

# HOW VIRTUAL ARE VIRTUAL TEAMS? REVIEW OF SELECTED DEFINITIONS AND MEASUREMENTS OF THE VIRTUALITY

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## **Abstract**

*People nowadays very often work from home or different business sites and can build teams of individuals based in many different locations, sometimes continents apart that have never met each other face to face but cooperate thanks to communication technologies. Such teams are known as virtual teams. It is rare to meet the teams that are not virtual at least to some extent (Kirkman & Mathieu, 2005). What is surprising is the fact that there is no agreement among researchers on how to define virtuality nor how to measure it. Because the phenomenon of virtual teams is very promising from both practical and theoretical perspectives, the aims of this article are following: to compare definitions of virtual teams, to check how virtuality was measured in selected empirical studies. Also, to present results of my empirical research on 206 individuals with two different measures of virtuality (distance between team members and a number of face-to-face meetings). In conclusions, virtuality as a feature of any team is presented, and researchers are encouraged to include virtuality dimension in the wider research on the teams.*

**Keywords:** virtual team, virtuality, virtualness, dispersed teams, team.

## **1. Introduction**

Virtual teams are prevalent forms of teams in modern organizations, as noted in 2000 by Maznevski and Chudoba, global virtual teams were almost unheard of a decade ago, but today they serve as a critical mechanism for integrating information, making decisions, and implementing actions around the world (Canney, Davison & Ward, 1999, after Maznevski & Chudoba, 2000). Virtual teams are very common in the modern organizations with 66% of multinational firms and 46% of all organizations declaring to use virtual teams (Minton-Eversole, 2012). With growing number of virtual teams in the business world, interest in this topic not only of practitioners but also of the researchers grew. Virtual teams' concept is a highly searched topic with over 500 000 hits on

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Google, 27 000 hits in Google Scholar and 4 000 hits in Web of Science for “virtual team” as of August 2016. Many recent studies whose authors prepared review of extensive literature, have stressed the fact that what is required is a research that will allow to understand the concept of virtuality as well as the more unified measurement and treatment of the construct which in turn would make cross-study comparisons possible (Gilson, Maynard, Young, Vartiainen & Hakonen, 2014).

Therefore, in reply to the suggestions of the cited authors, the aims of this publication are following:

- to compare definitions of virtual teams,
- to learn how virtuality has been measured in the selected empirical studies,
- to present results of my research with two different measures of virtuality.

In order to achieve the goals listed above, I have reviewed extensive literature on the subject as well as conducted my empirical research on 206 individuals to check whether different measures of the team’s virtuality indeed mattered when the relationship between identification with the team and team’s virtuality was assessed.

Authors try to define the concept of virtuality or virtualness (both terms will be used interchangeably) for over two decades now; many researchers have encouraged other authors to keep track of the previous findings and included them in latest work on the topic. Some of them (see, e.g., Foster, Abbey, Callow, Zu & Wilbon, 2015) have stated that this is not a case so far. In order to meet this expectation, I have aimed at a review of the latest literature on the team’s virtuality as well as virtuality’s measurement and have noticed a rich body of recent meta-analytical reviews as well as conceptual models summarizing the recent developments in the field (see, e.g., Ortiz de Guinea, Webster & Staples, 2012; Gibson, Huang, Kirkman & Shapiro, 2014; Foster et al., 2015). Consequently, rather than trying to review the findings of the authors from the past few decades of research, I have decided to focus on the critical analysis of the latest meta-analyses of the virtual teams’ literature. I have found support for my thesis that all the teams are virtual to some extent and virtuality should be a feature describing all the teams so that research on the team’s processes could be enriched with new findings. The selection of the definitions aimed at showing different perspectives in the past 20 years of the research on the topic based on the review of the highly cited and recent articles which describe conceptualization and measurement of virtuality.

