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Workplace-Initiated mHealth Intervention for Increased Physical Activity

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WORKPLACE-INITIATED MHEALTH INTERVENTION FOR INCREASED PHYSICAL ACTIVITY

Research in Progress

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Abstract

In this research in progress paper, we discuss the acceptance and appropriation of workplace mobile health interventions aiming to increase physical activity and reduce sedentary behaviour, and how this is connected to social cohesion in the workplace. We utilised script theory to investigate what visions, assumptions and choice is made by developers in the design of the mobile health technology, and the consequences this hold in regards of user mobilisation and the effects of the intervention at the workplace. We report preliminary findings from four different workplaces, and with a total of 709 users. We contribute by discussing the importance of flexibility of the Avantas Aktiv script, how the script is accepted by some and rejected by others, and how social cohesion is both a result of and a premise for successful mobilisation of users. Finally, we point to future avenues for research.

Keywords: *workplace intervention, physical activity, sedentary behaviour, wellbeing, digital, mobile health application, social cohesion, technology acceptance, empirical case study, script theory*

1 Introduction

In the industrialised world, there is an ongoing and worsening crisis of physical inactivity (Folkehelseinstituttet, 2014, WHO, 2020, Edwards and Greasley, 2010), and the workplace is considered an important arena to mitigate sedentary behaviour. This has led to an increasing interest for the development and utilisation of efficient measures to increase physical activity in the working population. Further, such interventions have increasingly become supported by underlying technology, aiming to increase effectiveness and user motivations (Rockmann and Gewald, 2018, Buckingham et al., 2019). In this context, we investigate the workplace-initiated mobile health (mHealth) intervention Avantas Aktiv, provided by the company Avantas Aktiv AS (henceforth referred to as AAAS). Current mHealth research in the workplace has a potential for focusing more on how to motivate sedentary users and the effect of groups. The objective of this case study is therefore twofold. First, we explore whether and how workplace interventions aiming to increase physical activity is accepted and appropriated by initially sedentary users. Second, we investigate how the case intervention affected the organisations exposed to it, more specific, whether such interventions interacted with the work environment and social cohesion in the workplace.

We address the following research questions: *RQ 1 How does the intervention mobilise initially sedentary users? RQ 2 How does the intervention interact with social cohesion in the workplace?*

This paper is organised as follows: In section 2 we account for the literature on physical activity and mHealth, and script theory, constituting the theoretical background of our investigation. In section 3 we present our case and our interpretative research strategy and design. In section 4, we provide an overview the case Avantas Aktiv from the developer's perspective, before we account for user's appropriations of this intervention. In section 5, we discuss what consequences the design holds for the efficiency of the intervention. Finally, we provide some concluding remarks, pointing forward towards future work.

2 Theoretical background

2.1 Physical activity and mHealth

Physical inactivity is considered one of the biggest public health problems of the 21st century, and there is now substantial evidence that sedentary behaviour and failing to meet the recommended guidelines for physical activity is associated with mortality and morbidity (Buckingham et al., 2019, WHO, 2020, Damen et al., 2020). According to a national mapping performed by the Norwegian Directorate of Health, merely 30 % of the adult population meet the WHOs recommendations (Hansen et al., 2017, WHO, 2020). Nevertheless, WHO (2020) states that there is high certainty evidence that any level and any intensity of physical activity is associated with positive health effects unconditional of intensity level. As such, interventions promoting physical activity is considered an important public health tool in mitigating sedentary behaviour (Peluso and Guerra de Andrade, 2005, Buckingham et al., 2019).

It is crucial therefore, to consider the impact of mHealth use on people on personal fitness activity (James et al., 2019) and the impact of mHealth (Bardhan et al., 2020). The term mHealth broadly refers to mobile applications that aims to provide healthcare information systems enabling users to manage, control and monitor healthcare information (Miah et al., 2017). Information system research has found how the affordance of technology matters including self-monitoring, performance analysis, exercise guidance, rewards, social comparison, watching others, social recognition, and self-presentation (Rockmann and Gewald, 2018). Little is known, however, of whether, how, and why users with differing motivation-relevant goals employ these motivational features (Rockmann and Gewald, 2019). Understanding mHealth involves considering connections and processes that include of additional stakeholders, including considering social aspects (Liu et al., 2020).

