

# Contextualising Goal Setting for Behaviour Change – from Baby Steps to Value Directions

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## ABSTRACT

Setting goals is a basic functionality of digital behaviour change interventions aimed at improving health. A challenge is to motivate and define personally relevant, small, easy-to-achieve (“baby step”) goals, to which a person can adhere to over time. The aim of this work is to contextualize goal setting, to identify potentially conflicting motives that affect goal setting and adherence to goals. The purpose of this study is to investigate how representations of different levels of activity in terms of activity theory, and their values and motives, can be used for goal setting. The study was conducted as a part of the design and development of a digital coach for preventing cardio-vascular diseases and exhaustion syndromes. The content of an early prototype was evaluated with 40 provisional users. This was done through a questionnaire, containing a part of the data collection module of the prototype. The results include a set of activities defined at different levels of activity in terms of activity theory, their potentially conflicting motives and arguments, importance, social and personal value. The results are integrated in an ontology of activity and embedded in a prototype for supporting behaviour change.

## CCS CONCEPTS

• **Human-centered computing** → **HCI design and evaluation methods**; • **Computing methodologies** → **Philosophical/theoretical foundations of artificial intelligence**; • **Applied computing** → **Health informatics**.

## KEYWORDS

goal setting, activity theory, persuasive technology, behaviour change, argumentation theory

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## 1 INTRODUCTION

Goal setting is a vital step towards achieving a change of habits to improve health and wellbeing [19]. However, depending on how prepared an individual is to change behaviour, it is more or less easy to formulate concrete, easy-to-achieve and measurable goals [23], and trying to set goals may even be counter-productive [18]. Even more complex is to find the motivation to do the activities, to maintain a commitment to continue, and to stay motivated [23, 24]. Several models and theories of motivation and behaviour change outline factors that influence motivation and readiness to change, e.g., [1, 17, 19, 23, 24]. Fewer provide models on how to manage conflicting motives and needs, in particular in situations where external factors also affect decisions to be made about whether to stick to a planned activity that promotes health. Locke and Latham point to that conflicting goals could undermine performance, if the related behaviours are incompatible [18]. To provide personalised, and situated support to individuals through intelligent coaching applications is seen as an approach that could address some of these challenges [3, 21].

The purpose of this study is to investigate how representations of different levels of activity in terms of activity theory, and their values and motives, can be used for goal setting. The following research questions are addressed:

- (1) How do participants view activities, their value and importance, motives for and barriers to conducting the activities, and how do they define related small-step, easy-to-achieve goals?
- (2) Can conflicting motives or activity conditions be identified?
- (3) How do the results translate into an ontology of activities, their motives and arguments, which could be used by digital coach agents when personalising their support?

## 2 RELATED WORK

There is extensive work on studying and embedding goal setting as a behaviour change technique in the design of persuasive systems [5, 21], and it is the behaviour change technique that is most frequently used [5]. Goal setting is embedded in ontologies for behaviour change and behaviour change interventions, e.g., [4, 16, 20]. The different aspects relating to goal setting to take into consideration in designing persuasive information systems have been summarised in five checklists by Cham and colleagues [8]. They cover the sources of behaviour goals, e.g., whether the individual sets their own goal, or if done by an expert or proposed by the system; goal identifiers; goal elicitation; monitoring and feedback; and deviation and countermeasures. While they mention automated goal generation, the management of conflicting goals is described to be done in dialogue with an health expert.

Ferron and Massa studied the relationships between stages of change, motivation types, and behaviour change techniques. They found that the stages of change affected the success of different behaviour techniques, and suggest that the adaptation of a behaviour change system should take the stages into consideration [9].

### 3 METHODOLOGY

A participatory and activity-centred design process is applied for developing a digital coach for preventing cardio-vascular diseases and stress [15, 22]. Addressed life-style changes relate to increasing physical activity, managing stress, nutrition, reducing alcohol intake and quit using tobacco. In this study, the content of an early prototype was evaluated with 40 tentative users (30–60 years old, 20 women, 20 men), with a focus on defining the activities targeted for behaviour change (from the level of value direction to small step goals), and the arguments for and against conducting the activity. This was done through a questionnaire, containing a part of the data collection module of the prototype. Quantitative and qualitative analysis methods were applied, described further in the following section.

The collected data was used for evaluating the formal knowledge representation, the system’s ontology and provided a basis for designing the interactivity of the goal setting module.