## 2. Virtuality – selected definitions of the concept

Nonwithstanding numerous publications, the efforts to establish a clear definition of the virtuality and virtual team have not brought satisfactory results so far. Schweitzer and Duxbury (2010) argued that the term “virtuality” is notoriously ambiguous due to disagreements as to whether electronic communication, geographic dispersion, or other dimensions make a team more virtual. Instead, a universally accepted definition of team’s virtuality could have allowed researchers to conduct comparative and cumulative research. A review of the selected definitions of the virtuality starts with how the word “virtual” is being used, points at similarities in the frequently used definitions, presents virtuality as a variable and finally, compares the dimensions of the virtuality. What is worth noting in the beginning is that research on the virtuality in the work context also includes such concepts and research topics as “work at a distance” (Olson & Olson, 2000), “work discontinuities” (Chudoba, Wynn, Lu & Watson-Manheim, 2005), “telecommuting”, “working remotely”, and “dispersed teams” (O’Leary & Cummings, 2007).

Watson-Manheim, Chudoba, and Crowston (2002) noted that word “virtual“ is freely applied in diverse situations and meanings which may lead to two main issues. It makes comparisons of the results of different studies more challenging as well as it increases the risk to overlook earlier research that might be relevant (e.g., research results on the communities of practice, alliances, work districts). Therefore, there is a common agreement on the need to provide a clear understanding of what constitutes “virtual“ work environment.

Chudoba et al. (2005) provide some examples of the usage of the word “virtual“ depending on the institutional context:

- outsourcing key components of production,
- forming *ad hoc* teams from diverse locations to solve problems,
- working from home, satellite offices or on the road,
- *ad hoc* groups of professionals who team across the Internet around a common topic, e.g., communities of practice which evolved around software development (e.g. Linux).

Watson-Manheim et al. (2002) list cases when term “virtual“ is being used to identify diverse emergent work forms different from traditional work concept:

- “virtual worker“ could be a contingent or contract employee who is self-employed and has no dominant organizational affiliation but rather temporary relationships with multiple organizations,
- “virtual groups” could consist of inter-organizational relationships when employees of multiple organizations collaborate to develop a product, provide a service, or foster new legislation.

I believe that the word “virtual” as a description of the virtual team has different meanings that the ones listed above which are just evidences of how wide in scope and confusing the concept may be. The investigation of what constitutes a truly virtual team would continue with a review of the common definitions of the “virtuality” of a virtual team that is listed in Table 1.

**Table 1.** Selected definitions of the team’s virtuality and virtual team

<b>Definition</b>	<b>Authors</b>
Virtual teams are forms of organization that allows teams to be composed according to qualifications and expertise without limitations of time, space, and the costs and disruptions of relocation.	Geber (1995), after: Schweitzer & Duxbury (2010)
Groups of geographically and or organizationally dispersed co-workers that are assembled using combination of telecommunications and information technologies to accomplish an organizational task	Townsend, DeMarie & Hendrickson (1998) after: Bell & Kozlowski (2002)
Virtual teams, or groups of individuals who work together from different locations, perform interdependent tasks, share responsibility for outcomes, and rely on technology for much of their communications	Cohen & Gibson (2003)
Physical dispersion of team members is a defining element of virtualness only to the extent that it deters members from meeting face to face, or conversely if proximity encourages members to meet face to face	Fiol & O’Connor (2005)
<i>Either</i> geographic dispersion (i.e. not collocated, not working at the same location); <i>or</i> asynchronicity (i.e. members work at different times, either across different time zones or at the same location, but with different work hours/shifts) or both determine virtuality.	Schweitzer & Duxbury (2010)
Distributed teams are complex and multi-dimensional in terms of configuration and distance. Configuration refers to the arrangement of team members across sites while distance relates to aspects of team member separation.	Ocker, Huang, Benbunan-Fich & Hiltz (2011)
We argue that virtuality is the physical or geographic distance between team members when at work, which may be measured in units of distance or time. This conceptualization of virtuality captures the notion that people may have different work hours.	Foster et al., (2015)

**Source:** Author’s own selection as per publications whose authors are listed above.

Definition of virtual team coined by Geber (1995, after: Schweitzer & Duxbury, 2010) points at potential benefits related to a group of highly qualified individuals who can work together overcoming temporal, spatial and budget limitations. In a widely cited work of Bell and Kozlowski (2002), authors define virtual teams as a single, identifiable phenomenon, distinct from proximate teams and referred to the publication of Townsend, DeMarie

and Hendrickson (1998) who stressed two main characteristics of virtual teams: dispersion (both geographic and organizational) as well as usage of technologies in order to work together at common task. Even wider definition was presented by Cohen and Gibson (2003) who claim that four conditions are to be met in order to call a team virtual: authors repeat what previously cited researchers listed (team members should work in different locations and communicate through technologies), but also stress the fact that their tasks should be interdependent and responsibility for the results should be shared among team members.