2.2 Worksite mHealth interventions for increased physical activity

The increasingly sedentary nature of work is affecting the physical activity behaviour amongst the working population (Hansen et al., 2017, Shrestha et al., 2018). Workplace sedentary behaviour is expected to increase due to automation and information technology use (Hendriksen et al., 2016), and there is great political and civic interest in tackling this issue.

Some studies have investigated the effect of workplace-initiated interventions aiming to increase physical activity and reduce sedentary behaviour (Chan et al., 2004, Genin et al., 2018, Mulchandani et al., 2019, Shrestha et al., 2018, van Drongelen et al., 2014, Schrager et al., 2017). However, previous studies have often focused on the information system development from a top-down perspective, while relatively few studies focus on the use and users of mHealth apps (Miah et al., 2017). Also, studies of mHealth interventions vary widely in terms of duration and certain sectors, like health and knowledge, are overrepresented (Buckingham et al., 2019, see also Yerrakalva et al., 2019, Krans et al., 2019). Further, such studies are often criticised for self-selection bias, high attrition rates, and poor outcome data (Mänttäri et al., 2021, Proper et al., 2006, Genin et al., 2018).

Group interventions have been postulated as more efficient than interventions focused on individuals (Krans et al., 2019, Dishman and Buckworth, 1996), e.g., because of the social cohesion and interaction and peer-support inherent in physical activity is expected to play an important role in the effects of exercise on mental health (Peluso and Guerra de Andrade, 2005). As employees often are part of a team, and spend a significant time with colleagues, these social dynamics could be used to leverage interventions promoting physical activity (Krans et al., 2019, Ryde et al., 2013). Thus, the workplace is a promising venue for promotion of physical activity, where such interventions could have beneficial effects on the psychosocial environment (Brinkley et al., 2017).

From an information systems perspective, it is important to grasp the use of technology in the workplace. Then it is relevant to consider the acceptance of technology as a staged process with adapted measurement methods (Schroeder et al., 2021). It is also crucial to consider the strong connection

between the design of a technology and how it is used, something mostly missing from current research on mHealth research (Miah et al., 2017). We therefore suggest using script theory as a lens on such interventions, as we discuss next.

2.3 Script theory

In our study, we were interested in investigating how the technology making up the intervention was developed, that is, for whom and for what cause, and whether this technology was accepted and appropriated by those exposed to it.

Script theory is an analytical tool developed to describe the complexity of technology in its context and the interplay between human and technology, investigating how a certain technology, developed for certain means, are appropriated by users. That is, allowing both developer and user perspectives. It starts from the rationale that technologies are not neutral, but carries with them the worldviews, visions and meanings of the designers in its *in-scriptions,* constituting *programs of action* (Ask et al., 2019, Akin et al., 2021). Neither, technology is not passively transferred to the user, but is construed and given meaning in the process where users react to this *script*, by either *subscribing* (acceptance) or *de-inscription* (rejection). In cases where the script is put to question, or even opposed, the users form *anti-programs* (Ingram et al., 2007, Ask et al., 2019, Fallan, 2008, Akrich and Latour, 1992).

In this terminology, *appropriation* reflects the opposite of scripting, namely the active roles the "users play fitting technologies and commodities into existing ways of life, frameworks of meaning, and contexts of practice", recognise the situated nature of technology acceptance, emphasising how attribution of meaning and purpose are culturally and situationally specific (Ingram et al., 2007). Thus, the setting provides the context in which human and technology *act.* Independent of whether technology is accepted or appropriated, or not, the interaction between humans and technology triggers a process of constant negotiation where users aim to make sense, the formation of meaning, to the technology they are being exposed to.

3 Method

3.1 Research strategy

The study was organised as a case study, using both qualitative and quantitative data. Case study research is considered "a useful mean of investigating the development, implementation and use of information systems in organisations" (Darke et al., 1998). The case study was subjected to an interpretive research approach within the philosophy of phenomenology and hermeneutics (Darke et al., 1998, Klein and Myers, 1999).

