A MATTER OF TOUCH

Designing clothing to address touch deprivation among young adults

Preface

I am happy to present this thesis project, which explores the role of touch and the experience of touch deprivation among young adults. Throughout this project, I had the opportunity to immerse myself in this topic, learn from personal stories and aim for a positive impact through my design. It has also allowed me to witness firsthand the power of human connection and the impact that touch can have on well-being.

As someone with a personal interest in psychology, human behavior, and well-being, I started this project with a curiosity to explore touch and its fundamentality in human experiences. I had the chance to actively involve and work closely with my target group and their stories and experiences inspired me along the way. This journey of learning and designing for a very personal, yet global experience has proven to be an exciting, sometimes challenging, and always a rewarding one.

I would like to express my gratitude to Gijs Huisman, Tingting Wang, and Sima Ipakchian Askari for their invaluable support, and for dedicating their time and expertise to this project. Their guidance and continuous support for my academic career have been a positive force in shaping this project and me as a designer. I would also like to extend my thanks to the individuals who participated in this project and trusted me with their deeply personal stories. These conversations and discussions made the project truly meaningful and further reinforced its importance, while also keeping me motivated.

I hope that this project will shed light on the significance of touch in the lives of young adults and contribute to their well-being. By designing clothing that addresses touch deprivation, I aspire to empower individuals to take steps toward improving their own well-being. I hope to initiate meaningful discussions, challenge societal stigmas, and promote the importance of touch in enhancing our human experiences and connections.

Thank you to all who have played a part in the making of this thesis. Your support, contributions, and dedication have been invaluable. I am grateful for the opportunity to undertake such an interesting and relevant project.

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Executive Summary

Touch deprivation, a largely unrecognized phenomenon that affects approximately 54% of people globally, has a significant negative impact on the well-being of these individuals. Having physical connections is a fundamental part of the human experience whether it is a warm hug from a loved one or a comforting pat on the shoulder. However, touching often has a stigma around it, and expressing touch-related needs can be a difficult task. The aim of the project was to understand the needs, difficulties, and overall experiences of touch-deprived young adults (18-30) and based on the findings design to improve their well-being. This led to the concept of a clothing line consisting of pieces designed for connections, comfort, and awareness.

Through a series of qualitative research activities with the target group, we could see that it is mainly a struggle among young adults who live far from their families and friends, long-distance couples, and individuals struggling with social anxiety or other mental health issues. Touch deprivation is a complex issue, influenced by other life experiences and often intertwined with the feeling of loneliness, anxiety, emotional regulation, and can lead to low self-esteem. However, the absence of touch goes beyond the physical sensations, young adults long for the emotional connections that come with closeness. While technology enables these groups to communicate and stay connected with others over long distances, it fails to satisfy this fundamental human need of social touch and young adults often question the value of even attempting to imitate these connections with devices (e.g. mediated social touch devices – remotely sending tactile sensations to imitate social touch). Although in-person social touch can not be replaced, sensory comfort can offer some relief. Young adults often seek comfort and distractions to avoid dealing with the negative feelings they experience. As found, touch deprivation is a hidden struggle, however, raising awareness of our touch needs is crucial for initiating self-reflection and active mitigation.

Designing garments as a response to address touch deprivation offers a subtle way to embrace these young adults and help with their negative experiences. Clothing not only influences how others perceive us but also how we perform (enclothed cognition). As a visual display, it can convey direct and symbolic messages and as 'our second skin' intimately touches our bodies every day. Through the design of these items, the intention is to invite affective social touch – provide sensory comfort to the wearer, act as a catalyst for creating in-person connections, and lastly raise awareness of the personal touch needs and the issue of touch deprivation. The project aims to stimulate and foster real-life connections and challenge the stigma surrounding touch while supporting individual comfort.

Ultimately, this project aspires to enhance the well-being and life experiences of touch-deprived young adults by providing them with designs tailored to their needs. By incorporating subtle messaging within an accessible format (choice of clothing), we aim to empower touch-deprived individuals to take a step toward facing the issue and improving their well-being. The project hopes to make a meaningful impact and spark a broader discussion on the importance of touch in human well-being.

Chapter 1
Introduction

We will provide an introduction into the thesis project – the topic, the target group, the approach, the purpose and aim.

1

Touch is a fundamental part of the human experience. It is often overlooked or underestimated as a sense and the research dedicated to understanding its impact on human well-being and social interaction is still in its early stages (Van Erp & Toet, 2015). It has a role to play in our everyday activities, from finding the light switch in the dark to hugging a loved one goodbye. Tactile stimulation and engaging in affectionate touch are necessary for mental and physical development and later for our well-being (Field, 2010). However, touch most often is not a simple sensation, there are a complex set of factors influencing this interchange of physical contact, making it a challenging interaction to design for.

The purpose of this project is to explore the role of social touch in the daily lives of young adults and investigate the potential impact of touch deprivation, a condition that affects around 54% of people globally (Hammond & Banissy, 2020), yet not clearly defined (Beßler et al., 2020). It is experienced when an individual receives or engages in less than enough physical contact with others leading to negative impacts on their (mental) well-being. The project aims to mitigate or ease these negative effects (e.g. difficulties with emotional regulation, a feeling of loneliness, body image, and other mental health issues) and improve their well-being.

This target group - young adults (aged between 18-30 years old) is particularly relevant as they could face touch deprivation due to many reasons, including their living situation (e.g. moving abroad or away from family for the first time) (Hysing et al., 2020), their relationship status (e.g. long-distance couple, single) (Waterman et al., 2017), or the difficulties of navigating social situations (e.g. social anxiety, mental health issues, loneliness)

– especially in light of Covid-19 pandemic (Pedersen et al., 2021). While loneliness is often thought of as a problem mainly affecting the elderly, the majority of people reporting loneliness are young adults (DiJulio et al., 2018). Research around loneliness and touch deprivation mostly focuses on children and elderly, leading to a lack of understanding about the experience of this demographic. Young adults are also an interesting target group since this generation is well acquainted with technology, a tool for constant communication and facilitator of connections, yet has a healthy skepticism about its use to make real, genuine social bonds.

In this project, we take a comprehensive approach, combining both empirical and theoretical research methods. We conduct a literature study to establish a theoretical foundation. Through the active involvement of the target group using the Contextmapping method (Sanders & Stappers, 2012), we learn about their needs, values, and challenges regarding social touch. Additionally, we follow a research through design approach, designing and developing prototypes to gain insights and generate new knowledge (Stappers & Giaccardi, 2017).

With this thesis project, we hope to shed light on how young adults use and think about social touch. We want to understand what they truly value and need in times when connecting through technology is easier than ever, yet the experience of touch deprivation continues to impact their well-being. Through our research, we aim to contribute to a deeper understanding of this unique challenge young adults face and explore design opportunities to promote meaningful and positive touch experiences that support their well-being.

Background

This chapter will present the findings of the literature study - the role of touch, the complexity of touch interactions, the effect and experience of touch deprivation. Then take a look at the existing haptic devices and their potentials.

2

To gain a deeper understanding of touch and its role in our lives, the research started with the investigation of existing literature on the topic - exploring the physiological, psychological, and emotional effects of touch, as well as its importance in interpersonal relationships and communication. Continuing with the examination of how touch fits into our fundamental psychological needs and the negative impacts when these needs are not met - touch deprivation, which is closely linked to loneliness and depression. Furthermore, the study covered the potential of haptic technology and devices/tools aimed to fulfill needs, research touch or facilitate human connections.

ROLE OF TOUCH

Touch as a sense, plays a crucial role in many aspects of the human experience. From infancy to adulthood and later at old age, touch can fulfill many functions from mundane tasks like finding our keys in our pocket to more important ones, such as medical care or preparing food (Jenkins & Lumpkin, 2017). Overall, touch can have an impact on people's social, emotional, and physical well-being (Field, 2010).

As the Fifth Sense

The sensory organ, responsible for our tactile sensation is the skin (Jenkins & Lumpkin, 2017). It is the largest human organ as well as the largest sensory system. The sense relies on the complex network of receptors in our skin, which respond to a wide range of tactile sensations, including pressure, pain, temperature, and vibration (Gardner, 2001). It is the first sense to develop in the womb, occurring somewhere between the 4 to 7 weeks of gestation (Bremner AJ, 2017).

Touch is important to gather information about the physical world around us. Glabrous

skin (non-hairy skin, found on the palms of hands, soles of the feet, and lips) plays a big role in this (Johansson & Vallbo, 1983). It can give highly accurate descriptions of mechanical events when in contact with other objects, providing such information is possible by the population of mechanoreceptive units innervating the glabrous skin (Johansson & Vallbo, 1983). This type of touch is referred to as discriminative touch.

Touch is also our most social sense (Field, 2019). What sets it apart from our other senses is its intimacy, to touch or be touched requires closeness and direct (skin) contact (Jenkins & Lumpkin, 2017). In studies around social touch (all interpersonal touch), CT touch which refers to the type of touch that triggers C fibers or 'caress fibers' in the skin, often gets a spotlight (Field, 2019). These fibers are believed to be present in hairy skin and only react to light and slow stroking motions, which then can result in arousal, pleasure, and stress reduction (Pawling et al., 2017). Therefore, appear to be significant for romantic, parent-child, and other interpersonal relationships (Goldstein et al., 2018, Feldman, Rosenthal, & Eidelman, 2014). CT touch had been referred to as affective touch in literature (Morrison, 2016), due to the activation of brain areas during the touch which are associated with positive affect (Pawling et al., 2017).

In Development & Well-being

As mentioned before, through touch, we learn about the physical world. In early development and childhood, tactile exploration - learning about textures, shapes, sizes, weight, and temperature - builds the foundation for cognitive and motor development (Field, 2014). However, having tactile stimulation is also of utmost importance in later life - keeping the elderly stimulated will beneficially impact their cognitive state (Gleeson & Timmins, 2004).

Affective touch has been found to improve the growth and both physical and cognitive development of infants and children, while the opposite - being deprived of touch - can lead to developmental delays (Field, 2014). Early touch experiences have long-lasting effects on social behavior and emotional regulation (McGlone, 2010). Touch has been shown to have a calming effect on the body and mind, making it a powerful tool for managing stress, depression, and loneliness (Field, 2010). Simply holding a loved one's hand before giving a public speech can reduce the stress level, resulting in better performance (Grewen, 2003). Touch-based interventions, such as massage therapy, can help to reduce symptoms of depression and anxiety and improve mood and well-being for both the receiver and the giver of the massage (Field, 2016).

In Communication & Relationships

Touch is an essential aspect of non-verbal communication, it can convey emotions, nuanced meanings, and additional messages to verbal communication (Elfenbein, 2002; Hertenstein, 2006). Through touch, humans can show attitudes and attributes that may be difficult to do so with spoken words. For individuals with sensory impairments, such as blindness, Braille (a writing system that relies on touch) enables them to read and write, providing access to information and communication that might otherwise be inaccessible (Mellor, 2006). Solely with touch, as the only communication form, people are able to convey and recognize accurately a wide set of emotions (Hertenstein, 2006), and most act of touches have linked symbolic meanings assigned to them, some accepted universally, some more culturally based (Montagu, 1986).

Furthermore, touch is a powerful tool for building and maintaining relationships, as it can promote feelings of trust, intimacy, and connection (Erk, 2015; Ellingsen et al.,

2014). Whether it is a handshake, a hug, or a simple touch on the arm, physical contact can form a bond between individuals. Physical touch is often a display of love or affection and had been identified as one of the five love languages (Goff, 2007). This refers to the preferred way to express or receive affection or love. For example, another love language, words of affirmation (expressing love and appreciation through words) might assure someone of being loved, while another individual who prefers touch might need the physical expression to believe the words or feel loved. Hugging and other forms of affective touch can cause the brain to release oxytocin, a hormone also known as the bonding hormone. It increases social interest and improves recognition of others' emotions leading to the formation of social bonds (Ellingsen et al., 2014).

Attachment styles, which are "systematic patterns of relational expectations, emotions, and behavior that results from an individual's history of attachment experiences" had been linked to touch experiences throughout life, mostly to childhood experiences with primary caregivers (Beltrán et al., 2020; Hazan & Shaver, 1987). Individuals with avoidant attachment styles are aversive towards social touch, people with anxious attachment styles seek and use more affective touch in close relationships, while affectionate touch in close relationships promotes attachment security, and relational and psychological well-being (Beltrán et al., 2020).

In a non-physical sense

So far in this report, touch had been investigated mostly through its physical sense - having and maintaining physical contact with someone or something and the meanings and circumstances of that action. However, the word touch refers to much more. Interestingly, in many languages, touch can have the meaning of being touched mentally or emotionally. And there are also many expressions used daily that refer to skin senses to describe actions, qualities, personalities, etc. Since touch can be a very powerful emotional experience, it is no wonder, it became reflected in common expressions and phrases. 'I'm touched by that gesture', 'keep in touch', 'I cannot put my finger on it' and many more are illustrative touch-related expressions that exist in everyday speech. Our tactile sense is deeply entangled in our languages further proving its significance (Linden, 2016). It raises questions, like:

Can non-physical touches have the same effect on people as physical touches? What can physical and non-physical touches have in common?

CONTEXTUALITY OF SOCIAL TOUCH

Although our sense of touch is a simple response to tactile information or physical stimuli (like pressure, temperature, pain, and vibration), through touch, we can send and receive a rich set of meanings and messages - particularly in the context of social interactions (Hertenstein, 2006). This type of touch is commonly referred to as social touch. By its top-down definition, social touch is all (non-accidental) interpersonal touch, including self-touch (Cascio, Moore, & McGlone, 2019). Social touch, seemingly a straightforward physical act, is often much more than that. It is highly influenced by a range of factors resulting in a complex and unique interaction.

The complexity of touch interactions

Social touch is a complex and multifaceted phenomenon influenced by past experiences (Beltrán et al., 2020) and momentary perception. There are numerous elements shaping social touch interactions. It goes beyond a mere sensory experience, its perception is subjective and personal, significantly affected by contextual factors and the involvement of other senses. Understanding the complexity of social touch requires considering its contextual, relational, personal, cognitive, and sensory dimensions. (For an overview see Table 1. & Figure 1.)

CONTEXTUAL LEVEL

Contextual factors can shape the meaning and interpretation of social touch. These factors may include the **physical setting and environment** in which the touch occurs, as well as the **cultural and social norms** that are accepted in that certain situation. For example, while certain social touch behaviors, like sharing a kiss in public or other forms to display affection publicly, are common and expected in some parts of the world (Mediterranean countries), in others, it might seem inappropriate or even considered an offense to public decency, e.g. in Dubai (Simpson, 2013; Sorokowska et al., 2021). There are also specific locations where touch appears to be more common due to the nature of the situation. An illustrative example is airports, where people bid farewell and greet loved ones leading to more frequent and recurrent social touches than in most other public spaces (Greenbaum, 1980). Current political climate can also influence touch behaviors or views around touch. Especially with the rise of the #Me too movement (Hillstrom, 2018), affective touch has been discouraged in schools and workplaces. Although the concern of sexual harassment is valid, this discouragement can have drawbacks – lack of positive effect of touch.

RELATIONAL LEVEL

The **relationship** between individuals, and **their personal history** can significantly impact the type of interaction one accepts or seeks from another person (Ellingsen et al., 2016). For instance, while in a hospital, we are more accepting of an unfamiliar doctor examining and touching our body intimately, while we would not tolerate the same actions from a stranger on the street.

Factors such as **gender, age, perceived status, or hierarchy** between the interaction partners can all impact the socially and/or personally accepted form of touch interactions (Henley, 1977). This can influence many parts of the interaction, such as **who initiates** the touch, the type of touch, and the body parts/area that is being touched (Nguyen, Heslin, & Nguyen, 1975).

PERSONAL LEVEL

On an individual level, besides **cultural factors, upbringing, and past touch experiences** can greatly influence a person's 'baseline' (meaning the preferred or ideal level of touch). It can impact their **attachment style, self-satisfaction, self-acceptance, and self-image** (Beltrán et al., 2020; Gupta & Schork, 1995). **Exposure** to touch such as how frequently, or how much touch one receives in daily life, can influence this baseline. For example, experiencing low touch exposure can lead to a less pleasant touch perception (Beltrán et al., 2020). Previously encountered negative or unpleasant touch experiences (like physical abuse or assault) could result in future negative touch perception, which then could lead to the avoidance of such future touch experiences. The momentary **emotional and psychological states** of the individual, but **sensory sensitivity** can also affect the way the physical contact is perceived (e.g. receiving affective touch when irritated can cause anger, while the same when feeling sad can provide comfort).

LEVEL	FACTORS
Contextual	physical setting, environment, cultural and social norms
Relational	personal history, relationship, gender, age, hierarchy, initiation
Personal	cultur, upbringing, past touch experiences, attachment style, self-satisfaction, exposure to touch, emotional and psychological state
Cognitive and sensory	message, non-verbal communication, action-reaction, multisensory experience, tactile stimulation

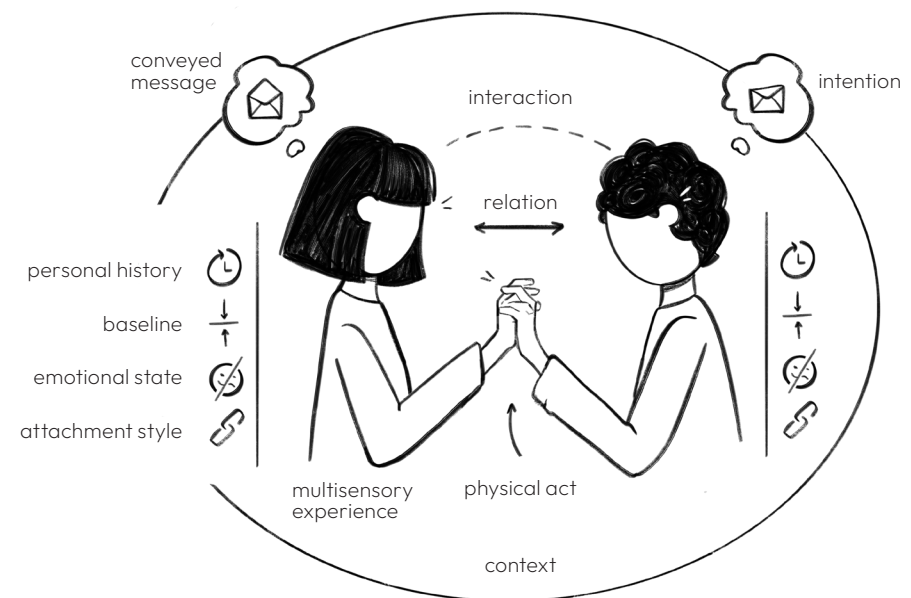*Table 1. Levels of touch interactions and example factors*

Figure 1. Factors influencing a touch interaction

COGNITIVE AND SENSORY LEVEL

All social touches convey a (symbolic) **message**. This message most often has an emotional indication, and the presence of touch as well as who initiates it in the first place can carry a meaning (Jones & Yarbrough, 1985). As with other **non-verbal communication** forms, touch is often ambiguous and can be easily misinterpreted, leading to misalignment between the sender's and recipient's intentions. Due to the undeniable and intentional nature of touch, misinterpretation can result in awkward or other undesirable outcomes (Jones & Yarbrough, 1985).

Touch is a **bi-directional interaction**; the act of touch almost implicitly will be followed by some form of response or feedback either through engagement or rejection (Jones & Yarbrough, 1985).

Most often than not, touch is accompanied by a **multisensory experience**, what we hear, see (e.g. body language), and smell (or taste) can influence the touch experience and the interpretation of the touch and its message. Interestingly, when verbal and non-verbal communication occurs simultaneously but sends conflicting messages, people tend to believe non-verbal cues over verbal ones, showing how powerful physical expression, like touch, can be (Phutela, 2015).

On a sensory level, the **tactile stimulation** one receives when touching or being touched is affected by a set of factors and qualities: the **body part, body area, tactile sensitivity, duration, intensity, frequency, temperature, pressure, and speed**. All these factors together can create a unique touch experience.

In summary, the perception of touch is influenced by a range of factors, including the context, the relationship between the individuals, personal history, cognitive processing, and sensory stimulation. These all can contribute to how the individuals will feel about and react to touch. This complexity makes touch interactions unique and a challenging situation to design for. In real-life touch interactions, these factors can be intertwined and hard to distinguish. Recent literature had also been redefining social touch interactions from a straightforward and traditional sender-signal-receiver model (where a message is being en- and decoded) and proposing new frameworks to conceptualize social touch. These highlight that touch is not always about conveying messages, but also about leaving an immediate effect on the parties (Schirmer et al., 2022). Seeing these social touches as bidirectional, reciprocal, and dynamic with expressive feedback in the communicative exchange (Jackson et al., 2022) or as an active social interaction rather than a message with a passive individual response (Huisman, 2022). Understanding the complexity of touch perception and the factors that can influence it, can help navigate these intricate interpersonal interactions.

TOUCH AS A FUNDAMENTAL PSYCHOLOGICAL NEED

To explore how touch and touch experiences can relate to our physiological needs throughout our lives and which psychological need(s) can be fulfilled through touch, we can refer to the *13 fundamental psychological needs*, identified by Desmet et al. (Desmet & Fokkinga, 2020). These needs are believed to be universal regardless of culture, age, and lifestyle and for an individual to develop and flourish all need to be fulfilled to a certain degree. These needs can be a source of motivation and satisfying them gives a strong sense of meaning and pleasure. The following overview can serve as a framework to explore the role of touch in fulfilling our psychological needs.

