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SYNERGY

When theory meets users in co-design: four strategies towards synergy between bottom-up and top-down input

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Abstract: In the co-design process, both evidence-based (top-down) and experience-based (bottom-up) input are important, especially in the healthcare context. While the risk of conflict is present, integration of both types of input can lead to synergetic design that encompasses the benefits of both worlds. By building on a case study in which we worked with cancer patients and oncology nurses to co-design an eHealth intervention focused on training self-compassion, this paper contributes to existing literature by exploring practical strategies to merge top-down and bottom-up input in the co-design process. The resulting strategies are: selecting (satisfy one need but not the other), combining (keeping multiple options in the design), integrating (designing a new and coherent functionality that serves both needs) and reframing (redefine perspectives in a way that dissolves the conflict). These bidirectional strategies can enable full co-creation, and further research could investigate their utility in other co-design spaces

Keywords: co-design; ehealth; evidence-based; experience-based

1. Introduction

In this paper we explore the merging of top-down and bottom-up input in the co-design process, as part of an ongoing research-through-design investigation. We draw insights from a case study in which we worked with cancer patients and oncology nurses to co-design an eHealth intervention, focused on training self-compassion skills. As design-researchers we investigate, on the one hand, what is needed to ensure that the resulting design artefacts will match and resonate with the daily experiences of the user. On the other hand, we also aim to create eHealth interventions that build on relevant medical or psychological theory. Sometimes, user requirements may collide with the theoretical evidence. The design may then be at risk of becoming a dilemma or power play between requirements that derive

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from theoretical evidence (which we call 'top-down input') and requirements that derive from acknowledging real-world, lived experiences and contexts of end-users (which we call 'bottom-up input'). When theoretical evidence-based elements are incorporated into the design, the design may be more likely to have the intended training effect by drawing from an existing knowledge base. For example, in our case we build upon knowledge of myriad benefits for well-being that training self-compassion can have, but also about what potential drawbacks or risks may be involved (thus facilitating responsible design for vulnerable groups). A research artefact should demonstrate a research contribution that is embedded in an existing field of knowledge (Zimmerman, Forlizzi, & Evenson, 2007). In our case, if the artefact does not contain substantial theoretical evidence-based self-compassion elements, then it is unclear what the artefact and its effects represent and what their meaning and contribution to the body of knowledge are. Moreover, since evidence-based healthcare is more and more the standard (Broom & Adams, 2012), evidence-based design becomes a societal design requirement in order to facilitate the financial and geographical availability of the design to users. At the same time, if the design does not match with the lived experiences of the user it is unlikely to be appropriated in daily practices (Carroll, Howard, Vetere, Peck, & Murphy, 2002) or to become part of ones' embodied and situated routines (Van Dijk & Verhoeven, 2016; Grönvall & Verdezoto, 2013). Dissatisfaction with the artefact and a mismatch of goals between the intervention and the user are common reasons for abandonment after limited or first use of an eHealth intervention. This mismatch may even illicit adverse effects such as frustration or irritation rather than generating positive emotions and feelings of accomplishment (Ludden, van Rompay, Kelders, & van Gemert-Pijnen, 2015). In that case it is unlikely that the design will have the intended effect regardless of the strength of the theoretical evidence. Therefore, a design should ideally encompass the benefits of both worlds.

Particularly in healthcare, the merging of top-down and bottom-up input is a common prerequisite. This is because its specialized knowledge-intensive context entails that solely considering user experience as the basis for design is insufficient. Both theoretical evidence-based (top-down) design approaches and experience-based (bottom-up) design approaches provide important benefits, while they each have limited merit in their isolated application in healthcare. It is in the integration of these different sources of input that a synergetic dynamic can be produced (Rosa, Borba, Vaccaro, & Leis, 2015). In recognizing that the value of top-down input depends on embedding it in the daily experiences of the users, it is necessary to foster a level of co-design that goes beyond consultation of and evaluation with users, in order to achieve integration (Carr, Sangiorgi, Buscher, Junginger, & Cooper, 2011). While the importance of integrating top-down and bottom-up input in the co-design process seems clear from existing research, not much is known about concrete, practical strategies to merge these different inputs - especially when they appear to be conflicting. In this paper we will build on our case study to explore practical design strategies for merging top-down and bottom-up input that support synergy rather than concession. The case study involved a nationally funded project by The Dutch Cancer Society with a consortium in which the University of Twente, the Medical Spectrum Twente, the University Medical Centre

Groningen and the Department for Digital Health Research from the Oslo University Hospital participated with the aim to develop a mobile self-compassion intervention for people with newly diagnosed cancer. Our main question is: what design strategies can be used to integrate top-down and bottom-up input in a design when their requirements appear to be conflicting?

