

Empathy and Criativity in Privacy Requirements Elicitation: Systematic Literature Review

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Abstract. This paper presents a Systematic Literature Review (SLR) in order to find in the literature papers that use creativity and empathy techniques in privacy requirements elicitation. These techniques have been used in requirements elicitation in order to facilitate the understanding of the requirements and provide a collaborative interaction between the teams and the end user. Thus, we investigated whether the literature already has reports on the use of these techniques as facilitators in the process of privacy requirements elicitation. As a result of the SLR, we found few papers related to the use of Empathy in privacy requirements elicitation and no papers that relate Creativity to the elicitation of privacy requirements.

Keywords: Systematic Literature Review · Criativity · Empathy · Privacy Requirements Elicitation

1 Introduction

With the emergence of new technologies and legislation, the protection of users' data needs have to be considered throughout the software development process. To implement software functionality that will make use of personal data, it is necessary to consider the privacy requirements during the requirements elicitation phase [45]. Protection of privacy is important in various sectors of a company. The privacy requirements elicitation in the early stages of system development is essential to provide a high guarantee of privacy protection for stakeholders and consumers [28].

According to Gharib et al. [24], privacy requirements have six main sub-categories: information ownership, information control (authentication), information usage, information transmission, privacy assessment and privacy verification [24]. Based on these principles, each organization defines its own privacy policies, for example, when websites collect information from customers, they

need to inform customers about the purpose for which the data is being collected, who is the recipient and for how long the data will be maintained and how the data will be used [28].

The adoption of Design Thinking in requirements elicitation has been widely used [41], [10], [52], [50], [32], as it provides a methodology to elicit users' needs more efficiently. Design Thinking is divided into several phases, and creativity and empathy [14] are two of them, which can be used to perform the privacy requirement elicitation.

Empathy is one of the five components, in addition to self-awareness, motivation, self-regulation and fitness in relationships. Together, they compose the notion of emotional intelligence [58]. Empathy is an innate ability to perceive and be sensitive to the emotional states of others, and to share feelings, reflecting the ability to put yourself in the other person's shoes and understand their feelings [53], [15].

Creativity is "the ability to produce work that is both novel (i.e. original, unexpected) and appropriate (i.e. useful, adaptive concerning task and constraints)" [55], [6]. Creativity is performed collaboratively, because the creator does not exist in isolation, but within an environment that has a significant influence on what can be created [51].

The aim of this paper is to perform a Systematic Literature Review (SLR) to identify the works in the literature related to the use of empathy and creativity techniques in privacy requirement elicitation. The SLR was chosen because it is the most appropriated method for providing a broad overview of a research area [34]. Altogether, in this paper we answer questions related to: 1) Are there works in the literature that use empathy in privacy requirement elicitation?; 2) Are there works in the literature that use creativity techniques in the privacy requirement elicitation?; and 3) What are the techniques of creativity and empathy that are used in the literature for requirement elicitation?.

2 Background

Privacy has become a major concern in software development due to data relating to unauthorized exploitation of data, misuse of information stored on systems, social media sites, internet data and disclosure of personal information to third parties [37]. According to Rudolph et al. [49], users specify privacy requirements on different systems using specification interfaces. Depending on the system, different types of specification interfaces are defined. These differ in following aspects: 1) Specification process: With which interactions do users set their privacy requirements in the interface? 2) Number of decisions: How many decisions do users have to take in the specification? 3) Degree of guidance: How much support is given to users during specification?

Therefore, when developing systems, there is a need to use techniques to privacy requirements elicitation [63]. Levy and Hadar [38] analyzed Empathy as a technique of Design thinking, identifying that software developers, in general, are not concerned with privacy requirements. The analysis of these authors shows

that the absence of Empathy can lead to the neglect of important aspects of privacy when designing software systems.

Cuff et al. [13] define empathy as “an emotional response (affective), dependent upon the interaction between trait capacities and state influences”. Batson et al. [5] argue that empathy involves the cognitive ability and resources to engage in taking the perspective of another person. Levy and Hadar [38] reinforce the need for Empathy with end users by stating that this is a requirement engineering skill as necessary as technical knowledge and social competence. Empathy is necessary to work with the diversity of users, allowing a better requirements elicitation.

Geher et al. [23] studied empathy as part of emotional intelligence and, in their work, they identified a strong link between the empathic element of emotional intelligence and creativity. Therefore, the ability to know or understand the feelings of others and the ability to create better and more appropriate products would be strongly related.