Fiol and O'Connor (2005) identify physical dispersion with the possibility to meet team members face to face and claim that this is defining the feature of team's virtuality. Schweitzer and Duxbury (2010) after analysis of nineteen definitions of the virtual team observe that there are only two conditions that the teams must meet in order to be called a virtual one: geographic and temporal dispersion or both of them, authors do not mention the reliance on technology as a defining feature of the virtual teams. Ocker et al. (2011) put, even more, attention into the geographic dispersion as instead of using word "virtual," they instead talk about "dispersed" team and highlight the role of configuration as well as separation of team members.

Foster et al. (2015) analyzed 29 unique approaches to conceptualizations of virtuality in order to propose their own definition of virtuality. Authors decided to enrich the research of Hollenbeck, Beersma and Schouten (2012) who stated that instead of creating additional categorizations and taxonomies of the teams (e.g., virtual versus face-to-face), it would be more beneficial for the research community to identify the dimensions that underlie different team types. Based on the review of 42 team types described by other authors, Hollenbeck et al. (2012) identified three core dimensions that can characterize any team: skill differentiation, authority differentiation, and temporal stability. Foster et al. (2015) analyzed additional 27 texts published between 1995 and 2012 in the subfield of virtual team research and came to the conclusion that Hollenbeck's model does not encompass one more dimension that is crucial for virtual teams – distance. Authors stated that distance is the one, most frequently proposed, virtuality dimension which refers to the actual physical distance between team members when working—this distance may be measured in units of distance (e.g., feet or miles) or travel time (e.g., minutes, hours, or days).

As presented above, some researchers have focused on the group context such as geographical and temporal dispersion of the team members (e.g., Schweitzer & Duxbury, 2010), but others understood virtuality as the extent of technological support (e.g., Bell & Kozlowski, 2002). I believe that what is single unique characteristic of the team's virtuality is the distance between

team members, therefore, to me “virtual team” stands for a group of individuals who work together thanks to ICT no matter how far they are located from each other. Consequently, in my understanding we talk about team’s virtuality if employees cooperate through communication tools that allow skipping the physical distance between them.

### **3. Virtuality – a single- or multi-dimensional construct?**

Gibson et al. (2014) reviewed all research papers published between 2000 and 2013 and found out that out of 392 papers, 95% included more than one dimension of the virtuality with the majority of the publications defining virtuality as geographic dispersion, electronic dependence, and national or cultural diversity. However, even if the majority of the theoretical papers examining the virtual teams describe the multidimensional concept of virtuality, rarely in the empirical research authors operationalize virtuality using multiple dimensions with almost 90% of papers using one dimension only to operationalize virtuality.

Based on the review of 29 publications on virtuality definitions and dimensions, Foster et al. (2015) observed that only two studies presented virtuality as single dimension concept with Fiol and O’Connor (2005) arguing that virtuality is the extent of face-to-face contact among team members and Saunders and Ahuja (2006, after: Foster et al., 2015) proposing that virtuality is the extent of team member geographic distribution. The majority of authors argued that virtuality is multi-dimensional construct (and identified between two to six dimensions). The most commonly cited dimensions of virtuality were geographic or spatial distance, temporal or time differences, organizational differences, and cultural distance (Foster et al., 2015). I agree with authors that both organizational differences, as well as cultural distance, can also characterize proximate teams whose members meet face to face on a daily basis and as such do not constitute defining feature of virtual team. Foster et al. (2015) critically reviewed also other common dimensions of the virtual teams: use of technology, face-to-face interactions, and extent of multi-team membership. Authors believe that when it comes to the usage of technology-mediated communication or face to face interaction, they may also characterize proximate teams who can use technology to share results of work or organize a face-to-face meeting instead (Hinds & Mortensen, 2005) so should not be considered a distinguishing characteristics of virtuality. I disagree with authors since it is usually the high distance and lack of budget for travels that hinders the possibility of the team to meet face-to-face so as a consequence, for some of the virtual teams, meeting in person would not be an available option. As such, virtual team members would be forced

to communicate electronically. Foster et al. (2015) argue instead that the teams make media choices independently of the physical distance between team members. What the cited authors recommend is that virtuality will be redefined as simply the distance between team members at work (geographic dispersion) and be measured as a continuous variable.

