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An Investigation of Empathy in HCD

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Abstract

In this study, we investigated empathy within a human-centered design context. While empathy is a well-researched subject within the field of psychology, there is little experimental research on its application in design. As such, the term "empathy" is often thrown around with a lack of clarity about what it actually means in design courses. Empathy is a complex psychological phenomenon that allows us to respond to and understand others' emotions, but it is unable to be "turned on." This study specifically aims to address the question of whether or not empathy is actually used within design. Participants completed two self-report surveys—one on trait empathy (the Interpersonal Relativity Index) and another on empathy in design (Empathy in Design Scale). Results from the study were analyzed using a simple linear regression, and revealed that participants with higher trait empathy also expressed higher empathy when thinking about design.

Key words: Design, Human-Centered Design, Empathy

Introduction

In recent years, there has been a significant rise in Human-Centered Design (HCD) across various design domains, emphasizing the need for empathic understanding in the design process. HCD is an iterative problem-solving approach that integrates the needs, desires, and experiences of end-users into the design process (IDEO.org, 2015). In contrast to traditional design methods that primarily "put aesthetics over usability," HCD places human experiences at the forefront of design, considering them as crucial elements in the creation of successful and impactful design solutions (Norman, 2021).

At the heart of HCD is the principle of empathy, which serves as the bridge between designers[1] and end-users.[2] Within HCD, empathy is realized through a method of user research known as empathy interviews, which are the cornerstone of the design process (IDEO.org, 2015). These interviews involve designers actively engaging with end-users to collect insights, understand their experiences, and establish a strong sense of empathy towards their needs. Essentially, they are intended to give designers a deeper understanding of the target audience, thereby enabling them to create design solutions that are not only functional but also truly resonate with the users' real-life needs and desires (*Empathy Field Guide*, 2015).

In other words, empathy is what distinguishes HCD from other design approaches. When designers empathize with users, they gain valuable insights that inform the entire design process, from problem definition to ideation, prototyping, and testing.

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[1] Defined by Chang-Arana *et al.* as "design practitioners and researchers."
[2] The person (or people) for whom a certain product is made.

Yet, within the context of HCD, empathy interviews may not be universally effective because they assume that all designers possess inherent empathic skills, which may not be true for everyone. This assumption is rooted in the belief that designers, by nature of their profession, are adept at understanding and relating to the experiences of end-users. However, this hypothesis challenges this assumption and suggests that the effectiveness of empathy interviews in guiding HCD may vary depending on the level of empathic skills possessed by designers.

Here, we will explore the role of empathy in HCD, focusing on the significance of empathy and its effectiveness in guiding the design process. To investigate our hypothesis, we will first delve into the psychological definition and types of empathy, such as affective and cognitive empathy, as well as the trait/situational influences on empathy and the importance of empathic understanding. We will then look into research on empathy in design and empathic training, emphasizing how designers often overlooks psychological understandings of empathy when assessing its necessity for design. Finally, we will highlight implications for future research in the field of empathy in design.

I. Coming to a definition of empathy

Empathy is an important part of everyday human interaction, as it enables us to understand and respond to others' emotions, inspiring prosocial behavior. Without it, effective communication and social interaction would be greatly compromised. Despite the seemingly straightforward nature of the term (we've all heard of the metaphor "put yourself in someone else's shoes"), it actually encompasses a rich and nuanced meaning that has evolved over time. Even within the field of psychology, there has been an

extensive ongoing debate regarding the definition of empathy and its various components, resulting in multiple interpretations that can be overwhelming at times (Batson, 2009; Cuff *et al.*, 2016).

Achieving a consensus on the definition of empathy is imperative, particularly if we intend to explore its role in design. While it's not feasible to explore all interpretations comprehensively, the subsequent examination of the term will provide a concise clarification of its multifaceted nature, establishing a foundational understanding of how empathy can be effectively used in design (Chang-Arana *et al.*, 2022).

What we commonly understand as empathy, the theoretical projection of oneself into another's perspective, is a psychological concept referred to by Theodor Lipps (1903) as *Einfühlung* (German), literally meaning "feeling into," and which was translated into the English word *empathy* by the renowned psychologist Edward B. Titchener in 1908 (Batson, 2009; Steuber, 2019). Notably, at the time, empathy was primarily associated with aesthetic understanding (OED; Steuber, 2019; Lanzoni, 2018; Lanzoni, 2019). It wasn't until much later that its meaning expanded to encompass delving into the emotional experiences of others (OED; Steuber, 2019).

In psychology, the concept of empathy is commonly divided into two primary categories (*cognitive* and *affective* empathy), along with a proposed third one, empathic concern (Cuff *et al.*, 2016). All of these aspects are integral to a comprehensive and multidimensional understanding of empathy (see *Figure* 1).

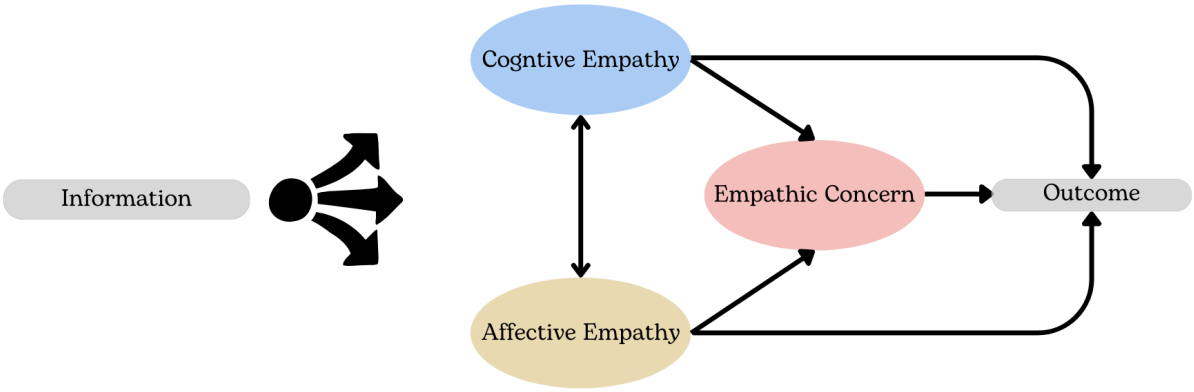


Figure 1: Structure Model for Empathy and Related Concepts. Depicts a nested model where components of empathy (affective and cognitive) interact with one another and can (but do not necessarily need to) produce empathic concern and related behavioral outcomes.

Cognitive empathy

Cognitive empathy (or empathic accuracy, perspective taking and theory of mind) refers to the capacity to understand another person's perspective, thoughts, and emotions (Chang-Arana et al., 2022; Bloom, 2017). In other words, it allows individuals to adopt another's psychological perspective and make accurate inferences about what they are feeling (empathic accuracy) (Hodges *et al.*, 2009,).

Affective empathy

Affective empathy (or emotional empathy), on the other hand, is characterized by the emotional response that is elicited when one perceives and shares the emotions of another (Chang-Arana *et al.*, 2022). It involves not only the observance of another person's emotional experience, but also a "connection with another person's emotional state" (Olderbak *et al.*, 2014, pp. 1). As such, affective empathy often leads to selfless reactions towards others, such as helping or engaging in other behaviors that are concerned with others' welfare (Hodges *et al.*, 2009; Olderbak *et al.*,2014).

Empathic Concern

In addition to cognitive and affective empathy, a third form, known as *empathic concern* (or prosocial concern), is sometimes separated from affective empathy (Batson, 2009; Weisz & Cikara, 2020; Håkansson & Montgomery, 2003). This form of empathy specifically involves responses driven by empathic feelings towards another, such as helping behavior (Weisz & Cikara, 2020; Chang-Arana *et al.*, 2022).

Given the above breakdown of the various parts of empathy, it is easy to see the complexity at arriving at a singular definition. Cuff *et al.* (2016), in their review of 43 different definitions of empathy, precisely defined empathy as follows (emphasis added):

> Empathy is an *emotional response* (*affective*), dependent upon the interaction between *trait capacities* and *state influences*. Empathic processes are automatically elicited but are also shaped by top-down control processes. The resulting emotion is similar to one's perception (directly experienced or imagined) and *understanding* (*cognitive empathy*) of the stimulus emotion, with recognition that the source of the emotion is *not one's own*.

