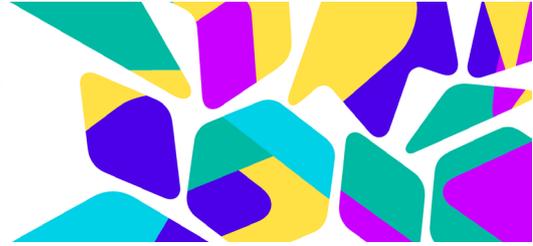




DRS2020
BRISBANE, 11–14 AUG
SYNERGY



A Diary Study on the Exercise Intention-Behaviour Gap: Implications for the Design of Interactive Products

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doi: <https://doi.org/10.21606/drs.2020.329>

Abstract: Increasingly aware of the importance of active lifestyles, many people intend to exercise more. One of the main challenges is to translate exercise intentions into actual exercise behaviour, the so-called intention-behaviour gap. To investigate barriers and enablers that affect this gap, we conducted a 7-day diary study with 16 participants. In this study, participants indicated what their exercise intentions and behaviour were per day, and whether and why they changed retrospectively during the day. Through the diary study, we gain insights into (i) the intention-behaviour interplay, and (ii) the experienced barriers and enablers that influence this interplay throughout the day. Based on the findings, we contribute new implications for design in supporting people translating their intentions into exercise behaviour, and propose three design concepts as examples. In these, the focus is on positively influencing the interplay of enablers and barriers of exercising and how these can be exemplified through design.

Keywords: exercising; intention-behaviour gap; diary study; design implications

1. Introduction

Our society has become more physically inactive over the past decades, since our everyday lives have become more sedentary and less physically active (Martin et al., 2015). The adverse health effects of being physically inactive have led to an increased awareness and importance of striving for a healthy lifestyle within our society (Troost, Blair & Khan, 2014). Due to this increased awareness, more and more people have intentions of being more active (Rhodes & de Bruijn, 2013). This is notably reflected in the increased popularity of unorganized recreational sports (such as running, cycling, fitness) (Janssen, Scheerder, Thibaut, Brombacher & Vos, 2017; Scheerder & Borgers, 2016). Despite these positive



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intentions, for many people one of the main challenges remains how to translate their intentions into actual, preferably long-term, exercise behaviour (Rhodes & de Bruijn, 2013). For example, a previous study indicates that the drop-out rate to exercise programs within the first six months is about 50% (Biddle & Mutrie, 2007), thus missing out on important health benefits. An important factor influencing this intention-behaviour gap are barriers and enablers that are experienced between the intention and the exercise behaviour (Litman et al., 2015; Mueller, Tan, Byrne & Jones, 2017).

Barriers and enablers to exercising have been studied extensively (McArthur, Dumas, Woodend, Beach & Stacey, 2014; Morgan et al., 2016; Pridgeon, 2012). Barriers that hinder exercise are for instance: weather conditions, lack of confidence and lack of social support. Enabling factors are among others maintaining a routine, anticipating positive feelings and social support. Besides fine-grained ways of categorizing (e.g., internal, environmental, social and physical factors, Stutts, 2002), these barriers and enablers are most often categorized as internal or external. External factors are usually characterized as part of the environment and 'out of your control' (e.g., weather, lack of social support), whereas internal factors are associated to the persons themselves (e.g., lack of energy, past experiences) (McArthur et al., 2014). Previous research indicates external barriers are perceived more often as compared to internal ones (Arzu, Tuzun & Eker, 2006). These barriers and enablers, external or internal, are instrumental in successfully turning intentions into exercise behaviour (Litman et al., 2015; Mueller et al., 2017), also referred to as the 'intention-behaviour gap' (Sheeran & Webb, 2016).

In line with the rise in recreational sports, there has been a growth in the development of sport-related wearables (such as activity trackers, sports watches and applications), aiming to motivate and support people in maintaining long-term exercise behaviour. These wearables mainly attempt at supporting people with their exercise session by allowing them to monitor and eventually keep track of their progress (Jensen & Mueller, 2014). Through the quantification of this progress, these products provide the possibility to track performance, enable competition and social support (Jensen & Mueller, 2014; Shih, Han, Poole, Rosson & Carroll, 2015). The question arises however, whether these wearables only reach a limited target group that already has a strong affinity and identify with exercise and thus is more interested in capturing health and sports-related data (Ellis & Piwek, 2018; Vos, Janssen, Goudsmit, Lauwerijssen & Brombacher, 2016; Menheere et al., 2019). Additionally, even though for some people keeping track of their progress is motivating in itself (Sheeran & Webb, 2016), it does not address barriers that might be experienced prior to the exercise.

