DESIGNING FOR AN ACTIVE LIFESTYLE: FACILITATING INTERDISCIPLINARY COLLABORATION

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Abstract

Designing wearable technology to make physical activity an integral and routine part of people's everyday life is a challenge, requiring expertise from different disciplines. COMMONS, a research prototype, is a serious game designed to facilitate interdisciplinary collaboration early in the design process. In this study, we present data obtained from four game sessions with 15 players from different disciplines. By combining objective data from the game with subjective data from a questionnaire, we gained insight into the process of interdisciplinary collaboration. COMMONS was found to have little effect on the internal views of players. However, the game has a positive effect on active involvement and sharing opinions, also players have a substantial influence on each other when adjusting a point of view. The results seem to suggest that COMMONS facilitates the readiness for collaboration between experts from different disciplines.

Keywords: interdisciplinary collaboration, wearable technology, physical activity, serious games

Introduction

A lack of physical activity and an increase in sedentary behaviour are responsible for major health risks in our society (Kohl et al. 2012). Activity trackers and smartwatches can support individuals in incorporating physical activity in their daily routines. However, the effect of these wearables on sustained physical activity remains minimal (Gal et al. 2018). In most consumer-based wearables a customized approach is not available, and these wearables are often no longer used within six months after purchase (Epstein et al. 2016; J. Clawson et al. 2015). To have a significant impact, the wearable technology must address individual, social, and environmental factors. To this end, interdisciplinary collaboration is crucial because interdisciplinary research and development can promote knowledge, insight, and understanding from multiple perspectives (Kostoff 2006). However, this kind of collaboration is not self-evident and requires focused research (Blandford et al. 2018). Members of interdisciplinary teams often have different research methods and different definitions of key terms. In addition, they may have internal views in which they fully or partially disregard other disciplines, leading to sub-optimal outcomes (Blandford et al. 2018; Thompson 2009).

In a previous study (Arts, Kromkamp, and Vos 2019), we found that the use of serious games is an option for facilitating interdisciplinary collaboration early in the design process. Both games and interdisciplinary collaboration involve rules and strategies, and both require consultation and adjustment of participant positions. As a result, we developed a research prototype, named COMMONS. In this study we used COMMONS: (1) to gain insight in interdisciplinary collaboration in designing wearable technology for physical activity and (2) to facilitate this design process.

Method

COMMONS is a research prototype with components for logging data, such as individual voting behaviour, voting composition, and card positioning. Data are collected by means of voting boxes, RFID cards and readers, and a microcontroller. The game starts with four players being assigned to a team to develop wearable technology focused on a fictional persona which is characterized by a context, goals, motivation, and obstacles to physical activity. To develop effective wearable technology, in which all determinants are addressed, the input of different disciplines is needed. Therefore, the players must have different backgrounds, such as in the behavioural sciences, movement sciences, industrial design, engineering, or user experience design. The game is played with a set of 52 features (cards) divided into four categories: hardware (12), software (11), user design experience (9), and behavioural change techniques (20). Players vote on these features with the persona in mind. The features can be accepted or rejected. However, if there is no consent a discussion round follows. Consent means that a decision has been taken when none of the players present argue or predominantly object to taking the decision. Only when there is agreement is there a decision. When a feature is accepted, players must agree on a ranked position (one to five) of the card on the board. If a discussion round is initiated, the overriding objections must be cleared, and the players discuss their opinions. The final solution consists of the five features that the players determine are necessary for the design.

At various moments, the players must resolve a 'Kairos' card, which is designed to disrupt the game and cause unpredictability. The disruption and unpredictability change the state of the game and requires the players to adapt to the situation. The only way players can handle these cards is by working together. A game session ends after 90 minutes, or when all 52 cards are played. Figure 1 depicts COMMONS.

Figure 1. COMMONS, including four voting boxes, the board with ranked positions, a set of features, Kairos cards, and the persona (Arts, Kromkamp, and Vos 2019).

