

# DESIGN FOR HEALTHY BEHAVIOR

## DESIGN INTERVENTIONS AND STAGES OF CHANGE

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### ABSTRACT

Designers have increasingly used the capacity of design to influence human behavior and consequently to address the challenges that our society faces. One of these challenges is the rise of 'lifestyle diseases', such as obesity and diabetes. A change towards a more healthy lifestyle could in many cases prevent or diminish such diseases, which would reduce demands and costs in care. Moreover, it could lead to a higher level of wellbeing for many people.

In response to this challenge, designers and computer scientists have created interventions that help people adopt a healthier lifestyle. We argue that designers need to consider the different stages that people go through to durably change their behavior. In this paper, we discuss how design interventions aimed at adopting a healthier lifestyle correspond to different stages in the Transtheoretical Model of Health Behavior Change. Furthermore, we discuss how designers could design for stages of change.

KEYWORDS: *Design, health, lifestyle, behavior change, stages of change.*

### INTRODUCTION

Design influences human behavior and designers are increasingly effective in using this capacity of design. Think, for example, of how the interactive crystals created by Dutch designer Daan Roosegaarde persuade, or rather, invite people to play and interact with them, and, consequently, with one another. Or, think of how a simple product such as a bowl, designed by Jan Hoekstra for Royal VKB, could persuade people to eat the right portion of food. This bowl tilts when filled with a certain weight, telling its user that the correct portion size was reached.

By using the power of design to influence people's behavior, designers can and are making successful contributions to diminishing some of the large societal problems that we face. One of these problems is the increase in so-called 'lifestyle diseases' such as obesity and diabetes (Lee et al., 2012) that negatively affect our well-being and lead to increasing costs and demands in healthcare. A large proportion of modern society does not live up to the recommended guidelines for healthy behavior. Lifestyle changes could counter this.

In the development of interventions aimed at changing lifestyle behavior, next to psychologists, researchers from two other fields are active; designers and computer scientists, creating, for example, interactive systems that try to persuade people to lead a more active life. The se types of non-personal interventions are promising because they could potentially reach a larger group of people than traditional interventions can (Norman et al., 2007). Furthermore, people using these interventions could potentially use them at any place and at any point in time (Fogg, 2010).

However, in the design of current non-person interventions, the motivational state of the user of the intervention is often not considered. In health psychology, stages of change models are used to define the different stages people go through from the moment they start thinking about changing their behavior to the moment that they have durably changed it. The stages differ with respect to how ready and willing people are to change, i.e. their motivational state. A dominant model is the transtheoretical model of behavior change (TTM), by Prochaska and di Clemente (1992). Designing an intervention in such a way that it matches the typical behavior of a person at

a certain stage seems logical and it is, in fact, what many psychologists do when they develop traditional health interventions (e.g., Johnson et al., 2008). However, considering the stage of change that a person is in is generally not part of a designer's approach.

In this paper, we will present and discuss design interventions and how they correspond to the different stages of change in the TTM. Finally, we will provide recommendations on how to better target design interventions to the motivational state of users of these interventions.

## STAGES OF CHANGE; THE TTM

In their work on health behavior change, Prochaska et al. (1992, 1997) identified ten distinct processes of change from a comparative theoretical study. When they presented these processes to their research participants, they reported that they used different processes of change at different times, thus revealing that behavior change follows a series of stages. Prochaska et al. (1992), suggest that to make a durable health change, whether it is to quit smoking, to eat a more healthy diet (e.g., less fat), or to increase physical activity, people pass through five stages: precontemplation, contemplation, preparation, action, and maintenance. In the first three stages, people build motivation to change, and in the last two stages people act. In this process, people may move through stages more or less quickly. For example, some people are stuck in the contemplation stage for long periods of time (chronic contemplation). Also, many people relapse from action or maintenance stages to an earlier stage, mostly to contemplate or prepare for another serious attempt at action. Finally, a durable behavior change can be reached. Figure 1 shows the stages with the descriptions of the motivational state of people in these stages (from Prochaska & Velicer, 1997).

