“Avatar based innovation: how avatars experience co-creation projects in second life”

AUTHORS	Kurt Matzler https://orcid.org/0000-0002-3132-4388 Johann Füller Thomas Kohler Daniel Stieger

ARTICLE INFO	Kurt Matzler, Johann Füller, Thomas Kohler and Daniel Stieger (2011). Avatar based innovation: how avatars experience co-creation projects in second life. *Problems and Perspectives in Management*, *9*(2)
RELEASED ON	Monday, 06 June 2011
JOURNAL	"Problems and Perspectives in Management"
FOUNDER	LLC “Consulting Publishing Company “Business Perspectives”

NUMBER OF REFERENCES **0**

NUMBER OF FIGURES **0**

NUMBER OF TABLES **0**

SECTION 2. Management in firms and organizations

Kurt Matzler (Austria), Johann Füller (Austria), Thomas Kohler (USA), Daniel Stieger (Austria)

Avatar-based innovation: how avatars experience co-creation projects in second life

Abstract

Practical examples as well as research highlight the potential of virtual worlds for new product development especially for utilizing the innovative capabilities and knowledge of consumers and consumer communities. However, most of the observed and often cited virtual new product development examples failed or could have done better. One of the main challenges of virtual product development projects in virtual worlds such as Second Life (SL) face, is to attract participants and to motivate them to actively contribute to the project and share their ideas and knowledge with the company. Therefore, one of the most important research questions is to explore how avatar-based innovation projects should be designed in order to motivate consumers to engage in avatar-based innovation projects and actively contribute to the solution of the stated innovation quest. Based on a quantitative survey with avatars that participated in virtual co-creation projects, the article provides insights regarding compelling co-creation experiences in virtual worlds. This research presents empirically grounded insights regarding compelling co-creation experiences in virtual worlds. It extends theory about virtual new product development in virtual worlds and provides practical guidelines on how to successfully design virtual co-creation projects in virtual worlds.

Keywords: second life, avatar-based innovation, co-creation, flow theory, technology acceptance models, consumer community theory.
JEL Classification: M10, M15.

Introduction

The integration of customers in new product development projects has become a major issue in innovation management. It leads with the generation of promising new product ideas (Kim and Wilemon, 2002), new product concepts (Lüthje and Herstatt, 2004), and valuable customer feedback in the early stages of new product development (Füller and Matzler, 2007). Especially through the Internet, in an iterative experimentation process customers can create solutions that are close to their needs (Weiss and Gangadharan, 2010). The emergence of virtual worlds and of Internet-based toolkits, new opportunities for virtual customer integration have come out.

Virtual worlds, such as the most prominent example Second Life (SL), are computer-generated physical spaces, represented graphically in 3D that can be experienced by many users, or so-called avatars at once (Castranova, 2005). Virtual worlds offer their users a completely new type of experience and unprecedented interaction possibilities. For example, avatars can not only read about products and review images, but the interactivity of virtual objects creates more direct product experiences (Schlosser, 2003). The representational and media rich environment allows every user to get in touch with other avatars and individually or jointly build and realize their ideas. For companies, the emerging technology facilitates the interaction and collaboration with their customers on a more direct and in-depth level. Hence, virtual worlds offer new opportunities to integrate consumers into a company's innovation process and to develop new products jointly with individual consumers or entire communities.

Ever since the emergence of the Internet, appeared unique and inventive opportunities to capitalize on users' innovative potential and knowledge (Nambisan, 2002), which resulted in various approaches to integrate consumers into new product development (Dahan and Hauser, 2002; Von Hippel, 2001). Incorporating the latest technological advances of virtual worlds into open innovation and co-creation practice further enrich existing web-based customer integration methods, by allowing real-time, media rich, and highly interactive collaboration between manufacturers and consumers.

The potential of virtual worlds for new product development seems to be obvious as most of the activities in virtual worlds are means for its inhabitants to express themselves and show their creativity. The playful user-generated environment of virtual worlds has been described as engines of creation that provide the freedom to experiment and lead to unprecedented rates of innovation (Ondreijka, 2007). The built-in tools encourage users to create iteratively and interactively almost anything imaginable, while sharing the act of creation with other users. This has proven to be fertile ground for many innovative thinkers and creative activities have become more visible and extensive. Virtual worlds resemble "playgrounds of the imagination" (Castronova, 2005, p. 2) and as the boundaries of the virtual and the real world dissolve, avatars might very well use their creativity to design products with real-world potential (Hemp, 2006).

We use the term avatar-based innovation (ABI) to refer to an interactive new product development process, where manufacturers collaborate with virtual world's avatars along the entire innovation process beginning with the identification of new trends and unsatisfied needs and ending with the launch of new products and the improvement of existing ones (Kohler et al., 2011a; Kohler et al., 2011b; Kohler et al., 2009). The aim of the virtual collaboration for a specific task or during an entire product development cycle is to generate superior and more customer-cantered new products and services, but also to provide value for its participants. Based on virtual world technology and employing open innovation mechanisms, consumers and manufacturers jointly develop innovations in a media rich and interactive environment.

Several companies already tried to leverage the innovative potential of virtual worlds and asked SL residents to engage in different innovation activities along various stages of the innovation process. For example, *Osram*, a light-manufacturer started an idea contest and invited SL residents to contribute ideas on the topic of lightning. *Toyota Scion* launched a virtual car model and invited participants to modify and customize their cars. Another example demonstrating the numerous opportunities of virtual worlds for innovation is the case of *Aloft*, a new hotel concept from Starwood Hotels. Before the real hotel was built, a virtual mockup was discussed, evaluated, modified, and further developed in SL. Based on the feedback, several changes to the overall design of Aloft resulted. These changes have been applied both to the virtual and to the physical hotels (Kohler et al., 2009).

Despite the promising opportunities provided by avatar-based innovation, one major challenge impeding its development is the lacking interest in corporate projects among avatars. The overwhelming majority of avatar based innovation pioneers are challenged by very few interested participants, and therefore very few activities that make the place a vibrant source of great connections and innovations. The underdeveloped state of these islands in terms of innovation tasks and the lacking knowledge of how to attract innovative avatars inhibits the ability of companies to achieve their product development goals, which, in turn, puts a damper on avatar based innovation. On a general level, many reports point toward nascent corporate presences being ghost towns (Rose, 2007), and the SL community is more interested in their own homegrown activities (Au, 2006).