2. Case study: self-compassion mobile health intervention for people with cancer

2.1 Top-down: theoretical background of self-compassion

Living with cancer entails not only physical complaints related to the disease or treatment (e.g. fatigue, nausea, pain and functional limitations), but also psychological problems (e.g. symptoms of guilt, anxiety and depression, impaired well-being, lack of acceptance) and social problems (e.g. loneliness/social isolation, absenteeism from work). While the incidence of cancer is rising (International Agency for Research on Cancer, 2019) the number of patients that need help with coping with these challenges is expected to increase. Current psychological interventions for cancer patients focus primarily on reducing distress in face-to-face settings (e.g. Van Weert et al., 2005). However, such programs reach only a small proportion of patients in need of support (Eakin & Strycker, 2001; Ryan et al., 2005; van Scheppingen et al., 2014). There is a lack of low-threshold interventions aiming to support patients in adapting to cancer and its treatment. Mobile health applications have the potential to surpass geographical and temporal barriers to care and thereby reach more patients (Silva, Rodrigues, de la Torre Diez, Lopez-Coronado, & Saleem, 2015).

Self-compassion refers to a warm, wise and kind attitude in times of difficulty and the ability to be sensitive to personal suffering (Neff, Kirkpatrick, & Rude, 2007). Self-compassion can be trained through compassion-based interventions, which usually have a modular, sequential structure and consist of core elements of psychoeducation about emotions and meditative, reflective and applied exercises. Most compassion-based interventions take place in a traditional setting of face-to-face meetings with a trainer (individual or in a group) with minimal use of technology (Austin, Drossaert, Schroevers, Sanderman, Kirby & Bohlmeijer, 2020). Key aspects of compassion training are reviewing self-criticism and shame-based thoughts/behaviours as safety strategies, developing compassionate acceptance and empathy for the origins and uses of these strategies, and developing skills such as mindful awareness and compassionate imagery to respond to difficulties (Gilbert, 2006). The intervention form or content may be adapted to the needs of the group of individual, while the sustainable cultivation of compassionate capacities and skills remains central (Gilbert, 2014). For example, people first learn to tune in to their emotions before they learn to develop compassionate acceptance towards them (Gilbert, 2006). Compassion-based interventions have been shown effective in various healthy and mental illness populations, as they yield reductions in anxiety, depression, psychological distress and increases in self-compassion and well-being (Kirby, Tellegen, & Steindl, 2017). Interventions for people with

long term physical conditions such as cancer are only emerging, though our recent review showed that they hold promise for this population (Austin et al., 2020). Furthermore, previous research at our department suggests that compassion-based interventions are also effective in self-help format (Sommers-Spijkerman, Trompetter, Schreurs, & Bohlmeijer, 2018). While the evidence is promising, it should be noted that some of these effects are still preliminary and other forms of compassion-based interventions are yet to be investigated.

A few key points from the top-down input for the design process are:

- Self-compassion requires a sensitivity to personal suffering, thus not seeing difficult emotions as 'a problem to be solved' but as an experience to have compassion for.
- Compassion-based interventions train self-compassion by using a sequential learning structure to continuously build upon acquired skills and knowledge. They rely on a mix of psychoeducation, meditative exercises and reflective exercises to cultivate self-compassion.
- While many cancer patients experience distress, few low-threshold psychosocial interventions are available and integration of technology is minimal. A self-help self-compassion intervention in the form of a mobile app may lower the threshold for cancer patients to accept an intervention.