Next to the five stages of change, Prochaska et al. (1992) describe ten processes of change that people who (self-)changed their behavior reported to have used to progress through the stages. These processes are also depicted in Figure 1, below the stages of change in which people reported to have used them most. It has been argued that these processes of change should guide the development of intervention programs, because people need to be able to use these processes to

progress through the stages (Prochaska & Velicer, 1997). Similarly, we would like to argue that non-person (or design-) interventions should support or enable people to use the different processes of change in different stages.

Psychologists have used the TTM to design their interventions so that they match the motivational state that people are in (e.g., Johnson et al., 2008). Research in the field with these 'traditional' interventions has shown dramatic improvements in retention and progress using stage-matched interventions (Prochaska & Velicer, 1997). Especially retention (adherence) is an aspect that has been found to be problematic for non-person interventions. Kelders et al. (2012) found that adherence to, for example, web-based interventions was very low. Often, these type of interventions are very action-oriented and do not necessarily comply with the motivational states of users. In the following, we will discuss how design interventions can address the correct stage of change by presenting for each stage of change two examples of matching design interventions. For each intervention, we discuss how it supports the processes of change that people have reported to use in that stage. In our examples, we use design interventions aiming at eating a healthier diet or at increasing physical activity. These two behavioral goals are often used for non-person interventions, the latter especially in computer science because they can easily rely on sensors in mobile phones that can be used to track people's physical behavior.

### Motivation building; (pre)contemplation

In the first two stages of the TTM, the precontemplation and contemplation stage, people built motivation to change. In these stages, people are not aware of a need to change; they are not yet ready to change. People are contemplating whether changing has more benefits than drawbacks for them, they are moving their 'decisional balance' (Prochaska & Velicer, 1997, p. 40). In these stages, a design intervention should probably have the form of a general (publicly available), rather than a personal intervention, because people will not yet be motivated to buy or even to start using a personal intervention. Interventions in these stages should have an emphasis on raising awareness of the importance of and the benefits of changing. In the case of interventions aimed at persuading people to change their lifestyle, the importance and the benefits of a healthy lifestyle must be stretched.

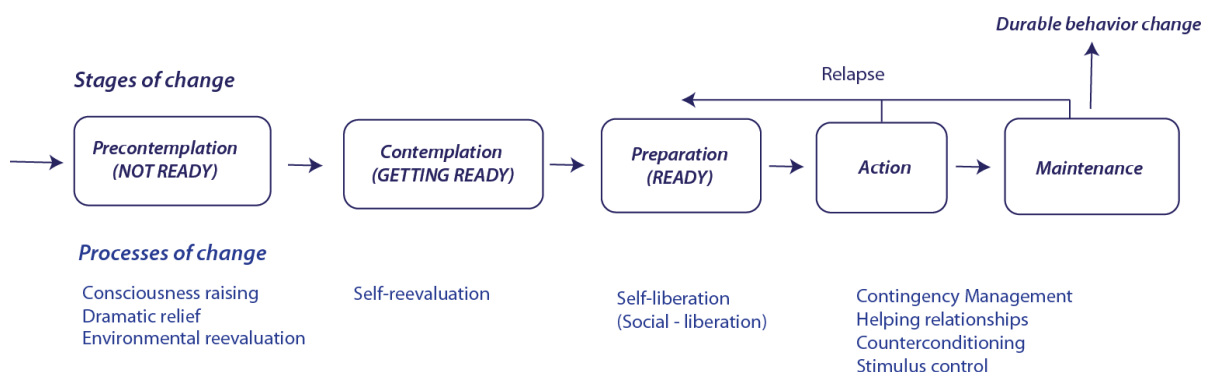


Figure 1. The five stages of change of the TTM and the ten processes of change.

## Precontemplation stage

The precontemplation stage is the stage in which people are not intending to take action within the next six months. People in this stage are avoiding to read, think, or talk about their unhealthy behavior.

