LA DELEGATION DE TACHES AUX OBJETS INTELLIGENTS: UN MODELE EXPLICATIF DE LA VALEUR PERCEUE APPLIQUE A LA CONDUITE AUTONOME

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Résumé : Avec le développement de l’Internet des objets, les consommateurs ont de plus en plus l’opportunité de déléguer un pouvoir décisionnel à des objets intelligents pour accomplir des tâches quotidiennes qui auparavant leur étaient dévolues. Dans cet article, un modèle conceptuel expliquant la valeur attribuée à cette délégation est développé sur la base de deux idées clé : (1) la décision de déléguer à une entité non humaine peut être à la fois envisagée comme une opportunité d’émancipation et une source d’anxiété (2) la capacité perçue de la délégation à améliorer le bien-être est un déterminant clé de la valeur dans ce contexte. Le modèle est empiriquement appliqué au cas de la conduite autonome. La valeur est principalement influencée par la capacité perçue de la délégation à créer du temps libre et à combler des faiblesses humaines. L’anticipation de l’amélioration du bien-être est un médiateur de la plupart des effets.

Mots clef : délégation de tâche ; conduite autonome ; bien-être ; pouvoir ; objets connectés

DELEGATING TASKS TO INTELLIGENT OBJECTS: A CONSUMER PERCEIVED VALUE MODEL IN THE CONTEXT OF AUTONOMOUS DRIVING

Abstract: With the “Internet of things” development, consumers have more and more opportunities to delegate decisional power to intelligent objects that will accomplish daily tasks that they were used to do themselves. In this article, a conceptual model explaining the value awarded to such a delegation is developed based on the ideas that (1) decisional delegation to a nonhuman entity may be viewed both as an opportunity to emancipate and a source of anxiety (2) perceived capacity of delegation to improve well-being is a key determinant of value in this context. This model is empirically tested for the case of a self-driving car. Value is more particularly influenced by the perceived capacity of driving delegation to free time and to overcome human weaknesses. The anticipation that driving delegation will improve well-being mediates most of these effects.

Key-words: task delegation; autonomous driving; well-being; power; connected objects
DELEGATING TASKS TO INTELLIGENT OBJECTS: A CONSUMER PERCEIVED VALUE MODEL IN THE CONTEXT OF AUTONOMOUS DRIVING

Introduction

With the “Internet of things” development, consumers have more opportunities to delegate decisional power to objects that will accomplish tasks that they used to do themselves. Thus, consumers let machines take decisions in a more or less complex environment. In a few years, they will have the possibility to totally delegate driving to their car, which is a highly complex and risk intensive task. This evolution raises research challenges for many academic disciplines. Marketing research, in particular, has to invest this research field to understand the impact of such of an innovation for consumer well-being and societal welfare. A crucial research question is related to factors that determine the value that consumers attribute to the delegation. In fact, the development of these objects requires huge financial R&D investments; so it is necessary to study predictors of willingness to pay, such as purchase value (Smith & Nagle, 2002). Additionally, delegation is a transfer of power to a nonhuman entity and may be viewed both as an opportunity to emancipate and a source of anxiety.

In marketing research, task delegation to intelligent machines is very rarely studied or even evoked. In this context, our objective is to develop and to test empirically a model apt to explain the purchase value granted to delegation of decisional power to intelligent objects. This model is expected to be relevant for most of the situation involving a transfer of control to objects. For a first empirical test, we studied the case of the autonomous (self-driving) car.

Delegation of Decisional Power

Technological advances on artificial intelligence and connected objects are disrupting economic sectors and consumers’ daily life. The later have growing opportunities to delegate complex tasks to machines and at times even their decisional power. While the challenges raised by such an evolution have been scarcely studied by consumer and innovation marketing research, an emerging academic literature explores the question of the human relationship with intelligent objects [mainly domestic robots], under an acceptance or intention to cooperate prism: most of the consumers seem to be favorable to an autonomous robot companion, which is able to help or to replace them for certain tasks. But are humans ready to delegate any tasks to objects that decide for them, and to what extent are they ready to pay for this option? Delegation of decisional power raises ambivalent feelings. On the one hand, human’s fallibility litigates for giving control to objects in various situations. On the other hand, perceptual, ethical, safety reasons might advocate a sort of status quo where humans remain in control while delivering less optimal outcomes than machines (Kurtzweil, 2000). This is particularly true in the context of autonomous driving. The prospect of improved safety should incite drivers to adopt it, but entrusting his life to a car is a complex decision.

This question is relatively absent of the literature on autonomous car, which has focused mainly on the relevant technologies. Nonetheless, a few studies evoke the question of public opinion. Fagnanta & Kockelman (2015) highlight potential benefits for consumers such as safety benefits and optimization of traffic operations. According to Schoettle and Sivak (2009) concerns are mainly linked to security issues, performance issues, interaction with non-self-driving vehicles, loss of driving skills (“disempowerment”) and data privacy.
Value Attributed to Delegation: toward a Conceptual Model

Perceived value is a central concept in marketing that refers to various theories. In this article, we explicitly mean to study purchase value (Zeithaml, 1988) by focusing on the value attributed to a technology that involves decisional power delegation. Our conceptualization pertains to an innovation context, more precisely to a phase in which the technology is operating and can be precisely described and explained to consumers who can project himself in a usage situation. Purchase value derives from the assessment of various benefits and costs. The theory of delegation for agent-based systems proposed by Castelfranchi and Falcone (1998) is used as a complementary theoretical framework. This theory balances the cost for the consumer which are linked to the delegation (i.e. perceived risks) and the cost he supports when he takes the action himself.

