

Stigma Probe: A Design Toolkit for Managing Older Adults' Stigmatisation Perception on HMWs

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HEALTH MONITORING WEARABLES (HMWs) are a recent technological trend that assists older adults in healthy ageing. Many older adults, however, do not accept, or may discontinue, the use of HMWs due to a phenomenon known as stigmatisation perception. To help HMW designers overcome this problem, this study reviews the literature on social psychology and design theory and deduces the conceptual composition of stigmatisation perception and the causes behind it. From there, it creates a stigmatisation perception research model, and finally, by investigating novice designers' understanding of stigmas, we summarise the difficulties and needs at different stages of design thinking. On this basis, the study proposes employing the design-thinking toolkit *Stigma Probe* to assist designers in developing a sensitivity to stigma issues at their various stages and offer solutions. Finally, the toolkit is used for testing in design workshops. The results show that *Stigma Probe* can gradually motivate novice designers to understand stigma issues and reduce older adults' stigmatisation perceptions.

Keywords: *stigmatisation perception; older adults; novice designer; design thinking; design toolkit; IASDR*

1 Introduction

Ideally, HMWs can provide meaningful health data and information, keep track of older adults' physical conditions, report emergencies to their families and medical centres, effectively forecast and intercept potential hazards in older adults' lives, and improve the everyday safety and independence of their lives (Fang & Chang, 2016; Kang et al., 2010). Still, it is not easy to make older adults voluntarily accept health monitoring technology, and stigmatisation perception is one of the major difficulties that designers need to overcome. (Rashidi & Mihailidis, 2013; Yusif, Soar, & Hafeez-Baig, 2016). For example, Holzinger et al. (2010) found that older adults are willing to buy hazard-warning smartphones for others but are not willing to use it themselves because they believe they are for patients with heart disease. Pritchard and Brittain (2015) also found that while alarm pendants are convenient, efficient and cost-effective, older adults nonetheless resist this kind of product because they feel stamped with a negative, ageist label. The author also found that stigmatisation perception will weaken older adults' motivation to use them, leading to an insufficient variety

of new design schemes. It follows that stigmatisation perception is an exceedingly confounding obstacle to the design of HMWs.

The purpose of this study, then, is to develop a design toolkit to enhance designers' sensitivity to stigma issues and their ability to resolve older adult, stigma-induced perception problems. The study started from literature on social philosophy and design theory, analysed the conceptual composition of stigmatisation perception and the causes of its formation in the context of design and constructed a stigmatisation perception research model. By investigating the understanding of stigma issues among novice designers, this study summarises their problems and needs at different stages. From there, the study proposes a design-thinking toolkit named *Stigma Probe*, which is used for testing in design workshops. Finally, the influence of this toolkit on novice designers is discussed.

2 Related Works

2.1 The Formation of Stigmatisation Perception in HMWs

Stigma studies derive from social psychology. Goffman (1963) found an important correlation between stigmas and stigmatised persons' social identity and argued that stigmas are formed in the chasm between real and virtual social identity. Based on Goffman's theory, Link and Phelan (2001) pointed out that the concept of stigma rests on the labelling of social identity, stereotyping, separation, status loss and discrimination. As a keyword in stigmatisation perception, the social identity issue is integral to design research. In light of design semiotics and product semantics, what people wear, consume or use can define their social identity as well as their differences (Csikszentmihalyi & Rochberghalton, 2002; Krippendorff, 2006). Therefore, some products, such as Rolex watch and Apple watch, are deemed as the symbols of identity and status of their users.

Besides the value of social identity, the Stigma-induced Identity Threat Model (SITM) summarised by Major, can also provide a valuable perspective to analysing design-induced stigmatisation perception (Major & O'brien, 2005). This recursive model interprets stigmatisation perception as an evaluation of identity threat. Its root causes are collective representations of the social culture a stigmatised person might find themselves in, along with the negative situational cues they encounter and prominent personal characteristics. Furthermore, Vaes (2014) once developed a stigma-induced product evaluation model with an evaluation tool on the basis of design theories regarding emotional design and product semantics and related concepts and their relationships. His study revealed stigma-related evaluations from three sides—user, spectator and culture—and provided designers with a design strategy capable of interrupting stigmatisation.