#### 3.1 Theoretical Framework for the Study

Theories on motivation and behaviour change provide the basis for the work in this study, materialised through the set of questions embedded in prototypes and in the questionnaires applied in the study. Self-Determination Theory (SDT) [24] provides three basic needs (autonomy, competence and relatedness) and models of motivation. Goal-Setting Theory provides the connection between goal setting and achievement motivation [19], where goal setting can provide sense of purpose, challenge and feelings of accomplishment. Other theories provide the connection to self-efficacy [2], and intrinsic and extrinsic motivation as described in Self-Determination Theory (SDT) [24]. Stages of change are described in the Transtheoretical Model of change (TTM) [23]. The stages range from *precontemplation* (not engaging in the behaviour and no intention to do so), *contemplation* (not engaged in the behaviour but intends to take action within six months), *preparation* (seriously considering starting, has taken some steps towards starting a behaviour), *action* (consistently engaged in the behaviour less than six months) and *maintenance* (consistently engaged in the behaviour for more than six months). These stages are also referred to as an individual’s readiness to change.

Activity Theory provides models for explaining human activity and its related actions, motives, goals and conflicts, and how development and change is central to human activity [12, 25]. In this work we adopt this holistic view on human activity, and view behaviour change and adherence to healthy habits as a life-long progress, which cannot be reached through goal setting alone. *Motives* that gives direction and energy to purposeful activities serve needs, such as *autonomy*, *competence* and *relatedness* [24]. Motives serve certain *values* related to needs, which provide directions for therapy in terms of *value directions*, for instance in Acceptance and Commitment Therapy (ACT) or Compassion-Focused Therapy

(CFT). Values in this context are e.g. good relation to family and friends, economic stability, physical and emotional health. Value directions are different from goals, in that they represent not end points, rather a continuing process. Therefore, we combine the notion of *value direction* to capture higher level motives, and *goal setting* to capture the measurable actions that a person do that are ideally motivated by their value directions.

The social environment has a fundamental influence on a person’s decision making, and consequently, on the choices made relating to change of behaviour. It may both be a facilitator, providing support for behaviour change, and a barrier when support is not provided. Therefore, to apply a holistic perspective on human activity and behaviour change, the social context is also taken into account.

A digital application that could serve as a supportive coach, is assumed to embed some social intelligence as a digital actor in relation to the human. It will need to communicate with the user on relevant matters relating to motives and goals. Furthermore, [9] showed that the support could also be tailored to an individual with respect to at what stage of change the person is based on TTM, and which level of motivation following SDT, they included amotivated, extrinsically and intrinsically motivated participants. To tailor the behaviour of a digital coach, a user model [14] (i.e., a Theory of Mind (ToM) of the user) needs to be embedded in the architecture. To capture the embedded tensions between value directions, motives and goals that may be in conflict, the concepts of *conflict* and *break-down* situations as described by activity theory are applied. These tensions can also be described in terms of Cognitive Dissonance Theory [10]. When an uncomfortable cognitive dissonance arises between desired behaviour and actual behaviour, the individual will strive to mitigate this by changing attitude, changing behaviour or by reducing the importance of the dissonance. These strategies can be externalised and verbalised through argumentation [26], which serves the purpose of externalising attitudes and increasing awareness about automated behaviours. In terms of activity theory, this transformation of operationalised actions the person is unaware of, into a level of conscious deliberation about reasons for an activity promotes the development of new behaviours [13]. Therefore, these tensions are further described within an argumentation framework to identify and manage conflicts between arguments supporting different motives and goals [26].

This leads to the following two main building blocks for this study: i) *General motives for activity as value directions*; and ii) *Areas of activities targeted for behaviour change including facilitators and barriers*.

#### 3.2 Data Collection

A questionnaire was composed based on a set of questions drawn from prototype applications addressing the themes outlined in previous section:

- *General motives for activity as value directions*: questions about importance, capability, and satisfaction;
- *Areas of activities targeted for behaviour change*: physical activity, stress, alcohol consumption and tobacco use.

The questions related to alcohol and tobacco consumption were only posed if they were consumers.

**3.2.1 General motives for activity as value directions.** The following questions were included to capture factors relating to *intrinsic* and *extrinsic motivation*, motivation relating to *needs*, *self-efficacy*, *readiness for change*, and *barriers* and *facilitators* for change. These factors are embedded in the model of behaviour change progress presented in [16].

Since there can be multiple motives for conducting e.g., a physical activity, one set of questions contained questions relating to the *perceived importance* of having contact with family and friends, keeping up with what is happening in society, feeling safe and secure, and having fun and being entertained. For the first two, they were also asked to what *extent they are able* to do this. Questions were also included on the perceived importance of exercising or to other physical activities, being able to conduct the activities that one wants to do, reducing worries, anxiety and/or stress, and finding time for recovery and increasing energy. For each of these value-directions they were also asked how satisfied they are with the extent they manage to do this. If there is a difference between *importance* in one hand, and *capability* or *satisfaction* on the other, this difference is interpreted as a *contradiction*, and it is assumed that that this indicates that there could be a *desire to change* the situation.