To engage and motivate consumers to contribute the innovation tasks a compelling and enjoyable experience is considered an important success factor (Füller and Matzler, 2007; Nambisan and Nambisan, 2008; Reichwald and Piller, 2006). Companies that intend to collaborate with consumers during product development have to design the interaction in a way that participants perceive it as attractive, and derive benefit from the innovation experience itself (Füller, 2006a). Thus, the interaction experience might be the key factor in determining the effectiveness of avatar-based innovation projects. It not only increases consumers' motivation and determination to participate, but also empowers consumers to become familiar with the innovation, discover its qualities, and learn from self-generated non-ambiguous experiences (Hoch, 2002; Hoch and Deighton, 1989). Further, a compelling virtual product experience enables consumers to realistically assess a new product (Jiang and Benbasat, 2007). It also inspires consumers to make creative contributions for improvement (Von Hippel and Katz, 2002). Therefore, the user experience should be a critical element of the design and development of avatar based innovation platforms. The question then becomes how to outline the interaction experience during co-creation.

So far, little is known about interaction experience during co-creation in a virtual world environment. This article analyzes consumers experience co-creation activities within a virtual world. The applied conceptual framework is partly based on the theory of flow (Csikszentmihalyi, 1997; Csikszentmihalyi, 1990), the technology acceptance model (Davis et al., 1989) and consumer and brand community theory (Füller et al., 2008; McAlexander et al., 2002). We are especially interested in antecedents and consequences of a compelling virtual world innovation experience.

The article is structured as follows. First, drawing on three streams of literature (flow theory, technology acceptance, community theory), we shed light on how a compelling co-creation experience in virtual worlds which motivates consumers to participate and supports them in accomplishing the stated innovation task may look like. Then, we introduce our empirical study conducted in cooperation with KTM – world leading producer of motocross, motorcycles, and Philips – Europe's largest manufacturer of consumer electronics. After presenting our results we discuss its theoretical as well as practical implications in the final section of the paper.

1. Conceptual considerations of a compelling experience

Flow theory, technology acceptance models and consumer community literature allow us to get a better understanding of how a compelling co-creation experience can be facilitated. These streams of literature reveal that an innovation activity, which

is considered enjoying and intrinsically rewarding, easy to use, and can be shared with other peer group members, may provide the right setting for enduring avatar participation and successful new product development projects in virtual worlds.

1.1. Flow theory. According to *flow theory*, a co-creation activity which draws participants' attention is neither too easy nor too difficult gives participants the feeling of control, and is considered as interesting per se. It provides ideal conditions to experience "flow", a term used to describe a highly enjoyable and rewarding "optimal" experience (Csikszentmihalyi, 1997; Csikszentmihalyi, 1990). When experiencing flow, consumers get totally absorbed by the activity and lose any sense of time and space (Csikszentmihalyi, 1997). They completely immerse themselves in virtual worlds and no longer differentiate between real products and virtual, yet to be realized innovations (Schlosser, 2003). Flow leads to increased persistence and interest in the activity. It empowers participants to perform at their peak level. Thus, flow experience provides ideal settings for virtual co-creation. Asking chess players, rock climbers, dancers, composers, and scientists what makes an experience enjoyable and how it feels, Csikszentmihalyi (2002) identified various elements determining flow. These factors are: clear goals, immediate feedback, balance between challenges and skills, merge of action and awareness, exclusion of distractions, no worry of failure, absence of self-consciousness, distortion of sense of time, and an autotelic activity. For the web context, consumers may most easily dive into a flow state during co-creation activities, that are characterized by a seamless sequence of interactivity, are intrinsically enjoyable, enable loss of self-consciousness, and are self-reinforcing (Hoffman and Novak, 1996).

1.2. Technology acceptance model. The *Technology acceptance model* (TAM), introduced by Davis (1989), has been developed to predict the adoption of technologies mostly in work contexts. It is an important modification that grew out of the theory of reasoned action (Ajzen and Fishbein, 1980). The TAM posits that the intention to adopt new technologies depends upon the attitude towards using it, which in turn is a function of the perceived usefulness for its users and the perceived ease of use. While perceived usefulness denotes "the degree to which a person believes that using a particular system would enhance his or her job performance", perceived ease of use refers to "the degree to which a person believes that using a particular system would be free of effort" (Davis et al., 1989, p. 985). Whereas a lack in perceived ease of use may hinder the adoption of an otherwise useful system, no amount of ease of use can compensate for lacking usefulness (Davis et al., 1989). In TAM and further extended models, perceived usefulness and perceived ease of use are assumed to influence the attitude towards and intention to try an object or technology. Ease of use can be considered as antecedent of a compelling experience. Perceived usefulness may be both an antecedent and a consequence of an intrinsically rewarding experience. It can also be derived from the positive outcome related to the activity.

While TAM models originally have been applied in working contexts, they have lately been amplified by other determining components such as intrinsic motivations and enjoyment (Davis et al., 1992), playfulness and anxiety (Venkatesh, 2000), and trust and risk in electronic commerce (Gefen et al., 2003; Pavlou, 2003). Integrated models have also been applied in studies of the adoption of electronic commerce (Pavlou and Fygenson, 2006), in the *adoption* processes of mobile services in cross-service comparisons (Nysveen et al., 2005), and for navigation prediction in the world wide web (Agarwal and Karahanna, 2000).

1.3. Consumer and brand community theory. It is presented by McAlexander et al. (2002). The interaction with other users in real time is among the major distinctive characteristics setting virtual worlds apart from other Internet and Web 2.0 applications. While, on the one hand, it is the very capacity which makes virtual worlds so unique and creates value for its users, on the other hand, the co-presence of avatars makes virtual world places more dependent on other members who simultaneously engage in an activity or visit a place. Besides of a few activities like building virtual objects, avatars enjoy exploring virtual worlds with fellow residents or seek to meet and socialize other people. Without any accompany the virtual experience may be less stimulating and it is the feeling of community which makes SL unique and creates value for its participants. Three main characteristics are typical for online communities: (1) shared consciousness, i.e., a strong connection to one another as well as demarcation to other users; (2) common rituals and traditions, i.e., vital social processes around shared product experiences that create and represent the meaning of the community within and beyond the community; and (3) a sense of moral responsibility for the group, that is, a sense of duty to the community as a whole and to its members. The formation of and identification with a community occurs through discussions, social interactions and shared experiences between members of the group (McAlexander et al., 2002). According to Algesheimer et al. (2005)

identification with the community is one of the central determinants of community member behavior. It increases members' interest in helping other members, participating in joint activities, acting in ways that endorses the community and enhances its value for themselves and others. Members who identify with the community support each other in solving problems and in generating new product ideas (Herstatt and Sander, 2004). Often, they become passionate about a brand, product, or common hobby (McAlexander et al., 2002; McWilliam, 2000; Sawhney et al., 2005). In order to enjoy co-creation activities in SL, it is important with whom one experiences them and if one can identify with the other members who are simultaneously engaging in it. Thus, the decision of using an avatar-based innovation platform is no longer an exclusively individual one, but reflects values and positions of the social structure in which the individual is embedded. Furthermore, we assume that the intrinsic connection members feel towards one another contributes to a positive experience. Especially when collaborating in real time, the immediate social interaction should positively influence the experience.