In my view, virtuality is indeed multidimensional concept with key aspects describing team's processes such as the physical distance between team members as well as the extent of face-to-face interactions of the whole team. These two aspects are closely related to each other since limited face-to-face meetings usually occur due to the long distance between teammates as well as high costs of travel (in terms of organizational and personal efforts as well as financial burden for the organizations).

#### **4. Virtuality – a discrete or continuous variable?**

Debate whether virtuality is a continuous variable is still open (see e.g., Fiol & O'Connor, 2005) with some authors claiming that virtuality should be seen on a continuum (Bell & Kozlowski, 2002; Cohen & Gibson, 2003; Kirkman, Rosen, Tesluk & Gibson, 2003). Also, others claiming that virtuality should be presented as a dichotomy due to the non-linear differences between the teams whose members never meet face to face and hybrid teams that occasionally meet (Fiol & O'Connor, 2005). According to the authors, differences between the teams whose members never met in person and the teams that are co-located stem from the lack of possibility for informal interactions due to physical dispersion. Researchers mention a few examples of informal information exchange situations that could enrich team members relationships as they occur spontaneously: coffee machine, water dispenser, lunch or parking lot discussions that enhance the bonds between employees and can lead to the creation of more positive work atmosphere, higher trust, and stronger team identification.

The majority of existing studies indeed treat the virtualness as a dichotomy and not a continuum. However in organizational reality, most teams would fall between the two extremes (Griffith, Sawyer & Neale, 2003; Martins, Gilson & Maynard, 2004), with some team members being collocated, others working in different time zones, yet all interacting with each other thanks to ICTs.

Webster and Staples (2006, after: Foster et al., 2015) conducted an extensive review of empirical studies of geographically distributed teams (176 unique datasets) and found virtuality is most often captured as a discrete variable. Only 14 of the 176 studies actually measured virtuality or the distance among team members. Most studies compared co-located with distributed teams and suffered in terms of external validity.

In a meta-analysis of research on virtual teams, Ortiz de Guinea et al. (2012) observed that 63 out of 79 analyzed empirical studies captured virtualness as a discrete measure (comparing co-located and distributed teams usually in laboratory settings) and only 16 studies examined virtuality as a continuous variable.

Interesting are the results of the research on team's functioning that differ depending on the way in which virtualness was treated by the authors. Different results were observed when virtuality was treated as discrete, categorical variable (experiments with student groups or strong manipulations experiments) or continuous variable (in field conditions that allow analyzing longer-term employee teams using survey methodology). In studies with continuous measures of virtualness, the relationship between virtualness and task conflict is more negative (lower conflict for more virtual teams), the relationships with knowledge sharing and satisfaction are more positive, and there is no impact on performance. Ortiz de Guinea et al. (2012) mention that measuring virtualness as a categorical variable instead leads to a simplistic view that does not capture the reality of virtual work in a natural setting. Researchers also question the accuracy of the results of the studies when virtualness was understood as technology use and whose authors would compare distributed teams who used one tool (such as e-mail) with co-located teams that were equipped with no tools (Ortiz de Guinea et al., 2012). The researchers concluded that the present body of research on virtuality cannot be used to draw generalizable conclusions about the relationship between virtuality and its impact on team functioning or outcomes because of the way in which virtuality is operationalized in majority of the studies (as discrete variable).

Building on these conclusions, I am convinced that we can learn more about team's virtuality treated as the universal characteristic of any group of employees if we keep track of virtuality understood as a continuous variable with many teams falling not on the extremes but rather in between the scale that starts with "low virtuality" and ends with "highly virtual team."