The relevant needs were mapped out, where touch can have an impact or a role to play. From mere tactile *Stimulation* to a more meaningful need like *Recognition*, where personal values are more significant. (see Figure 2) Three of the identified fundamental needs (*Security*, *Relatedness*, and *Recognition*) were linked to other needs, which could be viewed as a 'second layer'. While the four needs are generated, supported, or communicated by touch, the second layer represents the result that the touch (had in the first layer) can cater to.
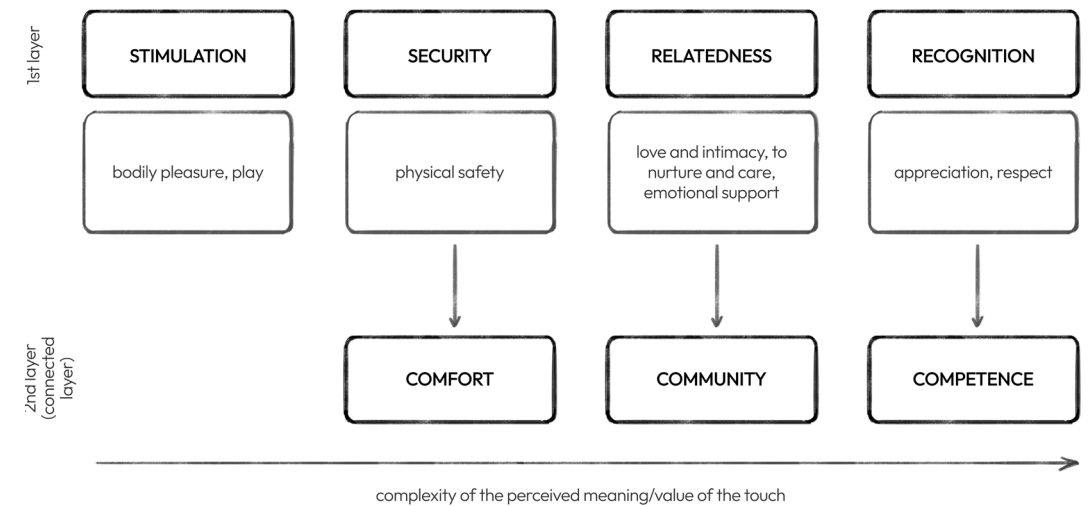
Figure 2. Relevant fundamental psychological needs to touch

STIMULATION

„Being mentally and physically stimulated by novel, varied, and relevant impulses and stimuli, rather than feeling bored, indifferent or apathetic."

Tactile stimulation is essential in our human experience, our physical and mental development rely on it, especially in infancy and early childhood (Field, 2014), but later as we age tactile stimulation can keep cognitive health in a good state (Gleeson & Timmins, 2004). People learn crucial information about the world through tactile stimulation, however, touch often satisfies less crucial tasks, such as in playing and experiencing bodily pleasures. Tactile stimulation can keep us engaged in playful or amusing activities, this form of play is called sensory play. Sensory play is often encouraged and enjoyed in early childhood (e.g. finger painting, playing with mud and sand), where touch is engaged leading to the development of motor and cognitive skills (Stanko-Kaczmarek, 2016; Wilson & Campus, 2022). As we age, touch remains an important part of our lives, and we may seek out tactile experiences for pleasure, stress relief, or to fulfill sensory needs. Bodily pleasure or sensory pleasure can be a form of tactile stimulation, where satisfying or intriguing sensations are experienced by the individual (Pawling, Cannon, McGlone, & Walker, 2017). For instance, the touch of a nice material like silk, or receiving a massage. Massage therapy, a popular form of the positive use of tactile stimulation, has been found to be beneficial for both the receiver and the giver of the massage (Field, 2019).

SECURITY

„Feeling that your conditions and environment keep you safe from harm and threats, rather than feeling that the world is dangerous, risky, or a place of uncertainty."

Experiencing physical safety through touch is especially relevant in infancy and childhood where being held has a calming effect and fosters security. This can be met through physical contact between the child and their caregivers in the form of a secure touch. Kangaroo care – where the baby is held beneath the clothing of the caregiver skin-to-skin – is a popular holding position that helps with soothing the baby and results in a deeper sleep (Feldman & Eidelman, 2003). However, this feeling of a secure touch is not only experienced in infancy. *"An innate impulse to be physically close was required for safety and survival."* (Higley, 2019) Throughout our life, a comforting stable touch has the power to induce the feeling of physical security and safety.

An outcome of providing security through touch and also a connected psychological need is *Comfort*. Being held in a secure touch often leads to a feeling of comfort and results in peace of mind.

RELATEDNESS

„Having warm, mutual, trusting relationships with people who you care about, rather than feeling isolated or unable to make personal connections."

„...a need to belong is a fundamental human motivation..." (Baumeister & Leary, 1995) Humans are social beings, and having interpersonal relationships, or a sense of belonging has been identified as a fundamental drive. Lacking these social connections can negatively impact the well-being of such individuals (Baumeister & Leary, 1995). As discussed before (in Chapter 2 - Role of touch - in Communication and Relationships), touch - among other things, has a significant role in forming, maintaining, and strengthening these social bonds (Ellingsen et al., 2014). Touch can help fulfill the need for *Relatedness* by forming personal connections.

The sub-needs of Relatedness identified by Desmet and Fokkinga and relevant to touch experiences are *love&intimacy, nurture&care, and emotional support.* Usually expressing love, intimacy, and emotional support naturally comes with interpersonal contact, while nurturing or caring for someone as an act is often physical (Beltrán et al., 2020).

By having these needs met, we can feel a sense of belonging and connectedness to others. This can result in the feeling of acceptance and in the experience of being part of a certain social group or *Community*.

RECOGNITION

„Getting appreciation for what you do and respect for who you are, instead of being disrespected, underappreciated or ignored."

When it comes to the need for *Recognition*, touch can play a role in communicating subtle meanings that show appreciation or respect. For example, a pat on the back or a hug can be a sign of congratulations or appreciation for a job well done (Jones & Yarbrough, 1985). In Western cultures, a handshake is a common form of touch used to convey respect and acknowledgment in various settings, such as business meetings, job interviews, or competitions (Hall & Spencer Hall, 1983). However, touch can also have negative connotations when it comes to recognition. For example, unwanted or inappropriate touch can make someone feel disrespected and undervalued. Certain aspects of touch, such as the pressure of a handshake, can communicate messages about status and dominance, which may not always be desirable.

Recognition can lead to the satisfaction of the need for *Competence* as it involves acknowledging and validating someone's skills, abilities, or accomplishments. When others recognize one's effort and success, it can give a sense of being in control or confidence and lead to a feeling of competence.

TOUCH DEPRIVATION

The phenomenon called touch deprivation - also referred to as skin hunger or touch starvation - occurs when an individual receives no or less physical touch than desired. (Since touch is reciprocal and "you cannot touch without being touched" (Chillot, 2013), this phenomenon more broadly happens when an individual participates in no or less physical touch than desired.) Individuals experiencing touch deprivation lack social touch with others – this may include affective, playful, supportive, or other positively perceived interpersonal touches. While self-touch or self-soothing practices can also be beneficial (Dreisoerner et al., 2021), such as touches with other living beings (pets) and the use of comforting objects (weighted blankets), these cannot fully satisfy this need. However, touch deprivation is not clearly defined yet (Beßler et al., 2020), aspects such as how long one has to lack touch to be called touch deprived, how much touch is (not) enough, the type of touch that is needed, how to measure it, etc. is unclear. The complex nature of touch itself and all the influencing personal factors make it hard to specify or pinpoint how and when this phenomenon can occur.

As discussed before, touch is essential in early (cognitive and physical) development (Cascio, Moore, & McGlone, 2019; Field, 2010). In cases where infants or children were deprived of affective touch strong negative effects could be seen - delay in growth, sleep disturbance, physical violence, aggression, and depressive and autistic behaviors (Frank, Klass, Earls, & Eisenberg, 1996). Although touch definitely had a role in these negative consequences, we have to see critically that these children were lacking more than just simple physical contact. Other negative side effects can be touch aversion, tactile sensitivity, allergic conditions, as well as negative relation to self-esteem and body image issues (leading to eating disorders) (Field, 2014).

NEGATIVE EFFECTS OF TOUCH DEPRIVATION

- *delay in growth & development*
- *sleep disturbance*
- *physical violence*
- *aggression*
- *depressive behaviors*
- *autistic behaviors*
- *touch aversion*
- *tactile sensitivity*
- *allergic conditions*
- *self-esteem & body image issues*
- *eating disorders*
- *low mood & energy*

As seen, serious touch deprivation can lead to significant negative consequences on one's overall well-being, but it might not need to be this serious to be addressed. The experience probably first appears as a feeling of 'longing for touch' or a sense of 'craving connections', where some negative impact is recognized on the individual's mood. 'Longing for touch' had been defined as: "is in principal perceived when a person's touch frequency is lower than their touch wish." (Beßler, 2020). When this gap appears between one's touch wish and their actual touch frequency, lack of touch is experienced. As touch deprivation will not happen in a day and it is most likely a slow process, which builds up over time, it could be addressed and dealt with earlier. This early experience is possibly easier reversible than a serious case of touch deprivation.

Covid-19, the pandemic which affected most of the world, forcing people to isolate and minimize their contact with others, raised awareness of this phenomenon, and the basic human need to have physical contact with others. Exercise was advised to battle the negative effects of touch deprivation, as its underlying mechanisms and effects are similar to touch stimulation (Field, Poling, Mines, Bendell, & Veazey, 2020). Creative solutions were implemented to allow for some form of connection without the serious risk of spreading the virus. 'Cuddle curtains' (Ellyatt, 2020) were installed to still feel the hugs of others, and 'Hands of love' ('Hands of love': warm latex gloves mimic human touch for COVID-19 patients in Brazil, 2021) gloves were given to lonely patients in isolation fighting the virus to mimic the sensation of holding hands. Daily greetings like handshakes were replaced with elbow bumps and feet bumps (Coronavirus: The 'Wuhan shake' or the elbow bump?, 2020), showing the importance of these small everyday interactions.
In the coming project, the term touch deprivation will refer to experiencing any level of dissatisfaction with the current amount of touch experienced which impacts the well-being, mood, or overall satisfaction with the life of the individual. It will be used interchangeably with longing for touch, skin hunger, touch starvation, lack of touch, craving touch, etc., and will not necessarily refer to the serious case of touch deprivation (with serious negative health effects) except highlighted otherwise.

"Like diet and exercise, people might need a daily dose of touch."

– Tiffany Field

Touch deprivation and loneliness

Loneliness and depression are often intertwined, as they share similar symptoms and can lead to similar outcomes, such as sleep disturbances, low mood, negative self-esteem, social isolation, and lack of interaction and touch with others. Both conditions exist on a scale with varying levels of severity.

A decrease in social touch, manly receiving touch (and social support) had been found to be a predictor of loneliness (Araújo et al., 2022). Loneliness by definition is the feeling when one's social needs are not being met by the quantity but especially the quality of social relationships (Hawkley & Cacioppo, 2010). Social touch, a shared sensory experience, had been proven to be a strong means of creating interpersonal bonds and a sense of connectedness or togetherness with positive effects on mental health and stress regulation (Morrison, Löken, & Olausson, 2010). Therefore, it is not surprising that lacking touch can also lead to the feeling of loneliness and contact therefore can reduce the feeling of loneliness (Heatley Tejada, Dunbar, & Montero, 2020). This connection between social touch and the feeling of loneliness had rarely been addressed.

Nonetheless, it is worth noting as the experiences of touch deprivation, loneliness, and depression can be akin or interconnected with similar negative effects on the individual's well-being (e.g. low mood and energy level, social isolation, sleep disturbance, negative self-esteem). Touch deprivation had been linked to depression repeatedly, and important associations were found between depression and loneliness as well (Ge, Yap, Ong, & Heng, 2017) (Figure 3).

It has been found that loneliness and depression can cause neural changes in the brain, such as sensory deprivation, and that these changes can be reversible (Neville & Bavelier, 2001; Eyre & & Baune, 2012; Cacioppo, Capitanio, & Cacioppo, 2014). This leads to the assumption that touch deprivation may also exist on a scale and could be reversible, as it shares many of the same effects on people's well-being as loneliness and depression.

Given that people are generally more familiar with the phenomenon of loneliness and depression, it is possible that in future research, participants may conflate the experiences of the three.

LONELINESS

TOUCH DEPRIVATION

DEPRESSION

- *sleep disturbance*
- *(social) isolation*
- *self-esteem & body image issues*
- *low mood & energy*

Figure 3. Similar negative effects of loneliness, touch deprivation and depression

HAPTIC TOOLS

There are numerous tools and devices that have been developed to research, stimulate, or substitute for the benefits of (physical) connection and touch between humans. These include technologies such as virtual reality, and haptic interfaces, which aim to simulate the experience of touch and interpersonal connection.

Haptic devices and other mediated touch tools have gained increasing attention in recent years as a means of enhancing human interaction and interpersonal communication at a distance. Affective Haptic Devices (AHDs) refer to tools that enable the user to send/receive tactile feedback through touch, such as vibration, pressure, or temperature changes. These devices can mimic a social touch (Mediated Social Touch - MST devices), such as the HugShirt (HugShirt, 2006), which allows users to remotely send and receive hugs through a combination of sensors and actuators embedded in a shirt, or the Kissenger (Zhang et al., 2016), a device that simulates a kiss through a combination of pressure sensors and haptic feedback. Furthermore, AHDs can also be used to convey symbolic messages through touch-like sensations (e.g. to communicate that the other person is thinking about them or loving them (as RingU by Pradana et al., 2015)), or create awareness of the connected person's activities, context (e.g. feeling the other's

movement on a pillow (Iwaki et al., 2008), see Figure 4). Askari, Huisman, and colleagues discovered that people are most interested in using AHDs to convey symbolic messages, such as emotions or expressions of love and affection (Askari, Huisman, Haans, & IJsselsteijn, 2022).

This design space had been systematized into 16 dimensions based on the characteristics of existing AHDs resulting in general system categories (e.g. bi-directionality, reversibility, reviewability) and haptic-specific categories (e.g. actuation, body location) (Ipakchian Askari, Haans, & IJsselsteijn, 2022). These give a good base and overview of the working of available haptic devices and possible directions.

However, the three main categories of AHDs (MST, symbolic messaging, and creating awareness) only cover a small part of the design space for haptic devices - with a focus on connecting people at a distance. Many more haptic tools create a specific experience through touch sensations without the intention to connect people or mimic in-person touch. For example, haptic feedback can be used to substitute another sense (e.g. wearable that translates sounds into vibration, helping hearing-impaired people (Novich &Eagleman, 2014)), or just to enhance a gaming experience (Begeot, 2021).
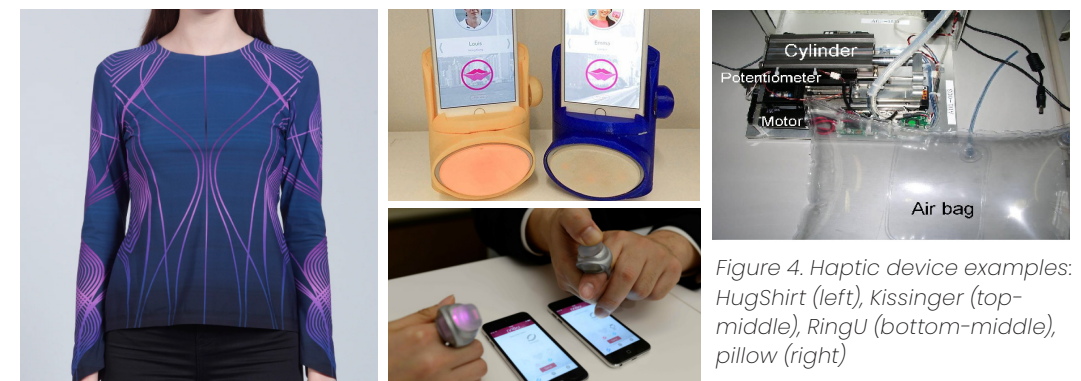

Figure 4. Haptic device examples: HugShirt (left), Kissinger (top-middle), RingU (bottom-middle), pillow (right)

Tools to help with touch deprivation

Affective Haptic Devices (AHDs) have the potential to simulate touch and connect people at a distance, providing similar benefits to physical touch. However, the research on the impact of MST devices compared to natural social touch has shown mixed results, with some studies unable to replicate the effects of touch with MST. Regardless, tools designed to target certain sensations of real touch, even without the connection to another person, have been found to have positive effects on emotional and physical regulation, such as weighted blankets (Eron et al., 2020), body pillows and simple inventions like the "Hands of Love" gloves ('Hands of love': warm latex gloves mimic human touch for COVID-19 patients in Brazil, 2021). (Figure 5) These examples illustrate the potential of touch-based devices to provide benefits in various contexts, whether for personal use or to connect with a loved one at a distance.

Figure 5. Self-soothing tools: (from left to right) weighted blanket, Somnox breathing robot pillow, Hands of love' gloves

Possible tensions

Comparing the characteristics of real-life social touch and the use of MST devices to simulate interpersonal contact, we can find some prominent conflicts between the two experiences. (Figure 6) While in most cases interpersonal touch is an act of spontaneity, purchasing and then using a device to recreate a type of physical contact gives the experience a sense of intentionality. This tension between the natural act – which is a main quality of social touch, and the deliberate choice to use external devices results in a fundamental conflict.

Furthermore, this intentionality can create a heightened sense of intimacy as well. Touch in itself is an intimate interaction, requiring physical closeness and contact, intentionally sharing the sensations through a device increases this feeling of intimacy. People have a hard time imagining the use of MST tools for everyday interactions, limiting it only to certain types of relationships – e.g. for romantic interests (Askari, Huisman, Haans, & IJsselsteijn, 2022). However, restricting social touch to a certain type of relationships, and people undermines the diversity of touch interactions and the possibility to strengthen all relationships through it.

Additionally, as discussed before social touch is a complex interaction, influenced by a set of factors resulting in unique and personal experiences. The range of sensations of MST devices are limited to vibrations, changes in temperature and pressure and often bound to a specific location or context. This also results in tension – the novel and personal perception of interpersonal touch and the restrained interaction offered by these devices.

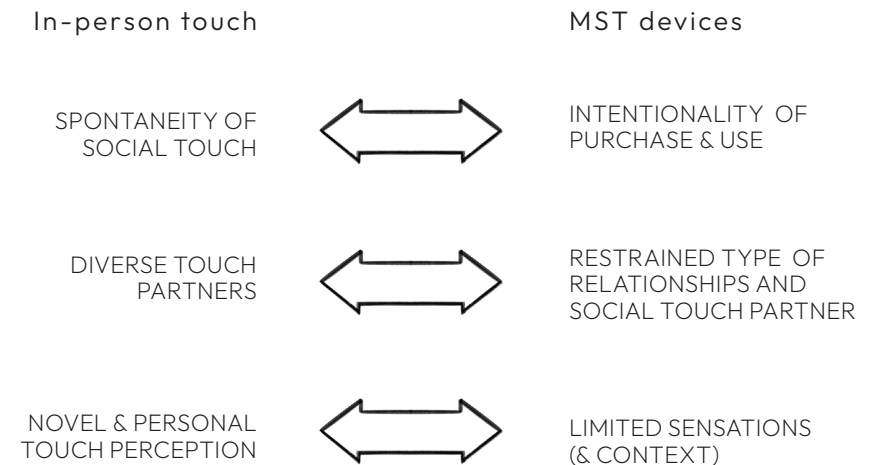| In-person touch		MST devices
SPONTANEITY OF SOCIAL TOUCH	⟷	INTENTIONALITY OF PURCHASE & USE
DIVERSE TOUCH PARTNERS	⟷	RESTRAINED TYPE OF RELATIONSHIPS AND SOCIAL TOUCH PARTNER
NOVEL & PERSONAL TOUCH PERCEPTION	⟷	LIMITED SENSATIONS (& CONTEXT)

Figure 6. Tensions between real-life interpersonal touch and MST devices

In the literature study, we gained a deeper understanding and the significance of our sense of touch. Through an exploration of touch interactions, we have learned about its dynamic and complex nature, its vital role in our lives, and the potential consequences of touch deprivation. We also presented an overview of the devices and tools aimed to fulfill elements of interpersonal touch.

First, we could see the significance of touch as a sense and its importance in social, emotional, and physical well-being. It discussed how touch, from infancy to old age, influences cognitive and physical development and has a calming effect on the body and mind. Touch is a powerful tool in non-verbal communication, conveying emotions, and building and maintaining relationships. The role of touch in non-verbal communication, its ability to convey nuanced meanings, and its association with trust and intimacy are essential to human connections.

The contextuality and complexity of social touch interactions were explored. Social touch is viewed as a multifaceted phenomenon influenced by contextual, relational, personal, cognitive, and sensory dimensions and recent literature is redefining social touch interactions, recognizing them as dynamic and reciprocal exchanges rather than simple sender-receiver communication models. Understanding the intricacies of touch perception and the factors that influence it can help navigate and design for these complex and challenging interpersonal interactions.

Furthermore, touch was examined through the lens of fundamental psychological needs. We could find that touch can directly or indirectly fulfill or cater to certain psychological needs, such as Stimulation, Security, Relatedness, and Recognition, which are all essential for an individual to develop and flourish. Then the concept of touch deprivation was looked into, to understand its definition, impact, and experience. Touch deprivation refers to the experience of receiving less physical touch than desired, leading to negative consequences on well-being and overall satisfaction with life. Touch deprivation can have both serious and less severe levels and the COVID-19 pandemic has brought attention to the importance of physical contact and the impact of touch deprivation. It also highlights that touch deprivation and its effects can be similar or intertwined with loneliness and depression.

Lastly, we examined the design space of haptic tools and devices offering tactile sensations with different aims; to connect people at a distance, mimic the sensation of social touch, provide sensory comfort, or enhance certain experiences by using tactile sensations. While these can provide some value to their users, tensions exist between real social touch and the use of Mediated Social Touch devices that with the currently available technologies at least cannot be resolved.

Having conducted this theoretical research on the nuances of touch interactions, the importance of touch, and the available research on affective haptic devices, provided a strong foundation on which the research can be continued with the involvement of young adults. The literature study gave us a general overview and important knowledge for starting qualitative research with the target group to gain a more personal perspective on the topic, to understand the effect of touch deprivation on this specific target group and with their involvement (learning about their feelings, opinions, values, and experiences) provide them with a design tailored to their needs. To gain these insights from the participants 4 main research questions were formed (see next chapter), which cover the areas of interest needed to continue with the research and design process.