1. *Design intervention for eating a healthier diet:* in their work on using strategies from behavioral economics to persuade people to make healthy choices, Lee et al. designed several interventions to promote healthy snacking in the workplace (Lee et al., 2011). These interventions aimed to present choices in a way that leverages people's decision processes and induces them to make self-beneficial choices. For example, one of the interventions they designed was a robot that would present two types of snacks, whereby it was made easier to pick a healthy snack (apple) than it was to pick a less healthy snack (cookie).

*Change Process addressed:* The example described above could be seen as a form of *stimulus control*: it removes a cue for an unhealthy habit (eating cookies is made slightly more difficult), and adds a prompt for a healthier alternative (picking the apple as a snack is made slightly easier) (Prochaska & Velicer, 1997). N.B., from Figure 1 it can be seen that stimulus control was mentioned as a process of change that people report to use in later stages (action or maintenance stages). We will come back to this in our discussion.

2. *Design intervention for increasing physical activity:* A few years ago, The Dutch Voedingscentrum (Centre for Food) released the game 'Na-aapje' (which could be translated as 'little copy-cat' but literally would be translated as 'little copy-monkey'). Na-aapje is a children's game that is designed to raise awareness with children that fruit and vegetables are healthy diet choices. The monkey in the game has to collect fruits and vegetables and the child scores high by collecting as many fruits and vegetables as possible.

*Change Process addressed:* *Consciousness raising.* Consciousness raising is aimed at increasing awareness of causes and consequences of problem behaviors (Prochaska & Velicer, 1997). In the example of Na-aapje, awareness of what healthy choices are is raised.

## Contemplation stage

In order to move through the contemplation stage, people have to gradually become more conscious of their unhealthy behavior. Eventually, their 'decisional balance' has to shift; people have to start to see changing their lifestyle as more beneficial and/or desirable for them than not changing their lifestyle.

1. *Design intervention for eating a healthier diet:* Brown et al. (2006) developed a system for college students to raise awareness of how (un)healthy their lifestyle was and how they could make changes towards a healthier lifestyle. To do so, they used a technique using photographs of food and activities developed by Frost and Smith (2003), and designed a mobile phone application to implement this

technique. The result was FotoFit..FotoFit visualizes activity and diet habits and helps users reflect on their lifestyle.

*Change Process addressed:* The FotoFit system uses the process of *Self-reevaluation*; the assessment of one's self-image with (and without) a particular unhealthy habit (Prochaska & Velicer, 1997). The FotoFit system enables people to more objectively review themselves and their diet and exercise habits, and thereby raises awareness of their unhealthy habits.

2. *Design intervention for increasing physical activity:* 'Bouncers' is a wallpaper on smart phones of a group of friends that visualises everyone's activity through moving circles. In this abstract way it tells its users about their movement in relation to that of their friends (Nelson, 2012).

*Change Process addressed:* 'Bouncers' also uses a form of self-reevaluation; the circles represent someone's activity relative to that of others and thereby allows for comparison and evaluation of one's behavior.

## Getting ready and acting; preparation, action and maintenance

### Preparation stage

This stage is characterized by getting ready to change once the user has decided that some change in behavior is desirable.

1. *Design intervention for eating a healthier diet:* Imagine a canteen in which salad ladles in different colors help people to make healthier diet choices. A display explaining the color code of the ladles informs people in this canteen about the type of salad ingredients that you can eat a lot of (green), the type that you can eat a small amount of (yellow), and the ones you should scoop most moderately in your salad (red) in order to eat a healthy salad.

*Change Process addressed:* social liberation; Social liberation involves creating opportunities for people to change their behavior. Prochaska and Velicer (1997) name smoke-free zones and salad bars as examples. This salad bar not only offers people the opportunity to eat salad in a canteen, the ladles also make it easier to assemble a healthy salad.

2. *Design intervention for increasing physical activity:* in the Netherlands, health insurance company Menzis offers its clients the possibility to collect points for healthy behavior (e.g., not smoking will give you a certain amount of points). Clients can use these points to buy healthy products and services. For example, a route application for mobile phones was offered (AbelLife, 2014) that makes it easy to find nice and inspiring walking and cycling routes.