**3.2.2 Areas of activities targeted for behaviour change.** For each of the areas of activities targeted for behaviour change interventions, the following questions were posed: how important it is to change their behaviour related to the habit; and how prepared they are right now to make a change. For alcohol and tobacco consumption, they were also asked if they decide to decrease or end their consumption, how confident they are in their ability to succeed. For the areas physical activity, alcohol and tobacco consumption, questions regarding reasons for doing the activity, and reasons for not doing the activity were posed with predefined alternatives in favour and against as examples, and the option to define own motives. The predefined reasons were formulated based on a categorisation of barriers and facilitators for behaviour change [16], for the purpose to help the participant to consider all of the types.

To capture individual differences relating to preferred activities and how they typically conduct these, and what small easily-achieved goals could be formulated (*goal-setting*), the following questions were formed. For the areas of physical activities and stress, the participant provides one or more activities aimed at improving health. For stress, they receive examples of recovery activities, and can define additional activities. They also mention which one works best for them as recovery activity. For each of these area of activities, they note with whom they typically do the activity (or none), what motivates the activity (list of examples is provided), how often, for how long, and for physical activity also how intensive. Participants are asked for all areas including alcohol and tobacco use if relevant to them, to define a small, intermediate, easy-to-achieve goal that could help to change their behaviour.

### 3.3 Data Analysis

In order to capture the diversity in how the participants viewed aspects relating to activities at different levels, quantitative analyses were made. This included analysis of the participants' general perception on value directions, how important, their capabilities

to achieve this, satisfaction with the situation, and discrepancies between these. At lower levels, quantification was made on how frequent activities appear among the participants' selected activities.

Qualitative analyses were made to capture qualities of contradictions, different types of arguments, motivational aspects and what kind of support the participants desired from a digital companion, in relation to their value directions and activities.

The findings were further analysed based on activity-theoretical models and argumentation theory, modelled into an ontology.

### 3.4 Participants

40 anonymous participants living in the Scandinavian countries were recruited through the Proflic service in the age range 29-60 years (1 29; 21 between 30-39; 12 between 40-49; 6 between 50-60), and even gender distribution (18 female, 20 male and 2 other). The age range was chosen based on the age range that are most common in stress rehabilitation clinics.

## 4 RESULTS

In the following sections the results on value directions, activities and motivating arguments, and small-step goals are summarised. The results are illustrated by four example cases among the participants in Section 4.3. The four participants represent candidate users with different readiness for change, interpreted using the Transtheoretical Model of change (TTM) [23].

### 4.1 Value Directions

About half of the participants found it highly important to keep up with society (50%) (Figure 2b), and having close contacts with friends and family (45%). 30% and 43% respectively rated that they had high ability to maintain this. A smaller proportion, 25%, and 15% respectively, reported having low capability to accomplish this.

More participants rated having fun and being entertained as highly important (60%), and feeling safe and secure (73%).