For this study, COMMONS was played four times with a total of 15 different players (three games with four players and one game with three players). Of all players, 67% were male, and the average age was 34 years old (±8,7). The participants had different backgrounds. Six participants had a background in exercise and lifestyle coaching. Six other participants had a behavioural sciences degree, six had a degree in human movement sciences, four had an industrial design degree, two had a degree in user experience design, two had a degree in information communications technology, and one had an engineering degree.

After the game ends, the players were asked to complete a questionnaire. Next to their personal background characteristics (gender, age and expertise), players were asked to rank their opinions on 27 items on a five-point Likert scale, ranging from one (strongly disagree) to five (strongly agree). These items relate to two major themes in interdisciplinary collaboration: (1) shifting the individual mental model (ten items) and (2) interdisciplinary work (17 items). With regard to the mental model, Mathieu et al. (2000) indicated that mental models serve the three crucial goals of helping people to describe, explain, and predict events in their environment. These internal views are formed by the norms, values, assumptions, beliefs, and expectations of the individuals (Clawson 2002). In terms of interdisciplinary work, it is assumed that different disciplines must cooperate to solve a problem. Influencing each other determines the content. The emergent insights transcend the boundaries of the individual professions (Kostoff 2006).

Results

Game data

The results showed a diversity of accepted features, voting behaviours, compositions, and vote changes. A significant amount of data was collected. We compiled the data that involved the (1) voting compositions, features, and their unpredictability, (2) resolution within the teams, and (3) vote changes. When the game was played with four players, with three choices per round (accept, reject, consent), there were 15 possible voting compositions per round. Figure 1 shows the total number of the different voting compositions for all four game sessions. In total, 177 rounds were played during the four games.

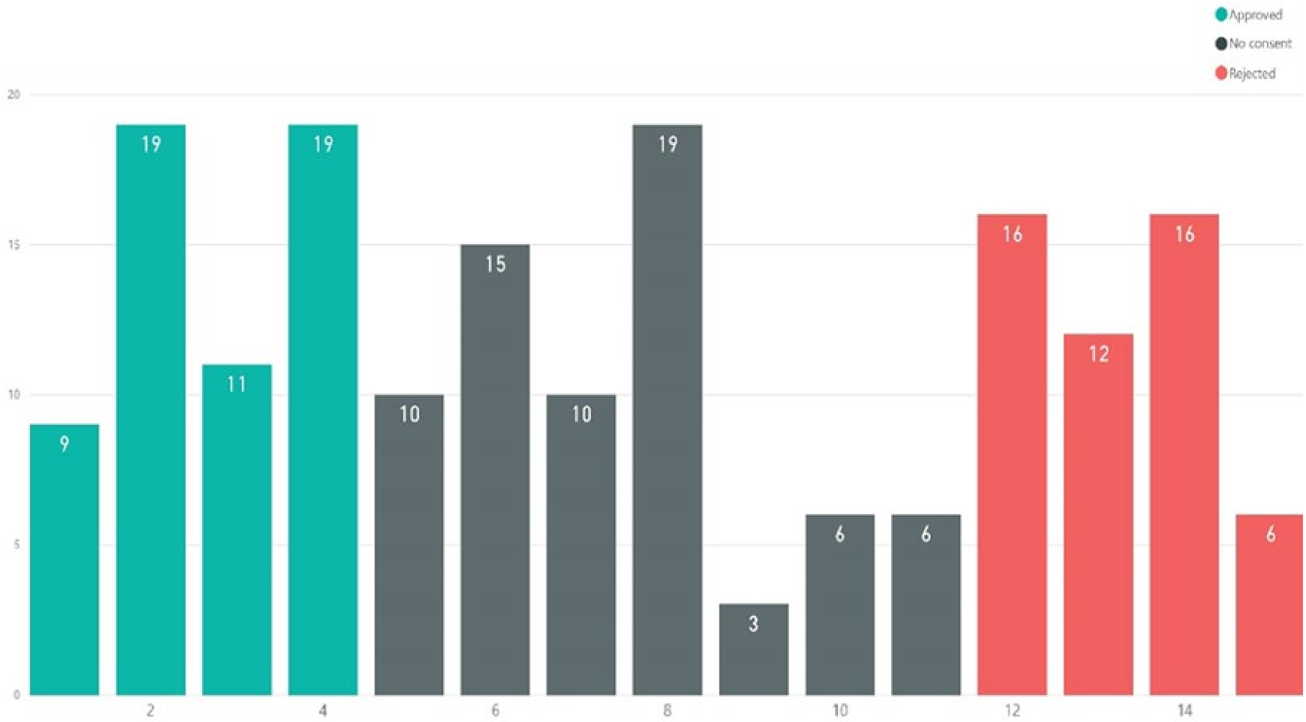


Figure 1. Occurrence (Y-axis) of each voting composition (X-axis) during the first vote (prior to discussion) coloured with respect to the result.

