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Abstract: This paper explores how to design for the value of compassion by means of multi-sensory design. It reports on a study with 77 university students, carried out in the context of a design master course. The study consists of two parts: the first one focuses on defining the value of compassion and its expressions, through sensory modalities, the second one focuses on embedding the expressions in design of caring and non-caring products. Through a student-led case study, we describe the entire design process, subject of the study. Finally, by analysing the results of the study, we critically reflect on how the expressions were embedded in design. This paper provides methodological exploration into designing for the value of compassion and informs the research on designing compassionate technology for healthcare and wellbeing.

Keywords: compassion; value sensitive design; multisensory design; design for health and wellbeing

1. Background

1.1 Compassion and Wellbeing

The value of compassion is present in many cultures, with different definitions and connotations, however its relevance for society is extensively recognized. Compassion is at the core of many religions, such as Buddhism, where it is described as "the wish to remove the suffering of all sentient beings" (Hughes, 2019). Importantly, compassion is considered to be at the core of the working alliance between doctor and patient (Galetz, 2019) and is one of the founding principles of care (Faith, 2013). For instance, the term 'compassion fatigue' is used to describe the struggle of healthcare workers to continuously feel for- and provide compassion to patients, especially in critical care contexts, such as cancer treatment or end-of life care (Ho et al., 2019). In addition, compassion has been reported to promote

wellbeing, support mental health (Feldman & Kuyken, 2011) and reduce stress (Cosley et al., 2010). Still, what is compassion and why is it so important in healthcare?

Its definition varies: Gilbert (2010) has referred to compassion as a motivational system that responds to negative feelings, while Goetz et. al (2010) refer to it as a distinct emotion. In particular, the authors state that *compassion* differs from *love* at the level of the antecedent events (Goetz et al.; 2010). While the latter has primarily positive antecedents (for example the realization of love and security), the former responds to the suffering of someone else, where the consequence of said suffering falls on the other person (Goetz et al., 2010). In 2016, Strauss et al. give an overview of the existing definitions of compassion and the ways it can measured in an extensive literature review. The review shows compassion is widely recognized to be oriented towards reducing the suffering of others (Strauss et al., 2016). The authors then propose a new procedural definition of compassion as an interpersonal, cognitive, affective, and behavioral *process*, divided in five different steps:

> "Recognizing suffering; 2) Understanding the universality of suffering in human experience; 3) Feeling empathy for the person suffering and connecting with the distress (emotional resonance); 4) Tolerating uncomfortable feelings aroused in response to the suffering person (e.g. distress, anger, fear) so remaining open to and accepting of the person suffering; and 5) Motivation to act/acting to alleviate suffering. (Strauss et al., 2016, p. 6)"

Because of the meaning and relevance of compassion with regards to *care*, a growing stream of research is looking to incorporate it in healthcare practices to improve the quality of patient care (Bleazard, 2020; Craig & Sprang, 2010) and to alleviate burnout in doctors, nurses, therapists and caregivers (Bleazard, 2020; Craig & Sprang, 2010). Within mental healthcare, (Gilbert, 2009) introduced Compassion-Focused Therapy, a new form of therapeutic treatment based on compassion. Similarly, many novel compassion-based treatments are arising, along with validation methods, such as Neff's questionnaire (Neff, 2003) that measures self-compassion and empathy. Compassion-based technological interventions are also being introduced in (mental) healthcare and for the general population, they often involve the use of new technologies, such as: virtual reality (Baghaei et al., 2020), 3D visualization technology for emotion regulation (Guriţă et al., 2019; Pradana & Buchanan, 2017), self-compassion chatbots (Lee et al., 2019) and social robots to support and teach social interaction (Heljakka et al., 2020). Designing compassion-based technological interventions is still a new topic. While the human-to-human dynamics of compassion have been analyzed and researched by different authors (Catarino et al., 2014; Goetz et al., 2010; Strauss et al., 2016), more research is needed to explore and clarify the human-technology dynamics with regards to compassion, and to explore the process of designing compassionate technology for healthcare and wellbeing (Kemp et al., 2020). The question of *how design can promote compassion* is still a challenging one, by addressing it, we also aim to contribute to the body of work on designing for values (by designing for compassion). To investigate the practical side of designing for compassion, this paper employs a multisensory design approach (Schifferstein, n.d.), this methodology allows us to