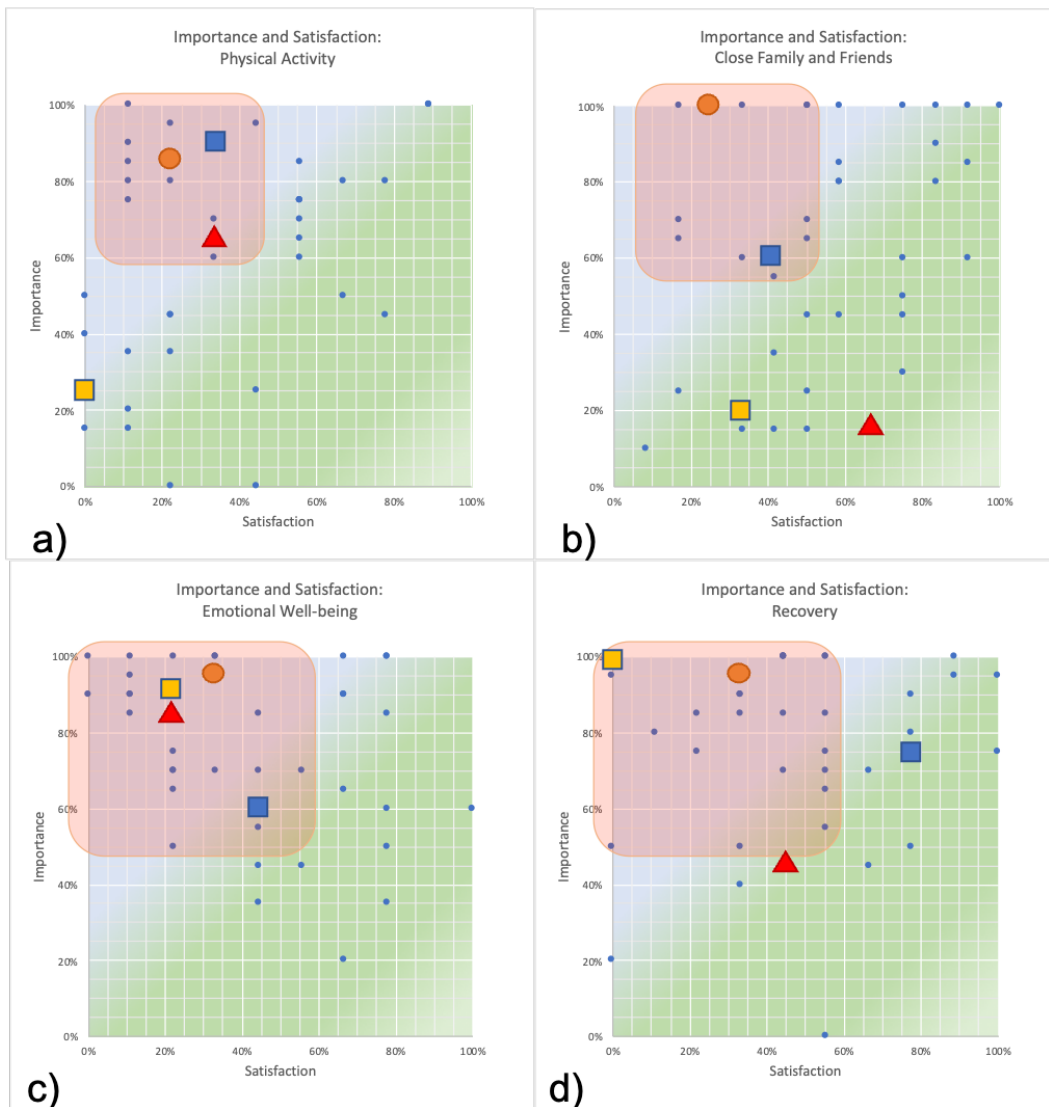
75% of the participants assigned high importance to being able to conduct the activities one wants to do, while only 15% rated high on to what extent they were also able to do the things they wanted to do.

75% found it highly important to find time for recovery activities. By contrast, only three participants (8%) reported that they have a good and healthy proportion of activities ongoing at the moment, and half of the participants assessed low on this question (Figure 2d).

More than half of the participants (53%) viewed exercising or doing other physical activity as being highly important, while (60%) rated low satisfaction with the extent they exercise, or are physically active. Only four participants (10%) were satisfied, rating high on this question (Figure 2a).

It was highly important to 68% of the participants to reduce their worries, anxiety and/or stress, and 30% found it important. Yet, half of them rated low on satisfaction with their emotional wellbeing, while seven of the participants (18%) were satisfied with their emotional wellbeing (Figure 2c).

Regarding sleep routines, the participants were distributed evenly over high, medium and low levels of satisfaction.



- Participant A: female, 38 years old, preparedness for increasing physical activity 46%
- Participant B male, 44 years old, preparedness for increasing physical activity 21%
- ▲ Participant C: male, 49 years old, preparedness for increasing physical activity 16%
- Participant D: female, 51 years old, preparedness for increasing physical activity 82%

**Figure 1:** The participants view on how important the following value-directions are (y-axis): (a) be physically active, (b) maintain contact with friends and family, (c) reduce stress and anxiety, and (d) engage in recovery activities; in relation to how satisfied they are with their situation regarding these (x-axis). The participants in upper left corner are those who are expected to desire a change of their situation the most. Four participants are highlighted as example cases.

We observed that there is a cognitive dissonance between how important many of the participants find being physically active, having healthy proportions of activities, and reducing worries, anxiety and stress, and how they perceive their own ability and satisfaction in relation to these values and needs (highlighted with coloured squares in Figure 2).

## 4.2 Activities and Motivating Arguments

In total, 141 arguments in favour for, and 74 arguments against increasing amount of physical activity were collected. Almost all participants noted that the reason for conducting physical activity is to improve health. A bit more than half of the participants referred to that research shows that physical activity prevents many diseases.

