Researching and Designing Healthcare Environments: a Systematized Review of Creative Research Methods

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Abstract

In research and design, *Creative Research Methods* (CRMs) are useful to gain insight into user perspectives. Reviews suggest that CRMs offer potential to engage people, yet little detail is available regarding their use in relation to built healthcare environments. Consider environments for cancer care, where patients are confronted with particular physical and emotional challenges. This review aims to synthesize what is known from existing literature about CRMs exploring user experience when researching and designing (cancer) care environments. Based on 16 items we evaluate the potential of CRMs, offering insight into why, how, where and when they are employed. Generally little consideration is shown for participants' abilities and limitations. Our analysis further emphasises the importance of reflecting on visual methods, and the need to report research approaches transparently including where CRMs are used. A sophisticated research approach can leverage CRMs' potential to study experience and carry artefacts forward to inform design(ers).

Keywords: communication, hospitals, research design, users' experiences,

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Research Methods

Caring for patients is central to the activities taking place within hospitals and healthcare

buildings. Surrounding and sheltering these activities, the built environment plays different roles.

Firstly, it contributes to the impression patients have of a healthcare organisation (Annemans,

Audenhove, Vermolen, & Heylighen, 2016), thereby hampering or supporting patients and

caregivers. Secondly, it can play a significant role in patients' satisfaction and recovery (Andrade

& Devlin, 2015; Ulrich et al., 2008). Their experience involves a wealth of interactions with the

built environment, within the hospital room and beyond (Annemans, Audenhove, Vermolen, &

Heylighen, 2018). Thirdly, the healthcare environment is a workplace, which professional users

may experience differently than patients (Huisman, Morales, van Hoof, & Kort, 2012).

In the context of cancer care, patients with physical and emotional challenges are often

exposed to multiple healthcare environments. Patients receiving chemotherapy may develop

nausea and fatigue, have their smell and taste affected, and be confronted with crowded facilities

and long waiting times. Patients receiving radiation therapy may travel to the hospital daily for

treatment that takes only 15 minutes. Changes in treatment possibilities and regimes have spatial

implications that also affect the users of cancer care environments (Bloom, Markovitz,

Silverman, & Yost, 2015).

To empathetically design fitting healthcare environments and tailor these to users' needs

and preferences, Evidence-Based Design (EBD) principles, as well as rich experiential data pay

specific attention to spatial aspects of the individual experience (Devlin, Andrade, & Carvalho,

2016; Elf, Frost, Lindahl, & Wijk, 2015). Interest is increasing in the experience, views and

opinions of users, who show potential to contribute their expertise to the design of healthcare

environments. To examine the role of architecture in an individual's experience it is necessary to acknowledge the difficulties one may have expressing how they experience a space (Annemans et al., 2016). How can users be supported in communicating these experiences that may be valuable as feedback for designers? This review aims to synthesize what is known from existing literature about creative research methods (CRMs) exploring user experience when researching and designing healthcare environments generally or in cancer care particularly. We consider actively involving participants in making, or facilitating conversations about the built environment through material representations or artefacts, an integral component of CRMs.

Background

That the user has something valuable which the designer does not, starts receiving increasing attention in business and marketing leading to professional-lay interactions in the development of new products and services (Wang & Oygur, 2010). In architecture, design for health care is seen to lead the way in trying to close the communication gap between the design team, various user groups and other stakeholders in the design process (Sanders & Stappers, 2008). Paying attention to the experience of users when designing lies at the heart of human-centred design. As meaning is relayed through a realised design it is key for designers to understand the divergence of interpretations that exist among its users (Crilly, Good, Matravers, & Clarkson, 2008; Krippendorff, 2006). Klaus Krippendorff's focus on semantics offers a framework that acknowledges that the meaning ascribed to an artefact develops in conversation and interaction as well as over time. It also allows exploring the (designed) built environment as conveying meanings that are interpreted differently by individuals depending on their context.

As the experience of living with serious or life-threatening illness is hard to convey, methods referred to as arts-based are described as especially appropriate to engage people and

enrich communication when researching healthcare contexts (Boydell, Gladstone, Volpe, Allemang, & Stasiulis, 2012; Fraser & Sayah, 2011). Arts-based methods offer opportunities to engage with vulnerable people (Coemans, Wang, Leysen, & Hannes, 2015) and are commonly seen to *add to* or *extend* methods used more generally in qualitative inquiry. In reviews of arts-based health research several authors acknowledge the unique contribution of the arts (Boydell et al., 2012; Fraser & Sayah, 2011). Besides enhancing engagement and making research more accessible outside of academia, arts-based methods generate data beyond what was considered the scope of 'normal' interview methods (Boydell et al., 2012; Cheung, Saini, & Smith, 2016). To better understand particular contributions of different art forms, however, a more "fully reflexive account of methodology" would be helpful (Boydell et al., 2012). Additional reviews have looked in health contexts at the use of particular methods such as, *photovoice* (Catalani & Minkler, 2010; Evans-Agnew & Rosemberg, 2016) and drawing (Cheung et al., 2016). Both allow recognising participants as co-researchers, enabling an exploration of their perspectives and highlighting the unique ways in which they perceive and experience health conditions and the care context. We see value in this growing body of methods and recognise that design research borrows enthusiastically from both arts-based and ethnographic methods.