## **5. Virtuality – measurements in selected empirical studies**

In order to learn how virtuality has been measured in empirical research, it might be useful to take a closer look at the operationalization of the virtuality index that was prepared by Chudoba et al. (2005) who received answers from 1269 Intel Corporation employees in a web-based survey that aimed at development of the measure of virtuality. This empirical study on the group of real employees (and not e.g., a student group) belongs to one of the unique researches as it operationalizes virtuality as a continuous variable with

18 questions assessing six different dimensions of the virtuality (so called discontinuities which present factors that contribute to a decrease in cohesion among the team). The details of the Virtuality Index are presented in Table 2 below.

**Table 2.** Virtuality Index with six discontinuities that characterize virtual teams

<b>Type of discontinuity</b>	<b>How it was assessed</b>
Geography	Work at home during normal business days. Work while traveling, for example, at airports or hotels. Collaborate with people in different sites or geographies. Collaborate with people you have never met face-to-face.
Time zone	Work extended days in order to communicate with remote team members. Collaborate with people in different time zones.
Culture	Collaborate with people who speak different native languages or dialects than your own. Collaborate with people from different cultural backgrounds.
Work practices	Work on projects that have changing team members. Work with teams that have different ways to track their work. Work with people that use different collaboration technologies and tools.
Organization	Collaborate with people from different Intel business groups. Work at different Intel sites. Have professional interactions with people outside Intel.
Technology	Work with people via Internet-based conferencing applications. Participate in real-time online discussions, such as chat or instant messaging. Meet with people via video-conferencing tools. Work with mobile devices.

**Source:** Chudoba et al. (2005).

Authors drawing from the virtual teams' literature have identified six discontinuities that capture distinctive aspects of the virtual teaming environment: geography, time zone, culture, work practices, organization, and technology. Each discontinuity was operationalized with few items that in turn were evaluated based on the frequency of the employee's experience (participants had following options to select from: 'daily', 'weekly', 'monthly', 'quarterly', 'yearly', and 'never'). Geography comes as the first dimension as this is most widely spread defining the feature of virtual teams which were created in order to allow the highly qualified people to work together regardless of their home locations. The next discontinuity is collaboration across multiple time zones which is a consequence of work with people from different geographic locations and may impact the way in which communication between team members takes place (synchronously or

asynchronously) depending on how many overlapping working hours between employees are available (if any), e.g., team members can spontaneously reach each other only for 2 hours if part of the team is located in Singapore and part of the team in Poland (6 hours of difference) assuming standard 8 hours long working day is considered. Third dimension that characterizes virtual team is cultural differences that may result from team members' cultural backgrounds. The cultural discontinuity according to authors plays an important role in virtual teams as communication is mediated through ICT and clearly, is linked to the other dimensions such as geography and time. Further discontinuity is work practices that encompass team members' different perspectives about how work should be done as well as differences in ICTs; common work practices would allow the team to work smoothly together. The fifth source of discontinuity is the organization which refers to employees being members of different organizations (interorganizational discontinuity) or different functional or business units (intra-organizational discontinuity) which may lead to the presence of dissimilar interests or priorities (e.g., local vs. global) among team members. The last discontinuity is technology that plays a crucial role in virtual team functioning that would not be possible without Information & Communication Technologies (ICT). Chudoba et al. (2005) asked participants about their experience with less common media such as conferencing application, instant messaging, or video-conferences.

As a result of the statistical analysis, authors observed only three discontinuities and eliminated four items from the original index due to redundancy, so that the final tool encompasses following dimensions of virtuality: team distribution (over different geographies and time zones, relying on basic collaboration technologies), workplace mobility (work in environments other than regular offices including different business sites, home, and travel routes) as well as the variety of practices (the degree to which employees experience cultural and work process diversity). What should be highlighted is the way in which the empirical study has been prepared and conducted which builds on the previous research body but at the same time aims at the creation of universally applicable new tool. A critical review of the six discontinuities originally identified by the authors would suggest that as much as geographical, temporal and technological are unique to the "virtual teams", other dimensions such as culture, organization, and work practice could also characterize proximate teams. It is interesting to learn that indeed only three discontinuities were identified in the group of Intel employees and it would be beneficial to learn how the tool was applied in different organizations.

Schweitzer and Duxbury (2010) instead in order to operationalize the dimensions of virtuality firstly ran a thorough analysis of the literature and identified four common dimensions of virtuality. Secondly, they have

conducted an empirical study of 107 team members of 30 virtual teams of Canadian technology sector company and applied three different dimensions of the virtuality. Table 3 below captures the dimensions of virtuality as well as the way in which virtuality was measured.

