

ServDes2018 - Service Design Proof of Concept
Politecnico di Milano
18th-19th-20th, June 2018

Co-creation with vulnerable consumers – an action research case study of designing a pictorial language for logistics

Schmitt-Rüth, S., Simon, M., Demuth, A., Kornacher, A., Isakovic, M., Krupp, M., & Stoll, M.
stephanie.schmitt-ruetb@scs.fraunhofer.de
Fraunhofer SCS, Nordostpark 84, 90411 Nuernberg

Abstract

Within the context of Universal Design and User Centered Design, vulnerable consumers, especially immigrants, still represent a fringe group when it comes to co-creation processes. Therefore, the aim of our study was to find ways to integrate immigrants into a co-creation process, namely the development and testing phase of a pictorial language for warehouse jobs. Within an action research case study consisting of a four-part storyline settled in a warehouse context, we identified and specified four key success factors that contribute to a successful co-creation project with vulnerable consumers: (1) integration at the very beginning of the co-creation project, (2) design of a suitable toolbox with service design, creative and varied methods, a storyline concept, use of easy language, additional icons and possibility of parallel use, (3) availability of network partners with access to vulnerable consumers as well as (4) the innovative setting of a living lab.

KEYWORDS: co-creation, vulnerable consumers, immigrants, open living lab, service design, pictorial language

Introduction

One of the most important trends in contemporary consumer society is the progressive inclusion of consumers in companies' processes where value is co-created (Arvidsson 2008). Already in 1991, Muller described initial experiences with the participatory design technique PICTIVE. In 2004, Prahalad & Ramaswamy (2004) analyzed co-creation as a new and critical development within the field of innovation. Concepts of interactive innovation development, such as Open Innovation by Chesbrough (2003), Wisdom of Crowds (Surowiecki, 2004) as well as the Lead-User concept (von Hippel, 1986) have promoted co-creation research, leading to a range of new business models and management tools that engage users in the process of innovation. Co-creation is a method of solving complex problems and developing innovative ideas. The concept is based on the collaboration of interdisciplinary groups that develop, test and implement in a repetitive and application-oriented process (Zwick, Bonsu, & Darmody, 2008). Integrating customers in order to learn

from and with them in the innovation process is a key success factor for companies (Edvarsson, Gustafsson, Kristensson, & Witell, 2010). It requires involving stakeholder group methods of interaction in transdisciplinary processes.

Vulnerable consumers as fringe groups

A phenomenon that has received less attention so far in the context of co-creation, user integration and service design are the so-called vulnerable consumers. Consumer vulnerability is defined as *“a state of powerlessness that arises from an imbalance in marketplace interactions or from the consumption of marketing messages and products. It occurs when control is not in an individual’s hands, creating a dependence on external factors (e.g., marketers) to create fairness in the marketplace. The actual vulnerability arises from the interaction of individual states, individual characteristics, and external conditions within a context where consumption goals may be hindered and the experience affects personal and social perceptions of self.”* (Baker, Gentry, & Rittenburg, 2005)

While there is no acknowledged definition for vulnerable consumers, there are several risk factors defining circumstances that could contribute towards making a consumer vulnerable (Legal Services Consumer Panel, 2014) and thus increase the likelihood of him being at a disadvantage or suffering loss or detriment during a transaction or communication with an organization. Such risk factors can be age, inexperience, learning or physical disabilities, low income or literacy, cultural barriers, mental health issues, a relationship breakdown, living in areas without internet or health problems. Scientific approaches such as Universal Design (UD) or User Centered Design (UCD) aim at integrating the needs of precisely the target group of vulnerable consumers. The term Universal Design was characterized in 1978 by Ron Mace at the Center for Universal Design of the North Carolina State University (Ostroff, 2011). UD is an integrative approach trying to focus on the needs of as many people as possible (rather than demanding individual solutions) while taking into account inclusion, social integration as well as heterogeneity and diversity (for a detailed description of the principles of UD see Story, 2001). In the concept of User Centered Design, the users are at the center of the whole design process, from the early stages of planning and designing the system requirements to the later stages of implementing and testing the product. The philosophy of UCD is (1) to know the product users as only then their needs can be analyzed by skillful questions and observation techniques (Gould & Lewis, 1985), and (2) to remember that the product developers and team members are not the product users. Within the context of UD and UCD, there are already activities and approaches with the vulnerable consumer group of elderly people in the field of Ambient Assisted Living (AAL) (Chernbumroong, Atkins, & Yu, 2010; Demiris, Rantz, Aud, Marek, Tyrer, Skubic & Hussam, 2004; Emiliani & Stephanidis, 2005; Holzinger, 2002) as well as with autistic persons in the field of health restrictions (Huijnen, Lexis, Jansens & de Witte, 2017). Findings for co-creation with immigrants as another subgroup of vulnerable consumers, however, are still rare. In the following, we will discuss this specific group and we will examine the question how to integrate immigrants into the development and testing process of a pictorial language for logistic processes.

Theory

To gain an overview of former research activities and to excerpt requirements for the design of our case study, we conducted a literature search by entering relevant keywords in various scientific search engines (e.g. science direct, emerald insight, google scholar). In particular, we searched for studies dealing with co-creation with immigrants and findings on the use of pictorial language with immigrants.