assign tangible, sensorial qualities to otherwise abstract values. In section 1.4 we provide background to the approach and its connection to studying compassion. To our knowledge, this is the first time that the multi-sensory design approach has been applied to design for compassion. In figure 1, we created a schema to visualise the approach and the topics described in this paper.
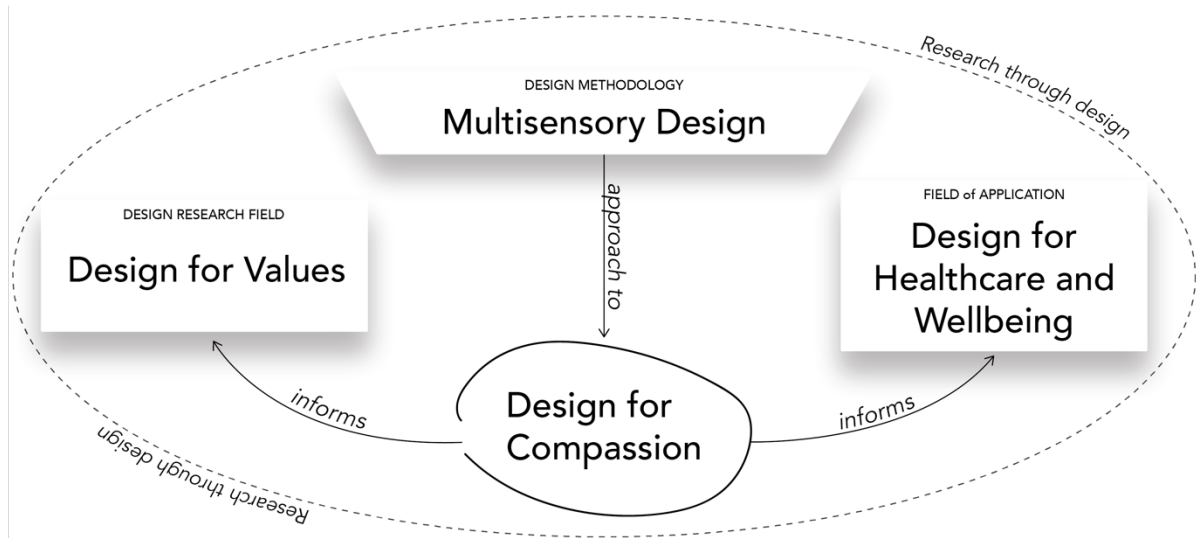

Figure 1. This schema visualizes the relations between the disciplines addressed, and the approach described in this paper. The central topic we explore is Designing for Compassion, for Healthcare and Wellbeing. To explore this, we employ a multisensorial approach to Design for Compassion, thus informing on Design for Values in a new way, within an explorative Research through Design study.

1.2. Design for Values

Through designing for compassion, this study informs on the practical process of designing for values, below we will further go into how compassion can be conceptualized as a value. In this paper, we refer to the word 'value' as what a person, or a group of people, consider important in life (Friedman et al., 2013). In 1996, Friedman talked about values as emerging from the interaction with a tool, a technology and how we choose to use them (Friedman, 1993). In the same papers, the author described Value Sensitive Design (VSD), a theoretically grounded approach that investigates the role of values in the evolution of the design process (Friedman et al., 2013). Since then, VSD has allowed designers to address ethical questions of responsibility, especially important when approaching new technologies, where new or unexpected values may emerge. Further methodologies observe and identify values throughout the design process. Smits et al. (2022) developed Values that Matter (VtM), a tool for designers to observe what values are present in the design, at any point of the creation and implementation process. In both VtM and VSD, the authors recommend that designers identify the values at stake in innovation processes and concretize the chosen ones in the final design. In this regard, the present study identifies compassion as a central *value* for healthcare and wellbeing and explores how to intentionally embed it in design.