Cropley [12] define creativity as “a social phenomenon that is facilitated by some social factors, inhibited by others. Focusing on the individual person, creativity is defined as an aspect of thinking, as a personality constellation, and as an interaction between thinking, personal properties and motivation” . In the area of Requirements Engineering, several authors Horkoff [31], Valenca [56] and Franco [18] emphasize the importance of treating the requirements elicitation as an inherently creative process of problem solving and identification of users’ needs, since this process encompasses cycles of incremental construction of knowledge. Thus, the question that is asked related to privacy requirements is, how can empathy and creativity help in this work of requirements elicitation? This work conducts a systematic literature review in order to investigate whether there are works in the literature that use the techniques of empathy and creativity for privacy requirements elicitation.

3 Systematic Literature Review

This paper presents a Systematic Literature Review (SLR) which is a way to identify, analyze and interpret available evidence related to a specific research question, area or phenomenon of interest [35]. Studies that contribute to an SLR are called primary studies. An SLR itself is considered as a secondary study [35]. During the accomplishment of this SLR, the phases of Planning, Conducting and Reporting of Results were followed [35],[8]:

- Planning: It aims to identify the real need for SLR that is the motivation for carrying out a research. This phase consists of the main activities of defining the objective, preparation of the protocol that will guide the SLR aiming to minimize bias that may be committed by the researcher and evaluation of this protocol, which in this work occurred with the test of the protocol in one of the databases chosen for automatic search.
- Conducting the review: during this phase of the SLR, studies are identified through the application of the search strategy and selected according to the

protocol defined in the planning phase. For the set of selected works, data are collected and synthesized in order to answer the research questions and thereby facilitate the analysis and synthesis to create the results.

- Reporting the review: the last phase of the SLR is related to the documentation and description of results, preparation of answers to research questions and dissemination of results to potential stakeholders.

3.1 Planning

The SLR was carried out with the objective of identifying the existing works in the literature that use Empathy and the Creativity techniques in the requirement elicitation. The research question specification is the most important part of any SLR, because it drives the entire systematic review methodology. Thus, we have defined the following research questions (RQ):

- RQ.1: What are the techniques of creativity and empathy that are used in the literature for requirements elicitation?
- RQ.2: Are there works in the literature that use empathy in privacy requirements elicitation?
- RQ.3: Are there works in the literature that use creativity in privacy requirements elicitation?

Research Strategy The research strategy involved the use of Automatic Search, which consists of searching through a search string in electronic databases, followed by Manual Search [43] and which searches must be carried out for work in conference proceedings, newspapers or specific magazines. The Automatic Search was carried out in three databases selected because they have a considerable volume of works published in journals and conferences in the area of Software Engineering: ACM Digital Library; IEEE Xplore Digital Library; DBLP-Computer Science Bibliography. The Manual Search was carried out in the Conference Proceedings and Journals that have trails focused on the requirement area.

The StArt tool (State of the Art through Systematic Review) [16], was used to assist in the stages of planning and conducting the SLR. The string used to search the libraries was as follows: (“Privacy” AND (“requirements” OR “requirements elicitation”) AND (“Creativity” OR “Empathy”)). The results that the search string returned during its execution in the digital Libraries were grouped in the StArt tool for selection of publications according to the inclusion and exclusion criteria and for the data extraction process.

Selection Criteria (Inclusion and Exclusion) The following selection criteria were defined for the selection of primary studies: 1. The study must be available in the digital databases previously defined. 2. The year of publication of the studies must be between 2009 and 2020. However, classic sources with definitions (books with classic concepts or pioneer articles) can also be considered. 3. The study must be related to the requirements elicitation area. 4. The

study must propose or evaluate methods, techniques or models of requirements elicitation.

As an exclusion criteria of the studies, it was considered the non-fulfillment of any of the inclusion criteria, as well as: these are unfinished works, published as short paper and studies that do not present enough information to extract the expected data, thus harming the quality or relevance of the work.

Data extraction strategy After completing the study selection process, we recorded the basic information of each article in the form of data extraction. Data extraction was performed using a structured extraction form in StArt tool to capture all information, for each included article, needed for later synthesis. We classified the data extracted in this SLR as Creativity and Empathy techniques for requirements elicitation. The data extracted from the included articles were analyzed with the objective of answering the research questions using descriptive analysis for the quantitative data and using the thematic analysis approach for the qualitative data. In Section 4 these results are exposed and discussed.