Interestingly, not all gerontechnology induces stigmatisation perception. Some protective, assistive and wearable products are more susceptible to stigma than others (Jacobson, 2014; Parette & Scherer, 2004; Vaes, 2014). HMWs are often included in three product categories. First, we combined stigma-related findings found in relevant studies with previously proposed theories. Then we attributed HMW-induced stigmatisation perception among older users to three levels: identity perception, social experience and design presentations. These three levels interact and reinforce each other, eventually forming the elders' strong stigmatisation perception and rejection of some HMWs (Figure 1):

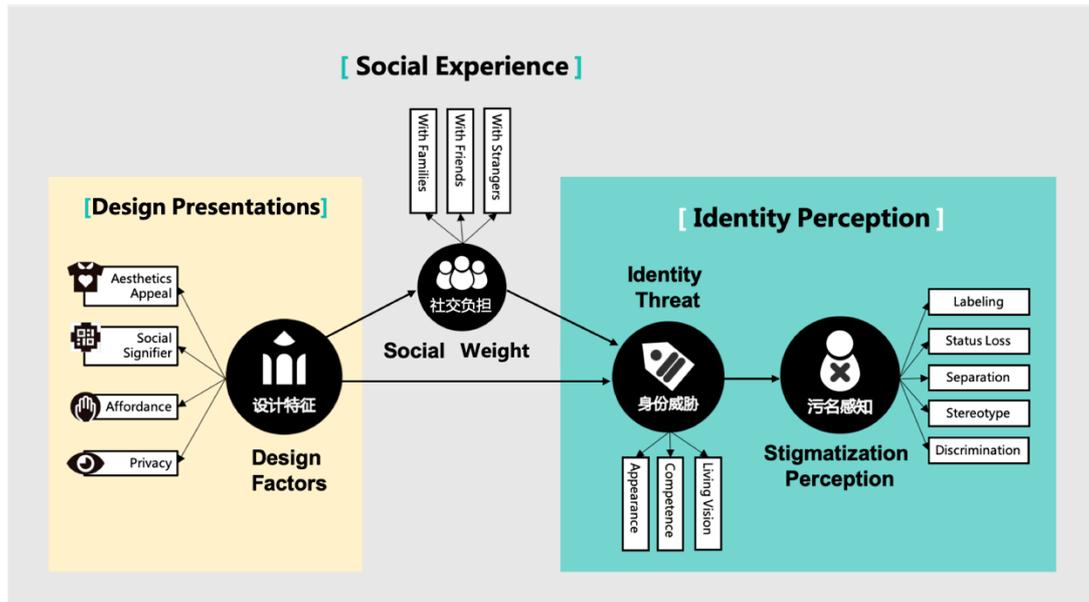


Figure 1. Three Levels of Problem about HMWs-induced Stigmatisation Perception among Older Adults

(1) Identity Perception - identity threat perceived by older adults: In line with the SITM viewpoint (Major & O'brien, 2005), older adult's recognition of identity threat is a key indicator for discerning the existence of stigmatisation perception. In an investigation of stigmatisation perception induced by smartwatches, older adults were found to attach to them many negative characteristics. They thought its target users were older adults with cognitive disorders, physically handicapped or lonely, isolated shut-ins. They did not wish to be associated with those users. The characteristics involved appearance, competence and their vision of older adults.

(2) Social Experience - Everyday, wear-induced social prejudice and undesirable interactive experience. Social prejudice is a set of shared concepts that fall into the category of collective representation, what Steele (1997) calls "a threat in the air". Previous cultural probe studies among older adults describe the many social prejudices against wearable technology. For example, prejudices towards HMWs for the elderly, their clothing habits, what groups are or are not suitable for HMWs and so forth. These prejudices will influence their social interaction when older adults wear these products, whether they will attract excessive attention, be treated reasonably and even accepted or rejected by social groups and so forth. The formation of stigmatisation perception is directly related to negative social prejudices and interactions.

