

An approach to the Contextual Design methodology in the context of Information Science

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Abstract: Based on an operative definition of Information Science (IS) as a study of the mediation aspects of the phenomena: data, information, knowledge and message, and their implementation in the cultural domain, the potential of Contextual Design (CD) as a methodology for the development of optimized interfaces between information resources and users is analyzed. The goals are (i) to identify papers that address or make use of the CD methodology in databases related to IS; (ii) to describe the approaches to the concept of CD in those papers; (iii) to point out the potentials and limitations of this methodology. We draw an exploratory / descriptive study based on a systematic review and categorical analysis. Eight papers were retrieved, which may act as a potential indicator of the reduced use of this methodology in the IS area. Furthermore, its application is essentially practical. Although the limitation of non-involvement of users throughout all the design process is pointed out, the CD methodology shows the ability to collect implicit information through user activities and the possibility of shared systematization of complex data. These characteristics make CD a potential value for the development of appropriate interfaces between information resources and their users.

Keywords: contextual design; information science; user-centered methodology; informational resources.

Resumo: *Partindo de uma definição operatória de Ciência da Informação (CI), enquanto estudo dos aspetos de mediação dos fenómenos: dado, informação, conhecimento e mensagem, e sua implementação no domínio cultural, considera-se o potencial da metodologia Contextual Design (CD) para o desenvolvimento de interfaces otimizadas entre recursos informacionais e utilizadores. Objetiva-se, (i) identificar artigos que abordem ou façam uso da metodologia CD, em bases relacionadas com a CI; (ii) descrever as abordagens ao conceito de CD efetuada nesses artigos e (iii) assinalar as potencialidades e limitações desta metodologia aí explicitadas. Desenhou-se um estudo exploratório/descritivo assente numa revisão sistemática e análise categorial. Recuperaram-se 8 artigos, sendo um possível indicador da reduzida utilização da metodologia na área da CI, a mesma apresenta-se essencialmente prática. Embora se aponte a limitação do não envolvimento dos utilizadores em todo o processo de design, a metodologia CD exhibe capacidade de recolher informação implícita através das atividades dos utilizadores e a possibilidade de sistematização compartilhada de dados complexos. Características que tornam esta metodologia uma potencial mais-valia para o desenvolvimento de interfaces adequados entre recursos informacionais e seus utilizadores.*

Palavras-chave: *contextual design; ciência da informação; metodologia centrada no utilizador; recursos informacionais.*

Introduction

Despite a certain difficulty in the delimitation of the field of knowledge designated by Information Science (IS), or perhaps precisely due to that difficulty, several authors have engaged in its epistemological study (Araújo, 2013; Barreto, 2008; Buckland, 2012; Capurro, 2003; Le Coadic, 1996; Machado, Simões, & Souza, 2017; L. V. R. Pinheiro, 2006; Saracevic, 2009; A. M. da Silva & Ribeiro, 2008; J. L. C. Silva & Freire, 2012; Souza & Almeida, 2009; Zins, 2006). In the 1970s, Shera and Cleveland (1977, p. 260) accounted for the many approaches regarding the origin of IS. The further increase of studies of this nature in the following years have led some authors to consider IS as one of the most introspective scientific fields (Souza, Almeida, & Baracho, 2013).

Amongst the several works that attempt to provide a better understanding of the field, we highlight a study by Chain Zins that included the contributes of an international panel formed by 57

researchers working in IS, which presents a mainstream vision of the field at the beginning of the 21st century (Zins, 2007a, 2007d, 2007c, 2007b).

In an effort to relate this vast number of contributions towards an agreement on the epistemology of the field, a definition of IS is suggested as a scientific field that studies the mediation aspects related to the phenomena of data, information, knowledge and message (D-I-K-M), and their implementation in the cultural domain, which is seen as the several ways in which society faces reality. Therefore, the area of activity of IS lies at the intersection between the D-I-K-M phenomena and the cultural domain or, more specifically, in the components that mediate users' information resources (cf. Figure 1).