Table 3. The measurement of virtuality dimensions

<b>Dimension</b>	<b>Operationalization</b>
<i>Proportion of team work time spent working virtually (WV)</i>	1The number of weekly hours spent on work activities related to the particular VT. The number of weekly hours spent working <i>virtually</i> (i.e. not face-to-face) on work activities related to the VT.
<i>Proportion of member virtuality (MV)</i>	The total number of different member locations divided by the number of team members and multiplied by 100.
<i>Degree of separation [distance virtuality (DV)]</i>	The distance team members must travel in order to meet, allowing for the number of collocated team members, the number of locations and the distance between those locations

**Source:** Schweitzer and Duxbury (2010).

The first dimension illustrates the proportion of time that the virtual team members spent on the team’s activities working apart, not face-to-face (neither through meetings or the collocation of some of the members). The second dimension is the proportion of member virtuality which shows what is the split between team members who work in different locations, e.g., a team that is 100% dispersed would have no two members working in the same location. The third dimension is the geographic distance between team members (e.g., the spatial distance between members, or the amount of effort or travel time necessary to meet as a team). Authors operationalized it as the distance that team members must travel to meet, e.g., employees collocated in the same city can have inexpensive, impromptu meetings whereas employees that are very far away from each other in terms of the distance in kilometers or hours spent in the airplane would require much more time and money to meet face-to-face. Statistical analysis of the results showed that even if the items are theoretically related, they do not measure the same construct (see also O’Leary & Cummings, 2007; Gibson & Gibbs, 2006 for similar conclusions on differing dimensions).

## 6. Virtuality – measurement in my own study

As described in meta-analytical studies, a rich tradition of different ways in which team’s virtuality has been measured in empirical research exists (Carte, Chidambaram & Becker, 2006; Gibson & Gibbs, 2006; Ziguers, 2003). Also, identification with the team belongs to the common research topics

(Huettermann, Doering & Boerner, 2014) as it is considered a team's adhesive having an impact on the external and internal teamwork results. Identification understood as the emotional importance that team members assign to the fact that they are part of a given group (van der Vegt & Bunderson, 2005) plays an important role supporting cooperative team processes as well as reducing the dysfunctional team processes. I have assumed that the team's virtuality would matter in terms of team member's identification with the group: the less virtual the team, the stronger the identification due to the personal contact (face to face meetings and team member's proximity) and run empirical research in order to verify this hypothesis.

Considering that there are many different approaches to the team's virtuality related to the empirical research as well as theoretical recommendations. I have decided to include two simple and universally applicable measures of the team's virtuality in the empirical study: one related to the spatial distribution of the team members and the other one related to the actual number of face-to-face meetings of the whole team. The study was conducted on the group of 206 individuals (116 women and 90 men) who were asked to complete an online questionnaire with questions about various aspects of their current job; the survey was eligible only for people who work in a team, and as such e.g., freelancers' answers would not be considered. The invitations to participate in the study by completing a questionnaire were shared on social networking website, online portals for graduates of the university of economics as well as through emails sent by the author. All of the people who joined the study work in a team and thus could describe their experience as a team member. 84% of the participants were between 17 and 37 years old and majority of them were of Polish origins (77%).

Earlier research has shown that indeed the place of work or employee location rather than the real distance between the employees affects the perceived distance among the team members (O'Leary & Mortensen, 2010). So no matter if the team members are only a few kilometers far from each other but work in a different office, it may have the same effect on the team functioning as if they would be hundreds or thousands of kilometers apart if they do not share the working space. What is important from this perspective and may have impact on the team identity and building trust is the possibility of spontaneous meetings, water-dispenser or coffee machine chats that are allowed only for the collocated team members and are hardly substituted for by the informal chats or videoconferences. This dimension of the virtuality has been measured by the question: *How would you describe most of your team members' location having as a point of reference your place of work: same room/ same building/ different building in the same city/ different city/ different country* (modified version of the measurement used by O'Leary &

Cummings, 2007). From the frequency analysis, it seems that majority of the participants work within small physical distance from their teammates with around 75% of people indicating that they either work in the same room or the same building as most of their team members.

