Protocol Questionnaire Study: which coping strategies are relevant for specific barriers for physical activity

Maya Braun[1], **Geert Crombez**[1], **and Annick L. De Paepe**[1]

[1]**Department of Experimental clinical and Health Psychology, Ghent University**
[2]**Department of Information Technology, Ghent University; imec**

Keywords: Physical Activity, Planning, Conceptualisation

1 RATIONALE

While many people want to be physically active, 46% of people with intentions to be physically active do not succeed in translating these intentions into behaviour [1]. Planning can help bridge the intention-behaviour gap [2], but is often perceived as effortful [3] and plans created by individuals aiming to change their behaviour are often of poor quality [4]. Support in planning in the form of personalized plan recommendations can help decrease user burden and increase plan quality. While something like this has been happening in one-on-one consultations with healthcare professionals or personal trainers, most individuals do not have access to regular support when trying to become more active. Automatically creating relevant recommendations is a promising avenue for making support more accessible and efficient. However, automatically creating relevant recommendations for a given individual in their specific context can be challenging, and requires a complex network of information.

The planned study is part of a larger project aiming to create such a network of information using ontologies. Throughout previous work, we have created lists of potential recommendations for activities, locations, social context, barriers and coping strategies based on data, expert- and user input, as well as existing theories and classification systems. Currently, we are linking the recommendations of different domains. In the planned study, we are planning to link barriers and coping strategies.

2 METHODS AND MATERIALS

2.1 Participants and procedures

Participants will be recruited using prolific (app.prolific.com), a website that allows recruitment for online studies from a pool of participants. Recruitment will take place to distribute the study evenly to male and female participants. Participants need to speak English and be older than 18 years in order to participate. Further, participants must live in Western Europe in order to be eligible for this study. The study is estimated to take maximum 45 minutes, and participants will be paid 7€ for valid participation.

The questionnaire was implemented using Qualtrics (https://www.qualtrics.com/uk/), and participants are asked to submit their answers from a desktop computer only – not from mobile phones or tablets. This is to ensure that wide questions are shown as intended on the participant's screen.

Participants will be linked to the study from prolific. Before the study, participants will receive information on the study's aim, what participation involves, and receive information concerning privacy and personal data. They are then asked for their informed consent. Only participants who provide their informed consent can proceed with the study.

Sociodemographic information regarding gender, age group, and highest level of education is collected in order to be able to describe the sample. This is followed by a questionnaire concerning relevant coping strategies for different barriers concerning physical activity plans. This questionnaire is the main part of the planned study and will be described in more detail below. After this part has been completed, participants are redirected back to prolific.

2.2 Questionnaire

The goal of the planned study is to connect potential barriers to physical activity action plans with adequate coping strategies given different circumstances. For this, we departed from lists of potential barriers and

coping strategies that we have identified in previous stages of the research project. The procedures that were used to arrive at these lists are described below, and the full lists can be found in the appendix.

2.2.1 Creating lists of barriers and solutions

This study is part of a larger research project, aiming to create an ontology of action- and coping plans for physical activities. As a first step in that project, we created lists of activities, relevant context and profile information, barriers and coping strategies.

In order to create a list of potential barriers to physical activities, we consulted (1) existing theory and classification systems, (2) researchers in the fields of behavioural sciences and physical activity promotion, (3) existing data on physical activity plans, and physical activity data, and (4) end users.

For both barriers and coping strategies, we departed from coping plans that were created by university students in an 8-day diary study [5]. Open-text data was coded by the researchers. For the barriers, the code book was created from scratch based on the text data. For the coping strategies, we departed from the self-enactable techniques [6].

The resulting list was mapped to the behaviour change intervention ontology (BCIO) [7], the barriers being mapped to the Mechanisms of Action [8] and the coping strategies mapped to the Behaviour Change Techniques [9]. Definitions were added for each barrier and coping strategy that was not yet defined in the BCIO. Mapping occurred in dialogue with the researchers developing the BCIO.

The resulting list and definitions were reviewed by an interdisciplinary research team including psychologists, sports- and movement scientists and computer scientists. The list was further refined based on literature research concerning barriers and facilitators for physical activity. A more detailed description of the development of the ontology of action and coping plans for physical activity is currently in preparation.

The final list used in the current study contains 50 barriers and 64 coping strategies. Due to the abstract labels used in the previous stages (e.g. ”advise to keep behavioural goal in mind BCT”, ”self-efficacy belief for a behaviour”), instances relevant to physical activity plans were created for each barrier and coping strategy.

