Verbal behaviour differences in virtual and physical agile teams: An exploratory study

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ABSTRACT

Given the fast pace of today's society, organizations go through constant changes. For instance, the structures of organizations are continuously transforming depending on the environment and the agile way of working has become more popular in the last decade with many organizations implementing it. Similarly, in the last couple of years the Covid-19 pandemic spurred physical team meetings to become virtual team meetings. However, little research has been done on the difference between virtual and physical teams that implement the agile way of working especially in regard to differences of verbal behaviours expressed during meetings by virtual and physical team members. Therefore, this research investigates the differences in verbal behaviours between virtual and physical agile teams. By exploring this topic, it is possible to improve communication, avoiding misunderstanding, whilst offering more objective ways of investigating team dynamics. More specifically, this research focuses on specific types of meetings (i.e., planning, refinement, and retrospective), specific types of behaviours (i.e., task-and relationship-oriented behaviours), and specific individuals (i.e., product owners). Within a large service organization that implemented the agile way of working, several meetings were videotaped and coded afterward. The data that was collected are the meetings of 2 virtual teams and 9 physical teams. Quantitative research has been done and showed that among the three meetings there were several differences in verbal behaviours between virtual and physical teams. Besides that, there was no significant difference between virtual and physical teams focusing on the specific types of behaviours. Last of all, there was only one verbal behaviour that showed a significant difference among virtual and physical product owners: *sharing personal information*. These findings extend current knowledge on virtual and physical agile teams by exploring team members´ verbal behaviours in an agile environment. In practice, these findings can help the management of agile teams to decide what works better for a team in regard to behaviour; virtual or physical teams.

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Keywords

Agile team, Physical team, Planning, Product owner, Refinement, Retrospective, Task-and Relationship-oriented Behaviours, Verbal behaviour, Virtual team

1. INTRODUCTION

Over the past decades, the fast pace of change has driven organizations to change quicker than their competitors. These changes are often in the disruptive technological sector (Davis and Sinha, 2021), but do not necessarily have to be technological in nature, since they could also happen in the service or manufacturing sectors, as well as in the structure of an organization. Among changes in organisational structure, agile is one of the most important and popular ones in today´s ways of working. The agile way of working can be defined as the flexibility and ability of an organization to adapt rapidly and steer itself in a new direction. It is about empowering people and minimizing handovers (McKinsey, 2017). Traditionally, agile teams do not have a leader but tend to work through a shared leadership model. Shared mental models and trust are key in effective teamwork for agile teams (Moe et al., 2016). This means that all members of an agile team share responsibility for the outcome of the project (Magpili and Pazos, 2018). According to the agile way of working, another word for an agile team is a squad. Every squad exists of agile team members, who work flexibly, are open, and toward a common goal. The is a shared leadership model within these squads, which means that there is a collective responsibility for the outcome of the project (Moe et al., 2016). In a squad there is a product owner, who is not a leader but owns the product (Kerr et al., 2018). The squads have different kinds of meetings: planning, refinement, and retrospective. After these meetings, the squads are often dismantled (McKinsey, 2017).

Another word for a squad is a team, which can be defined as a small task group in which the team/members have a common purpose, complementary skills, and interdependent roles (Gera, 2013). Moe et al. (2016) discussed that teams are becoming more and more agile. The structure of organizations is constantly changing and requires flexibility and fluid virtual teams, which suggests an agile way of working (Moe et al., 2016). Besides that, many organizations had to switch from physical teams to virtual teams during the Covid-19 pandemic (Seok Chai, 2022). Virtual teams exist of team members that use computer-mediated communication technologies. These team members work interdependently across time and space (Berry, 2011). On the contrary, physical teams can be defined as team members that work in close physical proximity and they work in the same building having face-to-face communication (Gera, 2013).

Whillans et al. (2021) discussed that because of Covid-19 employees used the shift to virtual work as a unique learning opportunity on their use of digital technology, which can give higher job satisfaction. Another research has noted that virtual team members are more engaged and have a high degree of satisfaction working online, because of greater flexibility (Sundin, 2010). All virtual employees are indeed able to do their work whenever they want. Virtual employees are also quicker to learn new technologies and are 20% more productive than employees involved in physical meetings (Sundin, 2010). However, there are also negative aspects related to virtual meetings and virtual teams. Research on virtual teams has shown that virtual meeting participants cannot observe what the other team members are doing or looking at. It is hard to see the body language compared to physical teams (Karl et al., 2021). Furthermore, virtual meetings tend to be too long, are planned one after the other so that there are too many, and team members often show up late. On top of this, there are often camera and microphone issues (Karl et al., 2021). Hence, these negative aspects may cause a higher risk of misunderstanding (Schulze et al, 2016).

To avoid such misunderstandings, research has pointed out that virtual teams should adapt their spoken and written behaviours (Schulze et al., 2016). In particular, verbal behaviours seem to play an important role in understanding team interactions (Raes et al., 2015). Yuki et al. (2002) explored different kinds of behaviours and defined task-oriented behaviours as high-efficient when it comes to resources and personnel, and high reliability of services, operations, and products. On the contrary, they defined relationship-oriented behaviours as those in which there is a strong commitment to the mission and a high level of trust and cooperation among team members.

Implementing this taxonomy, Hoogeboom et al. (2021) explored leadership behaviours within video-coded staff meetings in physical teams and distinguished the difference between task-oriented behaviours and relationship-oriented behaviours as well. The aim of Hoogeboom et al. (2021) was to extend the healthy physiological variability in studies about leadership. Raes et al. (2015) also investigated verbal team interaction in physical meetings to measure team learning behaviours. The authors identified a list of verbal behaviours of team members and concluded that sharing behaviours are contributions of individual team members.

However, this innovative research focusing on verbal behaviours has been conducted mostly in team meetings physically. Yet, since the dramatic events (e.g., the COVID-19 pandemic) of the past two years have significantly changed today's way of working making it more virtual, verbal behaviours in virtual teams should also be investigated. Furthermore, Zhao et al. (2019) also underlined the importance of implementing more objective ways of exploring team dynamics through, for instance, video recordings. Since scant research on verbal behaviours has been conducted so far via video observations (Hoogeboom et al., 2021), especially comparing virtual and physical teams, the following research question has been developed:

What are the differences in regard to verbal behaviours of team members in virtual and physical agile team meetings?

Next to this research question, there are some sub questions that also will be answered in this research:

1. *To what extend is there a difference in the three meetings within the data (planning, refinement, and retrospective)?*

2. *To what extend is there a difference regarding to the kinds of verbal behaviours (task- and relationship-oriented)?*

3. *To what extend is there a difference between virtual product owners and physical products owners regarding verbal behaviours?*

By answering the above research questions, this thesis contributes to the agile and (non)-virtual-team literature in two ways. Firstly, by exploring the rather under-researched actual, more objective, behaviours displayed by team members during meetings, this research extends current knowledge on the well-studied differences between virtual and physical teams through an innovative methodology, namely video observations. Secondly, by focussing on differences across specific types of meetings (i.e., planning, refinement, and retrospectives), specific types of behaviours (i.e., task-oriented vs relationship-oriented), and specific individuals (i.e., the product owners), this thesis offers a fine-grained analysis of the differences in virtual and physical teams that work agile. There is still a gap in research combining virtual and physical teams that implement the agile way of working. In terms of practical contributions, team members could benefit from the results of the research, because team members could become aware of the influences/consequences of their behaviours on team dynamics and effectiveness. This research could also give a practical contribution to team members that work in agile teams. The team members could benefit from it by seeing what works best within virtual or physical teams regarding verbal behaviours.

First, this research discusses the theory of agile teams followed by the theory of virtual and physical teams. In the final part of the theoretical background, the theory of verbal behaviour will be explored. After the theoretical background, there is the methodology, which explains how the research question will be answered. In the results and conclusion/discussion, the answer to this research question will be explored.