Although barriers and enablers to exercise have been studied extensively, the methodological approaches adopted in previous studies (mostly surveys or interviews, as in Larson, McFadden, McHugh, Berry, & Rodgers, 2018; McArthur et al., 2014; Pridgeon & Grogan, 2012) entail limitations to explain the interplay of enablers and barriers as well as the antecedents and correlates of exercising behaviour. Longitudinal methods, such as diary studies, could provide additional insights to inform design opportunities. The benefit of using diary studies is that it not only allows for obtaining commonalities and differences among

participants, but also within-person changes over time (Bolger, Davis & Rafaeli, 2003) as well as a lower recall bias from memory decay (Thibaut, Vos & Scheerder, 2019).

The aim of this study is to further investigate the exercise intention-behaviour gap among young adult women and when and why barriers and enablers to exercise occur. Additionally, we aim to provide new insights for design in supporting people translating their intentions into exercise behaviour, and provide three design concepts as examples.

2. Method

To further investigate barriers and enablers that affect the exercise intention-behaviour gap, and how design might potentially support in overcoming these, we use a 7-day diary study for which we designed an Exercise Diary. The participants were asked to report their daily exercise intentions and behaviour.

2.1 Participants

We recruited 19 women between the age of 23 and 30. Three participants dropped out during the study, resulting in a sample size of $N = 16$. Participants were recruited via social media platforms (Instagram and Twitter) and did not receive an incentive for their participation. We purposively sampled participants from a homogeneous age and gender group to more easily find commonalities and differences. Although the exercise intention-behaviour gap is experienced by both men and women, over various ages, there are reasons to believe these target groups have different motivation triggers. As a previous study on completion rates of exercise programmes indicated that young women were the least likely to complete their intentions (James et al., 2008), we decided to focus on further investigating the gap among young female adults within this study. Inclusion criteria were defined as being active in exercise while encountering motivational problems. The type of exercise they practiced was not a selection criterion. All respondents indicated to sometimes experience motivational problems before going to exercise. Data was collected in Spring 2019. Respondents' demographic and exercising practices are presented in Table 1. Participants were all working or studying a minimum of 24 hours per week and living independently (alone or with partner).

Table 1 Detailed overview of the participants

ID	Age	Kind of Household	Occupation	Exercise	Times
P1	28	Living with Partner	Office job, 40 h/w	Fitness, Walking	3x
P2	27	Living with Partner	Office job, 40 h/w	Golf, Fitness	3x
P3	27	Living with Partner	Student, 40 h/w	Hockey, Fitness	5x
P4	30	Living with Partner	Office job, 40 h/w	Fitness	3x
P5	25	Shared Apartment	Office job, 32 h/w	Running, Pilates	2x
P6	29	Living with Partner	Teacher, 32 h/w	CrossFit, Running, Weightlifting	3-4 x
P7	27	Living with Partner	Office job, 40 h/w	Home Fitness	1-4x
P8	27	Living with Partner	Teacher 30 h/w Hospitality 10-15 h/w	Horseback riding	3x
P9	27	Living Alone	Student, 30 h/w	Dancing, Yoga	3x
P10	27	Living with Partner	Office job 40 h/w	Weightlifting	2-3x
P11	23	Living with Partner	Shop Assistant 24 h/w	Fitness	1-2x
P12	23	Living with Partner	Student, 40 h/w	Dancing, CrossFit, Fitness	4x
P13	27	Living alone	Office job 40 h/w	Fitness, Running	2-3x
P14	26	Living with Partner	Office job 40 h/w	Running, Yoga	4x
P15	30	Living with Partner	Day-care 32 h/w	Volleyball	2-3x
P16	29	Living with Partner	Office job 40 h/w	Boxing, HIIT	1-2x

2.2 Exercise Diary

We designed an Exercise Diary (“Sport Dagboek”) covering three dimensions: (i) demographics, (ii) exercise-related variables, and (iii) daily setup about intentions and exercise behaviour. The demographics and exercise-related variables were asked once, while the intentions and exercise behaviour were asked daily.

DEMOGRAPHICS AND EXERCISE-RELATED VARIABLES

At the beginning of the study, participants were asked once to provide some demographic information including age, household type and occupation (Table 1). Exercise-related information was also collected, including what type of exercise they practiced, how often and how many minutes per week and what their primary reasons were to go exercise. Through these variables we aim to get a better understanding of the participants’ exercise pattern and motivations.

DAILY SETUP

In the daily setup of the diary (Figure 1), participants were asked to (i) indicate what their intentions to exercise were that day and at what moment of the day, (ii) indicate whether they eventually went exercising, what type of exercise, with whom and how long, and (iii) complete the following sentences.

1. My intention to exercise *has changed/has not changed* because I....
2. I was *motivated/demotivated* to exercise because...
3. I was hesitant of going to exercise the moment I...
4. Eventually I *did go/did not go* exercising because...

We used the sentence completion method, a cost-efficient way to collect rich qualitative insights (Kujala, Walsh, Nurkka, & Crisan, 2013), to trigger spontaneous responses from participants. This method is more inviting than open-ended questions, and thus can be adequate for diary entries (Lallemand & Gronier, 2018) where users have to provide feedback on a repeated basis. Through the four sentences, participants indicated why their intentions have or have not changed retrospectively and how this had been affected through barriers and enablers that they experienced.