The second measurement of the virtuality employed in the study consists of a number of face-to-face meetings of the entire team since the research results so far have indicated that the frequent direct interactions between team members reduce the perceived distance between employees (Muethel, Gehrlein & Hoegl, 2012). The measurement used was based on the tool tested in the empirical study conducted by Kirkman et al. (2003) and allowed for quantitative analysis with one question only: *How many times did your entire team meet face-to-face in the past year?* There were no options to be selected as answers to this question, so e.g., for people who answered “every day” the number of meetings was coded as 365. Based on the average number of the face-to-face meetings of the entire team (95 per year), we can state that participants work in teams that are virtual only to some extent considering that the F2F meetings are rather frequent. Table 4 presents the number of face-to-face meetings depending on the location of employees.

**Table 4.** Number of face-to-face meetings of the entire team depending on the team members’ location

Location	Number of participants	Average number of F2F meetings
Same room	82	137.78
Same building	73	96.19
Same city	12	67.00
Different city	21	15.71
Different country	18	4.33
Total	206	94.82

In order to learn how the virtuality’s operationalization matters, I have compared the relationship between team’s virtuality and identification with the team. Indeed, results differ depending on the way in which virtuality is captured in my study: there are no statistically significant links between virtuality and identification when virtuality is measured as a distance between team members (virtuality understood as physical dispersion of the team) but correlations are statistically significant when virtuality is measured as a number of face-to-face meetings (virtuality reversely coded: the higher the number of the direct interactions of the whole team, the lower the virtuality). It occurred that in the latter case, the more face-to-face meetings took place, the stronger the team member’s identification with the team. This result translates into a negative link between team’s virtuality and identification with the group: the more virtual the team is, to the lesser extent team members would identify

with the group. What is interesting is that the relationship between virtuality (understood as number of face-to-face meetings) and social identification mattered only for women. When participants' sex was considered for detailed analysis, it occurred that the positive significant relationship between number of face-to-face meetings and identification exists only in the group of women and is insignificant for men. Clearly, female team members would identify more strongly with the team, depending on the frequency of the direct interactions with team members.

**Table 5.** Relationship between number of face-to-face meetings and social identification

	Social identifica- tion (all)	Social identifica- tion (women)	Social identifica- tion (men)
Number of F2F meeting	0.226(**)	0.283(**)	0.157
Number	206	116	90

\*\* Rho Spearman is significant at 0,01.

## 7. Discussion of the results

We can observe disconnection between theory and practice in the research on the virtuality. On one hand, the extensive body of theoretical studies presents virtuality as a continuous variable with multiple dimensions and encourages researchers to study the phenomenon of the virtual teams in their natural settings. On the other hand, researchers who conduct the empirical studies tend to present virtuality as a discrete variable (comparing virtual teams with proximate teams) and operationalize virtuality with one dimension only with heavy reliance on student projects and laboratory studies (Martins et al., 2004; Schweitzer & Duxbury, 2010). The discrepancy between what is recommended and what is actually done could stem from the practical challenges that researchers experience with the access to the real teams, budgets required for long-term studies in the organizations and difficulties to apply theoretical recommendations (e.g., such as very detailed instructions on how to assess the geographical distance between team members) in practice while keeping the research process efficient and easily replicable.

Considering the previous arguments on how much the way in which virtuality is operationalized matters and at the same time learning that only in limited empirical studies different operationalizations of the virtuality were implemented, I have decided to compare two different measurements of the virtuality. Both of them were very simple (consisted of one item) but captured virtuality in a dissimilar manner (either as the physical distance or number of

the face-to-face interactions between team members). What is worth stressing is the fact that the measurements used in my study could be used by many different organizations as they did not require any additional calculations from the author and assumed that the participant of the study who is a team member would be the best source of information about the team's virtuality. Furthermore, considering that the tools are universally applicable, it allows the researchers to use them in different contexts and thus makes comparisons across various groups possible which enriches the research and creates bridges between studies (as opposite to the gaps caused by the tools that are too much customized to the needs of the given study and as such are limited to one research only). What should be stated as a limitation of my empirical study are statistical proprieties of the different ways of operationalizations (with virtuality as the location being categorical variable and virtuality as some meetings being continuous variable) as well as a relatively small sample of participants that may have an impact on the results. Yet, the findings from my empirical research seem to be consistent with the literature – the method to measure the variable used in the study mattered as for the relationship between virtuality and identification with the group.