This definition is a valuable foundation for the subsequent section for two reasons. Firstly, it has been instrumental for clarifying empathy within the domain of design (Chang-Arana *et al.*, 2022). Secondly, their definition highlights several key components that shape empathy, including trait capacities, state influences, and understanding (cognitive empathy), all of which will be explored further.

However, it is worth noting that Cuff *et al.*'s definition omits the behavioral implications of empathy (empathic concern), which are essential for understanding empathy in the context of design. In the following section, we will further investigate

these main elements of empathy, offering specific research examples to provide further insight.

II. Empathy as a psychological phenomenon

Empathy is a psychological phenomenon that occurs "both within and between individuals" (Håkansson & Montgomery, 2003, pp. 267). In this context, empathy can be viewed as *interpersonal*, that is to say it is a reciprocal process. Given this, it is imperative for designers draw insights from psychological research about empathy when examining its role in design. While several design researchers have made comparisons between psychological definitions of empathy and its application in design (Chang-Arana *et al.*, 2022), very few have actually examined empathy in psychology beyond its basic definition. As noted above, investigating the basis of empathy, whether it arises from innate or contextual factors, is crucial for understanding the accuracy of empathic responses. The following section goes into greater detail about trait capacity and state influences, shedding light on how these factors influence empathic accuracy. This insight is key for designers, as it provides a foundational understanding of why empathy interviews may not always be the most suitable method for the design process.

Trait capacity or state influence?

One fundamental question that psychologists have debated over is whether empathy is a stable, innate capability (*trait capacity*) or context specific (*state influences*). Evidence suggests that empathy is a result of the interaction between both innate biological processes and contextual factors (Cuff *et al.*, 2016).

From a biological standpoint, the intricate networks within the brain, particularly the insula and the mirror neuron system, play a critical role in empathy. Key aspects of empathy, such as self-awareness, social cognition, and the sensorimotor system, rely on functions integral to the insula, which facilitates subjective experiences (Uddin *et al.*, 2017; Gu *et al.*, 2013). Further support for the role of the insula in empathy comes from Fan *et al.*'s meta-analysis of fMRI studies, which revealed that the right anterior insula was associated with affective empathy, while the left insula is linked to both forms of empathy. Moreover, the mirror neuron system (MNS), found in brain regions such as the insula, premotor inferior frontal gyrus and the limbic system, plays a crucial role in empathy. As noted by Rajmohan and Mohandas (2007), these specialized neurons encourage individuals to imitate the actions of others, thereby promoting social communication and the development of empathic relationships.

Indeed, according to Decety *et al.* (2012), many empathy-related behaviors have been identified as evolutionary advantageous. One such example is a neural circuit located in the medial preoptic area (MPOA) in the rostral hypothalamus and adjoining bed nucleus of the stria terminalas (BTS) which is crucial for maternal responses. This circuit is believed to form the basis for empathic concern, suggesting that the neural mechanisms underpinning empathy may have evolved from those associated with caregiving and parental behavior. Taken together, these neurological foundations of empathy collectively suggests that, in general, people possess the inherent capacity for empathy.

However, while empathy is generally considered to have innate biological foundations, variations in empathic abilities among individuals have been attributed to factors such as gender, genetics, and other differences. Research has provided

substantial evidence for gender differences in empathy, as demonstrated by Christov-Moore *et al.* (2014, 2019). In their MRI study, they investigated whether there were neurological distinctions between men and women when observing another person's pain. Participants watched videos of individuals experiencing either painful needle pricks (test) or non-painful cotton swab touches (control), with the researchers measuring the blood oxygen level dependent (BOLD) signal in their brains to identify differences in brain activity. Their finding indicated that women exhibited a greater proficiency than men at understanding and deeply connecting with the emotional experiences of others (Christov-Moore & Iacoboni; 2019). Moreover, recent research has revealed additional biological factors contributing to differences in empathy, including levels of the hormone oxytocin (Andari *et al.*, 2010; Hurlemann *et al.*, 2010), damage to specific brain regions (Baren-Cohen *et al.*, 1994), and even genetic predispositions (Warrier *et al.*, 2018).

Evidence also supports that empathy is also activated by contextual factors. For instance, empathy can be influenced by cultural background and values (such as individualism/collectivism) on social interaction and empathic response (Heinke & Louis, 2009). As explored by Heinke & Louis (2009), collectivism, which prioritizes group collaboration over the individual, is linked to higher levels of empathy. These cultural values can shape how individuals perceive an engage with others, emphasizing the importance of context in understanding empathy.

Contextual cues also play a vital role in shaping empathic responses. Whether it's encountering someone in need or observing someone in pain, these external stimuli can trigger varying degrees of empathy depending on the specific context, as noted by Lishner *et al.* (2020). Additionally, the observer's personal orientation towards a target,

including how much they value them (Batson *et al.*, 2007), can influence the level of empathy experienced in a given situation. This dynamic and ever-evolving nature of empathy emphasizes its interactive nature, shaped by a blend of external influences and internal predispositions. Acknowledging the dual influence of both trait capacity and state influences is crucial in comprehending the intricacies of empathy within design.

In essence, empathy is not an all-or-none phenomenon but rather a complex interplay between a number of factors, including an individual's empathic capacity and context. Given this, it is essential to acknowledge that not everyone possesses the same capacity for empathy due to biological differences. For instance, individuals with brain impairments may have limitations in empathetic practices, whereas those with higher levels of oxytocin might naturally excel in this area. Gender differences also come into play, suggesting that men and women may approach empathy interview differently. Consequently, not everyone may be suitable for engaging in empathy interview practices, as they might need more deliberate efforts to enhance their empathic skills.

Furthermore, contextual influences, such as emotional arousal and situational factors, can significantly affect the manifestation of empathy, leading to fluctuations in empathic responses. As a result, designers must be attuned to these influences to foster effective empathic understanding in the design process. This may involve enhancing their observation and social communication skills to adapt to the ever-changing dynamics of empathy. Ultimately, incorporating empathy into design requires a nuanced and flexible approach, one that acknowledges the psychological underpinnings of empathy, as inaccurate emotional interpretations could lead to flawed design outcomes. In the next section, we will discuss the importance of empathic accuracy, emphasizing the reasons why it is not just beneficial but essential to the design process.

Empathic Accuracy (Understanding)

Empathic accuracy, often associated with cognitive empathy, refers to the "degree to which a perceiver is able to accurately infer the specific content of another person's successive thoughts and feelings" (Decety & Ickes, 2009, pp. 57). This ability is crucial in various professions committed to helping those in need, including design. As Batson (2009) noted, however, feeling for someone doesn't always require an accurate perception of their emotions. When it comes to addressing another person's needs effectively, especially in a professional context, the importance of accurately diagnosing their thoughts and feelings cannot be overstated (Batson, 2009). It is only by accurately recognizing these needs that one can provide the appropriate support and assistance.

The accuracy of empathic understanding has been widely researched in the field of psychology, however very little of these findings have been applied to design work. Notably, Hodges and his colleagues researched the role of similar experiences on empathy, emphasizing the importance of empathic accuracy. In their study, women's empathic reactions were measured as they watched videotapes of new mothers describing their experiences during pregnancy. Interestingly, it was observed that perceivers who had personally gone through childbirth expressed greater empathic concern compared to women who had not given birth. However, there was no difference in empathic accuracy between these two groups, suggesting that experience similarity alone doesn't necessarily lead to a deeper or more accurate understanding of the specific experiences of others (Hodges *et al.*, 2009, p. 406). Similar findings were reported for perceivers who consider themselves similar in personality to a speaker (Heinke & Louis, 2009). Additionally, Eklund, Andersson-Stråberg & Hansen (2009) acknowledged the

relevance of the perceiver's previous similar experience on empathy, even proposing that it might serve as an "antecedent" for empathy.