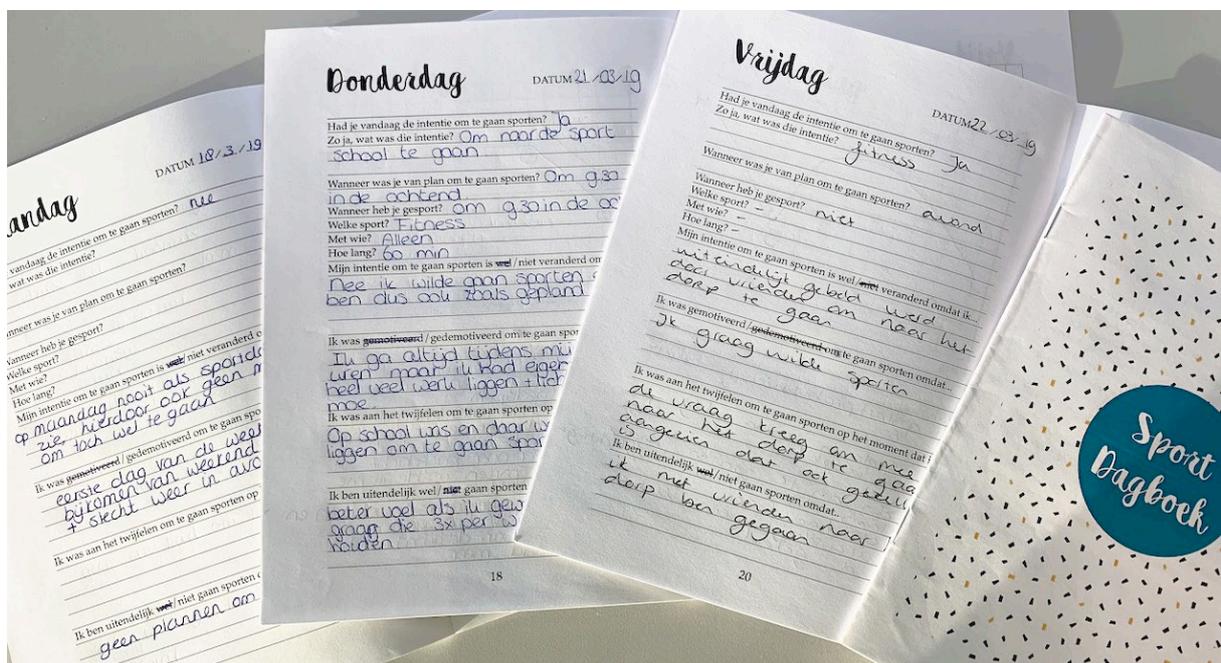


Figure 1 Example of the daily setup of the Exercise Diary

3. Results

Within the diary study, we prompted the daily intentions and exercise behaviour separately, providing a clear overview of the interplay of intentions and exercise behaviour, and how this changed throughout the day and week. This interplay results in four types of days, following 2 axes (intention vs. no intention and exercise vs. no exercise). When intention and exercise behaviour are aligned there are two options: (i) someone can have no intention and did not exercise ('Non-Exercise Day'), or (ii) can have the intention to exercise and actually went ('Exercise Day', *successful intender*). When intentions and exercise behaviour are not aligned, it might be that: (iii) someone can have the intention but didn't go ('I Didn't Go Day', *unsuccessful intender*) or (iv) did not have the intention but did go ('Went Spontaneously Day').

In the Exercise Diary, the participants also indicated why their exercise behaviour were (not) aligned with their initial intentions, providing insights in the perceived barriers but also in the enablers that help them overcome these. Through the diary study, we thus gain insights into (i) the intention-behaviour interplay, and (ii) the experienced barriers and enablers that influence this interplay throughout the day.

3.1. Intention-Behaviour Interplay

DISTRIBUTION DURING THE WEEK

Figure 2 represents the distribution of the four different type of days resulting from the diary study. It is visible that the two types of day: 'Exercise Days' and 'Non-Exercise Days' occurred most often, with more 'Non-Exercise Days' (total of 43%) compared to 'Exercise Days' (total of 38%). The day on which most women went exercising was on Monday. The total amount of 'Exercise Days' decreased over time until Thursday. Thursday was also the day where the least number of women went exercising. The only day where everybody stuck to their initial intentions was on Monday. On this day nine women intended to go exercising and seven women intended not to. The days of the week involving the most 'I Didn't Go Days' were Tuesday and Friday. On these days, four women intended to exercise but eventually did not go. The times women went sporting without having the intention upfront, all took place during the end of the week, on Friday, Saturday and Sunday. In total, the intention to go exercise was set 57 times among the participants, of which 25% of the time participants were not able to convert their intentions into exercise behaviour.