In this paper we use these three theoretical frameworks to explain the avatar's co-creation experience in virtual worlds and their motivation to participate in and contribute to company initiated virtual innovation projects in SL. In the next section of the paper, we describe the research setting, before we present the objectives and the method, and develop the hypotheses for your quantitative study.

2. Research setting: ideation question second life

To get a better understanding of avatars virtual co-creation experience and shed light on what they expect from open innovation projects in order to participate and share their ideas, we started the ideation quest initiative. In cooperation with KTM and Philips Design, the researchers designed, realized, and conducted the project which allowed the exploration of avatars' experience and their innovation behavior in-depth. Besides an online survey, we were able to observe and track their real behaviors. Two authors of this study have profound SL usage and programing experience. Prior to this project, they have already established virtual places, such as Ballers City in SL which was ranked among the ten most frequented corporate places in SL.

Ideation quest was specifically designed for the study to provide an opportunity to delve into the thoughts, behaviors, and feelings of the participants. By engaging participants in hands-on creative tasks rather than hypothetical scenarios, the experiment adds more realism. The ideation quest invited interested avatars to join an interactive process to contribute feedback on innovative concepts and share their ideas on a specific product category within SL. The projects were conducted in close collaboration with the companies with the following topics:

- sustainable living in the year 2020 (Philips Design);
- motorbike experience of the future (KTM Motorcycle).

A total of 769 avatars visited the virtual place during the five weeks the project was open. However, we only considered those avatars that spent more than ten minutes on the site as ideation quest participants. Visitors, spending less time, were regarded as explorers who either randomly teleported into this area or with the intention to visit other activities on the same island. We recorded 166 participants in the KTM setup, who spent 76 minutes on average per avatar and 167 avatars, who spent 80 minutes on average for the Philips setup.

Conforming to the premise that participants seek engaging and compelling experiences, the setup of the virtual environment and the process strived towards attracting and retaining participants' attention and engage them to constructively participate in co-innovation tasks. The ideation quest aimed to stimulate *avatars'* creativity by involving them in a number of *challenges*. The first activity users faced was a free-word association. This creativity technique is expected to facilitate creativity in a person and to encourage divergent thinking. To overcome the second challenge users needed to answer a set of knowledge questions and engage in a sentence completion task, encouraging the acquisition of domain-specific knowledge. Emphasizing the social nature of virtual worlds, the third challenge involved a semi-structured group discussion. A group of four people was invited to discuss various triggering questions that were directed to explore customer needs, work out problems or examine innovative opportunities. After discussing the questions participants mutually rated each other, voting the most creative contributor, the most constructive critic and the expert of the discussion round.

During the *ideation* phase, avatars were asked to visualize and express their ideas. Besides the sandbox area participants could collaborate to *innovate*, an attempt was made to further enhance the experience and facilitate the building process by integrating object libraries. The idea submission was the final task during this stage. Participants could submit their ideas in the form of a 3D model, in written form or in any graphical representation. The two latter options are available thanks to a web interface.

All ideas were displayed within SL for the stage of *idea review*. Participants were able to review, comment and judge other submissions for inspiration and to leverage the social community aspect. In order to initiate a vibrant meeting place, where participants come back to interact with like-minded peers and discuss the topics related to the project, frequent events were conducted and update information were sent to the community.

The outlined sequence of events, with every action leading to another, flow together into an overall experience.

2.1. Hypothesis development. To simplify the virtual interaction experience, *ease of use* is a key. Ease of use refers to "the degree to which a person believes that using a particular system would be free of effort" (Davis et al., 1989, p. 985). To date, virtual world places often suffer from severe usability problems, such as conceptual disorientation or the inability to easily interact with objects. Ease of navigation seems to be a critical component of usability. This requires that participants feel that they are in control of the navigation, which will be discussed in more details below. Findability is depending on a good structure and overview because only then participants get to know about the different tasks and environmental cues. One further issue is the notion of intuitive usage. Designers of the interaction experience need to employ highly intuitive navigation features and map natural human behavior. Avatars seek understandable processes and tools that are self-comprehensive and reduce their personal effort involved. All considered, the construct of ease of use is employed to represent the dimension of how usable a system is.

H1: Ease of use has a significant positive effect on a compelling experience.

Control is another important issue. The intention to perform a behavior or not is determined by the *perceived* behavioral control of an individual, which may differ from actual control (Ajzen, 2002). In information systems research, a similar component has been integrated termed self-efficacy. It denotes an individual's belief in his/her ability to perform a specific task in a given situation, and has been found to influence behavior (Mahatanankoon and O'Sullivan, 2008). The organization of the project needs to allow participants to feel that they know their current standing in the process and provide clear outlook on future interactions. Interactivity with the available tools and with the environment appears to be crucial for the users' sense of control. For many interviewees interactivity means that they are allowed to actively participate in a situation, which is the case if they are given the opportunity to touch and manipulate objects. Participants seek to be empowered to control the course of the navigation and expressed the desire to choose when to engage in the interaction. This finding resembles the insights generated from the review of flow literature, where control is one determinant of a compelling experience. We thus state:

H2: Perceived control has a significant positive effect on compelling experience.

Identification with the community (Algesheimer et al., 2005; Matzler et al., 2011) refers to the *social* dimension of the experience and the importance of collaboration. Many participants experience the process together. The participants themselves can in turn be an attraction. This is especially true in the case of introductions of celebrities, or if the suggestion of one interviewee is followed, a weekly live interview with the company's top innovators would increase the collaboration between avatars and the company. One of the main advantages of SL is the capability of connecting people. The project is a valuable platform to meet like-minded individuals. This leads to the third hypothesis.

H3: Feeling as a part of the innovation community has a significant positive effect on a compelling experience.