One review looked specifically at design and creative practice in health and social care that has shown impact (Chamberlain, Wolstenholme, Dexter, & Seals, 2015). The authors find evidence of expertise concerning methods and techniques used within the design community that engage with "the traditionally hard to reach". They encourage using these to engage with diverse stakeholders to deliver innovative outcomes in response to health challenges (Chamberlain et al., 2015, p. 52). A wide variety of designed outputs are included in the review. Although items with an emphasis on the physical environment as 'produced design' were coded as such, little detail is

given regarding the specificity of user-centred projects (no case study examples). Also little attention is given to the sensitive context within which the user-centred health projects take place, nor to the particularities of working with vulnerable participants. These points formed the incentive to conduct this review, which takes a closer look at studies that use CRMs when researching and designing built healthcare and cancer care environments. We seek to understand the *why, how, where* and *when* of the employed methods.

Methods

We intended to conduct a systematized review as defined by Grant and Booth including elements of a systematic review "while stopping short of a systematic review" (p. 95). See <author, date> (omitted for reviewing) for the search protocol. Before we could conduct this systematized review it was necessary to conceptually define CRMs more explicitly.

Directions of fit

To consider creative elements of research and design processes, we borrowed a notion advanced by philosopher John Searle (Searle, 1983). Searle describes a mental state (a belief, desire or plan) directed at an object as having a directedness. It is helpful in the way Heylighen et al. applied this notion to distinguish between research and design (Heylighen, Cavallin, & Bianchin, 2009). Generally research can be considered as having a world-to-mind direction of fit: how things are in the world informs the way the mind thinks of them, the mind adjusts accordingly. Compare this to design that proposes solutions for problems encountered in everyday living. The intention is to change the way things are in the world. This process has a mind-to-world direction of fit**.** Figure 1 illustrates that CRMs all have elements with both directions of fit. We base our definition on this dual relationship. While interview-based methods of qualitative inquiry can be considered creative, it is for the purpose of facilitating a

conversation about architecture that we require an element with a mind-to-world direction of fit to set the research method apart as 'creative'. Participants are activated in a design process, be it at the scale of an individually made object reflecting ideas and personal experience or in their hands-on engagement with a designed (and possibly realised) environment or building.

Selection process

To demarcate our search for relevant literature we used a total of 62 keywords (including Medical Subject Headings or MeSH terms), referring to the healthcare setting (e.g., hospital, palliative care, cancer, patient); the built environment (e.g., hospital design and construction, interior architecture, interior design and furnishings); and CRMs (e.g., arts-based, co-design, design inquiry, generative techniques).

First a database search was conducted in Scopus, Web of Science, Ebsco, ProQuest and PubMed. For an additional grey literature search titles in the following conference proceedings were scanned: Design4Health European Conference; Arts-based Research and Artistic Research Conference; Design & Emotion Conference; Include Conference; Cambridge Workshop on Universal Access and Assistive Technology (CWUAAT) and the European Academy of Design. The content lists of the following journals were also scanned: Health Environments Research & Design Journal; CoDesign; The Design Journal and Qualitative Health Research. Items were selected or excluded based on the screening of the title and abstract. From an initial 183 items, 42 duplicates were removed and 16 items were withheld (see Figure 2 (Moher, Liberati, Tetzlaff, Altman, & PRISMA Group, 2009)).

Assessment / appraisal

The selected items were primarily studied to find out what is known without conducting a formal quality assessment. Assessing the quality of arts-based research with guidelines used in

health sciences tends to oversimplify the nature of qualitative inquiry as these judge quality via the execution of proper method (Boydell et al. 2012). Rather, judgement requires thoroughly engaging with the reported process, understanding the interpretations and examining these in the light of the adopted research approach. A similar attitude is adopted to compare and discuss the results of design research conducted under a variety of methodological umbrella's (Matthews & Brereton, 2015). We therefore assessed the quality of the included items in terms of what we consider valuable to inform future research.

Results

Descriptive findings

The initial database search generated 144 items. Two researchers screened the titles and abstracts independently. Of the items found 12 met the selection criteria. We supplemented these by 13 items found in a grey literature search and retrieved full papers. At this point a further nine items were excluded. Closer inspection revealed that four items did not meet the inclusion criteria: the healthcare component referred to assisted living for older people; the physical environment component was tangential to a focus on healthcare services; or no particular CRMs were mentioned beyond a general reference to 'different types of participation'. Four items were unavailable and a PhD dissertation was excluded due to its disproportionate dimension.

In terms of the CRMs used, visual methods are commonly combined with verbal explanations. Photographs are used [13, 15], also video-elicitation [1], arts and crafts [9, 10] and plans [12]. Explanations are elicited through (semi-structured) interviews or focus group interviews. Visual methods feature prominently in the group of items typified by workshops (e.g. renderings [3], maps [6] and collage-making [8]), although the variety of activities increases. Games [7], site visits [4] and scenario's [3, 5, 16] are some of the types of participatory methods

employed. In the sessions dedicated to user-testing 3D models [12], mock-ups [5, 16] or a

prototype [2] the environment is represented to scale. Table 1 charts the selected items with a

brief description of the CRM, the healthcare and spatial context, and the research participants.