2. THEORETICAL BACKGROUND

2.1 Agile teams

The Agile Manifesto was developed in Agile Software, but can easily be applied to the development of many types of products. The Manifesto includes 4 agile values (Measey and Radtac, 2015), which are:
- Individuals and interactions over processes and tools
- Working software over comprehensive documentation
- Customer collaboration over contract negotiation
- Responding to change by following a plan

The agile way of working can be defined as the flexibility and ability of an organization to adapt rapidly and steer itself in a new direction. It is about empowering people and to minimizing handovers (McKinsey, 2017). Agile teams are designed to manage and accept change (Dikert et al, 2016). According to the agile way of working, another word for an agile team is a squad. A squad exists of no more than 9 people and is self-steering, there is no formal leader, and everyone is responsible for his/her actions. The squad works toward one common goal: the mission. After the mission is accomplished, the squad is often dismantled (McKinsey, 2017). In agile teams, there seems to be a shared leadership model, which means that there is a collective responsibility for the project outcome among the members (Moe et al., 2016). There is no individual leader within an agile team (Magpili and Pazos, 2018). In a squad, there is the product owner, who is not a leader but owns the product. He/she oversees the squad's work and takes responsibility for the team output (Kerr et al., 2018). Figure 1 depicts an overview of an agile team.

Figure 1: An Agile Team (McKinsey, 2017)

2.2 Virtual and physical teams

Teams are thus the unit of analysis in the agile way of working. Teams can be defined as a small task group in which the team/members have a common purpose, complementary skills, and interdependent roles (Gera, 2013). Depending on the context, two types of teams are distinguished: virtual teams and physical teams. Virtual teams exist of team members that use computer-mediated communication technologies. These team members work interdependently across time and space (Berry, 2011). On the contrary, physical teams can be defined as team members that work in close physical proximity and they work in the same building having face-to-face communication (Gera, 2013).

Recently, there has been a lot of research about virtual teams and physical teams. Karl et al. (2021), for instance, mentioned that virtual team meetings are in some way better than face-to-face meetings. Virtual teams have benefits like the use of polling, the chat function, and the ability to enhance relationships by seeing and learning more about team members' personal lives (Karl et al., 2021). Not everyone agrees with this. In another research, it is mentioned that virtual teams are more complex compared to physical teams because they cross boundaries related to distance, organization, and time. Next to this, virtual teams also may use difficult technology to communicate (Gera, 2013).

In a study by Branson, Clausen, and Sung (2008) face-to-face teams and virtual teams were compared by looking at different group styles for inventory differences between virtual and face-to-face teams. Physical teams scored higher on self-actualizing group style. This style includes innovative and creative ideas. Looking at the humanistic encouraging group style physical teams scored a higher number. This group style includes helping and supporting other team members. Physical teams also got more points on the affiliative group style (commitment to the group) than virtual teams. However, virtual teams scored higher on the passive/defensive, avoidance, dependent, and

power-oriented dimensions. This means that virtual teams may have more difficulties minimizing the negative effects of teaming on good decision making (Branson et al., 2008).

Similarly, Anawati and Craig (2006) discussed that in cross-cultural virtual teams there are certain concerning behaviours identified by the participants. Some of these behaviours are verbal behaviours, like abruptness, bad humour, not participating during team discussions, and formulation of criticism or praise (Anawati et al., 2006). Sundin (2010) has noted that virtual team members are more engaged and have a high degree of satisfaction working online, because of greater flexibility. And yet, whilst research has overall compared physical and virtual teams mostly regarding their advantages and disadvantages, as well as their different group styles, fewer works have explored how participants' behaviours differ. Research on virtual teams has shown that virtual meeting participants cannot observe what the other team members are doing or looking at. It is hard to see the body language compared to physical teams (Karl et al., 2021). Furthermore, virtual meetings tend to be too long, are planned one after the other so that there are too many, and team members often show up late. On top of this, there are often camera and microphone issues (Karl et al., 2021). Hence, these negative aspects may cause a higher risk of misunderstanding (Schulze et al., 2016).

2.3 Verbal behaviour

To avoid such misunderstandings, research has pointed out that virtual teams should adapt their spoken and written behaviours (Schulze et al., 2016). Behaviour can be defined as any observable action of an organism that generally includes verbal behaviour as well as physical movements (Bergner, 2010). Szabo defines behaviours as specific verbal and nonverbal actions that are reinforced through the mediation of other people, but only if people are behaving in ways they have been shaped and maintained by an evolved language or verbal environment (Skinner, 1987). In this thesis, the focus is on verbal behaviours which are defined as behaviours that are reinforced through the mediation of other people, who must respond to the situation to reinforce the behaviour of the speaker (Skinner, 1987).

Verbal behaviours studied through video observations, offer a more objective perspective on team dynamics and how they can be enhanced. Since the method of investigation (i.e. video observations) is rather innovative, there has been little research on the verbal behaviours of leaders within teams. One of the most important ones is Yuki et al.'s (2002) hierarchical taxonomy of leader behaviour. In this taxonomy, there are three different kinds of behaviour: task-oriented behaviour, relations-oriented behaviour, and change-oriented behaviour. Task-oriented behaviours are related to high efficiency when it comes to resources and personnel, and high reliability of services, operations, and products. Relationship-oriented behaviours are related to a strong commitment to the mission and a high level of trust and cooperation among team members. The objectives of change behaviours are innovative improvements and adaption to external changes (Yuki et al., 2002).

Implementing a similar taxonomy, Hoogeboom et al. (2021) also identified different kinds of leader behaviours to explore leaders' effectiveness namely, positive and negative relations-oriented and task-oriented behaviour. The different behaviours Hoogeboom et al. (2021) identified are: providing negative task feedback, task monitoring, correcting, directing, informing, structuring, giving his/her own opinion, agreeing on task-related matters, disagreeing on task-related matters, individualized consideration, intellectual stimulation, idealized influence behaviour, providing positive feedback, humour, giving personal information, showing disinterest, defending one's position, interrupting and listening. According to Hoogeboom et al. (2021) highly effective leaders show positive relationship-oriented behaviour more often by higher levels of physiological arousal. Raes and Boon (2015) also researched observing verbal team interactions to measure team learning behaviours. The authors identified a list of verbal behaviours of team members and concluded that sharing behaviours are contributions of individual team members. They also found that team members could contribute with verbal behaviours that facilitate sharing behaviours for other team members (e.g. asking questions).

Even though the above-mentioned studies explore verbal behaviours in leaders, they have investigated such behaviours in non-virtual teams. Hence, how virtual- and physical teams differ concerning manifestations of verbal behaviours is still unclear and it is thus worthwhile researching further.

3. METHODOLOGY

3.1 Research design

This research is focused on analysing video data through the verbal behaviours from the Organisational Behaviour, Change Management and Consultancy (OBCC) group's codebook. The team members whose verbal behaviour was measured work at a large service organization in the Netherlands. More than 5 years ago, this organization chose to implement an agile way of working. This research is quantitative in nature, which can be defined as a type of research that explains phenomena by collecting numerical data that are mathematically analysed based on certain methods (Sukamolson, 2007). This research will use exploratory and descriptive research techniques because it will be mainly focused on the difference between the characteristics of virtual and physical teams.

3.2 Data collection

The data was collected by the OBCC group. The video data that was collected before 2021 was recorded in situ, while the individuals were together in one room. The data that was collected in and after 2021 was recorded while the individuals were meeting online. There were 11 teams in total that were recorded. Every team had a different number of individuals within the team. In Table 1 below there is a short overview of the individuals within the teams. This table distinguishes between virtual and physical teams to see the differences between the data that is collected. This overview gives a clear overview of what data was used in this thesis. There were some other teams recorded by the OBCC group, where the recordings of the

meetings had really bad quality. These teams are not included in this research.