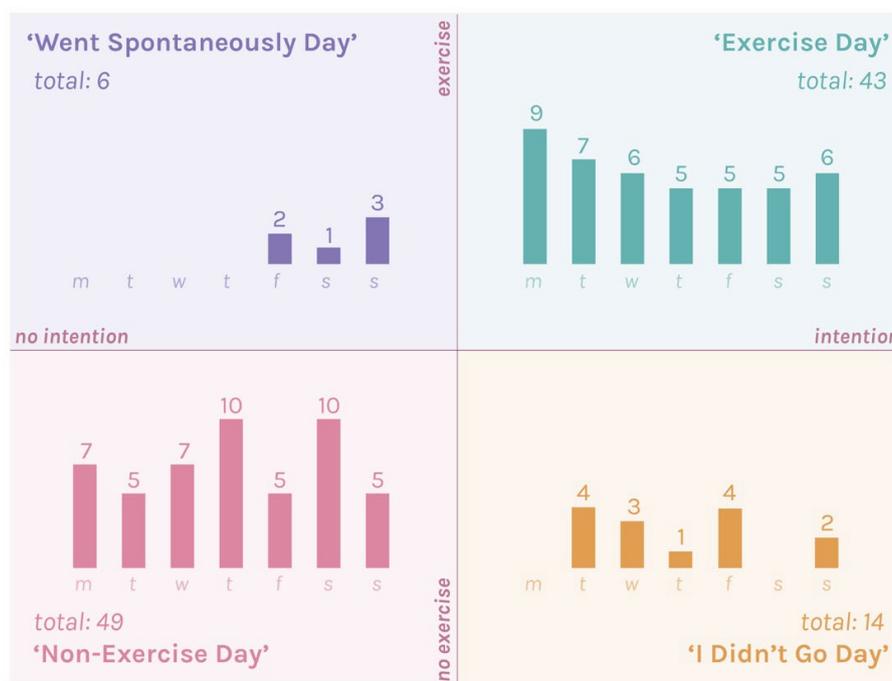


Figure 2 Distribution of the four different quadrants throughout the week, following 2 axes (intention vs. no intention and exercise vs. no exercise)

To make a clear distinction between the intentions and exercise behaviour throughout the week, we represent all the days where an intention was present on Figure 3a, making a distinction between successful ('Exercise Days') and unsuccessful intenders ('I Didn't Go Days'). On Figure 3b, we represent all the days where an exercise action was present, with an initial intention to do so ('Exercise Days') or not ('Went Spontaneously Days'). The difference between the Figure 3a and 3b illustrates how consistent the participants were in pursuing their intentions.

Figure 3a shows that the higher number of intentions were made on Tuesday, eleven women intended to exercise that day. This was followed by Monday, Wednesday and Friday, with a total of nine women having the intention to exercise. The days with the least amount of intentions to go exercise are Thursday and Saturday. Figure 3b shows a decrease in women who went sporting intentionally over time, with the highest amount on Monday. There is an increase in exercise behaviour visible again towards the end of the week, on Friday, Saturday and Sunday. When comparing both Figure 3a and 3b, a noticeable gap is visible between intention and exercise behaviour on Tuesday, Wednesday and Friday. Indicating these are the days where participants were least consistent in pursuing their intentions.