Interpretive methods of research in information systems are "aimed at producing an understanding of the context of the information system, and the process whereby the information system influences and is influenced by the context" (Walsham, 1993). Starting from this paradigm, and supported by script theory, the study was based on the rationale that users are not passive receivers of the technology pre- or proscribed them. Likewise, we as researchers are no passive mediators of research and the knowledge, we "receive" in the investigation. Rather, we as researchers affect each and every stage of the study. Guided by script theory, we have interpreted the data in constant iterations with theory, starting already in the data collection.

3.2 The case study

The case study lasted from September 2018 to December 2020. The sample of four case organisations (CO) are accounted for in table 1. These followed the Avantas Aktiv program, the case intervention, described in the following section.

Avantas Aktiv is a workplace intervention, delivered by the company Avantas Aktiv AS (AAAS), aiming to improve physical health and work environment in the companies exposed to it, and make lasting changes to habits and lifestyle. Employees are organised into teams, where the main purpose is collecting points for oneself and for the team by registering physical activity.

In terms of being a mHealth technology, Avantas Aktiv provide its users with tools to manage their health and wellbeing, that is, to monitor and administrate their physical activity while offering information//knowledge support in terms of delivering various training programs and other material on their app and webpage, where users can find information about different types of exercise as well as other advice on diet and lifestyle. The practical and physiological knowledge used to provide advice on how to exercise was already well-documented at the time and was supported by key personnel with extensive and varied experience with top-level athletics. The intervention utilises several individual and group level mechanisms. The central features are close in-person follow-up of users, team dynamics, and competition. Intervention features will be described in-depth in section 4.1.

The intervention was implemented in four case organisations (CO) localised in Northern Norway, representing different sectors (see Table 1). The sampling was based on wanting to represent sectors central to the region, while at the same time differing from each other in size, constellation, and location.

	Workplace/sector	Employees	User	Teams
CO1	Fish processing factory	82	58	8
CO2	Municipality	366	283	26
CO3	Hotel	32	21	3
CO4	Health care division	440	347	25
Total		920	709	62

Table 1. Summary of case organisations.

3.3 Data collection

	Data type	N	Description	Comment
Activity journal data	Quantitative data	709 users	Number of users	Self-reported user data from the activity journal. Monthly records of the number of enrolled and active users in the COs.
Survey	Quantitative and qualitative data	169 respondents	Provide user perspective, experiences, and appropriations	After the intervention, all employees, including non-users, in the COs were asked to complete a survey. They were asked about how they had been using the journal, and whether it had affected their activity level and wellbeing, as well as cohesion at the workplace.
Interview Avantas Aktiv AS (AAAS)	Text data; Transcripts	2 individual interviews	Provide insights about the script from developers	Two informants representing AAAS, asked about the visions, definitions, reasonings and presumptions constituting the in-scriptions into the script that is Avantas Aktiv.
Group interviews	Text data; Transcripts	4 interviews, 13 informants	Provide insights on user reactions and appropriations	Semi-structured group interviews with the Team Captains conducted after intervention conclusion. In total, 13 Team Captains were interviewed, from three of the four case organisations (excl. CO3).

Table 2. Data sources.

3.4 Data analysis

Data were collected, processed, and analysed in accordance with the internal logic of the respective methods by which they were collected. Throughout the intervention period, self-reported user data from the activity journal, providing data on both users and usage, were collected. In this paper, we present average participation rates from the COs based on the data from monthly records of the number of users in the COs. These data analysed using Microsoft Excel version 16.48. The survey data was conducted using SurveyMonkey Inc., and survey data was analysed using Microsoft Excel version 16.48. The interview transcripts were coded and analysed using Dedoose, version 8.3.45.

We were fundamentally interested in investigating the various in-scriptions constituting the script of Avantas Aktiv and how this was appropriated by the users. The rich data material enabled the examination of both the developer and user perspectives from different viewpoints. The respective results from each data set were discussed in relation to the RQs and the script theoretical framework. Script theory provided a useful framework, as it supported the investigation of the assumptions, choices, and intents in-scribed in the intervention, how these were expressed in the technology, and how users reacted to it.