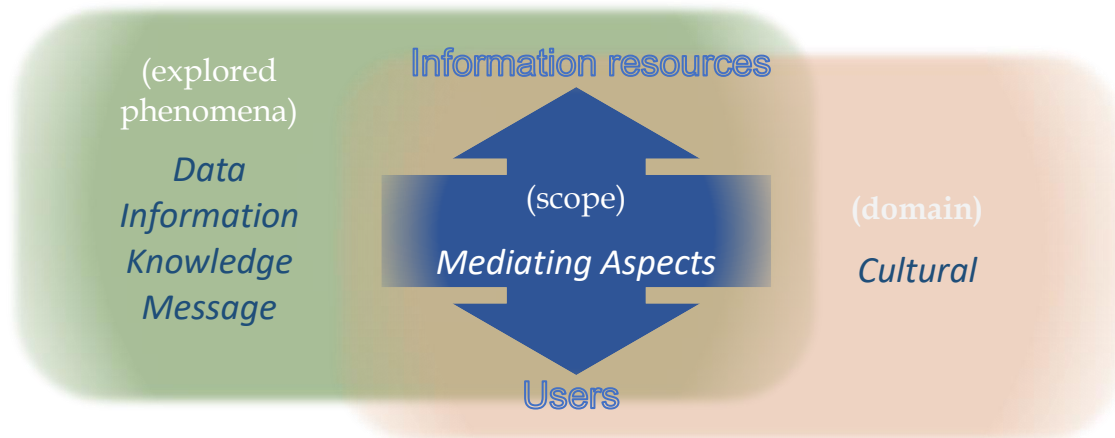


Figure 1. Schematic representation of the area of activity of IS (domain), according to the definition suggested in this study (elaborated by the authors).

The option to include the D-I-K-M phenomena in the pole identified ad-hoc as *information resources* reflects a broad conception of IS, as expressed by Buckland in (Zins, 2007b, p. 336) that includes the four phenomena, or in (Buckland, 2012) where he stresses the cultural aspect of the field. It is important to point out that this option should not be taken as an undifferentiated use of these concepts, a topic highly pertinent to IS (Marques, 2017, p. 64). It is emphasized, instead, the intrinsic relation shared by the distinct concepts, as stated by Silva and Ribeiro: “*Information is distinct, although not separated, from both knowledge and communication*” (Silva & Ribeiro, 2008, p. 48, italic in the original). Similarly, Marques (2015, p. 58) relates *information* with *message* as part of a *communicative* process from which results *knowledge*.

Considering this perspective, we adopt a position similar to Zins (2007c, p. 487), situating the D-I-K-M phenomena in the internal and external context of an individual and, as such, able (as artifacts) to undergo a mediation between them and the user. It is stressed the provisory nature of this position, since the complexity and controversy of this topic¹ far exceeds the framework of the current study. As a result, considering the previous discussion and the goals of this study, we adopt a similar interpretation to the one described by Zins:

[The] analysis of the panel’s definitions of D-I-K-M made it clear that the wording can be deceptive. Panel members often misused the terminology. Therefore, I adopt Begthol’s definition as an ad hoc position that IS explores D-I-K-M phenomena, without differentiating, however defined and in whatever relation to each other. (Zins, 2007b, p. 340).

¹ Vide the debate on the definitions of the concepts of *data, information, knowledge and message*, in Chaim Zins (2007c), or the critical review performed by Jennifer Rowley (2007) about the *data-information-knowledge-wisdom* hierarchy suggested by Russell Ackoff (1999).

Moving on towards the identification of the aspects that participate in the mediation between information resources and their users, Zins (2007d, p.528) indicates that they should answer the following questions: who? — the mediators (human and/or mechanical); what? — the matter (desired contents/subjects); why? — the motive (query reason); how? — the means (intervening methods); where and when? — the milieu (historical and social context).

In this framework, user-centered methodologies feature as potential processes not only for the creation of optimized interfaces between information resources and their users, but also to shape resources (perceived as artifacts). *Contextual Design* (CD) is one of these methodologies², introduced by its authors as “a user-centered design process that uses in-depth field research to drive innovative design, [...] a step-by-step process for collecting field data and using it to design any sort of technical product”, (Holtzblatt & Beyer, 2014, p. 1).

Since the introduction of the methodology is focused on the specific characteristic of the concept, i.e., in the term *contextual*, it is important to specify what should the broader term *design* encompass. In this study, the definition suggested by Ralph and Wand is adopted, according to which design is “a *specification* of an *object*, manifested by some *agent*, intended to accomplish *goals*, in a particular *environment*, using a set of *primitive components*, satisfying a set of *requirements*, subject to some *constraints*” (Ralph & Wand, 2009, p. 108, italics in the original).

The combination of these two definitions allows us to posit CD as a specification process of an artifact or service, based on systematically-collected data from users while these execute tasks related to the products to be developed. This monitoring constitutes the essential aspect of the methodology, as the observation of how users engage with a situation will serve as a starting point for the creative process (Iivari & Iivari, 2011, p. 140).