Table 1: Team composition

Team	Number of individuals
V1	6
V3	9
P1	9
P2	8
P3	8
P4	8
P6	7
P7	8
P8	7
P12	9
P14	5

Virtual teams (V): 15 individuals
Physical teams (P): 69 individuals

Each team had 3 different kinds of meetings. The three different meetings are planning, refinement, and retrospective. For every meeting the physical teams had, there are multiple cameras used from different angles for every team. The virtual teams only have one video for every meeting, so you can see every member. In total there are 5 meetings of virtual teams and there are 19 meetings of physical teams.

3.3 Research instrument

The individuals´ verbal behaviours were identified by video observation and coded following a verbal behaviour codebook (Wilderom, 2021). In Table 2 below there is a quick overview of the different verbal behaviours within the codebook.

Table 2: OBCC: verbal behaviours and Hoogeboom et al., 2021

	Relation-oriented	Task-oriented
Showing disinterest	X	
Defending one's own position	X	
Giving negative feedback-constructive		X
Disagreeing		X
Agreeing		X
Governing/Correcting		X
Governing/Delegating		X
Governing/ Interrupting	X	
Verifying		X
Shaping the discussion		X
Informing with facts		X
Giving direction/Own opinion		X
Giving direction/Long term	X	
Giving positive feedback	X	
Professional challenging/Asking for ideas	X	
Professional challenging/Stimulating teamwork	X	
Giving positive attention/Being friendly	X	
Giving positive attention/Showing personal interest	X	
Humour	X	
Sharing personal information	X	
Active listening	X	
Focused task behavior		X

This codebook is used next to the video-recorded data that is obtained by the OBCC group. Every individual is performing one behaviour at a time at a certain moment in the video, hence each behaviour is mutually exclusive. These videos are coded in the Observer XT software so that individuals within the video are matched with certain behaviours.

To investigate the difference between virtual and physical teams the data is transported to SPSS to compare the verbal behaviours. All the meetings that were used in this research were put together in one SPSS file. The verbal behaviours were divided into three meetings to examine the first sub-research questions. To find the answer to the research question about the difference between task-and relationship-oriented behaviours in this thesis two new variables were computed in SPSS. These two new variables are all the specific behaviours that either belong to task-or-relationship-oriented behaviours according to Hoogeboom et al. (2021). For the last research question, the verbal behaviours of the different meetings were put together and the individuals that were not the product owners were deleted in SPSS.

3.4 Analysis

Firstly, the video data is deductively analysed through the verbal behaviours in the codebook. All individuals are analysed within the squads comparing the virtual and physical squads. This research uses a frequency count of the behaviours for every squad. After the frequency count for the behaviours in every team, the standardization is calculated by dividing a frequency of a verbal behaviour by the total number of verbal behaviours in a meeting. After the frequency standardization of all verbal behaviours in every meeting was calculated a normality test is conducted. This is done for all verbal behaviours in every meeting in SPSS via a normality test, skewness, and kurtosis.

Based on the normality results, the Mann-Whitney U test was adopted most of the time because the normality could not be confirmed for every verbal behaviour in the different meetings. However, a few verbal behaviours were normally distributed, so a T-test was deemed more suitable. If the normality test revealed that one of the two groups was normally distributed and the other group was not, then the data was transformed into data via the option LOG10. After this was done, a T-test was run for all these verbal behaviours. If the outcome for the Mann-Whitney U test or t-test is below 0.05 then the null hypothesis can be rejected, which means that there is a significant difference between virtual and physical teams. The *p*-values of the normality test (Shapiro Wilk test) can be found in the appendix (Appendix, Table 1, 2 and 3). If the *p*-value is boldfaced it means that the data of the group is normally distributed.

The Mann-Whitney U test also calculated the mean ranks for all behaviours separately. The mean ranks can be used to see what the difference in mean ranks is between the virtual and physical teams (see Appendix, Table 1, 2 and

3). The t-test calculates the means, which can also be used to oversee the difference in means between virtual and physical teams (see Appendix, Table 3). In this way, this research can see what team (virtual or physical) uses a verbal behaviour more than the other team by looking at the means or mean ranks.

There are three different types of meetings within the data: planning, refinement, and retrospective. This research inspects if there is any difference between virtual and physical teams for each process. To answer the second sub-question the different behaviours are divided into task- and relationship-oriented behaviours. Hoogeboom et al. (2021) provided behaviours that are matched to task-and relationship-oriented behaviours. These task- and relationship-oriented behaviours are matched to the video-recorded data from OBCC group to answer one of the sub-questions (See Table 2: OBCC: verbal behaviours). To answer the third research question the difference between virtual product owners and physical product owners focused on verbal behaviours is interpreted. All the research questions are answered via Mann-Whitney U tests or T-tests.

4. RESULTS

Below, the quantitative results on the difference between virtual and physical teams regarding the verbal behaviours in the three different meetings are reported. The Mann-Whitney U test or T-test are used to answer both sub-research questions separately. First, this test indicates whether there is a difference in behaviours in the different meetings comparing virtual and physical teams. Second, a Mann-Whitney U test and T-test is done to compare task- and relationship-oriented behaviours within virtual and physical teams. Last but not least the virtual and physical product owners are also compared through the same T-tests. All the results together of these tests can be found in the appendix.

4.1 Planning, refinement & retrospective

First, addressing the first sub-research question of this thesis, the verbal behaviours for the three different meetings were examined. Table 3 below offers an overview of the outcome of the Mann-Whitney U tests or T-tests for every verbal behaviour in the different meetings, whilst the detailed results of the comparative tests can be found in the appendix (see Appendix, Table 1).

In table 3 more behaviours from *meeting 1* differ between virtual and physical teams than in the other meetings. These behaviours are: *giving negative feedback, verifying, giving positive attention/personal interest, humour,* and *sharing personal information*. Physical teams show more *humour* in *meeting 1*, while virtual teams show more *giving negative feedback, verifying, giving positive attention/personal interest and sharing personal information* in this meeting. In the second meeting, there were only three behaviours that have a significant difference between virtual and physical teams, which are: *giving direction/long term, professional challenging/stimulating teamwork,* and *focused task behaviour*. These behaviours were more shown by virtual teams compared to physical teams. All of these behaviours are not significant in *meeting 1*. However, in *meeting 3* there is one behaviour similar to *meeting 2* that is significant. This behaviour is *giving direction/long term* and virtual teams show this behaviour more often. *In meeting 3* three behaviours are significant, two of them were not mentioned in the other meetings as a significant difference between virtual and physical teams. These behaviours are *disagreeing* and *giving direction/own*

Table 3: Outcome Mann-Whitney U tests and T-tests comparing virtual and physical teams

	Meeting 1 (Planning)	Meeting 2 (Refinement)	Meeting 3 (Retrospective)
Showing disinterest	$p = 0.647$ (L)	$p = 0.993$ (M)	$p = 0.856$ (M)
Defending one's own position	$p = 0.212$ (L)	$p = 0.417$ (M)	$p = 0.763$ (M)
Giving negative feedback-constructive	**$p = 0.032$ (L)**	$p = 0.400$ (M)	$p = 0.862$ (M)
Disagreeing	$p = 0.093$ (M)	$p = 0.165$ (M)	**$p = 0.044$** (M)
Agreeing	$p = 0.597$ (M)	$p = 0.244$ (M)	$p = 0.647$ (M)
Governing/Correcting	$p = 0.792$ (L)	$p = 0.061$ (M)	$p = 0.685$ (M)
Governing/Delegating	$p = 0.673$ (M)	$p = 0.541$ (M)	$p = 0.907$ (M)
Governing/ Interrupting	$p = 0.547$ (M)	$p = 0.197$ (M)	$p = 0.256$ (M)
Verifying	**$p < 0.001$ (M)**	$p = 0.644$ (M)	$p = 0.239$ (M)
Shaping the discussion	$p = 0.054$ (M)	$p = 0.505$ (M)	$p = 0.708$ (M)
Informing with facts	$p = 0.557$ (L)	$p = 0.238$ (M)	$p = 0.070$ (M)
Giving direction/Own opinion	$p = 0.933$ (L)	$p = 0.831$ (M)	**$p = 0.031$** (M)
Giving direction/Long term	$p = 0.127$ (L)	**$p = 0.005$** (M)	**$p = 0.002$** (M)
Giving positive feedback	$p = 0.163$ (L)	$p = 0.568$ (M)	$p = 0.201$ (M)
Professional challenging/Asking for ideas	$p = 0.489$ (M)	$p = 0.843$ (M)	$p = 0.095$ (M)
Professional challenging/Stimulating teamwork	$p = 0.609$ (L)	**$p = 0.013$** (M)	$p = 0.802$ (M)
Giving positive attention/Being friendly	$p = 0.194$ (L)	$p = 0.859$ (M)	$p = 0.512$ (M)
Giving positive attention/Showing personal interest	**$p = 0.019$ (M)**	$p = 0.083$ (M)	$p = 0.610$ (M)
Humour	**$p = 0.013$ (L)**	$p = 0.213$ (L)	$p = 0.203$ (M)
Sharing personal information	**$p = 0.037$ (M)**	$p = 0.063$ (M)	$p = 0.290$ (M)
Active listening	$p = 0.684$ (L)	$p = 0.549$ (T)	$p = 0.548$ (T)
Focused task behavior	$p = 0.217$ (L)	**$p < 0.001$** (M)	$p = 0.267$ (M)