4 Results

In this section, we show that the design of the intervention and associated technology deeply impacts how it is appropriated by different groups of employees in a workplace.

4.1 Scripting low-threshold participation

The vision of Avantas Aktiv is "to get all people in shape" (AAAS informant 1). Initially sedentary employees are defined as the main target group, having the most to gain from a relative increase in activity. AAAS aim for a script with a low threshold for participation and are concerned with communicating to users that high intensity exercise is not required. "We have assumed that exercise is a relative term" (AAAS informant 2), thus, in-scripting physical activity as meaning different things to different people. The intervention is organised as a group intervention, with the intention of generating stronger motivations and mobilisation, building on theory that social conformity influences behaviour. "It's about forming teams and cultivate a community that can encourage each other" (AAAS informant 1). The assembling of employees into teams is a central aspect of the intervention, building on the theory that social conformity influences behaviour. AAAS refers to this as "positive peer pressure" (AAAS informant 2). Situating the intervention in the workplace setting also enables making use of existing social structures.

Users access the activity journal via smartphone application or website (see e.g., App store: https://apps.apple.com/us/app/avantas-aktiv/id1343820255?platform=iphone, and Google Play: https://play.google.com/store/apps/details?id=com.avantasaktiv.avantas&hl=no&gl=US for illustrations of user interface). The user interface is simple, and AAAS informants emphasise that the technology shall be perceived as accessible and intuitive by the users, lowering the threshold for subscription. The intervention originally dates back to 1993, and one of the AAAS informants has been in the company administration since then. This informant states that since the start-up year, there has been continuing adjustments, mainly in terms of enabling technologies and team communication features in the mobile and web app. The journal now enables self-reporting of physical activity, requiring only a smartphone or computer with an internet connection, either manually or with a third-party application. Each team is assigned a Team Captain with responsibility of providing extra motivation to the team members to be active and to register activity in the activity journal. In addition, there are competition periods where teams can win prizes.

Teams compete against each other in collecting the most points each period, where the team score is the average of the score of team members. Users score points by registering activity in the journal, with the

score for each activity based on type of activity, duration, and activity class of the user. The idea is, according to AAAS informants, that using these factors ensures that more sedate users are rewarded more for the same activity. By weighting activity according to activity classes, AAAS in-scribe motivational mechanisms for each user segment, through challenging individuals according to their respective level of skill. The objective is providing the right conditions to experience personal achievement and to enable everyone to contribute significantly to the team. This is at the core of their low-threshold vision.

4.2 User acceptance and appropriations

Over the intervention period, a weighted average of 54 % of employees in the COs participated each month. The participation rate has varied across the COs: CO2 had the largest average participation rate with 62 %, CO4 followed with 54 %, while CO3 and 4 had the lowest average participation rates, respectively 37 % and 35 %.

Not only did employees take part in the intervention, they also experienced individual positive effects. About 40 % of survey respondents reported that the Avantas Aktiv had contributed to them being more active, in better shape, more conscious about their health and lifestyle, and having increased energy in their everyday life. Moreover, about 30 % report having more energy at work. These effects were overall greater for respondents who identified as less or moderately active at the outset. Interviews with Team Captains confirm these findings and offer some more detailed reflection. In particular, they stressed excluding workout intensity as a factor in the score calculation as both pleasing the sedate and promoting more sustainable and lasting change in behaviour.

Based on survey free-text responses, we identified several descriptions regarding user subscriptions and de-inscriptions. The primary subscripting factors were easy-to-use logging tool, the ability to set and achieve personal goals, contributing to the team, and finally pure loyalty to the initiative as a workplace project. The de-inscripting factors concentrated around practical issues with the app and underlying technology, lack of perceived usefulness and failing to establish a routine for taking part. Thus, the technology itself was mentioned both as a source of subscription and de-inscription.