*The cost of performance: the emancipation through delegation.* Consumers delegate tasks that represent a cost for them. As such, the object which takes in charge the task emancipates the consumer from several constraints (Ray & Mondala, 2008):

- **overcoming human weaknesses** - Consumers benefit from delegation when they perceive that the object will perform the task with a higher reliability. The driving context example is meaningful: human gestures are submitted to variations that may deteriorate the final result. (e.g. drivers are subject to fatigue). Drivers can also be attempted by small violations of rules that create risky situations By delegating driving consumers emancipate themselves not only from their own weaknesses but from the unpleasant feeling that their mistakes are likely to endanger themselves and others.

- **optimizing performance** - Consumers should also perceive the potential benefit of delegation when they attribute the object capacities that exceed human skills (e.g. fuel consumption optimization thanks to autonomous driving). Thus delegation is also a way to emancipate from intrinsic human limitations.

- **freeing time** - Through delegation consumers can dedicate their time to achieving other tasks, to entertaining themselves or simply to have a rest, for example in a traffic jam.

*Anticipated costs and risks of delegation.* On the other hand, consumers may perceive risks linked to the delegation:

- **performance risk** - Castelfranchi and Falcone (1998) underline the importance of trust in the delegation. The decision to delegate depends on client’s expectation that the object will perform correctly a given action on which his well-being depends on. High level of risk is likely to dissuade consumers to delegate and to decrease perceived value. This should be especially true in the context of driving delegation. Autonomous cars incorporate numerous captors, sensors, and electronic programs. The risk of technological flaw is real and can be associated with very severe consequences in case of an accident.

- **loss of competencies / disempowerment** – Consumers who delegate decisional power to objects can fear to lose experience-based skills that require an enduring learning. This risk of “disempowerment” has been already stressed by exploratory studies on autonomous driving (Schoettle and Sivak, 2009).

- **risk of privacy violation** – Intelligent and connected objects work thanks to massive data exchanges. Privacy emerges as a strong concern at least for certain consumers’ segments and is expected to decrease the perceived value (Phelps et al., 2000).
The mediating role of the perceived improvement of well-being through delegation.

Consumer subjective well-being refers to a “broad category of phenomena that includes emotional responses, domain satisfactions and global judgment of life satisfaction” (Diener et al., 1999). Emancipation benefits of delegation put explicitly the emphasis on some facets of well-being. For instance, believing that the object is able to overcome weaknesses is a factor of stress reduction, time freed up can be used for entertaining or for interacting with others. In fact, technologies of delegation cannot be mainly assessed under the prism of usefulness but rather under the angle of their capacity to improve well-being. This is why we make the hypothesis that the determinants listed above, whether positive or negative, influence value through the mediation of the anticipated improvement of well-being.

Method

Research design. A quantitative online survey on a representative sample of 403 French drivers (in terms of gender, age, occupational status, a region of residence) was performed on the online panel of the CSA institute. 60 questionnaires were removed due to bad answers at an attention question and too fast questionnaire filling. Respondents were asked to watch a short film based on a TV report about the autonomous car [http://urlz.fr/2JCK] and then to project themselves as owners of a car offering such a self-driving option. The unique object of the questions was the technology of delegation presented in the film.

Scale development. In order to reduce the potential for halo effect and common variance bias, the order of items was randomized and varied scale formats were used. Items are based both on 3 interviews of automotive sector experts and literature. We relied on 3 researchers for assessing content validity. 5 items in total were removed after a classical purification process through exploratory and confirmatory analyses. At final, we checked for the quality of the measurement by verifying data fit, convergent and discriminant validity. All constructs have a satisfying reliability (see table 1). For the 8 constructs, average variance extracted was above .5, all latent factors share less variance with other constructs than with their own indicators.