Involvement in co-creation. Avatars engage in innovation activities because they show a certain interest for it. It is either the task itself or the consequence linked to the participation, such as recognition or a better product what motivates them to participate (Füller, 2010). More often, it is a combination of these motives rather than a single one which drives consumers to engage in co-creation projects. It is an important to offer a co-creation experience which is in line with participants' motives in order to meet their expectations and to provide the conditions for a compelling experience. While the motive structures may be quite heterogeneous among participants, they all lead to a certain level of interest in the co-creation activity. For all participants ABI is of high relevance. The high involvement in co-creation originates from various motives (Füller, 2010).

Motives resemble those mentioned in other motivation studies in the field of open-source software (Lakhani and Von Hippel, 2003) and virtual customer integration (Füller, 2006b) ranging from natural interest in innovation activities, curiosity, learning, up to the need for better products. No matter what motives drive avatars to engage in innovation activities, in order to enjoy it is important that they show a certain level of interest in it. We state:

H4: Involvement in co-creation has a significant positive effect on a compelling experience.

In addition to the stated antecedents, we draw upon flow theory to suggest *consequences* of a compelling experience. Since flow experience is intrinsically enjoyable, compelling, and rewarding (Csikszentmihalyi, 1990), it causes a number of positive consequences. For example, it attracts consumers, and positively influences attitudes and behaviors (Csikszentmihalyi, 2002; Deighton and Grayson, 1995; Novak et al., 2000). In addition, flow encourages consumers to be highly creative and perform at peak levels (Csikszentmihalyi, 2002; Deci and Ryan, 2002). Hence, we suggest the following relationships:

H5: Compelling experience has a significant positive effect on further interest in an idea quest.

H6: Compelling experience has a significant positive effect on word of mouth about the idea quest.

3. Study

To test our hypotheses and explore the impact of a compelling experience on avatars interest in ABI, we conducted an online survey, where we asked avatars who previously engaged at least in one ideation quest − KTM or Philips − about their experience and intention of future participation and interest in word of mouth communication about the quest as form of affective commitment.

Out of all 333 ideation quest participants, 94 completed the survey. Two participant records had to be removed, since they completed the questionnaire two times. Finally, data from 40 KTM and 54 Philips ideation quest participants were used. This corresponds to a total return rate of 28% for the survey.

On average, the age of the SL avatars participated in the survey one and a half year. With a self-provided SL skill-level of 3.4 on average (1 − newbee, 5 − expert), our data indicate that not only extensive SL users participated in our survey. However, the majority of participants can be considered as SL residents. On the "familiarity with SL functionality" scale our sample shows an average of 3.9 (1 − basic, 5 − sophisticated). 25 avatars said that building is their preferred activity in SL, 22 prefer learning activities, 21 are concerned with socializing. Attending live performances (6 avatars), scripting (5 avatars) and other activities (15 avatars) account for the rest of the sample. 64% of the participants (60 out of the 94) answered that they already had "ideas for new products that were not offered on the market so far". This rate is quite high compared to other user innovation studies in the field of consumer goods (Schreier and Prügl, 2008).

4. Measures

Four indicators from Algesheimer et al. (2005) were used to measure identification with the community, three indicators were adapted from Davis et al. (1989), Mathieson (1991), Taylor and Todd (1995) and Venkatesh et al. (2003) to measure ease of use. Control was operationalized with 3 items and compelling experience with 4 items suggested by Ghani and Desphande (1994). Three items suggested by Srinivasan et al. (2002) and originally applied by Zeithaml et al. (1996) were used to measure participants' word of mouth. The intention to engage in future co-creation activities was measured with three items similar to Bagozzi and Warshaw (1990), Barki and Hartwick (1994) and Loken (1983).

Ideation quest involvement was measured with 6 different motivation items (see Appendix). Instead of measuring involvement in the co-creation activity directly, we used the six different motivation items to measure the level of interest in the ideation quest. Since the 6 measures focus on different facets of motivation, considering all main facet mentioned in the interviews and encountered in the literature, we operationalized it with a formative measurement model (Jarvis et al., 2003). The items are not interchangeable and therefore do not necessarily correlate with each other. The measures form (or define) the construct in a sense that the construct is assumed as a function of its measures.

All items were measured on a 5-point Likert scale (1 − strongly agree, 5 − strongly disagree). All incorporated measurement models are reflective except the formative motive measurement.

5. Data analysis and results

The relationships between the constructs were examined with structural equation modeling using the partial least squares (PLS) approach. According to Hulland's (1999) procedure, a PLS model is examined and interpreted in two steps. In the first step, the measurement model ought to be examined by performing validity and reliability analyses on each of the measures of the model. This is needed to guarantee that only reliable and valid measures of the constructs are used before conclusions about the nature of the construct relationships are drawn (Hulland 1999). In the second step, the structural model is examined by estimating the paths between the constructs in the model, determining their significance as well as the predictive ability of the model.

Reliability and validity for reflective constructs were examined observing: (1) individual item reliabilities; (2) the convergent validity of the measures linked to individual constructs; and (3) discriminant validity. The item loadings are shown in Table 1. All items have loadings above 0.6 which show high item reliabilities. Convergent validity was assessed using composite reliability, which is superior to Cronbach Alpha

because it uses the item loadings obtained within the nomological network (Fornell and Larcker, 1981). Additionally to these measures the average variance extracted (AVE) is shown in Table 2. These values mean that also convergent validity is satisfying.

Table 1. Local fit indices and reliability of scales

Construct	Item	Factor reliability	Indicator reliability	Factor reliability (composite reliability)	Average variance extracted
Community	com2	0.90	0.95	0.94	0.83
	com3	0.90	0.95		
	com4	0.94	0.97		
Control	Con_1	0.95	0.98	0.95	0.91
	con_2	0.96	0.98		
Ease of use	eas_3	0.94	0.97	0.94	0.84
	eas_4	0.93	0.96		
	eas_5	0.87	0.93		
Involvement in co-creation	mot_10	0.73	Formative		
	mot_2	0.44			
	mot_4	0.36			
	mot_6	0.69			
	mot_7	0.75			
	mot_9	0.32			
Compelling experience	com_2	0.93	0.96	0.94	0.85
	com_3	0.91	0.95		
	com_4	0.93	0.96		
Word of mouth	wom1	0.94	0.97	0.96	0.88
	wom2	0.95	0.97		
	wom3	0.93	0.96		
Further interest	ei2	0.95	0.97	0.95	0.87
	ei3	0.93	0.96		
	ei5	0.92	0.96		

Discriminant validity means that measures of a given construct differ from the ones of another construct (Hulland, 1999). Discriminant validity can be measured from the latent variable correlations matrix (Table 2), where the square roots of the average variance extracted values calculated for each of the constructs along the diagonal is shown. The correlations between the constructs are shown in the lower left off-diagonal elements in the matrix. Discriminant validity is given, when the diagonal elements (square root AVE) are greater than the off-diagonal elements in the corresponding rows and columns (Fornell and Larcker, 1981). As Table 2 shows, discriminant validity is satisfactory. Overall, the measures report good reliability and validity.