Composition 1-4 (green) means the feature was accepted, 5-11 (grey) denotes no consent (leading to discussion), and 12-15 (red) means rejected. In total, 58 features (33%) were directly accepted, 50 features (28%) were rejected, and 69 features (39%) led to discussion. Of the 177 rounds that were played, 108 rounds resulted in an immediate consent (all players accepted or rejected the feature). As mentioned earlier, 69 rounds ended in a discussion (39%), of which 53 were resolved to consent after the discussion (77%). Only 16 features (23%) did not produce a consent (a discussion remained). Thus, there was a total of 161 resolved rounds (91%).

The amount of discussion within a specific category was diverse. Figure 2 shows that the category behaviour change technique (BCT) led to the most discussion, whereas the hardware category led to the least discussion. After discussion, only 16 features showed that no consent could be reached. In playing the game, these features are placed in the discussion box (no match) to sustain the game flow instead of continuing the discussion. Figure 3 shows the category distributions of these unresolved features.

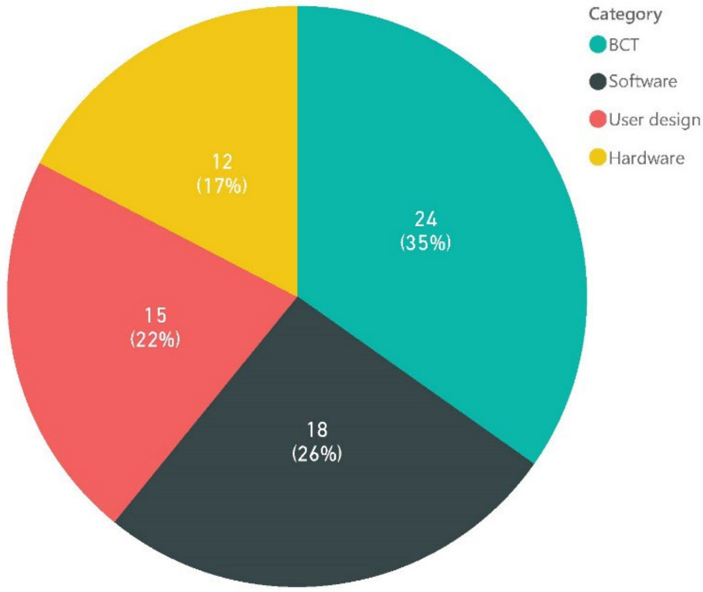


Figure 2. Number of times a feature within a category lead to discussion

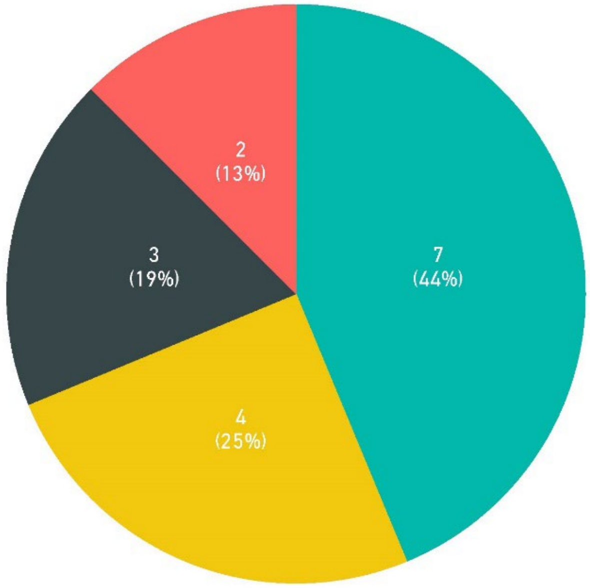
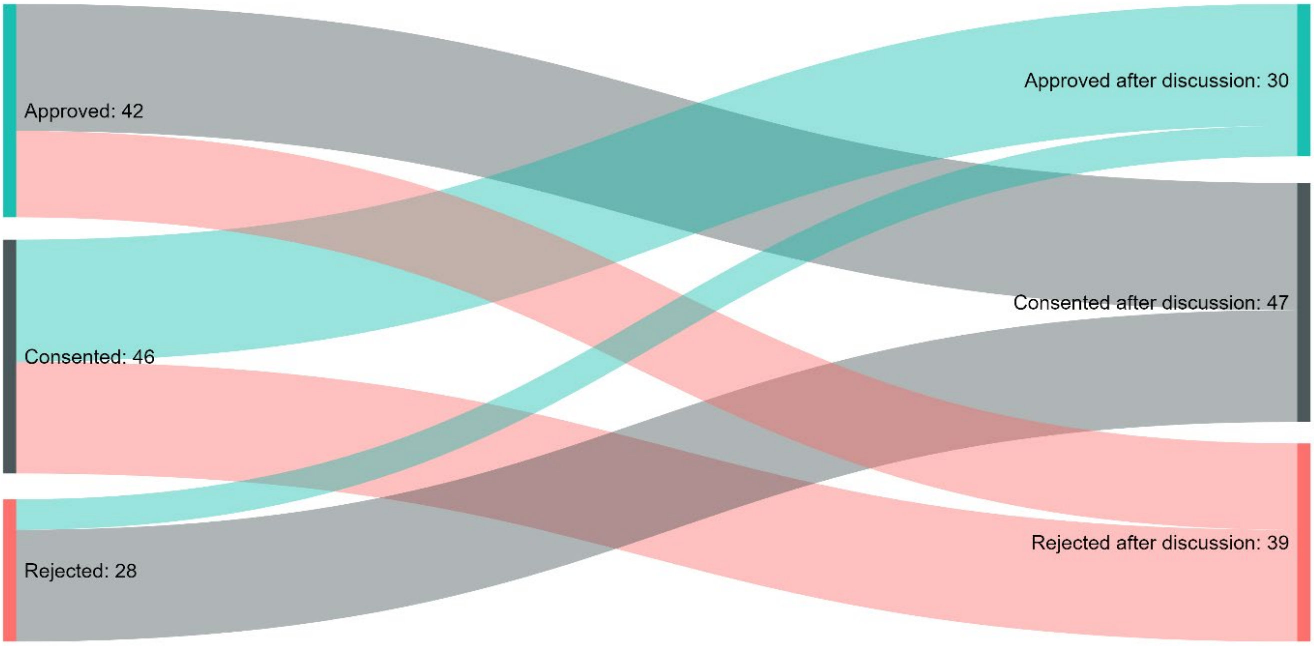


Figure 3: Categories where no consent was reached

A total of 116 individual votes were changed after the discussion. Of them, 93 votes (80%) were changed from rejected or accepted to consent, or vice versa. In addition, 23 votes (20%) were changed from rejected to accepted (six times), or from accepted to rejected (16 times).

Graph 4 shows how vote-changing players changed their vote after a discussion. This graph only includes player votes that changed after a discussion; it thus excludes votes that remained the same.



Graph 4. Player vote changes after discussion (N=116). The width of the streams is weighted by the number of votes.

Table 1. Percentage of participants (N=15) who disagree or agree with the statement or are neutral.