Moreover, research by Israelashvilli *et al.* (2020) demonstrated how one's own evoked emotions can impede the understanding of others' emotions, leading to the insertion of personal memories and inferences into the recollections of others, thus resulting in potentially incongruent empathic interpretations. In other words, individuals often tend to generalize others' experiences, drawing from their own experience and personality similarity in the process (Hakansson, 2003). While these findings suggest that similarity in personality and experience do not significantly increase empathic accuracy, a study conducted by Stinson & Ickes (1992) demonstrated that closeness in relationship (such as being friends) can indeed enhance empathic accuracy. This leads us to propose that fostering friendship-like relationships and improving emotion recognition are the most effective ways to enhance empathic accuracy and, consequently, design outcomes.

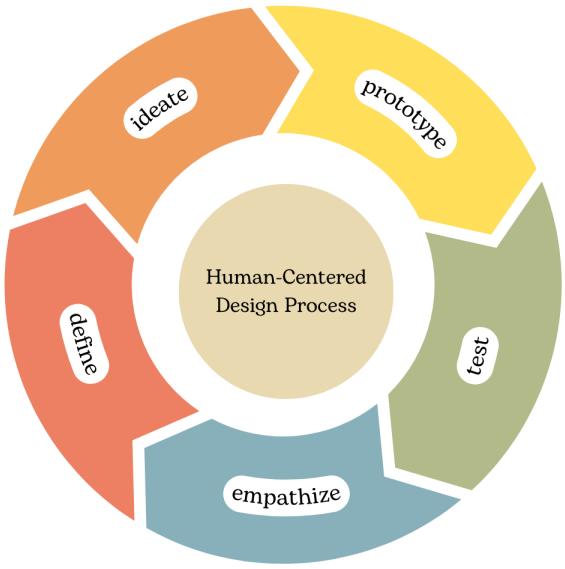
Building upon the insights from Batson (2009) regarding the significance of empathic accuracy in promoting prosocial responses, it becomes apparent that designers should prioritize the development of accurate empathic understanding to effectively inform their design solutions. One design flop that highlights the importance of empathic accuracy is the electric scooter company Bird. Founded in 2017, Bird was inspired by the founder's experiences with his children and its mission is transform transportation by contributing to "less traffic, cleaner air, and safer streets" (Bird). However, the e-scooters did *not* create safer streets and incentivized riders to recklessly use them, causing dangerous accidents and even several deaths. If Bird's designers had actually empathized with its intended users (adults commuting to work), they could

have accurately understood their needs and designed a better emission-free mode of transportation.

Furthermore, since empathic accuracy requires both the empathizer and the target to be actively engaged in the process, the efficacy of empathy interviews must be examined. These interviews typically assume a one-way process in which designers automatically aim to create something to help the target. This can create an imbalance in the interview between designers (who will personally gain something) and users (who might not gain anything). As a result, it is important to critically examine the accuracy of the current model of empathy interviews accurately reflects the complexities of empathic understanding. The subsequent section will provide a brief discussion of the details of empathy interviewing.

III. Empathy in design

HCD is fundamentally rooted in empathy, emphasizing that truly understanding the intricacies of people's lives is the key to discovering innovative solutions (IDEO.org). The HCD process typically comprises six stages: (1) empathize, (2) define, (3) ideate, (4) prototype, (5) test, and (6) reiterate, as outlined in several HCD field guides (IDEO.org, 2015; D. School, 2015) (see Figure 2). In this section, I will briefly outline what an empathy interview entails and then provide some context on research related to the use of empathy in design, shedding light on the reasons both in favor of and against its application.



"Human-centered design is about **cultivating deep empathy** with the people you're designing for; **generating ideas**; building a bunch of **prototypes**; **sharing what you've made** with the people you're designing for; and eventually, putting your **innovative new solution** out in the world." —IDEO.org

Figure 2: Human-Centered Design. Illustrates the HCD process, showing how it is an interactive method of designing that follows the above definition of HCD provided by IDEO.org.

Empathy interviews

Empathy serves as the initial first stage of the design process, serving as inspiration for design projects. Within the HCD field guide, various methods are detailed for fostering empathy, including, historical/secondary research, immersion, analogous settings, and observational exercises (IDEO.org, 2015). However, empathy interviews are considered "the crux" of HCD, as emphasized by IDEO.org (2015, pp. 39), the international design firm that pioneered HCD. IDEO.org's (2015) field guide to HCD provides explicit guidelines for conducting these interviews, with a key emphasis on asking open-ended rather than yes-or-no questions.

A more comprehensive outline of empathy interviews written by Stanford's D. School underscores the interview's purpose in eliciting "specific stories about what [the] interviewee does, and more importantly, thinks and feels" (2015, pp. 6). The insights derived from these interviews, which are further developed in the subsequent stages of the HCD process, ultimately from the foundation of any HCD project (see Figure 3).

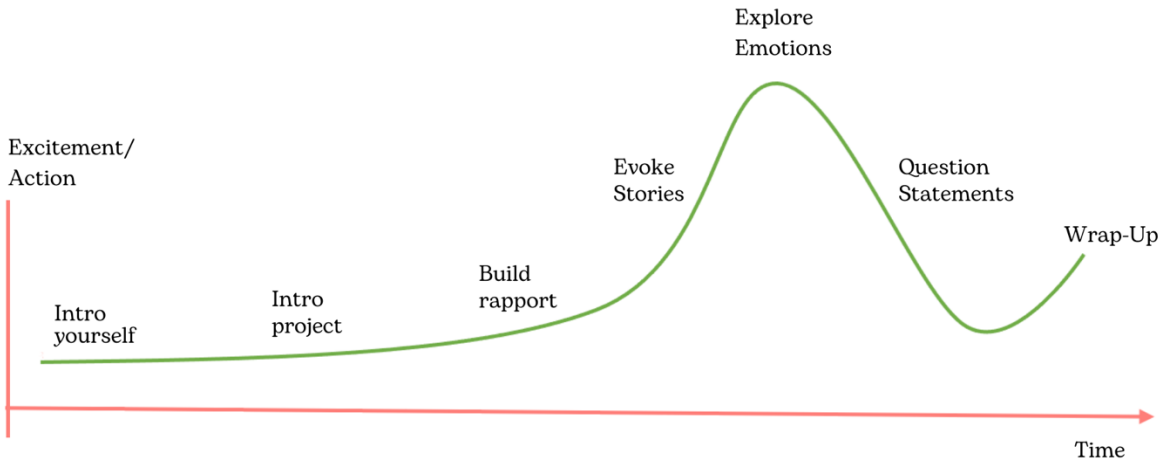


Figure 3: Anatomy of the Interview Process. Shows the different stages of an empathy interview, adapted from Michael Barry, a lecturer at Sandford's D. School.

Previous research on empathy in design

As previously noted, there is a lack of systematic research on empathy in design. While some design researchers (Chang-Arana *et al.*, 2022) have attempted to address this gap in knowledge by drawing insights from psychology to clarify the concept of empathy in design, there remains a scarcity of empirical studies in this domain. Nonetheless, these reviews offer valuable insights into the current conceptualization of empathy in design and its correlation with psychological principles. Among the notable studies that have contributed to this discourse are by Surma-aho & Hölttä-Otto (2022) and by Chang-Arana *et al* (2022).

Surma-aho and Hölttä-Otto's (2022) research addressed the deficiency of systematic research on empathy in design by combining knowledge from design, social psychology, and neuroscience to determine how empathy is conceptualized in design research and how can it be operationally defined. Through employing keyword searches and snowball sampling, they found articles about empathy in design, which they then quantitively coded to compare conceptualizations of empathy. Their findings identified five core concepts, many of which have been previously discussed, that form empathy in design: understanding, research, action, orientation, and empathic mental processes. Importantly, the authors suggest that while empathy is a fundamental aspect of design, it has not undergone extensive empirical testing or measurement. They also emphasized the need for new measurements for empathy in design and the importance of exploring the effectiveness of design research and user-centered activities.