In successful VSD, the design is to be (partly) informed by values, the designer has to translate values in design requirements (van de Poel, 2013). In fact, while the presented methods have been developed and adopted to explore the design of values in technology, they do not inform designers on how to design for specific values in the materialization of a product. This study aims to further inform on the implications of designing for values, and through a hands-on approach: multisensory design, with the aim to develop insights into how values could physically translate into products. We explain more about the approach in the next section.

1.3 The multisensory design approach

This study adopts the multisensory design approach (Schifferstein, n.d.) to explore embedding compassion in design, by deriving design requirements from the value of compassion in the form of sensory qualities. The multisensory approach allows the designer to assign tangible qualities to abstract values, thus providing a valuable tool to explore such a broad topic as designing for compassion, where a lot is still to be explored. By exploring the sensory qualities of compassion, we investigate both the contribution and message conveyed by the different sensory cues to the experience of compassion (Cortés et al., n.d.). The user's expectations on a design might be formed in different ways: from memories of past experiences, perceptions of the current sensory stimuli, and inferences drawn from related experiences, such as trial of other objects (Tolman, 1932). Therefore, the embodied sensory qualities can define the values technological products are expressing only to some extent. As Shimojo and Shams stated, our interactions are usually cross-modal interactions, they take place across multiple sensory modalities (Shimojo & Shams, 2001)thereby making our experiences blended, complex and shaped by all our senses. The goal of multisensory design is to explore abstract concepts and give them sensorial connotation, thus informing both design of tangible products and research on design for values and emotions (Rousi et al., 2017).

1.4 Expressions of compassion

In previous chapters (1.1), we stated that the question of how design can promote compassion, is still a challenging one and deserves further research. This question was first proposed in 1993 by B. Friedman about user autonomy, its answer seemed to be more complex than expected: "autonomy is protected when users are given control over the right things at the right time" (Friedman, 1996, p.3). Friedman and Nissenbaum then proceeded to "*identify aspects of the systems that can promote or undermine user autonomy*".

For the purpose of this study, we identified different aspects of compassion, both to investigate the multifaceted value that is compassion, and, to facilitate its embedding in design by breaking it down. We brainstormed with experts in mental healthcare to understand how we could translate the different aspects of compassion into *expressions of compassion*. This led to four different expressions of compassion, we will present them below by going through the procedural definition of compassion proposed by Strauss et al.

(2016) previously introduced in this paper (see 1.1). This definition is particularly interesting from the point of view of design, as it includes different phases of the compassionate interaction and aspects of compassion. 'Recognize suffering' is connected to being serious, heartfelt and sincere, qualities required to acknowledge someone else's suffering to ourselves and to the other. The second step 'Understanding the universality of suffering' is related to being vulnerable and humble, as it allows to see the bigger picture and shrinking ourselves in comparison to other (Neff, 2003). In the fourth step, courageous is linked to the ability to stay with and bear difficult feelings that accompany suffering (Gilbert et al., 2017). Finally, the fifth step was connected to being authoritative, required to act with confidence and empathy based on all previous four elements. Sincere, humble, courageous, and authoritative describe the balance of both the empathic, kind, warm, open-minded caring aspect, and the more strong, assertive one. Catarino et al. (2014) distinguishes between genuine and submissive compassion, choosing to focus on the former, as its submissive interpretation can lead to compassion burn-out, or compassion fatigue.

These expressions were selected to fit the design brief and better support the design exploration on compassion: breaking down the value of compassion enables us to work investigate each aspect of compassion singularly. At the same time, new questions arise, such as: do all the expressions need to be embodied for a design to be called compassionate?