Statement	Disagree	Neutral	Agree
Mental model			
I have gained insight into the arguments of other players	0,0%	0,0%	100,0%
I understand why other players consider other features important	0,0%	0,0%	100,0%
I look at the presented features from a different angle	6,7%	6,7%	86,7%
We better tailor the features to the user (profile)	13,3%	6,7%	80,0%
I've adjusted the importance of certain features	6,7%	20,0%	73,3%
It is clear why my expertise is needed	13,3%	20,0%	66,7%
I got more knowledge of the presented features	20,0%	26,7%	53,3%
I have often adapted to the opinion of the group	46,7%	26,7%	26,7%
I adjusted my vision on wearable technology	46,7%	33,3%	20,0%
I have adjusted images of other areas of expertise	46,7%	33,3%	20,0%
Teamwork			
I could freely express my opinion	0,0%	0,0%	100,0%
I could share my point of view	0,0%	0,0%	100,0%
I was actively involved in the process	0,0%	0,0%	100,0%
We listened to each other's point of view	0,0%	0,0%	100,0%
I had fun	0,0%	6,7%	93,3%
We could brainstorm pleasantly	6,7%	0,0%	93,3%
We have worked well together	0,0%	6,7%	93,3%
We let each other finish sentences	0,0%	13,3%	86,7%
I have more understanding for other people's views	0,0%	26,7%	73,3%
I got to know other areas of expertise and disciplines	13,3%	20,0%	66,7%
I can empathize better with someone else's vision	0,0%	33,3%	66,7%
We have come up with a joint solution	26,7%	6,7%	66,7%
As a team we have a clear direction	13,3%	26,7%	60,0%
We have clarified concepts and definitions	26,7%	20,0%	53,3%
We have created a common language	20,0%	26,7%	53,3%
We as a team have improved our adaptation skills	6,7%	40,0%	53,3%
We have clear idea of what is important in the design process	33,3%	13,3%	53,3%

Players were asked for the main reason for adjusting their vote. The question was multiple choice and players were allowed to give multiple answers. Of the players, 33% indicated that the 'choices of the other players' played a role in adjusting their vote. The following items had a greater influence: 'a new insight into the feature application' (67%), 'a better understanding of the feature' (73%), and 'knowledge of other players' (73%). The following responses were not listed as a reason to adjust their choice: 'I did not want to vote differently from the group majority' or 'I wanted to remain connected to one of the other players'.

Discussion and Conclusion

In this study we used a research prototype, COMMONS, to gain insight in interdisciplinary collaboration in designing wearable technology for physical activity and to facilitate this process. Insights into interdisciplinary collaboration

Blandford et al. (2018) contended that the differences in cultures, practices, and assumptions among disciplines are subtle but pervasive. The mental model results of our study support this contention. Of the players, 50% indicated that nothing changed in 'their view of wearable technology' or 'view of other areas of expertise'. However, a large portion of participants indicated that their changing view was based on 'new insight', 'an improved understanding', or 'the knowledge of fellow experts'. In the short term, COMMONS may thus change views; however, in the long term, with respect to assumptions, cultures, or beliefs, this effect may be smaller.

The game results provided us with insights on the voting compositions and features, as well as their unpredictability. Almost all voting compositions occurred during the respective game rounds. The overall results of each vote round formed an almost three-way split among 'approved', 'rejected', and 'no consent'. We conclude that, regardless of the team composition, no consent—and thus the occurrence of follow-up discussion—was inevitable and also unpredictable in terms of when this would occur and for what topic. This finding aligns with the conclusion that, if no action is taken, there will be a sub-optimal outcome (Blandford et al. 2018; Thompson 2009). However, it was clear that COMMONS was beneficial in helping teams engage in these discussions.

Regarding changing the vote/position, it is concluded that most of the changes proceed from consent to accepted/ rejected or vice versa (80%). It is thus unlikely that a 'yes' will become a 'no' or vice versa.

Limitations and future work

This study had some limitations, including the small number of game sessions played. Given the specificity of the theme (wearable technology in relation to physical activity), it was not easy to find specialists. Participants were obtained from throughout The Netherlands with very diverse backgrounds. Moreover, all participants indicated that they had multiple areas of expertise. Thus, they were already accustomed to extending their perspective and obtaining a broad view. Consequently, the results may have been more positive than when the game is played with individuals who are accustomed to working only within their own discipline. Future work should demonstrate how COMMONS works in interdisciplinary teams developing wearable technology for physical activity.

Conclusion

In conclusion, by means of our game COMMONS, we not only gain insight into interdisciplinary collaboration, but also identify a method to support and promote such collaboration.

Acknowledgements

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