PATHY: Using Empathy with Personas to Design Applications that Meet the Users' Needs

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Abstract. The importance of User Experience has been increasingly recognized in the context of developing interactive applications. The Personas technique aims to help designers to better understand users' needs. However, various Personas techniques use too much information and the textual description template does not explicitly guide designers in identifying functionality and features of the applications. Therefore, some designers have questioned the usefulness of the technique, limiting its acceptance and adoption. In this context, we proposed the PATHY technique, combining Personas and Empathy Maps in a novel approach. We conducted an empirical study to determine the participants' perception about the usefulness and ease of use of the technique. We analyzed the participants' quantitative and qualitative answers. The study showed that PATHY was considered both easy to use and useful. Furthermore, the results of the study offer insights for further improvements of the technique.

Keywords: Users' needs · Empathy · Personas · User experience · Empathy map

1 Introduction

Considering users' needs and emotions when interacting with a product is a key factor to software product success [23]. The importance of UX has steadily increased in the context of developing products that meet human expectations, by exploring these needs [1, 20]. A deep understanding about the users who will interact with the application is essential to develop and deliver useful systems [3]. The Personas technique aims to help software engineers to better understand the users' needs.

The Personas technique consists of gathering data about users, in order to provide the development team with an understanding about users' characteristics; defining personas based on this understanding; and keeping focus on these personas throughout software development [3]. Personas can instigate teams to think about users and their needs during the design process, supporting efficient design decisions while avoiding

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incorrect generalizations, and communicating knowledge about users to various stakeholders [15].

Despite those benefits, the technique is mainly criticized for being hard to implement [16]. Personas can be freely created; no guidance is given to software engineers about what should be described. Therefore, personas may contain information that is useless for the application being developed. A perception of low utility reduces the acceptance of a technique by designers.

We can use Empathy Maps (EM) to guide the personas creation with real user groups and to promote innovative ideas generation [17], supporting the design of business models based on the clients' perspectives [17]. EM proposes checklist questions to create customer segment profiles and a visual template to simplify its implementation. In our work, we adapted EM for personas creation.

We created the PATHY technique based on both Empathy Maps and Personas, aiming to help software engineers to reflect on the users' needs. To support application design, PATHY includes a template based on an EM template to cover both personas and software characteristics. Therefore, the PATHY technique provides better guidance for software engineers in thinking about the application features based on personas.

To evaluate PATHY, we conducted an empirical study to determine the participants' perception about the technique's usefulness and ease of use. During this study, we used the PATHY technique to help understand characteristics of the users and of the application being designed. Besides using the technique, participants answered a questionnaire about their perception of PATHY. We analyzed the participants' quantitative and qualitative answers. The study showed that the PATHY technique was considered easy to use and useful. Furthermore, the results of the study offer insights for further improvements of the technique.

This paper is organized as follows. In Sect. 2 we present some concepts about User Experience, Personas and Empathy Map. In Sect. 3 we present the PATHY technique. In Sect. 4 we describe the study, followed by results in Sect. 5. Finally, conclusions and comments about future work are provided in Sect. 6.

2 Background

2.1 User Experience

According to ISO 9241-210 [11], User eXperience (UX) is defined as: 'a person's perceptions and responses that result from the use and/or anticipated use of a product, system or service'. Such definition can be complemented by other interpretations, such as 'User experience explores how a person feels about using a product, i.e., the experiential, effective, meaningful and valuable aspects of product use' [22].

Modeling users is essential to understand, predict and reason about UX processes, and cause consequences to software design [14]. A product that meets or exceeds users' needs and expectations results in a positive user experience. However, a product that fails to satisfy users' needs and expectations results in a negative user experience [15].

2.2 Personas

A Persona is a hypothetical archetype of a real user [17], which describes a user's goals, skills, and interests [4]. Personas should be employed during technology design and development phases to avoid the 'elastic user' problem, i.e., a user description that can be modified to meet designers', developers', or stakeholders' needs, [15], but not the real users'.