The methodology comprises three stages: i) immersive experience in the “world” of the end-users (current, future or potential); ii) idealization of new concepts based on the global panorama obtained from the first stage; iii) development and test of the product using end-users (Holtzblatt & Beyer, 2014, p. 1). Amongst all these stages, the first is pivotal as it provides the big picture that will be the foundation for all subsequent developments. The creation of the visual models (diagrams) is most crucial step of this stage, as they not only organize and systematize collected data, but also play a pivotal role in addressing what Holtzblatt and Beyer (2014, p. 18) regard as the greatest challenge in development teams — to achieve a shared understanding of the “world” of the user.

Based on the aforementioned assumptions, we aim to identify and analyse studies in IS that address or use the CD methodology as part of the development of mediating solutions between information resources and users. Specifically, our goal is to: (i) identify peer-reviewed papers that discuss or use the CD methodology (in databases related with IS, as mentioned ahead); (ii) describe the approach to the CD concept used in the retrieved papers; (iii) highlight potential contributions and limitations of this methodology, as pointed out by those papers.

In order to address these objectives, we endeavoured on an exploratory/descriptive study based on a systematic review. A categorical analysis was performed on the corpus of papers selected using the methodology described in the next section.

² In addition to Contextual Design, other user-centered methodologies exist, such as Goal Directed Interaction Design, Scenario-Based Design and Human-Centered Systems Development Life Cycle. Iivari and Iivari (2011) identify advantages and limitations in the use of each of them.

Methodology

The following services were used as sources for the constitution of the corpus of the study: a) EBSCO Discovery Service (EDS); b) ProQuest (PQ); c) Web of Science (WoS); d) Directory of Open Access Journals (DOAJ); e) E-prints in Library & Information Science (E-LIS). With the exception of the latter, which is field-specific, queries in the remaining platforms were filtered to the following collections: in DOAJ, to *Bibliography - Library Science - Information Resources*; in WoS, to *Information Science & Library Science*; in PQ, to *Library and Information Science Abstracts*; and in EDS, to *Library & Information Science Source*; to *Library, Information Science & Technology Abstracts* and to *Information Science & Technology Abstracts*.

Since we intended to retrieve only papers in which CD plays a significant part, it was opted to restrict the query to papers in which the term ‘contextual design’ occurs in at least one of the following indexing fields: “title”, “subjects” or “abstract”. In addition to the restriction to peer-reviewed articles, no other formal or temporal filters were applied. We decided not to apply a temporal filter since we observed, in the exploratory queries, week occurrence of relevant results.

The corpus was submitted to a hermeneutic approach that seeks to form a progressive understanding of the texts under analysis (Kuckartz, 2014, p. 19). The technique of categorical and contingency analysis was used, namely categorization by “corpus” (Bardin, 2011, pp. 149-259). For the categories that emerged during the gradual classification process, meaning units formed by textual segments extracted from the corpus under analysis were attributed (Bardin, 2011, p. 134; Kuckartz, 2014, p. 44).

Results and discussion

Collection occurred in April 4th, 2018, in the mentioned platforms, according to the aforementioned methodology. The results were as follows: five papers in PQ; four in EDS and WoS; one in DOAJ and none in E-LIS. In the end, after the removal of duplicates, the corpus was comprised of eight studies (see Table 1).

Table 1 - Corpus of the study

tRef.	Sources	Publisher	Author(s)	Title
#01	WoS	(2001) Information & Management	Smart & Whiting	<i>Designing systems that support learning and use: a customer-centered approach</i>
#02	EDS PQ	(2001) Journal of Library Administration	Normore	<i>Reference in Context Project</i>
#03	EDS PQ WoS	(2004) Library & Information Science Research	Nesset & Large	<i>Children in the information technology design process: A review of theories and their applications</i>
#04	EDS	(2006) Universal Access in the Information Society	Marsico <i>et al.</i>	<i>A proposal toward the development of accessible e-learning content by human involvement</i>
#05	EDS PQ WoS	(2008) Program: Electronic Library and Information Systems	Keshavarz	<i>Human information behavior and design, development and evaluation of information retrieval systems</i>
#06	DOAJ PQ	(2008) Journal of Library and Information Science	Kruse <i>et al.</i>	<i>A User Field Study: Communication in Academic Communities and Government Agencies</i>
#07	PQ	(2009) Journal of Access Services	Kelly <i>et al.</i>	<i>Accessibility 2.0: Next Steps for Web Accessibility</i>
#08	WoS	(2016) Research and Advanced Technology for Digital Libraries	Heuwing <i>et al.</i>	<i>Contextual Design Methods for Information Interaction in the Workplace</i>

As far as the discussion of the CD concept in these papers is concerned, it was observable a high amount of descriptive and/or comparative studies of experimental projects using this methodology (six), in contrast with more theoretical studies (two), as shown in Table 2.