3.2 Selection of Studies

The selection process occurred in three different steps. First, reading titles, keywords, and abstract; considering the inclusion and exclusion criteria. Second, reading introduction, method and conclusion; considering the inclusion and exclusion criteria. Third, the studies included are thoroughly read; excluding irrelevant studies for the research questions. The search performed in digital libraries returned 102 publications. With the completion of the first step of the selection strategy, which consisted of reading titles, keywords, and abstract, 97 studies were pre-selected. The execution of second step of the search strategy, which consisted of reading introduction, method and conclusion, reduced the volume of pre-selected works for 57 articles.

In the execution of third step, which consisted of reading the whole articles and applying all the steps of the work selection strategy, 57 studies were pre-selected. We also performed a manual search in two conferences in the requirements area, four articles were pre-selected for the complete reading. At the end of the selection, we identified a total of 58 primary studies to be used in data extraction, as shown in Figure 3.

4 SLR Results

4.1 RQ.1. What are the techniques of creativity and empathy that are used in the literature for requirements elicitation?

A complete read of the selected studies (58 primary studies) allowed us to answer the research questions, aiming, respectively, to identify the creativity and empathy techniques for requirements elicitation. The following are the most representative works in relation to the techniques of creativity and empathy used in requirements elicitation.

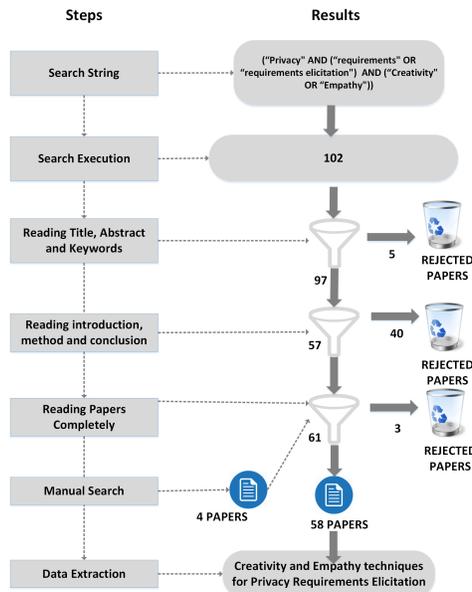


Fig. 1. Systematic Literature Review Process

Considering the context of creativity, Valenca [56] has integrated the philosophy of Design Thinking with creativity techniques, and proposed a structured process called Creativity. This process was evaluated by applying the process to a software development company, using a questionnaire to collect the data and an experiment for master students to use the process. In her work she mapped 60 creativity techniques classified them into 5 groups: Requirement Definition, Analysis and Design, Modeling, Implementation, Testing and Deployment. In the group of creativity techniques used for requirements elicitation, 41 techniques were identified, some already recognized by companies and academically, such as mind maps, Ishikawa diagram, focus group, hall of fame, among others.

Franco and Assar [18], in their part, argue that in recent years, Creativity-based Approaches for Requirements Elicitation (CAREs) have emerged as promising trends to assisting the requirements elicitation activity. In their work, they identified 30 Creative techniques, some techniques traditionally known and used in requirements elicitation, such as Brainstorming, Workshops and Scenarios. The authors also mention a large set of new techniques that have emerged recently, such as View points combination, Analogical reasoning, and Walk-throughs.

Horkoff et al. [31] combine goal modeling and creativity techniques for enhanced software Requirements Engineering (RE). They apply their methods to a historical case in air traffic control, providing example outcomes, illustrating the benefits of a creativity and goal-oriented approach to early software development. Horkoff et al. [31] presented 6 creativity techniques: Creativity workshops,

Customer journey maps, Hall of fame, Assumption Busting, Creativity triggers and Pair wise comparisons. Berntsson-Svensson and Taghavianfa [6] evaluated four different creativity techniques, namely Hall of Fame, Constraint Removal, Brainstorming and Idea Box, using creativity workshops with students and industry practitioners. The results indicated that Brainstorming can generate the most ideas, while Hall of Fame generates most creative ideas. Idea Box generates the least number of ideas, and the least number of creative ideas and Hall of Fame was the technique that led to the greatest number of requirements that was included in future releases of the software.