(3) Design Presentations - Some design characteristics that potentially induce stigmatisation perception are misused. A previous study has summarised the characteristics shared by stigma-inducing assistive products, such as lack of aesthetic appeal and complicated technical function (Carneiro, Rebelo, Noriega, & Pais, 2017; Jacobson, 2014; Vaes, Stappers, Standaert, & Desager, 2012). Evidence also pointed to a strong sense of conformity among elderly adults. Hence, HMWs need to reasonably fit into the daily living environments of older adults and match their daily clothing preferences. Through preliminary experiments, the researchers found design characteristics that can induce stigmatisation perception, including lack of aesthetic appeal, accentuated social signifiers, improper or unnecessary functions and underestimated privacy.

2.2 Empathic Techniques and Stigma-related Design Thinking Process

From identity perception to social experience then to design presentation, this study believes that a highly likely factor leading to HMWs-induced stigmatisation perception is ineffective communication between designer (or engineers) and end user in the design process. When designer misunderstands older users' identity, ability to use technology and real lifestyle, they are prone to simplify multilevel needs of older adults for wearable technology and design many products features that induce identity threat perceived by older users.

The key to user-centred design (UCD) is mapping rich information about users into the design space and building knowledge that others can use. Empathy design can pay close attention to special cues, such as user's negative emotions and time consumed to offer insights for innovation (Burns, Barrett, Evans, & Johansson, 1999). For stigma issues, empathic design-related mind-sets and tools can inspire designers to find and resolve stigmatisation perception, enhance their sensitivity to it and assist them in focussing on key elements of stigmatisation perception. In her masterpiece, *Disguised: A True Story*, industrial designer Patricia Moore described how she dressed up as an 80-year-old lady, entering society and finding abundant precious experience, including stigmatisation perception (Moore, Conn & Conn, 1985).

Currently, developing empathy with users has become a goal for most user researches. (Bruseberg & McDonagh-Philp, 2001; Suri, 2003; Mattelmäki, 2006). Design-thinking research conducted by Stanford University took building empathy as its first stage to inspire designers to consider user issues. We also associated stigmatisation perception issues with the same model, identified stigma-related objectives at different stages of design and handled stigma issue step-by-step in the process as demonstrated in Figure 2.

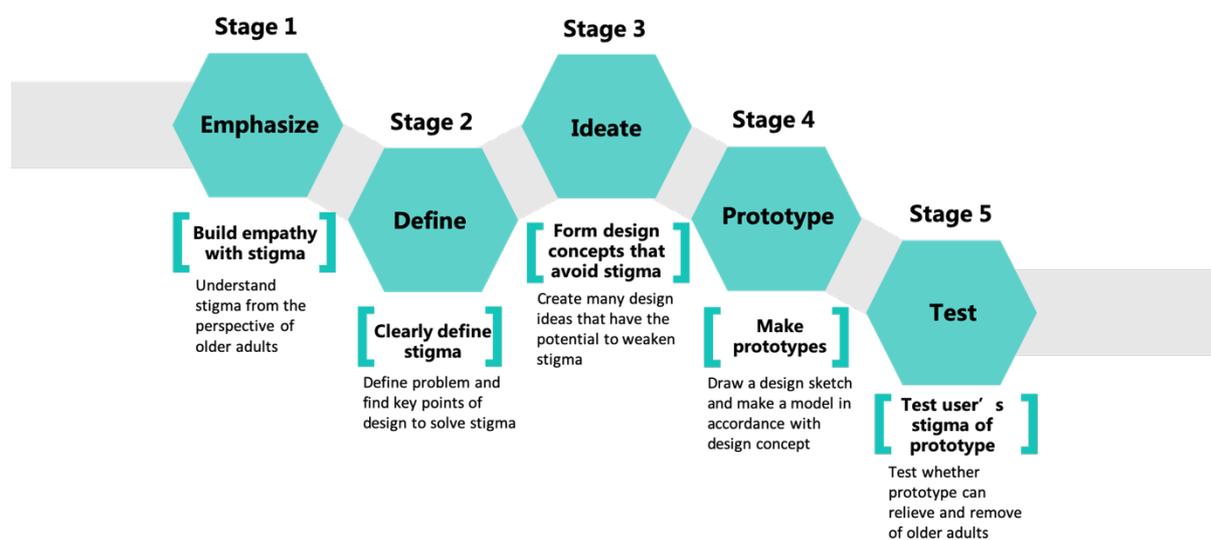


Figure 2. Stigma-related Design Thinking.