Table 2 (continues) – Categories and corresponding units of meaning taken into account when analyzing how the concept of CD was used by the studies of the corpus

Categories (study typology)	tRef.	Meaning units	
		(approach)	(specification)
a) descriptive studies of specific projects in which CD was used as a methodology, in its original form or adapted	#01	This study uses contextual design methods to gather and analyze information on users' wants, needs, and work habits when using computers.	the team explored methods of user assistance and documentation, with the goal of finding improved ways of helping users.
	#02	The method we used is called Contextual Design [...] we were interested in how people look for information.	Team members interviewed people, including reference librarians, faculty members, graduate, undergraduate and high school students, and a public library user.
	#04	The present proposal stems from blending issues related to the contextual design approach with characteristics of learner-centred design.	the design team would be comprised both of members with a varied expertise, from usability to domain knowledge, and of a sample of actual target users, from learners to teachers.
	#06	The study was conducted within the academic community at British and Danish universities and government agencies in The Netherlands, using the 'Contextual Design' approach and 'Cultural Probes'.	Qualitative data on researchers' and government agents' communicative and interactive behavior were collected and an affinity analysis carried out.
b) literature reviews on user-centered methodologies for the development of information systems	#03	This article reviews the literature on the role that children can play in the design of information technology applications intended for young users themselves.	It discusses several relevant design theories [CD and others] looks at usability issues in relation to design and children.
	#05	The paper takes the form of a literature review with particular concentration on the efforts made by information science researchers.	Though the importance of information behavior was identified in the early days of IR systems research, there are some recent approaches in which the topic is highly regarded as an influential element – especially “contextual design” and “participatory design”.
c) descriptive study of a project for a model of contextual approach	#07	The paper describes a tangram model which provides a pluralistic approach to Web accessibility, and provides case studies which illustrate use of this approach	A combination of the Tangram metaphor and Stakeholder Model forms an important basis on which a more informed, appropriate approach to accessibility can be taken.
d) comparative study of projects that use different user-centered methodologies	#08	This contribution presents and compares methods which can be used to elicit information about users in the workplace, and to analyze and to create requirements based on these results, especially from scenario-based design and contextual design.	results of several projects in similar work contexts can be analyzed as case studies to generate generalizable insights into the information behavior of a community of practice.

In descriptive/comparative studies, this methodology is used autonomously (#01 and #02) and in combination with other methods (#04, #06 and #08). Moreover, study #07 is worthy of note for the fact that it does not use CD as created and defined by Holtzblatt and Beyer, who are not cited. In this paper, the term ‘contextual design’ appears only in the key-words. The use of CD as a common-name to identify the specification of the model developed can only be inferred by an analysis of the study. Due to this, this study (#07) was not included when analysis the contributes towards the potentials and limits of the CD methodology.

Regarding the potentials made explicit in retrieved papers, five out of seven stress how effectively CD serves as a method to collect information amongst users (category a) of Table 3). Its relevance is also reflected in the several specifications listed in Table 3, amongst which is stressed its effectiveness in the collection of data about user's information behavior.

Table 3 – Categories and corresponding meaning units taken into account when analyzing the potential advantages of the Contextual Design methodology, as made explicit in the corpus