Already in 1933, Neurath stated that pictures can be used to overcome both cultural and educational differences. To achieve this aim, he based his graphic language Isotype (Neurath, 1935) on the rule of simplicity (Hochhäusl, 2011; Groß, 2015). Regarding co-creation with immigrants, Bobeth, Schreitter, Schmehl, Deutsch & Tscheligi (2013) show that the inclusion of immigrants (especially newly arrived and low educated ones) is simplified by supportive ICT services. The project contained a user-centered design (UCD) process, which becomes successful in terms of collaboration with non-governmental organizations (NGOs) or long-term immigrants. Chan, Han, Ng & Park (2009) examined the comprehension among Chinese and Koreans for American security safety symbols. As non-Americans have lower comprehension scores for American symbols than Americans themselves, immigrants may have interpretation problems. This insight stresses the consideration of the end user while designing safety symbols. Already in 1972, Cuny (1972) studied gestural commands effectiveness' on foreign workers. Instructions via a nonverbal, symbolic gestural code have been collected by experienced workers' observations. By showing films or drawings to foreign laborers, the experiments prove relationship closeness between symbolic and applied gestures. Furthermore, gestural codes can be used as useful initial training to foreign workers from the very beginning on the job. Low-literate readers can also be helped with an illustrated leaflet including antiretroviral information (according to Dowse, Ramela & Browne, 2011). Pictograms in the leaflet facilitated understanding among low-literate patients, especially for basic medication information. Culture and literacy skills should be considered in leaflet design, as well as verbal counseling combined with written information. Hare, Cameron, Real & Maloney (2013) consider in their case study the pictorial aid in health and safety communication for migrant construction workers. To reduce barriers, such as language and communication difficulties, they developed a pictorial inventory of images, and tested them for comprehension with the help of migrant workers. Due to the pictograms, a high amount of correct interpretations was reached. This study shows that simple hazards and controls can be communicated via pictorial aids as supplementation (not as substitution). However, cultural differences must be considered.

Based on the brief literature review and in-depth explanatory sources, we derive the following relevant framework conditions for co-creation with immigrants, which form the basis of analysis for our action research case study:

1. Methods should be targeted and user-centered.
2. The setting should be adapted to the specific user group. Familiar environments are preferred.
3. Early involvement of the user in the co-creation process can help in progressively testing and fine-tuning the prototypes (incremental design approach).
4. Creating a feeling of empowerment is useful for initiating an activity and increasing the persistence of task performance (Füller, Mühlbacher, Matzler & Jaweck, 2009).
5. The context should be set in a way that allows getting involved. E.g., self-efficacy can be strengthened through (1) positive emotional support, (2) encouragement (3) observing others' effectiveness, (4) feeling of successfully mastering a task (Bandura, 1977, Füller et al., 2009)
6. Each co-creation process should contain elements of enjoyment (Bandura, 1977).

Issues in Using Service Design in Co-Creation with immigrants – An Action Research Case Study

From a methodological perspective, our case study approached as action research case as it aims at understanding co-creation with vulnerable consumers, namely immigrants.

Brief description of the Project

Our co-creation project took place within a large scientific project (LogiPICs, 2017/2018) which aims to develop a pictorial language that displays work instructions for warehouse jobs in an interculturably understandable way. In addition to accelerating the training of new employees, the pictorial language aims at stabilizing and increasing both quality and efficiency of warehouse processes. By largely renouncing text, the main aim of the pictorial language is to integrate employees with a different mother tongue as German and illiterates. As such, it is essential that the pictorial language is in accordance with these employees in order to be accepted, understood and successfully used by them. To achieve this, we included immigrants as part of the intended users of the pictorial language in our co-creation project.

General Service Design Setting

The most important thing is to put oneself in the position of the intended users. It is not enough to just query them, you have to watch them closely to get new insights and hints for the product development process. The main concern must be to make products, services or concepts useable and useful by focusing on the users, their conditions and requirements. With this context in mind, our co-creation project for the development of a pictorial language for warehouse jobs consisted of four parts that followed a storyline starting with one's first working day at a warehouse, continuing with being promoted and ending with a company internal challenge. We used the storyline concept to create a feeling of immersion into the warehouse context (Spiegel & Hoinkes, 2009; Qin, Patrick Rau, & Salvendy, 2009). We presented the storyline on posters, combining an easily understandable language with additional icons adding to the understanding (Morrow, Hier, Menard, & Leirer, 1998; Mansoor & Dowse, 2003). Even though we mainly addressed immigrants as intended users of the pictorial language, we also included logistics experts (employers, supervisors, teachers and people currently working in the logistics sector) as well as potential users without migration background to find out if the pictorial language is a) acceptable and understandable for all of them b) if it depicts various logistic jobs correctly. To address this diverse group in our co-creation project, the language used had to be easily understandable for the immigrants, yet not too easy for the logistics experts and other potential users to be deterrent. We therefore used a language in accordance with the A2/B1 level of the Common European Framework of Reference for Languages CEFR (Council of Europe, 2001). All written texts used for our co-creation project were rated by three language experts (two teachers of German as a foreign language as well as an immigration expert) with regard to the A2/B1 criteria. The four parts of the storyline used different methods and mediums and were designed so that participants could either follow the storyline or also go through individual parts of the story, depending on their needs and preferences.

JOSEPHS® as living lab setting

The four parts of our co-creation project were set up in the form of a semicircle within the open innovation lab JOSEPHS®– Die Service-Manufaktur (www.JOSEPHS-service-manufaktur.de/en). We chose the JOSEPHS® for our co-creation project as it allowed us to access both immigrants as well as logistics experts and other potential users in a low-threshold way. JOSEPHS® follows a shop-like concept where visitors can drop in during the

regular retail opening hours and participate in various co-creation projects. As such, it allows both individuals and groups to decide freely when to co-create. Our co-creation project at JOSEPHS® started in September 2017 and ended in November 2017.