M = Mann Whitney U test, L = T-test via LOG10
If $p < 0.05$ than there is a significant difference (boldfaced)

opinion. These two behaviours are more shown by physical teams. There is not one verbal behaviour that shows there is a significant difference between virtual and physical teams in all three meetings. All the other behaviours are not significant, which means that team members in virtual and physical teams do not differ in the manifestation of these behaviours.

4.2 Task- and relationship-oriented

Secondly, addressing the second sub-research question of this thesis, the verbal behaviours for the two specific types of behaviours were explored. In Table 4 below, it is possible to see the results of these two different tests.

Table 4: Outcome Mann-Whitney U test and T-test comparing virtual and physical teams

	Z or *t(df)*	*p*-value	Means and Mean ranks
Task-oriented behaviours	*Z* = 0.380	*p* = 0.986 (M)	Virtual: -2.2754 Physical: -2.2770
Relationship-oriented behaviours	*t*(82)= 0.018	*p* = 0.704 (L)	Virtual: 40.33 Physical: 42.97

M = Mann Whitney U test, L = *t*-test via LOG10

Both types of behaviours are significant, which means that there is no significant difference between virtual and physical teams when it comes to task- and relationship-oriented behaviours. Furthermore, the mean rank and means is for both variables almost similar between virtual and physical teams, implying again that there is no significant difference between virtual and physical teams regarding task-and relationship-oriented behaviours.

4.3 Virtual and physical product owners

To answer the third sub-research question, this thesis focuses on the product owners in every team. The results of this question are shown in Table 5 below. The detailed results of the comparative tests can be found in the appendix (see Appendix, Table 2 and 3). In fact, we did not find a significant difference between virtual and physical product owners' behaviours, except for *sharing personal information* for all meetings together. The mean rank of virtual product owners was for this verbal behaviour higher than for physical product owners, which would mean that virtual product owners share more personal information with their team members than virtual product owners focusing on all meetings. However, focusing on the three meetings separately there are also other significant differences. In *meeting 1* (planning) there is a significant difference for the following behaviours: *verifying* and *giving direction/Long term*. For both verbal behaviours virtual product owners had a higher mean rank than physical product owners. In *meeting 2* there was only one verbal behaviour that showed a significant difference: *shaping the discussion*. Virtual product owners showed this behaviour more than physical teams again. Last but not least, virtual product owners implemented the verbal behaviours: *giving positive attention/being friendly* and *sharing personal information* more often than physical product owners in *meeting 3*.

Table 5: Outcome Mann-Whitney U tests and T-tests comparing virtual and physical product owners

	Meeting 1 (Planning)	Meeting 2 (Refinement)	Meeting 3 (Retrospective)	All meetings together
Showing disinterest	*p* = 0.485 (M)	*p* = 0.527 (M)	*p* = 0.623 (M)	*p* = 0.551 (M)
Defending one's own position	*p* = 0.153 (M)	*p* = 0.459 (L)	*p* = 0.914 (L)	*p* = 0.878 (M)
Giving negative feedback-constructive	*p* = 0.153 (M)	*p* = 0.114 (M)	*p* = 0.703 (L)	*p* = 0.109 (M)
Disagreeing	*p* = 0.264 (M)	*p* = 0.849 (L)	*p* = 0.485 (L)	*p* = 0.474 (L)
Agreeing	*p* = 0.810 (L)	*p* = 0.647 (L)	*p* = 0.558 (L)	*p* = 0.812 (L)
Governing/Correcting	*p* = 0.104 (M)	*p* = 0.522 (M)	*p* = 1.000 (M)	*p* = 0.521 (M)
Governing/Delegating	*p* = 0.485 (M)	*p* = 0.831 (M)	*p* = 0.157 (M)	*p* = 0.372 (M)
Governing/ Interrupting	*p* = 0.137 (L)	*p* = 0.845 (M)	*p* = 0.355 (M)	*p* = 0.286 (L)
Verifying	***p* = 0.008 (M)**	*p* = 0.474 (L)	*p* = 0.286 (L)	*p* = 0.374 (L)
Shaping the discussion	*p* = 0.131 (L)	***p* = 0.032 (L)**	*p* = 0.140 (M)	*p* = 0.610 (L)
Informing with facts	*p* = 0.759 (L)	*p* = 0.510 (L)	*p* = 0.544 (L)	*p* = 0.447 (L)
Giving direction/Own opinion	*p* = 0.938 (L)	*p* = 0.920 (L)	*p* = 0.587 (L)	*p* = 0.385 (L)
Giving direction/Long term	***p* = 0.008 (M)**	*p* = 0.334 (M)	*p* = 1.000 (M)	*p* = 0.229 (M)
Giving positive feedback	*p* = 0.396 (L)	*p* = 1.000 (M)	*p* = 0.165 (M)	*p* = 0.242 (M)
Professional challenging/Asking for ideas	*p* = 0.252 (L)	*p* = 0.256 (L)	*p* = 0.411 (M)	*p* = 0.664 (L)
Professional challenging/Stimulating teamwork	*p* = 0.999 (L)	*p* = 0.552 (M)	*p* = 0.157 (M)	*p* = 0.617 (L)
Giving positive attention/Being friendly	*p* = 0.617 (L)	*p* = 0.200 (L)	***p* = 0.049 (M)**	*p* = 0.240 (M)
Giving positive attention/Showing personal interest	*p* = 0.153 (M)	*p* = 0.527 (M)	*p* = 0.411 (M)	*p* = 0.200 (M)
Humour	*p* = 0.198 (L)	*p* = 0.636 (L)	*p* = 0.188 (L)	*p* = 0.216 (L)
Sharing personal information	*p* = 0.080 (M)	*p* = 1.000 (M)	***p* = 0.049 (M)**	***p* = 0.032 (M)**
Active listening	*p* = 0.629 (L)	*p* = 0.706 (L)	*p* = 0.873 (L)	*p* = 0.422 (L)
Focused task behaviour	*p* = 0.153 (M)	*p* = 0.629 (M)	*p* = 0.679 (L)	*p* = 0.766 (M)

M = Mann-Whitney U test, L = T-test via LOG10
If $p < 0.05$ than there is a significant difference (boldfaced)

5. DISCUSSION

The goal of this thesis was to contribute to agile and (non)virtual-team literature in two ways. Firstly, by exploring the under-researched, more objective verbal behaviours displayed by team members during meetings. This research extends the current knowledge of the differences between virtual and physical teams through an innovative method, namely video observations. Secondly, this thesis focuses on differences in specific types of meetings (i.e., planning, refinement, and retrospective), specific types of behaviours (i.e., task- and relationship-oriented behaviours), and specific individuals (i.e., the product owners). This thesis offers an analysis of the differences between virtual and physical teams that implement an agile way of working.

