front end of the Eco-Mobility application (named dashboard) is designed with the results of our preliminary study. In an effort to avoid certain biases and to isolate our information complexity variable, we have decided to remove some features usually present in self-tracking applications such as a detailed profile for the user (i.e., long-term history, consumption evolution, etc.) or a function to share one's consumption with other users or a wider audience. The social aspect of this kind of approach has been discarded in order to improve the measurement of the impact of the information on behavior.

The application dashboard includes common elements at the three levels of visual complexity, see Figure 1. In the upper right part of the screen, two functionalities are presented: the user's manual which explains the meaning of the data displayed in the different indicators (question mark symbol) and a data update functionality to know the CO_2 consumption in real time (the refresh symbol). In the lower part of the screen, the users find two icons (i.e., Dashboard and Profile) to navigate in our application. The first allow displaying the different data on his CO_2 consumption in line with assigned visual complexity group. The second gives access to the privacy functionalities such as the disconnect button and the possibility to download its own data in a readable format (JSON). This page has also a "push up" function to send the journey data to the server.

In the central part of the screen, all users receive two information on their daily CO_2 consumption: first, a numeric value presented in kilograms of CO_2 emitted during the day and, second, a CO_2 impact on a scale from A to E. The different levels of consumption represent respectively a range between 0 kg emitted up to 10 kg with a change of letter every 2,5 kg of CO_2 consumed, and above 10 kg for level E. This indicator is based on the idea of the Nutri-Score, also known as the 5-Color Nutrition Label or 5-CNL [22] and has already proven its effectiveness in consumption behavior [13, 30]. Below the CO_2 impact, users in the moderate and complex group also have their average weekly consumption. Finally, in the complex group, users have two additional pieces of information between the CO_2 impact indicator and the average weekly consumption: the minimum and the maximum consumption values over the week. We developed a specific display according to the user's complexity group. We also removed gamification or sharing features to avoid social bias.

Back end of Eco-Mobility: The back-end of Eco-Mobility is designed with several requirements using the "privacy by design" concept. First of all, the geolocation, although permanent, can be easily disconnected by the user and, in this case, the trips will not be tracked. In order to respect privacy, the collection of geolocation data is triggered two minutes after the user's movement is detected. For the most accurate calculation and therefore the most relevant information for the user, the application had to be able to detect as many means of transport as possible and also a combination of several of them. The detection phase of a means of transportation is done using the accuracy of the GPS points and the time associated with each point. These treatments are also used to detect the routes of each user in order to calculate the associated CO_2 consumption. First, the algorithm eliminates all the low accuracy points, then eliminates the identical points. Then, it considers all the points of the last five minutes and the last 10 GPS points associated with the user. It chooses the set of points containing the oldest point. If all the points in this set are within 100 meters of the last point found, then the path is considered complete. This processing also allows to take into account the weaknesses or possible errors of the GPS signal of the phone.

The application also needed to be able to use different reference values in the calculation of CO_2 emissions for each mode of transport. All these prerequisites allow us to avoid asking the user to perform many actions, such as filling out a questionnaire about their trip or transportation modes, which can be tedious. From the point of view of scientific protocol, not asking the user for additional information does not introduce any bias in our experiment. Indeed, as the application is not declarative, the participants cannot modify the result of their consumption. We added some features, such as the addition of group data and the timestamp of the analysis pipeline to indicate to the user when his CO_2

consumption is updated. We have also secured the data exchange between the client and the server with the HTTPS protocol.

Development of Eco-mobility: For the implementation of these ideas, we chose a hybrid framework (Apache Cordova [10]) to save development time in order to deploy eco-mobility on Android and IOS platforms. After initial inconclusive tests, with restricted automatic geolocation that activates when the user is in specific areas to preserve privacy, we selected an already proven development base, the E-mission project [34]. E-mission is an open source mobility platform developed at UC Berkeley that has already proven itself with several deployments around the world [33]. Our application is based on the E-mission architecture: the server is a python web application, the data is stored in a MongoDB database, the client is a Cordova application for Android and IOS. We have completely redesigned the client, with the integration of our protocol. We removed all third-party services (e.g., Google services), developed a single view (dashboard) with all data and stored all user data in our own MongoDB instance.

Deployment of Eco-Mobility: To facilitate the user's adoption, we have deployed Eco-Mobility on AppStore and Play Store. Google having refused us the access to its store, we took in hand the complete deployment for the Android platform. We have provided a APK file in our own cloud. This version is compatible with Android 6 to Android 12. For IOS devices, Eco-Mobility is compatible with IOS 8 to IOS 13.