In order to describe Personas, some of their characteristics should be detailed, such as: name, image, clothes, occupation, family, friends, pets, age, sex, ethnicity, education, socioeconomic status, life story, goals, and tasks [10]. Software engineers may choose different ways to represent personas, but they are usually represented in textual form, enhanced by a picture.

Some techniques to describe personas have been proposed to involve users in the software development process. Castro et al. [3] proposed the Personas* technique based on Cooper's version, including new steps to adapt personas to the software development process. In one of the stages use cases are built, based on both generated personas and on obtained knowledge about users after the personas creation process. Javahery and Ahmed [12] proposed the P2P technique, using the concept of personas to document and model user experiences. In this technique, design patterns are derived from personas to build the application user interface. Most Personas techniques make use of text with lots of information to describe personas [3, 6, 7, 12, 18]. However, a vast part of this information may not be useful to develop the application. Having too much information can cause personas to be considered as a tiring technique and this may lead to resistance in using the personas technique in software development. In addition, the textual description template does not explicitly give directions to designers about how to identify functionality and features of the applications. Inexperienced software engineers cannot stay focused on the application while creating personas and then the created personas will not be used. Therefore, some designers have questioned the usefulness of the technique, limiting its acceptance and adoption.

Among the benefits of using Personas, Cooper [4] mentions: (1) Provides support to the development team on understanding characteristics of a user group; (2) Proposes solutions related to major users' needs; and (3) Provides a human face as a way to bring potential users closer to the development team and represent them in a demographic context. Software designers use personas in two ways: in creating them and in communicating knowledge about users to other stakeholders [10]. However, the use of Personas is controversial. Personas creation can involve a lot of creativity, distancing them from real users. Moreover, verifying whether the described personas reflect relevant aspects of the application which is about to be developed is considered a hard task.

2.3 Empathy Map

Empathy Map (EM) is a technique that assists in designing business models according to customers' perspectives. It goes beyond demographic characteristics and develops a better understanding of a customer's environment, behavior, aspirations and concerns

[17]. The EM goal is to create a degree of empathy for a specific person (or group of people) [9]. An empathy map reveals the rationale underlying users' actions, decisions and choices; therefore it helps in designing for users' real needs [1].

Matthews [9] proposed four different areas that should be covered when creating an empathy map: What does the person hear? think and feel? see? say and do? Bland [2] mentioned Pain and Gain as important areas to look for, resulting in the template depicted in Fig. 1.

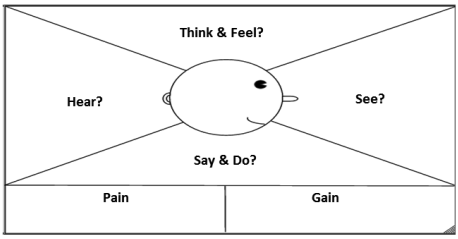

Fig. 1. Empathy map template [17]

3 The PATHY Technique

We developed the PATHY (Personas EmpATHY) technique to help to design for the users' needs, with the goal of improving the quality of the designed application and thus provide a better user experience. PATHY uses the Personas technique to create empathy with the users so as to identify their characteristics and problems.

The PATHY Technique unites Personas and Empathy Map. We adapted the EM template to present a persona's characteristics that can influence the application development. In addition to those characteristics, the technique also deals with the features that a persona would like in the application. The PATHY template is divided in six fields: (a) Do; (b) Feel/Think/Believe; (c) Experience with technology; (d) Problems; (e) Needs, and (f) Existing Solutions. Each field has a set of questions to guide the creation of the persona (see Figs. 2 and 3). The PATHY technique fields were adapted from the EM fields based on the results of a previous study where the structure of the EM was evaluated [8]. From the data analysis of this previous study using the EM it was possible to obtain suggestions for improvements, and from that, the PATHY technique was generated. Furthermore, to improve the support to software development, we added a second part in the PATHY technique, to deal with issues related to identifying the application features and characteristics. PATHY provides better guidance for software developers in thinking about application's features based on a persona's description.