*Change Process addressed:* *Self-liberation*, also called willpower, is gaining the belief that you are able to change and the commitment to act on that belief (Prochaska & Velicer 1997). Knowing how to act in order to change (and preferably having multiple action choices) is very important in this situation. By offering walking routes (among other options to increase physical activity) to its clients Menzis supports this process.

## Action stage

In the action stage, people have successfully changed their behavior for a short period of time (generally less than six months is used as a criterion). People in this stage can benefit from interventions that help them to avoid problematic behavior and that help them discover new healthy behaviors.

1. *Design intervention for eating a healthier diet:* In Amsterdam, a new concept of a food store was recently introduced that helps people avoid choosing less healthy (but quick) alternatives in the supermarket. This store, 'Bilder & de Clercq', aims to facilitate people to easily cook a healthy and tasty evening meal. The store is set up by recipe, and visitors can directly find the (fresh) ingredients needed at the recipe of their choice.

*Change Process addressed:* In their new concept for a food store, Bilder & de Clercq make use of the process of *counterconditioning*; healthier options for evening meals are more accessible to people, in the process, people learn healthier behaviors and can substitute this for problem behaviors (such as choosing the unhealthy but fast options for evening meals).

2. *Design intervention for increasing physical activity:* Philips Directlife activity monitor, this is a personal device that people own and use for a longer period of time to keep track of their behavior. The Directlife system consists of a personal activity monitor and personalized coaching tips based on the data that the activity monitor feeds into the system. For example, the personal coach will suggest going for walks during lunchtime if the measured activity is below a set goal.

*Change Processes addressed: Helping relationships and counterconditioning.* For *counterconditioning* to take place, people need to learn healthier behaviors that can substitute for problem behaviors. For example, in the Directlife coach, someone may be suggested to bike to work instead of driving to be more physically active. The process *helping relationships* is also part of this system; the coaching tips that are given are not fully personalized but they are designed to simulate a personal coach who is supportive of the behavioral change.

## Maintenance stage

People in the maintenance stage have been successful in changing their behavior for a longer period of time (over six months). They are working to prevent relapse and need to be motivated to keep up the newly achieved behavior.

1. *Design intervention for a healthier diet:* The Sense Mother system is a good example of a system that is designed to support people after they have decided to change their behavior in a certain way and need motivation to continue. The system exists of a 'Mother' and several 'motion cookies' that can be attached to almost anything. In this way, the cookies can help people track their activity, whilst also informing them whether they drank enough water. Multiple other applications are possible, all to be set by the user of the system. Reports are given through a storyboard on cell phone or tablet.

*Change Process addressed: Contingency management:* this process includes reinforcements of 'good' behavior, the storyboard reports that the Sense Mother system is an example, but the system also facilitates setting up competitions between users, thus enforcing group recognition and stimulation.

2. *Design intervention for increased physical activity:* The bowl designed by Jan Hoekstra for Royal VKB can be seen as a design intervention matching this stage. Although (as most interventions presented here) it wasn't originally designed to serve as an intervention that can help people to keep on eating the right portion of food, it may well be used as such.

*Change Process addressed: Stimulus control:* several studies have shown that small structural changes in personal environments can help reduce the unknowing overconsumption of food: e.g., eating from a smaller plate and food in smaller packages influence how much people eat (Wansink, 2004).

## TOWARDS A FRAMEWORK TO DESIGN FOR HEALTHY BEHAVIOR

The examples of interventions that match a certain stage of change presented previously show that for each stage, different characteristics of interventions are important. The interventions presented here were not specifically designed to match a certain stage but in theory, they would work better for certain stages than for others. It could even be counterproductive to offer people a certain intervention that does not match the stage of change that they are in (Prochaska & Velicer, 1997).

However, to further increase the effectiveness of design interventions (non-person interventions), designers could benefit from adopting stages of change theory. In recent years, designers have become used to following a user-centred approach. Adopting stages of change in their design process would enable them to design for the way people actually behave, and not for the way they want them to behave (Norman, 2007). This may seem contradictory, since the aim of these interventions is to change people (or at least their behavior). However, as Prochaska and Velicer (1997) put it: instead of expecting people to match the needs of the interventions, the interventions need to match the motivational states of people. Only if interventions are recognised as matching their motivational states, people will adopt them and use them, which is essential for moving through the stages of change.