Analytic findings

As mentioned above, we are interested in understanding the *why, how, where* and *when* of

the employed CRM. We start by analysing the rationale and intentions underlying the

exploration of user experience. In looking at *how* we touch upon which stakeholders and user

perspectives are sought, also supplementing the overview in table 1. The *where* question looks

more closely at the setting. And finally, *when* refers to the study's phase that the mind-to-world

direction of fit applies to.

Why? What are the intentions of researchers and designers choosing CRMs? And what

advantages of CRMs do they identify when looking into spatial aspects of experience? CRMs

enhance communication. This is found to be helpful when involving a diverse group and

diverging perspectives while simultaneously bringing complex aspects of healthcare situations to

the table. By visually summarising discussions that take place between stakeholders, issues are

carried forward in a design process in tangible form [6]. Visual and verbal storytelling

techniques were found to invoke emotive responses and empathy. These narrative techniques are

considered inspirational for designers to work with [4].

CRMs are being used with the general aim to collect input from hospital users: to gain

feedback and access to particular perspectives. Several studies include children, e.g. to test a

prototype for a paediatric waiting space [2], or understand what a supportive health environment

should constitute from their perspective [9, 10]. Arts and crafts sessions with young patients are

a point of departure to talk about their ideal hospital environment. Adult patients are approached

both ad hoc [1] and prior to participating [12, 13]. Involving users to improve their experience of the healthcare environment is central to an experience based design approach where innovating with end-users is explicitly mentioned as a source of competitive advantage for healthcare providers [15].

CRMs are specifically used to discover the role the physical setting of a hospital ward plays in patients' recovery [13]. Photos taken by patients were discussed both during their hospital stay and retrospectively once they had returned home. Even though pictures may look 'banal', the method proved effective in communicating what cannot be made visible. The authors point out that *"... the scope for using this technique in other health-related contexts is possibly one to be encouraged"* [13, p. 97].

In another group of items CRMs are employed for the flexibility and variety they offer. Providing options allows taking into account different abilities participants may have, their preferences or state of mind. Compared to interview-based research, offering options seems to stimulate participants to reflect on spatial aspects of their experience in new ways. Payne et al. [12] offered participants plans and scale models to design their preferred layout for a healthcare and wellbeing center. The various formats enabled participants to contribute in a way they felt comfortable with [12]. In studying the impact of spatial elements on patients' mobile hospital experience, Annemans et al. [1] also offered a variety of methods to allow people to reflect.

Finally, designers and researchers choose CRMs for their potential to facilitate change and innovation. In multiple cases their suitability is tested in a user-driven healthcare innovation or change management process [3, 11]. Particular CRMs are seen to have the potential to "stage co-design situations", engaging architects and engineers to explore materials [7, 8]. They also function as tools in interdisciplinary learning, equipping professional users with understanding

and techniques to take part in co-design [5]. Designed activities can bring people and materials together in unique ways to explore new ideas and ways of thinking. In these studies the spatial component is not the primary focus although an intricate co-dependency between the spatial and organisational design is sometimes acknowledged (e.g. in [3]).

How (and with whom)? How are CRMs used to explore user experience in research and design of healthcare environments? The multi-phase and multi-actor characteristics of these studies suggest an organisational and practical complexity. A willingness to improvise and adapt during the course of a project seems inherent but adds risk and uncertainty. This concerns participant numbers [12], as well as questions about timing and commitment [7, 8] and procedures [9, 10, 13]. Dreessen et al. [6] set out to involve neighbourhood residents and other stakeholders in conceptualising a new healthcare and housing concept. Since the architects were involved only in a later phase, insights from previous sessions had to be communicated with the risk of information being lost. This illustrates the challenge of having the right people, in the right place, at the right time. These factors affect any research conducted with CRMs in healthcare environments, but even more so when design and other industry stakeholders have a part to play. Incorporating CRMs requires intricate planning combined with a willingness to be flexible.

This cannot be considered an excuse to be vague about one's approach or intentions, however. Of the studies included in this review few mention methodology, data handling, theoretical constructs or choices made regarding data analysis. Whether these are absent in the approach or in the report only is not always clear. There are exceptions [6, 8, 11, 12, 13]. For example, critically assessing a photo method and its implications for qualitative analysis leads to an interesting discussion about technology, sensory experience and mimesis [13]: the camera

allows patients to 'make a breach' in the flow of the hospital experience where the senses are said to have been deliberately dulled. Mention is further made of qualitative content analysis conducted on visual materials [6, 12] and details regarding the coding process and use of qualitative analysis software [12]. Analysing their project from an Actor Network Theory perspective Jørgensen et al. [8] discuss the socio-material network that was formed, and consider how created artefacts could function as 'boundary objects' allowing actors to represent their knowledge and communicate. One quantitative, comparative study is included [15]. Surprisingly less than half of the studies mention ethical aspects of their project [1, 2, 9, 10, 11, 12, 13].

When exploring spatial aspects of experience one is inevitably faced with the question of scale. Tools and exercises are offered to enable participants, not trained in architectural design, to take part in discussions about the design of healthcare environments. It is suggested that the materials provided partly determine the artefacts made. For instance, children's 'designs' may have been influenced by the actual materials available to them and what was easy for them to create [9]. In an attempt to mitigate the effects, authors offer a wide range of materials and encourage participants to articulate their design before choosing materials. Heimdal and Rosenqvist [7] recognise different roles materials play in co-design settings. Their tentative framework distinguishes three types of tangible working materials – *representative, real* and *mediating* – and recognises the difference between basic and pre-designed materials. Also the order in which tools are used matters [15]. Particularly when created artefacts are used to inform design(ers), the choices made for and within CRMs can have a significant impact on the outcome.