Figure 2 shows the first part of the PATHY template, where the characteristics regarding the persona are described, and its guide questions. Figure 3 shows the second part of the template, where the persona's problems and existing solutions to those problems are described, and its guide questions. The fields that form the PATHY technique template are described in the following.

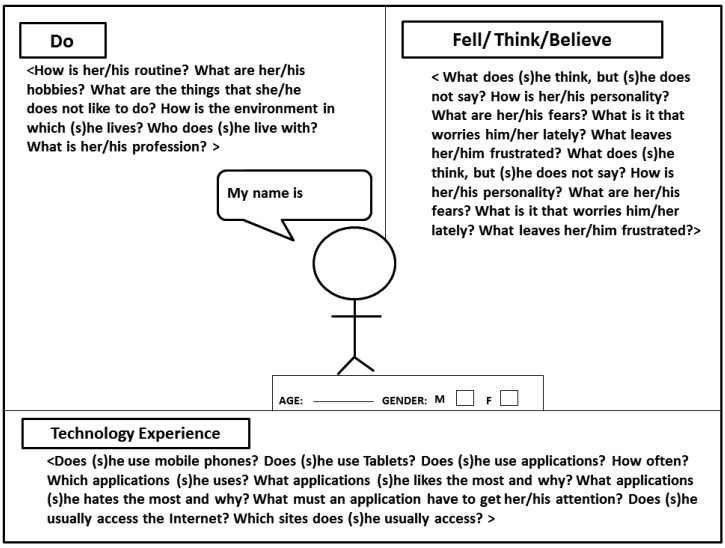

Fig. 2. First part of the PATHYs' template

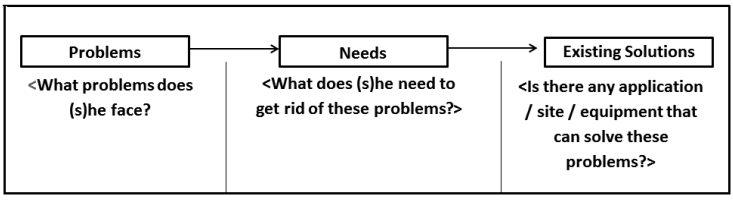

Fig. 3. Second part of the PATHYs' template

- **Do:** the characteristics of the persona's routine, including his hobbies, relevant aspects of the environment in which he lives and a description of the people with whom he lives.
- **Feel/Think/Believe:** subjective characteristics of the persona, including his ideas, aspects of his personality, his fears, and frustrations.
- **Experience with Technology:** the experiences that the persona had with other technologies, as well as application characteristics that please and displease the persona. The goal of this field is to get a better understanding of the user's preferences.
- **Problems:** the problems the persona faces, which can be resolved by the application being designed. The goal of this field is to get a better understanding of the user's problems.
- **Needs:** what is needed to solve the problems described in the previous field.
- **Existing Solutions:** existing solutions to solve the problems, as well as ideas to improve them or to include them in the application to be designed.

4 Designing Personas Using PATHY

In order to evaluate PATHY, we conducted an empirical study to determine the participants' perception about the usefulness and ease of use of the technique. During this study, we applied PATHY to generate personas and to identify the applications requirements from the information in the personas. The study was carried out with 23 third-year Computer Science students. They had already taken classes on Human-Computer Interaction (HCI) and Software Engineering and had designed and developed more than one application.

The study was carried out in two parts. First, the participants created personas based on the textual description provided. Second, the participants formed groups of four people. Each group should write the description of an application that they would like to develop. After choosing the application, the participants had one 1-hour lesson on how to use the PATHY technique. Furthermore, examples of how to use the technique were presented. Each group created the persona for their previously chosen application. Table 1 presents examples of some characteristics filled in the fields of the PATHY template regarding two applications chosen by the participants. One application is to denounce pedophilia. The second application is to help people solve mechanical car problems.