3 Research Methods

Based on the related works, we followed three steps to create the design toolkit: (1) analyzing needs for stigma design toolkit, (2) designing the design toolkit, and (3) evaluating the design toolkit. Each of the steps is described below.

Based on various works, we followed three steps to creating the design toolkit. We: (1) analysed the need for it, (2) design it and (3) evaluated it. Each step is described below.

(1) Analysing the need for a stigma design toolkit

Before designing the toolkit, we conducted a brief preliminary survey targeting novice designers in mainland China, namely undergraduates and postgraduates with little experience in design practice. We hoped to compile their insights into older adult stigmatisation perception via a semi-open questionnaire.

The questionnaire consisted of three parts: Part One had four questions pertaining to basic design information, including gender, grade, number of years of design education and professional development. Part Two involved their design experience in gerontechnology and their impressions of older adults. Part Three investigated the difficulties and other aspects to avoid stigmatisation perception in older adults. Respondents were invited to answer two additional questions regarding different stages of design thinking: (i) What problems and difficulties have you found at each stage? (ii) What kinds of design tools do you use?

(2) Designing the design toolkit

Armed with prior research data and insights of the novice designers, the research team produced the following viewpoints: (i) the toolkit should be flexible and easy to access and share; (ii) it should not only assist designers in developing sensitivity to stigma-related information at different stages of design thinking, but; (iii) it should also provide solutions to problems at different stages, including the collection and analysis of qualitative and quantitative data.

In the end, we proposed a design toolkit named *Stigma Probe*. This toolkit takes empathic thinking as its basis and provides five tools fitted to different research stages: Identity Image Card, Sensitive Experience Map, Stigma Insight Card, Design Strategy Cards and Stigmatisation Perception Evaluation Scale. These tools will be more fully explored later.

(3) Evaluating the design toolkit in the workshop

Stigma Probe was used for testing in the 'Wearable X Healthcare' workshop. The schedules of this workshop included a two-day meeting and a five-day social survey. Twenty undergraduate design majors were divided into four groups, each group including students from different specialties—visual communication, product design, digital media and fashion design. Each group was offered a uniform *Stigma Probe* Toolkit, with electronic components, sewing tools and moulding materials.

During the workshop, the participants were asked to use the *Stigma Probe* Toolkit to complete the entire design-thinking process and propose a wearable design and materials. After the workshop, the researchers found 30 elderly adults to examine the design schemes and utilise a stigmatisation perception scale to estimate their likelihood of inducing stigmatisation perception(s). Schemes submitted by each group were measured in terms of stigmatisation perception to deduce whether the toolkit effectively helped the participants avoid stigma problems.

4 Results and Discussion

4.1 Results of Analyzing Needs for Design Toolkit

4.1.1 Comprehensive analysis of participants

This survey collected responses from 37 design students: (1) 17 males and 20 females; (2) 29 undergraduates and eight postgraduates; (3) all participants had studied design for no more than five years; (4) 19 product design majors, eight interactive design majors, eight fashion design majors and two digital media majors.

An analysis of the participants' design experience in gerontechnology shows that: (1) 11 had not participated in any designs intended for older adults, versus 26 who had done so. The topics they had taken part in included assistive devices, such as wheelchairs, walking sticks and shopping carts, small gadgets like pill cases and portable massagers and smart technology products such as mobile applications, alarm apparatuses and smartwatches. (2) 28 respondents felt design for the elderly was so challenging, even daunting, that they felt compelled to offer assistance to elderly adult-related design projects.