While many studies involve patients [1, 2, 4, 8, 9, 10, 12, 13, 14, 16], little mention is made of how their condition may have affected their contribution. Yet, the sensitive nature and

potential unpredictability of health related issues are bound to affect participation. Because

Broberg et al. [3] had difficulty recruiting participants for workshops and simulation activities,

patients from the outpatient department were represented by medical staff and researchers. In

another study [9, 10], 16 of the 55 child patients recruited did not want to engage with arts and

crafts. Annemans et al. [1] too found it challenging to collect visual contributions from patients.

While this could have several reasons, their condition may likely be influential. Interestingly, a

limited participant sample size is not necessarily found to be problematic [12]. Although not

explicitly mentioned a small group format seems commonly accepted for participation in CRM.

Besides with patients, collaboration is sought with stakeholders who are not directly

users, such as industry partners [4, 7, 8], healthcare organisations and representatives [6, 11, 12]

and neighbourhood residents [6, 12]. Jørgensen et al. [8] stress the importance of overcoming

resistance and raising participants' interest. They also question who should select which people

to involve and whether participants should be paid. These are valuable questions that should be

considered for all types of participants.

An awareness of the sensitive nature of the healthcare environment is apparent in how

some CRMs are employed, as well as in the focus of particular studies. Because of restrictions on

engaging participants in making photos or videos in a hospital, Annemans et al. [1] employed

videography recorded by the researcher to evoke reflections on participants' previous experience.

The focus on accessible play opportunities in paediatric waiting spaces is for Biddiss et al. [2] a

strategy to alleviate anxiety and enhance the experience of the environment. This required

engaging key hospital stakeholders together with patients and their families. Given the immense

variety underpinning the interest in the built environment, however, it is challenging to compare

the studies and make claims about which approach is most effective. CRMs are used to consider

the experience of the entire healthcare facility as well as departments, wards or spaces. The study's focus is on a personal and located lived experience [1, 2, 9, 10, 13] or on the general and holistic experience that professionals hold [3, 5, 7, 8, 11]. Within a hospital ward, Radley and Taylor [13] propose looking at *spaces* (e.g. bed arrangement), *places* (e.g. bed area) and *objects* (e.g. medical technology) as presenting the patient with a psychological and social terrain across which bodily health must be recovered. At the building scale, Lahtinen et al. [11] offer a basic structure of phases and zones passed through by a 'rehabilitation customer' or employee.

Lastly, we value the attempts to consider multisensory qualities of the healthcare environment. With an interactive media display Biddiss et al. [2] aimed to address the growing demand for accessible, contact-surface-free options for play. CRMs were in this case employed during the prototype's realisation and evaluation. For the latter children engaged with the prototype in a multisensory way during an unstructured play session. Annemans et al. [1] also combined mobile and interactive research methods to study the experience of motion en route in hospital. This seemed effective to gain insight into spatial aspects of patients' experience.

Where? In some cases the place under study is also the place where the CRM is employed. This is the case when the experience of an existing healthcare environment is being studied in 'real-time' with patients [1, 9, 10] or a prototype is being evaluated in the hospital [2]. Conceiving and realising a design lab also fits in this group. This defined and accessible place near a hospital's main public area, physically represents a collaboration between a healthcare and a design institute [14]. Some attention is given to describing the main features of these settings. Lambert et al. [9, 10] suggest that the existing hospital context may have impacted on children's ability to envision an ideal hospital beyond their current surroundings. Radley and Taylor [13]

offer an alternative by conducting a photo-elicitation study in a hospital ward, followed by a retrospective discussion of the experience and photo documentation at participants' homes.

Several authors refer to a particular building without further details. The focus is on a certain department of a healthcare facility for example, but it remains unclear where activities take place [3, 7, 8, 11]. On one occasion photographs included suggest a setting within the hospital as some participants seem to be wearing uniforms [3]. In two cases stakeholders are brought together to design a non-existent space. In the first, meetings are held "in the community" [6]. In the second, recommendations are developed for a future health and well-being centre [12]. The meetings are organised at a hospital. Lastly, there is research conducted in a laboratory [15] and in another study, mock-ups of inpatient rooms are tested in an unspecified place [16].

When? The studies included vary regarding *when* the element with a mind-to-world direction of fit is incorporated in a research or design process (see Figure 3). Studies situated in a predominantly world-to-mind group employ CRMs in research activities to explore user experience in an existing context [1, 9, 10, 13]. These studies share an awareness of the richness and variety of individual experiences and some sensitivity towards participants' current abilities. They mostly examine how an existing healthcare environment is used to inform an architectural brief [9, 10] or to more generally provide insight for design(ers) [1]. In this category we see an emphasis on reflexivity. Talking about visual methods and created materials with participants is key to meaning making. Studies aiming to test, modify or show the suitability of (a) method(s) are also part of this group [3, 7, 11, 15].