Similarly, the research conducted by Chang-Arana *et al.* (2022) delved into the role of empathy in design, specifically addressing the ambiguities surrounding the definition of empathy in the design field. Their approach encompassed a review of both psychology and design literature, as they proposed that a clear definition of empathy in design should be based on psychological principles. By aligning the design concept of empathy with well-established psychological definitions, they attempted to bridge the gap between the two disciplines. The paper's findings highlight the similarity between psychological and design perspectives on empathy. It identifies key components of empathy, including the affective (emotional response) and cognitive (understanding) elements, as well as the factors that influence empathic abilities, such as trait and state empathy. Moreover, the paper asserts that empathy plays a pivotal role in achieving successful design outcomes. However, it is important to note that this paper is primarily

theoretical and conceptual in nature, and it does not present empirical evidence to support its claims. As such, it underscores the need for further research in this area, suggesting that designers would greatly benefit from a more comprehensive understanding of how empathy works. While it these two papers lay the groundwork for a more precise definition of empathy in design, they also highlight that empirical studies are essential to for understanding how empathy can lead to improved outcomes in the design process.

In the ongoing exploration of empathy in design, it's important to note that HCD is not confined to design alone—it also extends to related fields such as engineering and architecture. A distinct perspective emerges from the paper titled "A Model of Empathy in Engineering" by Walther, Mille & Sochacka (2017). This study delves into the role of empathy within engineering and engineering education, examining the parallels between engineering and social work. By investigating four years of dialogue between engineering education and social work education researchers, the authors develop a model of empathy in engineering. This model posits that empathy as a teachable and learnable skill just like any other “soft” skill. However, it is crucial to note that this conclusion somewhat oversimplifies the complexities of empathy. While aspects of empathy, such as emotion recognition and emotional regulation, can be improved through education and training, the individuals’ varying empathic capacities**,** influenced by both trait and state factors, remain an important consideration that this research does not fully address. As such, further cross-disciplinary research is needed to explore individual differences in empathic abilities and to develop tailored educational approaches within the context of engineering education.

IV. The Present Study

In HCD, there is a universal assumption that empathy is used. However, this might not be the case, because not all designers possess inherent empathic skills. As such, we hope to learn more about how empathy affects a designers' outlook and performance for design projects. The results of this experiment will give us considerable insight into whether or not designers' actually use empathy in HCD. We are interested in whether trait empathy predicts how much designers say they use empathy in a design context. Additionally, we are also interested in whether designers' emotional interest in users is predicted by a specific dimension of empathy or just empathy overall.

We hypothesized that designers' trait empathy scores are significantly correlated to their reported use of empathy when designing. Since previous research suggests that empathy is used as a term in the design field, our research aims to examine if empathy is used or if it is just an overused meaningless buzzword. As such, we predicted that empathy in design would be higher if trait empathy was too. Through understanding the relationship between trait empathy and empathy in a design context, we seek to illuminate a more psychological understanding of designers' empathy.

Methods

Participants. 22 7C students were recruited via in-class announcements, the LGCS Litserv and various other campus advertisements. Participants were asked to be over the age of 18, fluent in English and to have taken an HCD-related course.[3] The courses

[3] The options included: (1) ENGR 180 HM-01 Human-Centered Design, (2) ENGR 190BA HM-01 Adv Tics/Prjts Human Cent Desig, (3) ART 021 PO-01 Foundations in 2D Design, (4) ART 122 PO-O1 Design History and Production, and (5) PSYCH 350-CGU User Experience Research Methods

participants were recruited from were chosen because of their known connection to HCD thinking principles. Participants were informed they would receive $5 for the survey that would take approximately 20 minutes.

Of the 22 students who signed up for the survey, only 19 completed the survey. The class that most participants reported taking was Introduction to Human-Centered Design (13) and User-Experience CGU was the least reported class (5). Two participants reported taking all four courses on the sign up. Of the 18 participants whose data was able to be analyzed, 11% identified as male, 78% as female and 11% as genderqueer. Additionally, 61% of participants reported that they were White/Caucasian, 39% Asian, 17% Hispanic/Latinx, and 11% Middle Eastern/North African. The study was conducted with the consent of the participants and was approved by Scripps College.

Materials and Design. The materials consisted of the Interpersonal Relativity Index (IRI) (Davis, 198) and the Empathy in Design Scale (Drouet *et al.*, 2022), along with a few demographic questions about gender and race.

Questions from the IRI can be found in Appendix A. The IRI is a 28-item self-report measure on a 5-point Likert scale used to assess various dimensions of empathy. For the purpose of this study, it was adapted to a 7-point Likert scale to maintain consistency across both surveys. Participants were asked to rate how much they relate to statements on a 1-7 scale, with 1 being “does not describe me at all” and 7 being “completely describes me.” The IRI has four subscales that measure different aspects of empathy: Perspective Taking, Fantasy (imaginative positioning of oneself into the feelings of fictional characters), Empathic Concern, and Personal Distress (anxiety).

Together, these subscales measure both the cognitive and affective processes of empathy (Davis, 1980).

Questions from The Empathy in Design Scale can be found in Appendix B. The Empathy in Design Scale is an 18-item self-report scale measures designers' and users' empathic tendencies in the designer process. As one of the first scales specifically targeting empathy in design, it is still undergoing testing and development (Luce Drouet *et al.*, 2022). It is measured on the same 7-point Likert scale as described above. For this experiment, some questions were adapted so that they specifically asked participants about their experiences as designers (and not as "employees").

Participants answered the surveys using Qualtrics, a web-based survey software. The survey was split into 5 sections: (1) a consent agreement, (2) the IRI, (3) the Empathy in Design Scale, (4) participant demographic information and (5) a final section debriefing participants on the experiment's purpose. It consisted entirely of multiple-choice questions. There was no time limit to the survey.

Procedure. Participants were given a link to a Qualtrics survey and an anonymous identification number via email. Participants were first presented with a message asking them to not to look at other websites while completing the surveys. On the next page of the survey, participants were asked for their experiment ID. This ID was collected so that participants' answers were anonymized. Then, participants were shown a consent form providing background on the study and participants' rights. Participants were asked to provide their consent before continuing on to the next survey phase.

Following consent, participants were instructed to fill out the IRI and the Empathy in Design Scale by indicating how accurately the questions statements

described them. Then, they were asked to complete two demographic questions. The last page of the survey contained a debriefing script so that participants' were able to learn more about the study's purpose and be reminded about their rights.

Results

Two exploratory regression analyses were conducted following data collection. Prior to these analyses, data was cleaned and linearity was checked in SPSS—no violations were revealed. Of the 19 responses, only 18 were eligible for analysis. Participants were excluded for leaving the entire second survey incomplete. The remaining responses were analyzed in SPSS. On average, participants scored 68.8% on the IRI (M = 135.00 and SD = 16.32) and 83.4% on the Empathy in Design Scale (M = 105.11 and SD = 12.85).

Following this, a simple linear regression was run in order to examine whether or not higher scores on the IRI predicted higher scores on the Empathy in Design Scale. Table 1 and 2 illustrate the results of the model:

Model Summary[b]

Model	R	R Square	Adjusted R Square
	.513 [a]	.263	.217

a. Predictors: (Constant), Comp.IRI

b. Dependent Variable: Comp.EDS

Table 1: Model Summary

Coefficients[a]

Model	Standardized Coefficients Beta	t	Sig.	95.% Confidence Interval for B Lower Bound	Upper Bound
Comp.IRI	.513	2.389	.030	.045	.762

a. Dependent Variable: Comp.EDS

Table 2. Coefficients

Simple linear regression indicated that participants who reported higher IRI scores also expressed significantly higher scores on the Empathy in Design Scale, R^2 = .26, $F(1,16) = 5.71$, $\beta = .513$, $p = .030$, 95% CI [.045, .762]. Our hypothesis that higher IRI scores predict higher Empathy in Design Scale scores was supported.