A bit more than half also referred to that it makes them feel good, almost half found that it gives them energy, 25% found it relaxing and/or reducing pain. Some referred to sitting still all day which makes it a necessity. That it reduces stress was mentioned, and one mentioned the purpose to lose weight.

The main reasons for not engaging in physical activity were that they do not think that it is fun, and/or cannot find the time for it (37-40%). 12 mentioned that it is not a habit, and 10 mentioned poor weather conditions. Other barriers noted were that they want to do things with others who are not available, pain conditions and economy barriers. A few related to a lack of discipline, not enough energy, or depression.

The questions relating to alcohol consumption were relevant to 26 of the 40 participants. The most common reasons for why participants consume alcohol (between 62-73%) were that they found it to be a way to relax, a social thing, and that they like the taste. Six participants refer to it as being a habit, and a few to reduce pain or other discomfort. The main reasons for why they would reduce their alcohol consumption were the risk for cancer and other health aspects, and because it is expensive. A few referred to that it causes discomfort, one mentioned the purpose to reduce weight.

The questions relating to tobacco use were relevant to seven of the 40 participants. Six of the seven participants noted that it is a way to relax, and four that they need to occupy their hands with something. The main reasons for quitting was the cost and health aspects. To summarise, both internal and external barriers and facilitators were identified. Emotion-oriented arguments and facts-based arguments can be distinguished, as well as conflicting motives and activity conditions. Conflicting motives were exemplified, for instance, when a person motivates smoking or tobacco use that it is relaxing, and on the other hand, relaxation is what needed to alleviate stress.

**4.2.1 Motives and Barriers for Change: Four Examples.** Four participants were selected as example cases that represent and illustrate different perspectives on the behaviours targeted in this study and their situations (Figure 2).

All four mention improving physical and emotional wellbeing as the motivations for increasing physical activity. Participant D, who already is physically active at some level, mentions also that physical activity gives energy, rest and recovery.

Common for Participants A, B and C is the lack of another person with whom they can/would like to do the physical activity. Participant B includes also other's expectations as motivator. Lack of social support is the only identified barrier for Participant C, while Participants A and B also mention that they don't think physical activities are fun. Economic reasons and lack of energy are also barriers.

Participant D who is already physically active, mentions only lack of time as a barrier to increase the amount of physical activity.

The importance of social activities relating to managing stress and emotional wellbeing was mentioned. Participants A, B and D list recovery activities that involved family or friends as the most preferred (attending cultural events, hiking, or playing games), among also other activities that they like to do alone.

Participants A and C use alcohol, however, reducing the alcohol consumption is not as important as managing stress and increase

physical activity. Both preparedness and confidence that they would manage to reduce their alcohol consumption are rated low. Participant A mentions the social aspects of alcohol consumption as a reason for consuming alcohol, Participant C that it is a habit, and both mentioned that it is a way to relax.

Participant B uses tobacco, and mentions that reasons for quitting is that people they care about object, and that it is expensive. However, the perceived importance, preparedness and confidence in managing a change are rated low.

To summarise, each of these four candidate users of a digital behaviour change intervention, would need content and approach tailored to their individual needs and preparedness for making a change.

### 4.3 Activities and Small-Step Goals

27 participants were able to specify small, measurable goals to increase physical activities relating to their interests (including Participants A, B and D in Figure 2). The most frequently mentioned goals referred to taking walks, jogging/running, cycling or go to the gym/lift weights. These participants can be viewed as being in the *preparation* (Participants A and B in 2), *action* (Participant D in 2) or *maintenance* stage of the TTM model [23].

Ten participants mentioned general, unspecific goals such as lose weight, work less, eat healthy, do more sports, etc. (including Participant C in Figure 2). Four of these goals related to the organisation of activity, such as do planning, better scheduling, to book a class for some sports activity, to work less, or to provide small rewards. These participants can be viewed as being in the *contemplation* stage of the TTM model (for example, Participant C, who rated low preparedness to increase physical activity). Three participants could not think of something, who, consequently, could be viewed as being in the *precontemplation* stage.

Among the 40 participants some expressed that they had already a routine to do some physical activity (maintenance stage), while they were still not satisfied, and wanted to set new goals and increase physical activity (contemplation or preparation stage). The observed patterns that may relate to TTM model are summarised as follows:

- (1) *Precontemplation stage*: unable to suggest goals
- (2) *Contemplation stage*: propose vague goals, relating to the organisation of activities, or character-related
- (3) *Preparation stage*: propose concrete, achievable goals, combined with several arguments against changing the behaviour or low on readiness for change
- (4) *Action stage*: propose concrete, achievable goals, combined with one or two barrier arguments
- (5) *Maintenance stage*: propose concrete, achievable goals, and measurable accomplishments

**4.3.1 Recovery Activities.** 75% of the participants use physical activity as recovery activity, and over half spend time in nature for recovery. Creative activities such as gardening, carpeting, handi-crafts, or painting were mentioned 19 times.