Aldave et al. [1] performed a systematic literature review to investigate the state of the art of the approaches that leverage creativity in requirements elicitation within Agile Software Development, as well as the benefits, limitations and strength of evidence of these approaches. The authors identified that approaches that use creativity in requirements elicitation can be successfully implemented in real software projects. In addition, projects related to the user interface development, such as those for mobile or web applications are the ones that most use creativity techniques. The authors had also found that agile methodologies such as Scrum, Extreme Programming or methodologies based on rapid modelling are preferred when introducing creativity into requirements elicitation.

There are several works in the literature that use creativity techniques to support the software development process [11], [57], [56], [36], [26], [42], [19], [30]. In addition, several authors use creative techniques to elicit requirements during the agile software development process [21], [46], [40], [27], [44], [59]. It is possible to find relevant works that address requirements elicitation and Empathy in general [60], [9], [20], [29], [62], [54], [4], [61]. Levy and Hadar [38] reinforce the need for Empathy with end users by stating that this is a requirement engineering skill as necessary as technical knowledge and social competence. Empathy is necessary to work with the diversity of users, allowing a better requirements elicitation.

Gasparini [22] conducted a case study to address the intersection between Design Thinking and Empathy, and presents the results of a workshop organized by the Norwegian University Library addressing Open Access services. The methodologies and techniques used were Photoethnography, Live Notes, User journey, Touch points and Service Design Cards. User journey is the representation of all the steps a customer need to perform to achieve the final goal of the service. Each situation where the user is in direct contact with the service provider is called a touch point. Using Service Design Cards one can make the aforementioned journey, where each card is a touchpoint. Gasparini [22] concluded that the use of emotional and cognitive Empathy in the design process has good results, but that this subject still needs to be researched, aiming to improve the understanding of how these dimensions of Empathy can be used to obtain a perception best suited to the user's needs.

To improve the requirements elicitation and the experience of using the software, the PATHY technique (Personas empATHY) Ferreira et al. [17] was created. This technique integrates the guide questions and the Empathy Map struc-

ture with the idea of describing users through personas Ferreira et al. [17]. The technique is based on six-steps: What the user does; what the user feels or thinks; what is the experience with technology; what are the problems to be solved with the solution to be developed; what are the application features and if there are existing solutions.

Bittner and Shoury [7] recognize that the Empathy Map Method (EMM) in the Design Thinking approach is a powerful tool, but methodological skills and expert experience are required to guide the team. The authors identify the needs of practitioner EMM facilitator, who has these skills to make this knowledge available to teams. According to the authors, identifying and hiring a facilitator with these specific skills is expensive and EMM requires many social and cognitive skills from the facilitator. Thus, the authors propose an approach to make complex collaborative techniques widely available to practitioners with no EMM experience by documenting knowledge about facilitation through Collaborative Engineering (CE) approaches in structured process projects. The knowledge of the method can be implemented in preconfigured Information Technology (IT) Systems, in order to execute the process in a semi-automatic way. Bittner and Shoury [7] tested a pilot with 3 participants and presented promising results.

4.2 RQ.2. Are there works in the literature that use empathy in privacy requirements elicitation?

Levy and Hadar [38], performed an analysis using Design Thinking and found that, in general, software developers do not meet privacy requirements. The study found that the lack of empathy leads developers to neglect important concerns about the privacy of user data when designing software systems. The authors concluded that the Design Thinking empathy stage is a necessary component of requirements engineering to unravel and address requirements with a high risk of being ignored. In addition, the authors concluded that the use of empathy techniques and tools in privacy requirements elicitation can promote empathy practices and skills among software engineers, who generally do not practice empathy in their requirements elicitation activities. The authors concluded that the lack of empathetic practices leads to neglect of privacy requirements. The use of empathy can provide better requirements elicitation, leading to better performance in privacy requirements elicitation activities.

Levy and Hadar [39] also conducted an experiment with a multidisciplinary team using the empathy phase of Design Thinking. The authors concluded that being part of multidisciplinary teams, students of engineering courses participated in design processes that were unfamiliar to them, for example, creating personas to define end users and building maps of empathy, which helped teams in eliciting privacy requirements.