User Research

In this chapter, we will present an overview of the research methods and activities which involved the target group and led to valuable insights (see Chapter 4). Then we will provide an explanation how the synthesis was carried out.

3

RESEARCH QUESTIONS

The literature study provided a comprehensive overview of our tactile sense, the impact and experience of touch deprivation, and existing directions for mediating or researching social touch. Building upon these findings, a set of research questions emerged which will be investigated through qualitative research methods involving the target group.

1. How do young adults perceive and value touch in their daily lives?

2. How do young adults experience touch deprivation and how does touch deprivation affect their social connections and mental well-being?

3. What are the existing coping mechanisms or strategies young adults employ to mitigate the effects of touch deprivation?

4. How can design interventions address touch deprivation among young adults and enhance their overall sense of well-being and quality of life?

By investigating these research questions through qualitative research methods, we hope to gain a deeper understanding of the perspectives of young adults regarding touch and touch deprivation. This research will serve as the foundation for developing design interventions addressing the issues and improving the overall well-being of young adults.

METHODOLOGY

The research made use of the Contextmapping method and approach, which believes that people are the experts of their experiences (Sanders & Stappers, 2012). Relying on both 'say' and 'make' methods, such as interviews and generative sessions to understand the experience of the participants and access their latent needs, values, and thoughts with the aim to gather qualitative data.

This approach meant the preparation of three separate, but interconnected research activities. Firstly participants were 'sensitized' by filling out a booklet made to start them reflecting on the topic and their behaviors, this was followed by an in-depth interview. Lastly, they were invited to participate in a generative session where they could share their ideas and stories. For an overview, see figure 7. These activities are explained in detail in the coming pages (p36-38).

SENSITIZING

(prepare participants
- start reflecting and
thinking of topic)

INTERVIEWS

(learn about their
behaviors, thoughts,
feelings and experience)

GENERATIVE SESSIONS

(engage them in creative
thinking activities to get a
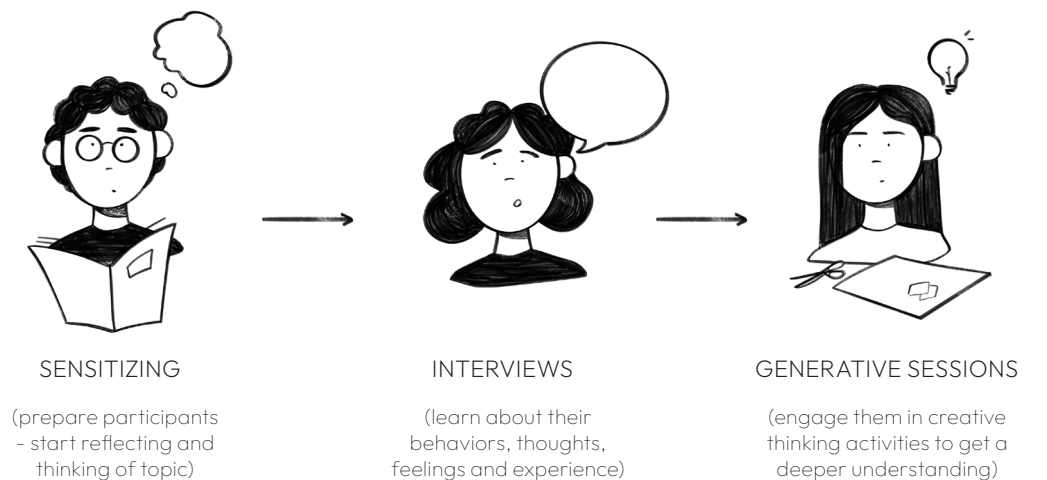deeper understanding)

Figure 7. Overview of research activities with the target group

PARTICIPANTS

The participants were recruited through online and offline channels (convenience sampling) to support the research by partaking in their preferred activities - filling in a sensitizing booklet and/or giving an interview and/or partaking in a generative session. Participation was voluntary, and no compensation was offered. The Human Research Ethics Committee of Delft University of Technology approved the research activities and the involvement of the participants.
Overall 16 participants contributed to the research, they were international (and Dutch), 6 were currently in a long-distance relationship, and 13 moved to the Netherlands from abroad to continue their studies. (An overview of all the participants with a color-code can be found in Appendix A. The participants are color-coded to indicate in later activities the source of information.) 10 participants were interviewed (see Table 2), of whom 7 filled in the sensitizing booklet beforehand, 5 male and 5 female. 10 participants joined the creative sessions (4 out of the 10 had been interviewed as well as filled in the booklet), overall 4 female and 5 male. Two sessions were held, the first with 4 young adults (3 female, 1 male), and the second with 6 participants (5 male, 1 female). The participants in these activities were between the age of 20 and 28, with one male participant, (only) interviewed being 60+ years old.

PARTICIPANT	BI – 1	I – 1	BI – 2	I – 2	BI – 3
SENSITIZED	yes	no	yes	no	yes
AGE	28	22	25	25	23
GENDER	Male	Female	Female	Male	Female
NATIONALITY	Italian	Belgian	Colombian	Indian	Indian
RELATIONSHIP STATUS	single	single	was in a long-distance relationship (now in a relationship)	single	in a long-distance relationship
EXPERIENCING TOUCH DEPRIVATION	yes (currently)	yes (in the past)	yes (in the past)	no	yes (currently)
ADDITIONAL INFO	-	has an identical twin	hobby: high-contact combat sport	-	difficulties in relationship due to long-distance
PARTICIPATE IN GENERATIVE SESSION	no	no	no	no	no

	BIS – 1	I – 3	BIS – 2	BIS – 3	BIS - 4
	yes	no	yes	yes	yes
	24	60+	20	23	26
	Female	Male	Male	Male	Female
	Indian	Dutch	Dutch	Dutch	Indian
	in a long-distance relationship	married	single	was in a long-distance relationship	single
	no	no	yes (currently)	yes (currently)	yes (currently)
	-	-	serious social anxiety	-	BPD (borderline personality disorder)
	yes	no	yes	yes	yes

*Table 2. Overview of the interview participants*

Sensitizing

Following the Contextmapping method for data gathering, to immerse and 'sensitize' the participants about the topic of the research, a sensitizing booklet was designed. The goal of the booklet was to prepare the participants for the following interview, and get them to start reflecting on the subject - their behavior, routines, thoughts, and feelings, so they can give more detailed, thought-trough answers and the conversation can go beyond a superficial layer (Sanders & Stappers, 2012).

Although self-reporting touch events can be inaccurate (Chan, 2010), it will make the participants aware of the research topic and start to reflect on their touch behavior. The booklet is aimed to help them prepare by the time of the interview to describe and talk about their touch experience with more awareness and hopefully with more accuracy.

The booklet or workbook consists of short activities, spread out over 4 days, which take the participants a maximum of 10 minutes to complete daily. Each day a different topic area was covered to build up to the interview. On day 1, they mapped out the people they have touch interactions with currently. On day 2, they reflected on their touchiness, how much touch they initiate, and their satisfaction with the current situation. Day 3 was dedicated to understanding the qualities and meanings of certain acts of touches. Finally on day 4, awareness of the number of daily touches was prompted.

The sensitizing booklet and additional materials can be found in Appendix B.
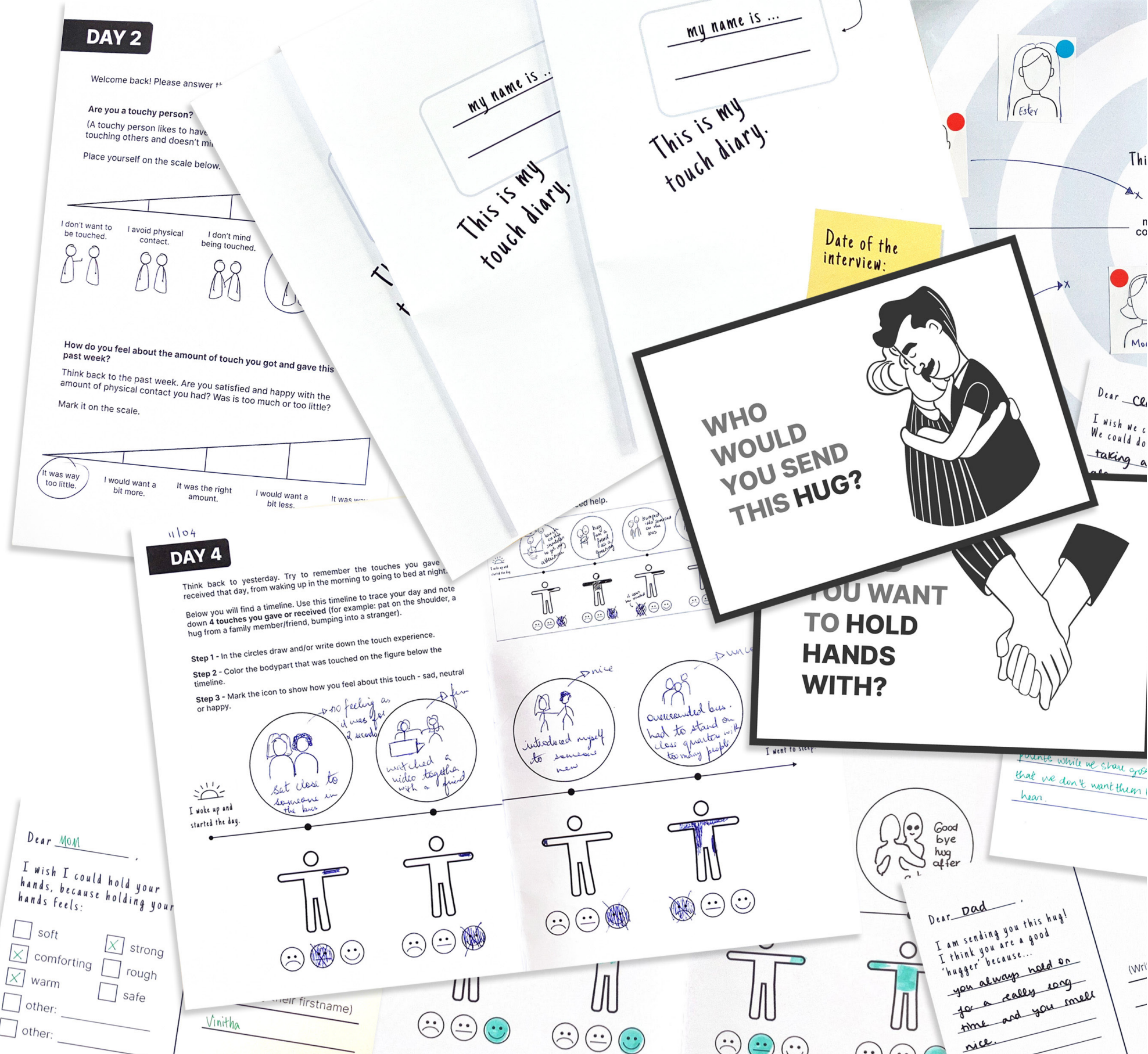
Interview

The one-hour, semi-structured interview followed a script loosely, focusing on the main topics but with the flexibility of following the participants' natural thought processes and going deeper into personal stories. The goal of the interview was to hear and understand people's experiences, habits, needs, and values around their touch behavior or the lack of it. A limitation of interviews is that what people say is often different from what they actually do. Self-report of touch behavior and habits might not be accurate or reflect the truth perfectly. For the interview script see Appendix C.

The interview focused on topics such as:

- the cultural and social background of the participant (how touch plays a role in their culture, family, and social life) - to get an understanding of their personal baseline,

- their adaptation to the Dutch culture (if applicable) and current situation - to see if there is a noticed change in the baseline

- their long-distance relationship situation and touch habits with their partner (if applicable) - to understand their preferred behavior and what they miss

- awareness of touch experiences generally - to get an understanding of the importance of their daily touches

- their positive touch experience - to understand the qualities, values, and needs regarding positive touch experiences

- their experience of touch deprivation - to see the effects, influencing factors, and overall experience of touch deprivation

- their Covid-19 experience - to see how social distancing, isolation affected them

- their view on tools aimed at fulfilling the need for touch - to understand their opinions and acceptance

Genrative session(s)

The generative session made use of multiple research techniques, tools, and methods to get the desired insights through a series of creative thinking activities. The main goals of the sessions were to get a general understanding of what matters or contributes to a touch experience (influencing factors), what makes one good and memorable (qualities and values), what are people's needs or coping strategies when lacking touch and finally their outlook on using tools to mediate touch. See Table 3 for an overview of these activities. The generative session script and generated materials can be found in Appendix D.

	METHOD	GOAL	OUTCOME
activity 1	Modified brainwriting - The participants were asked to note down everything (internal and external factors) that can influence a touch experience. Afterward, they could share, discuss and build on each other's thoughts.	1. Discover the influencing factors of touch interactions that contribute to or shape the experience in any way. 2. Make them aware of the complexity of social touch, to consider them in the second activity.	Cards with the main points or keywords were generated during the discussion to be used in the second activity as a guide.
activity 2	Collage making- It is a 'make' tool, which reveals deeper levels of understanding and engages participants in associative and creative thinking. Participants were given different materials to create a collage/representation of a memorable moment where touch played a major role. The previously generated keyword cards were used to recall more details. The participants then shared these memories supported by their collages.	1. Understand the important qualities of a positive touch experience. 2. Allow them to express their thoughts and feelings - reaching more tacit and latent knowledge.	Collages of special memories
activity 3	The participants were asked to recall a moment when they were in need of touch and fill in the following sentence: I was in need of touch when [short description of the moment], I wanted [person] to [act of touch]. The participants were not asked to share this.	1. Prompt participants to recall a moment when they were in need of touch to get them in that mindset for the following activity.	Filled-in sentence. (Participants could keep them, tear them, etc.)
activity 4	Ideation/random association - The participants were given some random objects (tennis ball, paper plane, mug, wooden heart, etc.) to redesign (modify, add technology, etc.) and turn into something that could have helped at that moment. The participants were asked to explain their concepts.	1. Understand what people need, value or do to cope with an in-need-of-touch experience.	Ideas for (realistic and unrealistic)tools that can in some way ease the negative feeling of needing touch.
activity 5	"In a world where" speculative method (Joshi, 2021) - World building technique to invite participants to come up with a provocative statement about a speculative world's status quo and how that would influence people in response. The participants were asked to come up with as many as they can, with the main question and the topic of the session in mind. They were asked to share, discuss and build on each other's ideas.	1. Get a sense of people's views (fears, hopes, etc.) on mediating touch with tools or technology.	Future world status quo-s where touch is mediated through tools or technology

Table 3. Overview of the generative session activities

Curiosity

Soothing

simple

PAST

PRESENT

The mind state

Fabrique
Digital design agency

post /D

A way of learning

Fabrique
Digital design agency

post /D

In a world where WE TALK WITHOUT SEEING E
[insert provocation]

people WILL APRETIATE MORE HUMAN
[insert what people d

In a world where ALL INIXEN INTERACTIONS
ROBOTS
[insert provocation]

people NEED TO
PEOPLE

THE SITUATION
THAT CALLS FOR BE
A TOUCH?
SORROW? HAPPY?
POST ID

TRUST &
SAFETY
post /D

Fabrique
Digital design agency

How does it work? (feel free to draw or write)

Possible feature:
breathing
exercise
helper

ME

HEAD REST

BLIND FOLD/GOOGLE GLASES THAT IS WARM,
TIGHT, DISPLAYS IMAGES AND MUS

• How would have it helped in that
HELP ME TO REFLECT THE
CONTEXT.

• Why do you think this could have h
AT THAT MOMENT I JUST
REALITY. MAYBE THIS C

change   closeness

weight

connected

pressure

calm

breath

FRAGILE
HANDLE WITH CARE

THE RESPONSE
OR HOW THEY REACT
WHEN YOU INITIATE?
POST ID

TEXTURES

The methods used in the user research resulted in the collection of a rich set of qualitative data (sensitizing booklets, interview transcripts, generated materials from the creative session, and transcript). The participants shared interesting and valuable personal stories.

In a world where

people will have

replicated
[insert provocation]

In a world where touch can be
hugs are delivered virtua

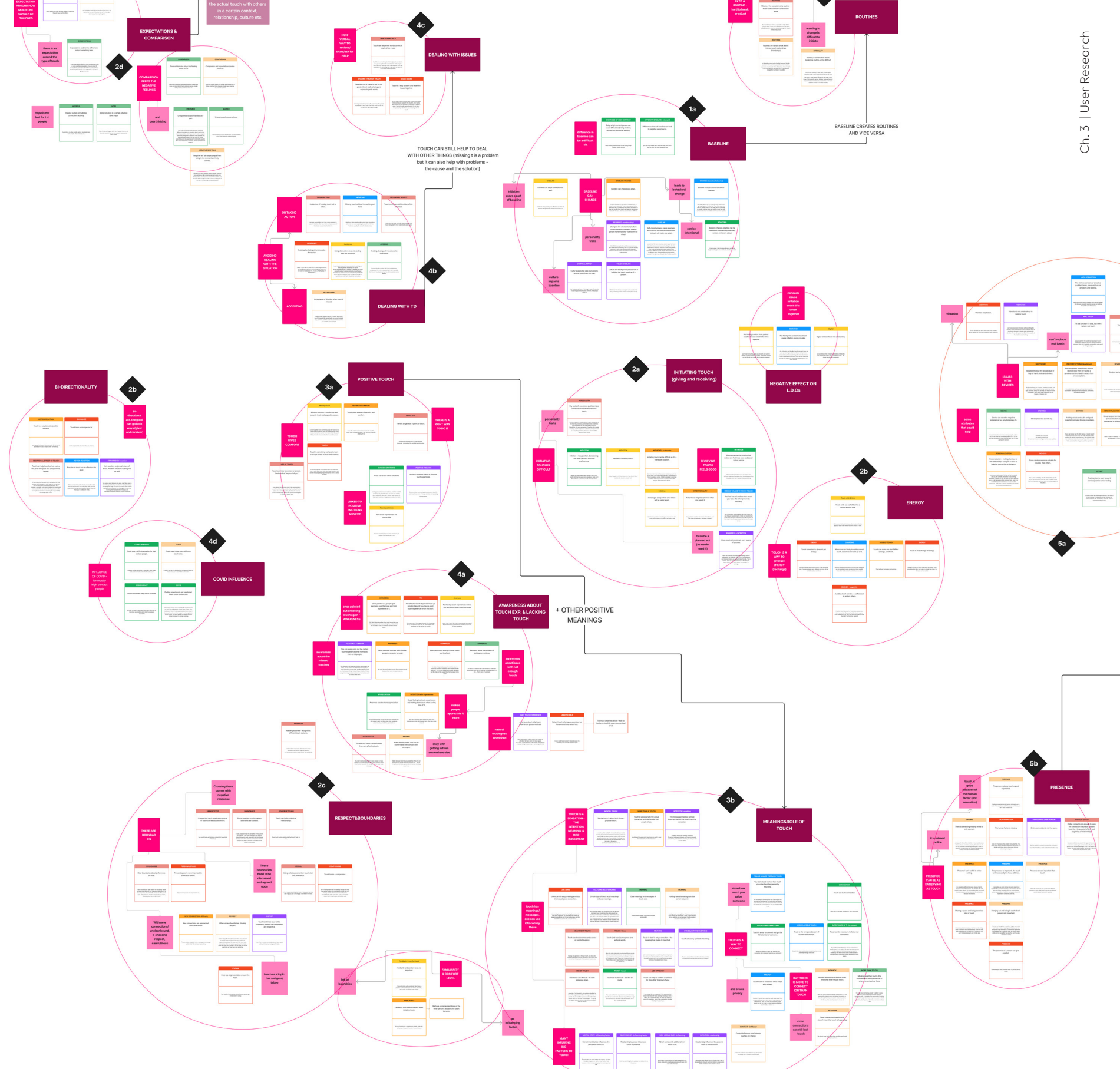people wouldn't be afraid
[insert provocation]

SYNTHESIS

The synthesis of the gathered data was executed following thematic synthesis and the Contextmapping method (Sanders & Stappers, 2012). The interviews were transcribed, then statement cards were created. (A statement card includes an interesting quote taken from the interview, its interpretation generated, then given a title; it is also color-coded to indicate the participant - see example Figure 8). The numerous statement cards generated from the transcripts were then clustered based on their topics. These clusters then were arranged based on more overarching themes and connections were drawn between the smaller clusters. These themes, clusters, and the connections between them led to an overview of all the findings. (The generated materials of the creative sessions were also clustered based on common themes.) See Appendix E for the detailed synthesis process. The results of these synthesizing activities are explained and presented in the following chapter.

Color code of the participant

ACTION-REACTION — Title

Bi-directionality of touch, reaction to touch has an effect on the giver of the touch as well. — Interpretation

"Whenever I kiss him on the cheeks, he has like a little smile on his face and I find that really, really cute and very comforting that, you know, my kiss would affect you to smile." — Quote

Figure 8. Example statement card

TOUCH CAN STILL HELP TO DEAL WITH OTHER THINGS (missing t is a problem but it can also help with problems - the cause and the solution)

BASELINE CREATES ROUTINES AND VICE VERSA

EXPECTATIONS & COMPARISON

COMPARISON FEEDS THE NEGATIVE FEELINGS

DEALING WITH ISSUES

NON-VERBAL WAY TO ASK FOR HELP

ROUTINES

BASELINE

DEALING WITH TD

ACCEPTING

AVOIDING DEALING WITH THE SITUATION

OR TAKING ACTION

BI-DIRECTIONALITY

POSITIVE TOUCH

TOUCH GIVES COMFORT

THERE IS A RIGHT WAY TO DO IT

LINKED TO POSITIVE EMOTIONS AND ESP.