2. Methods

This paper presents the first iteration of an explorative, on-going research through design study (Gaver, 2012), on embedding the value of compassion in design with a multisensory design approach (see Figure 1). The study was carried out in the context of the 'Multisensory design' course, within the Master Programs of Industrial Design Engineering and Interaction Technology, at the University of Twente. It ran over a three-month timespan and included 77 master students of mixed gender. Cause of the explorative nature of the study, no further demographics were collected. However, it is important to acknowledge that most of the students were of Dutch nationality, therefore the sensory references chosen to describe compassion may be rooted in cultural experiences and may not be shared by everyone.

Due to the Covid19 measures in place at the time, the course was almost entirely held on the Canvas platform, in the form of online lectures and presentations. The students were divided into 14 groups, autonomously chosen. The course is divided in two parts: the expression exploration (1), and the design brief (2).

In the first part, the students were asked to choose one of the expressions of compassion (humble, sincere, courageous, and authoritative), and define it across the five main sensory modalities (visual, auditory, tactile, gustatory, olfactory). The exploration lasted four weeks, in which the students collected materials and selected sensory qualities for the chosen expression of compassion. In conclusion of this first phase, each group created a visual presentation and shared their view on the expression with the class.

The expected result of the expression exploration is to have a collection of sensory qualities that describes the chosen expression of compassion. This multisensorial approach allowed us to build an understanding of compassion, that goes beyond theory, in the following ways: (1) it informs the choices in the design process (i.e., materials, finishing, shape, texture); (2) it allows us to reflect on how the value translates in design, and the implications of said process.

In the second part of the course, the students were asked to embed the chosen expression in different caring and non-caring products categories. The included products part of our daily care, that contribute to our wellbeing, such as: a toothbrush, an alarm clock, and a pill dispenser. We also included an opposite category, the category of weapons, designed to cause harm when used. While the former category is intrinsically closer to the caring part of compassion, the latter appears significantly further away from it, in that it has the potential to create suffering, rather than responding to it, as compassion does. This study makes use of the contrast between the above-mentioned categories to observe how each one can embody the expressions of compassion, how they are transformed by the value and how they differ in this.

At the end of the design brief, the students were asked to visually present their final concept in an online Canvas session, and to write a short report that summarized the design process. While presentations narrated the researched materials visually (the sensory qualities, the sketches and design concepts), the reports added reflections from students on the design choices and inspirations over the entire course of the study. To further understand those motivations and inspirations, and critically reflect on them, this paper draws from the students' reports and presentations.

3. Results

In this study 77 students divided in 14 groups, first explored expressions of compassion (humble, sincere, courageous, and authoritative), and subsequently embedded them in design. In Table 1, we summarized the results of the expression exploration. The table reports on the most common qualities connected to each expression, divided per sensory modality, providing an overview of the sensory cues that linked to the expressions of compassion.

Table 1 (and over). Sensory qualities divided per expression.

Expression	Vision	Touch	Taste	Smell	Sound	Sensory (In) Congruency
Humble	Round	Soft	Creamy	Warm	Low volume	Incongruency between soft look and hard
	Neutral, pastel colors	Airy	Fresh	Organic	Low pitch	