In this study, we used the factors defined within the Technology Acceptance Model (TAM) [5] to investigate the participants' perception of the PATHY technique. The TAM model is based on two factors [13]:

- *Perceived Usefulness*, defined as 'the degree to which a person believes that using a particular technology would improve their job performance';
- *Perceived Ease of use*, defined as 'the degree to which a person believes that using a particular technology would be free of effort' [13].

On the questionnaire we employed a six-point scale with the items: totally agree, strongly agree, partially agree, partially disagree, strongly disagree and totally disagree. We did not use an intermediate level as suggested by Laitenberger and Dreyer [13], since this neutral level does not provide information regarding the side to which the participants are inclined (either positive or negative).

Besides the items regarding usefulness and ease of use of PATHY, to which the participants had to indicate their degree of agreement, we added the following three questions to the questionnaire to obtain some qualitative feedback:

- If you had to use personas again, would you choose the textual description or the PATHY technique? Why?
- What aspects of the PATHY technique do you consider positive?
- What aspects of the PATHY technique do you consider negative?

Table 1. Examples of filled-in PATHY fields

Field	Persona 1 (denouncing pedophilia)	Persona 2 (car problems)
Do	'I live with my husband and my two children: one is 7 years old and the other one is 9 years old.'	'I am a college student; I study psychology at night and work during the day. I just bought my first car and I do not quite understand how it works.'
Feel/think/ believes	'Violence is increasing in our days, which is what worries me. I'm afraid that something might happen to my family.'	'Because I am new in town and I do not understand the car mechanics I feel afraid to hire an unreliable mechanical service.'
Technology experience	'I use a smartphone as a tool' 'I use applications to support communication (e.g. whatsapp)'	'I make frequent use of the phone.' 'I like applications that facilitate my daily life'
Problems	'I worry about what my children access on the Internet.' 'I am concerned with who my children, who are minors, are chatting with on the internet.'	'She doesn't know where the places in the city are.' 'She has no ability to solve mechanical problems.'
Needs	'Identifying the content of the conversations in order to prevent pedophilia.' 'Monitor the child's behavior on the web'	'Find someone of trust to solve her problem.' 'Having qualified help available to meet her at the location of an unexpected problem/accident.'
Existing solutions	'There is a site in England that tracks pedophiles surfing the internet.'	'Google maps' 'Foursquare' 'Ask acquaintances'

5 Results

5.1 Quantitative Analysis

For the analysis of the quantitative results, we considered the participants' answers regarding the empathy map on usefulness and ease of use. Table 2 shows the answers to each statement related to the perceived usefulness of the PATHY. The statements were 'Using PATHY would…'

- U1 enable me to create Personas more quickly.
- U2 improve my performance when creating personas.
- U3 increase my productivity when creating personas.
- U4 enhance my effectiveness when creating personas.
- U5 make it easier to create personas.
- U6 be useful for creating personas in my projects.

Table 2. Number of participants who agreed or disagreed with each statement related to the perceived usefulness, together with a sample quotation

Item	Disagree	Agree	Quotation
U1	2	21	*'The need to incorporate a persona makes the process very subjective and time consuming.'* – P15
U2	0	23	*'The performance has greatly improved due to the fact that there are guides on how to fill out the template.'* – P09
U3	0	23	*'The process was more quickly and productive.'* – P10
U4	0	23	'*With PATHY the persona was richer in details.*' – P05
U5	1	22	'(…) *It has many fields with details'* – P16
U6	1	22	'*PATHY helps me get useful information* (…)' – P13

The results regarding usefulness showed that most of the participants considered PATHY useful for creating Personas. Table 3 shows the answers regarding the perceived ease of use of the PATHY technique. The statements were:

- E1 Learning how to use the PATHY would be easy for me.
- E2 I understood what I had to provide in every part of PATHY.
- E3 It is easy to remember how to create personas using PATHY.
- E4 Using PATHY it was easy to create the persona that I wanted.
- E5 It was easy to become skillful in creating personas using PATHY.
- E6 I find PATHY easy to use.