2.2.2 Preliminary linking of barriers and coping strategies

Due to the amount of barriers and coping strategies, it is not feasible to thoroughly test each combination. Due to the level of specificity and resulting obvious mismatch between some items (e.g. ”material might be broken” as barrier and ”check the weather in advance” as coping strategy), Hence, preliminary links were created in order to exclude clearly irrelevant combinations from the study. For this, expert workshops were conducted, and data from previous studies [5] was consulted. Lastly, the theories and techniques tool [10] was consulted.

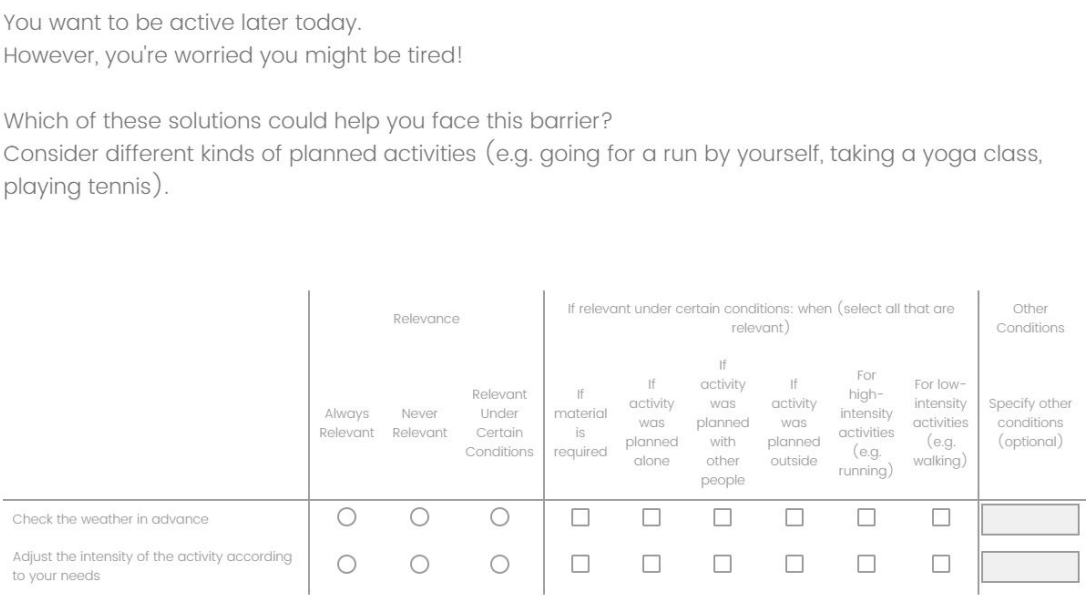
Exclusion was done conservatively, as to not exclude potentially relevant combinations. In the end, a total of 1093 combinations were deemed relevant to test, with strong variation in how many relevant coping strategies there are between barriers.

2.2.3 Questionnaire

Questions in the questionnaire were structured as follows: first, participants were provided with a scenario including a plan to be active and a barrier. The plan was kept as unspecific as possible. For most barriers, this was ”You want to be active later today”. However, if barriers were only relevant to specific plans (e.g. ”rain” is only a relevant barrier for plans outdoors, ”my activity partner might cancel” is only a relevant barrier for plans together with another person), this was included in the plan (e.g. ”You want to be active with a friend later today”. Participants are then asked to think about which coping strategies might help them face the barrier. They are prompted to consider different kinds of activities, and provided with some examples that differ in intensity, social context (alone vs not alone), location (indoors vs outdoors) and required materials (nothing required vs something required).

Within each question, participants are provided with 10 coping strategies. They are then asked to rate the relevance of the coping strategy for the barrier (Always Relevant, Never Relevant, Relevant Under Certain Conditions). If they choose ”Relevant under certain conditions”, they can further choose which conditions need to be met for the coping strategy to be relevant (”If material is required”, ”If activity was planned alone”, ”If activity was planned with other people”, ”If activity was planned outside”, ”For high-intensity activities”, ”For low-intensity activities”). They can also enter different conditions in an open text field. An example of a question is shown in Figure 1.

Figure 1. Example of a question for the barrier ”tired”.



If a barrier has more than nine relevant coping strategies, it is separated into multiple questions. For example, if a barrier has 24 relevant coping strategies, it is separated into 3 questions with an equal amount of relevant coping strategies. Irrelevant coping strategies were then added to each question until it contained 10 items. Any set of coping strategies should contain at least one strategy that is assumed to be irrelevant. Thus, if a barrier has 19 relevant coping strategies, it would be separated into three questions rather than two. This was done to help participants differentiate between relevant and irrelevant items (which can be difficult when only relevant items are shown). Further, these items can be used to ensure appropriate responses.