Expression	Vision	Touch	Taste	Smell	Sound	Sensory (In) Congruency
	Organic, abstract shape	Warm	Subtle	Subtle	Calm	material to the touch.
	Minimalistic	Uneven surface	Slightly sweet	Gently sweet	Continuous	
	Small	Malleable			In the background	
Sincere	Transparent or white	Can be both smooth and rough	Authentic	Organic	Unpolished	Congruent and predictable. There should be congruency between tactile and visual sensory cues.
	Simple shape	Warm	Homemade	Fresh	Continuous	
	Natural Pattern (specific to that material)	Thick	Recognizable	Pungent	Nature sounds (wind, leaves, birds)	
	Matte surface	Both soft and hard	Strongly present	Recognizable		
	Imperfect surface		Unprocessed	Can be both subtle and strong		
Courageous	Highly saturated colors	Rough	Intense	Intense	Loud	Sensory congruency across qualities.
	Spiky	Hard	Burning	Burnt	Rhythmic	
	Bulky	Heavy	Crunchy	Contrasting	Rumbling	
	Contrasting colors and shapes	Sturdy	Row (not necessarily edible)	Spicy	Beating	
		Can be both warm and cold	Unknown	Salty	Low-pitched	
Authoritative	Neat shape	Cold	Spicy	Strong	Both low and high pitch	
	Sharp edges	Firm	Strong	Recognizable	Overbearing	Sensory incongruency between the burning taste and coldness to the touch.
	Bulky	Weighed	Smokey	Smokey	Solemn	
	Red, dark colors	Pressured	Bitter	Dry	Clear	
		Hard	Recognizable	Herbal, nutty	Loud	

In Table 2, we can observe an overview of the groups, the explored expressions, and the products. 2 groups chose the authoritative expression, 3 groups chose humble, 4 groups chose courageous, and 5 groups chose sincere. At the final concept stage, the following products were presented: 2 toothbrushes, 4 pill dispensers, 6 alarm clocks and 2 weapons. Both pill dispensers related to authoritative, while the alarm clocks were mostly connected with courageous and humble. After the expression exploration, the students were given the choice to include one or more expressions in the chosen product category, 4 groups decided to add one expression as seen in Table 1. Each group was free to choose the expression and product to work on.

Table 2. Overview of the expressions and products investigated in the second part of the study. The table also shows which expressions are connected to which products, and which expression were embedded together in the second part of the study.

Group	Expression	2nd expression	Product category
1	Humble	Courageous	Alarm Clock
2	Humble		Alarm Clock
3	Humble		Weapon
4	Sincere	Courageous	Toothbrush
5	Sincere	Courageous	Pill Dispenser
6	Sincere		Weapon
7	Sincere	Authoritative	Pill Dispenser
8	Sincere		Alarm Clock
9	Courageous		Alarm Clock
10	Courageous		Alarm Clock
11	Courageous		Toothbrush
12	Courageous		Alarm Clock
13	Authoritative		Pill Dispenser
14	Authoritative		Pill Dispenser

Furthermore, drawing from Table 1 and 2, we will shortly discuss the role of sensory (in)congruency on informing design decisions. To provide some background, sensory (in)congruency has been studied in relation to the surprise effect: while different types of sensory information, that are congruent, may enhance the perceived expression of a product, sensory information that is incongruent may cause a surprise reaction towards a product (Ludden & Schifferstein, 2007; Ludden & van Rompay, 2015) . In Table 1, we can observe that four Groups included information on sensory (in)congruency in their reports. For the courageous and sincere toothbrush, Group 4 stated that the design should match

the expectations of the user about visual and tactile stimuli. In the same way, Group 6 found that the sensory experience of a sincere weapon should be congruent and predictable. Conversely, when exploring authoritative, a sensory incongruency was described in the copresence of a burning gustatory quality, and coldness to the touch, and of both low and high pitch. From this, we can observe how sensory congruency is specific to the expression and relevant to its embodiment in design.

Finally, as this paper presents a study carried out in the context of a University Master Course, the results of the design brief vary greatly from project to project, from student to student. To better describe how the students went from exploring expressions of compassion to embedding them in design, in the next chapter we introduce a case study describing the process of designing a *humble* weapon. The chapter also serves to introduce the discussion in Chapter 5 on how the different expressions contribute to the embodiment of compassion in design.

4. Case study: Flower bomb, humble weapon

This chapter presents a case study on the design of a *humble weapon*. Through this case study we intend to further describe the explorative design process of embedding the expression into a non-caring product, in this case a weapon. In the first part of the course (expression exploration), the group collected sensory attributes for *humble*, shown in Table 3, and defined the expression through auditory, visual, olfactory, gustatory, and tactile sensory qualities. In the group's exploration, humble is seen as round, small, characterized by neutral colors or transparent; it feels tepid, smooth, soft, and creamy; it has a fresh and warm aroma, a subtle taste, and produces raw, calm sounds.