5.1 Theoretical implications

5.1.1 Planning, refinement & retrospective

This thesis found out that there is a significant difference between virtual and physical teams in the different meetings for some verbal behaviours. The three meetings are very different from each other focusing on their nature (i.e., features and characteristics), which this thesis discovered while coding and watching the videos, which could explain why there are differences between the meetings for certain verbal behaviours.

Kart et al. (2021) mentioned that virtual team members lean more about the personal lives of other team members, because they are able to see them in another environment (i.e. their house). This would explain why *giving positive attention/showing personal interest (meeting 1) and sharing personal information (meeting 1*) are higher for virtual teams compared to physical teams. However, Branson, Clausen, and Sung (2008) discussed that physical teams are more innovative, creative, and helpful/supporting than virtual teams in meetings. They also found that physical team members show more commitment to the team. Nevertheless, the results of this study seem to contradict the literature. Indeed, multiple verbal behaviours of Table 3 match some of these concepts (i.e., helpful/supporting, commitment to the team) and show a significant difference between virtual and physical teams. These verbal behaviours are: *professional challenging/stimulating teamwork (meeting 2), giving positive attention/showing personal interest (meeting 1), and sharing personal information (meeting 1*). For all of these three behaviours the mean rank is higher for virtual teams than for physical teams, which would mean that this study has the opposite result compared to the research of Branson, Clausen, and Sung (2008). However, this is only the result in *planning* and partly *refinement*. In the other meeting (*retrospective*), there is not a significant difference between virtual and physical teams for these verbal behaviours. This could be explained by the different objectives of the different meetings. In virtual teams, a lot of the team members often do not know each other yet (Grober and Baumöl, 2017). Branson, Clausen, and Sung (2008) did research on traditional teams and not on agile teams, which could explain the difference in the results of this study. Similarly, in the first agile meeting (planning) of virtual teams, everyone needs to get to know each other on a certain level, to see who can do what in the planning phase. This could explain why there is a high degree of *positive attention/showing personal interest and sharing personal information* for virtual teams in *meeting 1*.

According to Prommeger et al. (2019) the agile way of working shows a higher degree of organizational commitment, teamwork, and personal interest, which could be the reason that there is a significant difference between virtual and physical teams for *professional challenging/stimulating teamwork (meeting 2), giving positive attention/showing personal interest (meeting 1) and sharing personal information (meeting 1*). Besides this, Grober and Baumöl (2017) said that there has not been enough research yet on the performance of virtual teamwork to a sufficient degree. This could explain why professional *challenging/stimulating teamwork (meeting 1)* is higher for virtual teams and is not aligning with the research of Branson, Clausen, and Sung (2008).

Branson, Clausen, and Sung (2008) is not the only research that does not align with this study. Anawati and Craig (2006) argued that virtual teams show more abruptness and are less participating during discussion. These behaviours would overlap with the verbal behaviours: *governing/interrupting and showing disinteres*t. According to Anawati and Craig (2006) virtual teams would not be so strong in shaping the discussion. However, Table 3 tells a different story because there is not a significant difference between virtual and physical teams for these verbal behaviours in the three different meetings. According to this research, virtual teams show no more abruptness and disinterest than physical teams focusing on all the individuals in the three different meetings. This could also be explained by the agile way of working, because these characteristics were not mentioned in the description of an agile team before (Magpili and Pazos, 2018). Anawati and Craig (2006) did not use the agile way of working in their research, which could be the reason why the results of their research and this thesis differ.

There is only one verbal behaviour that is significantly different between virtual and physical teams *in meeting 2 and 3*, which is: *giving direction/long term*. Moe et al. (2010) discussed that giving direction is an essential behaviour used in an agile team. However, this does not give a clear link to virtual teams yet. Hunsaker et al. (2008) concluded that virtual teams are more likely to provide direction and specific future goals among team members. This could explain why virtual teams show the verbal behaviour: *giving direction/long term* more often than physical teams in these two meetings.

5.1.2. Task-and relationship-oriented

This thesis found that there is no significant difference between virtual and physical teams focusing on task-and relationship-oriented behaviours. Yoo and Alavi (2004) mentioned in their research that virtual teams compared to face-to-face teams focus more on leading and tasks, which leads to a task-oriented environment. However, Yoo and Alavi (2004) did not do research on agile teams, but on traditional teams, which could explain why there is no significant difference between virtual and physical teams

focusing on task-and relationship-oriented behaviours. Yoo and Alavi (2004) also did not do research on verbal behaviours specifically, but on behaviours in general, which could also explain the difference in results. Henkel et al. (2019) mentioned that a more relationship-oriented leadership behavioral style is implemented in the environment of physical agile teams. However, maintaining relationships within a virtual team is important to make sure that the team is performing well (Jawadi et al., 2013). In this way both virtual and physical teams focus on relationship-oriented behaviours. Comparing virtual and physical teams focusing on relationship-oriented behaviours could confirm part of the results of this second research question about task-and relationship-oriented behaviours.

5.1.3 Virtual and physical product owners

According to Matturro et al. (2015), a product owner within agile teams should have interpersonal skills and communication skills in physical teams. This means that a product owner should use the verbal behaviour: *sharing personal information* during meetings. This thesis found that there is a significant difference between virtual and physical product owners *for sharing personal information*. Virtual product owners showed this behaviour more often than physical product owners. This could be explained by the importance of personal interest within virtual teams (Nemiro, 2016). A virtual team, including the product owner, often spends more time on personal interests to get to know the other team members. Physical teams meet in person, which makes it easier to get to know the fellow team members. On the contrary, research from Bergiel et al., (2008) mentioned that virtual team members are dispersed, which makes it difficult to communicate directly and personally. In order to have the same atmosphere of physical team, the product owners could try to share more personal information. In physical teams this is mostly done by initial small talk. Bergiel et al. (2008) also do not include agile teams. Combining agile product owners and virtual teams, could be another reason why the verbal behaviour: *sharing personal information* is more common among virtual product owners in all meetings.

Virtual product owners show *verifying* and *giving direction/long term* more often in *meeting 1* than physical product owners, which could be explained by the difficulty of interpreting the body language online. Especially in the first meeting this would be difficult, because team members do not know each other yet and the way they react in certain situations. If a virtual product owner does not know for sure that a team member understands the message, verifying would be the solution. The verbal behaviour: *giving direction/long term* could be explained by the theory that virtual teams are more likely to provide specific future goals and direction among team members (Hunsaker et al., 2008). Particularly in the first meeting this is important, to make sure all the team members understand the goals for all the meetings. Discussing future goals in person is often easier to understand than online, because it is sometimes difficult to see the reaction of team members.

According to Bell and Kozlowski (2002) the shaping and development of team processes are often difficult for virtual team leaders. In *meeting 2* virtual product owners show more of the verbal behaviour *shaping the discussion* than physical product owners. As mentioned above virtual product owners need to guide and shape the discussion a bit more, because this is more difficult online than in person. In the last meeting virtual product owners scored higher for the verbal behaviours: *giving positive attention/being friendly* and *sharing personal information*. This could also be explained by the theory of Nemiro (2016), who mentioned that personal interest is important within virtual teams. This of course includes sharing personal information, but also being friendly towards fellow team members. In the last meeting it is also important that the product owner ends the last meeting with a positive environment and that every team members feels at ease.

5.2 Practical implications

The results of this thesis are beneficial and important also for practice because verbal behaviours within virtual and physical (agile) teams can impact managers and team members´ decisions as well as team dynamics. More specifically, because of the results of this thesis, managers that are planning to use the agile way of working now could have better insights into verbal behaviours within virtual and physical teams. By seeing a clear comparison between virtual and physical teams and seeing what the actual differences are, managers can choose which team members would match with being present in one of the three meetings for example (i.e. *sharing personal information* in a virtual meeting in the *planning* stage). Also, for team members, the results of this thesis can help with trying to understand which verbal behaviours are more present in a virtual team compared to physical teams or the other way around. Understanding which verbal behaviours are important in a specific meeting could help team members to focus on verbal behaviours that are the most important.