The processes of change can serve as a starting point for the design of stage-matched interventions. However, the distribution of processes over the stages may well be somewhat different from a design point of view. The original distribution was made based on the strategies people mentioned they had used to support their behavior change. A design intervention may, on the one hand, aim to support the use of these processes of change in a certain stage. On the other hand, a design intervention could also aim to elicit a process of change



more unobtrusively. For example, Prochaska and Velicer (1997) place the process of change *stimulus control* under the stages of change of action and maintenance. Apparently, people use these processes in these stages. Our example of an intervention in the precontemplation stage shows that the same process could also be used by a designer to seduce, or to nudge (Thaler & Sunstein, 2008) those people still in the earlier stages of change to make further healthier choices. It should be noted, however, that in this case, although the intervention may have a positive effect on healthy choices at the moment a person encounters this intervention, the intervention does not directly help a person in moving on to the next stage. For this to happen, people should be made aware of their choices.

On another note, the same design intervention could mean different things (and therefore work differently) for people in different stages. For example, as we described, for someone in the preparation stage, the colored ladles in a salad bar could work as an enabling element, helping to make the right choices, whereas it would raise awareness of the mere existence of healthier choices for people in earlier stages.

Based on our analysis of design interventions with the examples presented, we propose a preliminary framework for stage-matched design interventions (Figure 2). In this framework, processes of change, stages of change, design strategies, and their relationships are represented. The processes of change are not strictly connected to each of the stages, because, as we have seen from the examples above, designers may use different processes to design interventions for different stages. Four types of design strategies have been defined that lead to four different (design) aims: ‘raising awareness’, ‘enabling’, ‘motivating’, and ‘fading out’. As can be seen from Figure 2, the design strategies spread over multiple stages.

Design strategies for ‘raising awareness’ can move people into a process of behavior change, these are the strategies that help people evaluate the choices they have made so far and place them in a new perspective. The result should be that they move into the preparation stage because they are ready (i.e., willing, feel capable) to change. Next, design strategies that are aimed at ‘enabling’ are in order. We use the term

enabling to characterize interventions that support people in making the right choices; choices that lead to adoption of a healthier lifestyle and that fit their personal situation and preferences. In other words, interventions should incorporate strategies that empower people to create their own action plan. Well into the action and maintenance stages, *motivating* becomes the primary aim of interventions. In these stages, people have already changed and strategies that can support them to maintain changes or to help find new possibilities for change are needed. Finally, in entering the termination stage, right before a durable behavior change is reached, design interventions should incorporate a *fading out* phase. Prochaska and Velicer (1997) found in their clinical trials a negative effect of stopping personal counselling, people had become dependent on the social support and social monitoring and performed worse after these influences were withdrawn. A similar effect could be expected for personal design interventions.

While this framework begins to explain the relationships between health behavior change and design interventions, it also raises questions. First, we have proposed four types of design strategies that should help people progress through the different stages. Each type, however, may come in several variations. In current design interventions, for example, many different strategies to motivate have been explored. More research (and design) is needed to further explore the various possible strategies and the effectiveness of each. Secondly, we have emphasized that design interventions should help people to move through the different stages. This raises the issue of what happens in the interaction with an intervention when someone moves through various stages. As a consequence, the intervention a person uses may at some point not be as effective because it was designed for a stage that the person has moved beyond. Perhaps, at some point, a person should adopt a different type of intervention addressing a new aim. Or, alternatively, an intervention should adapt (or be adapted) to the stages. How (and if) such a dynamic intervention would work has not yet been explored. Finally, within the various stages and strategies, the issue of adherence needs further exploration. Again, within action and maintenance stages adherence has gained some attention, but in earlier stages adherence has hardly been addressed.