A predominantly mind-to-world direction of fit characterises a second group of studies, which include CRMs as part of research while working towards a design(ed) outcome [2, 6, 8,

12, 14]. One study describes a *classic design* process [2]: the purpose is to realise a design. It is a multidisciplinary endeavour from the outset and input from intended users is requested in multiple phases including prototype evaluation. Other studies in this group incorporate CRMs that are custom-made for the purpose and typified by multiple phases of interaction. These projects resemble the 'classic design' projects, except that they do not yield a final design or prototype. Results are reported to share insights and inform design briefs [6, 12, 16].

Two anomalies are worth pointing out here. First, Jørgensen, Lindegaard and Rosenqvist [8] tackle a general 'design problem' in health care namely, textiles vanishing from the hospital environment. Second, Reay et al. [14] report on establishing and prototyping a design lab space situated within a hospital aiming to bring together staff, family and patients in developing design-led solutions in the healthcare context. Both studies involve stakeholders, employ CRMs and contribute to design outcomes with varying levels of abstraction. The scope includes but is not limited to the user experience of the built environment. The latter also overlaps with the third group as it transitions from a temporary and experimental, to a more permanent and mature place of collaboration.

The third group of studies has a more longitudinal character. Little detail is given regarding CRMs although the overall process aims at contributing to design outcomes. Carmel-Gilfilen and Portillo [4] sought to share strategies promoting empathy in a senior-level design studio focusing on an outpatient cancer care centre. Students were able to interact with cancer survivors, family members and caregivers as well as industry partners – all primarily considered a source of information, not co-designers. Cesario and Stichler [5] developed a graduate-level course preparing nurses to be design team members. The course facilitated interaction between industry partners and PhD students, which was considered mutually beneficial: industry partners

facilitated nursing students building full-scale models while gaining feedback from them.
Judging from the included items, the mind-to-world direction of fit is incorporated in the
outcome, or as a distinct part of the study. In some studies we see both (also see Figure 3).

Discussion

Terminology and reflexivity

This review included research and design processes exploring user experience in relation
to built healthcare environments. We found definite parallels between both, in terms of aims and
purpose, but also significant differences in terminology used. Compare for example, the
academic terms used in the design participation course for nurses [5] with the design perspective
of the students involved in prototyping within a hospital environment [14]. This may also refer to
the shared terminology that different stakeholders of a particular project need to negotiate and
develop. Jørgensen et al. [8] call this *the language game,* emphasising the need of all involved to
master the terminology common to the most influential actors.

Multiple studies emphasised the importance of reflecting on or talking about visual
methods and created materials [1, 9, 10, 12]. Taking seriously the collaborative, creative
processes in sensitive contexts and/or with vulnerable participants involving *making* at whatever
scale, requires giving attention to the role of language and reflexivity. How the built environment
and the objects it is comprised of are *talked about* makes aspects observable and experience
communicable. Reality and language are interwoven and intrinsically linked to the people
involved, the stakeholders, the community. If we relate this to the linguistic turn in philosophy
(as described by Krippendorff, 2006), we can no longer talk about facts regarding the experience
of users, rather the reality of the people and the environment surrounding them is brought forth

by what they say and do. Even with an explicit focus on artefacts and outcomes, it is important to support and to elaborate on their meaning with annotation and explanation.

Methods and materials

In arts-based research the focus remains on knowledge transferal, whether this takes place between participant and researcher or in a dissemination product (Boydell et al., 2012). When in design research the focus shifts to the tangible outcome, the knowledge transfer that takes place is no longer centre stage. Where research is explicitly made part of a participatory design process, reporting on data handling and data analysis is generally absent. A lack of adherence to conventional research practice in design research makes it hard to incorporate studies in a review synthesis. Assessing the value of a contribution is particularly difficult when explicit information on research methods is missing. This also connects with the issue of incomplete or missing abstracts and the general abundance of poor quality research. Systematically bringing together materials from different disciplines therefore has inherent challenges. These are important issues acknowledged in ongoing discussions, as illustrated by Britten, Garside, Pope, Frost and Cooper (2017).

Specifically in relation to participation in architectural design, the level of abstraction required to imagine and consider a non-existent building is a refined skill in itself [12]. Where some people may be assisted by mock-ups or scale models, others may find plans and sections sufficient. The 'power' of materials even seemed to co-determine the designs that children made [10]. In co-design materials may have different functions [7]. For instance, particular cards may serve as boundary objects in the early phase of the design process [11]. CRMs that involve active *making* result in artefacts that embody meaning and emotion. As Agger Eriksen (2006) suggests, materials used in these types of interactions should be considered not just a part of the method,

but active agents themselves. Also, explicit thought should be put into how the (tangible)

outcomes of interactions are taken along in a continuing design process.

Furthermore, knowledge claims are not often given a physical location in a particular

geographical or material environment. Conducting research in and designing for healthcare

environments requires a thorough awareness of the context to relate individual users' experience

to the complexity of the surrounding built environment. Studies concerned with user experience

of the built environment, may find it helpful to consider the place as an actor, describing its role

and the ways in which it is present.