5.3 Limitations and future research

There are some limitations to this thesis that need to be discussed. One of these limitations is the small sample size of the team-level variables. For this thesis, nine physical teams and two virtual teams were analyzed. The sample size could have been bigger, but there was limited time to code the newly recorded videos. This is why this study was only able to use two virtual teams, which limited the variability of the data in virtual teams. However, the sample size was sufficient enough to carry out the analyses in this thesis. Also, there was a lot of missing data. A few meetings were not recorded and coded from specific teams, which made it difficult to compare the three different meetings. Future research could take more teams or meetings into account to see if there is a significantly different result in the outcome.

Furthermore, this thesis used the data of one specific large service organization within the Netherlands. Further research could use multiple service organization within the Netherlands or even outside the Netherlands to explore the outcome of this study a bit more. It could also be

interesting to focus on different cultures of service organizations in other countries for example.

Another interesting factor could be the duration of the verbal behaviours between virtual and physical teams. This study only focused on the frequency of these verbal behaviours, but if the duration of the verbal behaviours could be implemented in further research, the results could be explored even more.

6. CONCLUSION

The research question that has been explored in this thesis was: *What are the differences in regard to verbal behaviours of team members in virtual and physical agile team meetings?* Quantitative research has provided the answer to this question. 10 out of 22 verbal behaviours differ between virtual and physical teams divided across the three meetings. Hence, this thesis can say that there is a significant difference between virtual and physical teams.

Focusing on the three meetings, *planning* has the most differences between virtual and physical teams. This could be explained by the nature and objectives of the meetings. The differences between virtual and physical teams in the three meetings showed that there was not much overlap between the meetings. The only verbal behaviour that showed a significant difference between virtual and physical teams in two meetings is: *giving direction/long term*. In both meetings, virtual teams proved that they used this verbal behaviour more than physical teams. In the first meeting (*planning*) there was also a significant difference between virtual and physical teams focusing on *giving positive attention/showing personal interest* and *sharing personal information*. Virtual teams used these behaviours more than physical teams, which means that in the first meeting virtual teams tend to focus more on personal interests compared to the other meetings.

Based on this research it cannot be said that there is a difference between virtual and physical teams focusing on task-and relationship-oriented behaviours. However, there was a small difference between virtual and physical product owners. Virtual product owners are more likely to show the verbal behaviour: *sharing personal information* compared to physical product owners. In the first meeting, this was also the case between virtual and physical teams. Further research is needed to further explore the outcome of this thesis and to see if there is a difference in results with a larger data set.

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8. REFERENCES

Anawati, D., & Craig, A. (2006). Behavioral adaption within cross-cultural virtual teams. *IEEE Transactions on Professional Communication, 49*(1), 44-56.

Bell, B.S., & Kozlowski, S.W.J. (2002). A Typology of Virtual Teams. Implications for effective leadership. *Group & Organization Management, 27(1)*, 14-49.

Bergiel, B.J., Bergiel, E.B., Balsmeier, P.W., Nature of virtual teams: a summary of their advantages and disadvantages. *Management research news, 31*(2), 99-110.

Bergner, R. (2011). What is behavior? And so what? *New ideas in Psychology, 29*, 147-155.

Berry, G. R. (2011). Enhancing effectiveness on virtual teams. Understanding why traditional team skills are insufficient. *The Journal of Business Communication, 48*(2), 186-206.

Branson, L., Clausen, T.S., & Sung, C.H. (2008). Group Style Differences Between Virtual and F2F Teams. *American Journal of Business, 23*(1), 65-70.

Davis, G.F., & Sinha, A. (2021). Varieties of Uberization: How technology and institutions change the organization(s) of late capitalism. *Organization Theory*.

Dikert, K., Paasivaara, M., & Lassenius, C. (2016). Challenges and success factors for large-scale agile transformations: A systematic literature review. *Journal of Systems and Software, 119*, 87-108.

Gera, S. (2013). Virtual teams versus face to face teams: A review of literature. *IOSR Journal of Business and Management, 11*(2), 1-4.

Grober, B., Baumöl, U. (2017). Why virtual teams work – State of the art. Procedia. *Procedia Computer Science, 121*, 297-305.

Henkel, T. G., Marion, J. W., & Bourdeau, D. T. (2019). Project Manager Leadership Behavior: Task-Oriented Versus Relationship-Oriented. *Journal of Leadership Education, 18*(2).

Hoda, R., Noble J., & Marshall, S. (2013). Self-Organizing Roles on Agile Software

Development Teams. *IEEE Transactions on Software Engineering*, 39(3), 422-444.

Hoogeboom, M.A.M.G., Saeed, A., Noordzij, M.L., & Wilderom, C.P.M. (2021*).* Physiological arousal variability accompanying relations-oriented behaviors of effective leaders: Triangulating skin conductance, video-based behavior coding and perceived effectiveness. *The Leadership Quarterly, 32(6).*

Hunsaker, P.L., & Hunsaker, J.S. (2008). Virtual teams: a leader's guide. *Team Performance Management, 14*(1/2), 86-101

Jacobs, P., Schlatmann, B., & Mahadevan, D. (2017). ING's agile transformation. *McKinsey Quarterly.*

Jawadi, N., Daassi, M., Favier, M., Kalika, M. (2013). Relationship building in virtual teams: A leadership behavioral complexity perspective. *Human Systems Management, 32*, 199-211.

Johnson, R.B., Onwuegbuzie, A.J., & Turner, L.A. (2007). Towards a Definition of Mixed Methods Research. *Journal of Mixed Methods Research, 1*(2), 112-133.

Karl, K. A., Peluchette, J.V., & Aghakhani, N. (2021). Virtual Work Meetings During the COVID-19 Pandemic: The Good, Bad, and Ugly. *Small Group Research, 53*(3), 343-365.

Kerr, W.R., Gabrieli, F., Moloney, E. (2018). Transformation at ING (A): Agile. *Harvard Business School Press*, N9-818-077.

Lensges, M. L., Kloppenborg, T. J., Forte, F., (2018). Identifying Key Agile Behaviors That Enhance Traditional Project Management Methodology. *Journal of Strategic Innovation and Sustainability, 13*(2).

Magpili, N., C., Pazos, P. (2018). *Self-Managing Team Performance: A Systematic Review of Multilevel Input Factors.*

Matturro, G., Cordovés, F., Solari, M. (2015). The role of Product Owner from the practitioner's perspective. An exploratory study. *Software Engineering Research and Practise*.

Measey, P., & Radtac. (2015). Agile Foundations - Principles, Practices and Frameworks. *BCS The Chartered Institute for IT.*

Moe, N., B., Cruzes, D., S., Faegri, T., E., & Faugstad, J., E. (2016). Enabling knowledge sharing in agile virtual teams. *IEEE 11th International Conference on Global Software Engineering (ICGSE)*, 29-33.

Nemiro, J., E. (2016). Connection in Creative Virtual Teams. *Journal of Behavioral and Applied Management, 2(2),* 814

Prommegger, B., Huck-Fries, V., Wiesche, M., Krcmar., H. (2019). Agile and Attached: The Impact of Agile Practices on Agile Team Members' Affective Organisational Commitment. *Department of Informatics Munich*.

Raes, E., Boon, A., Kyndt, E., & Dochy, F. (2015). Measuring team learning behaviours through observing verbal team interaction. *Journal of Workplace Learning, 27*(7), 476-500.

Schulze, J., & Krumm, S. (2016). The "virtual team player": A review and initial model of knowledge, skills, abilities, and other characteristics for virtual collaboration. *Organizational Psychology Review, 7*(1), 66-95.