This resulted in a total set of 157 questions. Participants were presented with a random set of 20 questions in order to keep the task feasible. Multiple questions concerning one barrier but different coping strategies could be presented to one participant.

2.2.4 Training Item

Due to the complexity of the questionnaire, a training item was implemented before the start of the survey. Here, participants are asked to rank two coping strategies, one of which is assumed to be clearly relevant and the other one clearly irrelevant. If participants replied as expected, they could proceed to the questionnaire. If not, participants were asked if they were sure, and the expected answers were clarified. The instructions for the task were repeated, and participants could then proceed to the questionnaire.

2.3 Planned Analysis

Analysis will be primarily descriptive. Frequencies of the different combinations of barriers and solutions will be reported, and heatmaps with barriers on the y-axis and coping strategies on the x-axis will be created for ”always relevant” and ”relevant under certain conditions”.

For each barrier, frequency tables will be created with counts of the different options for relevance and specified conditions. In a first table, co-occuring conditions will be counted separately (e.g. if someone noted that a certain strategy is relevant “If material is required” and “If activity was planned alone”, each of those category would get an additional count). In a second table, co-occuring conditions will be counted as combinations of conditions (e.g. combination “material is required AND planned alone” would get an additional count).

Open text entered under “Other conditions” will be coded by a researcher, and added to the count tables above.

REFERENCES

[1] Ryan E Rhodes and Gert-Jan de Bruijn. How big is the physical activity intention–behaviour gap? a meta-analysis using the action control framework. *British journal of health psychology*, 18(2):296–309, 2013.

[2] Falko F Sniehotta, Urte Scholz, and Ralf Schwarzer. Bridging the intention–behaviour gap: Planning, self-efficacy, and action control in the adoption and maintenance of physical exercise. *Psychology & health*, 20(2):143–160, 2005.

[3] Laurent Degroote, Delfien Van Dyck, Ilse De Bourdeaudhuij, Annick De Paepe, and Geert Crombez. Acceptability and feasibility of the mhealth intervention 'mydayplan'to increase physical activity in a general adult population. *BMC Public Health*, 20:1–12, 2020.

[4] Emely De Vet, Anke Oenema, and Johannes Brug. More or better: Do the number and specificity of implementation intentions matter in increasing physical activity? *Psychology of Sport and Exercise*, 12(4):471–477, 2011.

[5] Maya Braun, Helene Schroé, Delfien Van Dyck, Geert Crombez, and Annick L De Paepe. The relationship of affective and bodily states with goals and plans to increase physical activity: An 8-day study in students. *Applied Psychology: Health and Well-Being*, 2023.

[6] Keegan Knittle, Matti Heino, Marta M Marques, Minna Stenius, Marguerite Beattie, Franziska Ehbrecht, Martin S Hagger, Wendy Hardeman, and Nelli Hankonen. The compendium of self-enactable techniques to change and self-manage motivation and behaviour v. 1.0. *Nature Human Behaviour*, 4(2):215–223, 2020.

[7] Susan Michie, Robert West, Ailbhe N Finnerty, Emma Norris, Alison J Wright, Marta M Marques, Marie Johnston, Michael P Kelly, James Thomas, and Janna Hastings. Representation of behaviour change interventions and their evaluation: Development of the upper level of the behaviour change intervention ontology. *Wellcome open research*, 5, 2020.

[8] Paulina M Schenk, Alison J Wright, Robert West, Janna Hastings, Fabiana Lorencatto, Candice Moore, Emily Hayes, Verena Schneider, and Susan Michie. An ontology of mechanisms of action in behaviour change interventions. *Wellcome Open Research*, 8(337):337, 2023.

[9] Elizabeth Corker, Marta M Marques, Marie Johnston, Robert West, Janna Hastings, and Susan Michie. Behaviour change techniques taxonomy v1: Feedback to inform the development of an ontology. *Wellcome Open Research*, 7, 2022.

[10] Marie Johnston, Rachel N Carey, Lauren E Connell Bohlen, Derek W Johnston, Alexander J Rothman, Marijn De Bruin, Michael P Kelly, Hilary Groarke, and Susan Michie. Development of an online tool for linking behavior change techniques and mechanisms of action based on triangulation of findings from literature synthesis and expert consensus. *Translational behavioral medicine*, 11(5):1049–1065, 2021.