Conduct of the experiment: After a short presentation of the experiment, the future users were invited to use the application regularly (2-weekly reminders were sent to users) and committed to visualize their CO_2 emission at least once a day. The Eco-mobility application transmitted to the user the CO_2 impact of their travels. We focused on students from the University of La Rochelle who were personally approached in the university's classrooms in March and April 2022. In total, 186 participants installed the application out of 1000 requests, a penetration rate of (18%). Of the 186 individuals, 51 used the application for a period of at least 9 days. Our study focused on these 51 participants, concentrating our analysis on the first 9 days of use for reasons of equity. The data collected by the Eco-mobility application is stored on the university's server and analyzed. The reduced sample of 51 participants varied in terms of gender (57% female), age (38 between 15 and 20 years old, 12 between 21 and 25 years old and 1 above 26 years old) and academic year. We randomly assigned the three levels of visual application complexity to the subjects. The distribution is as follows, 22 subjects in the simple group, 14 subjects in the moderate group and 16 subjects in the complex group. Respondents first rated their intention to use transport modes that emit less CO_2 than the car. All constructs were measured by 7-point Likert scales. A score is assigned to each participant for each three-day period and an overall score for the whole nine days. An average is calculated according to the main mode of transport recorded by the application (1 = walking or cycling, 2 = bus or train, 3 = car). The score is then compared to the questionnaire data.

4 Results

4.1 Situational setting experiment

Our experiments were analyzed in order to validate or refute our hypotheses through statistical analysis. For this we used the SPSS software. We analyzed the effects of an independent variable on a dependent variable by the analyses of variance (ANOVA). We relied on classical statistical tests of analysis of variance such as the average difference, standard error, F-test, R-test, R^2-test and the P-value. As shown in Table 1, the average values tell us that the groups are from the same population and thus demonstrate the influence between the variables. We evaluated the differences between each homepage in order to test the greater effectiveness of a moderated homepage as we assumed. This tool also allows us to perform statistical analyses of mediation. Mediation effects reflect the influence of one variable on another through a third variable. we will now present the results of each hypothesis.

HS1. An ANOVA test is performed (acceptability, p=0.001). The results show that the page with moderately complex stimuli generates a higher acceptability of the application (mean=4.60, SE=0.110) compared to stimuli of low (mean=3.99, SE=0.125) or high (mean=4.18, SE=0.100) complexity. This is confirmed by a Tukey significant difference test: Complex vs. Simple=0.184, p=0.468; Moderate vs. Simple=0.609, p=0.001; Moderate vs. Complex=0.426, p=0.016 (see Table 1, upper part). Thus, Hypothesis **HS1** is confirmed, stimuli of moderate complexity generate higher acceptability of the application, while stimuli of high or low complexity generate lower acceptability of the application.

HS2. A 1-factor ANOVA test is performed (transport intention, p=0.080). The results show that moderately complex stimuli does not significantly generate, in a direct way, a higher intention of responsible urban mobility behavior with the application (mean=5.33, SE=0.181) compared to stimuli of low (mean=4.71, SE=0.216) or high (mean=4.93, SE=0.155) complexity. This is confirmed by a Tukey significant difference test (Complex vs. simple=0.221, p=0.659; Moderate vs. simple=0.615, p=0.071; Moderate vs. complex=0.394, p=0.255). Nevertheless, the Pearson correlation showed a significant effect (p=0.027). Thus, Hypothesis **HS2** is partly confirmed, there is no direct relationship.

HS3. To test this hypothesis, we performed a linear regression. We found that the regression of the acceptability of the application on the intention to take more responsible transport gave a positive result (SE=0.078, p=0.000) (see Table 1, bottom part) thus validating our third hypothesis. Acceptability has a significant effect on the behavioral intention to take more responsible transport. In other words, the participants perceived the application of moderate complexity (compared to high or low complexity) as more acceptable which influences the intention to use more sustainable transport than a car (see Table 1).

After having conducted the first study on behavioral intentions, it seemed appropriate to observe the effects on behavior under real conditions.

Acceptability of the application

Complexity	Av. diff.	SE	P-value	
Moderate vs. complex	0.426	0.153	0.016	
Moderate vs. simple	0.609	0.171	0.001	
Complex vs. simple	0.184	0.156	0.468	
Intergroup	F	P		
	6.840	0.001		
Intention to use means of transport that emit less CO_2 than the car				
Summary of the model	R	R^2	F	P-value
	0.358	0.148	6.689	0.000
Independent variable	B	SE	T	P-value
Acceptability	0.619	0.078	7.918	0.000

Table 1: Results of the situational setting experiment.