Finally, the authors collected 66 descriptions of older adults used by design students in the Impression Description part. An analysis of these descriptions shows: (1) some descriptions are positive and include appraisals like 'industrious and thrifty', 'amicable and lovely', 'have a sense of proportion', 'love learning' and 'love life', which indicates that young students are capable of finding positive characteristics of older adults. (2) Negative impressions account for over 50% of all descriptions, e.g. 'lonely', 'low-mobility', 'vulnerable', 'have difficulty accepting something new', 'childish' and so forth, which suggests that design students also have many stereotypes about older adults.

4.1.2 Design Difficulties and Needs for Coping with Stigmatisation Perception

This part invited respondents to think about how to solve stigma-related problems at different stages of design by explaining a case of HMW-inducing stigmatisation perception, to write down the difficulties they had encountered and the help they needed. By sorting and summarising their answers, this part obtained the following results (cf. Table 1):

Table 1 Design Difficulties and Needs for Stigma-related Design Process.

Stages of design thinking	Objective and task	What are the difficulties in this stage?	Which design tools and assistance you do want?
Build empathy with stigmatisation perception	Understand stigmatisation perception from the perspective of older adults	<ul style="list-style-type: none"> • Lack of understanding of stigmatisation perception, don't know how to plan problems to survey; • Don't know how to build empathy, how to operate to save time, what problems are needed to be noticed in interview or observation.; • A huge generation gap with older adults, don't know how to communicate with them. 	<ul style="list-style-type: none"> • A detailed understanding of stigmatisation perception; • Investigate question cues; • Operating procedure guidance.
Clearly define stigmatisation perception	Define problem and find key points of design to solve stigmatisation perception	<ul style="list-style-type: none"> • How to pinpoint key problems that induce stigmatisation perception of older adults; • How to effectively classify and converge problems collected; 	<ul style="list-style-type: none"> • Direction of problem convergence; • Hints on key points.

Form design concepts that avoid stigmatisation perception	Create many design ideas that have the potential to weaken stigmatisation perception	<ul style="list-style-type: none"> • Don't know how to solve the problem after finding it; • How to choose a better scheme for further development. 	<ul style="list-style-type: none"> • Need to know whether there is a case of removing stigmatisation perception; • Design scheme selection strategy.
Make design prototypes	Draw a design sketch and make a model in accordance with design concept	<ul style="list-style-type: none"> • Inspiration and strategy in the process of prototype design. 	<ul style="list-style-type: none"> • Provide the possibility of testing the scheme on their own.
Test user's stigmatisation perception of design prototype	Test whether design prototype can relieve and remove stigmatisation perception of older adults	<ul style="list-style-type: none"> • How to estimate whether the scheme can remove stigmatisation perception; • If stigma issue still exists, how to quickly find the root cause. 	<ul style="list-style-type: none"> • Technique able to effectively evaluate stigma-related problems.

4.2 Results of Designing the Design Toolkit

Based on thinking and discussion of the research team, we proposed the design-thinking toolkit Stigma Probe. This toolkit starts from the concept of empathy design, expands to issues related to stigmatisation perception and then explains thinking methods and workable operations according to the five stages of design thinking. This process assists designers in finding answers to stigma problems step-by-step. The toolkit contains the following five small tools:

(1) User Image Card (Left in Figure 2): The Image Card is used in the empathy stage to help designers collect design features in three ways—looks, living skills and a caring vision of older users. This leads designers to pay attention to and record sensitive identity characteristics of older users.

(2) Sensitive Experience Map (Right in Figure 2): The Sensitive Experience Map is also used in the empathy stage of design thinking to help designers collect and sort older users' relationships with family, friends and strangers, along with the lead designer, to find a reasonable interaction between users and stakeholders.