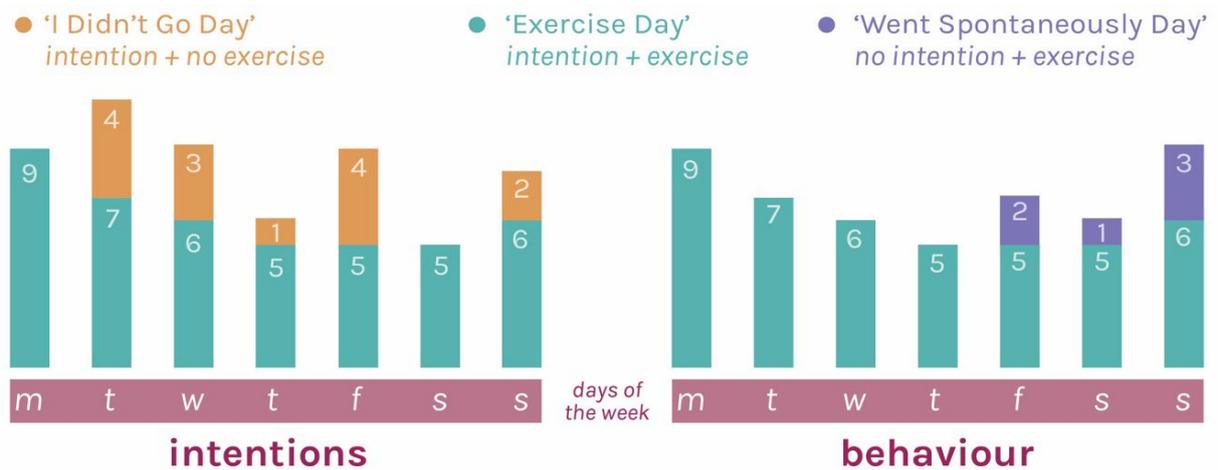


Figure 3 Distribution of exercise intentions and behaviour over the week

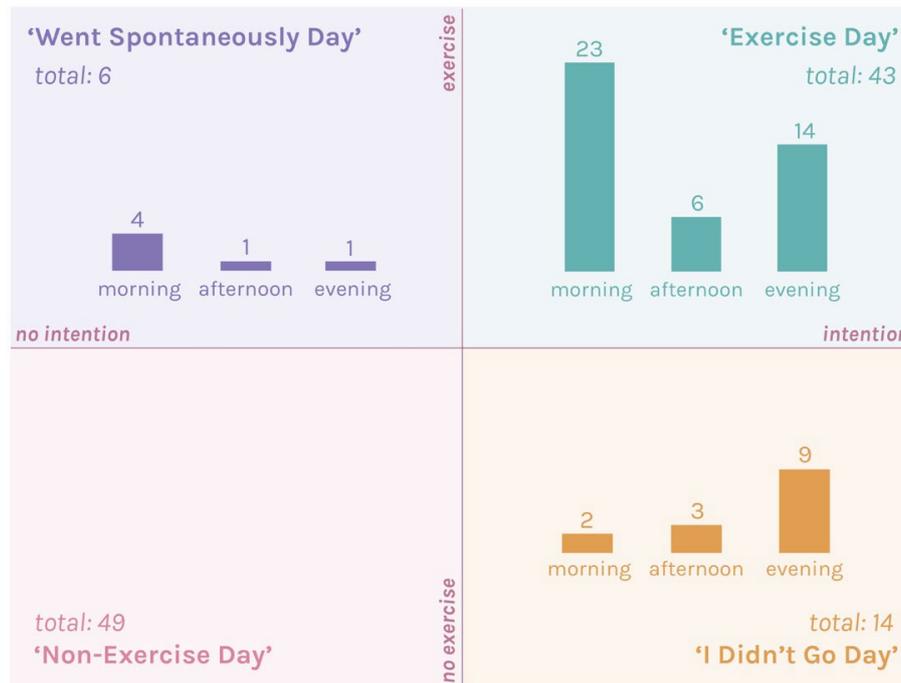


Figure 4 The amount of different types of days experienced throughout the diary study and during which part of the day the intentions were originally set

INTENTION-BEHAVIOUR GAP DURING THE DAY

Since the participants were asked when (i.e., part of the day) they intended to exercise, and if/when they actually went exercising, we were able to analyse on which part of the day women were less likely to convert their intentions into exercise behaviour. Figure 4 visualizes the different part of the days for which the intention was made to go exercise, but clustered in the eventual type of day (e.g. 'I Didn't Go Day'). In this figure, the 'Non-Exercise Days' are excluded, since participants did not set any intentions to go exercise for this type of day. Figure 4 shows that 26 times, someone set the intention to go exercising in the morning throughout the week, and these were pursued 23 times. However, when setting the intention to go exercising in the evening (total of 23 times), only 14 times, women were able to keep their intention and went exercising. Respondents who made plans to exercise in the morning thus were more likely to convert these intentions into actual exercise behaviour than when intentions to exercise were set in the evening.

INDIVIDUAL PATTERNS

Figure 5 visualizes a comparison of two participants' individual patterns. These women were selected because they both experienced three or more different types of days throughout the week, with at least two days where the intention and exercise behaviour were not aligned. Initially we see that both respondents were able to convert their intentions into exercise behaviour. What is noticeable however is that when these participants experienced a 'I Didn't Go Day', this was followed by a 'Non-Exercise Day'. However, two of these 'Non-Exercise Days' were in turn followed by an 'Exercise Day'. This is visible in P9's week, who

had an unsuccessful intention to go exercise on Tuesday, but actually went exercising on Thursday. This also holds true for P1, who wanted to exercise on Wednesday yet eventually went on Saturday and Sunday. When P9 experienced an unsuccessful 'I Didn't Go Day' on Friday, this again was followed by a 'Non-Exercise Day'.