Part one of our storyline: Online questionnaire

The first part of our storyline (first working day at a warehouse) was designed as an online questionnaire which was presented on two tablets to allow parallel use. The aim of the questionnaire was to decide on the ideal figure for explaining work instructions for warehouse workers. The questionnaire was designed using LimeSurvey (2017) and consisted of five questions on the figure design as well as six additional demographic questions (gender, education, spoken languages, mother tongue, home country, work experience at a warehouse). The figure design questions were presented as single choice and ranking questions. Participants had to choose the figure or pair of figures most suitable for explaining warehouse work instructions, the figure they personally liked most and the figure they identified with most.

To be accessible for as many participants as possible, the online questionnaire was available in German and English and used the A2/B1 language level (Council of Europe, 2001). However, the ability to read was no mandatory requirement since the JOSEPHS® concept includes so called JOSEPHS® guides ready to assist the participants whenever there are questions or problems. In the same line, the knowledge of how to use a tablet was no mandatory requirement since the JOSEPHS® guides could also assist in case a participant had never used a tablet before. Even though there were only two tablets available, the questionnaire allowed parallel use by more than two participants. This was achieved by printing the questionnaire on sheets with a size of 8.3 x 11.7 inches, with one question per sheet. The printed version was also available in German and English, additionally in Arabic, and allowed parallel use by up to 15 participants, which made it easily accessible to groups.

Part two of our storyline: Simulation and structured interview

The second part of the storyline (first work experience at a warehouse) was designed as a simulation in combination with a structured interview. The aim of this part was to test the understanding of two pictorial work instructions in a warehouse model. The work instructions showed the jobs of a) unloading a truck and b) packing away a pallet, which we had identified as typical warehouse jobs when visiting five warehouses in preparation for the co-creation project. The two pictorial work instructions that were presented in random order consisted of a) a single picture containing four work steps (unloading a truck) and b) four work steps presented as one picture per work step (packing away a pallet) (see Figure 1).

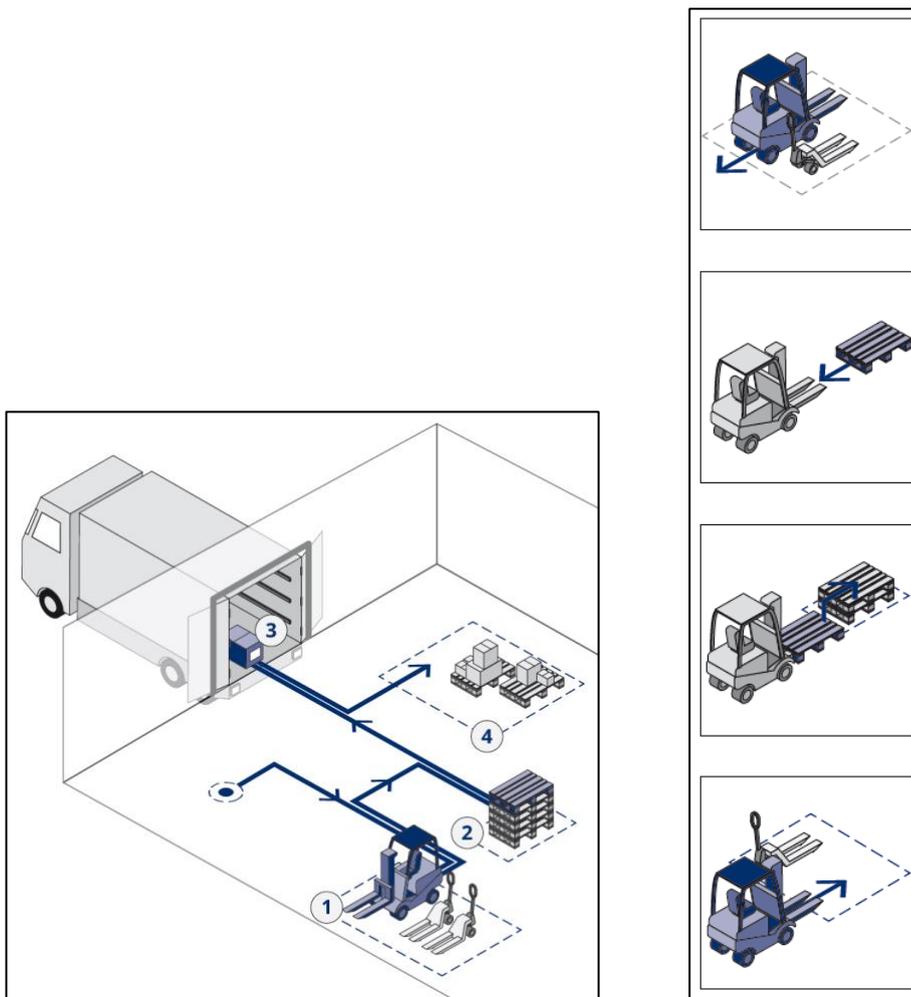


Figure 1: Pictorial work instruction for a) unloading a truck (left) and b) packing away a pallet (right)

The work instructions were printed in color on laminated papers (8.3 x 11.7 inches) and handed over to the participants by the JOSEPHS® guides. As soon as the participants received the first pictured work instruction, they went to the warehouse model (see Figure 2) and tried to carry it out there. The participants could either work in silence or comment on the working steps. In case the participants had previously given their consent, this part of the storyline was audio-recorded to capture all comments and remarks that could be useful for improving the design of the pictorial language. In addition to the audio recording, the JOSEPHS® guides used standardized evaluation sheets to record whether a precise work step was carried out correctly or incorrectly. As soon as the participants had completed the task in the warehouse model, the JOSEPHS® guide continued with a structured interview consisting of five to eight questions depending on the pictorial work instruction. The questions covered colors used, numbering, arrows, order of work steps, difference between model and work instruction, as well as overall clarity of the work instruction. The participants could answer the questions with yes/no only or also make additional comments. Once the participants had finished both tasks, the JOSEPHS® guide asked which of the work instructions was easier to follow and why. The guide furthermore noted which work instruction was handed out first and which second to control for sequence effects.