Seok Chai, D., & Park, S. (2022). The increased use of virtual teams during the Covid-19 pandemic: implications for psychological well-being. *Human Resource Development International, 25*(2), 199-218.

Skinner, B.F. (1989). Upon further reflection. *Behaviorism, 17*(1), 79-83

Sukamolson, S. (2007). Fundamentals of quantitative research. Language Institute, Chulalongkorn University, Bangkok, Thailand.

Sundin, K. (2010).Virtual Teams: Work/Life Challenges - Keeping Remote Employees Engaged. *CAHRS White Papers*.

Szabo, E., Reber, G., Weibler, J., Brodbeck, F.C., & Wunderer, R. (2001). Values and behavior orientation in leadership studies: reflections based on findings in three German-speaking countries. *The Leadership Quarterly, 12*(2), 219-244.

Whillans, A., Perlow, L., & Turek, A. (2021). Experimenting during the shift to virtual team work: Learnings from how teams adapted their activities during the COVID-19 pandemic. *Information and Organization, 31*(1).

Yoo, Y., Alavi, M. (2004). Emergent leadership in virtual teams: what do emergent leaders do? *Information and Organization, 14*(1), 27-58.

Yuki, G., Gordon, A., & Taber, T. (2002). Hierarchical Taxonomy of Leadership Behavior: Integrating a Half Century of Behavior Research. *Journal of Leadership and Organizational Studies, 9*(1), 15-32.

Zhao, E., Y., Thatcher, S., M., B., & Jehn, K., A. (2019). Investigating, engaging in, and managing group conflict: A review of the literature addressing the critical role of the leader in group conflict. *Academy of Management Annals, 13*(1).

Appendix Table 1: Outcome Mann-Whitney U tests and T-tests comparing virtual and physical teams.

	Meeting 1 (Planning)					Meeting 2 (Refinement)					Meeting 3 (Retrospective)				
	t (df)	*Z*	*p* -value	Mean rank/Mean (Virtual)	Mean rank/Mean (Physical)	*t (df)*	*Z*	*p* -value	Mean rank/Mean (Virtual)	Mean rank/Mean (Physical)	*t (df)*	*Z*	*p* -value	Mean rank/Mean (Virtual)	Mean rank/Mean (Physical)
Showing disinterest	-0.462 (34)		$p = 0.647$ (L)	-2,423	-2.317		-0.009	$p = 0.993$ (M)	30.53	30.49		-0.181	$p = 0.856$ (M)	26.47	27.21
Defending one's own position	-1.281(26)		$p = 0.212$ (L)	-2.874	-2.712		-0.812	$p = 0.417$ (M)	33.37	29.54		-0.302	$p = 0.763$ (M)	27.90	26.64
Giving negative feedback-constructive	-2.528 (9)		$\mathbf{p = 0.032}$ **(L)**	-2.956	-2.632		-0.841	$p = 0.400$ (M)	28.13	31.29		-0.174	$p = 0.862$ (M)	27.57	26.78
Disagreeing		-1.682	$p = 0.093$ (M)	23.50	35.03		-1.387	$p = 0.165$ (M)	25.40	32.20		-2.014	$\mathbf{p = 0.044}$ (M)	20.67	29.50
Agreeing		-0.529	$p = 0.597$ (M)	38.00	33.61		-1.166	$p = 0.244$ (M)	25.97	32.01		-0.458	$p = 0.647$ (M)	28.53	26.39
Governing/Correcting	-0.270 (12)		$p = 0.792$ (L)	-2.925	-2.887		-1.872	$p = 0.061$ (M)	36.53	28.49		-0.405	$p = 0.685$ (M)	26.07	27.37
Governing/Delegating		-0.422	$p = 0.673$ (M)	31.50	34.25		-0.611	$p = 0.541$ (M)	28.83	31.06		-0.117	$p = 0.907$ (M)	27.23	26.91
Governing/ Interrupting		-0.602	$p = 0.547$ (M)	38.50	33.56		-1.289	$p = 0.197$ (M)	35.50	28.83		-1.137	$p = 0.256$ (M)	23.27	28.47
Verifying		-8.113	$\mathbf{p < 0.001}$ **(M)**	64.50	31.00		-0.462	$p = 0.644$ (M)	28.70	31.10		-1.178	$p = 0.239$ (M)	23.07	28.55
Shaping the discussion		-1.923	$p = 0.054$ (M)	47.42	32.68		-0.667	$p = 0.505$ (M)	32.90	29.70		-0.374	$p = 0.708$ (M)	25.93	27.42
Informing with facts	-0.590 (60)		$p = 0.557$ (L)	-1.926	-1.815		-1.179	$p = 0.238$ (M)	25.90	32.03		-1.810	$p = 0.070$ (M)	20.93	29.39
Giving direction/Own opinion	0.085 (59)		$p = 0.933$ (L)	-1.966	-1.982		-0.214	$p = 0.831$ (M)	29.67	30.78		-2.155	$\mathbf{p = 0.031}$ (M)	19.77	29.86
Giving direction/Long term	-1.828 (5)		$p = 0.127$ (L)	-2.464	-2.801		-2.796	$\mathbf{p = 0.005}$ (M)	37.87	28.04		-3.045	$\mathbf{p = 0.002}$ (M)	34.53	24.03
Giving positive feedback	-1.434 (26)		$p = 0.163$ (L)	-2.409	-2.629		-0.571	$p = 0.568$ (M)	28.60	31.13		-1.279	$p = 0.201$ (M)	31.27	25.32
Professional challenging/Asking for ideas		-0.692	$p = 0.489$ (M)	37.83	33.62		-0.197	$p = 0.843$ (M)	31.10	30.30		-1.670	$p = 0.095$ (M)	22.87	28.63
Professional challenging/Stimulating teamwork	-0.517 (33)		$p = 0.609$ (L)	-2.754	-2.668		-2.472	$\mathbf{p = 0.013}$ (M)	38.47	27.84		-0.250	$p = 0.802$ (M)	26.30	27.28
Giving positive attention/Being friendly	-1.350 (18)		$p = 0.194$ (L)	-2.971	-2.797		-0.178	$p = 0.859$ (M)	30.00	30.67		-0.656	$p = 0.512$ (M)	28.80	26.29
Giving positive attention/Showing personal interest		-2.338	$\mathbf{p = 0.019}$ **(M)**	45.00	32.92		-1.734	$p = 0.083$ (M)	26.50	31.83		-0.511	$p = 0.610$ (M)	28.40	26.45
Humour	2.594 (48)		$\mathbf{p = 0.013}$ **(L)**	-2.018	-2.416	1.264 (43)		$p = 0.213$ (L)	-2.164	-2.309		-1.274	$p = 0.203$ (M)	31.27	25.32
Sharing personal information		-2.084	$\mathbf{p = 0.037}$ **(M)**	44.92	32.93		-1.856	$p = 0.063$ (M)	26.00	32.00		-1.059	$p = 0.290$ (M)	30.27	25.71
Active listening	0.409 (61)		$p = 0.684$ (L)	-1.209	-1.263	-0.603 (58)		$p = 0.549$ (T)	0.517	0.590	-0.604 (51)		$p = 0.548$ (T)	0.502	0.057
Focused task behavior	-1.409 (10)		$p = 0.217$ (L)	-2.545	-1.756		-6.008	$\mathbf{p < 0.001}$ (M)	48.73	24.42		-1.110	$p = 0.267$ (M)	23.43	28.41

M = Mann Whitney U test, L = T-test via LOG10

If $p < 0.05$ than there is a significant difference (boldfaced)

Appendix Table 2: Outcome Mann-Whitney U tests and T-tests comparing virtual and physical teams product owners