Table 3. This table shows how the sensory attributes collected in the first part of the course were used to inform the design choices in second part of the course.

Vision	Design	Touch	Design	Audition	Design	Olfaction	Design
Round	Sphere	Soft	Eventually melts	Calm	Soft sound even when it explodes	Fresh	Perfume of flowers
Neutral colors	Sugar glass, Transparent, opaque	Smooth	Smooth surface of the glass			Warm	Odor of sugar and earth
Transparent		Subtle	Thinness of the sphere glass material	Raw	Unpolished sound of explosion, with earth scattering	Soft	
Minimalistic	sphere						
Small	Can held in hand						

In the second part of the course, the group proceeded to embed *humble* in the design of a weapon. Since the expression and the product intrinsically embody different values and goals, a humble weapon provides a very interesting case for exploring how the expression modifies

the all-round experience. As the group stated in the final report: "aggression, loud noises, anger, and pain are likely associated with weapons, all emotions and qualities that would not be considered humble" *(quote from Group 3).* The typical scenario of a weapon has potential to hurt someone, as this is contradictory to humble, closer to caring for the other, a caring weapon needs another goal. For this reason, the group developed a flower bomb (Fig. 1). As stated in the group's report "to spread love is humbler than to hurt somebody". In this concept, the flowers become the weapon, an idea inspired by the flower power movement of the 1970's.
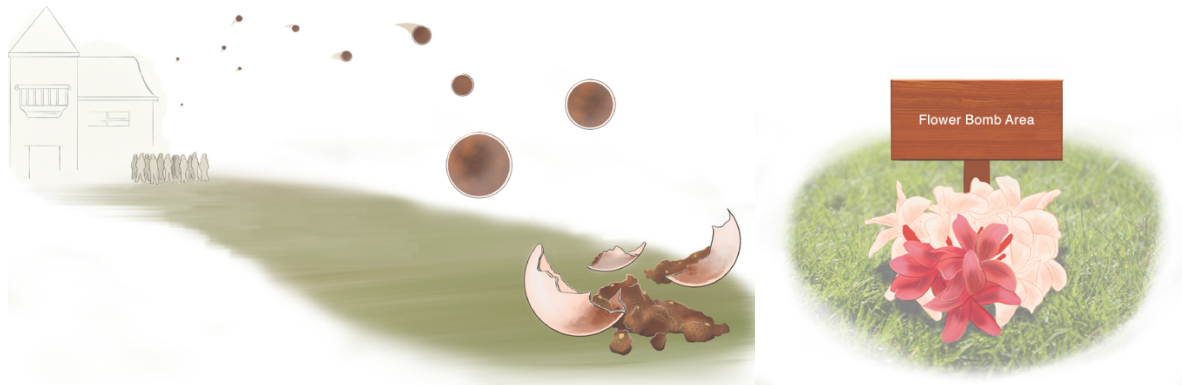

Figure 2. Flower bomb, humble weapon. Illustration of final concept. In the image on Design developed by the students: Sterre van Arum, Wilke de Jong, Silke Jonkman, Leon Klement, Frederique Voskeuil.

The flower bomb is a mix of soil and flower seeds, enclosed in a sugar glass sphere, as shown in Fig. 2. It was designed to be used during events or ceremonies as a memorial and celebrative gesture, where the user will throw, roll, or place the 'bomb' on the ground. When the glass sphere hits the ground, the fragile material breaks, and, when the soil is watered, the sugar glass dissolves into the ground. The flowers will start appearing with their normal growing process, allowing for a delayed surprise and reward. The plant and flowers will also serve as reminder of the event and trace of the bomb, a sign can be placed on the ground to commemorate the event.