Boydell et al. (2012) raise interesting points regarding ethical considerations pertaining to

privacy, consent to be photographed and potential negative feelings that participants may have

when stimulated to express health-related experience in more embodied ways. With regards to

arts-based health research, they suggest a need to develop guidelines for reviewers in ethics

boards as qualitative studies incorporate arts-based methods. It is necessary to find a balance

between protecting participants' anonymity in health research and recognizing an individual

making a creative and unique contribution. A similar tension may play in design research

although it is not addressed in the items included in the review. This may be a sensitive issue

with vulnerable participants being torn between empowerment and 'the spotlight' on the one

hand, and exposing sensitive information about themselves or their situation on the other.

Participation

In the studies included in this review, interaction is often characterised by *consultation*.

With this type of input participants seem to lack power to ensure that their views will be heeded.

Several studies covered multiple phases of participation, calling upon the same stakeholders

repeatedly. The iterative nature of such a process is inherent to collaborative design processes

(Wang & Oygur, 2010) and generates engagement over time, a particular characteristic of the items with a longitudinal character. This resonates with the observation that photovoice projects showing a "high quality of participation" tended to result from long term engagements in the community and ongoing partnerships (Catalini and Minkler, 2010).

Participation also relates to the question of *who* designs, researches, initiates and manages the process. In one study the authors realised that as initiators of a co-design process their vested interests had grown disproportionately over time [8]. Their influence on constructing and maintaining the participating network makes them question their own neutrality. While labelling it a co-design process, they recognize a disproportionate effort required on their part. In this respect Degnegaard (2014 citing Ramaswamy and Gouillart, 2010) makes a helpful distinction between the types of actors that initiate participation. *Inside–out* starts with the organisational resources where the organisation can include end-users in co-creating processes and new types of experiences. *Outside–in* begins with the human experience where (potential) end-users create a platform that can connect their experience to an organisation's offerings. The latter was never the case in the included studies, but its potential seems to align with findings elsewhere regarding the ability of organised user-groups (Heylighen, Van der Linden, & Van Steenwinkel, 2017) and research-based knowledge (Kirkeby, 2015) to inform design process.

Limitations

This review has several limitations. The list of search terms that comply with the definition of CRMs as we present it could be expanded on indefinitely. This is not necessarily a limitation as the field is developing rapidly and relevant terms reflect their time. Yet, as our understanding evolved, we realised that certain terms are predecessors to ones that were included (e.g., *participatory design* having been commonly used before co-creation or co-design (Sanders

& Stappers, 2008)). Similarly, knowing what we know now, we would reconsider some of the broad terms used. For CRMs, for example, we tried to list descriptive terms that were not too specific, yet often based choices regarding specificity on a surface-level understanding. Also, a more thorough understanding of synthesis and quality assessment techniques may have led to a more effective amalgamation of the materials collected in this review.

A challenge identified by Chamberlain et al. (2015) concerns the very specific and *unique identifiers* that are developed in creative practice to refer to a designed outcome. Instead of assigning keywords to indicate commonality, many designers prefer unique identifiers. While helpful to generate a mutual understanding among stakeholders, for broad searches they are an obstacle rather than asset. Unless general keywords are included, these items may be excluded entirely in a review such as this.

Possible biases concern the grey literature search where the initial screening was conducted reading titles only; the choice of English language studies only and the geographic bias intrinsic to certain databases (Bettany-Saltikov, 2010).

A consequence of conducting a systematized review is the disproportionate representation of particular studies. In two cases our search led to the including multiple items reporting on the same study. Should these have been treated as duplicates from the start? Lambert et al., who aim to inform the planning of new healthcare services, present children's perspectives on ideal *social spaces*, with an emphasis on the role of technology, in one article [9] and ideal *physical design features* in the other [10]. Similarly Heimdal and Rosenqvist [7] and Jørgensen et al. [8] report on different aspects of the same research project. Within qualitative synthesis the nuanced differences may be valuable yet the actual number of items does not correspond with the number of unique studies included.

Concluding remarks

Wherever CRMs are used, decisions made concerning participation are design decisions and to a certain extent define the type of input stakeholders can give and the knowledge that can be generated. It is therefore essential that researchers and designers make explicit the aims, what input they are looking for, how the input will be analysed and what they expect from participants and the possible outcomes. This needs to be a part of the research *and* reporting process to result in transferable insights and healthcare environments that meet the needs of its diverse users. There furthermore seems to be an opportunity for patients and other healthcare environment users to claim a place at the 'stakeholder table'. Although there is not much evidence that they are used in this way, created artefacts could have a dual role to play: to represent participants' experience in a tangible way and subsequently to illustrate or support knowledge dissemination. Finally, bringing together materials from different disciplines with a systematized approach has offered valuable insights but has inherent challenges.