Table 1: Measurement scales

<table>
<thead>
<tr>
<th>Construct</th>
<th>Example of items</th>
<th>Rhô</th>
<th>Format</th>
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<tbody>
<tr>
<td>Perceived value</td>
<td>2 items from Cronin Brady and Hult (2000) scale; 1 item focused on the interest to add the option to the vehicle in spite of its costs.</td>
<td>.88</td>
<td>Bipolar 7/9 pts</td>
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<tr>
<td>Improving well-being</td>
<td>7 items based on key facets of well-being (ex. “Using this technology instead of driving myself will reduce my level of stress”)</td>
<td>.93</td>
<td>Likert 7 pts</td>
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<td>Overcoming human weaknesses</td>
<td>4 items on 5 (ex. This technology can overcome some of my weaknesses as driver inattention)</td>
<td>.78</td>
<td>Likert 5 pts</td>
</tr>
<tr>
<td>Optimizing performance</td>
<td>2 items on 3 (ex. By optimizing routes, acceleration, and trajectories, this technology can allow me to save money (optimized fuel consumption, less tire wear...))</td>
<td>.88</td>
<td></td>
</tr>
<tr>
<td>Freeing time</td>
<td>4 items on 5 (ex. This technology would free me from the time usually devoted to driving)</td>
<td>.92</td>
<td></td>
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<tr>
<td>Performance risk</td>
<td>2 items for uncertainty (ex. Although this technology undergoes extensive testing before launch, I fear an electronic flaw * 2 items for negative consequences (ex. I have a feeling that an electronic flaw of this technology would seriously endanger the driver and passengers))</td>
<td>.96</td>
<td></td>
</tr>
<tr>
<td>Disempowerment risk</td>
<td>5 items on 6 (ex. Using this technology could make me a less skilled driver)</td>
<td>.88</td>
<td></td>
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<tr>
<td>Privacy risk</td>
<td>2 items on 3 (With this technology, I am afraid of revealing too</td>
<td>.89</td>
<td></td>
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Model estimation. The model is estimated through structural equation modelling on AMOS with maximum likelihood estimation. The theoretical model fits the data well (see figure 1). There are very small discrepancies between estimated parameters and average estimations based on 2000 samples estimations; this suggests that multinormality violation is not a serious issue. Finally common method variance was controlled a posteriori by introducing a 3 items marker theoretically uncorrelated with the other constructs. Very small differences, between .001 and .016, were observed with initial parameters suggesting that our results are not altered. Finally, VIF for independent variables were estimated through an OLS model on SPSS. All were under 1.9 suggesting estimated parameters are not polluted by multicollinearity.

Main findings

The underlying idea of this model is that perceived value of delegating decisional power to an object is influenced by the benefits associated with emancipation, by the risks that make control delegation costly and through the anticipation of an improvement of well-being. Mediations test are based on the examination of indirect effects significances after 2000 bootstrap replications; the bias-corrected 90% interval must not include 0. In the context of autonomous driving (AD), this mechanism is validated for four variables on six. The anticipation of gaining free time by delegating driving influences value both directly (.21; p<.001) and indirectly through well-being (.11; [.06;.18]). Free time can be associated with entertainment and relaxing and thus with an improvement of well-being, but the direct effect suggests that this time can also be used in a utilitarian perspective. The feeling that AD is as a way to optimize performance, to go beyond human capacities has both a direct (.17; p=.002) and a small indirect effect (.04 [.01;.09]) on perceived value. Interestingly the perceived capacity of AD to overcome human weaknesses is an only-indirect but important driver for value (.18 [.11; .27]). Drivers know they can hesitate, do mistakes and delegation may help them to feel more relaxed on board. On the negative side, performance risk has also an only-indirect effect on value (-.19 [-.17; -.07]). Feeling insecure inside the car annihilates well-being. The fear to lose competencies (risk of “disempowerment”) in the mid or long term corresponds to the idea that AD will diminish human skills. So it can be hardly associated with immediate well-being. Thus, it only has a direct effect on value (-.19; p <.001). Finally, descriptive statistics on our sample reveal rather high level of privacy concern (Mean = 61.5 on a max of 100). Nevertheless, it does not influence significantly the well-being and the value.
Discussion

Our concern in this paper was to elucidate a crucial question for innovation marketing. As artificial intelligence offers new opportunities for consumers to emancipate from constraining tasks, decisional power transfer is likely to raise several forms of risk perceptions. In this rather new context, key antecedents of purchase value had to be identified. The model isolates six determinants and a mechanism, the mediation of the anticipated well-being improvement. This model is expected to pertain in various contexts that involve the delegation of decisional power to an object. However, the weight of indicators will certainly vary. For autonomous driving, the model explains more than 60% of the variance of purchase value and the statistic results provide several teachings. First the promise of emancipation has a much higher impact on value than the perceived risk of delegation. This finding is in line with previous work that found that in an innovation context, perceived benefits have a key role (Rivière, 2015). The findings also deploy on a radical innovation the innovation resistance model of Ram and Seth (1989) who identified value-barrier and risk-barrier as strong factors of consumer resistance to innovations. On a managerial viewpoint, the findings demonstrate that the success of autonomous car is first based on the carmakers capacity to associate driving delegation with an improvement of well-being. To achieve this goal, our empirical results suggest different levers that are maybe not adapted to all consumers segments. For example, it is probably relevant to highlight the capacity of AC to palliate human weaknesses for drivers who lack confidence in their driving ability. On the other hand, Carmakers have to be really convincing on security aspects because anxiety due to perceived risk of performance inhibits subjective well-being. The present research has several limitations. First, our concern was to develop a general model but we only tested it in one context. It has to be replicated on other intelligent objects maybe less involving than autonomous cars. Second, we asked consumers to project themselves in a delegation situation through a short film. Additional studies using immersive survey methods (simulation, prototype testing) would allow a more robust test of the model in this context of radical innovation.
References