4.2 Real condition experiment

In order to assess the effect of visual complexity on urban mobility behavior, the overall score for the 9 days of the study is taken into account. **HR1** hypothesis is tested by a 1-factor ANOVA analysis considering each level of complexity. We use the same statistical tools as in the previous study. As shown in Table 2, the values show the influence between the variables. In order to test the greater effectiveness of a moderate home page, as we had assumed, we evaluated the differences between each home page. The results show a non-significant effect of complexity on urban mobility behavior (behavior, p=0.252). According to the mobility score, we find that participants with moderate complexity application visuals do not have more responsible urban mobility behaviors (mean=1.900, SD=0.5148) than participants with low (mean=2.092, SD=0.6262) or high (mean=2.286, SD=0.6075) complexity application visuals (see Table 2, upper part). A Tukey significant difference test is then performed to confirm these results. No difference is observed between the groups: Simple vs. moderate=0.1917, p=0.621; Simple vs. complex=-0.194, p=0.599; Moderate vs. complex=-0.3857, p=0.222 (see Table 2, middle part). Our hypothesis **HR1** is therefore rejected: the moderate complexity visual did not lead participants who used it to behave more responsibly than participants who used an application with a lower or higher complexity visual. We know that complexity has an impact on behavioral intentions [41] and that it affects information processing positively or negatively [29].

From the literature we know that moderate visual complexity positively influences intentions, our study then shows that in our context, framing does not work on responsible behavior.

The **HR2** hypothesis is tested by regression analysis. The effect of behavioral intention on more responsible urban mobility behavior is significant and positive (B=-0.118, SE=0.042, p=0.007) thus validating our hypothesis (see Table 2, bottom part). The study shows that behavioral intentions are antecedents of urban mobility behaviors. However, the influence of urban mobility behaviors should be checked before the experiment. We controlled for the influence of transport behaviors before the use of the application. The analysis of the control variable shows a non-significant effect of transport habits before the experimentation both on the effect of technology adoption on behavioral intentions (SE=0.4058, p=0.2147), the effect of technology adoption on behavior (SE=0.1403, p=0.1484) and the effect of behavioral intentions on behavior (SE=0.0734, p=0.4528), thus confirming our hypothesis **HR2**.

Descriptive statistics on the effect of complexity on behaviour

Dependent variable	Simple	Moderate	Complex
Behaviour (M)	2.092	1.900	2.286
Standard deviation (σ)	0.6262	0.5148	0.6075

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Complexity	Av. diff.	SE	P-value
Simple vs. Moderate	0.1917	0.2049	0.621
Simple vs. Complex	-0.1940	0.2001	0.599
Moderate vs. complex	-0.3857	0.2292	0.222
Intergroup	F	P	
	1.417	0.252	

Effect of behavioural intention on urban mobility behaviour

Summary of the model	R	R^2	F	P-value
	0.371	0.138	7.826	0.007
Independent variable	B	SE	T	P
Behavioural intention	-0.118	0.042	-2.798	0.007

Table 2: Results of the real condition experiment.

5 Conclusion and Perspectives

By examining the effect of information complexity on intention and behavior, we contribute to the growing body of visual complexity literature that seeks to understand the effects of information complexity on individuals [3, 41]. We were interested in conducting two studies, one in the laboratory and one in real-world conditions, to account for the changing effects of visual complexity under different conditions. The goal of our research is to provide elements for organizations offering responsible urban mobility programs. The results of our study demonstrate that while intentions reveal responsible behavior, the green gap dilemma is not reduced by visual complexity. Therefore, designers of mobile application should not only think about the framing of the information presented, but also consider factors that may encourage users to continue using the app, such as gamification or features for increasing interactivity between users or sharing on social networks [6]. In fact, the aspect of acceptance of the media on which the information is transmitted allows to reinforce the intention and the responsible behavior. Taking into account environmental variables (e.g., weather, public transport networks, terrain topography...) may also be relevant to explain the difference between intention and behavior, with a negative impact on bicycle use for example [15].

This study is not free of research limitations. The experimentation does not allow us to know whether the repetition of information influences user's processing during the use of the device. Which, in turn, through habituation, could reduce the effectiveness of the visual complexity. We assume that presenting the visuals before asking about technology acceptability could contribute to the effect of the visual complexity on intention and behavior. Indeed, we surveyed our participants before they saw the homepages and used the application. It would also be interesting to check the following order of the variables (Complexity; Acceptability; Intention; Behaviour). This may help explain the difference in effectiveness between visual complexity on intentions (situational study) and visual complexity on behavior (real conditions study). Another limitation is that our study mobilizes users from a single city and a specific age group. In summary, we highlight the importance of visual complexity in the intention as well as in the behaviour of responsible urban mobility, underlining the need to take into account other parameters such as the acceptability of the application as well as environmental variables that have not been taken into account in our explanation of the phenomenon. Based on this assumption, we want to integrate features with components such as social comparison and individualization of information into a second version of the mobile application. We also want to extend the scheme to a larger and heterogeneous public.

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