5. Discussion and implications

In this section, we discuss the results of the study on embedding compassion in design. First, we will address the relevance of each expression in conveying compassion, then we will discuss our conclusions on the contribution of the expressions for design for compassion.

5.1 Is one expression enough to convey compassion?
In the example of an authoritative pill dispenser, the device is characterized by a strong and recognizable smell, a clear and neat visual appearance and is hard to the touch. We argue that such sensory cues make it possible for it to portray authoritativeness but fail to convey the caring aspect. In contrast to the pill dispenser, we consider a humble and courageous alarm

clock in Fig. 3, that contains visual, olfactory, and tactile sensory inputs. The student group felt inspired to use light as a predominant awakening feature of the alarm clock, as it embodies the idea of a humble way to wake up. In particular, the light was designed to come from within the alarm clock, as well as upwards towards the user, a wall, or the ceiling. The *light from within* could be considered both courageous because of the energy shining from within, as well as humble because of the indirect light and softness on the eyes.
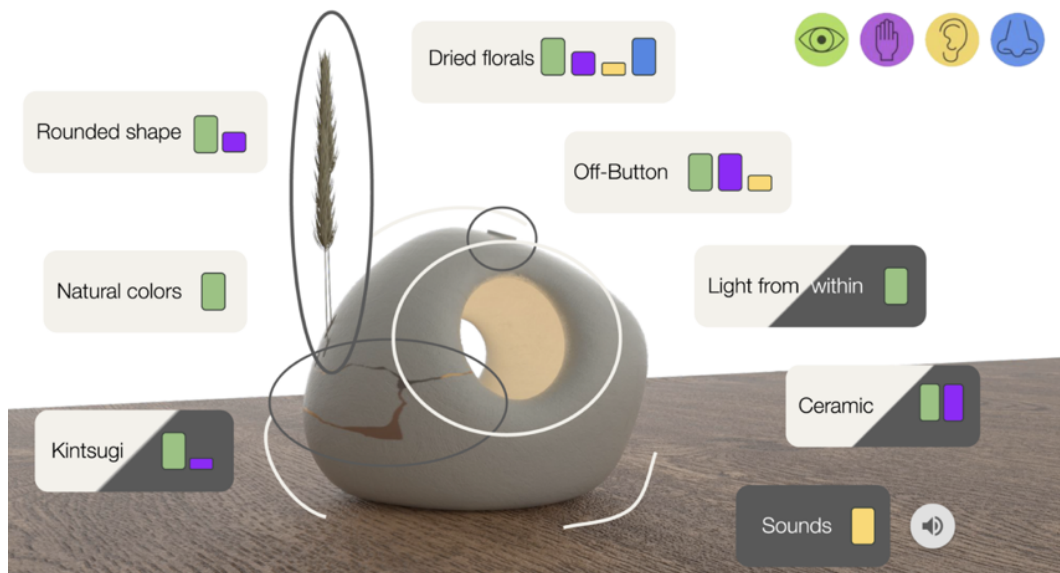

Figure 3. Lux Natura, humble and courageous alarm clock. Final concept. Design developed by the students: Åström, Joep Eijkemans, Amanda Kullberg, Rinalds Kugis, Elisa Nguyen, Nora Tunc.

Special attention was paid to additional characteristics that highlight the humble nature of the clock, as well as a courageous backstory; these were visually translated into the Kintsugi art form and an analogue clock to display the time. Kintsugi refers to the Japanese art of mending broken ceramics with gold. If we compare the *authoritative pill dispenser* and the *humble and courageous alarm clock*, we can argue that the latter expression embodied in the product led to a more complete experience of compassion than the authoritative expression. This leads to the observation that authoritative alone might be insufficient to embody compassion, while humble, sincere and courageous might be closer to conveiyng to compassion even when embodied alone

Therefore, we can observe how compassion does not only relate to painful negative situation, but to the broader spectrum of deep emotional states that move a person. For this reason, we argue that a single expression alone is not enough to support compassionate interaction or successful embodiment of compassion. The complex dynamics of compassion occur in the context of an interaction, and include strong, courageous, assertive, empathic, and genuine responses to the suffering or to the feelings of others.