INITIATING TOUCH (giving and receiving)

NEGATIVE EFFECT ON L.D.Cs

RECEIVING TOUCH FEELS GOOD

INITIATING TOUCH IS DIFFICULT

COVID INFLUENCE

INFLUENCE OF COVID - for mostly high contact people

ENERGY

TOUCH IS A WAY TO give/get ENERGY (recharge)

AWARENESS ABOUT TOUCH EXP. & LACKING TOUCH

+ OTHER POSITIVE MEANINGS

PRESENCE

PRESENCE CAN BE AS SATISFYING AS TOUCH

RESPECT&BOUNDARIES

THERE ARE BOUNDARIES

MEANING&ROLE OF TOUCH

TOUCH IS A WAY TO CONNECT

BUT THERE IS NEED TO CONNECT ION THAN TOUCH

FAMILIARITY & COMFORT LEVEL

TOUCH IS SOMETHING THE INTENTION/ MEANING IS MORE IMPORTANT

Chapter 4
Results

This chapter will present the results of the user research - nine overarching themes supported with quotes from the participants providing the takeaways from the research activities and four personas created to represent the target group and be used later as a tool to guide the design process.

4

THEMES

From the synthesis, several themes have been constructed, providing valuable insights into the complex nature of touch and touch deprivation among young adults. By systematically exploring and analyzing the collected data from all the activities (sensitizing booklet, interviews, and creative sessions), these themes offer an understanding of the (emotional) experiences, needs, values, and behaviors of this specific target group. The insights are supported by quotes from the participants stated during the interviews or sessions. These findings will guide the design process and the development of interventions aimed to address touch deprivation.

1 | Change in baseline & routines

Our baseline (preferred or ideal level of touch) is shaped by culture, social values and norms, family traditions, and personal upbringing. Young adults' baseline can change and adapt to the current touch culture and environment they are exposed to. This change in environment (e.g. moving abroad to a different country, a new friend group), therefore influences their touch routines, and behaviors and sometimes triggers or brings out personal traits, such as self-awareness,

"Sometimes I felt very conscious about myself on how I should be like when someone is touching me." (BIS-1)

*"...person naturally becomes more reserved in behavior until you develop certain understanding."* (I-2)

self-consciousness, and reservedness. This baseline change can be both an increase or decrease in the need to receive or initiate touch, see the example of participant BI-1:

"It's weird because I'm not used to that anymore... It doesn't come automatically [to touch anymore]." (when visiting family and friends in Italy after living abroad for 5 years).

Also, depending on some characteristics of the individual, this adaptation of touch routine can go unnoticed but occasionally can be an intentional choice on someone's part. In cases where there is a misalignment between people's baselines, the situation can lead to disappointment or other negative experiences.

"I had to adapt. ...going north, people don't like to be touched or they keep distance, and in the beginning, this gave me a lot of loneliness." (I-1)

However, when one is unsatisfied with their current touch routines and their touch wish is not fulfilled, breaking the routine or starting a conversation about it can be difficult.
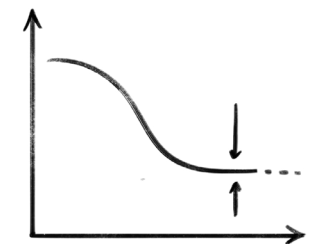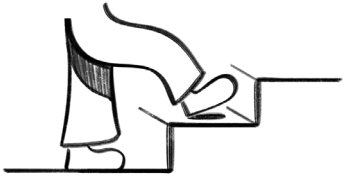
2 | Initiation of touch

Reaching out and initiating an act of touch can pose some challenges. Some find being the initiator tricky or a vulnerable position, as it relies on 'reading the room' and the other person's signals correctly. The risk of crossing boundaries or coming across as disrespectful leads to overthinking and hesitancy, as expressed by participants BI-3 and BI-1:

"I expect people to initiate it, but when they don't, I also hesitate like… should I… should I not?" & "…there is always a little bit of 'OK, let's see the territory'."

However, touch can be planned sometimes to convey a certain message or when feeling the need or seeing someone else needing it. This can cause the individual to find a moment to execute a planned hug, handshake, etc.

"…so, in that case, I planned it. Because I needed it." (BI-1)

But initiation can go both ways, participants found being the receiver of an affectionate touch more pleasant (than initiating it), because it made them feel seen and valued. One participant (I-1) with high touch wish expressed how she feels closer to people who reach out to her than to the ones to whom she has to reach out more:

"…when somebody reaches out to me that's a very different experience because then I feel really seen."

Touch is a bi-directional interaction, one might initiate or lead the act, but the positive effects of it can be experienced by both. Engaging in touching is like a non-verbal conversation, one acts to which the other responds. Often receiving a positive response, or seeing the positive impact on the receiver (a smile, calming breath, joy, etc.) can fill the giver with positive emotions as well.

"Whenever I kiss him on the cheeks, he has like a little smile on his face and I find that really, really cute and very comforting…" (BIS-1)

Therefore, touching can be an exchange of positive emotions, feelings, or 'energy'. Multiple participants believe that through touch one can give and get energy, it's a way to feel fulfilled and charged.

"They're [hugs] recharging the batteries." (BI-1)

"…we do need human contact to like exchange kind of energy between each other." (BIS-4)
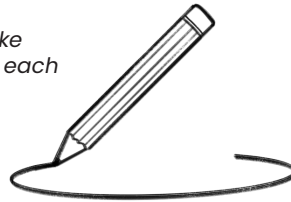
3 | Respect & boundaries

Touching as a topic often has a stigma around it or feels taboo and people feel embarrassed to talk about and share their touch-related needs. We all have clear boundaries (where is it okay for a stranger, a friend, or a partner to touch), which can be easily pointed out when asked about in the interview, as participant BI-2 did:

"…on top of my knee, this part of my arm is private. This part is open. This part is not. Head is very private…"

While some really value their personal space, others are more forgiving about it. However, talking about these boundaries with others is a more difficult conversation, these compromises can be addressed verbally or non-verbally as well. Mostly male participants expressed that they approach new connections, and unclear boundaries with respect and carefulness to come across as considerate.

"…I tend to be more safe than sorry instead of on the other end of the spectrum, so I was very restrictive." (BIS-3)

Negative touch experience on the receiver end where the boundaries were crossed, can lead to distress or other strong negative emotions. Touch can build, but also damage interpersonal relationships.

"Good touch builds a relationship. Bad touch. Yeah, it's just…" (BI-2)

4 | Expectations & comparison

There are overall expectations around touch experiences on a cultural and contextual level (how to act in school, at a family gathering, or on a date). Also on a more personal level, people set expectations for themself on what life experiences should they have at what age, like participant BIS-3:

"I did tend to think about it as in I was missing out on things…"

These expectations can easily turn into pressure. In the case of long-distance relationships (romantic or familiar), these parties feel the need to talk online and keep each other updated on a regular basis. One participant expressed how this had been difficult in her relationship, as it caused guilt when these expectations couldn't be met.

"… we speak maybe twice a day while still texting each other like it doesn't have to be… There doesn't have to be any rule or any guilt." (BI-2)

A sense of comparison had been also mentioned by the participants who lack touch and social connections. The feeling of missing out on experiences that seemingly everyone else has at the same age or the same part of life (e.g. university) can also result in negative emotions or a sense of pressure. In the age of social media, where young adults share the highlights of their everyday lives, it's easier than ever to feel left out or behind. And this is also relevant to touch-related life experiences, quoting participant BIS-2:

"I realize now more and more that I'm falling behind."
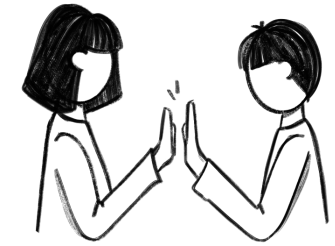
5 | Meaningful touches

As mentioned before, touch can create positive feelings in the receiver and the giver if it's done the right way. Touch interactions have a right 'rhythm' to it that needs to be met to feel pleasant. Most commonly the positive feelings generated by touch are comfort and security, love, support, trust, pride, happiness, familiarity, and calmness. However, touch can also be a powerful tool to evoke latent feelings and needs, as we can see the example of participant I-1:

"We hugged each other several times, and then we both spontaneously started crying. So there was actually some realization like I didn't realize I was missing her that much."

Through touch one can convey messages and intentions, the different acts of touches can hold different meanings but also the way they're executed can be an indicator. Hugs are associated with comfort and protection, holding hands with showing 'we are close' or 'you're mine', and a kiss on the cheeks can show caring. Most often than not, these messages and the intention of the touch are more important than the physical sensations it is linked with. Touch is a great way to create connections, show that you value someone, or create a sense of intimacy or privacy, but these can be achieved without touch as well. Individuals who have emotional and social connections can still lack touch and vice versa - one can experience touch without having connections.

"I would say that mostly for me touches are always mental… it's less physical but more mental." (I-2)

"Touch doesn't have so much importance to me. It is more the relationship and the interaction." (BI-1)

6 | Touch deprivation

Due to the lack of awareness about touch deprivation, people are often unaware that they're experiencing its effects. Once they become familiar with the term, they can easily relate to the experience and start reflecting on their own touch wishes and the actual touch 'amount' they engage in. However, awareness can also rise when the individual experiences a significant touch experience (e.g. hug from a parent they haven't seen for a long time) they were lacking.

"I like hugged her and I felt like a weight off my shoulder, and I was like, oh, this is what's been missing in my life the last six months." (BIS-4)

A lack of general awareness about touch needs makes this issue an invisible source of negative impact. As people reflect on their touch needs, this awareness can also create an appreciation for current and past experiences, like participant I-1:

"I realized that this is what I need. And then when somebody gives me a hug, I really like, appreciate it."

Participants could easily recall what touch they miss and how it makes them feel.

Lacking touch in general was described by the participants as feeling low and tense while missing emotional and physical closeness. It's a difficult state, young adults are less motivated, things are less enjoyable, and they experience loneliness and loss of general comfort. If the individual misses touch from a single source (their long-distance significant other), the experience can also manifest in irritation and frustration, as seen with participant BIS-1:

"...the longer it goes we pick up more fights. And then like we will get more annoyed at each other and things like that."

However, in general, lack of touch isn't really identified as the source of these feelings. Some defined it as a void inside, having a low battery, or carrying weights that can only be lifted when receiving the touch, we need.

*"It's like a void in your inside of you. Like this*

empty hole and it can't be filled unless... You get what you need. That touch." (BIS-4)

Touch deprivation can be linked to other life situations which can contribute to, or increase negative feelings and experiences. Touch deprivation is rarely an issue on its own, just as touch itself, touch deprivation is also complex with many influencing or enhancing factors. These factors and the experience of touch deprivation are intertwined; often it's hard to pinpoint if they are a result or a cause for lacking touch. Changed life statuses, such as changes in living, relationships, and social situations, but also difficulties with mental well-being can all influence the experience of touch deprivation. Stress experienced from work or school, and a decrease in the comfort and quality level of home were also factors mentioned by the participants.

"I was in the more uncomfortable physical space. It just losing general comfort." (BI-2)

Surprisingly, dealing with the restrictions of the Covid-19 pandemic wasn't as impactful on the participants' well-being. Most of them stayed at home, spent more time with family or a few selected friends, and kept busy with their studies and/or work. It was harder for people with a high touch wish, but for young adults who were lacking touch before Covid-19 as well, the restrictions didn't change much, as seen by participant BIS-3:

"It wasn't that big of a difference for me when it comes to touch."
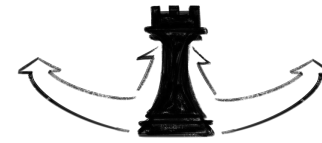
7 | Coping with touch deprivation

Dealing with the negative impact and emotions of touch deprivation isn't an easy task. Participants either showed avoidance, acceptance, active mitigation, or sought comfort. Most often these young adults prefer to look for distractions and avoid dealing with the issue, this can be in the form of consuming different entertainment content (watching Netflix, TikTok, or playing video games).

"...mainly I try to take my mind off it by watching something." (BI-3)

This suppression often was linked with a sense of acceptance.

"I'm not sure if it impacts my mental health... because it's just a matter of accepting it." (BIS-3)

Another common choice was to look for a sense of comfort, either through the feeling of nostalgia (by looking at pictures, personal objects), or by finding tactile comfort. Only a few young adults actively faced the issue; by participating in a high-contact combat sport or just looking for more touch from available sources like friends.

"I became aware of that and I took some measures to adjust it. And then after that, I think I've been aware of how touch was so important for me." (BI-2)

Interestingly, participants mentioned that touch is an easy non-verbal way to ask for help or express that 'I'm not okay.' without really sharing one's thoughts and feelings. Through touch, the individual can communicate their negative experience and instantly get comfort from the interpersonal interaction. Touch can help when words can't, the bodily expression of touch can simply share and/or ease one's emotions.

"It's not about always sharing with words but sharing with touch." (BIS-4)

8 | (Haptic) devices & tools

Participants were shown and asked about AHDs (some are in the category of mediating social touch, some conveying more symbolic messages, and devices/tools aimed at helping individuals on a sensory comfort level). There were some negative opinions about using MST devices to connect at a distance, questioning their real value and clearly stating that they believe it can't replace real touch, as participant BI-2 said:

"It kind of feels disrespectful. For me, it's better to lack touch with dignity."

When talking about the way they function, vibration as one of the modalities was also met with criticism. The sensation of vibration is linked with noise and electronic devices (like phones), which feel like an unnatural way to replace touch.

"We have always seen vibration with something like maybe a motor or mixer and it's an unpleasant thing in your house because it creates noise..." (I-2)

"...for the vibration just send them a text. Your phone gonna vibrate too. Like like, why do you need that here?" (BIS-4)

Participants mentioned some attributes that could help the acceptance of these devices; as every human interaction is unique, personalization could benefit these tools, also combining them with visuals and/or audio.
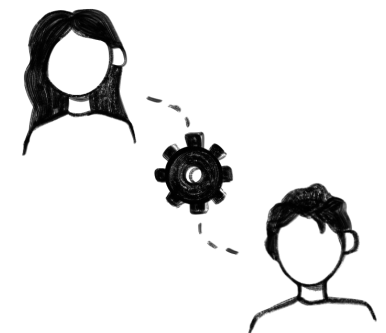
There was a more positive response to symbolic devices, which don't aim to mimic touch but create a symbolic link between their users. In this case, the intention to use it was mentioned to be more meaningful. Similarly, self-comforting or helping tools (such as a weighted blanket) were met with positivity. Participants saw the possibility of how they could support or give comfort to the individual by using it in a respectful way.

"It's not like trying to impersonate someone, it's just like something that makes you feel good." (I-1)

"I feel [that] they are more respectful in the sense we are not pretending to be another thing." (BI-2)

9 | Presence

Building on the previous theme, we can see that young adults are skeptical about the actual value of mediated touch that in ways tries to mimic real-life interpersonal touch. They believe real-life, in-person touch can't be imitated or replaced, as it's missing the 'human factor' or 'presence'. During the research, the term 'presence' came up multiple times, referring to the feeling of sharing or being in the same space with another. With MST devices, that remotely allow to hug, kiss, or shake hands, etc., or online forms of communication people show dissatisfaction or reject the idea altogether.

"The idea [MST devices] to me sounds like you're replacing this person with a machine." (BI-2)

Participants expressed that the touch is desired and feels good because of the person in the first place, if you remove/replace the person - the only thing left is the sensation. And touch is more than a mere sensation. For building, maintaining, or feeling a sense of connection real-life interactions are essential. Often the presence itself can be satisfactory in building connections and give more comfort overall than touch, expressed by participants BIS-4 and BIS-3:

"...sometimes just close proximity itself, it's just so calming for me."

"...you could realize that her presence is gone and it was also much more comfortable at come with my sister."

In explaining what this presence is, participants mentioned attention, lack of distance, sharing experiences (in real life), hanging out, and being in close proximity or in each other's private space. It could also be linked to the previously mentioned 'energy' that people receive (and give) when touching, which cannot be transmitted through a device.

PERSONAS

To create a realistic representation of the target group and the participants involved in the research and to show their key characteristics, needs, and values, four personas were generated based on the qualitative research executed beforehand. These personas are meant to provide a human-centered perspective by introducing the target audience and serve as valuable tools for decision-making, iterating, and validating ideas.

PERSONA 1 - „OVERTHINKING LONE-WOLF"

"Hey, I'm Alex. Being an **introverted** person, I find it **challenging sometimes to make social connections**, and that makes me feel kinda lonely. It's not just lacking touch... it's this **deep sense of loneliness** that has a real impact on my well-being.

I know I tend to **overthink** things, and my **social anxiety** often makes it difficult for me to take the first step or actively participate in social settings. It's also hard to initiate conversations or join groups, even though I would want to - which only adds to my feelings of being alone. Deep down, I'm not really satisfied with myself or the situation and I should definitely improve on my self-esteem. I'm quite **aware of the issue** I'm facing and **genuinely want to change**, but at times, I feel incapable or unsure of how to overcome these challenges.

Currently, I'm **single**, and I often find myself **comparing my life to others**, experiencing FOMO (fear of missing out), and feeling pressure from all these societal expectations. It can be really overwhelming, so **I like to take my mind off of it** by playing video games. I know this isn't the healthiest way to cope with the situation... to avoid it. I do **take small steps**, mostly making mental decisions and gradually taking action to challenge myself. I hope to improve my social anxiety and slowly build up my confidence in social situations.

For me, touch is **not only about physical contact; it's about experiencing a sense of community and relatedness**. But also it's very human to touch and be touched so I guess it's also about feeling competent. Obviously, it also gives a sense of security and comfort and stimulation I guess."

PERSONA 2 - „DISCONNECTED INTERNATIONAL"

"Hi there, I'm Maya. I consider myself to be quite **socially active**, I enjoy reaching out to others and participating in social activities. However, despite my efforts, I often find that I **don't connect with people on a touch level**. We talk and hang out, but barely hug or show affection that way... which leaves me with this sense of **tactile loneliness**.

I know that I **need more physical contact in my life to feel seen**, but it also makes me feel vulnerable. I have this feeling that I am missing out on something significant, and it **affects my mood**. Growing up, touch was a natural part of my life (culture and family), but now I find myself longing for it. **Leaving my home to study in a different country** and culture made me appreciate touch, but also recognize that my needs are not met here. I love being here and experiencing everything, but this part of my life is missing. However, I am a **sensitive** person and often feel **self-conscious** about expressing my need for touch.

I did notice some changes in my well-being, as I often experience low moods and waves of sadness. I do think that physical touch can give me a sense of relatedness, security, and comfort. It's also a source of stimulation and a sense of recognition, I believe. I find myself **avoiding these conversations and situations** that may highlight my need for touch or make me feel more self-conscious about it. This strategy usually provides some temporary relief, but I know it doesn't truly solve the issue. Although I feel vulnerable, I am **motivated** to find ways to change it. I long for meaningful touches in my life and hope to navigate through this period in a way that brings me a sense of fulfillment and emotional well-being."

PERSONA 3 - „SOCIAL LONG-DISTANCE PARTNER"

"Hi, I'm Sarah! I'm an **extroverted** and socially active girl, who enjoys being around people and has **no trouble making connections** with others. However, there's a particular aspect of my life that leaves me feeling a sense of longing. Currently, I'm **in a long-distance relationship**, which means I can't have the touch I desire. While I am aware of my touch experience and **actively seek out touches from others**, like friends or engage in sports, it's not quite the same as that **specific touch I crave from my partner**. And I don't only mean sexual touches, I just want to hold hands, be held, or just feel his **closeness and presence**.

I know that I will have all that, but unfortunately, it's just not available to me at the moment due to the physical distance. This makes me **feel low** sometimes and **dissatisfied**. The distance also affects our relationship sadly, I noticed we get more easily frustrated or irritated with each other - which isn't a nice experience.

I consider myself a **caring and sensitive** individual, and I'm also very **aware of my touch needs** and how not meeting them affects my mental health. Touch holds great significance for me, providing a sense of security and comfort, as well as a feeling of connection to others. While my efforts of coping with the lack of touch help to some extent, I am still eager for the specific touch, partner, and kind of touch that I miss so much."

PERSONA 4 - „CASUAL EXTROVERT"

"Hello, I'm Daniel. I'm an **easy-going** guy, who enjoys socializing and connecting with others. However, when it comes to **touch experiences, it's something that I haven't given much thought to before**. It has always been kinda natural or „invisible" for me, something that I didn't pay attention to. I **like to keep my mind busy** with work, school, and my other interests.

I don't think I ever experienced touch deprivation, or at least it **hasn't had a significant impact on my life**. I do get stressed sometimes... maybe comforting touches could help there, but I don't know. I **do understand its importance, but I find satisfaction in connecting with others through different means**, and I haven't given too much value to touch in my personal relationships. By the way, I'm **not in a romantic relationship** right now.

That being said, there are moments when I **miss certain interactions** with my family, especially since I am an **international student**. Being away from home, there are times when I long for the hug of my mum or dad. In terms of touch's significance, comfort is the primary aspect that I associate with it. Feeling a sense of relaxation and ease through touch brings a level of comfort that I appreciate."

The themes present the key findings regarding touch deprivation and its impact on social interactions among young adults, highlighting several points that are essential for our understanding of these subjects.

It became evident that in-person social touch with the currently available technologies cannot be easily replaced. The physical presence of individuals is of utmost importance in fostering meaningful connections. We found that coping with touch deprivation requires a more nuanced approach, as taking active (and risky) steps may be difficult or undesired for this target group. On the other hand, awareness of the importance of touch interactions and its impact on well-being acts as a positive step toward addressing touch deprivation. Young adults value physical and sensory comfort as a means of self-support when experiencing the negative effects of touch deprivation. Moreover, while touch is valued

and appreciated when received, the act of initiating it can be intimidating. This insight emphasizes the need for interventions that facilitate or encourage touch initiation. The key findings presented also resonate with previous literature, which emphasized the complex nature of social touch interactions and their emotional relevance. Touch deprivation is not a standalone issue but rather intertwines with various factors and experiences. The insights about AHDs are also in line with the literature - devices for symbolic messaging were well received and comforting tools were found to be useful.

Building upon these conclusions, we introduced 4 personas - based on the findings and the characteristics of the target group, and in the next chapter will explore promising design directions with the potential to ease the struggles of touch deprivation among young adults.

Chapter 5
Scoping

In this chapter, the primary explorative design process is presented, from the synthesis to the selected concept direction. Based on the results of the synthesis, firstly some design directions were mapped out followed by an initial idea generation.