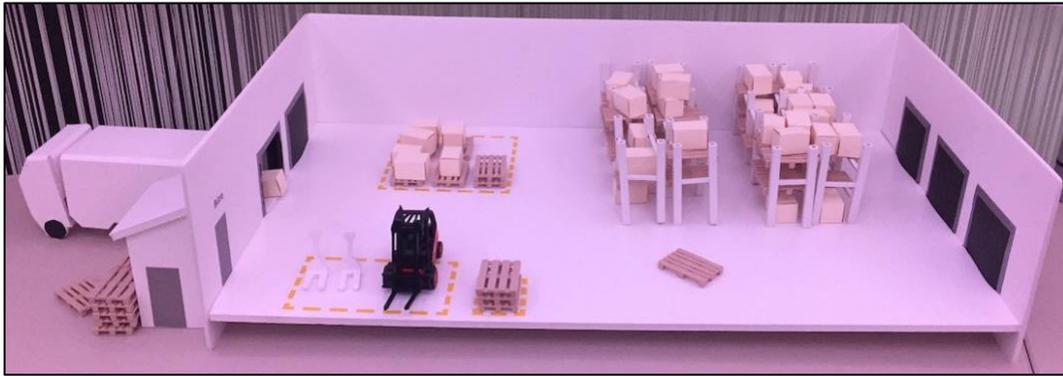


Figure 2: Interactive warehouse model

To be accessible for as many participants as possible, the structured interview was available in German, English and Arabic and used a language in accordance with the A2/B1 level (Council of Europe, 2001). In case participants did not understand the meaning of a standardized question, the JOSEPHS® guide was allowed to explain the question using the warehouse model. As to answering the questions, an A1 language level was sufficient as they could be answered with yes/no only. The usage of the warehouse model allowed the participants – also those with no previous work experience in a warehouse – to fully immerse into the warehouse context and to understand the problems of creating an understandable and acceptable pictorial language.

Part three of our storyline: Creative paper and pencil questionnaire

The third part of the storyline (being promoted) was designed as a creative paper & pencil questionnaire which allowed parallel use. The creative paper and pencil questionnaire, which was available in German, English and Arabic, consisted of a sheet of paper (8.3 x 11.7 inches) with four written work instructions accompanied by basic pictograms giving the context for the work instructions. The participants' task was to create their own pictorial work instructions based on the written work instructions, ideally without using any text. The written work instructions that had to be transferred into pictures covered a prohibition, indicating a movement, marking a position and highlighting something (see Figure 3). The participants could choose freely among eight different colors and could use any combination of colors and form they considered suitable. Ability to read was no mandatory requirement since the multilingual JOSEPHS® guides could read and explain the questions to the participants.

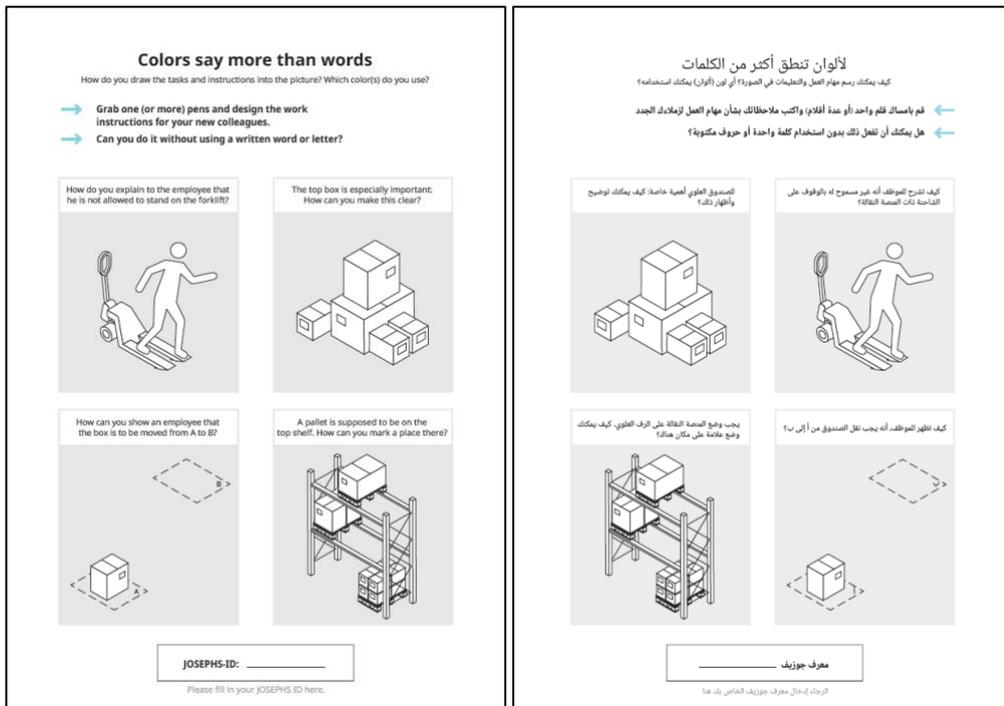


Figure 3: Creative paper and pencil questionnaire (here in English (left) and Arabic (right); German also available but not displayed)

Part four of our storyline: Creativity task

The fourth part of our storyline (company internal challenge) was set as a creativity task and aimed at designing a logo for the pictorial language. Thus, this part went beyond the actual designing of the pictorial language and asked the participants to think about marketing criteria such as recognition value and timelessness. To design their logo, the participants could choose freely among a set of 24 colored pencils and could use a stamp as well. To follow the storyline concept of a company internal challenge, the participants did not just draw their logo on a piece of paper but were given a small t-shirt model (see Figure 4), as the company internal challenge was about designing the logo on a t-shirt. After having completed their logo, the participants could either hand their designed t-shirts to a JOSEPHS® guide or hang them on a model clothesline where they served as an inspiration to other participants. Since there were no limitations concerning forms or colors used (apart from choosing from a set of 24 colors), it was a low-threshold task that required no particular language knowledge apart from understanding that it was about designing a logo.