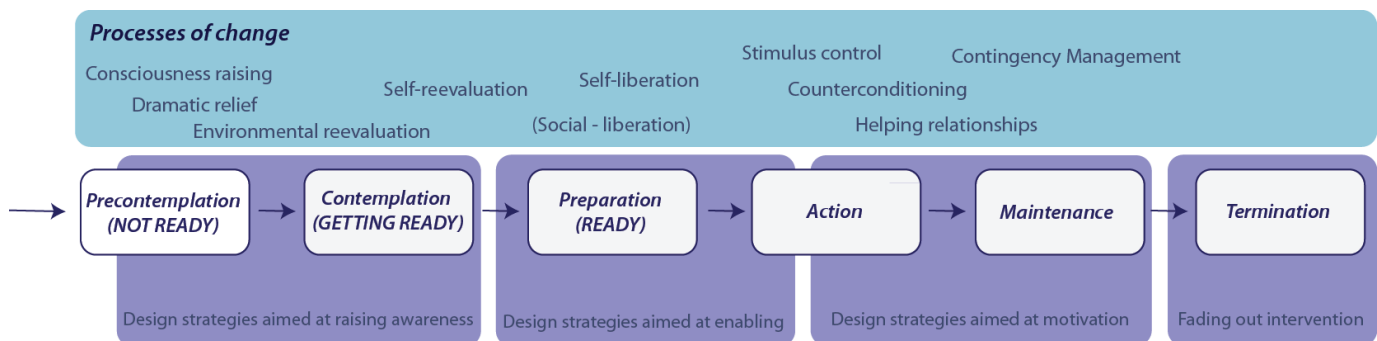


Figure 2. Preliminary framework for stage-matched design interventions.

## CONCLUSION & DISCUSSION

In this paper, we have presented a variety of existing non-person interventions, ranging from web-based interventions, to mobile phone applications, to separate interactive products (or product-service systems) and simple physical products. Although the examples presented here give insight into how design interventions could support a user's progression through the different stages of change, a larger review of existing interventions is needed to support our claim that most of the current interventions are action oriented, and to further explore how existing interventions would match the stages of change. To our knowledge, a complete review of non-person interventions that includes non-interactive designs has not yet been made.

In their review of eHealth interventions for physical activity and dietary behavior change, Norman et al. (2007) discuss three generations of eHealth interventions. The first generation facilitated tailoring of interventions using computers (e.g., tailored feedback messages), interventions of the second generation allowed for direct interaction between users and technology, and the third (now emerging) generation of eHealth interventions makes use of new platforms (mobile devices) with new functions (sensing, location-based knowledge presentation, etc.). A similar view on the future of persuasive technologies is also held by Chatterjee and Price (2009). The examples discussed here have shown second and third generation interventions. In spite of the variety of interventions presented here and referred to in these review studies and outlooks, we would like to argue that the possible solutions for the design of (e)health interventions could have an even broader range. Within each stage, more creative and challenging solutions could surely be found when designers consider the motivational states of people in these stages, and the processes of change that could be used. To name a few: in the maintenance stage, the change process 'contingency management' could be supported by offering people a device in the form of a closed box in which they can place a personal reward that they will obtain when certain (measurable) goals are met for a period of time. The box will only open when the goals are met. With such a device, the (digital and surreal) rewarding system, which many web-based or mobile applications use, could be replaced by a real-life award. In the earlier stages, alternative and more interactive awareness raising interventions could be imagined. For example, one could think of a public screen in a waiting area at a station that senses activity of the people in that area and displays tips to increase activity. This screen could even be coupled to activity enabling devices that people could use while waiting. The possibilities are endless and can be found beyond interactive devices with sensors that people carry around.

Most of the examples discussed here are conceptual designs or prototypes and only a few of them are completely worked out applications that are commercially available. As a consequence, the practical implications of these and other concepts, and how effective they would be, are largely unknown.