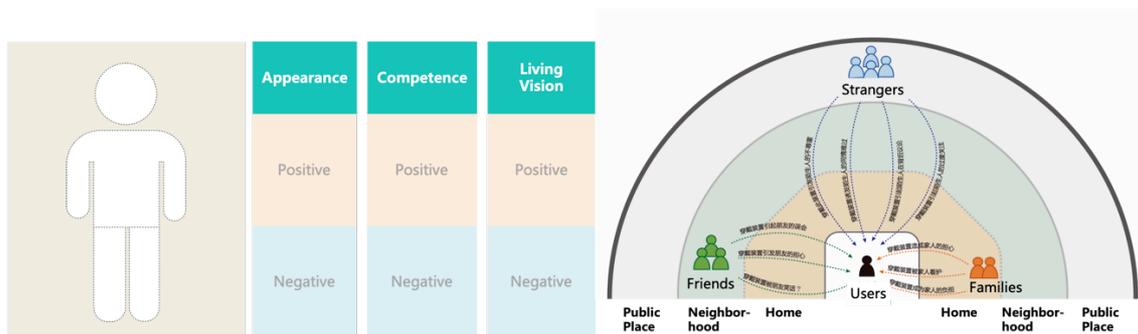


Figure 3. User Image Card (Left) and Sensitive Experience Map (Right).

(3) Stigma Insight Card: The Stigma Insight Card is used in the problem definition stage. The card prompts designers to summarise the keywords of stigma issues. It could lead

designers to think about potential concerns of users beyond just stigma and feasible solutions to form design concepts.

	Keyword	User Needs	What can we do next ?		2	1	0	1	2	
Identity Threat				Labeling	This HMW will put a negative label on me	<input type="checkbox"/>				
Social Interactive Experience				Stereotype	This HMW is often used by older adults with special needs	<input type="checkbox"/>				
Design Features				Separation	Using this HMW makes me feel different from others	<input type="checkbox"/>				
				Status Loss	I feel ashamed to use this HMW	<input type="checkbox"/>				
				Discrimination	Using HMW makes me ostracized by those around me	<input type="checkbox"/>				

Figure 4. Stigma Insight Cards (Left) and Stigmatisation Perception Evaluation Scale (Right).

(4) Design Strategy Cards (Figure 4): Design Strategy Cards are used in the prototype design stage (Figure 4). The card includes 18 strategies to manage stigmatisation perception in design schemes. These strategies are derived from previous studies of other scholars and discussions among our research team. Moreover, the card has related illustrations and descriptions that can inspire designers.



Figure 5. Design Strategy Cards.

(5) Stigmatisation Perception Evaluation Scale (Right in Figure 3): The Stigmatisation Perception Evaluation Scale is used in the testing stage. The author once experimented with evaluation indicators in this scale. The results showed that they can effectively probe the existence of stigmatisation perception and reveal the underlying problems. A designer can use this scale to evaluate their design and collect user opinions after providing design schemes and product prototypes to users to ascertain whether their design can avoid stigmatisation perception.

4.3 Results of Evaluating the Design Toolkit

We evaluate the efficacy of the *Stigma Probe* elements to negate stigmatisation perception. Our research team conducted a design workshop called ‘Wearable X Healthcare’. All participants were novice designers from different specialties who not only had limited experience designing HMWs but also need the opportunity to get to know each other. As the ‘icebreaking’ session, the workshop attendees used the unit where they learned to design

wearable electronic components and circuits. This process not only helped team members get to know each other but also let them become familiar with the essential conditions to make an HMW. After the icebreaking, four groups of students designed the survey according to their topics and with *Stigma Probe*, came up with their design schemes, made design prototypes and conducted prototype tests and scheme optimisations. In the end, the workshop obtained four interesting HMWs design projects:



Figure 6. Activities in “WearableHealthcare” Workshop

Project 1: ‘Ironman’ Handband. This is intended for adults over 60 years old who do not exercise but who have the ability to act and care for themselves. It reminds older adults to exercise moderately by sending vibrations that monitor heartbeat changes and gauge the amount of exercise. It simulates sunscreen oversleeves, comes in a common white colour and is close-fitting and easy to wear and hide.