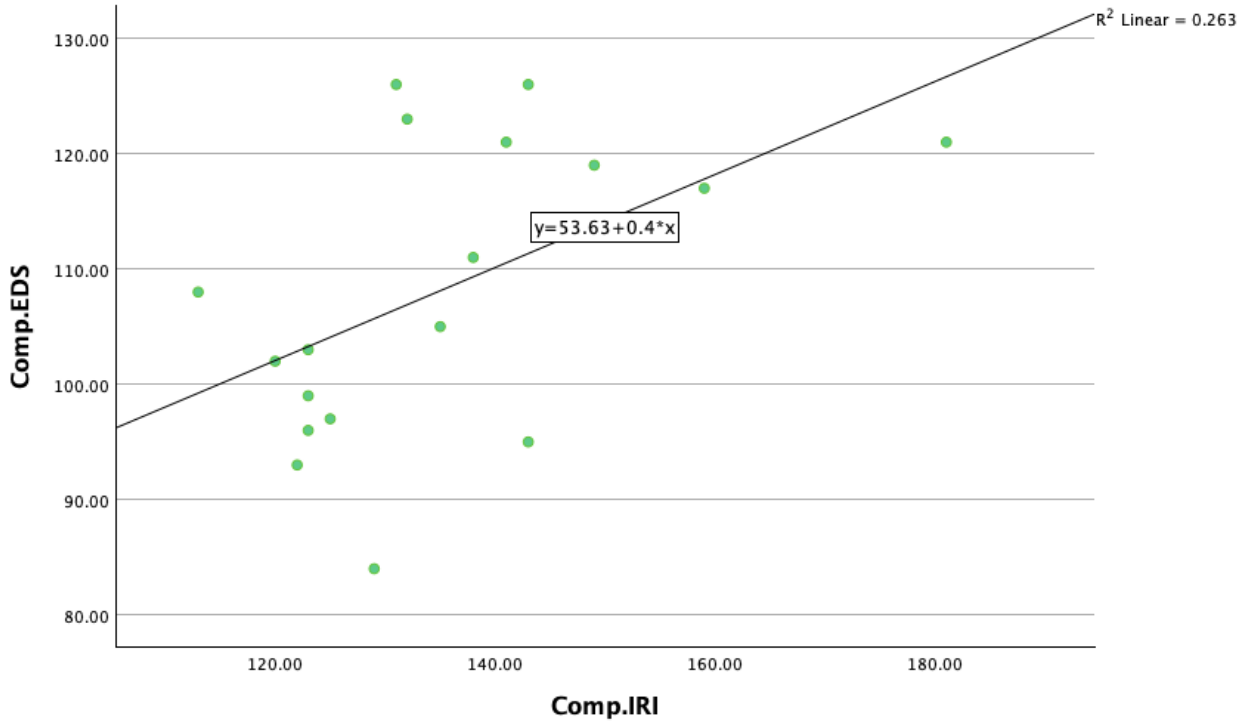


Figure 5. Scatter plot showing mean composite IRI and composite Empathy in Design Scale for each participant.

A multiple regression was then run to explore if fantasy (X1), empathic concern (X2), perspective taking (X3) or personal distress (X4)—the IRI subscales—determined emotional interest on the Empathy in Design Scale. Before the regression was conducted, data was mean-centered. The results of the indicated that the four predictors did not significantly influence emotional interest, $R^2 = .234$. The probability that a participant was emotional interested in users was not significantly affected by any of the independent variables. The model indicates there is no significant fantasy (B = .12, p = .64), empathic concern(B = .05, p = .843), perspective taking (B = .378, p = .158), or personal distress (B = .183, p = .469). Although the statistical analysis does not indicate any significant effects, when charted it can be concluded that the residual value is normally distributed, so the regression analysis is an appropriate model and has been completed (see fig. 6). Possible explanations for these findings are discussed below.

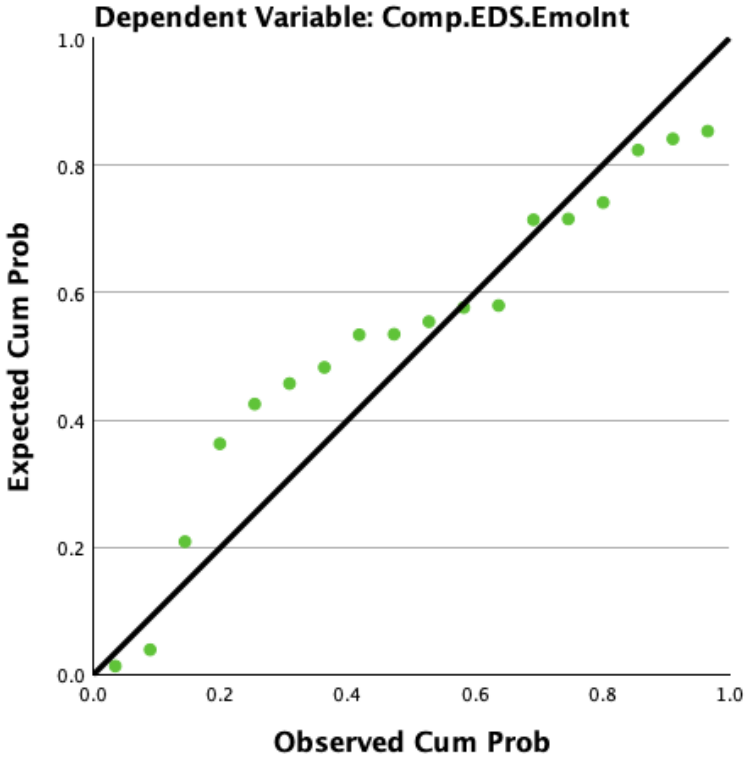


Figure 6. Normal P-P Plot of Regression Standardized Residual.

Discussion

In this study, we hoped to learn more about how different levels of empathy affect a person's ability to design empathically, as well as how it affects their emotional interest in the users they are designing for. We hypothesized that higher scores on the IRI would be associated with higher scores on the Empathy in Design Scale. This would suggest that cognitive and affective empathy are at play when people are designing for users. We also predicted that emotional interest would be mediated by both perspective taking and empathic concern. Specifically, we hypothesized that participants with higher levels of perspective taking and empathic concern would also have high levels of emotional interest, which would be related to their willingness to learn about a user.

The results of this study confirm that high empathy overall is correlated to high empathy within a design context. In accordance with the first half of this prediction, Empathy in Design scores increased as IRI scores increased. However, the latter portion of the original hypothesis is not supported. While Empathy in Design scores did increase as IRI scores increased, perspective taking and empathic concern did not significantly interact with emotional interest. Essentially, the results of the study show that a high IRI score predicts a high Empathy in Design score.

While empathy hasn't been studied psychologically within the design field, it has been researched in numerous other helping professions. These findings are congruent with multiple other studies on empathy and helping professions. Lelorain *et al.* (2012) conducted a systematic review of empathy and patient outcomes using patient self-reports. Analysis of the surveys led Lelorain *et al.* (2012) to conclude that clinicians' empathy was associated with higher patient satisfaction and lower distress. Likewise,

Reynolds W. & Scott B. (1999) found that empathy is crucial for facilitating helping relations in nursing and other helping professions because it increases helpers' willingness to help and understand clients.

Empathic patient care is not just limited to caretaker-patient relationships—it is also critical to design care centers with empathy. In a case study by Carmel-Golfolen and Portillo, empathic design was used by a studio designing an outpatient cancer care center. To do so, narrative inquiry was utilized to provoke empathy in designers. By becoming more conscious of empathy, designers were more engaged with the project and generated more innovative ideas (Carmel-Golfolen & Portillo, 2016). Similarly, a study conducted by Peixoto & Moura (2020) examined how empathy maps—a tool used in HCD—impact healthcare work. Their results revealed that empathy maps improve helping aspects of healthcare by stimulating the development of different empathy components (Peixoto & Moura, 2020). Thus, encouraging those in helping professions to actively use empathy increases its accuracy.

The current study takes this conclusion further by demonstrating that empathy is actually what is being used in design. Contrary to other studies, this one uses psychological understandings of empathy as the basis for inquiry, as doing so provides clarity. While empathy has been proved to be used by designers, it is up for debate as to whether this is beneficial or not. As such, it is crucial for design researchers to examine empathy empirically, rather than just using the word as a "buzzword."

Improving empathy?

As we delve deeper into the question of whether empathy can be improved, it's clear that there's a lack of empirically backed research in the design field. Empathic training is

often praised by design researchers (Walther, Miller & Sochacka, 2017) its positive impact. However, psychologists commonly argue that current empathy-enhancing methods are insufficient. According to Weisz & Cikara (2021), the major drawback of empathic trainings lies in its tendency to oversimplify empathy, addressing it as a singular entity rather than recognizing its multifaceted nature.