2.2 In search of the bottom-up: a series of co-design workshops

To map the daily contexts, lived experiences, needs and wishes of our target group, we conducted four parallel rounds of co-design workshops with 3 oncology nurses and 6 cancer patients (predominantly with the same participants). Patients were 6 females and 6 males (aged 29-64 years), diagnosed between 6 and 24 months ago with a form of cancer (most commonly breast cancer and lymphoma). Nurses were 4 females and 2 males (aged 31-54 years), with 11 to 27 years of experience in working with cancer patients. The main motivation for participation was to be able to help future cancer patients. The modality of the design (smartphone-based) was determined in a prior pilot interview study with 11 cancer patients, who indicated during semi-structured interviews that their preferred modality for a self-compassion self-help intervention was smartphone-based. Since research funding was then obtained based on the premise of designing a smartphone app, the choice of modality was no longer part of the design process.

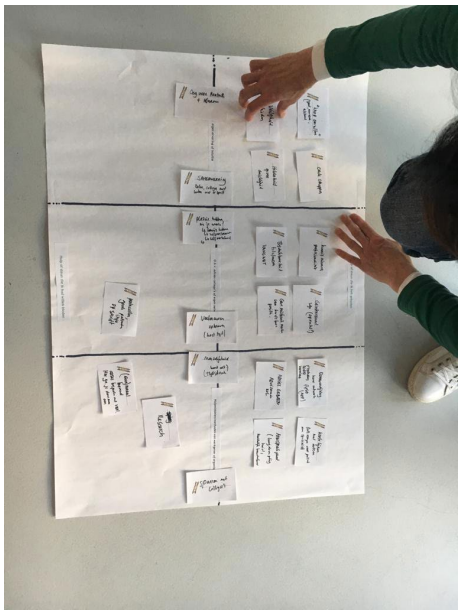
In the workshops we focused on co-designing application content (information in text, audio, video etc.), functionalities, visual appearance, and implementation and support structures of the application. The main goal of the workshops was to study the user experiences through co-design exercises. Each workshop lasted 3.5 hours and consisted of an introduction and discussion of output from the previous session, two-to-three co-design tasks and a general discussion. Further details on topics and co-design exercises are displayed in Table 1. The extent to which exercises were more structured or more open-ended depended on the objective of the co-design exercise. Moreover, co-design exercises were discussed and

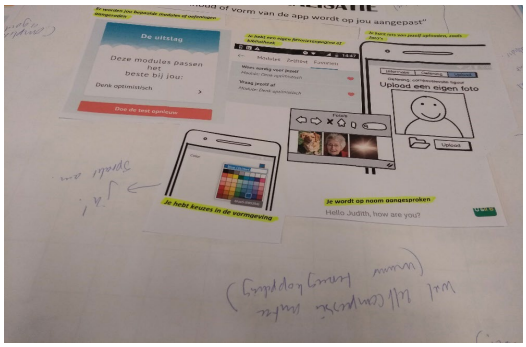
refined with our team of patient representatives before including them in the co-design workshops. Merging top-down and bottom-up input was explicitly part of the workshops, since we presented theory on self-compassion and then asked participants for their thoughts. The goal of these discussions was not just to educate participants about self-compassion, but to empower them such that they would be well equipped to contribute to the design process. For example, in the fourth workshop we presented five lessons learned from our literature review and five lessons learned from the participants' input and then discussed the resulting differences and similarities. Thus, the content of the co-design workshops was set up to facilitate the merging of top-down and bottom-up input.

A few key points from the bottom-down input for the design process are:

- Concrete, practical topics to be addressed within the context of self-compassion are valued, such as: lifestyle and taking care of the body, acceptance of the illness and functional limitations, communication with the social network (e.g. setting boundaries), positivity and appreciation of what is still possible despite physical/ functional limitations .
- Freedom to use the app in a way fitting with the personal situation and preferences is important, for example by skipping irrelevant parts and easily navigating to favourite parts.
- While personal(ized) feedback is valued, the busy and fluctuating nature of the care context precludes one-on-one monitoring of or responding to users by oncology nurses.