Another interesting aspect, in the sense that it was a source to both subscription and de-inscription, was the competitional aspect of the intervention. Some reported of finding motivation in competing against others and oneself. However, the Team Captains reported that the competitional aspect also functioned as a major source of de-inscription amongst the users, leading to the formation of anti-programs. If the team e.g., did not manage to mobilise a significant number of active users, collecting points to the team, this sabotaged for the rest, making it impossible for them to assert themselves in the competition against the other teams. One Team Captain stated: «It's demotivating when you cannot climb the list. It ruins it for those who want to join [the competition]».

4.3 The role of social cohesion

In the survey, almost half stated that being part of a team motivated them to be more active, and to use the activity journal, with no significant difference depending on initial activity level. Team Captains elaborated on this, emphasising the competition with other teams as a key source of fun and motivation, many having a rival team with which to compare themselves. One Team Captain said: "Being on a team, I think it helped a lot. One certainly doesn't want to be the one dragging the team down". The intervention provided a reason for increasing physical activity, as well as to lower the threshold for being active *together*. Although not every team took the opportunity to engage in social exercise, Team Captains cite examples of such initiatives, also beyond the intervention period. A Team Captain stated that: "Maybe we would have chosen to do something else if it weren't for Avantas bringing the focus on doing something physically active".

This illustrates that the Avantas Aktiv program offered the employees with a social arena, thus, facilitating workplace cohesion. In the conducted survey, about 30 % reported that the intervention had affected wellbeing and togetherness in the workplace. Also, 11 % even reported that the intervention

had affected togetherness outside work positively. While 89 % of respondents however did not report of the intervention affecting social cohesion outside work, this finding still is interesting as it illustrates the potential of workplace interventions to also have an effect on employees' sence of togetherness also outside of the workplace. This is supported by the Team Captains accounts, stating that, in general, one managed to make Avantas Aktiv a positive focus in the workplace, a "group thing" and "topic of conversation", that is, a feeling of having something common, unifying employees within and across units. Thus, the team spirit was at play and mobilised users, and seemed to at least have a temporal effect on cohesion.

Team Captains reported about difference in group level subscriptions depending on whether the team was made up of collocated people in the same organisational unit, in contrast to teams spread across units or locations. For instance, Team Captains reported that in teams from within organisational units, communication flowed more easily since the team members interact and socialise daily, whereas for "spread" teams, it was harder to follow up regularly, as they did not meet face-to-face and did not know each other as well prior the intervention. This observed distinction can be deduced to the initial level of social cohesion in these teams. Moreover, Team Captains stated that pre-existing challenges to the work environment turned out to impede participation. One TC reported pre-existing challenges to the work environment that they hoped the intervention could alleviate or at least that it would not impede participation. However, it did not work out for this team, which seems to indicate that some degree of social cohesion is a necessary precondition for making us of the in-scripted team features. This implies that building on relations and workplace cohesion existing prior to the implementation could also be a disadvantage. That is, the workplace *setting*, with its own *program of action*, affects how the technology is accepted and appropriated by the users, which can be both a blessing and a curse.

5 Discussion

This study aims to contribute to the body of knowledge of interventions for increased physical activity and reduced sedentary behaviour, and how they affect the organisations and people exposed to them (see e.g., Buckingham et al., 2019, Krans et al., 2019, Schrager et al., 2017).

5.1 The flexibility of the script

Regarding the specificity of the script, that is, the extent of control exercised over actions between the users and the technology (Gläser et al., 2017), the Avantas Aktiv is not a "one-size-fits-all" program of action (Rockmann and Gewald, 2018, van Drongelen et al., 2014). That is, although AAAS have stayed true to the choice of main target group, they have tried to accommodate several user groups by striving to make their script as accessible and relevant as possible for most users. The script accounts for various usage and users, as well as it is tailored to the worksite at organisational level. The target and vision are rather specific, but the road thither is versatile. Apart from being dependent on a specific type of user's self-registration, the script tolerates and *proscribes* deviations in how and when users input data and counting a variety of activities, accounting for the relativity and flexibility of the program of action. This approach is the result of years of negotiation since the establishment in 1993, between developers, script and users, both the actual users and the assumptions made of them (Akrich, 1992, Stokke, 2017).