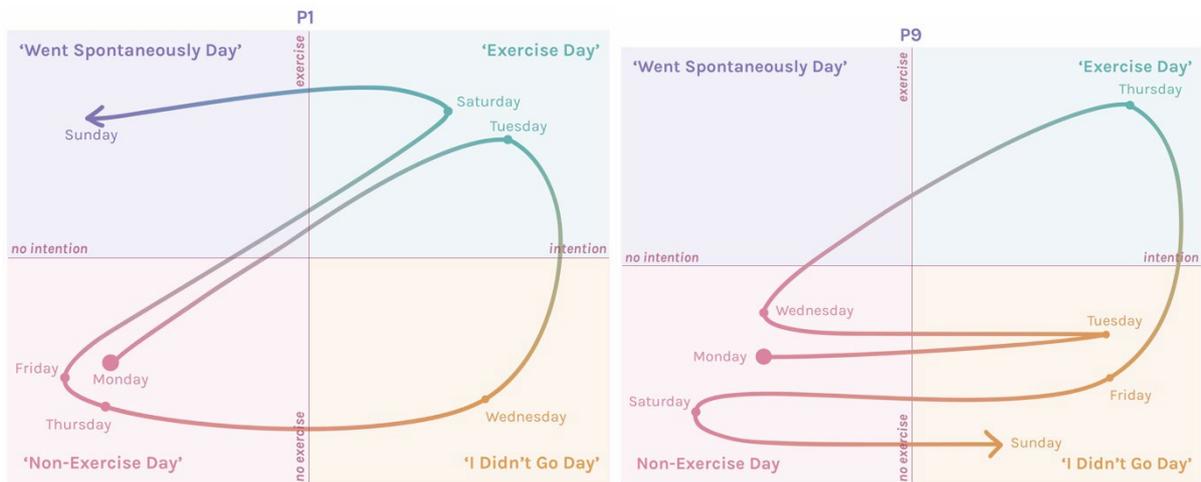


Figure 5 Left the individual pattern of P1, right the individual pattern of P9

3.2 Barriers and Enablers to go Exercising

We conducted a thematic analysis of the diaries' textual entries. This resulted in a general overview of the barriers and enablers experienced throughout the week, as described by our participants. Barriers that were indicated most often were 'difficulties with getting started', 'lack of time' or 'lack of energy'. Social factors like 'cancellation of exercising partner' or 'getting asked for a social activity' were also experienced as barriers often. Barriers that were indicated less often were 'weather' and 'long commute time'.

Enablers that were experienced most often were 'feeling like going to exercise', but also social factors like 'working out with a friend or trainer', or 'taking a class'. Participants also indicated to use 'self-commitment' as an enabler to go exercise. Another important enabler was participants' use of emotions when reflecting on previous behaviour, like 'regret' and 'guilt' or 'anticipating positive emotions' that one experiences after exercising.

BARRIERS AND ENABLERS PER TYPE OF DAY

We see a difference when analysing the barriers and enablers per type of day.

'Went Spontaneously Day'		exercise	'Exercise Day'	
BARRIERS	ENABLERS		BARRIERS	ENABLERS
Getting started (2)	Nice weather (4) Others asked me (3) Taking a class (2)		Getting started (27) Lack of energy (13)	Self-commitment (31) Social support (29) Feeling like it (22) Planning (19) Positive anticipation (18)
no intention			intention	
'Non-Exercise Day'		no exercise	'I Didn't Go Day'	
BARRIERS	ENABLERS		BARRIERS	ENABLERS
Lack of time (22) Rest/recovery (17) Promise of going tomorrow (12)		Better alternative (11) Other demands (9) Cancellation partner (8) Lack of energy (5) Not feeling like it (5) Getting started (5)	Regret/Guilt (4) Feeling like it (3)	

Figure 6 Overview of the barriers and enablers experienced by participants per type of day, and how often they were indicated in between brackets

'I Didn't Go Day'

The barriers that were experienced the most often on a 'I Didn't Go Day' were due to a better alternative or other demands like work, school or household related tasks.

"I have not been exercising for 2 weeks already, so I felt I needed to go, however, I also felt I needed to tidy up the house." – P9

"I had to work late for school, and I felt that was more important." – P12

Cancellation of their exercise partner and lack of energy was also indicated to be an important barrier among the participants.

"When my sister-in-law cancelled up on me, my motivation dropped immediately" – P2

"I was completely worn out from work and dragged myself home" – P10

"I've had an exhausting day and made a different choice to just go walking with the dog" - P5

Additional barriers that were often experienced by unsuccessful intenders are when participants did not feel like exercising as well as troubles with getting started.

"I was tired and was not feeling like changing my clothes" – P6

Even though the participants did not follow up on their intentions, they did indicate to experience enablers. The most important ones were the feeling of regret or guilt and feeling like going to exercise.

"I was motivated to go exercise because... the rest of the week I went exercising only once" – P9

"I felt guilty towards 'name of trainer' that I had to tell her I was not able to come" – P12

However, on this day the enablers were not experienced as strong as the barriers, and thus resulted in a 'I Didn't Go Day'.

'Exercise Day'

When someone indicated to follow up on their intention to exercise, less barriers were experienced compared to a 'I Didn't Go Day'. The two barriers that were also experienced on this day were troubles with getting started and a feeling of lack of energy.

"When I came home I was doubting, because I was tired and I just wanted to lay on the couch" – P8

"I was doubting to lay in bed a little bit longer" – P13

However, on this successful type of day participants also indicated to experience more enablers, the most important being to remind oneself of the commitment made to exercise and social support

"I intended to do so and I do not want to postpone it further this week (procrastinating)" – P1

"I do not want to go, the couch is calling my name, but I HAVE TO!" – P15

"Even if I do not feel like it, I will go. You cannot bail on your team." – P3

Feeling like exercising, as well as the use of positive anticipation when reminding how good one feels after exercising were highlighted as essential enablers.

"I promised myself that I would go and I know that it makes me feel good all day long" – P13

The enabler that was experienced not as strong as the others was the use of planning an exercise session beforehand.