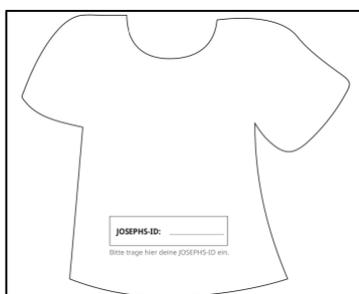


Figure 4: T-shirt model for company internal challenge

Service Design Evaluation

The data of N = 325 participants of our co-creation process (n = 163 female, n = 162 male; mean age 34.5, SD = 14.25), with n = 48 having another home country and mother tongue than Germany/German, were used for evaluating the different storyline parts. We used a purely quantitative approach using SPSS 20 for evaluating the multilingual questionnaire of part one of the storyline. Our main finding here was that regardless of sex and culture, our participants had a clear idea of the figure that is best suitable for explaining warehouse work instructions with pictures. For the simulation task in the warehouse model (part two of the storyline), we used a qualitative content analysis based on Mayring (2000), finding that colors and additional aids such as numbers and arrows are essential for understanding pictorial work instructions and that a sequential presentation is easier to understand than a all-in-one presentation. As to part three of the storyline, we again applied a quantitative approach using SPSS 20 and identified icons, symbols and indexes that were each combined with a certain set of colors in order to depict a prohibition, movement, position and highlighting something. For part four of the storyline (company internal challenge), we chose a qualitative approach, which led us to three logo families which we then used for further evaluation so that we could find a single ideal logo for the pictorial language.

Discussion and Implications

The above-mentioned findings of our different storyline parts were all used by the graphic designers for further developing the pictorial language. At the time of writing, we have two typical warehouse processes in pictorial language ready for further testing in May 2018. The figures, general layout, forms and colours used in these two processes are all based on our findings presented above. These numerous and various findings however, would not have been possible without the following success factors of our case study which resulted in so many participants and thus opinions and thoughts:

Involvement

One of our main success factors was integrating the users, particularly the immigrants but also the logistics experts and other potential users of the pictorial language, at the very beginning of the creation process: Our co-creation project involved the users at a very early stage where we had to decide on design basics such as colors, figures and forms used. Being integrated at such an early stage gave the participants the feeling that their thoughts and opinions are important.

Toolbox

The usage of easily understandable, yet creative and varied design thinking methods helped us to promote co-creation with participants. They enjoyed co-creating and did not see it as a burden. A major success factor was the usage of a storyline concept. This allowed the participants to fully immerse into the warehouse context. Those participants who had never worked in a warehouse before could develop a feeling for typical warehouse jobs when working in the model and could understand the difficulties and problems of creating a pictorial language for such jobs. Some of the younger participants got inspiration for a possible workplace for them.

- Verbal representation: The material used (e.g., storyline posters, (online) questionnaire, structured interview, written work instructions) had to be formulated in language level A2/B1 at maximum. This allowed access to a wide range of participants (e.g. immigrants, logistics experts, potential users of the pictorial language without migration background).

- Non-verbal representation: Another success factor was the usage of additional icons, added for understanding the tasks in case of limited language knowledge or reading competency. This implicated a reduced “risk“ for illiterates of having to ask for help and being discovered as illiterates.

Setting

The JOSEPHS® living lab setting with its open space character allowed us to involve and stimulate our diverse intended and potential users to participate. With its pleasant and creative atmosphere and not being in an old-fashioned laboratory setting, participants could enjoy co-creating. The possibility of working simultaneously and parallel on the same tasks (except for the warehouse simulation task) made it especially easy for groups to access our co-creation project. Immigrants would probably not have participated individually but enjoyed participating when in a group of other immigrants, was feedbacked to us. Furthermore, the presence of trained and multilingual guides at JOSEPHS® was an important fact, especially with regard to vulnerable consumers, such as immigrants with limited proficiency of German or illiterate participants.

Commitment

Co-creation with vulnerable consumers can only work with network partners who have access to such groups. One of our partners is specialized in various job trainings and integration programs for immigrants and illiterates and helped us to define the language level, inform the vulnerable consumers about the project and brought them to our co-creation setting in the JOSEPHS®.

Our case study identifies two further aspects that we consider to be success factors in the integration of vulnerable consumers such as immigrants:

Identification of Vulnerable Consumers

Much is talked about the concept of lead users: The term lead user was introduced in 1986 by Eric von Hippel. A lead user is defined by two characteristics: First, he is confronted with the needs and requirements of products, processes and services that will gain importance for the masses in the future. Second, he benefits considerably from the satisfaction of these needs or requirements. Von Hippel (1986) developed a methodology to identify lead users. The methodology involves four major steps, beginning with the delineation of a search field and ending with the development of a product (Lüthje & Herstatt, 2004). Recruitment of users for user integration should be in close consultation with product/service developers and psychological/sociological researchers.