Project 2: ‘HeartCare’ Waistband. This device is intended for adults over 70 years old who are prone to chills and aches and have difficulty moving. Its function is to monitor daily heart rate, gather data to guard against heart disease and avoid medical emergencies, as well as help older adults with recovery from lumbar spondylosis. It looks like a wide waistband. With a low-key black colour and leather decoration, it is easy to match.

Project 3: ‘Tongxuebao’ Neck Massager. This product is for older adults prone to neck pain. It combines heartbeat monitoring with a neck massager, making HMWs a handy aid for older adults. It is matched with a remote-control wristband and a data-recording mobile application. This product can record users’ state of health and give them the fun of monitoring their health.

Project 4: ‘Mini Q’ Cuff. This HMW is designed for sporty older adults and provides them with heartbeat monitoring of motor processes. Its exterior design simulates a common towelling cuff. The display screen can be hidden inside the waist and be lightened when a hand is raised. It is easy to use and hide for older adults.



Figure 7. Four Projects Designed during “Wearable Xhealthcare” Workshop (Left) and Older Adults’ Stigmatisation Perception on the Four Projects (Right)

Following workshop, the researchers invited 30 older adults to evaluate the prototypes of the four innovative HMWs in terms of the Perceived Stigmatisation Questionnaire (Lawrence, Fauerbach, Heinberg, Doctor, & Thombs, 2006). Fourteen of the 30 were male, 16 were female. The youngest was 60 years old, while the eldest was 78. Eleven were comparatively healthy, 12 reported chronic cardiovascular disease, while the remaining seven had lumbago, neck ache or other conditions. The results showed that when they wore the HMWs in their daily lives, they did not induce other people’s confusion and staring behaviour, hostile behaviours, nor did they reduce people’s friendly behaviours (Right in Figure 7).

4.4 General Discussion

This study gone through three stages. Its purpose is to explore how to assist designers in coping with stigmatisation perception-related problems in designing HMWs, and some phenomena and problems revealed in this process are worth reflecting on. At the first stage, we collected the difficulties that designers have in design thinking about stigmatisation perception and their requirements for design tools. The researchers found that novice designers’ negative stereotypes about the elderly are universal rather than exceptional. Meanwhile, they have a limited understanding of the concept of stigma and they are more likely to have troubles in the empathy stage of design thinking due to their limited design experience, so gradual operating guidance is more in need than an evaluation tool simply leading the concept; at the second stage, the design team tried to develop the details of design toolkit, and the needs of different stages of design thinking were taken as the bases for designing the small tools. The research team needed to anticipate various scenarios that designers may encounter and make the small tools connected and easy to operate; at the third stage: assessed the influence of design toolkit by performing the experiment of the open workshop. The researchers found that infiltrating stigmatisation perception-related points of information into the design process step by step can help enhance novice designers’ understanding of stigma issue and lower the level of difficulty in dealing with stigma problems. Feedbacks given by the students after the workshop show that they gained a more comprehensive and prudent understanding of the needs of older users and had less stereotypes about older adult, and it can enhance their positive understanding of the aging process, which was manifested in their design schemes in many aspects.

5 Conclusion

This study started with the analysis of HMW-induced stigmatisation perception among older adults. It identified the difficulties and related needs that designers must meet step-by-step.

The research team successfully designed a design-thinking toolkit called *Stigma Probe* containing five small tools, namely Identity Image Card, experiment crisis map, stigma insight extraction card, design intervention strategy and stigmatisation perception evaluation scale. This toolkit sought to reduce cultural complexity between HMWs, older adults and their social environments, simplify key information which designers need to notice in the face of stigmatisation perception and provide them with operational approaches for each stage of design-thinking. This toolkit was tested by the workshop and the results proved that the toolkit can indeed effectively lower the probability of inducing stigmatisation perceptions of older adults. A follow-up study will further test and optimise the toolkit in order to expand the influence of the toolkit. The author is sincerely grateful to the participating adults and the student respondents who received the survey, students who participated in the workshop and experts and scholars who offered great help to this study. Thank you for your precious time and valuable information.

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