While the benefits of empathy, such as boosting emotional well-being (Wei *et al.*, 2011), improving social relationships (Morelli, Lieberman & Zaki, 2015), and alleviating pressure amongst designers (X. Wu et al., 2022) have been well documented, it is important to acknowledge that it can also yield adverse effects. For instance, empathy may hinder helping behavior because it can cause our biases to collide with our moral principles, leading us to prioritize assisting those who are similar to us ('ingroup bias') or 'identifiable' (i.e., a human being rather than an organization) (Bloom, 2017, p. 3). Consequently, it can "reduce the impact of aid by narrowing the focus of helpers' concern to proximal recipients instead of distal and needier ones" (Bloom, 2017). In the context of our study, it is imperative to acknowledge that designers may sometimes misplace their empathic focus. Designers should ideally extend their care beyond just users, yet the spotlighted nature of empathy often prevents this broader perspective.

Furthermore, it is essential to note that empathy training has also been linked to empathic distress. In series of investigations, Kilmecki *et al.* (2014) explored the differences between empathy and compassion training. Their findings indicated that empathic training was associated with a higher incidence of empathic distress, which serves as a precursor to burnout and often leads individuals to avoid situations that trigger discomfort. In contrast, compassion training not only promoted prosocial behavior but also helped individuals with effective coping mechanism for handling

stressful situations (Kilmecki *et al.*, 2014; Singer & Kilmecki, 2014). Several other studies have demonstrated a correlation between occupational burnout and empathy (Wilkinson *et al.*, 2017; Williams, 1989). If this correlation holds true within the field of design, it raises the possibility that empathy could potentially have detrimental effects on design outcomes by causing individuals to become consumed by negative feelings and withdrawn (Singer & Kilmecki, 2014). As such, interventions to sustain empathy, such as empathy trainings, might be necessary (Wilkinson *et al.*, 2017).

In light of these findings, it is essential to acknowledge that individuals differ in their ability to use different parts of empathy (Weisz & Cikara, 2021). As proposed by Weisz & Cikara (2021), targeting specific components of empathy can offer a more effective approach to training empathy. This approach might prove to lead to more refined and tailored interventions within the context of HCD. As highlighted by Weisz & Cikara (2021), two specific practices—meditation and emotion regulation—have been observed to target specific aspect of empathy.

Certain studies indicate that mindfulness mediation fosters compassion and can even enhance specific aspects of empathy, such as empathic concern (Lim, Condon & DeSteno, 2015; Condon *et al.*, 2013). In both of these studies, individuals who had undergone extensive mindfulness meditation training were more likely to offer their seats to suffering strangers than those without meditation training. In other words, it enhances prosocial responding towards others.

Emotion regulation is another crucial way to promote prosocial responses. A recent study in which individuals were encouraged to adopt an optimistic perspective on

how they can help others revealed the positive impact of emotional reappraisal[4] on empathic responding (Brethel-Haurwitz, Stoianova & Marsh, 2020). This positive impact, in turn, was also associated with an increase non-reciprocal prosocial behavior and a decrease emotional distress responding (Brethel-Haurwitz, Stoianova & Marsh, 2020). Identifying which training methods work for increasing specific aspects empathy would be useful for the field of design.

Limitations

There were a number of limitations to this study due to the time constraints. One of the most impactful limitations was the small number of participants surveyed. Typically, the minimum number of survey respondents for statistically significant results is 30. However, as only 18 student designers signed up, the survey results simply cannot be generalized to the larger population of designers. In hindsight, less restrictive sign-up requirements might have led to more participants. It would be interesting to see if a control group with no design experience would have the same significance.

Another limitation on this study was the methods used. Most psychologists agree that self-report surveys should not be used alone, as they may be subject to biases. Ideally, this study would have examined empathy interviews with neuroimaging so that we would be able to draw from brain anatomy rather than subjective data. However, things did not go as planned so we had to pivot and adjust our study to collect only self-report data. Originally, this study was intended to explore whether or not empathy was used specifically during empathy in the HCD process. However, as neuroimaging data

[4] Emotional reappraisal involves "changing one's interpretation of an emotional situation in order to change one's reaction to it" (Brethel-Haurwitz, Stoianova & Marsh, 2020).

takes a long time to collect and interviews cannot be controlled, we had to change the study to focus on surveys. While we were unable to incorporate neuroimaging into our study, we were able to cross compare two different self-report studies on empathy.

Future directions

Overall, the existing literature emphasized how little we know about empathy within a design context. While our study shows that higher levels of empathy are associated with higher scores on the Empathy in Design Scale, we do not know enough yet about empathy in design to assert that empathy increases designers' ability to help users. As mentioned in our literature review, there is no concrete definition of empathy in design, which can cause confusion as to whether it is the psychological phenomenon or just a buzzword. Exploratory studies addressing this lack of consensus, such as this one, are imperative for future developments in HCD.

Acknowledgements

After four years studying cognitive science, I have to admit that I still don't know what cognition is. Sure, I know about certain aspects of cognition, such as language acquisition, neural networks and emotions. But I don't think I will ever fully know why cognition exists—and that makes cognitive science all the more exciting. There is so much to learn, and I will continue exploring cognition my whole life.

I would like to thank my thesis advisor, Professor Shannon Burns, for first introducing me to the vast research on empathy. Working in your lab during my senior summer break was one of the most insightful moments for me during college. Without MIC lab, I would have never immersed myself in studying empathy for my thesis. Thank you so much for your guidance and support during this thesis process—and for helping me find a research topic I am truly excited about.

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References

Andari, E., Duhamel, J. R., Zalla, T., Herbrecht, E., Leboyer, M., & Sirigu, A. (2010). Promoting social behavior with oxytocin in high-functioning autism spectrum disorders. *Proceedings of the National Academy of Sciences of the United States of America*, *107*(9), 4389–4394. https://doi.org/10.1073/pnas.0910249107

Batson, C. D., Eklund, J. H., Chermok, V. L., Hoyt, J. L., & Ortiz, B. G. (2007). An additional antecedent of empathic concern: valuing the welfare of the person in need. *Journal of personality and social psychology*, *93*(1), 65–74. https://doi.org/10.1037/0022-3514.93.1.65

Batson, C. D. 2009 These things called empathy: eight related but distinct phenomena. In The Social Neuroscience of Empathy (ed. W. J. Ickes & J. D. Jean), pp. 3–15. The MIT Press; doi:10.7551/mitpress/9780262012973.003.0002.

Baron-Cohen, S., Ring, H., Moriarty, J., Schmitz, B., Costa, D., & Ell, P. (1994). Recognition of mental state terms. Clinical findings in children with autism and a functional neuroimaging study of normal adults. *The British journal of psychiatry : the journal of mental science*, *165*(5), 640–649. https://doi.org/10.1192/bjp.165.5.640

Bloom P. (2017). Empathy and Its Discontents. *Trends in cognitive sciences*, *21*(1), 24–31. https://doi.org/10.1016/j.tics.2016.11.004

Brethel-Haurwitz, K. M., Stoianova, M., & Marsh, A. A. (2020). Empathic emotion regulation in prosocial behaviour and altruism. *Cognition and Emotion*, *34*(8), 1532–1548. https://doi.org/10.1080/02699931.2020.1783517

Chang-Arana, Á. M., Piispanen, M., Himberg, T., Surma-aho, A., Alho, J., Sams, M., & Hölttä-Otto, K. (2020). Empathic accuracy in design: Exploring design outcomes through empathic performance and physiology. *Design Science*, *6*(16). https://doi.org/10.1017/dsj.2020.14

Chang-Arana, Á. M., Surma-aho, A., Hölttä-Otto, K., & Sams, M. (2022). Under the umbrella: Components of empathy in psychology and Design. *Design Science*, *8*(20). https://doi.org/10.1017/dsj.2022.13

Christov-Moore, L., & Iacoboni, M. (2019). Sex differences in somatomotor representations of others' pain: a permutation-based analysis. *Brain structure & function*, *224*(2), 937–947. https://doi.org/10.1007/s00429-018-1814-y

Christov-Moore, L., Simpson, E. A., Coudé, G., Grigaityte, K., Iacoboni, M., & Ferrari, P. F. (2014). Empathy: gender effects in brain and behavior. *Neuroscience and biobehavioral reviews*, *46 Pt 4*(Pt 4), 604–627. https://doi.org/10.1016/j.neubiorev.2014.09.001

Condon, P., Desbordes, G., Miller, W. B., & DeSteno, D. (2013). Meditation increases compassionate responses to suffering. *Psychological Science*, *24*(10), 2125–7. https://doi.org/10.1177/0956797613485603

Cuff, B. M. P., Brown, S. J., Taylor, L., & Howat, D. J. (2016). Empathy: A Review of the Concept. *Emotion Review*, *8*(2), 144-153. https://doi.org/10.1177/1754073914558466

Davis, M. H. (1980). Interpersonal reactivity index.