Table 2. Latent variable correlation matrix

	Community	Compelling	Control	Ease of use	Further interest	Word of mouth	Involvement in co-creation
Community	**0.91**						
Compelling	0.40	**0.92**					
Control	0.30	0.58	**0.95**				
Ease of use	0.30	0.46	0.59	**0.92**			
Further interest	0.52	0.36	0.25	0.26	**0.93**		
Word of mouth	0.58	0.41	0.39	0.35	0.53	**0.94**	
Involvement in co-creation	0.28	0.64	0.42	0.44	0.43	0.37	Formative

6. Path coefficients and predictive ability

Figure 1 shows the path coefficients, their significance level and the R^2 values. PLS uses the bootstrapping method (Efron and Gong, 1983) to calculate the standard errors and thereby assesses the significance of the structural coefficients. Standard errors of parameters were calculated on the basis of 500 bootstrapping runs (value of t-statistic is set in parentheses next to path coefficients).

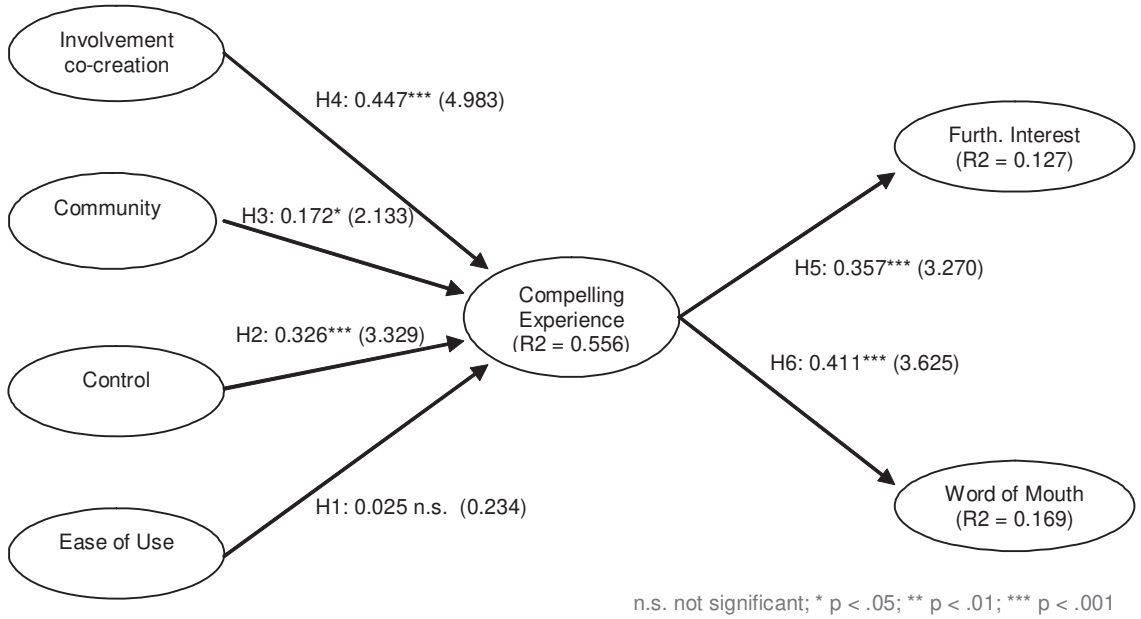

Fig. 1. Model and path coefficients

All paths are statistically significant except the load of ease of use on compelling experience. The antecedents of compelling experience explain 57% of its variance and R^2 for further interest is 0.17 and 0.13 for word of mouth. The results confirm hypotheses H1, H2, H3, which cover our proposed antecedents of a compelling experience. Significant positive effects of a compelling experience on word of mouth and further interest (H5, H6) are also found. Surprisingly, hypothesis H4 must be rejected. Although there is a positive effect of ease of use on compelling experience, the expected direction is not significant.

Surprisingly and contradicting our hypotheses, ease of use was not positively related to compelling experience. As our model contains another construct that is positively related to both constructs (control) we conducted a post-hoc test of a mediation effect.

The latent variable correlation matrix (Table 2) shows a relatively strong relationship between ease of use and control (0.59). As our understanding of control is conceptually very close to control (which is an overall statement concerning the ideation quest handling), the relationship between ease of use and compelling experience could be mediated by the individual's control.

To test this mediating effect, Baron and Kenny's (1986) logic was applied. A variable is a mediator when it meets the following three conditions: (1) the independent variable significantly influences the mediating variable (path a); (2) the mediating variable significantly influences the dependent variable (path b); and (3) when path a and path b are controlled, a previously significant relation between the independent and the dependent variables is now longer significant. Hence, first the direct path from ease of use to compelling experience without the variable control was tested. The path is positive and significant (β = .18, p < .05). When control is introduced as a mediator, the path becomes not significant, whereas ease of use strongly influences control (β = .59, p < .001), and control significantly influences compelling experience (β = .34, p < .001). Hence, the relationship between ease of use and compelling experience is fully mediated by the individual's control (Figure 2).