The most common recovery activity is watching movies or TV series (85%), more than half of the participants listen to, or play music, and half read books as recovery activity.

Almost all could specify which recovery activity that they found works best for them. Most common was low-effort activities (16 participants) mentioning reading, listening or playing music, gaming and watching movies. Physical activity was also common as the activity that works best (13 participants), most common is to spend time in nature and/or to take walks. Four participants mentioned social activities, and four participants active recovery activities such as meditation.

#### 4.4 Activity Ontology

The participants suggested activities as a part of specifying short-term goals, related to the domains or behaviour change in focus for the study and their motives. Since the motives of activities are personal, and may change over time, a general definition of activity was applied in the study and further developed. Since different types of recovery activities are important to identify, these are embedded in the ontology. Examples of categories of activities that relate to behaviour change for improving health are shown in Figure 2. Other categories include activities of daily living, vocational and educational activities.

The dual aspects of activity in terms of what motivates the activity and what prevents the activity is captured, which provides the basis for representing potential conflicts and related arguments, and for evaluating changes of behaviour and motives over time.

## 5 DISCUSSION

The study presented in this paper provided an overview of participants' views on values and goals related to behaviours they may want to alter in order to improve their health. The major limitations of the study is the low number of participants, and that all were living in the Scandinavian countries. The participants are also expected to have high computer literacy, since they were recruited through an online digital service, and thus are not fully representative to the population in the region. However, they are representative for a group that use digital tools, who are also the target group for digital interventions to improve health. As such, the study is valuable, and provided a basis for further developing the ontology and reasoning mechanisms underlying the person-tailored support provided by the system.

Most of the participants expressed discrepancies between perceived importance and satisfaction related to more than one value directions, in addition to conflicting motives for these, which indicates that the support provided by a person-tailored behaviour change system needs to take this into account. However, research on behaviour change systems and persuasive technology rarely combine health concerns in a common scenario, such as providing support for multiple behaviours to be changed, while also addressing this cognitive dissonance. Considering that goal setting is a common behaviour change technique embedded in persuasive technology [6], which may have a positive impact, or negative, depending on which stage in the behaviour process the person is, what kind of motivation the person has, and whether incompatible behaviours are reinforced by multiple goals, the persuasive system's management of motives, goals and activities, and its adaptation to a situation is vital. The study has elicited how the information collected as baseline relates to the information collected as a part

of goal setting, which is useful information for the system in its adaptation of support for the user. Recent studies explore the application of computational models of argument to elicit conflicting viewpoints to change behaviour, i.e., applying arguments for why do something as well as arguments for why to not do something, for example, whether or not to take the Covid vaccine [7, 11], or manage conflicting motives for increasing physical and social activities in older adults [3]. Studies have shown some evidence that persuasive dialogues based on computational argumentation may change attitudes to fees in university education [7, 11]. To capture, represent and elicit the potentially conflicting motives, the design of the goal setting module is based on the activity ontology to capture arguments connected to value-directions, and on a formal argumentation framework to embed computational methods in the support generated by the system. The arguments and the person's level of readiness for change will be used for tailoring the support provided to the user. Whether argument-based persuasive dialogues have effect on attitudes and behaviour in a positive direction in the holistic health perspective applied in this study remains to be investigated in our future work. As one method for evaluating effects in future work, the information collected by the system based on the study presented in this work will feed into a model of behaviour change progress based on theories of behaviour change, which will be used for assessing long-term progress and additional needs for personalisation [16].

## 6 CONCLUSIONS

The representation of activities and their motives, values and barriers that was explored in this study, provides a baseline for constructing a user model, which can also function as a repository for person-tailored arguments that can be used by a digital coach or companion for supporting the person in their pursuit of changing behaviour to improve their health.

Future work includes the implementation and evaluation of the digital coach and the dialogue embedding motives and computational models of arguments.