Consideration of ethical aspects

In the context of integrating users into co-creation, an early examination of ethical aspects should take place. It has to be asked whether a study, in our case the co-creation project, can exert a negative physical or psychological effect on the participants and whether the expected test results are worth it. The following information gives an insight into the topic of ethical aspects (Lindfelt & Törnroos, 2006; Greenbaum, 2015; Döring & Bortz, 2016): Participants should at least be informed about the aspects of a study that could influence their willingness to participate. If desired, the results of the study should be provided to participants. It is important to investigate whether intentional deceit of participants can be avoided by using other study design methods. If it is necessary to conceal the true purpose of an examination due to the design of the study, the participants should be informed of the actual purpose after the study has been completed. If possible, mental or physical impairments should be avoided.

Figure 5 summarizes the relevant findings on co-creation with vulnerable consumers in form of a basic framework for Service Design, illustrated by the example of pictorial language with immigrants.

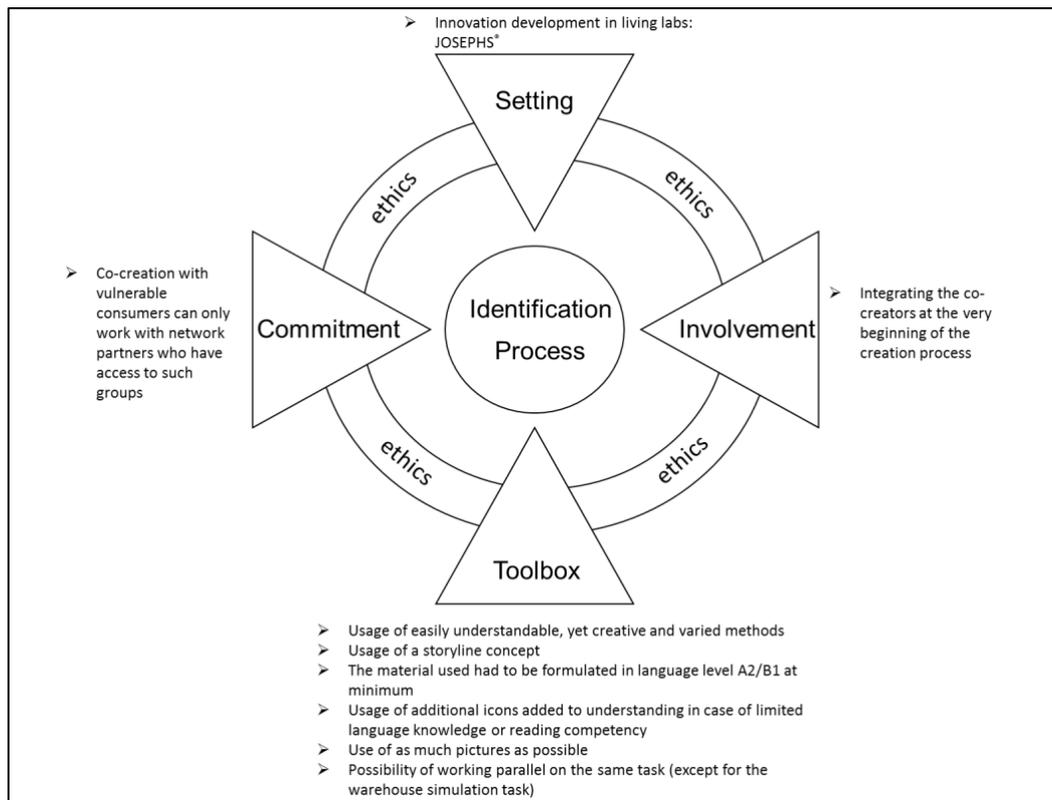


Figure 5: Co-creation with vulnerable consumers – Basic Framework for Service Design (illustrated by the example of pictorial language with immigrants)

Limitations and Further Research

After considering all the success factors of our case study, it is important to discuss critical factors and limitations in general and especially for our co-creation project.

Toolbox

The performance contribution of the users can vary between the passive supply of information and active participation, focusing on existing information to emasculate new knowledge (Holt, 1984). Many different methods can be applied (Kleinschmidt, Geschka, & Cooper, 1996): user observation, user survey, joint working groups and creativity workshops. The individual methods, which subsume under these generic terms, differ in their interaction strength. In our co-creation project, especially groups had to follow the storyline in a different order, which may have created different feelings of immersion into and understanding of the warehouse context and problems of a pictorial language.

Setting

Ballon, Pierson & Delaere (2005) define living labs such as the JOSEPHS® as an experimentation environment in which technology is given shape in real life contexts and in which users are considered actual co-producers. In living labs, products, services or concepts are tested in a real-life context, with participants as important informants in the tests (Kusiak, 2007). Living labs are ideal co-creation environments for human-centered research Schmitt-Rüth, S., Simon, M., Demuth, A., Kornacher, A., Isakovic, M., Krupp, M., & Stoll, M. 333 Co-creation with vulnerable consumers – An action research case study of designing a pictorial language for logistics Linköping University Electronic Press

and innovation (Nyström & Leminen, 2011). However, even though theoretically living labs are thought to be for everyone to participate, in practice the typical audience at the JOSEPHS®, for example, is German and of higher education. Immigrants and/or other vulnerable consumers need to be recruited separately and do not just drop in. As mentioned before, a partner specialized in such groups is important. Another limitation of the living lab setting is that immigrants and/or other vulnerable consumers may not feel at ease. In our open lab there are for example a lot of female interviewers. Additionally, the general setting at the JOSEPHS® which is not specifically aimed at immigrants or other vulnerable consumers may generate a non-pleasant atmosphere for them.

Vulnerable group identification

A major disadvantage in our use-case setting was that illiterates were not identified as such (in case there were any!). Therefore we have to think of other techniques to identify them in future. In general, further efforts are needed to find out how illiterates can be recognized, not only among immigrants, but also among other vulnerable consumers. Even though we made first research experiences in our case study, the questions of how to get illiterate people more involved in co-creation processes and to find out how many participated in co-creation require further research. The adaption of specific methods for illiterates from other scientific disciplines should be considered. Furthermore, the recruitment of this specific vulnerable consumer group is associated with effort. A recruitment network can help here.