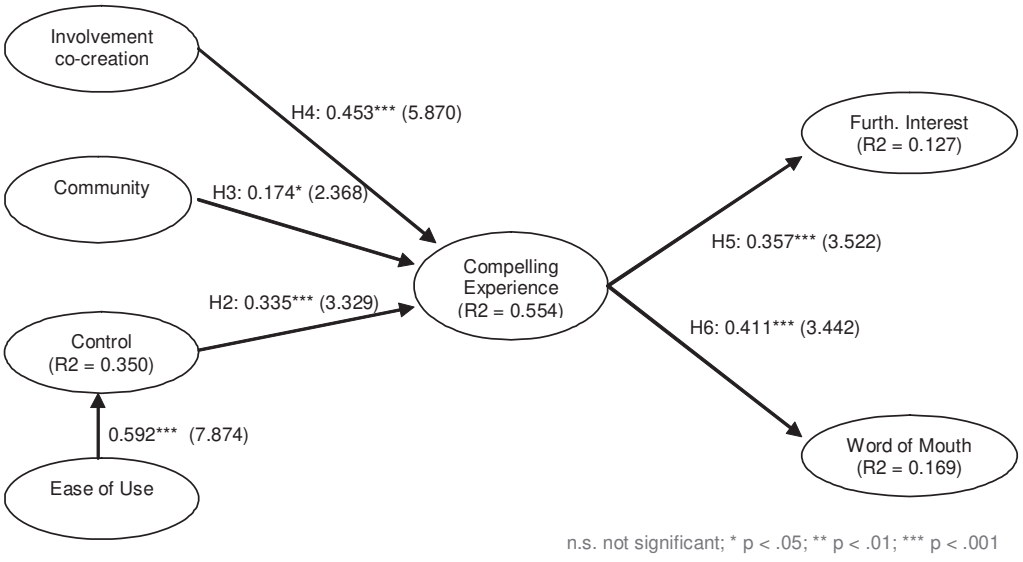

Fig. 2. Path model with control as mediator

Discussion and conclusion

In this paper we studied the consumer's experiences of their participation in co-creation in virtual worlds. This research provides a step forward in exploring the often highlighted notion of the user experience during co-creation and contributes to a better theoretical understanding of consumer behavior during virtual co-creation activities. Several researchers emphasized the importance of understanding what is involved in an experience and to outline the components of an effective user experience (Berry et al., 2002). The findings of this research may serve as an indication that the virtual co-creation experience consists of multiple dimensions, and that each dimension features distinctive factors that facilitates engaging and compelling interactions for participants of open innovation.

A compelling experience is a crucial factor in avatar-based innovation projects. The compelling experience itself is conceptually close to the flow construct, in the sense that it induces positive feelings and fun. A compelling co-creation experience leads to further interest in co-creation activities and positive word of mouth. Especially the power of word of mouth may be beneficial to avatar based innovation, as it reduces the challenge of recruiting interested participants. Both consequences of compelling experiences indicate the importance of de-

livering an enjoying interaction experience in virtual worlds.

As expected and in line with our theoretical considerations, involvement in the co-creation activity, control, as well as community identification can be considered as important antecedents of compelling co-creation experience in SL. Surprisingly, in our study ease of use had no direct effect on compelling co-creation experience when integrating control in the framework. However, the perceived control over the co-creation activity, which encompasses aspects of ease of use, as shown by the full mediation, positively affects a compelling experience. As known from flow theory and TAM, our findings confirm that avatars who feel in control of the application perceive their participation as more enjoyable and compelling.

In virtual worlds, the collaboration and identification with other community members seems to be especially important. So far, the community identification aspect have not been considered as an important antecedent of a compelling experience in any other empirical studies exploring flow on the Internet or the acceptance of new technologies. Similar to other self-determined leisure activities, avatars have to show a certain level of involvement in the co-creation activity in order to enjoy their participation and consider it as rewarding. As suggested for creativity in general, and virtual customer integration in particular (Füller, 2010), natural interest to engage in co-creation is important to enjoy and derive value from its participation. As other studies have already shown in the context of open-source software and virtual customer integration (Füller, 2010), our results revealed that avatars interest in the co-creation activity may originate from various motives. Among these motives the intrinsic motivation, collaboration with other avatars, as well as the gaming aspect was found to be the most important ones (see Appendix).

A compelling co-creation experience can be characterized as intrinsically enjoyable, engaging, immersive and playful.

This research provides a step forward in exploring the notion of the user experience during co-creation activities. Whilst the transfer of the findings of web-based customer integration research may provide some interesting insight, the transfer is difficult as virtual worlds are in some respects significantly different from the traditional web. Navigation in a three-dimensional environment, avatar-mediated communication and the interactivity with virtual tools pose unique issues for co-creation. This is in line with Hoffman and Novak's (2007) suggestion to look for additional antecedents of flow in times of a more interactive Internet and virtual worlds. Even if the present study did not directly employ the flow construct, the notion of an intrinsically motivating experience was put in the center. We demonstrated that the social dimension has a strong positive effect on the participants' experience of avatar based innovation initiatives. Evidence of the positive consequences contributes to establish the experience as a critical success factor for co-creation projects. Our qualitative study allowed us to get a better understanding what control, involvement in co-creation activity, ease of use and community identification mean in the context of virtual worlds.

The research implies that utilizing the latest technological advances can help leverage a firm's innovation process, both by harvesting the medium-related benefits, and by tapping avatars' creativity. Unquestionably, when setting out to co-create with consumers in virtual worlds, companies are faced with a set of questions about how to design the methods and whether existing rules still apply. If companies decide to employ a co-creation strategy in virtual worlds, they must recognize that an invitation for avatars to actively participate in co-creation is not enough. The mere existence of a formal co-creation project will not have any effect on the innovation performance. Instead avatars seek to be engaged in a compelling experience and look for immersive and fun activities.

What is most striking is the need to embrace the social experience. The challenge for managers is to build a community of avatars who are willing to collaborate and take part in the innovation tasks. Events proved to be a viable mechanism to reach a critical mass at least during scheduled times to allow participant interaction. Engaging the most active community members, could start a groundswell of word of mouth and contribute substantially toward the success of the avatar based innovation project.

Judging from the practical experiences and as well as from both studies, the navigation through 3D environments and the complex opportunities to interact with objects during tasks, presents unique issues for the design of the interaction. To increase users' perceived control a clear structure and an understandable task is important. While avatars appreciate being empowered to control the course of their interaction, companies need to guide carefully participants from one task to another.