This calls for more in the field controlled trials with design interventions. Field trials are also needed to determine which design strategies can be best used at which stage of change. Also, the possible positive effects of dynamic interventions (that adapt when the user moves through the stages) need to be further investigated. Therefore, (the first author of this paper) aims to design interventions which will be subject to a field experiment with a between subjects design, with people in three different stages of action in order to test whether they are indeed more effective (in terms of increase in activity, acceptance, and adherence) for the relevant stage. Next to this, a dynamic intervention will be created and compared to a static intervention in a randomised controlled trial (RCT).

Eventually, adopting stages of change theory to design for behavior change aimed at adopting a healthier lifestyle will help designers to design interventions in such a way that they will be more easily accepted by people, increasing the use of these products and services. This will have a positive impact on people's well being and society at large: Successful adoption of interventions aimed at healthy living by more people will eventually lead to a healthier population which will lower demands and costs in care.

## REFERENCES

- Author(s), (2014). *Abellife*. Available from: <http://www.abellife.nl/nl/Over-Abel>. [2<sup>nd</sup> February 2014].
- Brown, B, Chetty, M., Grimes, A. and Harmon, E. (2006) 'Reflecting on Health: A system for students to monitor diet and exercise', *Proceedings of CHI 2006*, 22-27 April, Montreal, Quebec, Canada, pp.1807-1812.
- Consolvo, S., McDonald, D. W., Toscos, T., Chen, M. Y., Froehlich, J., Harrison, B., and Landay, J. A. (2008) 'Activity Sensing in the Wild: A Field Trial of UbiFit Garden', *Chi 2008: 26th Annual Chi Conference on Human Factors in Computing Systems Vols 1 and 2, Conference Proceedings*, pp.1797-1806.
- Chatterjee, S. and Price, A. (2009) 'Healthy living with persuasive technologies: framework, issues and challenges', *Journal of the American Medical Informatics Association*, 16, (2), pp.171-178.
- Lee, I. M., Shiroma, E. J., Lobelo, F., Puska, P., Blair, S. N., and Katzmarzyk, P. T. (2012) 'Effect of physical inactivity on major non-communicable diseases worldwide: an analysis of burden of disease and life expectancy', *The Lancet*, 380, (9838), pp.219-229.
- Fogg, B. J., and Hreha, J. (2010) 'Behavior Wizard: A Method for Matching Target Behaviors with Solutions', *Lecture Notes in Computer Science*, 6137, pp.117-131.
- Frost, J. and Smith, B.K. (2003) 'Visualizing health: Imagery in diabetes education', *DUX 2003 ACM Press*, pp.1-14.
- Johnson, S., S., Paiva, A. L., Cummins, C. O., Johnson, J. L., Dymont, S. J., and Sherman, K. (2008) 'Transtheoretical model-based multiple behavior intervention for weight management: Effectiveness on a population basis', *Preventive Medicine*, 46, pp.238-246.
- Kelders, S.M., Kok, R.N., Ossebaard, H.C., and Van Gemert-Pijnen, J.E.W.C. (2012) 'Persuasive System Design Does Matter: A Systematic

Review of Adherence to Web-Based Interventions', *Journal of medical Internet research*, 14, (6), p.152.

Norman, D. A. (2007) *The Design of Future Things*. New York: Basic Books.

Norman, G. J., Zabinski, M. F., Adams, M. A., Rosenberg, D. E., Yaroch, A. L., and Atienza, A. A. (2007) 'A review of eHealth interventions for physical activity and dietary behavior change', *American Journal of Preventive Medicine*, 33, pp.336-345.

Prochaska, J. O., DiClemente, C. C., and Norcross, J. C. (1992) 'In search of how people change', *American Psychologist*, 47, pp. 1102-1114.

Prochaska, J. O., and Velicer, W. F. (1997) 'The Transtheoretical Model of Health Behavior Change', *American Journal of Health Promotion*, 12, (1), pp.38-48.

Thaler, R. H. and Sunstein, C. R. (2008) *Nudge: Improving Decisions About Health, Wealth, and Happiness*. New Haven, CT: Yale University Press.

Wansink, B. (2004) 'Environmental factors that increase the food intake and consumption volume of unknowing consumers', *Annual Review of Nutrition* 2004, 24, pp.455-79.