It will be important to evaluate the success factors found in our setting. More studies with the use case of pictorial language are an option and can thus help to make the co-creation process more powerful. Furthermore, although we have consciously diversified the setting and storyline, it remains to be said that there are other groups of vulnerable consumers with other specifics as well. Here, for example, elderly people can be mentioned, who in turn will have different needs for a pictorial language. For the process of co-creation, some aspects valid for our target group of immigrants will certainly be transferable to other groups. Hence, vulnerability is not necessarily a permanent state (see United Nations, 1998, in Financial Conduct Authority, 2015). People can move in and out of vulnerability, and can suddenly be plunged into a vulnerable state by a dramatic life event (see Consumer Affairs Victoria, 2004, in Financial Conduct Authority, 2015). Depending on the situation, every one of us can be a vulnerable consumer at a time.

References

- Arvidsson, A. (2008). The ethical economy of customer coproduction. *Journal of Macromarketing*, 28(4), 326-338.
- Baker, S. M., Gentry, J. W., & Rittenburg, T. L. (2005). Building understanding of the domain of consumer vulnerability. *Journal of Macromarketing*, 25(2), 128-139.
- Ballon, P., Pierson, J., & Delaere, S. (2005). Test and experimentation platforms for broadband innovation: Examining European practice.
- Bandura, A (1977). Self-efficacy: toward a unifying theory of behavioral change. *Psychological Review*, 84(2), 191-215.
- Bobeth, J., Schreitter, S., Schmehl, S., Deutsch, S., & Tscheligi, M. (2013, September). User-centered design between cultures: Designing for and with immigrants. In *IFIP Conference on Human-Computer Interaction* (pp. 713-720). Springer: Berlin, Heidelberg.
- Schmitt-Rüth, S., Simon, M., Demuth, A., Kornacher, A., Isakovic, M., Krupp, M., & Stoll, M. 334
Co-creation with vulnerable consumers – An action research case study of designing a pictorial language for logistics
Linköping University Electronic Press

- Chan, A. H., Han, S. H., Ng, A. W., & Park, W. (2009). Hong Kong Chinese and Korean comprehension of American security safety symbols. *International Journal of Industrial Ergonomics*, 39(5), 835-850.
- Chernbumroong, S., Atkins, A., & Yu, H. (2010). Perception of smart home technologies to assist elderly people. In *The fourth international conference on software, knowledge, information management and applications* (pp. 90–97). 4th International Conference on Software, Knowledge, Information Management and Applications.
- Chesbrough, H.W. (2003): *Open Innovation. The new imperative for creating and profiting from Technology*. Boston: Harvard Business Review Press.
- Consumer Affairs Victoria (2004). *Discussion paper: What do we mean by 'vulnerable' and 'disadvantaged' consumers?*. Retrieved from: <http://www.consumer.vic.gov.au/library/publications/resources-and-education/research/what-do-we-mean-by-vulnerable-and-disadvantagedconsumers-discussion-paper-2004.pdf>
- Council of Europe (2001). *Common European Framework of Reference for Languages: Learning, Teaching, Assessment*. Cambridge University Press.
- Cuny, X. (1972). Gestural commands: An experience with beginning foreign workers. *Bulletin De Psychologie*, 26(14-16), 847-852.
- Demiris, G., Rantz, M. J., Aud, M. A., Marek, K. D., Tyrer, H. W., Skubic, M., & Hussam, A. A. (2004). Older adults' attitudes towards and perceptions of 'smart home' technologies: a pilot study. *Medical informatics and the Internet in medicine*, 29(2), 87-94.
- Döring, N., & Bortz, J. (2016). *Forschungsmethoden und Evaluation*. Heidelberg: Springer.
- Dowse, R., Ramela, T., & Browne, S. H. (2011). An illustrated leaflet containing antiretroviral information targeted for low-literate readers: Development and evaluation. *Patient Education & Counseling*, 85(3), 508-515.
- Edvardsson, B., Gustafsson, A., Kristensson, P., & Witell, L. (2010). Service Innovationservice innovation and Customer Co-development. In *Handbook of service science* (pp. 561-577). Springer US.
- Emiliani, P. L., & Stephanidis, C. (2005). Universal access to ambient intelligence environments: opportunities and challenges for people with disabilities. *IBM Systems Journal*, 44(3), 605-619.
- Financial Conduct Authority (2015). Consumer Vulnerability. Occasional Paper No, 8.
- Füller, J., Mühlbacher, H., Matzler, K., & Jawecki, G. (2009). Consumer Empowerment Through Internet-Based Co-creation. *Journal Of Management Information Systems*, 26(3), 71-102.
- Gould, J. D., & Lewis, C. (1985). Designing for usability: key principles and what designers think. *Communications of the ACM*, 28(3), 300-311.
- Greenbaum, D. (2015). Expanding ELSI to all areas of innovative science and technology. *Nature biotechnology*, 33(4), 425-426.
- Groß, A. (2015). *Die Bildpädagogik Otto Neuraths: Methodische Prinzipien der Darstellung von Wissen* (Vol. 21). Springer-Verlag.

Hare, B., Cameron, I., Real, K. J., & Maloney, W. F. (2012). Exploratory case study of pictorial aids for communicating health and safety for migrant construction workers. *Journal of Construction Engineering and Management*, 139(7), 818-825.

Hochhäusl, S. (2011). *Otto Neurath - city planning: proposing a socio-political map for modern urbanism*. Innsbruck: Innsbruck University Press.