5.2 Competing values: between interaction modalities and values

The interaction modality of a product holds an intrinsic value (Poel, 2013), for example the bomb usually has strong, violent connotations. It is normally characterized, among other things, by heat, strong smells sudden bright light and extremely loud sounds. What is the role of compassion in this scenario and at what point does it modify the interaction modalities or the experience? The example of the flower bomb suggests that experiences change when the value of compassion comes into play. For instance, the humble bomb will rather roll into place or be gently positioned, instead of being thrown. Similarly, the strong smells, loud sounds of explosion and the bright light are replaced with a soft, delicate crackling, no light but the reflection on the surface and earthy, sweet smell. Moreover, it is important to consider how the user's energy, gesture, and movements embody the compassionate expression. In the flower bomb example, it is important to discuss that both the stereotypical bomb and the humble bomb can be placed, rolled into place, or thrown, however the sensory cues following this act greatly differ in the two cases.

However, there is a conceptual problem with the weapon category, as a category rather than a particular product (bomb, gun, mine, etc.), it induces different considerations and reflections on what a weapon is and weather it can have a purpose different than hurting the other.

> *"Associations one will most likely have with a weapon are things like aggression, loud noises, anger, and pain. All things that would not be considered humble. This is mainly caused by the most common use scenario of a weapon, which is to use the weapon to hurt someone". (Quote from Group 3)*

In chapter 5, we present the humble weapon case study to observe how both caring and non-caring products evolve when designed for (expressions of) compassion. The group continues affirming that "as hurting someone is contradictory to humble, since humble is more about caring for someone or something, this is something to move away from". During the design assignment, the students explained how the weapon had to lose its aggressive, violent connotation to find a more caring meaning or goal. This new reading of what a weapon can be, derives from the intentional embodiment of the humble expression in the design process of a bomb. Therefore, it appears that 'humble' is indeed a powerful expression and brings a significant meaning that can lead designers in their choices, "to decide the whats and whens" (Friedman, 1996, p.3). In conclusion, while the interaction modalities may be in contrast with the sensory cues, it is the sensory information together with the object's function and goal, that define the values embodied in a design.

6. Limitations and future work

In this section we present the limitations of our explorations and our vision for the future of research on design for compassion.

Defining the compassionate expression as comprehensively as possible in the design process can be challenging. As it can also be the case for understanding compassion or suffering

(Joshanloo, 2014), there is a relevant risk of cultural bias. As B. Friedman (1996) stated: "pre-existing bias has its roots in social institutions, practices, and attitudes".

For example, while defining the 'authoritative' expression, a group of students presented examples of negative and positive authority in "Ruler Archetypes". In particular, the students differentiated positive and negative authority, by giving examples of political leaders. In the positive examples they presented Barack Obama and Martin Luther King, while indicating Kim Jon Un and Adolf Hitler as the negative ones.

While differentiating between positive and negative authority might be relevant and helpful to understand the expression, the presented example clearly shows a culturally biased understanding of positive authority. This presents an ethical problem, where being intentionally aware of the cultural perspective from which we are defining our expression is fundamental for a successful translation of the value or expression into the final design, in other words, to be intentionally aware of our cultural perspective and adapt it to the target user or context you are designing for. This is a generally relevant principle in design, but it becomes even more important in the context of design for values, as to design for a value it is necessary to first define it (Merlijn et al., n.d.).

In the future, a broader exploration is needed to better understand how to practically design for values. Specifically, we need experimentation (user evaluations) to provide evidence that this is an effective approach that will indeed lead to products that people experience as compassionate. Finally, we will need to study transport this knowledge in more complex settings such as design of systems in the real-world context, that are behaving in a compassionate way as well as embodying compassion.

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