3 APPENDIX

FULL LIST OF BARRIERS

ID	Label Ontology	Text used in Study
COPPER:3000	injury feeling	An injury
COPPER:3001	pain feeling	Pain
COPPER:3040	back pain	Back pain
COPPER:3002	headache	A headache
COPPER:3003	menstrual pain	Menstrual Pain
COPPER:3004	muscle soreness	Sore Muscles
COPPER:3005	activity-induced pain	Pain from the activity
COPPER:3006	stomach ache	A stomach ache
MFOEM:000055	shame	Feeling embarassed
MFOEM:000124	feeling nervous	feeling nervous
MFOEM:000124	feeling nervous	feeling nervous
COPPER:3007	injure anxiety	Worried I might hurt myself
MFOEM:000108	feeling bad	feeling bad
MFOEM:000119	feeling weak	feeling weak
COPPER:3008	feeling ill	feeling ill
MFOEM:000080	feeling tired	feeling tired
MFOEM:000080	feeling tired	feeling tired
MFOEM:000205	hunger	feeling hungry
BCIO:006010	physical skill	I'm not fit / strong enough to do it
COPPER:3009	access to facilities	no access to workout/ sports facilities (gym, court, ...)
COPPER:3010	access to space	no access to sufficient space
COPPER:3011	access to transportation	no access to transportation
COPPER:3012	distance to location	long distance to location
COPPER:3013	access to materials	no access to required materials (bike, workout equipment, ...)
COPPER:3014	usable material	material is broken / not usable
COPPER:3015	natural light opportunity	it is too dark
COPPER:3016	appropriate ground conditions	the ground is slippery / muddy
COPPER:3019	sufficiently warm temperate	it is too cold
COPPER:3020	sufficiently cool temperature	it is too warm
COPPER:3022	sufficient lack of precipitation	it is raining / snowing
COPPER:3025	sufficient lack of wind	there is too much wind
COPPER:3027	pollen-free environment	there is too much pollen
COPPER:3029	access to required activity companion	I don't have anyone to join me (required)
COPPER:3047	access to desired activity companion	I don't have anyone to join me (desired)
COPPER:3030	access to instructor	I don't have anyone to instruct me
COPPER:3031	external attentional self-regulation capability	I will get distracted by others or things around me during the activity
COPPER:3032	internal attentional self-regulation	I will not be able to focus during the activity

	capability	
COPPER:3033	time management capability	I will lose track of time
COPPER:3034	procrastination tendency	I will procrastinate it
BCIO:006154	self-efficacy belief for a behaviour	I won't feel confident that I can do it
COPPER:3036	remember material	I will forget my material or equipment
BCIO:006133	behavioural motivation	I will not be motivated
COPPER:3038	evaluative belief about sweating due to physical activity	I don't want to sweat
COPPER:3039	evaluative belief about pain induced by exercise	I think I will be in pain after
COPPER:3041	goal conflict preventing relocation	I can't relocate due to other responsibilities
COPPER:3042	goal conflict concerning time	I won't have the time
COPPER:3043	unexpected goal conflict for time	Something might come up so I won't have time
COPPER:3044	goal conflict concerning energy	I won't have the energy
BCIO:006053	knowledge regarding a behaviour	I don't know enough about this
COPPER:3045	activity companion cancellation	My activity companion might cancel
BCIO:006146	belief about social support	The people around me will not be supportive of this