Table 1 Topics and co-design exercises for each of the four co-design workshops

Work-shop no.	**Topic**	**Co-design exercises**	**Visual example of co-design exercise**
1	Problem exploration and exploration of self-compassion	-Mapping of individual obstacles and helpful tools in dealing with the cancer diagnosis, visualized as rocks and ladders - Mapping of support that was or was not present from oneself/ own network/professionals after the diagnosis, using a card sorting method - Identifying individual moments of self-compassion (on green post-its) and self-criticism (on blue post-its) in relation to the diagnosis, then categorizing them in groups	

2	Content of the intervention	- Trying out various self-compassion exercises on paper in the two weeks prior to the workshop - Building a desired app and an undesired app represented on paper smartphone models, by categorizing and altering the self-compassion exercises - Identifying additional topics and exercises to be addressed in the app, by adding and altering to topics identified in workshop 1	
3	Features, visual design and use of language	- Trying out other psychosocial apps in the week prior to the workshop - Presenting the used apps to each other in small groups, highlighting positive and negative user experiences - Creating a map of the similarities and differences in the experiences of functionalities in these apps, focused on: filling out and sharing information, motivational elements, feedback, personalization and mode of information - Exploring language use in the app by playing a card game in which the story of the app was presented with five different ways (based on metaphors) on five cards, where participants “played out” their preferences - Creating a diagram of the way the app could be offered and supported by nurses (when/to whom/how/how often)	
4	Structure and flow of the intervention	- Shaping the flow of and processes within the app, using cardboard boxes representing different app modules to write on and move around - Creating paper prototypes of parts of the app using both defined (e.g. printed buttons) and undefined (e.g. random stickers) materials	

3. Towards synergy: strategies for merging top-down and bottom-up input

The results of the workshops provided input for designing the content, functionalities and visual appearance of the mobile intervention. In this paper we focus on the design process and use the results of the co-design workshops to illustrate our design strategies. In some cases top-down and bottom-up input were aligned and could be merged effortlessly. In other cases top-down and bottom-up requirements mostly matched, but the content or functionalities required some modifications (e.g. making the content more concise or realistic). In other cases, top-down and bottom-up requirements did not match and appeared to be conflicting. These are the cases that required co-design strategies to facilitate synergetic design decisions. In order to arrive at these strategies, we used reflection, field notes and process evaluation. All co-design workshops were evaluated with participants at the end of the workshop via group discussion and anonymous feedback forms. After each workshop researchers further evaluated the workshops and the design requirements using field notes, feedback forms and transcripts of the workshops. Output of all workshops was analysed and clustered by the main research team, which included a designer and two psychologists, focusing on types of strategies as they emerged during the sessions, in attempts to resolve any apparent tensions between opposing bottom-up and top-down requirements. We concluded that the employed solutions in the workshops could be categorized into four main strategies: selecting, combining, integrating and reframing. We will discuss these now, based on examples from our case study. See Figure 1 for an overview of the strategies.

3.1 Selecting: satisfy one need but not the other

For our intervention, we envisioned that nurses would have an active role within the application, by monitoring patients' progress or giving personal feedback. We know from previous research that interaction with a caregiver can increase effectiveness of eHealth interventions in general (Kelders, Kok, Ossebaard, & Van Gemert-Pijnen, 2012) and compassion-based interventions in particular (Sommers-Spijkerman et al., 2018). However, in the co-design exercises with nurses that addressed their role in offering and guiding the intervention, it became clear that they found an active supporting role within the application not feasible. Nurses described the chaotic nature of their work, the amount of information and questions they already have to process and the fact that the self-compassion intervention should only be a small part of their daily tasks. After considering the options we decided that an interactive communication function will not be part of the design, since the chances of nurses making use of a functionality that does not meet the reality of their work are slim. Therefore, despite the possibility of reduced efficacy of the design, we chose to satisfy bottom-up but not top-down needs.

3.2 Combining: keeping multiple options in the design

Having a modular learning structure is central to most compassion-based interventions,

in order to build upon previously acquired skills and knowledge (see Austin et al., 2020). While intervention content can be adapted and the personal learning process is not linear, sustainable cultivation and building of compassionate capacities and skills are key (Gilbert, 2014). Compassion-based interventions often start with psychoeducation and basic awareness of the breath, body or present moment experiences before incorporating more specific compassion practices. Since self-compassion exercises involve an awareness of personal suffering, it is important not to start these exercises without the necessary preparation. On the other hand, in our workshops some end-users clearly indicated that they wanted immediate in-the-moment support or inspiration. They anticipated that they would open the application at a moment when they would want input, with the expectation that the application will offer this input promptly. Concurrently, they expressed doubts about having to go through a lot of material before accessing a relevant suggestion or about not having instant access to all relevant material. Since both the modular structure and the usage needs of end-user are important design requirements, we decided to combine both needs in the design by including a sequential structure of self-compassion modules to acquire skills and a homepage with directly accessible features for immediate support. These features are based on the needs of end-users and include among others a short daily exercise that does not require much preparation and a page with practical information and links. Thus, when accessing the intervention, the user will have the choice between exploring the homepage features or starting/continuing with the modular training. The modular training and the homepage features will be interlinked, since the homepage features will refer to module items for further information or practice and there will be a list of marked favourite module exercises accessible from the homepage. In this way, we combined different needs in the design by including separate functionalities, while interlinking these functionalities to provide coherence.