5

POSSIBLE DESIGN DIRECTIONS

After the synthesis, three main directions were defined from the results based on the key insights - designing for relatedness, comfort or to create awareness.

Since we found that real-life interpersonal touch cannot be replaced, this design project will not aim to mimic or try to substitute for real-life touch. Instead of trying to connect people at a distance, the project will focus on building (new) connections in-person. Real touch cannot be replaced*, but values that come with and from touching can be created or designed for, such as the feeling of connectedness (design for relatedness) and a sense of comfort (design for comfort). Comfort is proven to be helpful when feeling low, and is an existing parctice among touch-deprived young adults.
Relatedness and comfort also relate back to the fundamental needs framework discussed in Chapter 2. Touch has a role in providing the feeling of comfort and security - so designing for self-comfort is beneficial for well-being, and it is key in forming relationships and bonds - so designing for relatedness is a promising way to connect and tackle touch deprivation.

As seen in the results, being aware of the possible implications of not engaging in enough affective touch can lead to reflection on one's own behavior, feelings, and needs. Participants expressed their liking for filling out the sensitizing booklets and hearing and talking about the project, as it allowed them to reflect on the topic in their personal lives. Creating awareness about this phenomenon can have beneficial effects on young adults, such as having an appreciation for touch experiences, reaching out more to others, starting a conversation about touch needs, and feeling that one's not alone in experiencing a lack of touch (which can aslo lead to relatedness).

*Some recent developments aim to recreate sensations and feelings of real-life experiences using immersive VR technologies and haptic systems with sensors on the body (e.g. Teslasuit, 2022). This, however, is outside of the scope of the project as it is inaccessible to wide audiences.

DESIGN DIRECTION 1 - SELF-HELP (DESIGN FOR COMFORT THROUGH TACTILE SENSATION)

As individuals recognize the value of self-help tools (e.g. weighted blankets, or body pillows) for providing support during times when comfort is needed, one promising direction lies in the development of designs that aim to offer a sense of comfort. All participants in the study expressed an openness to the idea of using such self-supporting tools. These tools can take the form of 'wearable' products, designed to be worn on the body, or individual products that do not require being worn. Using tactile stimulation to soothe and comfort have the potential to enhance emotional well-being.

DESIGN DIRECTION 2 - CONNECTION (DESIGN FOR RELATEDNESS)

Participants experiencing touch deprivation long for meaningful connections with others and for a feeling that they are not alone in their situations. Addressing this need for relatedness can be achieved through two approaches: by fostering new connections in person to satisfy unmet needs or by supporting existing connections with loved ones who are at a distance. To make new connections the ideas focus on the encouragement of seeking opportunities, and to battle the distance, creating enablers.

DESIGN DIRECTION 3 - AWARENESS (DESIGNING FOR REFLECTION AND AWARENESS)

Drawing from the results, acquiring awareness of touch deprivation as a phenomenon and initiating a process of self-reflection regarding one's touch needs and daily experiences can be beneficial. There are two potential avenues for intervention: designing initiatives that foster collective and public awareness of touch deprivation or encouraging individuals to develop consciousness regarding their personal touch needs.

MAP OF IDEAS
TARGET GROUP

	CATEGORY				
		SELF HELP (comfort through sensation)	CONNECT PEOPLE (relatedness)		AWARNESS OF TOUCH DEPRIVATION
		NON-WEARABLE	WEARABLE	IN PERSON (encourage)	AT A DISTANCE (enablers)	T.D. AS AN ISSUE	PERSONAL NEEDS
LONG-DISTANCE COUPLES							
LIVING ABROAD FAR FROM HOME (family, friends)							
LONELINESS DUE TO SOCIAL SITUATION		(e.g. WEIGHTED BLANKET, PLUSH TOYS)	1 - SELF HUG SHIRT / 2 - INTERACTIVE PJ / 3 - INTERACTIVE CLOTHING / 4 - REVERSED COVID SEATINGS	5 - 'WALK WITH ME' / 6 - MEMORY FOAM OBJECT	7 - TOUCH POSTER / 8 - PROVOCA-TIVE CALL OUT	9 - TRACKING APP / 10 - BATTERY

Figure 9. Map of ideas

FIRST ROUND OF IDEATION

To visually present the initial ideas, a map was made showing who the idea is aimed at and in which direction(s) is it positioned (see Figure 9). All the sketches with a short description can be found in Appendix F.

CHOSEN CONCEPT AND DIRECTION

The choice to follow a certain direction was made based on initial discussions within the project team and with the target group. Several factors were considered in making this choice, including the potential value and positive impact of the ideas, as well as personal interest. The decision was made to explore the concept of clothing pieces, as it holds the potential to provide value across various subgroups as well as achieve the design directions. The idea of clothing aligns with the finding that real-life social touches are more fulfilling compared to attempts to mediate it remotely since the interactions would happen in person. And clothing as a medium offers the opportunity to incorporate comforting qualities. Although the original idea did not aim to create awareness, it is a direction that can be applied to the idea of interactive clothing. In the next chapter, we will provide an in-depth explanation of the promise and significance of clothing items and their fit to the design directions and tackle touch deprivation.

In conclusion, the synthesis revealed three design directions: relatedness, comfort, and awareness. Based on some discussions, the chosen direction focuses on interactive clothing, as it aligns with the finding that real-life social touches are more fulfilling and comfort is valued. Moving forward, the next chapter will provide a detailed overview of the design process, presenting the outcomes that emerged during the exploration of designing clothing as a means to tackle touch deprivation and support well-being.

Chapter 6
Concept Development

This chapter will present the design process that led to the final concept of this project. Starting with some initial findings around the influence and use of clothing, then continuing with its connection to touch deprivation and how its alignment with the design directions. Then the chapter will outline the iterative design process – testing elements of designs and incorporating user feedback to refine the concept.

6

THE SIGNIFICANCE OF CLOTHING

Clothing has always been a powerful way of self-expression, and one of the factors in how others perceive and form an impression of us (Hester & Hehman, 2023). The way one dresses offers visual cues about their identity, personality, interests, and status and plays a role in people's social categorization. However, the perceivers have their own perceptual lens, incorporating their individual beliefs, stereotypes, attitudes, and preferences (Hester & Hehman, 2023). Physical appearance (clothing and accessories among other things) in the process of personality judgment, can offer strong cues (recognized with a significant level of accuracy) of one's openness, emotional stability, and extraversion (Naumann et al., 2009). "The loneliest targets stood in less energetic and more tense ways and appeared more sickly, messy, and unstylish."

The way we dress not only influences how others see us but also the way we behave. This phenomenon called enclothed cognition, is the systematic influence that clothes have on the wearer's psychological processes (Adam & Galinsky, 2012). Clothing comes with symbolic meanings and wearing said clothing can influence performance.

Touch is intimate and personal, just like our clothing. Our clothes intimately cover up our bodies and morph by our individual use. Clothing is dual in nature - having an inside touching the wearer and an outside

presenting their social identities, mental status, status, and aesthetic tastes to their surroundings (Hester & Hehman, 2023). Due to sensory adaptation, feeling the inside of a familiar piece of clothing rapidly goes unnoticed after putting it on (O'Mahony, 1986). The constant sensation of pressure on our skin generated by worn items, is being filtered out by our brain as it is redundant information. The times when we are aware of our clothing are connected to unpleasant sensations, such as itchiness of material, irritation due to the sawn-in labels, or being restricted by the fit. While the duality of the inside vs. outside of clothes could propose an interesting opportunity to explore, the phenomenon of sensory adaptation limits the impact of this direction.

Clothing, just like other products, is going through changes once in use, and material properties will adapt or wear out. While clothes are designed for use, some adaptations still happen when the individual start wearing the piece. Overtime use can cause bobbling or thinning in contact places of the fabric (e.g. in between legs from walking, the pocket where a certain item is always kept), but fading, stains, and smells can also indicate how the clothing is being used, such as the stretching and morphing of the textile to one's unique body. Clothes are defined by use not just by design, making the surface "an embodied marker, leaving a record of bodily use and wear" (Stanes, 2019).

HOW CAN CLOTHING TACKLE TOUCH DEPRIVATION?

Drawing from the research findings, we can see that people value self-comforting tools, such as weighted blankets, but are skeptical about tools aiming to replace real-life social touch. Therefore, it is not an objective of this project to try to replace or mimic affective touch at a distance. Since having connections is more important than the sensation of touch itself, the design will focus on supporting the building of connections. Also, awareness of our personal touch needs can cause self-reflection, which we found to be a positive action which then could even lead to active mitigation. Therefore, the goal is to tackle touch deprivation by supporting the comfort of individuals, trying to foster connections, and raising awareness, or starting a dialogue about our needs for social touch and the issues related to the experienced touch deprivation. Clothing plays a huge role in our perceived comfort throughout the day, e.g. restrictive, uncomfortable clothes might irritate the wearer, but a comfortable outfit can make one feel free or supported. And while most self-comforting tools are limited to a specific context† (e.g. being at home), the dress we choose in the morning can accompany us anywhere we go. The clothes we wear, among many other things, can influence how others view us and even impact our approachability, which then could affect our daily interactions of forming or maintaining connections with others. Not to mention, how clothing is a visual display of our personality, beliefs, and interests, which makes it a good platform for communicating our needs, but also our views about an issue to raise awareness.

Fostering comfort, connection, and awareness

With the idea of using clothing or accessory items to explore and as a medium to design for touch and touch deprivation, the same three main design directions can be applied as previously; designing for self-comfort, designing for connection, and/or for awareness. (Figure 11) These directions with clothing are not exclusive and can be all achieved at some level at the same time. Touch can be a sensitive subject and comfort levels are quite personal, therefore the interactions should be designed with respect, boundaries, and comfort level in mind. Since social and affective touch is mostly associated with the upper body (receiving touch on the lower body is often considered uncomfortable or even taboo regardless of gender (Suvilehto et al., 2015)), the concepts also focus on that area. The items are not aimed to invite sexual touch, or touches that could be disrespectful or unwelcomed. The heatmaps (see Figure 10) can act as a guide to the body areas where touch is accepted or even welcomed from and by all (Suvilehto et al., 2015).
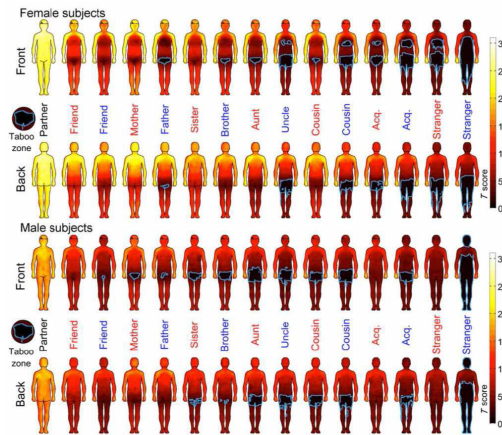

Figure 10. Relationship-specific touch area map

Designing an accessory (item attachable to clothing) could be more beneficial compared to designing a clothing item in many ways. Since most clothing items on the upper body (T-shirts, shirts, tops, etc.) are not worn continuously on multiple days due to mostly hygiene reasons, it could be practical to have this item placed on any clothing. Being able to place it on any already owned clothing and style it in a unique way can add a personal touch to these pieces. This would also be a more sustainable practice than producing more clothing items.

WHY IS DESIGNING CLOTHING A GOOD WAY TO SELF-COMFORT?

Experiencing tactile comfort can help reduce the negative feelings experienced when touch deprived. There are many self-comforting and self-calming tools available that are aimed at providing sensory comfort, like weighted blankets, blanket hoodies, and special pillows. Since clothing is in direct contact with our bodies throughout the day, aiming for tactile comfort through the wear of the pieces can offer a continuous and accessible source of support.

WHY IS DESIGNING CLOTHING A GOOD WAY TO RAISE AWARENESS?

The way we dress can communicate and act as a visual display of certain messages. It can be through symbolic (e.g. the fit, style, symbol, colors, brand) or more direct messaging (e.g. text and images). These can allow us to effectively communicate our beliefs and inspire a conversation about the impact of affective touch experiences or even action to battle touch deprivation.

WHY IS DESIGNING CLOTHING A GOOD WAY TO INVITE TOUCH OR COMMUNICATE TOUCH WISHES?

Clothing, which some even call our second skin (Crewe, 2011; 2017), is a powerful way to express ourselves. Clothing can act as a visual display or a revealer of one's personality, character, or even state of mind. With clothing, we can communicate non-verbally and influence how others perceive us, affecting our approachability (Naumann et al., 2009). Therefore, clothing could be used as a means to express to others one's touch wish or even invite social touch. Playing with visual, sensory, and interactive elements on the clothing, social and affective touch interactions could be prompted.

While clothing creates a barrier to direct skin-to-skin touch, it does not take away from its value. Most social touch happens through at least one layer of clothing, but it still conveys the meaning and benefit of the affective touch. As participant BIS-4 said: "...I would hug my mom through 50 layers if I'd have to and I would still feel her love...".
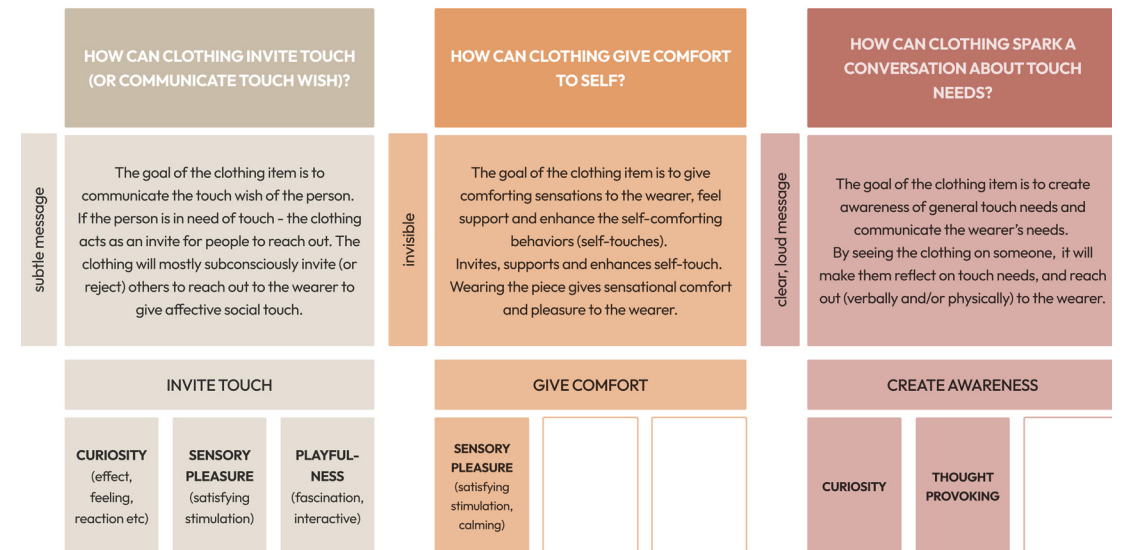

Figure 11. Breaking down how clothing fits the design directions

List of requirements

A list of requirements were defined to guide the design process (see Table 4). These were specified with the findings of the literature, the values and needs of the participants, and the design directions in mind, also considering usability and general requirements of regular clothing pieces. Items on the list noted as 'hard requirement' (H) must be fulfilled, the ones labeled 'soft requirement' (S) are good-to-haves.

The clothing/accessory should be functional	H
The clothing/accessory should be washable without much alteration	H
The clothing/accessory should not stand out from current fashion, or draw unwelcomed attention	S
The clothing/accessory should not invite sexual touch (avoid form-fitting, revealing clothing)	H
The item should be personalizable	S
The clothing/accessory should focus on the body areas which people are comfortable receiving touch (see figure 10)	H
The clothing/accessory should have both interactive and sensory elements	H
The clothing/accessory should invite social, affective touch	S
The clothing/accessory should act as a statement piece - conveying the message and starting the conversation about touch needs	S
The clothing/accessory should mediate pleasant touch for both the giver and receiver	S
The clothing/accessory should allow for tactile exploration and pleasure	S
The clothing/accessory should use textiles and other sewing articles (haberdashery)	S
The item should fulfill one or more design directions	H
The clothing/accessory should be unisex - the style and interaction fit all genders	H

Table 4. List of requirements

Critical reflection & limitations

Although designing clothing items is an interesting direction to explore, there are some limitations to tackling touch deprivation simply by wearing different clothes.

Clothing designed for touch may offer temporary relief, but not an overall solution to touch deprivation among young adults. Due to the complexity of human touch interactions and the many possible sources of the development of touch deprivation (often because of systematic not individual issues), more comprehensive interventions than a time-limited thesis project would be required.

Missing touch is often a manifestation of missing connections, which a clothing item cannot create alone - but could cater to. Although the design will not directly build (emotional) human connections only physical ones, touch has been found to be a powerful way to bond and therefore could partially play a role in forming potential connections. While the real power still is in the hand of the wearer to make a meaningful connection, the clothing can act as an invite or catalyst to start an interaction.

As found, people tend to follow an avoidant mitigation strategy or seek sensory comfort, while purchasing clothing item(s) designed for touch deprivation would require an active strategy from the participants. However, it can be considered a small and easy step to make, which could lead to bigger changes and impact later. The concept also assumes that people are familiar with this issue and their touch needs - with creating a brand, raising awareness could be the focus of the brand's marketing and achieved through marketing campaigns.

While the project focuses on the experience of young adults, the direction of designing clothing items is not limited to young adults. Since touch deprivation affects people of all ages, the clothing can be worn by all. While the design is executed with the target group in mind (following their trends, and habits), these are not meant to be fashion pieces that come and go with a new wave of trend. The aim is to design timeless pieces with meaning.

ENVISIONED SCENARIOS & IDEATION

Three scenarios were envisioned for the interaction with the designs. The ideas generated in the ideation round for items of clothing are sorted into these scenarios and presented with textual explanations in Appendix G.

SCENARIO 1 - ENHANCED SELF-COMFORT

In the first scenario (Figure 12), the clothing's added functionality is to comfort its wearer. When the individual reaches out to self-soothe, it will interact with the elements on the clothing, which in response assists and enhances the comforting action.

SCENARIO 2 - INTERACTION & AWARENESS THROUGH SELF-COMFORT

The second scenario (Figure 13) relies on the self-soothing action of the wearer to then reveal a message to their surroundings, thus inviting touch and sparking a conversation. The wearer engages in a self-soothing action, which will through a subtle message indicate that the individual is in need of touch, inviting others to reach out (comforting touch interaction) and start a dialogue with the wearer (awareness).

SCENARIO 3 - INTERACTION & (AWARENESS) THROUGH CLOTHING

In the third scenario (Figure 14), the interaction is started by the clothing itself without the wearer's intention or action of self-comfort. The clothing will evoke curiosity visually from the outsiders, inviting them to explore its tactility. This touch interaction then can lead to a conversation about touch deprivation.

reaching out to self-comfort → interacting with the element → enhanced self-comforting

Figure 12. Envisioned scenario number 1

supported self-comforting action → reveals the need for touch → invites others → interaction & awareness

Figure 13. Envisioned scenario number 2

wearing the clothing → clothing evokes curiosity → interaction & awareness

Figure 14. Envisioned scenario number 3

Figure 15. Participants interacting with the different textures

Feedback on the ideas

To progress further with the ideas, the project team relied on internal discussions and the opinions and feedback of the target group to make decisions. 4 young adults who were previously involved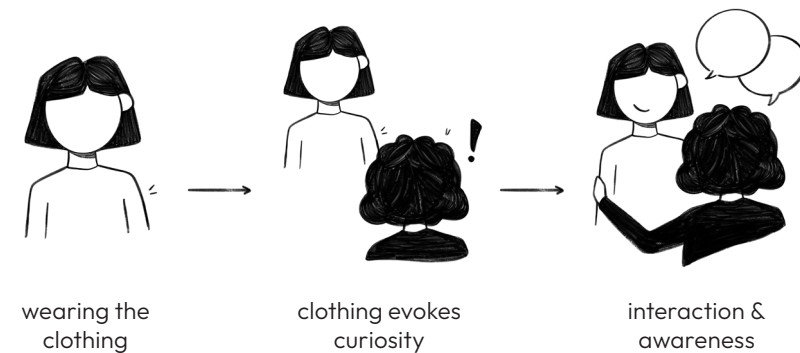 in the user research activities give their thoughts on the ideas in an informal setting. The scenarios and the sketches with supporting images were shown and briefly explained to these individuals. The following points had been made, based on the feedback of the young adults.

The visuals of the 3D textures were perceived with excitement (see idea number 6 in Appendix G) and showed promise for inviting tactile exploration. They expressed curiosity and described an impulse to reach out and feel the colorful, textured surfaces.

The subtle messaging using semi-transparent materials (idea 3) was also well received by the target group - showing interest and understanding of how the interaction would flow. This subtle way of action to reveal your needs to others felt in line with the topic according to participants.

Ideas aimed at scenario 1 (enhanced self-comfort) sparked less excitement in the individuals, even though self-comfort is valued by them. The added interaction elements fell flat or even create some dissonance in the young adults (e.g. "I would not want to have magnets on my body... that just feels wrong.").