References

1. Agarwal, Ritu and Elena Karahanna (2000). Time flies when youre having fun: cognitive absorption and beliefs about information technology usage, *MIS Quaterly*, 24 (4), pp. 665-694.
2. Ajzen, Icek (2002). Perceived behavioral control, self-efficacy, locus of control, and the theory of planned behavior, *Journal of Applied Social Psychology*, 32 (4), pp. 665-683.
3. Ajzen, Icek and M. Fishbein (1980). Understanding attitudes and predicting social behavior, Englewood Cliffs, NJ: Prentice-Hall.
4. Algesheimer, Renè, Uptal M. Dholakia, and Andreas Herrmann (2005). The social influence of brand community: evidence from European car clubs, *Journal of Marketing*, 69 (July), pp. 19-34.
5. Au, W.J. (2006). The mixed success of mixed reality, retrieved from http://nwn.blogs.com/nwn/2006/10/why_mixed_reali.html, October 23, 2006.
6. Bagozzi, Richard and Paul R. Warshaw (1990). Trying to consume, *Journal of Consumer Research*, 17 (September), pp. 127-140.
7. Barki, H. and J. Hartwick (1994). Measuring user participation, user involvement, and user attitude, *MIS Quarterly*, 18 (1), pp. 59-82.
8. Baron, R.M. and David A. Kenny (1986). The moderator-mediator variable distinction in social psychological research: conceptual, strategic, and statistical considerations, *Journal of Personality and Social Psychology*, 51 (6), pp. 1173-1182.
9. Berry, L.L., L.P. Carbone, and S.H. Haeckel (2002). Managing the total customer experience, *MIT Sloan Management Review*, 43 (3), pp. 85-89.
10. Castranova, E. (2005). *Synthetic worlds: the business and culture of online games*, Chicago, London: The University of Chicago Press.
11. Csikszentmihalyi, Mihaly (1997). *Finding flow: the psychology of engagement with everyday life* (1st ed.), New York, NY: Basic Books.
12. Csikszentmihalyi, Mihaly (1990). *Flow: Psychology of Optimal Experience*, NewYork: Harper & Row.
13. Csikszentmihalyi, Mihalyi (2002). Creativity: flow and the psychology of discovery and invention, New York: HarperPerennial.
14. Dahan, Ely and John Hauser (2002). The virtual customer, *Journal of Product Innovation Management*, 19 (5), pp. 332-353.
15. Davis, Fred D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology, *MIS Quaterly*, September, pp. 319-340.
16. Davis, Fred D., Richard P. Bagozzi, and Paul R. Warshaw (1992). Extrinsic and intrinsic motivation to use computers in the workplace, *Journal of Applied Social Psychology*, 22 (14), pp. 1111-1132.
17. Davis, Fred D., Richard P. Bagozzi, and Paul R. Warshaw (1989). User acceptance of computer technology: a comparison of two theoretical models, *Management Science*, 35 (8), pp. 982-1003.
18. Deci, Edward and Richard Ryan (2002). Handbook of Self-Determination Research, Rochester, NY: The University of Rochester Press.
19. Deighton, J. and Kent Grayson (1995). Marketing and seduction: building relationships by managing social consensus, *Journal of Consumer Research*, 21 (March), pp. 660-676.
20. Efron, B. and G. Gong (1983). A leisurely look at the bootstrap, the jackknife, and cross-validation, *The American Statistician*, 37 (1), pp. 36-48.
21. Fornell, C. and David F. Larcker (1981). Evaluating structural equation models with unobservable variables and measurement error, *Journal of Marketing Research*, 18 (February), pp. 39-50.
22. Füller, Johann (2010). Refining virtual co-cretion from a consumer perspective, *California Management Review*, 52 (2), pp. 98-122.
23. Füller, Johann (2006a). What motivates creatives consumers to participate in virtual new product development, in 4th International Workshop on User Innovation, Munich, Germany.
24. Füller, Johann (2006b). Why Consumers Engage in Virtual New Product Developments Initiated by Producers, in Advances in Consumer Research, Cornelia Pechmann and Linda Price, eds. Vol. 33.
25. Füller, Johann and Kurt Matzler (2007). Virtual product experience and customer participation − a chance for customer-centred, really new products, *Technovation*, 27, pp. 378-387.
26. Füller, Johann, Kurt Matzler, and Melanie Hoppe (2008). Brand community members as a source of innovation, *Journal of Product Innovation Management*, 25 (November), pp. 608-619.
27. Gefen, D., Elena Karahanna, and D.W. Straub (2003). Trust and TAM in online shopping: an integrated model, *MIS Quaterly*, 27 (1), pp. 51-90.
28. Ghani, Jawaid and Sathish Desphande (1994). Task characteristics and the experience of optimal flow in human-computer interaction, *Journal of Psychology*, 128 (4), pp. 381-391.
29. Hemp, P. (2006). Avatar-based marketing, *Harvard Business Review* (June), pp. 48-57.
30. Herstatt, C. and J.G. Sander (2004). Einführung: Virtuelle Communities, in Produktentwicklung, C. Herstatt and J.G. Sander, eds. Wiesbaden: Gabler Verlag.