3.3 Integrating: designing a new and coherent functionality that serves both needs

Mood tracking can empower users to have a more active role in their wellbeing by enabling them to reflect on their mood (Caldeira et al., 2017). With self-report mood tracking, users are asked to manually enter their emotional state, usually on a text-based or illustrated/ animated scale. Mood tracking can serve creating greater awareness and may also facilitate behavioural change (Kanjo, Al-Husain, & Chamberlain, 2015). In our design we intended to include a basic mood tracker in order to facilitate greater awareness and self-regulation of emotions, which in turn can facilitate compassionate responding to these emotions. Since self-compassion requires a sensitivity to personal suffering without seeing the suffering (e.g. a bad mood) as a problem to get rid of, we did not intend to provide recommended actions based on the user input. However, when participants tried out different apps that included mood trackers, some participants posited that this functionality and the increased awareness of mood is only useful to them if a suggested action is coupled with the input. In addition, participants repeatedly communicated through discussion and through prototypes the wish to enter a negative mood in order to get a suggestion on how to handle the mood.

Therefore we decided to design a different type of mood tracker were participants get personalized feedback that facilitates compassionate responding to the mood while also offering suggestions for further practice (e.g. offering a self-compassion exercise or linking to a module). In this way, we integrated a top-down need (mood tracking for greater self-awareness) with a bottom-up need (getting solutions for feeling bad) into a new functionality (mood tracking that offers compassionate suggestions based on input).

3.4 Reframing: redefine perspectives in a way that dissolves the conflict

Compassion-based interventions train self-compassionate capacities using a mix of information provision (psychoeducation) and various experiential exercises. These exercises enable participants to engage with their own difficult experiences and to practice with compassionate responding. In our workshops participants expressed a need for gathering and receiving a plethora of information about cancer diagnoses and treatments, local health care options and lifestyle tools and tips. It appeared that many patients go through a phase post-diagnosis where they try to gather as much information as possible related to their diagnosis. Seeking information can be a constructive strategy in response to illness (Campos, Besser, Ferreira, & Blatt, 2012; Grönvall & Verdezoto, 2013), however participants repeatedly mentioned that this action often made them feel overwhelmed. In addition to the fact that an extensive bibliography of information does not match the varied components of compassion-based interventions, it also seems that 'getting more information' is not necessarily what patients are seeking as such. We may *reframe* their desire for information as being a coping strategy through which participants attempt to regain grip on their situation, given their recent diagnosis, and that regaining grip is ultimately not achieved by consuming extensive amounts of information. With this reframing we were able to incorporate the need for getting a grip on the situation in other ways, such as by stimulating users to take moments to pause and step back from their situation, which did match the evidence-based aims of the application. Thus, by reframing a need we allowed for an alternative solution to be produced (Paton & Dorst, 2010).

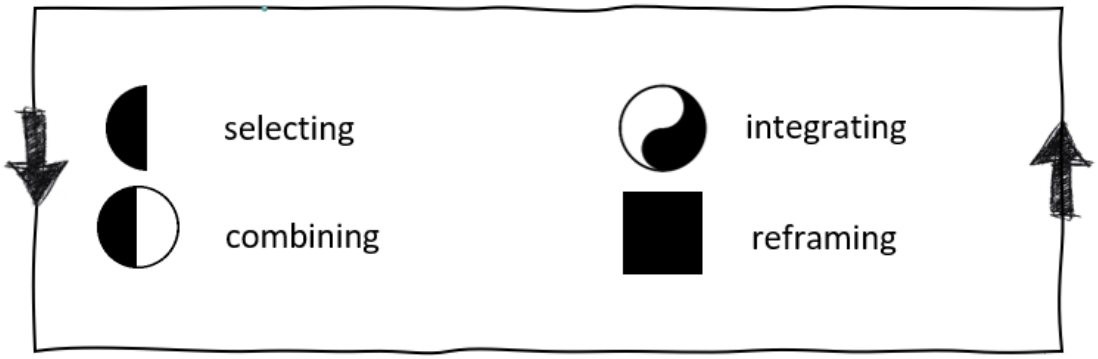


Figure 1 *Practical strategies for merging top-down and bottom-up input in co-design when requirements appear to be conflicting.*