'Non-Exercise Day'

On a 'Non-Exercise Day', the participants indicated to only experience barriers, which were not experienced on the other three type of days. The most important one was the lack of time to go exercise.

"Even though I didn't go yesterday, I know I don't have the time today" – P5

"I know that I do not have the time because I have planned other things" – P9

Apart from time constraints, a physical barrier was experienced, where the participants indicated the need to recover or take a rest from previous exercise sessions.

"I felt that my body needed some rest" – P12

This was also the type of day were participants indicated to promise themselves to go tomorrow.

"I promised myself that I will go tomorrow" – P13

'Went Spontaneously Day'

On the days when women went spontaneously exercising without having an initial intention, they often only report enablers, for instance nice weather or other people asking them to go exercise.

“I actually did not want to go exercise, but I saw the good weather and thought; why not?” – P13

“I spontaneously agreed with a friend of mine to go and play golf” – P2

These enablers were all rather unexpected, where the participants initially did not consider exercising due to internal reasons. The only barrier that was experienced on this type of day was to get started with exercising.

“I was hesitant: I prefer staying in bed a little bit longer” – P12

4. Design Concepts as Enablers

In the following section we showcase how the findings from the diary study can inspire designs to support women in overcoming barriers to exercise. To illustrate this, we present three design concepts related to one of the four types of days we distinguished within the results section. When generating ideas, we attempted to focus on an experienced barrier on a ‘I Didn’t Go – Day’, while amplifying an enabling factor through design. The enabling factors we aim to amplify are the ones being experienced on a ‘Exercise Day’. The design concepts presented are work-in-progress, designed at the department of Industrial Design at the Eindhoven University of Technology.

4.1 Raya: Reminding of One’s Commitment

Since self-commitment is mentioned as an important enabler on an ‘Exercise Day’, we designed Raya (Figure 7a). Raya is a personal tangible sports buddy designed to help women to plan their workout, through a scheduling feature, and additionally asks the user for her personal motivation to exercise on that day. When the user eventually is in doubt about making the decision to go or not, Raya sparks a dialogue remembering her of her initial commitment of wanting to go exercising and aiming to stimulate the actual intended behaviour through a conversation. Raya therefore specifically focuses on using the enablers of self-commitment and planning, when someone is experiencing the barrier of not feeling like it.



Figure 7 a) *Raya* is a personal tangible sports buddy, designed by Alynne de Haan
b) *Iris* is an interactive clothes hanger, designed by Yvonne Bruin, Jorg Eikens, Lynne de Kluizenaar & Roos Vlaar

4.2 *Iris: Emotional Design to Support Getting Dressed*

Getting started was mentioned as one of the barriers on a ‘I Didn’t Go Day’ by the participants. To overcome this barrier, we designed *Iris* (Figure 7b). *Iris* is an interactive clothes hanger that persuades women to change into their sport outfit when they are hesitant of getting started. With *Iris*, we focus on this moment and aim to lower the threshold of getting dressed. When someone has the intention to go exercise that day, she hangs her sporting clothing on the hanger. Later, when it is time to go exercise *Iris* will light up and starts moving to get attention from out the closet, to eventually stimulate the user to change outfits. Through *Iris* we target the getting started barrier through emotional design and planning, where *Iris* gets happy if the clothes are taken off the hanger and gets angry if they are put back too quickly. *Iris* could also support new types of enablers, not yet experienced now because there is no technological evaluation.

4.3 *Laina: Positive Anticipation through Heatmaps*

One important enabler on an ‘Exercise Day’ was the use of positive anticipation before the exercise session. To amplify this moment, we designed *Laina* (Figure 8). *Laina* is a shape-changing art piece that visualizes abstract running routes, by actuating pieces of wood integrated in the frame. By running different routes, users can change their art piece: *Laina* thus enables them to explore and be creative with every exercise. Additionally, the feedback of the last run is not immediate, rather slowly displayed over two days. *Laina* thus gives the user the opportunity to be more engaged in their piece of art, being able to change it by going for a run, but also by pressing the sticks back to their original position (as a reset of the art piece). Through *Laina* we target the enabler of positive anticipation, where the user is not only encouraged of how good she feels after exercising, but also how their run allows for changes in the art piece.



Figure 8 Laina, a piece of art visualising heatmaps of previous running sessions, designed by Evianne van Hartingsveldt & Mads Birkebæk

5. Discussion

We used a 7-day diary study in order to investigate the exercise intention-behaviour gap among young adult women, and when and why barriers and enablers to exercise occur. The results of the study provide new insights into the intention-behaviour interplay, and the experienced barriers and enablers that influence this interplay throughout the day.