Drawing from these discussions, the focus will be on Scenario 2 (Interaction & Awareness through Self-comfort), as participants reacted positively and it is also aimed to fulfill all the design directions. In the next section, through some explorative activities, we will be iterating on the ideas numbers 3 and 6.
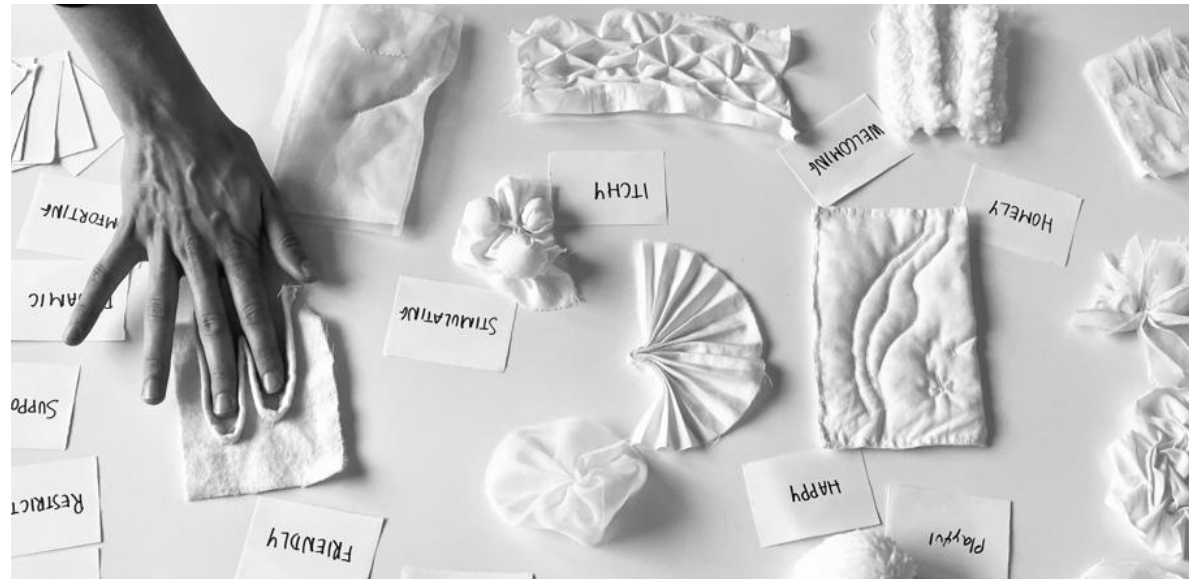
Texture Exploration

To explore how people interact with different 3D textile textures and what kind of touch acts they invite. 15 different texture samples were (see Figure 16) prototyped and tested with young adult individuals. (Figure 15) The samples were made with only white fabrics to not create unnecessary biases or influences by having color preferences impact the testing. The number of textures was enough to cover a wide variety of possible interactions, but not too much to overwhelm the participants. The test relied on their visual and tactile senses. The 5 participants (international students, aged between 23-28, 4 of them in long-distance relationships currently) were first asked to pick the most inviting sample based on visual input only. Then they were free to touch and interact with the samples. Their task was to assign the texturea qualities (pre-selected qualities, but participants could also create new ones).

„This one reminds me of a bed." – P2

"This one is more dynamic because I can stretch and pull." – P5

[P3 making playful „beep" sounds when pinching the soft rounded shapes]

"This is surprisingly nice, because this alone [the semi-transparent material] doesn't appeal me that much." – P5

The goal of the test was to see what kind of touch interactions different textures evoke and whether there are textures that visually invite touch more than others. Since the clothing is meant to visually evoke curiosity in the outsiders and prompt them to reach out, it was useful to explore what can induce this experience. Also, since the aim is to give comfort, certain types of touches are more desired (stroking, gentle touches) than others (poking, pinching). The assigned qualities also help to see what associations and emotions these samples bring to mind and select more positive ones.

RESULTS

The explorations were mostly systematically done - influenced by the placement of the samples. To avoid any preconceived notions or biases, the samples' placement was randomized with each participant. Starting from the most inviting one, touching the neighboring ones, then jumping to another inviting one further from those and exploring the tactility of the samples surrounding that one. The most inviting samples (2,5,11, and twice number 13) were round (cushioned) shapes or made from soft, fluffy material (or both). There were a few textures (numbers 12,

15) that clearly did not interest the participants much (shortly explored or not touched at all) or they found unpleasant. The samples were approached with different types of touches - some more gentle, some more rough/explorative (see Figure 15). The different elements evoked different motions - poking pinching, stroking, pulling, grabbing. Some were assigned with similar positive qualities (5,6), some with overly negative ones, and a few with very mixed qualities (see Table 5).

LIMITATIONS

Interactions on a larger scale or larger-sized texture might result in different approaches and types of touches. The samples were created based on available resources and level of expertise - with different white fabrics and more advanced sewing skills, the samples could have been more advanced as well. The textures were also tested with a smaller sample (5 participants only), executing the tests with a larger sample size could lead to different and more reliable results.
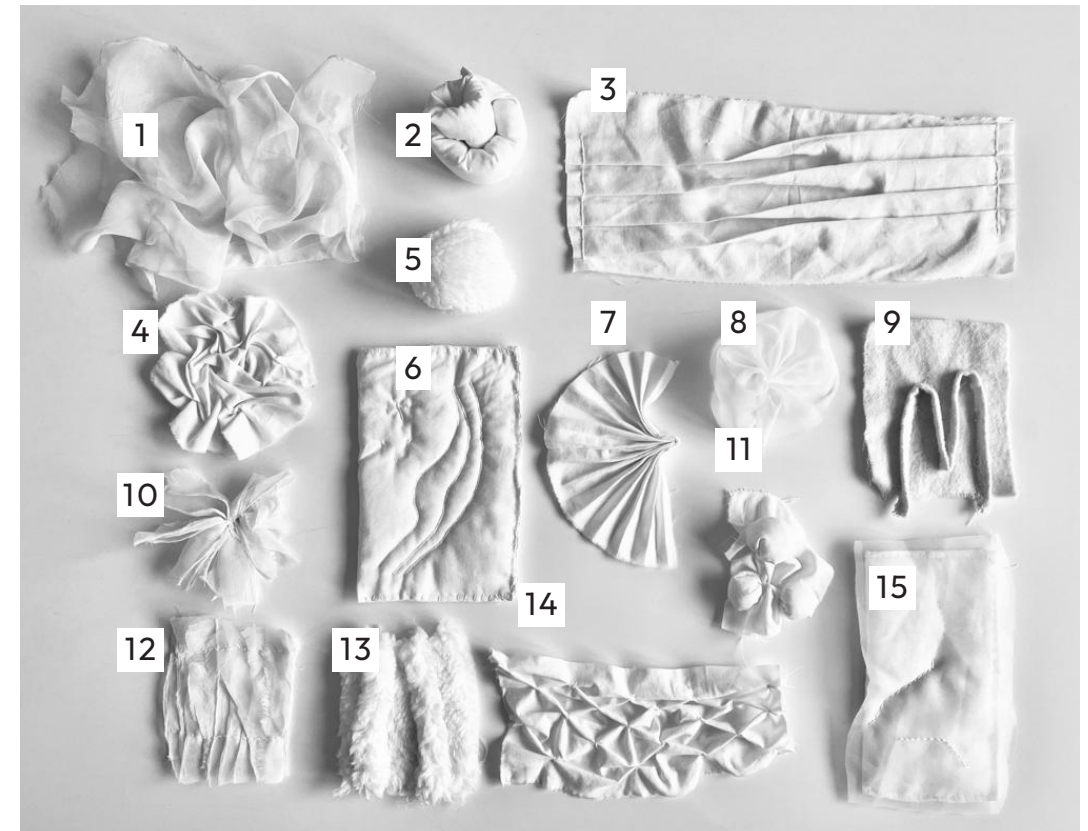
Figure 16. Texture samples numbered

	1	2	3	4	5	6	7
most inviting		x			x		
P1	fascinating	playful	annoying	harmonious	happy	homely	dynamic
P2	strange, mysterious		pleasurable	suffocating	playful, happy	homely	
P3	welcoming, harmonious	happy	supporting		playful, engaging	friendly	itchy
P4	confusing	engaging	harmonious	stimulating	welcoming	familiar	dynamic
P5	itchy	strange, playful	dynamic	mysterious	stimulating	homely	happy

8	9	10	11	12	13	14	15
			x		xx		
strange	restrictive	sad	stimulating	mysterious	comforting	frustrating	suffocating
	friendly	annoying	stimulating, itchy		welcoming		
fascinating		strange, mysterious		sad	comforting, serene, pleasurable	dynamic	
boring	itchy	frustrating	strange	frustrating	comforting	playful	mysterious
flimsy	confusing	unpleasant	playful, strange		comforting	mysterious	pleasurable

Table 5. The assigned qualities to the texture samples (Figure 16)

Message evaluation & prototyping

To investigate how people feel about certain messaging on their clothing to invite touch (idea number 3 - Appendix G), 4 possible messages were illustrated and evaluated with the target group in the format of a survey. The 4 examples visualized different approaches, from a direct invite to more abstract and subtle messaging (see Figure 17). The survey was filled in by 14 young adults (students - mostly design students, between the ages of 24 and 29).

The participants were shown a mockup image about how the message would be revealed on the clothing, briefly explained the interaction and the goal of the design, then presented with the 4 examples. They were asked about the clarity of the message to invite touch, the likeliness of them reaching out to someone wearing the message, and the likeliness of them wearing the designs. Lastly, they could pick their overall preferred message and share any ideas or concerns. The detailed results of the survey can be found in Appendix H.

RESULTS

As anticipated, the most direct message (message number 1) provided the highest level of clarity. However, the message that received the highest preference among participants was the more subtle Braille written message (number 4). Additionally, number 4 ranked second in terms of clarity and was identified as

the most likely to motivate individuals to take action, but also as the one they would most likely wear themselves. One of the participants commented that the visual on number 4 evokes tactile curiosity in them and would want to explore the feel of the message.

When designing the messaging on the garments, It is important to find the right balance between the level of clarity of the invitation and avoiding the perception of instructions. Using abstract and more metaphorical terms with ambiguity could be an approach to help sparking conversations as well. Nevertheless, the messaging should effectively communicate the purpose of the garment - inviting others to engage in affective social touch interactions (or initiating conversations), without creating a sense of guideline. By ensuring clarity in the messaging, individuals approaching the wearer will understand the purpose and be more likely to respond in a supportive manner. However, it is also important to maintain openness for interpretation, allowing for natural interactions to take place. Additionally, it is essential that the messaging aligns well with the intentions and wish of the wearer, so the garment prompts the desired type of interaction.

To achieve this balance, careful consideration should be given to the wording and visuals of the messages. They should be inviting with emotional depth, conveying a sense of warmth and approachability, while well-adjusted to the wearer's intent. Using subtle messaging

rather than direct commands can evoke curiosity and interest in outsiders, prompting them to engage in a more genuine manner.

PROTOTYPING

Finding the right type of message was essential, but more practical factors and aesthetics also play a role in conveying the message. Picking the right way to materialize it, as well as the right font, size, and visuals are important in terms of readability, attracting attention, and having a visually pleasing design to wear.
To test how these messages can be placed on the clothing, different methods were followed; using embroidery, textile glue, iron-on textile sticker, and paint (see Appendix I). The message needed to show up once the hand is placed beneath the material, but be as invisible as possible when only in contact with the t-shirt, having the right colored whites was crucial. Two different semi-transparent materials were tested - a sheer polyester voile, and a micron nylon filter mesh fabric. Readability, another essential factor, was considered. While the embroidered message might look aesthetically pleasing and have a 3D texture to it, reading the text is harder.

Defining areas of self-soothing touch practices

To define the placement of the interactive elements, a short (self-)observatory activity and literature study were executed. Drawing from the previously mentioned heatmap (Figure 10) (Suvilehto et al., 2015), and recommended self-soothing practices (Dreisoerner et al., 2021), while combining the observatory activities the following body map was generated (Figure 18). The observatory activity included self-observation - noticing self-touching behavior in the context of university while working on this current project and observing other students during work in a stressful period of exam weeks and deadlines. Most commonly these students,

including myself, were supporting their heads, touching their faces and hair, or fidgeting with their hands. Regarding their upper body, they held or massaged their neck-shoulder-upper arm area, or were scratching/rubbing their forearms, but often they placed their hands on their upper chest as well. These findings together with the literature study led to the development of the body map.
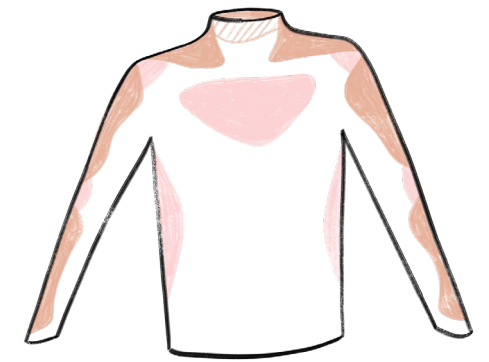

Figure 18. (Upper-) body map of self touches - light pink indicating less frequently touched places, orange showing the common areas that get touched

Figure 17. Message examples - message number 1, 2, 3, 4 (from left to right)

ITERATIONS

These short research activities involving the target groups resulted in valuable insights which were implemented to improve the initial ideas. In line with the takeaways from the primary discussions within the team and with the target users, the refined iterations are meant to fit Scenario 2 (Interaction & Awareness through Self-comfort). This phase of iteration ended in the following two designs:

DESIGN I. - TRACES OF TOUCH

The Traces of Touch design (Figure 19) is an improved version of the original idea number 3 (Appendix G). The main interaction element stayed the same - pocket covered with semi-transparent fabric, only revealing the message once the wearer's hand is placed there. However, the design was refined by

implementing the results from all the short research activities (Texture exploration, Message evaluation & prototyping, and Defining placement of self-soothing touch practices). The 'pocket' placement was aligned with the generated body map, and a hidden layer of comforting texture was added between the fabrics of the t-shirt and the translucent pocket for the wearer to interact and self-soothe with. Lastly, based on the message evaluation - it was clear that the message needs to be subtle yet clear and in alignment with the wearer's intent. Still undefined, the idea of personalized messaging arose, to uniquely reflect every wearer's intention and wish. An initial prototype was created to explore the envisioned placement, interaction, and use of material, while also practicing the needed sewing skills for the final prototypes.

DESIGN II. - HIDDEN TEXTURES

The Hidden textures design (Figure 20) is a combination of idea numbers 6 and 7 (Appendix G), combining the elements of a hidden area for the hugger and the evoked tactile curiosity of visually inviting textures. This interactive element on the clothing is envisioned with three possible stages. First, this textured area can be fully hidden and closed off from others and the wearer. When partially open, the wearer can fidget and self-soothe by interacting with the texture, also visually revealing only parts of the textures can create curiosity in outsiders. The last stage is a direct invite, revealing the whole hidden textured area for others to touch and explore. While the second stage is more subtle and also more intimate due to the 'half-open' state, the third stage is allowing for less intimate interactions, opening for a wider

audience. The decisions for the selection of textures and the placement of these elements were done based on the previous research activities. The texture selection relied on the most inviting and positively perceived example samples, and the ones that evoked the desired type of touches.

We chose the most promising direction (Concept I. - Traces of touch) to work on further and prototype. The other designs are represented as visuals only which are part of the clothing brand.

Figure 19. Traces of touch concept sketch
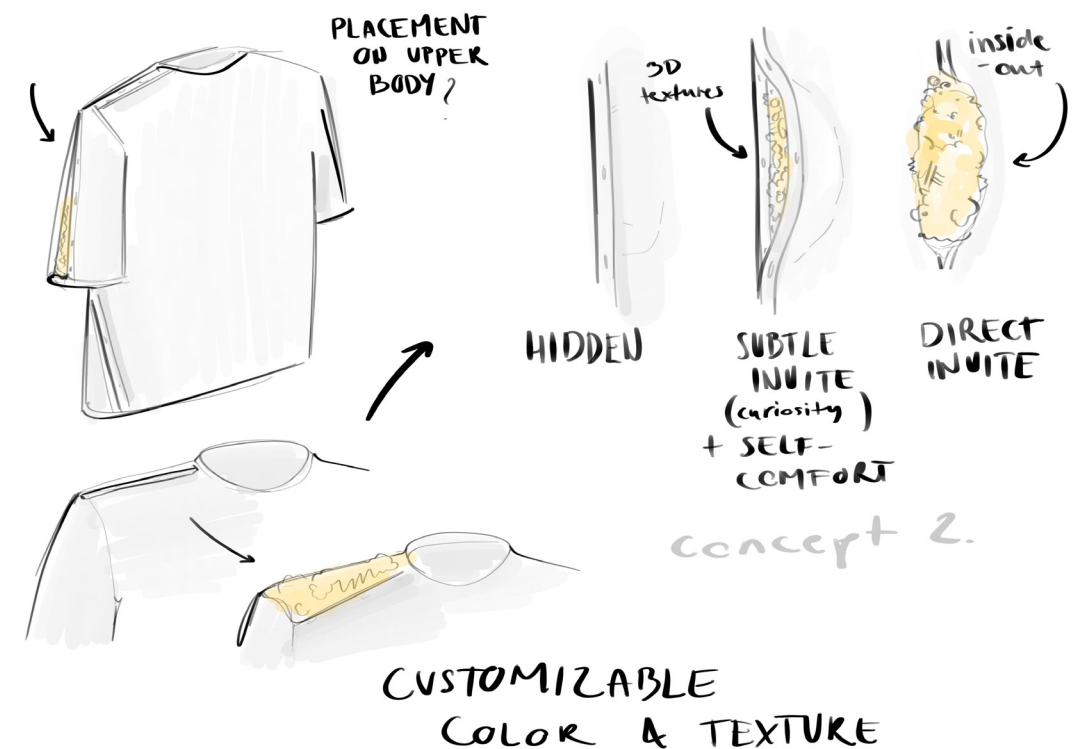
Figure 20. Hidden texture concept sketch

Designing garments as a response to address touch deprivation offers a subtle way to embrace young adults and help with their negative experiences resulting from touch deprivation. Clothing not only influences how others perceive us but also how we perform (enclothed cognition). As a visual display, it can convey direct and symbolic messages and as 'our second skin' intimately touching our bodies every day. Through the design of these items, the intention is to invite affective social touch – create in-person connections, provide sensory comfort to the wearer, and lastly raise awareness of the personal needs of the wearer and the issue of touch deprivation. The next chapter will present the final concept with the final iterations and considerations of the clothing design. It will showcase the prototyping process and results, followed by the evaluation of the designs.

Chapter 7
Final Concept

In this chapter, we will provide a detailed explanation of the final concept - a clothing brand with carefully designed pieces supporting young adults in tackling touch deprivation. We will showcase the finalized designs and the prototyping process, then present the evaluation method and results. Ending the chapter with a critical reflection on the designs and final concept, with recommendations for improvement and future work.

7

EMBRACE COMFORT • EMPOWER CONNECTIONS • ADDRESS TOUCH DEPRIVATION

DO
YOU
FEEL
TOUCH
DEPRIVED?

matter
of touch

MATTER OF TOUCH

The final concept of this project is a clothing brand with a collection of garments that aims to provide comfort, foster connections, and raise awareness of personal touch needs. The pieces are designed to tackle the negative experience of touch deprivation and are tailored to the needs of young adults.

Matter of touch is offering a clothing line that goes beyond fashion. The pieces are created with a purpose in mind and are inspired by the personal stories of young adults experiencing the negative impact of touch deprivation firsthand. These garments are designed to support individuals with sensory comfort and empower them to take a subtle step toward facing this issue and establishing their needs for (physical) connections. In the long term, this line is meant to improve their well-being and spark a broader discussion on the importance of touch in the human experience.

The brand's goal is to support those who seek comfort and real-life connections and believe that physical touch is fundamental to human experience and well-being. Making young adults feel as if they are not alone in their struggles and achieving all this, by leaving a positive mark.

The target audience is young adults aged 18 to 30 who long for touch, recognize the importance of physical contact, and are ready to take small steps toward addressing touch deprivation and their individual needs.

We imagine the brand to offer multiple different designs aimed at comfort, connection, and awareness, however, currently, we only developed fully the Traces of touch idea. Some concepts will be presented visually as part of the clothing brand, but these did not get prototyped or evaluated.

Clothing designs

Self-soothing is maybe the most simple way to ease the effect of touch deprivation, by offering a sense of comfort and tactile pleasure. The interactive elements on the clothes assist in self-comforting, which then leads to the invite of affective touches and creates the opportunity to foster relationships and form new connections. The garments act as a catalyst, both for the building of these bonds and for breaking the barriers and stigma that is often around touch and our need for touch.

The intended interaction flow clearly follows Scenario 2 (Figure 13), the wearer comforts themself by interacting with the soothing sensory element hidden below the semi-transparent fabric (see Figure 21). The change in the 'background' color - their hand beneath the material instead of the same color T-shirt as the message - reveals the messaging on the semi-transparent layer. The message then communicates their wish for touch and invites others to reach out or start a conversation.

The material of the self-soothing element was based on the results of the Texture exploration (see Ch. 6 - p74) and its placement on self-soothing touch practices (see Ch. 6 - p79). The most comforting and inviting texture was picked to be the flat fluffy plush fabric (number 13 in Figure 16), it also evoked a desired gentle stroking and caressing interaction. A small section beneath the translucent fabric is covered with the plush material to provide a comforting feel (see Figure 21). For the prototyping process see Appendix I.

The clothing line consists of three designs (Figure 22, 23 and 24)- iterations of the Traces of touch idea (Figure 19) - aimed at the different personas/target subgroups. These three designs, based on the target subgroups' needs, have different levels of communication and different placement in terms of visibility (for a detailed explanation see Table 6). (Only the Traces of touch designs got fully prototyped and evaluated.)

Figure 21. The comforting element beneath the semi-transparent layer

	LEVEL I - INDIRECT MESSAGING	LEVEL II - CLEAR BUT SUBTLE MESSAGING	LEVEL III - INSTRUCTIONS
PLACEMENT	On the shoulder - least visible from outside, fitting the meaning of the message.	On the upper arm - more visible placement.	On the chest - most visible placement.
MESSAGE	"a shoulder to cry on" It was chosen because of the indirect, yet emotional connotation of the message. And also the due to the positive feedback on it from the survey.	(braille) (please touch) It was the most preferred text, evoking tactile curiosity and providing a clear message without the feel of instructions.	**Step-By-Step Guide to Hugging** **Step 1:** Please approach me with a friendly smile. **Step 2:** Get my attention and ask me 'how are you?'. **Step 3:** Offer a hug and wait for my response. The message is very clear and direct, yet still only revealed when the individual is self-soothing.
TARGET (SUB-) GROUP/PERSONA*	Young adults in long-distance relationships (Persona 3 - „Social Long-Distance Partner") These individuals are missing touch from a certain someone and are aware of their needs. They do not need direct messaging asking for touch, but with this subtle text, they can reveal their ability to support and their need for contact. This group mostly misses touch from a single person, and faces less difficulty in actively reaching out to meet their needs. Therefore, the message can act more as a conversation starter than a direct invite. This metaphorical line conveys more emotion, yet still inviting for a type of touch (placing head on shoulder). It can be an opening for a meaningful conversation, but also for a simple act of touch.	Young adults facing tactile loneliness (Persona 2 - „Disconnected International") These individuals do not connect on a physical level with the people in their lives, leaving them to experience tactile loneliness. They long for affective touches but otherwise do not lack connections. Since this group can handle social situations but find it difficult to express their needs for physical contact, the message on the clothing can do it for them. The message is in line with their needs and by adding the Braille - which invites tactile exploration - it automatically attracts what the person lacks.	Young adults without social connections (Persona 1 - „Overthinking Lone-Wolf") These individuals have difficulty connecting with others, leaving them with a sense of deep loneliness and a negative impact on their well-being. They often struggle with social anxiety or other mental health issues which makes navigating social situations difficult. Since this group needs more guidance to handle social interactions, being prepared and able to anticipate how the interaction will go can help them be present and engaged instead of overthinking. Therefore this very direct messaging can act as a guide for others and a clear indicator of the needs of the wearer. Taking active steps to deal with this issue like asking for help and touch is also a difficult task for this group. Wearing the design can communicate the need but in a safe way.