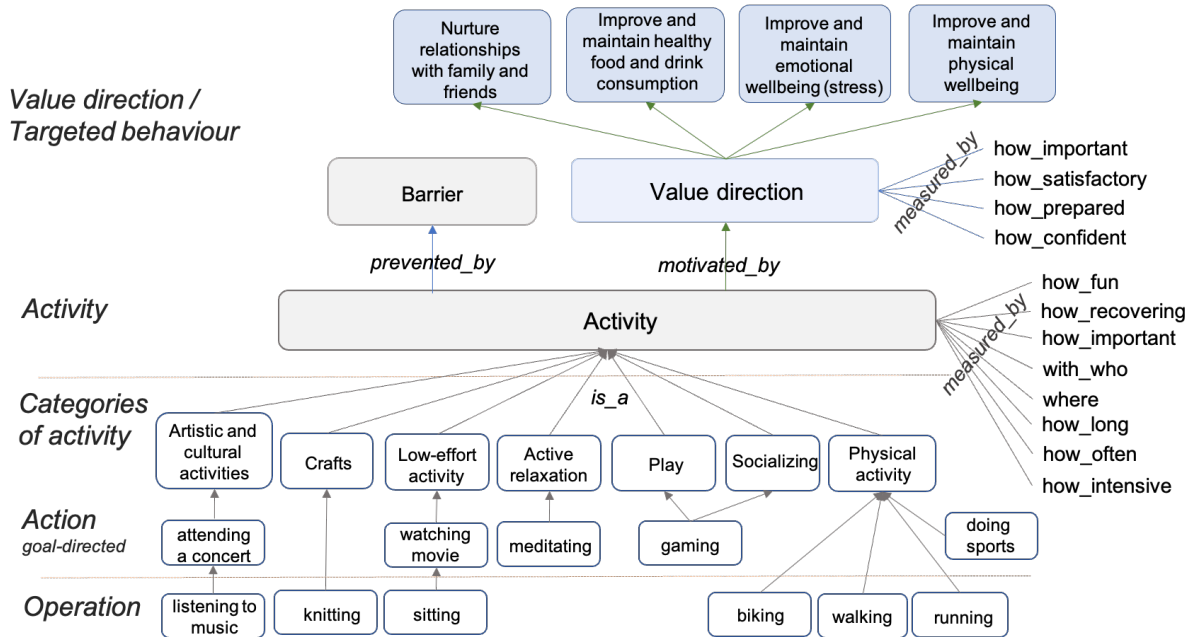
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## REFERENCES

- [1] Icek Ajzen. 1991. The theory of planned behavior. *Organizational Behavior and Human Decision Processes* 50 (1991), 179–211.
- [2] Albert Bandura. 1977. Self-efficacy: Toward a unifying theory of behavioral change. *Psychological Review* 84 (1977), 191–215.
- [3] Jayalakshmi Baskar, Rebecka Janols, Esteban Guerrero, Juan Carlos Nieves, and Helena Lindgren. 2017. A Multipurpose Goal Model for Personalised Digital Coaching. In *International Workshop on Agents Applied in Healthcare (A2HC) (Lecture Notes on Computer Science, Vol. 10685)*. Springer, 94–116.
- [4] Maria Inês Bastos, Ana Paula Cláudio, Isa Brito Félix, Mara Pereira Guerreiro, Maria Beatriz Carmo, and João Balsa. 2022. Operationalizing Behavior Change Techniques in Conversational Agents. In *Proceedings of the 14th International Conference on Agents and Artificial Intelligence, ICAART 2022, Volume 1, Online*

## Levels of activity (Activity Theory)



**Figure 2: Activity ontology with example activities that the participants mentioned. The measures associated with value directions and activities can be used for both goal setting and for evaluating the effects of an activity.**