Decety, J., & Ickes, W. (Eds.). (2009). *The social neuroscience of empathy*. Boston Review. https://doi.org/10.7551/mitpress/9780262012973.001.0001

Decety, J., Norman, G. J., Berntson, G. G., & Cacioppo, J. T. (2012). A neurobehavioral evolutionary perspective on the mechanisms underlying empathy. *Progress in neurobiology*, *98*(1), 38–48. https://doi.org/10.1016/j.pneurobio.2012.05.001

Design thinking frequently asked questions (FAQ). IDEO. (n.d.). https://designthinking.ideo.com/faq/whats-the-difference-between-human-centered-design-and-design-thinking

D. School—Hasso Plattner Institute of Design at Stanford . (2015, March). *Empathy Field Guide*. HCI.Stanford. https://hci.stanford.edu/courses/cs147/2022/wi/readings/FIELDGUIDE-Screen-DTBC-March-2015-V2.pdf

Drouet, Luce & Bongard-Blanchy, Kerstin & Koenig, Vincent & Lallemand, Carine. (2022). Empathy in Design Scale: Development and Initial Insights. 1-7. 10.1145/3491101.3519848.

Eklund, J., Andersson-Stråberg, T., & Hansen, E. M. (2009). "I've also experienced loss and fear": Effects of prior similar experience on empathy. *Scandinavian Journal of Psychology*, *50*(1), 65–69. https://doi.org/10.1111/j.1467-9450.2008.00673.x

Fan, Y., Duncan, N. W., de Greck, M., & Northoff, G. (2011). Is there a core neural network in empathy? An fMRI based quantitative meta-analysis. *Neuroscience and biobehavioral reviews*, *35*(3), 903–911. https://doi.org/10.1016/j.neubiorev.2010.10.009

Gross, J.J., & John, O.P. (2003). Individual differences in two emotion regulation processes: implications for affect, relationships, and well-being. *Journal of personality and social psychology, 85 2*, 348-62 .

Gu, X., Hof, P. R., Friston, K. J., & Fan, J. (2013). Anterior insular cortex and emotional awareness. *The Journal of comparative neurology*, *521*(15), 3371–3388. https://doi.org/10.1002/cne.23368

Håkansson, J., & Montgomery, H. (2003). Empathy as an interpersonal phenomenon. *Journal of Social and Personal Relationships*, *20*(3), 267–284. https://doi.org/10.1177/0265407503020003001

Heinke, M. S., & Louis, W. R. (2009). Cultural background and individualistic-collectivistic values in relation to similarity, perspective taking, and empathy. *Journal of Applied Social Psychology*, *39*(11), 2570–2590. https://doi.org/10.1111/j.1559-1816.2009.00538.x

Hodges, S. D., Kiel, K. J., Kramer, A. D., Veach, D., & Villanueva, B. R. (2009). Giving birth to empathy: The effects of similar experience on empathic accuracy, empathic concern, and perceived empathy. *Personality and Social Psychology Bulletin*, *36*(3), 398–409. https://doi.org/10.1177/0146167209350326

Hurlemann, R., Patin, A., Onur, O. A., Cohen, M. X., Baumgartner, T., Metzler, S., Dziobek, I., Gallinat, J., Wagner, M., Maier, W., & Kendrick, K. M. (2010). Oxytocin enhances amygdala-dependent, socially reinforced learning and emotional empathy in humans. *The Journal of neuroscience : the official journal of the Society for Neuroscience*, *30*(14), 4999–5007. https://doi.org/10.1523/JNEUROSCI.5538-09.2010

IDEO.org. (2015). *The Field Guide to human-centered design: Design kit* (1st ed.). IDEO. October 19, 2023, https://www.ideo.com/journal/design-kit-the-human-centered-design-toolkit

Israelashvili, J., Sauter, D.A., & Fischer, A.H. (2020). Different faces of empathy: Feelings of similarity disrupt recognition of negative emotions☆. *Journal of Experimental Social Psychology, 87.*

Lanzoni, S. (2018, November 21). *The origin of empathy*. Yale University Press. https://yalebooks.yale.edu/2https://yalebooks.yale.edu/2018/11/21/the-origin-of-empathy/018/11/21/the-origin-of-empathy/

Lanzoni , S. (2019, November 30). *The surprising history of empathy*. Psychology Today. https://www.psychologytoday.com/us/blog/empathy-emotion-and-experience/201911/the-surprising-history-empathy

Leonard, D., & Rayport, J. F. (2014, August 1). Spark innovation through empathic design. *Harvard Business Review Magazine*. Retrieved October 18, 2023, from https://hbr.org/1997/11/spark-innovation-through-empathic-design.

Lelorain, S., Brédart, A., Dolbeault, S., & Sultan, S. (2012). A systematic review of the associations between empathy measures and patient outcomes in cancer care. *Psycho-oncology*, *21*(12), 1255–1264. https://doi.org/10.1002/pon.2115

Lishner, D.A., Stocks, E.L., Steinert, S.W. (2020). Empathy. In: Zeigler-Hill, V., Shackelford, T.K. (eds) *Encyclopedia of Personality and Individual Differences*. Springer, Cham. https://doi.org/10.1007/978-3-319-24612-3_513

Lim D, Condon P, DeSteno D (2015) Mindfulness and Compassion: An Examination of Mechanism and Scalability. PLOS ONE 10(2): e0118221.https://doi.org/10.1371/journal.pone.0118221

Morelli, S. A., Lieberman, M. D., & Zaki, J. (2015). The emerging study of positive empathy. *Social and Personality Psychology Compass*, *9*(2), 57–68. https://doi.org/10.1111/spc3.12157

Norman, Don. Interaction Design Foundation - IxDF. (2021, June 14). What is Human-Centered Design?. Interaction Design Foundation - IxDF. https://www.interaction-design.org/literature/topics/human-centered-design

Olderbak, S., Sassenrath, C., Keller, J., & Wilhelm, O. (2014). An emotion-differentiated perspective on empathy with the emotion specific empathy questionnaire. *Frontiers in Psychology*, *5*. https://doi.org/10.3389/fpsyg.2014.00653

Olga M. Klimecki, Susanne Leiberg, Matthieu Ricard, Tania Singer, Differential pattern of functional brain plasticity after compassion and empathy training, *Social Cognitive and Affective Neuroscience*, Volume 9, Issue 6, June 2014, Pages 873–879, https://doi.org/10.1093/scan/nst060

Peixoto, J. M., & Moura, E. P.. (2020). Health Empathy Map: Creation of an Instrument for Empathy Development. *Revista Brasileira De Educação Médica*, *44*(1), e029. https://doi.org/10.1590/1981-5271v44.1-20190151.ING

Rajmohan, V., & Mohandas, E. (2007). Mirror neuron system. *Indian journal of psychiatry*, *49*(1), 66–69. https://doi.org/10.4103/0019-5545.31522

Reynolds, W. J., & Scott, B. (1999). Empathy: a crucial component of the helping relationship. Journal of Psychiatric and Mental Health Nursing, 6(5), 363–370. https://doi.org/10.1046/j.1365-2850.1999.00228.x

Singer, T., & Klimecki, O. M. (2014). Empathy and compassion. *Current Biology : Cb*, *24*(18), 878. https://doi.org/10.1016/j.cub.2014.06.054

Spreng*, R. N., McKinnon*, M. C., Mar, R. A., & Levine, B. (2010). The Toronto Empathy Questionnaire: Scale Development and initial validation of a factor-analytic solution to multiple empathy measures. *Journal of Personality Assessment*, *91*(1), 62–71. https://doi.org/10.1080/00223890802484381

Stinson, L., & Ickes, W. (1992). Empathic accuracy in the interactions of male friends versus male strangers. *Journal of personality and social psychology*, *62*(5), 787–797. https://doi.org/10.1037//0022-3514.62.5.787

Stueber, Karsten, "Empathy", *The Stanford Encyclopedia of Philosophy* (Fall 2019 Edition), Edward N. Zalta (ed.), URL = <https://plato.stanford.edu/archives/fall2019/entries/empathy/>.