5.2 Qualitative Analysis

We have also conducted a qualitative analysis of the participants' textual answers. Qualitative methods support a better comprehension of the issues that need a more specific and detailed analysis, allowing the researcher to consider human behavior and thoroughly understand the studied object [19]. The qualitative analysis performed in this work is based on procedures from Grounded Theory, namely *coding*, i.e., the process of assigning meaning to the data [21].

While we analyzed the data contained within the questionnaire, we created codes associated with text fragments. Another researcher reviewed the codes related with the citations in each questionnaire transcription. This researcher verified the codes and categories in order to audit the coding process and therefore to mitigate the bias eventually caused by the participation of a single researcher in the coding process.

After the open coding, we initiated the axial coding phase, creating relationship codes. We identified three main groupings: (a) Ease of use of PATHY; (b) Benefit for the creation of Personas by using PATHY; and (c) PATHY's limitations. Table 4 shows the codes regarding ease of use and benefits of use of the PATHY technique.

Through the qualitative analysis, we identified that the technique helps to:

- understand what should be designed (see quotation from P04 and P03 below);
  '(…) it makes it easy to elicit the features that can be used in the software.' – *P04*

Table 3. Number of participants who agreed or disagreed with each statement related to the perceived ease of use, together with a sample quotation

Item	Disagree	Agree	Quotation
E1	0	23	*'(...) it is easy to learn how to use it.'* – P23
E2	1	22	*'it is more simple to understand the filled fields (...)'* – P09
E3	1	22	The participant who disagreed did not explain why.
E4	1	22	The participant who disagreed did not explain why.
E5	1	22	The participant who disagreed did not explain why.
E6	0	23	*'I could understand how to use it in a short time and is very simple and easy to use.'* – P18

Table 4. Comments about Ease of Use and Benefits of use

Group	Quotations
Ease of use	It is easy to learn how to use PATHY: *'PATHY has practical ways to create personas; it is also easy to learn how to use it.'* – P23
	It is easy to fill out: *'Fields are simple to understand, that is why there is an improvement in the efficiency'* – P09
	The approach is simple: *'The approach is simple and has a broad scope (needs, existing products, experiences that he already has)'* – P17
	The guiding questions are easy to understand: *'The guides/guidelines are easy to understand, in simple language.'* – P18
Benefit of use	It helps to create persona more accurately: *'The persona was created quickly and accurately.'* – P13
	It helps to create personas with richer details: *'With PATHY the persona becomes richer in detail'* – P05
	It helps to think about the users' needs: *'(...) All the guide questions helped identifying the real needs of the target user of the application.'* – P07
	It helps to think about the subjective characteristics of the persona: *'(...) With the technique I was able to describe the persona in several situations, as well as his states of mind and humor.'* – P03

'(..)Description of problems/needs and solutions, it is essential to better understand what needs to be designed.' – P03

- think in the important characteristics for the application (see quotation from P18 and P12 below). This is a very relevant result, once PATHY's main aim is to help designers describe personas according to the desired features for the software.

  'I found many other things that our app can do, beyond what was proposed before.' – P18

  'Somehow it makes you focus on the important features for application.' – P12

The discovery of relevant characteristics can help in the design of an application that meets the users' needs. Since this was the motivation for proposing PATHY, we carried on an additional analysis aiming at discovering which characteristics for the software applications were identified using the technique. Table 5 presents the features

Table 5. Identified characteristics for the applications

Application description	Identified characteristics
To hitch a ride	Option to request ride Option to call a taxi
To combine sounds and create ring tone	Application should be quick and simple List the audio files that are on mobile
To control calories	Indicate places where the diet products are sold Indicate the prices of diet products

described in the PATHY's template for the different software applications. These features formed the basis for some requirements of the software applications.