Table 6. The three levels of the Traces of touch designs

*The placement and message choices per design were made to fit certain target groups, however, this is not a requirement. Young adults are free to choose their preferred choice of clothing item regardless of which target subgroup they belong to or which persona they resonate with the most.

Figure 22. Traces of touch - Level I. design
with the message ,a shoulder to cry on'

Figure 23. Traces of touch - Level II. design
with the textured Braille written message (please touch)

Step-By-Step Guide to Hugging

Step 1: Please approach me with a friendly smile.

Step 2: Get my attention and ask me 'how are you?'.

Step 3: Offer a hug and wait for my response.

Figure 24. Traces of touch - Level III. design
with a step-by-step instruction on how to hug the wearer

COLOR, GENDER & STYLE

In the design process of the clothing pieces, a color consideration was made to ensure inclusivity and the effective communication of the intended message - resulting in the choice of white for this specific design. This decision was motivated by the desire to ensure that the message is clearly visible on the semi-transparent material against any skin color beneath. (By using a color like black, there is a risk of hindering the visibility of the message, especially on individuals with darker skin tones.) Choosing white as the main color allows for enhanced visibility, ensuring that individuals with all skin tones can equally wear the designs and successfully convey the messages. As the brand's focus is on interactive elements rather than grabbing attention through distinctive color choices, the overall color palette of the clothing line will mainly be neutral colors such as black, white, sand, and grays. This approach aims to create an inclusive aesthetic that prioritizes interactions with the designs.

The designed clothing is intentionally unisex to ensure inclusivity and address touch deprivation as a universal issue regardless of gender. The garments are not form-fitting, aiming to create a comfortable and non-sexualized experience for all individuals. By avoiding tight or revealing designs, the clothing does not invite or suggest sexual touch but rather focuses on promoting comfort and meaningful connection. The unisex approach also aligns with the current trend in clothing, allowing the garments to seamlessly blend with everyday fashion. The goal is to create pieces that are accessible and wearable by every young adult, regardless of their gender identity. These considerations collectively contribute to the overarching purpose of the project, which is to provide individuals with comfortable and inclusive clothing that was designed with their needs in mind.

Figure 25. Messages unrevealed

BEFORE THE INTERACTION (WITH THE COMFORTING ELEMENT)

The messages are barely visible, due to the same color message and fabric. (Figure 25) The comforting element beneath the semi-transparent layer is similar in color and therefore hidden form the outside.

DURING THE INTERACTION (WITH THE COMFORTING ELEMENT)

The messages are clear and visible. The hand of the wearer separates the semi-transparent layer with the message and the fabric of the T-shirt, due to the coloring of the skin the message is revealed. (Figure 26)
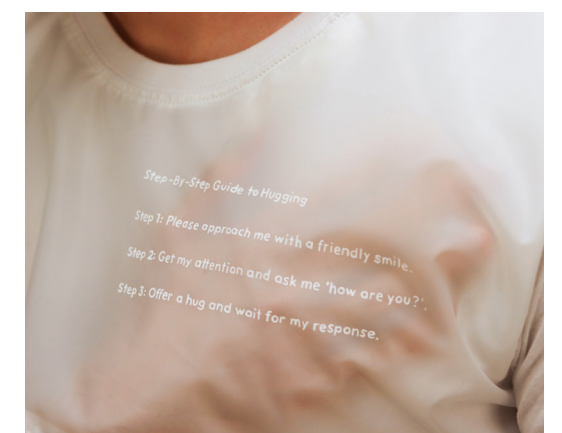

Figure 26. Messages revealed

BRANDING

In order to strengthen the message and the purpose of the clothing pieces, a mockup website was created. Branding and marketing can be a powerful way to get people familiar with the issue (touch deprivation) and urge them to take a small step towards connecting with others. By making a website, we can extend the reach of our project beyond the participants and engage a wider target group. A website can provide a broader audience with information about the topic and the mission of the designs. Simple exposure to the brand and its aim can result in curiosity to know more or generate awareness.

The website also serves as a medium for initiating conversations and discussions surrounding touch deprivation. By presenting the project's purpose and designs in a visually pleasing manner, we aim to encourage visitors to tackle the issue and connect with others, while supporting their needs for comfort. Creating a mockup website (Figure 27) for our designed clothing pieces serves as a strategic approach to support our message, reach a wider audience, and engage individuals in a meaningful dialogue about touch deprivation. Through this platform, we hope to create awareness, inspire action, and ultimately contribute to the recognition of touch as a fundamental aspect of human well-being. The website's visitors can find information backed up by research on touch deprivation and the fundamental role touch plays in our human relationships. They can learn about the mission of the brand and the function of the different pieces. (Figure 28)

Currently, the brand offers the Traces of touch designs, the Hidden textures line (based on the idea under the same name - see figure 20, not fully developed), and simple branded pieces without interactive elements for people who want to support the cause but not lack touch in their lives. Wearing all the designs can act as a small yet active step towards battling touch deprivation, but can also simply act as a statement. (Figure 29)

ABOUT   PROJECT   MISSION   matter of touch   DESIGNS   SHOP   CONTACT

Comfort, connection & awareness

Embrace comfort, empower connections
& address touch deprivation
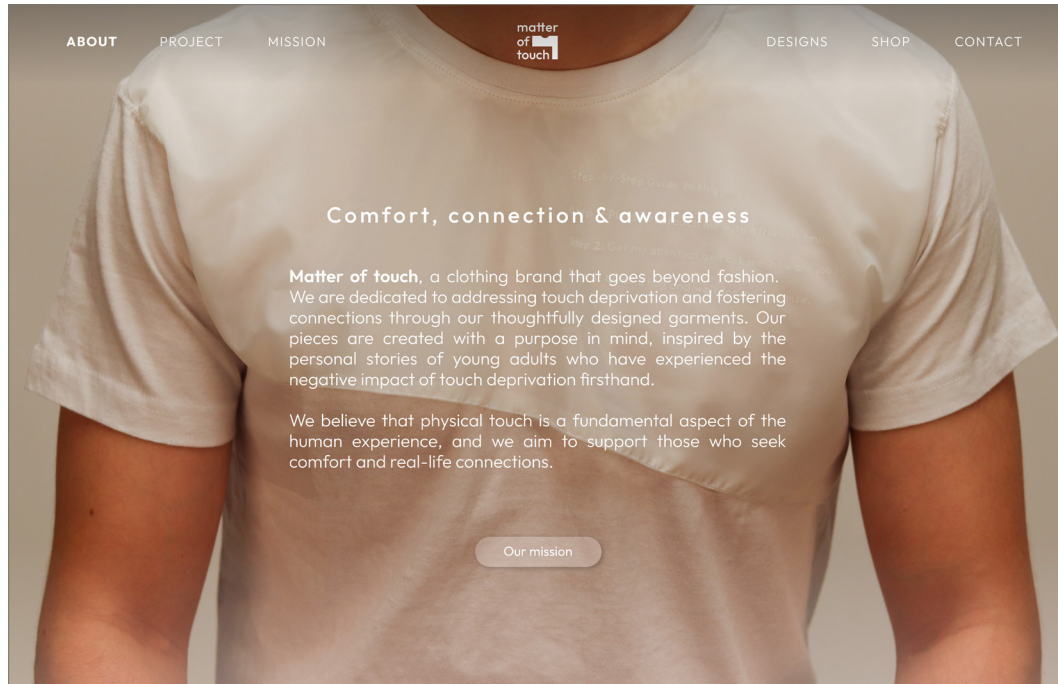
"a shoulder to cry on"

Read more
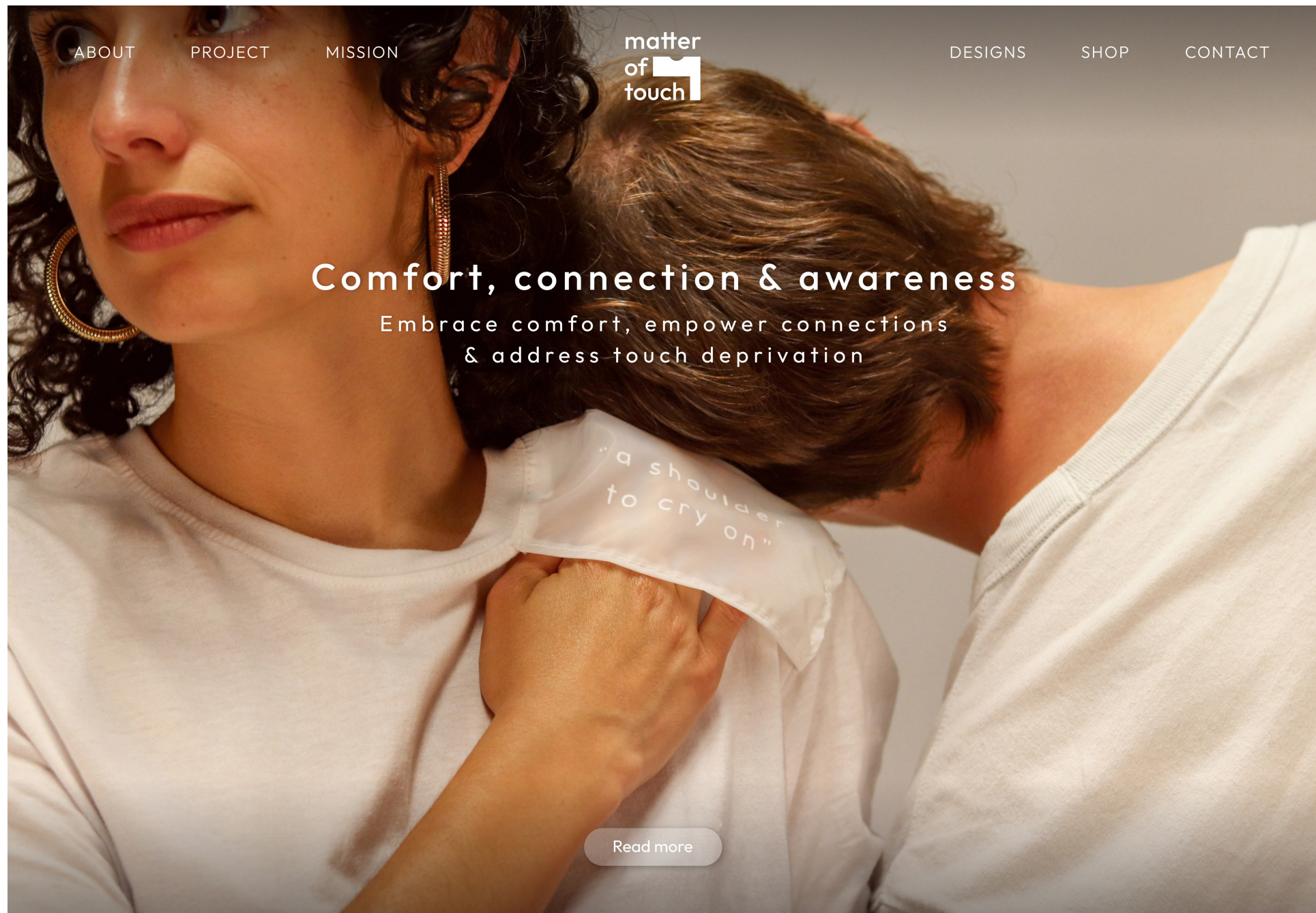
Figure 27. Mockup website opening page

Figure 28. Mockup website ‚About' & ‚Mission' page

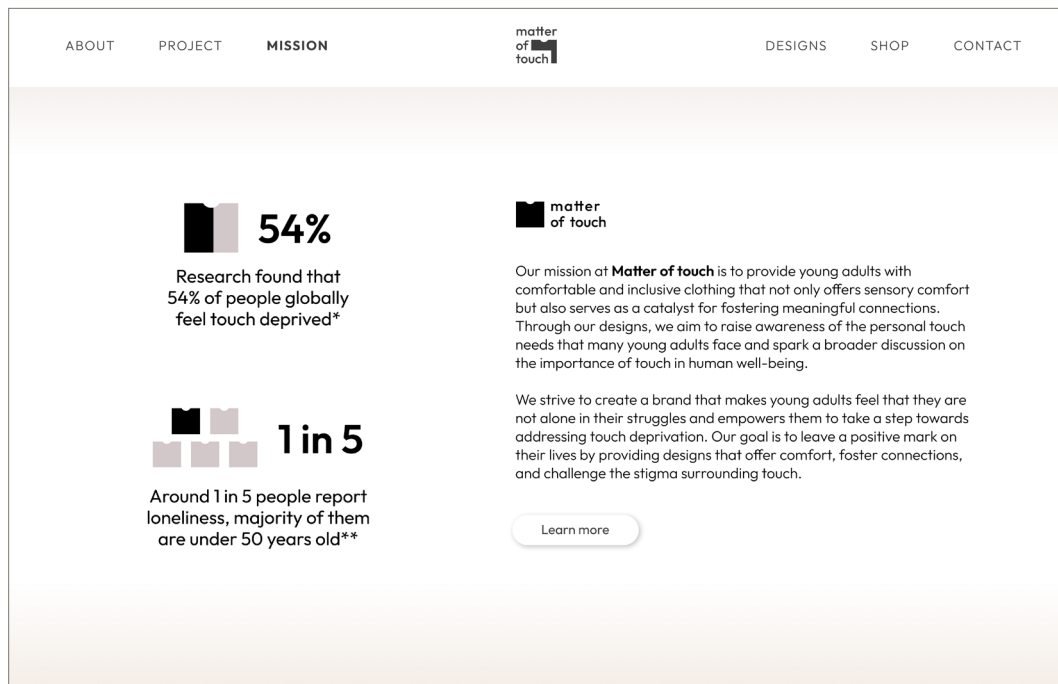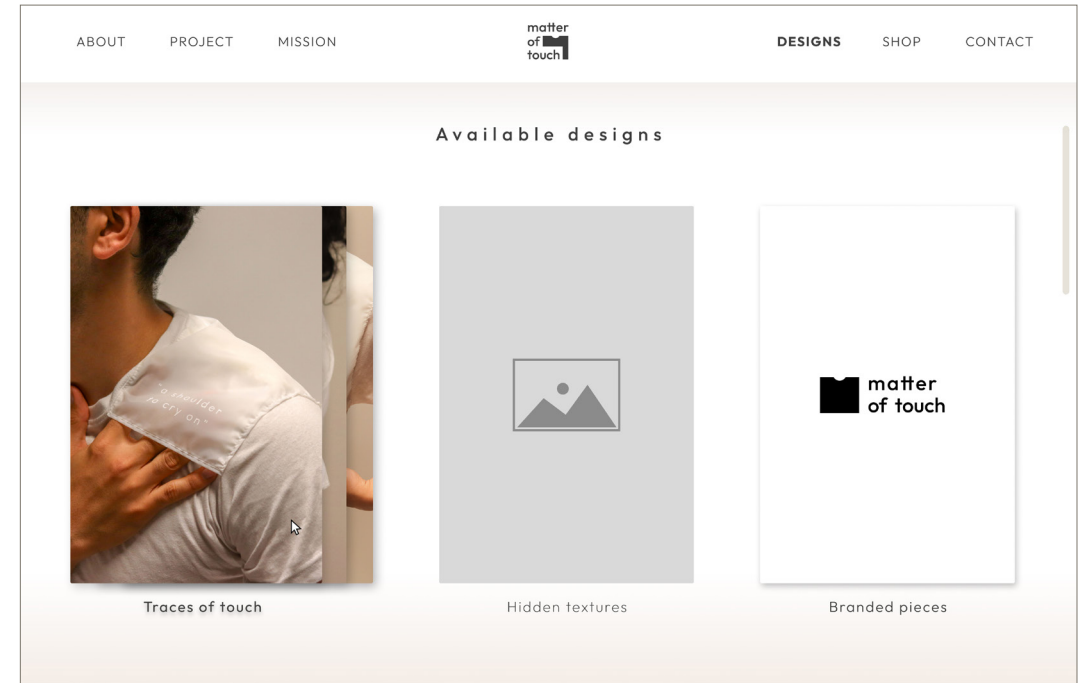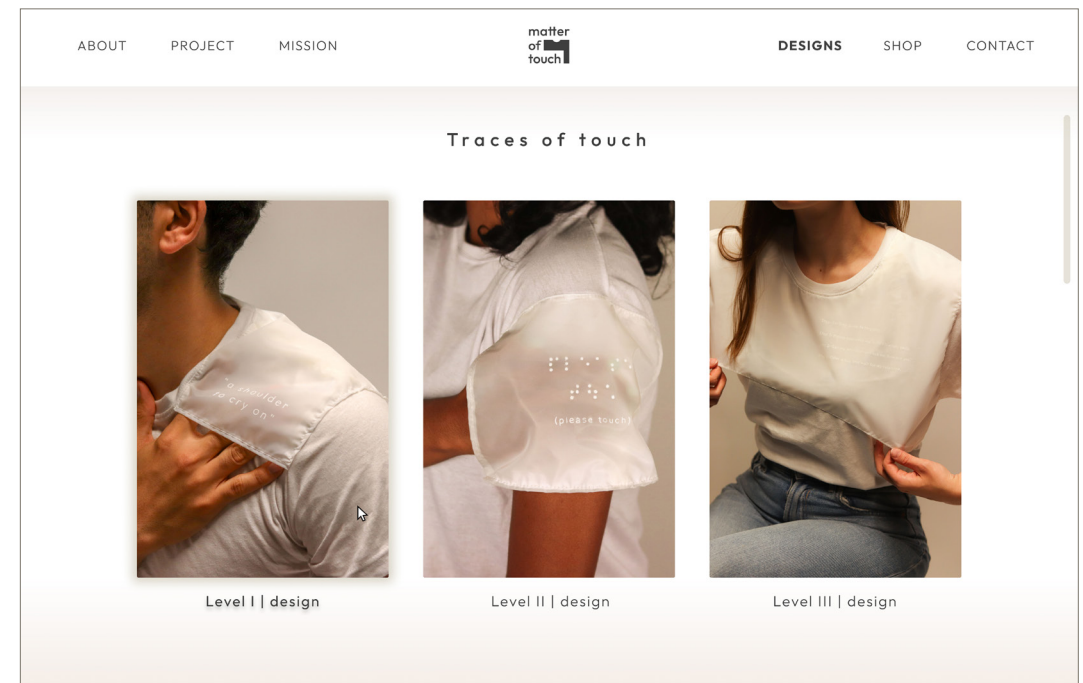*Figure 29. Mockup website ‚Designs' page*

EVALUATION OF THE DESIGNS

To test and evaluate the concept, the previously shown prototypes were distributed, and worn in context. The designs were tested with 2 participants per design, overall 6 young adults who are all part of the target group. (International students, between the ages 24 and 29, 2 of them in long-distance relationships. See overview in Appendix A.)

The evaluation started with a short questionnaire asking about their current well-being (mood, stress level, satisfaction with the current level of touch, wish for touch, self-image, and awareness of clothing and self-touch). To define the possible answers to the question related to mood, we relied on the work of Xue and colleagues (Xue, Desmet & Fokkinga, 2020). See Appendix J for the full questionnaire. Then the participants were asked to wear one of the designs in a public context (in this case the university - see Figure 31) for a period of approximately two hours. They were free to act as they like in the context. During the time period, participants were observed with special attention being paid to the interaction with the clothing, self-touching, and how other people react to the revealed message. After the time of wearing the piece, they were asked to fill in the same questionnaire and give some general feedback in the form of a short semi-structured interview (see Figure 32 for an

overview of the evaluation process). Questions covered their general experience, their envisioned use (when, where in what context), and ideas to develop the designs further.
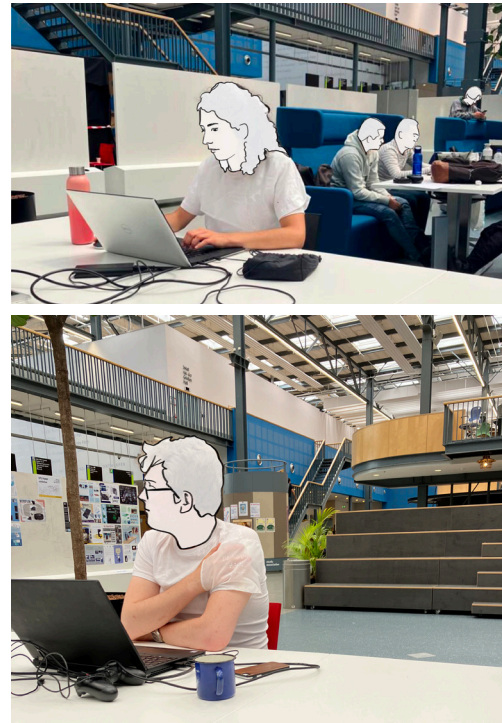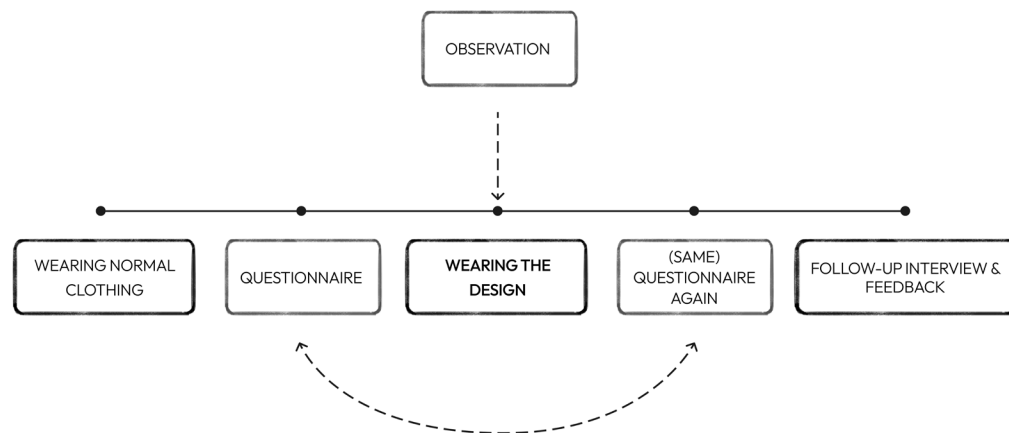

Figure 31. Evaluation context

Figure 32. Evaluation process

Results of the evaluation

The planned evaluation activities with the participants lead to some very interesting results. First, we will discuss how the clothing performed in terms of comfort, inviting touch, and raising awareness. We will share how wearing the clothing impacted the behavior of the individuals and present their feedback regarding the design and their view of how the concept could evolve.