5.2 Double-edged script: accepted by some, rejected by others

Design-wise, choosing a vision and focus will necessarily involve prioritising something in favour of something else. Simultaneously, we see that AAAS strives for flexibility in the program of action, thus constituting a *weak* script (Aune, 2002, Stokke, 2017). Consequentially, the design of the Avantas Aktiv script holds several double-edged in-scriptions, functioning as both motivating and mobilising (subscription), and as suppressors for participation (de-inscription), simultaneously. One in-scription as such, is the vision itself. Some found Avantas Aktiv *too* low threshold, finding it demotivating that it is too easy to score points and that there is no reward of intensity. The point system makes it hard for teams to assert itself if not a significant portion of the team members are active and logging. Further, the

attempt to include *all* users, does not mean that there is no out-group, and some even reported that Avantas Aktiv in some cases had contributed to exclusion in the workplace (Krans et al., 2019). Thus, even though AAAS emphasises flexibility in the script, it does not mitigate the effect of trade-offs necessary to serve the target group.

5.3 Social cohesion as premise and result

We found that a significant portion of the employees exposed to Avantas Aktiv stated that the intervention affected the work environment and social cohesion positively. Organising Avantas Aktiv as a group intervention was highlighted by everyone as making the intervention more efficient and effective in mobilising users, compared to mere individual-oriented interventions. This is in accordance with previous work (see e.g., Krans et al., 2019, Ryde et al., 2013, Brinkley et al., 2017). Moreover, AAAS assumes a reciprocal relationship between mobilisation and social cohesion in the workplace. This further reflects how the script aims to facilitate social cohesion and *team spirit* amongst users.

As discussed in section 4.3, the Avantas Aktiv program had the greatest effect on group cohesion where there was a certain level of kinship and unity prior to the intervention. Poor social cohesion prior to the intervention reportedly affected the implementation of the intervention and the sub-scription rates negatively. Achieving a critical mass of active users within the team was stressed as important to mobilisation of users being sustained over time. Because of how the program is designed, getting the team members up and running and the team spirit going becomes even more important. That is, there is a social dimension to subscribing and de-inscribing. Thus, social cohesion is both a premise for and a result of successful mobilisation of users into the intervention.

6 Concluding remarks and future work

Based on our study of the workplace-situated mHealth intervention and underlying technology of Avantas Aktiv, from both the developers and users' perspective, supported by a script theoretical lens, we conclude that technology is not neutral. Indeed, we find that a seemingly simple technology, as the case of Avantas Aktiv, the technology, and thus, acceptance and appropriation of it, is situated in a social dimension of the developers and users, and the organisations, with its pre-existing *program of action,* in which the technology is to be used.

Overall, the results of this case study were positive. The intervention seems to succeed in mobilising initially sedentary users, in the sense that this target group is both active users and report of positive effects from participating. Based on feedback from users, we conclude that workplace situated group interventions offer a promising strategy to promote physical activity, reduce sedentary behaviour and increase social cohesion in the workplace. Further, we find that the choice of target group, and the priorities made to target these, reflects in how the intervention and underlying technology is designed, what features are implemented, and how this affects different groups of employees, implying that technology developers can gain from being informed and aware off the target group and be willing to make priorities and essentially downgrades, based on these choices.

For future work, we plan to make further use of the self-reported activity journal data collected, and elaborate on the group effects and critical mass of users mobilised by the intervention: Achieving a certain level of participation within a given time frame was stressed as important, both by AAAS and the Team Captains. Detailed knowledge on this, that is, the interplay between physical activity/sedentary behaviour and social cohesion, could provide businesses and policy makers with guidelines to increase the effectiveness and efficiency of such interventions.

Other topics to be further elaborated are mapping motivational mechanism and behavioural change techniques in-scripted in the intervention (Ryan and Deci, 2000, Franken and Brown, 1995, Cornaglia et al., 2019, Direito et al., 2016, Jennings et al., 2019, Buckingham et al., 2019); participation bias due to characteristics such as age and gender (Niederle and Vesterlund, 2007, Buckingham et al., 2019, Rigby et al., 2020); and changes in physical activity during the covid-19 pandemic (Colley et al., 2020, Venter et al., 2020, Barton et al., 2021).

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