By choosing to conduct a diary study we were able to gain insights in when the intentions were set and what part of the day seemed to be more successful in pursuing intentions. Intentions set for the morning were more often pursued compared to intentions set in the afternoon or evening. This reveals new opportunities for design with a focus to persuade people to set their intentions to exercise in the morning or more persuasive designs that implement the interaction in the afternoon or evening. Furthermore, our findings show a decrease in exercise behaviour through the course of the week. This is not considered a problem when people still maintain to exercise regularly, yet when this is not the case, it might be valuable to contextualize designs that offer different approaches when the week is passing, or focus on this specific part of the week.

When investigating which barriers and enablers influence the intention-behaviour gap, our findings show similarities with previous studies. Lack of social support was perceived as a barrier on a 'I Didn't Go Day' (Morgan et al., 2016; Pridgeon & Grogan, 2012). Maintaining routine, anticipating positive feelings and social support were all indicated to be important enablers on a 'Exercise Day' (McArthur et al., 2014; Morgan et al., 2016). As compared to previous work, weather conditions were not experienced as a common barrier among our participants. As the study took place during Spring, with a generally more pleasant weather, we however cannot draw conclusions on this factor. Supplementary to previous studies indicating a list of barriers and enablers, we gained new insights in what types of barriers

and enablers were experienced on different types of days. Even though some barriers are not easy to overcome through design (e.g., environmental barriers), we identified new opportunities for design, for instance adopting a strategy of amplifying enablers. Our illustrative design concepts all strengthened an enabler mentioned by the successful intenders group of participants in the 'Exercise Days'. The diary study thus gave insights in barriers and enablers placed in context, which constituted inspiring and actionable design materials to explore this topic further using a research-through-design approach (Koskinen, Zimmerman, Binder, Redstrom & Wensveen, 2011). Whether these design concepts actually empower people in pursuing their intentions when experiencing a barrier needs user-testing, but it shows promise of how contextualised findings inspire design concepts.

Using the diary study, we were able to obtain commonalities and differences among participants, but also within-person changes over time (Bolger et al., 2003). In these patterns, individuals sometimes did not follow up on their intentions but were still able to exercise on a different day later in the week. What is interesting to see is how much influence a 'I Didn't Go Day' might have on the subsequent days. Does it only affect the day itself, where the intention is not followed up, or does it also influence the days after, either positively or negatively? Since this study only lasted 7 days with a relatively low sample size, the generalization of our results is limited. However, further investigating how many days a 'I Didn't Go Day' affects motivation might give better insights in how big the intention-behaviour gap is.

We chose a diary study approach to overcome the limitations of previous work in the domain of understanding barriers and enablers to exercise, with a majority of studies following a survey or interview approach (Larson et al., 2018; McArthur et al., 2014; Pridgeon & Grogan, 2012). Surveying and interviewing people to understand the intention-behaviour gap, allows us to list several barriers and enablers in a retrospective way. Relying on memory, surveys and interviews might emphasise certain factors over others, which can thus be reported as less prominent. With our diary study, we investigate the antecedents and correlates of experiences, which is a prerequisite for the design of effective interventions. Through design, we aim to overcome the barriers perceived before exercising, and act in the moment: in the present study, we collected actionable insights on how these barriers and enablers are perceived in context.

One of the limitations of the use of a diary study is the duration, affected by the time investment for participants. Since we conducted the diary study for 7 days beginning on Monday, Monday was indicated to be the day where the intentions and exercise actions were most aligned. However, it is uncertain whether this was due to the study starting on Monday, or because Monday is a day where people are more likely to follow their intentions. Furthermore, the relatively small sample size and homogeneity of the participants made it less possible to generalize the findings to other groups of people (as compared the surveys involving large samples). However, the diary study method allows for more qualitative insights, essential to inform and inspire design processes, where one needs more contextual

material to design an effective intervention and more storytelling to get inspiration from people's life.

6. Conclusion

By conducting a 7-day diary study with 16 women, we gained insights in how various barriers and enablers affect the intention-behaviour gap in exercising. We divided intention and exercise behaviour into quadrants, creating four typical patterns of days in the exercise diary. Our findings emphasise the temporal dynamics of the intention-behaviour gap according to these types of days. We contribute new implications for design in supporting people to translate their intentions into exercise behaviour. Through three design concepts, we illustrate opportunities to positively influence the interplay of enablers and barriers of exercising. We also advocate that design can amplify enablers to exercise through tangible and emotional propositions. Design practitioners and researchers can use the insights presented as inspiration sources to develop new concepts.

In future work, we will use the presented design concepts as research artefacts in order to deepen our understanding of the phenomenon. Our aim is to generate design research knowledge which can feed back into psychological theories on motivation and further inform how to design for the exercise intention-behaviour gap.

Acknowledgements: We would like to thank all the participants who contributed to this study. Additionally, we also thank the talented students from the TU/e Vitality Squad supervised by Daphne Menheere and Carine Lallemand on the creative projects described in the paper: Alynne de Haan, Yvonne Bruin, Jorg Eikens, Lynne de Kluizenaar, Roos Vlaar, Evianne van Hartingsveldt and Mads Birkebæk. This work is part of the project Nano4Sports, which is financed by Interreg Vlaanderen-Nederland.

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