Categories (potential advantages)	Subcategories (specification)	tRef.	Units of meaning
a) CD provides an effective method to gather information from users...	... in a systematic way:	#01	the contextual-design methodology provided a valuable method for gathering customer data in a systematic, usable way.
	... in a way that is implicit in their actions:	#01	the contextual design process provided a method for finding out what users actually do, not just what they think they do or want.
		#05	"contextual design" could be viewed as a method utilizing the "field methods" in which communicating with users and understanding their implicit needs can be provided.
	... in their work environment:	#01	[the] information about users and their work is best gathered through the process of observing and working with users in their environment in the context of their work.
	... regarding their information behavior:	#02	The project provided both input about the usefulness of the method and data to support our understanding of the factors affecting information-seeking behavior by librarians and library users. [CD techniques] provides insight into the process and information environment based on real user data.
		#05	Contextual design and participatory design are among the new methods where users' behavior, factors and contexts are considered more proactively than previously when designing information systems.
		#06	The first [result] was a conceptual model of flow from idea to dissemination as an integrated process in academic work, providing an overview of phases relevant for a contextual addressing of questions of preservation and documentation.
		#08	It has been demonstrated that methods from the area of user centered design can be applied to understand information seeking in the workplace.
b) CD adds value to information systems and to the organizations responsible for them:	#01	Implementing contextual design or other participatory design methods ultimately will increase the value of systems and help organizations remain competitive.	
c) CD includes techniques to organize sets of complex and diversified data:	#02	by using the techniques that Contextual Design teaches [we were able to] organize what would otherwise be an unmanageably large and complex set of information.	
d) CD provides a structure that allows individuals without prior experience to perform interviews:	#02	The method provided sufficient structure that individuals without a strong set of previously developed skills in collecting user data were able to be effective listeners and data collectors.	
e) CD incorporates an interdisciplinary approach:	#03	[KidPad project] incorporate children's ideas into working software. Not only is the KidPad team intergenerational, but also borrowing from the contextual design approach, it is interdisciplinary.	
	#04	This paper emphasizes the role of multiple members in the lifecycle design team [made possible when] Participatory and contextual design strategies are merged with the LCD approach, focusing the whole framework on accessibility issues.	

As far as limitations are concerned, only four were identified. The only limitation mentioned in more than one paper was associated with the lack of involvement of users in all the stages of a system's development (category c) of Table 4). This limitation, in addition to the one expressed in category b), are explicitly mentioned in papers classified as literature reviews in the methodology.

Table 4 – Categories and respective units of meaning taken into account when analyzing limitations of the Contextual Design methodology, as made explicit in the corpus

Categories (limitations)	tRef.	Units of meaning
a) CD implies a new form of action that may hinder its use:	#01	acceptance by the company took time [because] the process [of CD] required a new way of thinking and doing, allowing individuals and groups to be involved in the process in new ways
b) CD “demands” cooperation with untrained individuals:	#03	the main difficulty of using PD techniques with children is similar to that raised in an adult context with contextual design, the benefits versus the drawbacks of using the opinions of the untrained user versus those of the design professional
c) CD does not involve the users in all stages of the process:	#03	CD does not involve users in all aspects of the design process
	#05	through methods like round-table discussions and qualitative interviews, users are seen as information providers without having to take active roles in contextual design activities
d) CD and other similar methods are not sufficient when dealing with complex information systems:	#08	methods from the area of user centered design can be applied to understand information seeking in the workplace. However, they have to be adapted and enhanced with forms of group discussion and participation to provide results which are actionable for the design of complex information systems and to enable interdisciplinary communication

Regarding the limitations found in comparative/descriptive studies, it was observed that one paper (#08) does not restrict it specifically to CD, but extends it to all user-centered methodologies. Moreover, paper #01 does not express that limitation as a methodological problem. In contrast with the others, this limitation suggests that the difficulty in implementing a CD methodology lies in its novelty. However, considering the use history of CD (Holtzblatt & Beyer, n.d.) in the Human-Computer Interaction (HCI) field, this methodology can hardly be considered a novelty in 2001, when this study was published.

Figure 2 shows a graphical representation of the diachronic comparison between the publication years of the studies that constitute the corpus, and representative works of the evolutionary process of CD as a methodology, according to its entry in the *Encyclopedia of Human-Computer Interaction*, available online.