Holt, K., Geschka, H., & Peterlongo, G. (1984). *Need assessment: a key to user-oriented product innovation*. Chichester: John Wiley & Sons.

Holzinger, A. (2002). User-Centered Interface Design for disabled and elderly people: First experiences with designing a patient communication system (PACOSY). *Computers helping people with special needs*, 467-484.

Huijnen, C. A., Lexis, M. A., Jansens, R., & de Witte, L. P. (2017). How to Implement Robots in Interventions for Children with Autism? A Co-creation Study Involving People with Autism, Parents and Professionals. *Journal of Autism and Developmental Disorders*, 47(10), 3079-3096.

Kleinschmidt, E. J., Geschka, H., & Cooper, R. G. (2013). *Erfolgsfaktor Markt: Kundenorientierte Produktinnovation*. Springer-Verlag.

Kusiak, A. (2007). Innovation: The living laboratory perspective. *Computer-Aided Design and Applications*, 4(6), 863-876.

Legal Services Consumer Panel (2014). *Recognising and responding to consumer vulnerability, A guide for legal services regulators*. Retrieved from: <http://www.legalservicesconsumerpanel.org.uk/ourwork/vulnerableconsumers/Guide%20to%20consumer%20vulnerability%202014%20final.pdf>

LimeSurvey [online survey tool]. (2017). Hamburg: LimeSurvey GmbH.

Lindfelt, L. L., & Törnroos, J. Å. (2006). Ethics and value creation in business research: comparing two approaches. *European Journal of Marketing*, 40(3/4), 328-351.

LogiPICs (2017/2018), <https://www.scs.fraunhofer.de/de/forschung/diversifizierung/logipics.html>; <https://www.hs-augsburg.de/Wirtschaft/LogiPICs-Bildsprache-gegen-Arbeitskraeftemangel.html>. Das IGF-Vorhaben LogiPICs 19374 N der Forschungsvereinigung Bundesvereinigung Logistik e.V. - BVL wurde über die AiF im Rahmen des Programms zur Förderung der Industriellen Gemeinschaftsforschung (IGF) vom Bundesministerium für Wirtschaft und Energie aufgrund eines Beschlusses des Deutschen Bundestages gefördert.

Lüthje, C., & Herstatt, C. (2004). The Lead User method: an outline of empirical findings and issues for future research. *R&D Management*, 34(5), 553-568.

Mansoor, L. E., & Dowse, R. (2003). Effect of pictograms on readability of patient information materials. *Annals of Pharmacotherapy*, 37(7-8), 1003-1009.

Mayring, Ph. (2000). *Qualitative Inhaltsanalyse. Grundlagen und Techniken* (7th ed.). Weinheim: Deutscher Studien Verlag.

Morrow, D. G., Hier, C. M., Menard, W. E., & Leirer, V. O. (1998). Icons improve older and younger adults' comprehension of medication information. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences*, 53(4), P240-P254.

Schmitt-Rüth, S., Simon, M., Demuth, A., Kornacher, A., Isakovic, M., Krupp, M., & Stoll, M. 336
Co-creation with vulnerable consumers – An action research case study of designing a pictorial language for logistics
Linköping University Electronic Press

- Muller, M. J. (1991, April). PICTIVE—an exploration in participatory design. In *Proceedings of the SIGCHI conference on Human factors in computing systems* (pp. 225-231). ACM.
- Neurath, O. (1933). Bildstatistik nach Wiener Methode in der Schule. In Rudolf Haller & Robin Kinross (Eds.), *Gesammelte bildpädagogische Schriften* (pp. 265-336). Wien: Hölder-Pichler-Tempsky. (1991).
- Neurath, O. (1935). Isotype und die Graphik. In Rudolf Haller & Robin Kinross (Eds.), *Gesammelte bildpädagogische Schriften* (pp. 342-354). Wien: Hölder-Pichler-Tempsky. (1991).
- Nyström, A. G., & Leminen, S. (2011, June). Living lab—A new form of business network. In *Concurrent Enterprising (ICE), 2011 17th International Conference on Concurrent Enterprising* (pp. 1-10). IEEE.
- Ostroff, E. (2011). Universal design: an evolving paradigm. *Universal design handbook, 2nd ed. McGraw-Hill*.
- Prahalad, C. K., & Ramaswamy, V. (2004). *The Future of Competition: Co-creating Unique Value with Customers*. Harvard Business Press.
- Qin, H., Patrick Rau, P. L., & Salvendy, G. (2009). Measuring player immersion in the computer game narrative. *Intl. Journal of Human-Computer Interaction, 25*(2), 107-133.
- Spiegel, S., & Hoinkes, R. (2009). Immersive serious games for large scale multiplayer dialogue and cocreation. *Serious Games: Mechanisms and Effects*, 469-485.
- Story, M. F. (2001): Principles of Universal Design. In: Preiser, Wolfgang F. E.; Ostroff, Elaine (Eds.) *Universal Design Hand-book*. New York, NY: McGraw-Hill, pp. 10.3-10.19.
- Surowiecki, J. (2004): *The Wisdom of Crowds: Why the Many Are Smarter Than the Few and How Collective Wisdom Shapes Business, Economies, Societies and Nations*. London: Little Brown.
- United Nations Economic and Social Council (1998). *Report of the Expert Workshop on ways and means to enhance social protection and reduce vulnerability*. Retrieved from: <http://www.un.org/documents/ecosoc/cn5/1998/ecn51998-5.htm>
- Von Hippel, E. (1986). Lead users: a source of novel product concepts. *Management science, 32*(7), 791-805.
- Zwick, D., Bonsu, S. K., & Darmody, A. (2008). Putting Consumers to Work: Co-creation and new marketing governmentality. *Journal of consumer culture, 8*(2), 163-196.