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[own citation omitted to send in as 'blinded' version]

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Table 1 Descriptive findings of the items selected for review

#	Reference	CRM	Study purpose/ questions	Healthcare context	Type of building/ space	Participants/ stakeholders
1	Annemans, M., Audenhove, C. H. V., Vermolen, H., & Heylighen, A. (2014)	Image production, video elicitation, accompanied walks/rides (in hospital bed), semi-structured interviews	Providing insight into how to design future hospital buildings that address hospital patients' needs before, during, and after transport by focussing on their personal experience	In a general hospital	Route from day ward to operation room	12 patients
2	Biddiss, E., McPherson, A., Shea, G., & McKeever, P. (2013)	Iterative, 'classic' design process developing a prototype: workshops, focus group interviews & questionnaires	Designing an innovative interactive media display that addresses demand for accessible, contact-surface-free options for play	Paediatric hospital clinic	Waiting space	10 staff members, 11 children/ youths (patients & siblings for prototype evaluation), and 6 parents
3	Broberg, O. & Edwards, K. (2012)	Participatory process with 2 days of observation, 4 co-design workshops and 3 table-top simulation workshops	Developing & testing methods for organisational development in health care with focus on simulation	Outpatient department of hospital	Layout of the space	Research team of 5 people with engineering or nursing background. User group from outpatient department with 2 medical doctors, 2 nurses & 1 secretary
4	Carmel-Gilfilen, C., & Portillo, M. (2016)	Verbal, visual & written narratives were both part of the data collection and a way to present designs	Sharing strategies for promoting empathy to create empathic design solutions that foster a culture of care for patients, families, and staff	A two-storey prototype cancer care centre	The lobby, public restrooms, a resource centre & pharmacy; clinical areas & staff areas	18 senior level design studio students engaging with (former) cancer survivors, family members and caregivers
5	Cesario, S. K., & Stichler, J. (2009)	Hands-on learning opportunities, scaled magnetic boards, architectural software, mock-ups etc.	Developing graduate-level courses to prepare nurses to participate in design process/ design team	Variety of healthcare contexts where nurses could potentially participate in processes of planning and implementing change through design	For example: a renal transplant room, paediatric hospice suite, and assisted living apartment	Nurses working toward PhD; industry partners
6	Dreessen, K., Schepers, S., & Schrijvers, J. (2015)	Map-it workshops, summarizing visual map, public feedback session, 2 sessions with architects	Showing how Participatory Design (PD) methods can bring aspects of complex healthcare situations to the surface and thus inform architectural design	Healthcare and housing concept for new facilities, focus on older people.	Facility & services (early design phase)	Neighbourhood & other stakeholders (caregivers, care receivers, policy makers, …) later on architects

7	Heimdal, E., & Rosenqvist, T. (2012) (see also 8)	2 daylong co-design workshop sessions with 2D and 3D materials. Variety of PD-inspired tools to develop textile solutions	Showing the potential of PD tools for staging co-design situations and report on personal experience of those engaged in designing for hospital environment (textile design)	Existing hospital	(Textiles in) patient ward, intensive care, outpatient clinic, hospital environment in general with focus on designing for new hospital	Architects, engineers & textile experts
8	Jørgensen, U., Lindegaard, H., & Rosenqvist, T. (2011) (see also 7)	1-year co-design process (design laboratories) within 3-year long research and innovation project	Sharing & analysing experiences of a co-design process directed towards solving the problem of textiles vanishing from hospital environment	Existing hospital	(Textiles in) hospital environment in general with focus on designing for future facilities	Architects, engineers, textile designers, hospital planners; future users (patients, relatives, staff)
9	Lambert, V., Coad, J., Hicks, P., & Glacken, M. (2014a) (see also 10)	Semi-structured interviews incorporating drawings and arts & crafts to stimulate conversation. Mostly carried out one-to-one, a few workshops	Exploring young children's perspectives of hospital environments and present their perspectives of ideal social spaces	Inpatient, outpatient & emergency departments of 3 children's hospitals	The constructed environment and available opportunities to interact with family, friends and others while in hospital	55 children (5-8 years old) across 3 hospital sites. Various health conditions
10	Lambert, V., Coad, J., Hicks, P., & Glacken, M. (2014b) (see also 9)	Semi-structured interviews incorporating drawings and arts & crafts to stimulate conversation. Mostly carried out one-to-one, a few workshops	Exploring young children's perspectives of hospital environments and present their perspectives on what constitutes ideal hospital physical design features	Inpatient, outpatient and emergency departments of 3 children's hospitals	The (ideal/ perfect) hospital room and interior furnishings in preparation of the planning and design of a new children's hospital	55 children (5-8 years old) across 3 hospital sites. Various health conditions
11	Lahtinen, M., Nenonen, S., Rasila, H., Lehtelä, J., Ruohomäki, V., & Reijula, K. (2014)	4 participatory methods: strategic vision & change workshop, change survey, multi-method assessment tool and PD generator cards	Describing a set of PD methods developed or modified for developing work and service environments to better suit renewable rehabilitation processes	3 rehabilitation centres	The indoor environment	Management and staff; multi-method assessment tool also included facility manager and experts in building technology
12	Payne, S. R., Mackrill, J., Cain, R., Strelitz, J., & Gate, L. (2015)	3 sequential activities within workshop (organised 3 times): survey with open discussion, table discussions, 2D & 3D designing activity	Examining potential end users' expectations and needs regarding the physical environment to develop (recommendations for) interior design briefs for healthcare and well-being centres	Hospital as case study for future healthcare and well-being centres.	Interior of healthcare and wellbeing centre (ambulatory services)	53 Trust Members and existing Steering Group members (patients, carers, local people interested in the hospital). All were older adults. No staff members
13	Radley, A., & Taylor, D. (2003)	A simple camera; written guidelines	Critical discussion of the use of photography as		*Spaces, places* and *objects* as	Patients: 5 women & 1 man in surgery, 2