FULL LIST OF COPING STRATEGIES

ID	label	Instance
BCIO:007252	provide positive consequence for behaviour BCT	Provide a positive consequence or reward for doing the activity
BCIO:007122	make a goal public BCT	Make my goal public
COPPER:4000	plan inclusion of audio media BCT	Put on music or a podcast
COPPER:4001	plan inclusion of audiovisual media BCT	Watch something during the activity
COPPER:4002	plan inclusion of taking pictures BCT	Take pictures during the activity
BCIO:007016	advise goal integration	Combine being active with something else I want to do
BCIO:007016	advise goal integration	Call someone while doing the activity
BCIO:007015	affirm commitment BCT	Make a commitment to myself to really do this!
COPPER:4003	affirm commitment despite barriers BCT	Make a commitment to myself to do this no matter what comes in my way!
BCIO:007141	advise to keep behaviour goal in mind	Keep my goal in mind
COPPER:4005	adapt starting time BCT	Do it at a different time today
COPPER:4006	divide activity BCT	Divide the activity into shorter parts
COPPER:4007	shorten activity BCT	Shorten the duration of the activity
COPPER:4008	review plan (other activity) BCT	Change what I am going to do
COPPER:4009	adapt intensity BCT	Change the intensity of the activity
COPPER:4010	review plan (other location) BCT	Do it somewhere else
COPPER:4011	move indoors	Do it indoors instead
COPPER:4012	take a path that is not dark if possible	Take a different path
COPPER:4014	add company BCT	Ask other people if they want to join
COPPER:4015	reduce company BCT	Do the activity alone
COPPER:4017	start day early BCT	Start my day early enough to have time for the activity
COPPER:4018	plan departure BCT	Plan when I have to leave to have enough time
COPPER:4019	plan transport BCT	Plan how to get there
COPPER:4020	confirm facility availability BCT	Confirm that the gym / court / ... will be available
COPPER:4021	confirm others' commitment BCT	Confirm with the other(s) that they will join
COPPER:4022	confirm suitable weather BCT	Check the weather in advance
BCIO:007284	reduce distraction BCT	Take away distractions
COPPER:4024	make self visible BCT	Make sure to be visible
COPPER:4025	prepare required material BCT	Set my material or equipment ready to use
COPPER:4026	prepare suitable clothing BCT	Set suitable clothing ready to use
BCIO:007031	advise to seek emotional support BCT	Find someone who supports me in this, either online or offline, e.g. by encouraging me.
COPPER:4027	advise to seek emotional support from a pet BCT	Find social support in a pet
BCIO:007030	advise to seek instrumental support BCT	Find someone to help me with those practical barriers

COPPER:4031	seek reminder from others BCT	Ask someone to remind you of your activity
BCIO:007032	advise to seek informational support BCT	Find someone to provide you with the needed information, either online or offline
COPPER:4029	advice to seek demonstration of the behaviour online	Find someone to demonstrate the behaviour for you online, for example in a video
COPPER:4030	advice to seek instructions for the behaviour online	Find someone to provide you with instructions for the behaviour online, for example in a video or text
COPPER:4032	set alarm BCT	Set an alarm
COPPER:4033	introduce visible reminder BCT	Put a visible reminder, like a postit, somewhere where I will see it
COPPER:4034	introduce visible material BCT	Put the material I will need within my sight as a visible reminder
BCIO:007063	inform about health consequences BCT	Learn about the consequences this will have on my health
COPPER:4035	inform about health risks BCT	Learn about the risks of not doing the behaviour
COPPER:4036	inform about health benefits BCT	Learn about health benefits of doing the behaviour
BCIO:007068	increase salience of consequences BCT	Remind myself of the positive effects this will have on me
COPPER:4037	increase salience of health consequences BCT	Remind myself of the positive effects doing this will have on my physical health
COPPER:4038	increase salience of emotional consequences BCT	Remind myself of the positive effects doing this will have on my mental health
COPPER:4039	increase salience of social consequences BCT	Remind myself of the positive social effects doing this will have
BCIO:007065	inform about emotional consequences BCT	Learn about the consequences this will have on my mental health
BCIO:007067	induce anticipated regret BCT	Think about how I will feel tonight if I haven't managed to do this
BCIO:007134	conserve mental resources BCT	Reduce the mental load by making most decisions (e.g. what to do exactly, what to wear, when to do it) ahead of time, or outsourcing some decisions
COPPER:4041	advice to pace activity BCT	Adjust the intensity of the activity according to your needs
COPPER:4042	advice to take breaks BCT	Take breaks whenever needed
COPPER:4044	encourage short term pharmacological support BCT	Take medication to help with the symptoms
COPPER:4045	encourage caffeine consumption BCT	Consume caffeine (e.g. coffee, energy drinks, caffeine pills) to help with this
COPPER:4046	appropriate nutrition BCT	Make sure to eat well before and after, and time your meals appropriately
COPPER:4047	warm up BCT	Make sure to warm up sufficiently before the activity
COPPER:4048	non-pharmaceutical pain management BCT	Deal with my symptoms without medication, e.g. by massaging affected areas or using heat/cold
COPPER:4049	appropriate sleep BCT	Make sure to get enough sleep before the activity
BCIO:007017	monitoring BCT	Keep track of my activity
COPPER:4043	monitor behaviour passively BCT	Keep track of my activity using a device, such as a fitness tracker
BCIO:007239	prompt thinking related to successful performance BCT	Think about situations where I achieved similar goals
BCIO:007140	prompt self-talk BCT	Use positive selftalk
BCIO:007137	persuade about personal capability	Tell myself that you can do this, and think about

	BCT	why
COPPER:4050	advise to use motivational content	Look up inspirational content, such as videos or posts, online