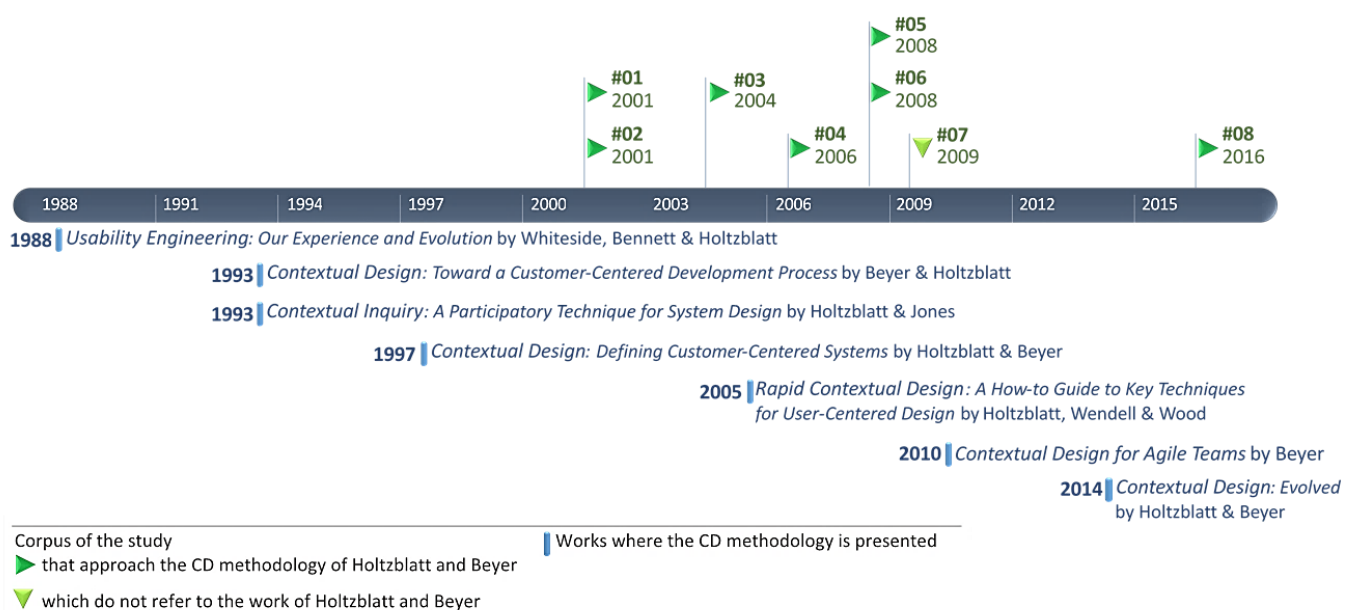


Figure 2. Schematic representation of the diachronic comparison between the publication years of studies that constitute the corpus and representative works of the evolutionary process of CD as a methodology (elaborated by the author).

It is possible to verify in Figure 2 that retrieved papers in the IS field appear only after almost a decade, in relation to the first works carried out in 1993.

Conclusions

This study enables us to draw some indicators regarding the use of CD as a methodology, applied to the development of mediation solutions between information resources and users. However, conclusions are limited by the exploratory nature of research.

The first indicator is related to the low number of retrieved papers (eight), considering the diversity of databases queried and the nearly three decades of existence of this methodology. This number indicates a low use-rate of this methodology in IS.

In regard to the approaches to the concept of CD, it was concluded that it is essentially empirical, as the methodology is used to obtain the desired results. Furthermore, it was observed a trend to combine methodologies, which is reflected in the mixed approaches revealed by each descriptive/comparative study since 2004.

Two potential uses of CD as a methodology were also noted, each related to a different moment of the process: data collection and organization. In the first, the possibility of performing contextual interviews that collect implicit data in user's actions, in addition to information they made explicit, allows the collection of data that reflects the real needs of the target audience of the system, which individuals are sometimes not aware of. In the latter, it was highlighted the ability to systematize in categories usually large and complex amounts of data, through visual models of the "world" of the user. As a result, it can be concluded that CD provides added value for the development of suitable interfaces between information resources and its users.

Finally, there might be a potential link between how limitations are made explicit and the methodological orientation of studies, since the two limitations most directly concerned with intrinsic characteristics of CD were revealed by the literature review. These two limitations refer to user engagement, and can be seen as opposite: some authors indicate as a limitation the non-engagement of users in the whole design process, whereas others call out to the difficulty of working with individuals without specific training.

Final remarks

This study stresses the interdisciplinary nature of CD as a methodology, both at a domain-level and in its use in multidisciplinary research teams. This plural nature might be the echo of the equally interdisciplinary nature of IS, although this topic is not consensual.

The overview conveyed by this research concerns the explicit use of this methodology, without considering partial uses of methods or techniques that do not refer to CD as a whole. Some examples can be found in studies that apply techniques such as 'contextual inquiry' or 'contextual interview', which can be considered a part of CD. However, by not making this bond explicit, they were not included in this study as it is questionable whether or not the authors know about the CD methodology.

These issues may constitute interesting starting points for future research. It might be interesting to perform a more extensive survey on the use of CD in IS, or to verify if researchers that use adjacent techniques — e.g. contextual inquiry/interview — relate them to other components of the CD methodology. Such endeavors would complement and complete the initial overview that this study provides.

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