4. Discussion

We started out suggesting that in co-design, it is important to merge requirements based on theoretical evidence ('top-down input') with requirements derived from mapping the lived experiences and everyday contexts of end-users ('bottom-up input'). Sometimes these requirements may be in conflict, thus posing a challenge to the design researcher to solve this conflict in a way that strengthens, rather than weakens the design outcome. Trade-off decision making is inherent to design (Howard, 1997). However the challenge is not just one of making a straightforward trade-off between requirements, because the requirements in question cannot be easily compared and ranked given their fundamentally different sorts of validity: grounded in theoretical evidence on the one hand, and grounded in the lived, human experiences of the co-design participants on the other hand. Analogously, we can look at the way merging top-down and bottom-up input has been investigated in health care research. The rise of evidence-based medicine on the one hand (using the best available evidence to inform healthcare), and shared decision making on the other hand (based on patient autonomy and enlarging the patients' control over health decisions) has created a complex dynamic (Barratt, 2008). For example, a patient may choose a medical treatment based on their personal lifestyle/life-orientation preferences, whereas empirical evidence shows that the chosen treatment yields suboptimal effects. In health-related and psychosocial interventions, a conflict between top-down and bottom-up input reflects, more often than in other design contexts, friction between what is healthy or beneficial for the patient in the long-term, and what is matching the needs and wishes of the patient in the short-term. For example, top-down input sometimes represents knowledge of beneficial behaviours or cognitions with delayed benefits (e.g. moderate alcohol intake, practicing acceptance of suffering), while bottom-up input then represents behaviours or cognitions with immediate gratification (e.g. enjoying multiple bottles of wine, avoidance of suffering) (Lawless, Drichoutis, & Nayga, 2013). On the other hand, bottom up factors can also represent a long term benefit, sometimes missed by top-down generated intervention strategies. For example, in designing interventions for the elderly (Steen, 2012) or for people on the autism spectrum (Spiel, Frauenberger, Fitzpatrick & Keyes, 2019), we see how healthcare interventions may be effective 'in theory', but will in practice not have a long-term effect if this intervention if people do not appropriate the intervention within their everyday lives. As described in the RE-AIM framework for healthcare interventions, factors such as adoption and reach of the intervention are crucial in addition to evidence of efficacy in ensuring intervention success (Glasgow, McKay, Piette, & Reynolds, 2001). To ensure long-term benefits of an intervention, meeting both top-down and bottom-up requirements involves engaging the users with the artefact in the present moment, while also ensuring the evidence-based long-term benefits in a way that makes sense to the user and leads to sustainable appropriation of the intervention in daily life. To achieve a merging of top-down and bottom-up requirements, we have explored four practical design strategies based on a series of co-design workshops. These workshops represent a co-design context of down-to-earth exercises that remained close to the already determined modality of a smartphone platform (as opposed to, for example, fantasy-driven co-design exercises). Nevertheless, we

expect that the four strategies are relevant in other healthcare co-design contexts in which friction between top-down and bottom-up requirements is common.