Suitor, J. J., Pillemer, K., & Keeton, S. (1995). When experience counts: The effects of experiential and structural similarity on patterns of support and interpersonal stress. *Social Forces*, *73*(4), 1573–1588. https://doi.org/10.2307/2580459

Surma-aho, A., & Hölttä-Otto, K. (2022). Conceptualization and operationalization of empathy in design research. *Design Studies*, *78*, 101075. https://doi.org/10.1016/j.destud.2021.101075

Uddin, L. Q., Nomi, J. S., Hébert-Seropian, B., Ghaziri, J., & Boucher, O. (2017). Structure and Function of the Human Insula. *Journal of clinical neurophysiology : official publication of the American Electroencephalographic Society*, *34*(4), 300–306. https://doi.org/10.1097/WNP.0000000000000377

Walther, J., Miller, S.E. and Sochacka, N.W. (2017), A Model of Empathy in Engineering as a Core Skill, Practice Orientation, and Professional Way of Being. *J. Eng. Educ.,* 106: 123-148. https://doi.org/10.1002/jee.20159

Warrier, V., Toro, R., Chakrabarti, B. *et al.* Genome-wide analyses of self-reported empathy: correlations with autism, schizophrenia, and anorexia nervosa. *Transl Psychiatry* **8**, 35 (2018). https://doi.org/10.1038/s41398-017-0082-6

Weisz, E., & Cikara, M. (2020). Strategic regulation of empathy. *Trends in Cognitive Sciences*, *25*(3), 213–227. https://doi.org/10.1016/j.tics.2020.12.002

Wei, M., Liao, K. Y.-H., Ku, T.-Y., & Shaffer, P. A. (2011). Attachment, self-compassion, empathy, and subjective well-being among college students and community adults. *Journal of Personality*, 79(1), 191–221. https://doi.org/10.1111/j.1467-6494.2010.00677

Williams, C.A. (1989), Empathy and burnout in male and female helping professionals. *Res. Nurs. Health*, 12: 169-178. https://doi.org/10.1002/nur.4770120307

Wilkinson, H., Whittington, R., Perry, L., & Eames, C. (2017). Examining the relationship between burnout and empathy in healthcare professionals: a systematic review. *Burnout Research*, 6, 18–29. https://doi.org/10.1016/j.burn.2017.06.003

Wu, X., Siu, K.W.M., Bühring, J. (2022). Empathy Between Designers in the Design Synthesis Stage. In: Stephanidis, C., Antona, M., Ntoa, S., Salvendy, G. (eds) HCI

International 2022 – Late Breaking Posters. HCII 2022. Communications in Computer and Information Science, vol 1654. Springer, Cham. https://doi.org/10.1007/978-3-031-19679-9_27

APPENDIX A:

INTERPERSONAL REACTIVITY INDEX

The following statements inquire about your thoughts and feelings in a variety of situations. For each item, indicate how well it describes you by choosing the appropriate number on the scale at the top of the page: 1, 2, 3, 4, 5, 6 or 7. When you have decided on your answer, fill in the number on the answer sheet next to the item number. READ EACH ITEM CAREFULLY BEFORE RESPONDING. Answer as honestly as you can. Thank you.

ANSWER SCALE:

The 7-points of the scale are: 1/ Does not describe me at all 2/ Barely describes me 3/ Somewhat describes me 4/ Neutral 5/ generally describes me 6/ Mostly describes me 7/ Completely describes me

1. I daydream and fantasize, with some regularity, about things that might happen to me. (FS)
2. I often have tender, concerned feelings for people less fortunate than me. (EC)
3. I sometimes find it difficult to see things from the "other guy's" point of view. (PT) (-)
4. Sometimes I don't feel very sorry for other people when they are having problems. (EC) (-)
5. I really get involved with the feelings of the characters in a novel. (FS)
6. In emergency situations, I feel apprehensive and ill-at-ease. (PD)
7. I am usually objective when I watch a movie or play, and I don't often get completely caught up in it. (FS) (-)
8. I try to look at everybody's side of a disagreement before I make a decision. (PT)
9. When I see someone being taken advantage of, I feel kind of protective towards them. (EC)
10. I sometimes feel helpless when I am in the middle of a very emotional situation. (PD)
11. I sometimes try to understand my friends better by imagining how things look from their perspective. (PT)
12. Becoming extremely involved in a good book or movie is somewhat rare for me. (FS) (-)
13. When I see someone get hurt, I tend to remain calm. (PD) (-)
14. Other people's misfortunes do not usually disturb me a great deal. (EC) (-)

15. If I'm sure I'm right about something, I don't waste much time listening to other people's arguments. (PT) (-)
16. After seeing a play or movie, I have felt as though I were one of the characters. (FS)
17. Being in a tense emotional situation scares me. (PD)
18. When I see someone being treated unfairly, I sometimes don't feel very much pity for them. (EC) (-)
19. I am usually pretty effective in dealing with emergencies. (PD) (-)
20. I am often quite touched by things that I see happen. (EC)
21. I believe that there are two sides to every question and try to look at them both. (PT)
22. I would describe myself as a pretty soft-hearted person. (EC)
23. When I watch a good movie, I can very easily put myself in the place of a leading character. (FS)
24. I tend to lose control during emergencies. (PD)
25. When I'm upset at someone, I usually try to "put myself in his shoes" for a while. (PT)
26. When I am reading an interesting story or novel, I imagine how I would feel if the events in the story were happening to me. (FS)
27. When I see someone who badly needs help in an emergency, I go to pieces. (PD)
28. Before criticizing somebody, I try to imagine how I would feel if I were in their place. (PT)

NOTE: (-) denotes item to be scored in reverse fashion

PT = perspective-taking scale

FS = fantasy scale

EC = empathic concern scale

PD = personal distress scale

APPENDIX B:

Empathy in Design Scale:

Instructions: The table below includes statements related to your design work. Please use the 7-point scale to indicate the degree to which these statements accurately describes you or not. Respond spontaneously: there are no right or wrong answers, only your perspective matters.

Item Code	Item
	Emotional interest/Discovery (EI)
EI1	I am interested to learn about the users' experiences and needs.
EI1	I imagine how users think feel or behave in different situations.
EI2	I am curious about users' experiences and needs.
EI4	I want to learn about users' experiences and opinions about the designs.
	Sensitivity/Immersion (S)
S1	I am sensitive to the experiences of users.
S2	I observe without judging how users experience the designs.
S3	When thinking about designs, I take the users' point of reference.
S4	I immerse myself in the users' world.
S5	I go to the field in order to feel in touch with users.
S6	I am concerned about the experiences of users.
	Personal experience/Connection (PE)
PE1	When thinking about designs, I consider and reflect on my own experiences and feelings.
PE2	The experiences and feelings of users resonate with my own.

PE3 I understand the users' experiences because I know how it feels.

PE4 I compare users' experiences with the ones of people I know.

Self-awareness/Detachment (SA)

SA1 I imagine how I would feel and think if I were a user rather than a designer.

SA2 I am aware that my experiences as a designer are different from ones of users.

SA3 I realize that there are similarities and differences between my experiences and the ones of users.

SA4 I understand why users perceive things differently than I do as a designer.

*The 7-points of the scale are: 1/ Does not describe me at all 2/ Barely describes me 3/ Somewhat describes me 4/ Neutral 5/ generally describes me 6/ Mostly describes me 7/ Completely describes me