	Meeting 1 (Planning)					Meeting 2 (Refinement)					Meeting 3 (Retrospective)				
	t (df)	*Z*	*p* -value	Mean rank/Mean (Virtual)	Mean rank/Mean (Physical)	*t (df)*	*Z*	*p* -value	Mean rank/Mean (Virtual)	Mean rank/Mean (Physical)	*t (df)*	*Z*	*p* -value	Mean rank/Mean (Virtual)	Mean rank/Mean (Physical)
Showing disinterest		-0.697	$p = 0.485$ (M)	6.00	4.29		-0.632	$p = 0.527$ (M)	3.50	4.20		-0.492	$p = 0.623$ (M)	4.00	3.25
Defending one's own position		-1.429	$p = 0.153$ (M)	7.00	4.14	1.138 (1)		$p = 0.459$ (L)	-2.401	-3.045	-0.137 (1)		$p = 0.914$ (L)	-2.456	-2.754
Giving negative feedback-constructive		-1.429	$p = 0.153$ (M)	7.00	4.14		-1.581	$p = 0.114$ (M)	5.25	3.50	0.440 (2)		$p = 0.703$ (L)	-2.481	-2.625
Disagreeing		-1.118	$p = 0.264$ (M)	2.00	4.86	0.207 (3)		$p = 0.849$ (L)	-2.702	-2.810	0.850 (2)		$p = 0.485$ (L)	-2.331	-2.108
Agreeing	0.252 (6)		$p = 0.810$ (L)	-1.946	-2.085	-0.507 (3)		$p = 0.647$ (L)	-2.049	-1.830	0.825 (1.18)		$p = 0.558$ (L)	-1.632	-2.108
Governing/Correcting		-1.627	$p = 0.104$ (M)	8.00	4.00		-0.641	$p = 0.522$ (M)	4.75	3.70		0.000	$p = 1.000$ (M)	3.50	3.50
Governing/Delegating		-0.697	$p = 0.485$ (M)	6.00	4.29		-0.214	$p = 0.831$ (M)	4.25	3.90		-1.414	$p = 0.157$ (M)	4.50	3.00
Governing/ Interrupting	-1.771 (5)		$p = 0.137$ (L)	-2.673	-1.919		-0.195	$p = 0.845$ (M)	3.75	4.10		-0.926	$p = 0.355$ (M)	4.50	3.00
Verifying		-2.646	***p* = 0.008 (M)**	8.00	4.00	0.816 (3)		$p = 0.474$ (L)	-1.588	-1.761	1.296 (3)		$p = 0.286$ (L)	-1.686	-2.172
Shaping the discussion	1.894 (4)		$p = 0.131$ (L)	-1.164	-2.048	3.801 (3)		***p* = 0.032 (L)**	-1.459	-2.460		-1.476	$p = 0.140$ (M)	5.00	2.75
Informing with facts	-0.321 (6)		$p = 0.759$ (L)	-1.619	-1.483	0.745 (3)		$p = 0.510$ (L)	-1.423	-1.691	-0.667 (3.23)		$p = 0.544$ (L)	-2.393	-2.175
Giving direction/Own opinion	-0.081 (6)		$p = 0.938$ (L)	-1.606	-1.568	-0.109 (3)		$p = 0.920$ (L)	-1.379	-1.350	-0.590 (4)		$p = 0.587$ (L)	-1.981	-1.710
Giving direction/Long term		-2.646	***p* = 0.008 (M)**	8.00	4.00		-0.966	$p = 0.334$ (M)	5.00	3.60		0.000	$p = 1.000$ (M)	3.50	3.50
Giving positive feedback	0.949 (4)		$p = 0.396$ (L)	-2.004	-2.475		0.000	$p = 1.000$ (M)	4.00	4.00		-1.389	$p = 0.165$ (M)	5.00	2.75
Professional challenging/Asking for ideas	1.414 (3)		$p = 0.252$ (L)	-2.071	-2.588	1.574 (2)		$p = 0.256$ (L)	-2.048	-2.740		-0.822	$p = 0.411$ (M)	4.25	3.13
Professional challenging/Stimulating teamwork	-0.002 (4)		$p = 0.999$ (L)	-2.372	-2.371		-0.641	$p = 0.552$ (M)	4.75	3.70		-1.414	$p = 0.157$ (M)	4.50	3.00
Giving positive attention/Being friendly	-0.555 (3)		$p = 0.617$ (L)	-2.849	-2.624	5.268 (2)		$p = 0.200$ (L)	2.50	4.60		-1.967	***p* = 0.049 (M)**	5.50	2.50
Giving positive attention/Showing personal interest		-1.429	$p = 0.153$ (M)	7.00	4.14		-0.632	$p = 0.527$ (M)	3.50	4.20		-0.822	$p = 0.411$ (M)	4.25	3.13
Humour	1.483 (5)		$p = 0.198$ (L)	-1.808	-2.360	0.553 (2)		$p = 0.636$ (L)	-1.924	-2.197	1.591 (3.96)		$p = 0.188$ (L)	-1.872	-2.245
Sharing personal information		-1.750	$p = 0.080$ (M)	8.00	4.00		0.000	$p = 1.000$ (M)	4.00	4.00		-1.967	***p* = 0.049 (M)**	5.50	2.50
Active listening	0.509 (6)		$p = 0.629$ (L)	-0.852	-0.975	0.415 (3)		$p = 0.706$ (L)	-0.906	-0.993	0.170 (4)		$p = 0.873$ (L)	-1.164	-1.189
Focused task behavior		-1.429	$p = 0.153$ (M)	7.00	4.14		-0.483	$p = 0.629$ (M)	4.50	3.80	-0.479 (2)		$p = 0.679$ (L)	-2.807	-2.494

M = Mann Whitney U test, L = T-test via LOG10

If $p < 0.05$ than there is a significant difference (boldfaced)

Appendix Table 3: Outcome Mann-Whitney U tests and T-tests comparing virtual and physical product owners; All meetings together

	t (df)	*Z*	*p*-value	Mean rank/Mean (Virtual)	Mean rank/Mean (Physical)
Showing disinterest		-0.596	$p = 0.551$ (M)	6.00	4.71
Defending one's own position		-0.153	$p = 0.878$ (M)	5.25	4.93
Giving negative feedback-constructive		-1.604	$p = 0.109$ (M)	7.50	4.29
Disagreeing	0.765 (6)		$p = 0.474$ (L)	-2.691	-2.988
Agreeing	0.247 (7)		$p = 0.812$ (L)	-1.976	-2.071
Governing/Correcting		-0.641	$p = 0.521$ (M)	6.00	4.71
Governing/Delegating		-0.893	$p = 0.372$ (M)	6.50	4.57
Governing/ Interrupting	-1.171 (6)		$p = 0.286$ (L)	-2.339	-1.978
Verifying	0.961 (6)		$p = 0.374$ (L)	-1.899	-2.235
Shaping the discussion	0.537 (6)		$p = 0.610$ (L)	-2.019	-2.305
Informing with facts	-1.666 (7)		$p = 0.447$ (L)	-2.147	-1.589
Giving direction/Own opinion	-0.926 (7)		$p = 0.385$ (L)	-1.991	-1.597
Giving direction/Long term		-1.203	$p = 0.229$ (M)	6.50	4.57
Giving positive feedback		-1.171	$p = 0.242$ (M)	7.00	4.43
Professional challenging/Asking for ideas	0.460 (5)		$p = 0.664$ (L)	-2.672	-2.828
Professional challenging/Stimulating teamwork	-0.533 (5)		$p = 0.617$ (L)	-2.864	-2.654
Giving positive attention/Being friendly		-1.176	$p = 0.240$ (M)	7.00	4.43
Giving positive attention/Showing personal interest		-1.283	$p = 0.200$ (M)	7.00	4.43
Humour	1.361 (7)		$p = 0.216$ (L)	-1.983	-2.418
Sharing personal information		-2.141	**$p = 0.032$ (M)**	8.50	4.00
Active listening	-0.853 (7)		$p = 0.422$ (L)	-1.263	-1.059
Focused task behavior		-0.298	$p = 0.766$ (M)	5.50	4.86

M = Mann-Whitney U test, L = T-test via LOG10
If $p < 0.05$ than there is a significant difference (boldfaced)