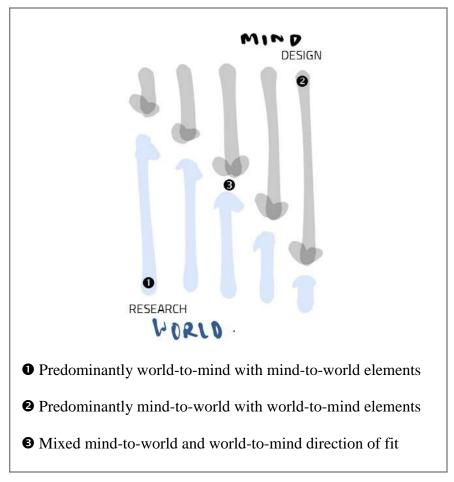|					
		about the photography exercise; sheet on which participants could plan their shots in advance; photos were taken with researcher present	method (and its implications for qualitative analysis) to discover the role the physical setting of a hospital ward plays in patients' recovery	Surgical ward (and medical ward for comparison)	presenting the patient with a psychological and social terrain across which bodily health must be recovered	women & 1 man on medical ward
14	Reay, S. D., Collier, G., Bill, A., Kennedy-Good, J., & Old, A. (2015)	Prototyping both a physical space and a relationship. Series of prototyping sessions, a Journey Map for patients, student research	To develop design-led solutions for health environments, while providing real-world opportunities to advance applied and theoretical research into how design can contribute to improved health and wellbeing	Temporary lab/ design space in Auckland Hospital	A new environment, a place for empathetic design in the middle of a healthcare context, close to demand	Students, patients, family and staff
15	Shi, L., MacKrill, J., Dimitrokali, E., Dawson, C., & Cain, R. (2015)	A paper-based tool was used to collect suggestions for improvement. 1 week later a digital tool (tablet attached to large screen) was offered to perform the same tasks	Comparative study aimed at understanding end-users' perceived engagement when using a digital tool versus traditional paper-based tools in co-designing a healthcare environment	Lab simulation of (cardiothoracic) hospital ward	4 pre-defined areas in ward: the entrance, the patient bay, the view outside and the corridor	15 computer science PhD students
16	Watkins, N., Myers, D., & Villasante, R. (2008)	5 workshops spanning 4 months	To use mock-ups to test, verify, and establish Evidence-Based Design standards for Veteran Affairs (VA) inpatient room prototypes to be used in renovated and future VA healthcare facilities	Inpatient rooms for acute care, intensive care and isolation patient rooms	Space requirements, optimum clearance for operations and optimum room configuration (including bathrooms)	71 participants: patient and staff representatives from throughout the VA healthcare system

❶ Predominantly world-to-mind with mind-to-world elements

❷ Predominantly mind-to-world with world-to-mind elements

❸ Mixed mind-to-world and world-to-mind direction of fit

Figure 1 Positioning CRM on the basis of direction of fit (author, date)

Figure 2 Study Flow

experience   **research**   **design**

❶ CRM in predominantly world-to-mind research activities [1, 3, 7, 9, 10, 11, 13, 15]

❷ CRM integrated in research activities *and* design outcome(s) [2, 6, 8, 12, 14, 16]

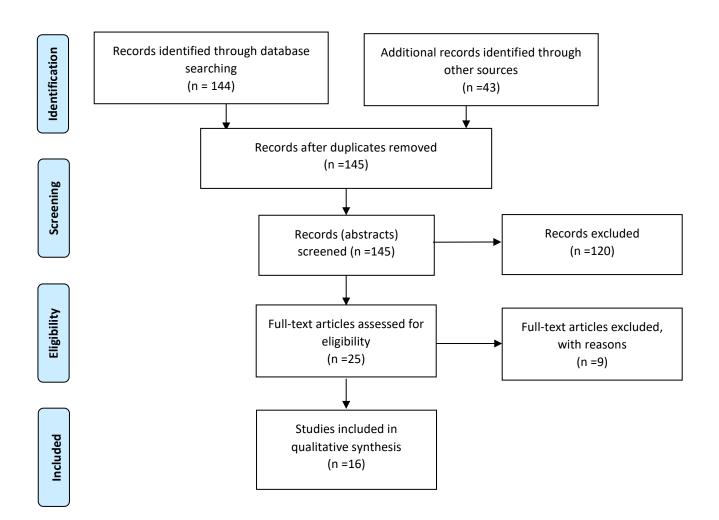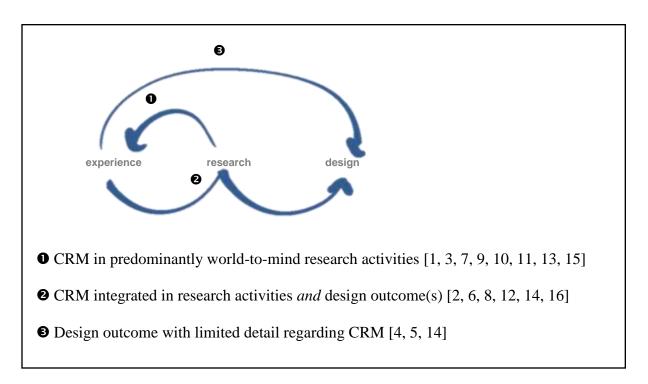❸ Design outcome with limited detail regarding CRM [4, 5, 14]

Figure 3 Situating the element with a mind-to-world direction of fit