31. Hoch, Stephen J. (2002). Product Experience is Seductive, *Journal of Consumer Research*, 29 (3) (December), pp. 448-454.
32. Hoch, Stephen J. and John Deighton (1989). Managing What Consumers Learn from Experience, *Journal of Marketing*, 53 (2) (April), pp. 1-20.
33. Hoffman, D.L. and T. Novak (2007). Flow online: lessons learned and future prospects, Working Paper, University of California.
34. Hoffman, Donna and Thomas Novak (1996). Marketing in Hypermedia Computer-Mediated Environments: Conceptual Foundations, *Journal of Marketing*, 60, pp. 50-68.
35. Hulland, John (1999). Use of partial least squares (PLS) in strategic management research: a review of four recent studies, *Strategic Management Journal*, 20 (2), pp. 195-204.
36. Jarvis, Cheryl Burke, Scott B. MackKenzie, and Philipp M. Podsakoff (2003). A critical review of construct indicators and measurement model misspecification in marketing and consumer research, *Journal of Consumer Research*, 30 (September), pp. 199-218.
37. Jiang, Zhenhui and Izak Benbasat (2007). The Effects of Presentation Formats and Task Complexity on Online Consumers' Product Understanding, *MIS Quarterly*, 31 (3), pp. 475-500.
38. Kim, J. and D Wilemon (2002). Focusing the fuzzy frond-end in new proudct development, *R&D Management*, 32 (4), pp. 269-279.
39. Kohler, Thomas, Johann Füller, Kurt Matzler, and Daniel Stieger (2011a). Co-creation in virtual worlds: the design of the user experience, *MIS Quarterly*, 35, pp. 1-16.
40. Kohler, Thomas, Johann Füller, Daniel Stieger, and Kurt Matzler (2011b). Avatar-based innovation: Consequences of the virtual co-creation experience, Computers in human behavior, 27, pp. 160-168.
41. Kohler, Thomas, Kurt Matzler, and Johann Füller (2009). Avatar-based innovation: using virtual worlds for real-world innovation, *Technovation*, 29, pp. 395-407.
42. Lakhani, Karim and E. von Hippel (2003). How Open Source Software Works: “Free” User-to-User Assistance, *Research Policy*, 32 (6), pp. 923-942.
43. Loken, B. (1983). The theory of reasoned action: examination of the suffieciency assumption for a television viewing behavior, *Advances in Consumer Research*, 10 (1), pp. 100-105.
44. Lüthje, C. and C. Herstatt (2004). The lead user method: an outline of empirical findings and issues for future research, *R&D Management*, 34 (5), pp. 553-568.
45. Mahatanankoon, Pruthikrai and Patrick O'Sullivan (2008). Attitude towards mobile text messaging: an expectancy-based perspective, *Journal of Computer-Mediated Communication*, 13, pp. 973-992.
46. Mathieson, K. (1991). Predicting user intentions: comparing the technology acceptance model with the theory of planned behavior, *Information Systems Research*, 2 (3), pp. 173-191.
47. Matzler, Kurt, Elisabeth Pichler, Johann Füller, and Todd Mooradian (2011). Personality, person-brand fit, and brand community: an investigation of idnividuals, brands, and brand communities, *Journal of Marketing Management*, pp. 1-17.
48. McAlexander, James H., John W. Shouten, and Harold Koenig (2002). Building brand community, *Journal of Marketing*, 66 (1), pp. 38-54.
49. McWilliam, Gil (2000). Building Strong Brands through Online Communities, *Sloan Management Review*, 41 (13).
50. Nambisan, S. (2002)/ Designing virtual customer environments for new product development: toward a theory, *Academy of Management Review*, 27 (3), pp. 392-413.
51. Nambisan, Satish and Priya Nambisan (2008). How to Profit from a Better 'Virtual Customer Environment, *MIT Sloan Management Review*, 49 (3), pp. 53-61.
52. Novak, Thomas, Donna Hoffman, and Yiu-Fai Yung (2000). Measuring the Customer Experience in Online Environments: a Structural Modeling Approach, Marketing Science, 19 (1), pp. 22-42.
53. Nysveen, Herbjorn, Per E. Pedersen, and Helge Thorbjornsen (2005). Intentions to use mobile services: antecedents and cross-service comparisons, *Journal of the Academy of Marketing Science*, 33 (3), pp. 330-346.
54. Ondreijka, C. (2007). Collapsing Geography (Second Life, innovation, and the future of national power), *Innovations: Technology, Governance, Globalization*, 2 (3), pp. 27-54.
55. Pavlou, Paul A. (2003). Consumer acceptance of electronic commerce: integrating trust and risk with the technology acceptance model, *International Journal of Electronic Commerce*, 7 (3), pp. 69-103.
56. Pavlou, Paul A. and Mendel Fygenson (2006). Understanding and predicting electronic commerce adoption: an extension of the theory of planned behavior, *MIS Quaterly*, 30 (1), pp. 115-43.
57. Reichwald, Ralf and Frank Piller (2006). Interaktive Wertschöpfung, Wiesbaden: Gabler Verlag.
58. Rose, F. (2007). How Madison Avenue is wasting millions on a deserted Second Life, *Wired Magazine*, 15 (8).
59. Sawhney, Mohanbir, Gianmario Verona, and Emanuela Prandelli (2005). Collaborating to create: the Internet as a platform for customer engagement in product innovation, *Journal of Interactive Marketing*, 19 (4).
60. Schlosser, Ann E. (2003). Experiencing Products in the Virtual World: the Role of Goal and Imagery in Influencing Attitudes versus Purchase Intentions, *Journal of Consumer Research*, 30 (2), pp. 184-198.
61. Schreier, Martin and Reinhard Prügl (2008). Extending lead-user theory: antecedents and consequences of consumers' lead userness, *Journal of Product Innovation Management*, 25 (4), pp. 331-46.

62. Srinivasan, Srini S., Rolph Anderson, and Kishore Ponnavolu (2002). Customer loyalty in e-commerce: an exploration of its antecedents and consequences, *Journal of Retailing*, 78 (1), pp. 41-50.
63. Taylor, Shirley and Peter A. Todd (1995). Assessing IT usage: the role of prior experience, *MIS Quaterly*, 19 (4), pp. 561-570.
64. Venkatesh, Viswanath (2000). Determinants of perceived ease of use: integrating control, intrinsic motivation, and emotion into the technology acceptance model, Information Systems Research, 11 (4), pp. 342-365.
65. Venkatesh, Viswanath, Michael G. Morris, Gordon B. Davis, and Fred D. Davis (2003). User acceptance of information technology: toward a unified view, *MIS Quaterly*, 27 (3), pp. 425-478.
66. Von Hippel, E. (2001). Perspective: user toolkits for innovation, *Journal of Product Innovation Management*, 18 (4), pp. 247-257.
67. von Hippel, Eric and Ralph Katz (2002). Shifting Innovation to Users via Toolkits, *Management Science*, 48 (7), pp. 821-833.
68. Weiss, Michael and G.R. Gangadharan (2010). Modeling the mashup ecosystem: structure and growth, *R&D Management*, 10 (1), p. 4049.
69. Zeithaml, Valerie A., Leonard L. Berry, and A. Parasuraman (1996). The behavioral consequences of service quality, *Journal of Marketing*, 60 (April), pp. 31-46.

Appendix

Table 1. Summary of measures

Construct	Items	Mean	S.D.
Community	I identify myself with others Philips ideation quest participants.	3.13	1.23
	I consider the Philips ideation quest participants as my friends.	3.22	1.20
	I consider myself as a member of the Philips ideation quest community.	3.15	1.20
Control	I had control over using the ideation quest.	2.53	1.03
	I was in charge of the navigation through the ideation quest.	2.52	1.08
Ease of use	I consider the ideation quest as:		
	♦ User-friendly.	2.42	1.10
	♦ Easy to use.	2.48	1.03
	♦ Clear and understandable.	2.39	1.09
Involvement in co-creation	Complete with others.	3.29	1.37
	Play the game.	2.54	1.21
	To get a better solution for my needs.	2.95	1.15
	Because I like to innovate.	2.09	0.98
	Because I want a better motorbike.	3.65	1.42
	To meet other interesting people.	2.23	1.10
Compelling experience	Participation was exciting.	2.29	1.03
	I enjoyed the mere participation.	2.22	1.01
	Participation was fun.	2.19	1.06
Word of mouth	I can say positive things about the Philips ideation quest to other people.	2.20	1.09
	I can recommend the Philips ideation quest to anyone who seeks my advice.	2.35	1.10
	I wouldn't hesitate to refer my friends to the Philips ideation quest.	2.34	1.13
Further interest	Participating in the Philips ideation quest lead to the result that:		
	♦ I got interested in the new Philips sustainable living concept.	2.29	1.15
	♦ I intent to engage in future co-creation activities.	2.16	1.15
	♦ I would like to further contribute to the development of new Philips concepts.	2.35	1.22

Note: All items were measured on a 5-point Liker scale, anchored by 1 = "strongly agree" and 5 = "strongly disagree".