In addition to helping to identify application characteristics, PATHY helps to think about similar characteristics in other applications. These characteristics were collected in the field "Existing Solutions". Table 6 presents some examples of characteristics of other applications that can be improved or reused on the application to be designed.

Table 6. Identified similar characteristics of other applications

Application description	Similar characteristics
To hitch a ride	There are applications that inform bus routes in the city.
To combine sounds and create music	There is similar software for creating music but there is not a mobile version.
To control calories	There is an application that shows restaurants but does not show the nutritional information of the dishes served.

From the qualitative analysis, we identified some limitations in the technique:

- The choice of the technique depends on the type of project: '*(…) I consider that the variety of elicited details provides a broad view. On the other hand, this variety may not be useful, depending on the scope of the application.*' – P04
- It does not show relationships between the persona and environment: '*the relationship between the persona and its environment/society is missing*' – *P03*
- It limits the description of the persona: '*(…) sometimes it limits the designer because he only follows the guidelines set in the form.*' – P18

Despite P18's opinion that PATHY restricts the description of the persona, some participants stated the contrary, i.e., the technique helps create a more detailed persona:

'(…) it has, in detail, all the necessary information that helps me develop the personas for my project.' – P14

Furthermore, the technique was also described as broad:

'The description was more consistent and broad.' – P10

To overcome those limitations and improve the technique, we propose the following:

- **Scenario Integration**: In addition to describing the persona and the characteristics of the application, the designers will be able to describe a scenario representing the context of use of the application.
- **Fields Choice**: From the description of the fields, the designer can choose which fields he wants to use in order to make the description of the persona. The fields can be chosen according to the needs of each project.

In this section, we noted that the qualitative research helped us identify the categories and relationships of factors that influence the use of PATHY. Furthermore, we also identified limitations that can help us to improve the technique in the future.

6 Conclusions

This paper proposed PATHY, a novel technique for creating personas. The proposed technique is based on Empathy Maps. The technique aims not only at describing the personas characteristics, but also at providing the designer with an overview of the features that the application should have. In this way, the designer can think of the application characteristics according to the identified users' needs.

To verify the perception of the participants regarding the use of PATHY for the creation of personas, we conducted an empirical study, in which the participants used PATHY to create personas of an application to be designed. After using the technique, the participants answered a questionnaire to evaluate their perception about the usefulness and the ease of use of the technique, as well as their intention to use it, together with positive and negative features of the technique.

The study showed that the PATHY technique was considered easy to use and useful. Our next steps involve evaluating the revised version of PATHY with professional software developers.

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References

1. Adikari, S., McDonald, C., Campbell, J.: Reframed contexts: design thinking for agile user experience design. In: Marcus, A. (ed.) DUXU 2013, Part I. LNCS, vol. 8012, pp. 3–12. Springer, Heidelberg (2013)
2. Bratsberg, H.M.: Empathy maps of the FourSight preferences. In: Creative Studies Graduate Student Master's Project. Buffalo State College. Paper 176 (2012)