- Streaming, February 3-5, 2022*, Ana Paula Rocha, Luc Steels, and H. Jaap van den Herik (Eds.), SCITEPRESS, 216–224. <https://doi.org/10.5220/0010826800003116>
- Lauren Connell Bohlen, Susan Michie, Marijn de Bruin, Alexander J. Rothman, Michael P. Kelly, Hilary NK Groarke, Rachel N Carey, Joanna Hale, and Marie Johnston. 2020. Do Combinations of Behavior Change Techniques That Occur Frequently in Interventions Reflect Underlying Theory? *Annals of Behavioral Medicine: A Publication of the Society of Behavioral Medicine* 54 (2020), 827 – 842.
  - Rachel N Carey, Lauren E Connell, Marie Johnston, Alexander J. Rothman, Marijn de Bruin, Michael P. Kelly, and Susan Michie. 2018. Behavior Change Techniques and Their Mechanisms of Action: A Synthesis of Links Described in Published Intervention Literature. *Annals of Behavioral Medicine: A Publication of the Society of Behavioral Medicine* 53 (2018), 693 – 707.
  - Lisa Chalaguine and Anthony Hunter. 2021. Addressing Popular Concerns Regarding COVID-19 Vaccination with Natural Language Argumentation Dialogues. In *Symbolic and Quantitative Approaches to Reasoning with Uncertainty: 16th European Conference, ECSQARU 2021, Prague, Czech Republic, September 21–24, 2021, Proceedings* (Prague, Czech Republic). Springer-Verlag, Berlin, Heidelberg, 59–73. [https://doi.org/10.1007/978-3-030-86772-0\\_5](https://doi.org/10.1007/978-3-030-86772-0_5)
  - Sainabou Cham, Abdullah Algashami, John McAlaney, Angelos Stefanidis, Keith Phalp, and Raian Ali. 2019. Goal Setting for Persuasive Information Systems: Five Reference Checklists. In *PERSUASIVE*.
  - Michela Ferron and Paolo Massa. 2013. Transtheoretical Model for Designing Technologies Supporting an Active Lifestyle. In *Proceedings of the Biannual Conference of the Italian Chapter of SIGCHI (Trento, Italy) (CHIItaly '13)*. Association for Computing Machinery, New York, NY, USA, Article 7, 8 pages. <https://doi.org/10.1145/2499149.2499158>
  - L. A. Festinger. 1957. *A Theory of Cognitive Dissonance*. EStanford University Press, Stanford, CA.
  - Emmanuel Hadoux, Anthony Hunter, and Sylwia Polberg. 2021. Strategic Argumentation Dialogues for Persuasion: Framework and Experiments Based on Modelling the Beliefs and Concerns of the Persuadee. <https://doi.org/10.48550/ARXIV.2101.11870>
  - Victor Kaptelinin and Bonnie Nardi. 2018. Activity Theory as a Framework for Human-Technology Interaction Research. *Mind, Culture, and Activity* 25, 1 (2018), 3–5.
  - Victor Kaptelinin and Bonnie A Nardi. 2006. *Acting with technology: Activity theory and interaction design*. MIT press.
  - Alfred Kobsa. 2005. User modeling in dialog systems: Potentials and hazards. *AI & SOCIETY* 4 (2005), 214–231.
  - Helena Lindgren, Timotheus Kampik, Esteban Guerrero Rosero, Madeleine Blusi, and Juan Carlos Nieves. 2021. Argumentation-Based Health Information Systems: A Design Methodology. *IEEE Intelligent Systems* 36, 2 (2021), 72–80. <https://doi.org/10.1109/MIS.2020.3044944>
  - Helena Lindgren and Saskia Weck. 2021. Conceptual Model for Behaviour Change Progress – Instrument in Design Processes for Behaviour Change Systems. *Stud Health Technol Inform* 285 (2021), 277–280. <https://doi.org/10.3233/SHIT210614>
  - Edwin A. Locke and Gary P. Latham. 1984. The Health Belief Model: a decade later. *Health Educ Q* 11, 1 (1984), 1–47. <https://doi.org/10.1177/109019818401100101>
  - Edwin A. Locke and Gary P. Latham. 2002. Building a Practically Useful Theory of Goal Setting and Task Motivation: a 35-Year Odyssey. *American Psychologist* 57, 9 (2002), 705–17.
  - Edwin A. Locke and Gary P. Latham. 2019. The development of goal setting theory: A half century retrospective. *Motivation Science* (2019).
  - 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. 2020. Representation of behaviour change interventions and their evaluation: Development of the Upper Level of the Behaviour Change Intervention Ontology. *Wellcome Open Research* 5 (2020).
  - O. Oinas-Kukkonen and M. Harjumaa. 2009. Persuasive systems design: key issues, process model, and systems features. *Commun. Assoc Inf Syst.* 24 (2009), 485–500. Issue 28.
  - A. Paramythis, S. Weibelzahl, and J. Masthoff. 2010. Layered evaluation of interactive adaptive systems: framework and formative methods. *User Model User-Adap Inter* 20 (2010), 383–453. <https://doi.org/10.1080/10447318.2021.1925436>
  - J.O. Prochaska, C.A. Redding, and K.E. Evers. 2015. *The transtheoretical model and stages of change*. 97.
  - R.M Ryan and L.M. Deci. 2000. Self-Determination Theory and the facilitation of intrinsic motivation, social development and well-being. *American Psychologist* 55 (2000), 68–78.
  - Lev S Vygotsky. 1978. Mind in society: The development of higher mental processes (E. Rice, Ed. & Trans.).
  - Douglas Walton and Erik C. W. Krabbe. 1995. *Commitment in Dialogue: Basic Concepts of Interpersonal Reasoning*. State University of New York Press.