COMFORT & SELF-TOUCH

Participants expressed their liking of the soft comforting material ("It reminds me of a baby's blanket" - E-1) and its hidden and private nature. The ability to interact with this 'secret' comforting element in a subtle way without others knowing was well-received. It also supported them in their self-touching and fidgeting behaviors (e.g. "I do touch my clothes a lot anyways" & I touch those places normally, so the soft material felt like an indicator of those stress points."). There were some mixed feelings around the semi-transparent fabric, some were fond of the smoothness of it and liked the touch and sound of it, while others associated it with more of a medical context.

From observing the participants, we could identify more intentional acts (being part of an experiment, therefore interacting with the clothing), but also some less conscious behaviors. The design unintentionally supported fidgeting. Young adults who wore the level 3 design, with the semi-transparent fabric on the front, often simply hold onto or played with the fabric. When asked about it, they mentioned, the action came naturally and some do fidget with their clothes on a regular basis. We could also observe the exploration of the material from the outside as well - feeling the soft plush element through the semi-transparent fabric, the texture of the Braille writing on the level 2 design, and just the smoothness of the surface. Some participants also played with the sound it could create when rubbing the fabric.

From the questionnaire, it is hard to draw conclusions on the stress level specifically related to the clothing's self-soothing element. While most participants (4 out of 6) indicated lower levels of stress – which might seem like a positive result, there can be many influencing factors and cannot be taken as a guaranteed result of the clothing's soothing intention. Some individuals expressed excitement and curiosity about being part of an experiment and that participating acted as a distraction from their work.

INTERPERSONAL INTERACTIONS & CONTEXT OF WEAR

The scenario did not play out the intended way. While the participants did interact and reveal the messages, they did not get approached by outsiders. A few participants expressed some disappointment as they were excited to see how the interaction would unfold.

When the participants interacted (chatted) with others (who were not part of the experiments), they recalled changes in their behaviors, due to wearing the designs. First of all, they reported more self-awareness about their posture and the worn garment. They were conscious of the message and were contemplating whether to reveal it or not. There was an internal tension noted; while interaction with the clothing would require a more closed body position (arm covering/ crossing chest), having a conversation prompts the opposite - a more open posture. It also created some anxiety in one of the participants, she was questioning whether showing the message would come across as 'pushy' and whether she even wants this other person to touch her. This led to her appreciation for having control over the interaction and when and to whom to reveal the message.
On the other hand, another participant saw the previously mentioned tension in a more

positive light. He explained how he usually has a more closed body language (crossing his arm, holding his shoulder/neck) when in a situation where he is not fully familiar, and how this design would use this position to achieve the opposite effect. Turning a closed body position into an invite for others, which he found to be positive.

Discussing the context in which they would wear these designs, one participant (S-2) explained how she would prefer more of a 'cozy setting' like a movie night where closeness and touch are more likely to happen with familiar people. However, she also explained that she would probably not wear the pieces herself, but be attracted and intrigued by them if someone else wore them. Wearing the design is similar to wearing colors for her - she likes it on others but not on herself. Since the design is meant to attract some kind of attention, it is likely that other young adults also feel the same way.

AWARENESS & REFLECTION

Overall, the design of the clothing pieces was positively perceived by the participants as they did not stand out from regular clothing nor made the participants feel exposed (which was a hard requirement of the designs). Having to wear the designs did change their behaviors, causing them to be more self-aware and conscious about their actions, especially during an exchange with others (see previous section).

We can see from the questionnaire's results, that there are some clear changes in the level of satisfaction with the amount of touch they receive, their awareness about their clothing and their self-soothing behavior, and their prioritized comfort level when dressing. After the evaluation, some individuals indicated a lower level of satisfaction with the amount of physical touch they receive. This could be the result of more awareness about the topic due to the experiment or the lack of invited touch that the participants anticipated from

interacting with the designs. Wearing the clothing clearly prompted more awareness over the clothing they wore and their self-soothing behaviors - indicating that they do those actions more often. Surprisingly, there were notable amount of changes in the answers to the statement: 'I prioritize physical comfort when choosing clothing.' Three female participants indicated lower levels (going from strongly agree to agree, or neutral to disagree) and two male participants expressed higher levels after the experiment. This result can indicate that the oversized shirt did feel comfortable or at least made them reflect on their usual levels of comfort when choosing clothes.

LOOK & PLACEMENT & DESIGN

Placement of the interactive element

In some cases, the interaction elements were not on the preferred sides (now being on the left side, allowing for interaction mostly with their right hand), as it required them to stop working with their dominant hands. The positions for the movement were generally in the right area, but changes in the side and the opening of the pockets require more iterations (now one oversized shirt - some fit better, some less, created different placements on the participants). Also, with the level 2 design, the opening for the pockets was reachable from a less natural hand movement – approaching the pocket from the front instead of more from the top, as the caressing movement would naturally go.

Regarding the level 3 design, there were some concerns expressed about the placement, the size, and the amount of the message. The placement can be unfortunate especially in the case of females, being close to their chests - prompting others to look in that direction, which could cause discomfort. Also, unlike the other designs, the message is quite long, which takes some time to read, and as predicted the font size is a bit small.

Feedback on the messages

The messages were not specifically asked about, however, one participant communicated negative feelings about the instructions (level 3 design). She said: "Physical touch belongs to the dimension of life that is a little less quantifiable or cannot be broken down into pieces, making a list reduces it to something that it's not." It was interesting how direct messaging which might be needed in the case of socially anxious young adults can provoke a strong negative reaction in a young adult who is naturally touchy and have a more active strategy (BI-2).

Question of color

When asked for feedback on the design and the concept, two participants mentioned that they would appreciate colors. These two young adults (BI-2 and E-1) prefer colorful garments in their wardrobes and wear colors on most days. They mentioned that colors would make them feel more confident and would strengthen the purpose of the clothing items in their case. However, the preference for colors in clothing is personal.

Question of accessory

During the conversation with participant S-2, the idea of turning the design into an accessory came up. She disagreed with the proposal, as the design now is functional on its own while turning it into an accessory would make it 'additional'. She said: "It would feel like wearing an employee tag."

INTERPRETATIONS OF THE CONCEPT

The participants were also asked about their opinions and views on how these designs would evolve. Many of the young adults saw it as a way to make a statement, create awareness, or act as an activist movement. It made them recall different mediums like a documentary about why people are so distant called The Swedish Theory of Love (Erixon, 2015) and an experimental product, a ring meant to be worn by single people - indicating

that the wearer is not in a relationship but open to being in one (Pearing, 2023). As they were not explained beforehand about the intention of the designs and the branding to raise awareness, it was a positive reassurance. Participant BI-2, who did not agree with the subtle messaging and would prefer bold colors and different textured fabrics to invite touch, also changed her mind after the whole concept was revealed. "I think understanding better the purpose, I feel it's kinda powerful because I think the discretion of it aligns with the 'little-by-little' that you need to have with touch."

In conclusion, the evaluation of the clothing designs revealed positive perceptions among the participants. The designs were well-received, with participants appreciating the soft and comforting material and the hidden, private nature of the pieces. Although the intended scenario and interactions with outsiders did not unfold as planned, - this can partially be due to the limitations of the evaluation: 1. the open places where the participants wore the clothes were not crowded and most people were busy with their own studies - thus did not see or pay attention to the designs, 2. they were wearing it for only a short period of time - wearing the designs still led to changes in behavior, body language, and increased self-awareness about touch needs among the participants. The designs supported the wearers by providing a sense of comfort and sensory stimulation. Questionnaire responses indicated changes in participants' satisfaction levels with touch, awareness of their clothing, and prioritization of physical comfort when dressing. The participants did see the designs as a way to start kind of a movement or create awareness and spark discussions on a bigger level, which is partially the goal.

Overall, the findings suggest that the clothing designs have the potential to offer a subtle and personal approach to addressing touch deprivation, empowering individuals to

take control of their interactions and raise awareness of their touch needs. While the desired interactions with outsiders did not occur, the designs had an impact on participants' behavior and self-awareness. The feedback received from the target group will guide future recommendations.

LIMITATIONS OF THE EVALUATION

It is essential to mention some of the limitations that could arise from the way the evaluation was carried out. To create the most realistic setting, participants wore the pieces at the university's open study places. Although it is a lifelike environment, it is also very unpredictable and uncontrolled. The interactions cannot be foreseen, nor the possible partners who may see and engage with the participants. Being in a familiar environment might help the participants behave naturally, however avoiding any biases or ensuring completely genuine behavior cannot be guaranteed. As they are aware of being observed and being part of prototype testing, participants may feel obliged to interact with the clothing in a certain way and be more self-aware of wearing the items.
Furthermore, the prototype testing is conducted over a relatively short period of time. This timeframe may not reflect the possible long-term effects and the potential benefits or drawbacks of wearing interactive clothing items. Lastly, the evaluation strongly relies on self-reported and subjective data. Participants' mental state, need for touch, self-esteem, and other subjective measures may be influenced by other factors beyond the prototype itself. Therefore, it can be challenging to identify changes that are solely a result of wearing the designs.

Chapter 8
Conclusions

In this chapter, we conclude this thesis by providing the key insights and main takeaways from the literature study and user research. We summarize how the idea of the clothing brand to address touch deprivation among young adults was developed and evaluated. We end by sharing recommendations and personal reflections.

8

CONCLUSIONS

This thesis centers around the issue of touch deprivation among young adults with the aim to ease their struggles and improve their experience and well-being through a design intervention.

The theoretical research provides a deeper understanding of the topic of touch, touch deprivation, and haptic tools. Touch, as a sense, is fundamental to the human experience and plays a significant role in human relationships and connections. Seemingly a simple act, interpersonal touch is often a complex and dynamic interaction influenced by contextual, relational, personal, cognitive, and sensory dimensions. It is essential to the development of infants, and at an older age touch also plays a role in cognitive and emotional well-being. Our tactile sense can offer both stimulation and a feeling of security while engaging in social touch enables us to connect and form bonds. On the other hand, lacking these social touch interactions with others can lead to touch deprivation, a phenomenon defined as the experience of engaging in less physical touch than desired.

Touch deprivation can negatively impact the mental and physical well-being of the individuals who experience it, causing low mood and energy, aggression, touch aversion, depressive behaviors, negative self-esteem, and body image issues leading to eating disorders. The experience can range from missing merely the physical contact (tactile loneliness) to a feeling of longing or craving for touch to being touch deprived with serious negative effects. There are tools and devices aimed to help these individuals. An array of haptic tools is available to provide its users with 'touch'; connecting people at a distance through different haptic sensations, mimicking the feel of real-life touch, or providing sensory comfort. While some may ease the struggles of touch-deprived individuals, ultimately these devices and technologies (currently) are unable to replicate the effect and experience of in-person social touch.

To gain a more personal and target group-specific perspective on touch deprivation and the role of touch in the lives of young adults, a series of qualitative research (Contextmapping) was executed involving the target group. We saw that touch deprivation is mainly a struggle among young adults who live far from their families and friends, long-distance couples, and individuals struggling with social anxiety or other mental health issues. The research activities led to many insights into the needs, values, feelings, and experiences of the individuals facing touch deprivation, moreover, to the creation of four personas representing the target group. It was further proven that navigating social touch interaction is often very complex, causing difficulties for young adults. Considering other people's boundaries, aligning each individual's expectations and needs, yet engaging in natural touch interactions can be challenging and lead to overthinking and reservedness. Touch is rarely solely about the sensations, it can provide meaningful and nuanced messages. The perceived intention and its bi-directional effects on all the parties exchanging touches are more powerful than the tactile feeling itself.

The empirical research further shaped the project by identifying three main design directions. Firstly, touch deprivation is a hidden struggle, without general awareness about the phenomenon and also the importance of touch in our human experiences and connections. Throughout the research individuals expressed the positive impact of gaining awareness and engaging in self-reflective activities. Awareness of the issue led to the appreciation of touch experiences and to take small steps towards facing touch deprivation. Secondly, this need for touch is more often than not actually a need for in-person connections. Young adults had strong negative opinions about MST devices replicating their loved one's touch and the lack of popularity and use of haptic devices to connect also explains how the presence of the person is strongly valued over mere tactile sensations. Lastly,

many young adults chose avoidant strategies to cope with their negative experiences and this also often includes the seek for sensory comfort. Sensory comfort is proven to be helpful in dealing with touch deprivation, and young adults saw the tools aimed at providing them with soothing sensations to be valuable. Seeing these results, the three defined design directions were designing for awareness, (in-person) connections, and sensory comfort.

The design process led to the conceptualization of a clothing line with clothing pieces aimed at fostering connections, comfort, and awareness. Clothing is a powerful way of self-expression and one of the factors in how others perceive and form an impression of us. It offers visual cues about the wearer's identity, personality, and interests, as well as about their openness, emotional stability, and extraversion. As a visual display, it can convey direct and symbolic messages and as 'our second skin' intimately touches our bodies every day. The way we dress not only influences how others see us but also the way we behave (enclothed cognition).

The intention of these designed clothing items was to invite affective social touch, provide sensory comfort to the wearer, act as a catalyst for creating in-person connections, and raise awareness of personal touch needs and the issue of touch deprivation. The interaction with the clothing pieces followed the scenario: the wearer engages in a self-soothing action, which will through a subtle message indicate that the individual is in need of touch, inviting others to reach out (comforting touch interaction) and start a dialogue with the wearer (awareness). Through a series of testing with the target group, we learned about their preferences in terms of textiles and textures, their self-soothing behaviors, and their preferred messaging. To successfully cater to the needs of different young adults across the target group, we tailored these pieces to the previously defined personas, resulting in

three T-shirt designs. These three designs all followed the same scenario, but the placement and the messaging of the interactive elements on the clothing were different, based on their needs ranging from subtle and indirect placement and messaging to more direct and instructional.

The evaluation of the pieces took place in a realistic context with the target group. It was observed that, unfortunately, the scenario did not play out as anticipated, the items did not invite outsiders to interact with the wearers. However, the young adults showed changes in their behaviors, and body language, and their self-awareness about their touch needs increased. The items successfully supported their wearers by providing them with soothing sensations and sensory stimulation. There were changes noted in the wearer's satisfaction with the amount of touch they engaged in daily, their awareness of the clothing pieces, and their comfort level, before and after testing the designs, indicating that it induced an overall sense of awareness. The participants also viewed the designs more as statement pieces that are part of a movement or campaign raising attention to our needs to connect and to touch deprivation.

Currently, these design artifacts rather than being solely functional clothing pieces, serve as instruments to prompt a dialogue about our human needs for touch and connections and their role in our well-being. The designs' purpose is to spark reflection and thought-provoking conversations in both wearers and observers about the value of touch in their lives. And as research through design pieces, they have fulfilled their role in uncovering fresh insights about the role clothing can play in shaping behaviors, fostering connections, and raising awareness.

Overall, this thesis presents valuable insights into the experience of touch deprivation among young adults and the potential of a design intervention to tackle this issue. This work aspires to contribute to the well-

being and quality of life of young adults by promoting meaningful discussions and emphasizing the significance of touch in enhancing our human experiences. Moving forward, we hope these findings can offer a foundation for further exploration and refinement of design interventions and empower individuals to take steps toward improving their own well-being and fostering meaningful connections in their lives.

RECOMMENDATIONS

In the coming section, we will present some recommendations that aim to guide future research and refine design approaches to address the multifaceted challenges of touch deprivation.

FUTURE RESEARCH

There is still relatively little known about the development, measurement, and mitigation/treatment of touch deprivation. Researching to answer questions such as how long one has to lack touch to be called touch deprived, how much touch is (not) enough, the type of touch that's needed, how to measure it, how cultural differences play a role, how well different types of relationships can fulfill our needs for touch, the impact of touch deprivation across ages, etc. could benefit all future studies, designs, and interventions aimed to improve the experience of touch deprivation. Gathering more data and information globally would positively affect all initiatives addressing this issue.

DIFFERENT APPROACH

Since touch preferences and routines are very personal, to address the issue of touch deprivation on a more individual level, tracking and gathering data for a longer period of time to then tackle the issue in a more personalized matter could be beneficial. This could result in wider data gathering across different ages, backgrounds, and cultures, and lead to the

improvement of the situation with attention to individual needs, values, and habits. Targeting touch deprivation at the earliest signs, and preventing it all together should be the overall goal.

This final concept has its limitations since clothing pieces alone cannot fully tackle such a complex issue as touch deprivation. To address this successfully a more comprehensive solution would be required, which also challenges all the systematic issues that play a role in the experience of touch deprivation.

LONG-TERM USE OF THE DESIGNS

The testing and evaluation of the designs happened in a relatively short period of time. Understanding whether these pieces generate any long-term impacts on the well-being of young adults and after some time how they relate to these items could benefit the further iterations of the clothing designs. Additionally, seeing the possible effects and interaction across different contexts, locations, and situations could lead to insights beneficial to improve the clothes.

IMPROVING THE CURRENT DESIGNS

On a small interaction level, the placement, size, and opening of the semi-transparent pockets could be improved to fit the diverse body types of young adults better.

The question of the color choice also came up and the preference of colorful clothes over the current white designs is something to be considered. Involving a wider audience, and testing different colors and materials could serve these clothing designs.

The current design could be turned into accessories easily with some changes, which would make the design a more sustainable piece. It could be worn over already existing items in the individuals' closets and would allow more frequent wear, not to mention the possibility to personalize it more. However, this

decision would require some user involvement to see whether this direction is desired and whether having accessories over fully functional clothing is desired.

The clothing brand currently has some designs that never got prototyped or tested. Further developing these could also result in some interesting insights, seeing how different interaction elements would influence the behavior and interactions of the wearers and what values would it generate.

EVALUATION RECOMMENDATIONS

To ensure that the participants get approached during the evaluation process and the intended scenario plays out fully, changes could be made in the way we tested the prototypes. More open and social places could be picked, where coming up to someone unknown is viewed as more conventional and not as an act of disturbance (e.g. social gatherings and events). We could also involve more participants in the testing and assign roles, the wearer and the person who approaches the wearer, to enact the scenario. This way we lose some of the authenticity and spontaneity of the interaction between the involved parties, but many valuable insights could still result from this method.

INVITED INTERACTION

One of the main goals of the designs is to invite affective touch from outsiders. Further iterations are recommended to define and consider the touch interaction - if it takes place. Currently the design doesn't fully consider who might approach the wearers and in what way (especially with the level I and II designs), and since during the evaluation it did not happen, we would recommend looking into further to these scenarios, to avoid any unwelcomed situation and physical contact.

DEVELOPING THE CONCEPT INTO A MOVEMENT RAISING AWARENESS

We would also recommend looking into how these pieces and the whole idea of a clothing brand could be further developed to serve as a movement - through which these young adults can connect. Considering how could it reach a wider audience and how can it create awareness and promote its mission better to help touch deprived individuals. Further work developing strategies to achieve this purpose would be beneficial.

INVOLVING PROFESSIONALS

Lastly, collaborating with (mental) health professionals and organizations (not only the target group) and involving them in the design process and evaluation would ensure that the designs contribute positively to individuals' well-being. Their expertise and resources could offer an invaluable source of information and insights, which would potentially improve the value and effect of the designs.

PERSONAL REFLECTION

This project had given me the opportunity to pursue a topic of my interest and shape it along the way. I could practice the skills I have gathered during my education, and learn new ones. Overseeing this project required me to be everything in one, the project leader and manager, facilitator, writer, researcher, data analyst, observer, note taker, student, graphic designer, photographer, tailor, etc. It made me realize what parts I enjoy the most about being a designer (and what parts not so much). I discovered how rewarding and inspiring research can feel when you closely involve your target group and the joy of making sense of an array of raw data (both things that make me feel scared at first).

Along the way, I became truly fascinated by how big of a part touch plays in our lives and connections. As an international student myself, far from my family and friends at home, I could really resonate with the experience of touch deprivation, making this project more personal to me. I believe there is much more to be done to provide solutions to this issue and help those who are dealing with it, but I hope this project contributes some value to this field of research and design.

Two years ago, coming to the university I had a very vague understanding of what Design for Interaction actually is, but this master's has reshaped my view on design and made me realize how powerful it can be. Designers are dealing with versatile and complicated issues, navigating abstract concepts, and untangling messy data all to make a positive impact and bring value into the world. Studying at TU Delft had been an amazing experience and this project is a good way to close this chapter of my education. Bringing with me all the things I have learned about design and myself (as a person and a designer), I hope to continue shaping experiences, fostering connections, and creating value in the world through design.

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Appendix

Appendix Overview

(Appendices are located in a separate PDF document)