3. Castro, J.W., Acuña, S.T., Juristo, N.: Enriching requirements analysis with the personas technique. In: Proceedings of the International Workshop on: Interplay Between Usability Evaluation and Software Development (I-USED 2008), pp. 13–18 (2008)
4. Cooper, A.: The Inmates are Running the Asylum: Why High-Tech Products Drive us Crazy and How to Restore the Sanity. Sams Publishers, Indianapolis (1999)
5. Davis, F.: Perceived usefulness, perceived ease of use, and user acceptance of information technology. MIS Q. **13**(3), 319–339 (1989)
6. Faily, S., Fléchais, I.: Finding and resolving security misusability with misusability cases. J. Requirements Eng. **21**(80), 1–15 (2014)
7. Faily, S., Fléchais, I.: Persona cases: a technique for grounding personas. In: Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, pp. 2267–2270. ACM (2011)
8. Ferreira, B.M., Silva, W.A.F., Oliveira, E., Conte, T.U.: Designing personas with empathy map. In: 27th International Conference on Software Engineering and Knowledge Engineering (SEKE 2015), Pittsburgh, vol. 1. pp. 501–506 (2015)
9. Gray, D., Brown, S., Macanufo, J.: Gamestorming – A playbook for innovators, rulebreakers and changemakers. O'Reilly Media, Inc., Sebastopol (2010)
10. Grudin, J., Pruitt, J.: Personas, participatory design and product development: an infrastructure for engagement. In: PDC 2002, pp. 144–152 (2002)
11. ISO DIS 9241-210:2010. Ergonomics of human system interaction - Part 210: Human-centred design for interactive systems (formerly known as 13407). International Standardization Organization (ISO)
12. Javahery, H., Ahmed, S.: P2P mapper: from user experiences to pattern-based design. AIS Trans. Hum. Comput. Interact. **4**(2), 107–128 (2012)
13. Laitenberger, O., Dreyer, H.M.: Evaluating the usefulness and the ease of use of a web-based section data collection tool. In: Proceedings of the 5th International Symposium on Software Metrics, pp. 122–132 (1998)
14. Law, E.L.C., Abrahão, S., Vermeeren, A.P., Hvannberg, E.T.: Interplay between user experience evaluation and system development: state of the art. In: International Workshop on the Interplay between UX Evaluation and System Development, pp. 14–17 (2012)
15. Mashapa, J., Chelule, E., Van Greunen, D., Veldsman, A.: Managing user experience – managing change. In: Kotzé, P., Marsden, G., Lindgaard, G., Wesson, J., Winckler, M. (eds.) INTERACT 2013, Part II. LNCS, vol. 8118, pp. 660–677. Springer, Heidelberg (2013)
16. Nielsen, L., Nielsen, K.S., Stage, J., Billestrup, J.: Going global with personas. In: Kotzé, P., Marsden, G., Lindgaard, G., Wesson, J., Winckler, M. (eds.) INTERACT 2013, Part IV. LNCS, vol. 8120, pp. 350–357. Springer, Heidelberg (2013)
17. Osterwalder, A., Pigneur, Y.: Business Model Generation. Alta Books Editora, Rio de Janeiro (2013)
18. Pruitt, J., Adlin, T.: The Persona Lifecycle: Keeping People in Mind Throughout the Product Design. Morgan Kaufman, San Francisco (2006)
19. Seaman, C.B.: Qualitative methods. In: Shull, F., Singer, J., Sjøberg, D.I.K. (eds.) Guide to Advanced Empirical Software Engineering, pp. 35–62. Springer, Heidelberg (2008)
20. Sproll, S., Peissner, M., Sturm, C.: From product concept to user experience: exploring UX potentials at early product stages. In: Proceedings of the 6th Nordic Conference on Human-Computer Interaction: Extending Boundaries, pp. 473–482. ACM (2010)
21. Strauss, A., Corbin, J.: Basics of Qualitative Research: Techniques and Procedures for Developing Grounded Theory. SAGE publications, Thousand Oaks (1998)

22. Vermeeren, A.P., Law, E.L.C., Roto, V., Obrist, M., Hoonhout, J., Väänänen-Vainio-Mattila, K.: User experience evaluation methods: current state and development needs. In: Proceedings of the 6th Nordic Conference on Human-Computer Interaction: Extending Boundaries, pp. 521–530. ACM (2010)
23. Väänänen-Vainio-Mattila, K., Roto, V., Hassenzahl, M.: Towards practical user experience evaluation methods. In: Law, E.L.C., Bevan, N., Christou, G., Springett, M., Lárusdóttir, M., (eds.) Meaningful Measures: Valid Useful User Experience Measurement (VUUM), pp. 19–22 (2008)