Our first strategy. 'selecting', is based on the question "*Can (or should) one of the requirements be satisfied but not the other?*" This is a common strategy, since the pragmatics of the design process often do not allow for a combination of functionalities (Howard, 1997). Designing means making choices, and thereby not leaving all the choices for the end-user to be made. In a study on trade-off decision making among designers, Howard (1997) found that designers often see alternatives as mutually exclusive while attempting to synthesize or otherwise manipulate them is much less common. However, the other three strategies we propose are more a matter of generating rather than choosing alternatives. The second strategy, 'combining', points to the question "*Can the perspectives be combined by keeping multiple options or aspects in the design?*". Combining different design elements is at the heart of creation, and can create novel solutions (Simon, 1995; Boden, 2003). By combining different requirements, multiple requirements and their associated benefits can be met in a single design. The third strategy 'integrating', points to the question "*Can the perspectives be integrated in a new and coherent functionality that serves both needs?*". This applies when conflicting top-down and bottom-up requirements share an apparent common ground or link that can be exploited to create a new functionality that serves both needs. The fourth strategy, 'reframing', points to the question "*Can one or both of the perspectives be redefined in a way that dissolves the conflict?*". Reframing allows for a problem to be seen in a qualitatively new way, which means to revisit some of the underlying assumptions and concepts, on the basis of which the situation was up to then conceived. It is often seen as a key step in design thinking (Paton & Dorst, 2010). By reframing the conflict between top-down and bottom-up input, the conflict can sometimes be dissolved, allowing for different requirements to emerge with their own associated design solutions. Which (combination of) strategies should be used most likely depends on the specific co-design process and the context of technical, theoretical, social, financial and user-based requirements that have to be taken into account. Trade-off decision making greatly varies in the complexity or simplicity of the decision making and the key elements and arguments involved (Howard, 1997). We therefore suggest that there is no hierarchical structure to the proposed strategies, but that their use depends on the context of each decision to be made. What is crucial in each of the strategies, in our view, is to resolve the apparent conflict through design, exploring various options by using a variety of the strategies just described, rather than attempting to judge a priori which of the requirements, bottom-up or top-down, are 'most' important.

While the focus of this paper is on merging top-down and bottom-up input, this is not to suggest that top-down and bottom-up input are the only key sources of information, nor that they are internally homogeneous. The design context includes health care practices and regulations, governmental and insurance policies regarding healthcare interventions, project scope and requirements, differences between end-users, and various top-down theories (e.g. about participatory design, psycho-oncology, eHealth etc.). Furthermore, certain aspects of top-down theoretical input may not have been thoroughly researched yet, thus making it

challenging to determine how important their implementation is in the face of opposing user needs and experiences. In that case, the co-design process may further inform the theory by trying out different iterations and monitoring their effects. The iterations can then serve as scaffolds to generate shared understanding (Van Dijk & Van der Lugt, 2013). Similarly, not all users have the same needs, values and experiences. Particularly in our workshops, differences between users' preferences were often present and these differences require their own resolving strategies. We speculate that our strategies could apply to apparent conflict between different end-users or other types of information sources. For example, when 'combining' different requirements in a design, designing for personalization may further cater to different user preferences. Thus what we have shown to be already a complex relation between top-down and bottom up, in reality expands into a much more complex network of information sources, most of which cannot be readily compared but must be integrated nonetheless into a coherent design. Further research could investigate the utility of these strategies in other types of co-design spaces as well as with other types of information sources. Furthermore, it would be interesting to explore whether designers using explicit co-design strategies create more feasible, creative or effective designs than designers who do not.

Noteworthy, the term evidence-based is sometimes misused as a demand for recognition of the validity or even superiority of protocols or procedures, thereby undermining the dependence on bottom-up input to allow for real-life implementation (Carr et al., 2011). If synergy is to be achieved, the benefits of both sources of input need to be integrated as part of a mutually informative process (Carr et al., 2011; Rosa et al., 2015). We would like to emphasize to approach the co-design process as such and to see the suggested strategies as bidirectional options. For example, when 'selecting' requirements, in some cases it may be prudent to choose an alternative based on top-down input and at other times bottom-up input may take prevalence. Building on the work of Sanders and Stappers (2008), we illustrate our strategies as part of a mutual co-design approach (see Figure 2). Our work contributes to the ongoing movement in design research from the predominantly unidirectional user-centred design approach to a dynamic co-design approach (Sanders & Stappers, 2008). The suggested strategies offer applicable tools for design researchers in healthcare and other contexts to support their co-design practices.