Bargh and Choenni [3] used the Design Thinking empathy phase (from the 6-phase model) to define three Privacy by Design (PbD) components for complex Information Systems: problem space, solution space and mapping space. Design thinking was considered appropriated by the authors to support the elicitation of privacy requirements, since the empathy phase made it easier to discover

and understand the concerns, problems and real experiences of the stakeholders. Gračanin et al. [25] proposed a unified framework that incorporates a game theoretic model to address empathy, privacy and ethics (EPE) interplay in Smart Built Environments (SBEs). The authors say that the use of Empathy in software development activities leads developers to create products that can improve human well-being. Furthermore, in the context of SBEs, products need to be empathetic and maintain the privacy of users' data as required by law. Thus, the authors use empathy in the software development process, with the aim of creating empathetic products, maintaining privacy and ethics in the development of SBEs applications.

4.3 RQ.3. Are there works in the literature that use creativity techniques in privacy requirements elicitation?

The need for innovation in creative solutions has driven requirements engineering to obtain useful and appropriate requirements. Some works were found that relate creativity to Requirements Engineering, but no works were found that relate creativity to the elicitation of privacy requirements. Thus, we chose to identify articles that work with privacy requirements and cite creativity techniques (identified by other authors as creativity techniques) in eliciting requirements. Rudolph et al. [49] studied the use of personas (related to privacy) in conjunction with the identification of the requirements specification paradigm to be adopted (Template instantiation, Default Policies, Wizard, Security levels) to increase effectiveness, efficiency and satisfaction of privacy requirements. Valença et al. [56] identified personas as one of the creative techniques to be used in requirements elicitation.

He et al. [28] suggest the combined use of goals and scenarios to privacy requirements elicitation. Kalloniatis et al. [33] also cited the use of many goal-oriented modeling to privacy. It is interesting to note that Horkoff et al. [31] identified goals-oriented as one of the creativity techniques to be used in requirements elicitation. Ayala et al. [2] presented the use of stakeholder scenarios to privacy requirements elicitation, while Peixoto et al. [48] suggest the use of scenario of system use as one of the techniques to be used in privacy requirements elicitation. Valença et al. [56] identified scenarios as one of the creative techniques that can be used in privacy requirements elicitation. Peixoto et al. [47] used the user stories technique to build the PCM Tool model and Aldave et al. [1], identified this technique as a creative technique.

4.4 Threats to Validity

During the planning and execution of this systematic literature review, we found the following threats to validity. There is a threat to construction validity when deciding which studies should be included in the review. However, we believe that this aspect has been attenuated, since we executed a protocol [34],[35]. The SLR protocol was also iteratively revised by two other researchers with practical experience in the research areas we studied. Regarding external validity, the

results of this review cannot be generalized because they are based on a specific set of keywords in the search sources that were used for data collection and at a particular time interval (last ten years). Therefore, our results may be limited. However, some strategies such as the definition of a broader search string and the inclusion of non-exclusive search sources in the area of requirement elicitation have been taken to obtain a greater number of possible primary works.

Internal validity can be raised due to replications of similar works. To mitigate such a threat, some measures were taken: (1) a SLR protocol was defined and strictly followed, considering mainly the exclusion and inclusion criteria; (2) where necessary, two researchers with extensive experience in this area of study were consulted until we reached a consensus on the acceptance of the identified studies. However, it may be possible that, if other researchers replicate this SLR, small variations in the identified studies can be observed due to differences in personal aptitude and reflection on the returned studies. A potential threat to theoretical validity is the small sample size of the studies evaluated. This sample may not provide an accurate and complete explanation of all approaches used in privacy requirements elicitation. Thus, to overcome this bias, we carried out a continuous discussion and revision of the SLR by two other experienced researchers.

5 Conclusion

This paper presents a Systematic Literature Review (SLR) to identify in the literature the works that use creativity and empathy techniques in requirements elicitation. After applying the inclusion and exclusion criteria, we identified 58 primary studies to answer the research questions that were defined to conduct the SLR. Thus, we can conclude that in the literature there are several works that use creativity and empathy techniques in requirements elicitation.

We also investigated whether there are works that use the techniques of empathy and creativity in privacy requirements elicitation. We have identified some works that use empathy in privacy requirements elicitation, although it is still in a very beginner way. Most of the works identified at RSL mention and study empathy as part of Design Thinking. On the other hand, we have not identified any work in the literature that uses creativity techniques in privacy requirements elicitation. We found some techniques considered by the literature to be creative. These techniques were mentioned in the primary studies on privacy requirements. This finding allows us to conclude that it is an area of research that deserves the attention of researchers and needs to be explored by the software development community. As a future work we intend to use creativity techniques to carry out privacy requirements elicitation in the development of a real software system.

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