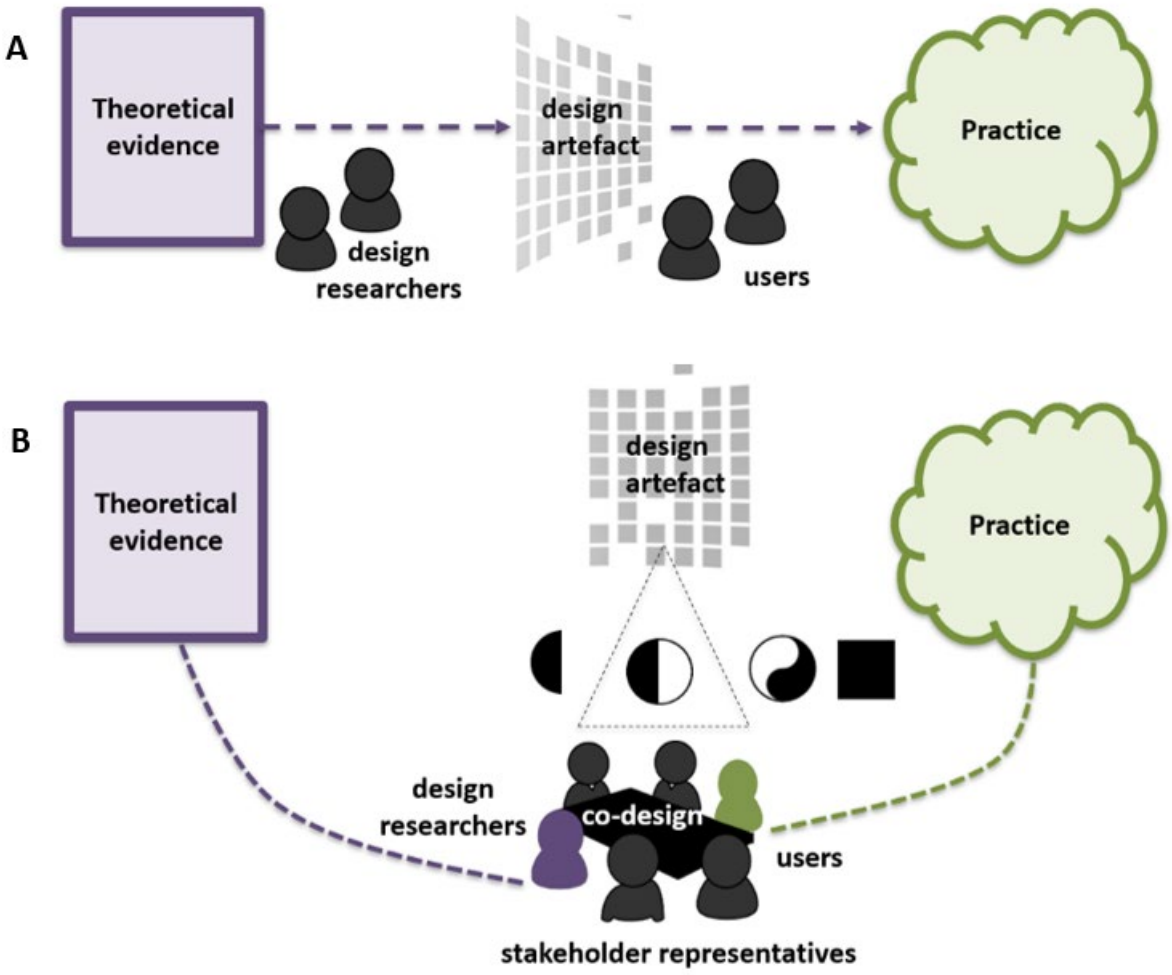


Figure 2 *A) depicts a user-centred design process, often presented as co-design, that adapts theoretical evidence to the user while B) depicts a co-design process in which theoretical evidence (top-down input) and user requirements (bottom-up input) are merged in a co-design process by using the four strategies.*

5. Conclusion

Based on a case study in which we worked with cancer patients and oncology nurses to co-design an eHealth self-compassion intervention, we explored strategies for merging top-down and bottom-up input in the co-design process. The strategies that we propose to resolve apparent conflicts between top-down and bottom-up requirements are: selecting (satisfy one need but not the other), combining (keeping multiple options in the design), integrating (designing a new and coherent functionality that serves both needs) and reframing (redefine perspectives in a way that dissolves the conflict). These bidirectional strategies serve as tools to aid the co-design process in a way that promotes synergy rather than concession. Further research should investigate the application of these strategies in

other co-design projects and explore their benefits and applications as well as other potential useful strategies.

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