McGrath's definition of a team – “an entity that interacts, is interdependent, mutually aware, with the past and an anticipated future” (McGrath, 1984, p. 6, after: Griffith & Neale, 2001) at no point mentions that face team members should stay within a closer physical distance from each other or should have face-to-face contact in order to be called a team. McGrath stressed the fact of team members' interactions with each other and worked on the common goal which is a real defining feature of any team. Considering the developments of the technology in the recent few decades that allow people to cooperate across the distance; there is a purpose to talk about the new phenomenon. But, maybe instead of calling it virtual teams, we could discuss the virtuality of the modern teams.

Treating virtuality as a variable that can describe the context of each and every team can enrich research on team processes in terms of the team effectiveness models. Contextual factors impact team outcomes via direct, mediating, and/or moderating effects. Virtuality seen in a similar manner as team characteristics (for instance team size or teamwork skills) and organizational or environmental factors (e.g., trainings, rewards) in the description of the team processes can allow us to more fully understand and assess teams (Foster et al., 2015). Griffith and Neale (2001) came to similar conclusion suggesting that virtualness is just one of many characteristic features of a team and not the defining dimension of the “virtual team” so it should be considered in a similar way as, e.g., conflict management or diversity that affects team performance. Consequently, what I recommend instead of comparing two

(virtual and proximate) or three (virtual, proximate, and hybrid) categories of teams is to see virtuality (understood as reliance on the Information and Communication Technology that allows skipping the geographical and temporal distance between team members) as a continuous variable that can describe any team. I believe that the challenges with defining the virtuality or stating what are the differences between virtual and non-virtual teams are evidences that the virtual teams' field is not necessarily immature but it might be erroneous to talk about the virtual teams per se. Much of existing literature on virtual teams is indeed anecdotal and descriptive with much attention being given to the Anecdotal description of the characteristics, costs, benefits, and challenges of virtual teams have dominated the scientific discourse for the past few decades (Martins et al., 2004; Gibson & Gibbs, 2006). Instead, it might be more efficient to see virtuality as a dimension of any team that will allow to develop new theories, cumulate the knowledge on the team context and apply it to team research (Foster et al., 2015). Therefore, I encourage the future research to use simple, universally applicable tools to measure the virtuality of the teams that would enrich wider literature on the team functioning and reduce the need to decipher level of details and definitions split that is currently hindering the scientific debate. Adding virtuality to the contextual variables when conducting team research could help further theory development and integration of the research on both virtual teams and teams which allow for aggregation of results across studies and generation of cumulative knowledge in the subfield of virtual team studies.

## **8. Conclusions**

Organizations in the recent decades have implemented more changes related to the structure than in the past centuries as result of the advanced technology changes. As much as organizations are changing; so do employees and their work conditions. Two decades ago, working at a distance might have been a rare option for organizations and employees, yet currently “virtual work” belongs to rather common work arrangements (Herbsleb, 2007) Therefore, it might be beneficial not to ask whether a team is virtual but “how virtual is the team?” (Schweitzer & Duxbury, 2010, p. 275).

When it comes to the three aims of the article: to compare definitions of virtual teams, to learn how virtuality has been measured in the empirical studies, and to present results of my own research with two different measures of virtuality, I have come to the following conclusions. Firstly, majority of authors would define the team's virtuality as the distance (both geographic and temporal) between team members, but other would add reliance on the technology (that allows replacing the face-to-face contact) among team

members. I assume that it is primarily thanks to the developments of the ICTs that virtual teams are created and allow team members to skip the distance and replace face-to-face interactions. Secondly, based on the results of the meta-analytical studies, it was observed in theoretical research that although the virtuality was mainly presented as continuous and multi-dimensional variable, in majority of the empirical research, the virtuality was measured as a dichotomy and single dimension only. I have selected empirical studies (Chudoba et al., 2005; Schweitzer & Duxbury, 2010) whose authors did follow the theoretical recommendations and measured team's virtuality on the few different dimensions. Thirdly, in my own empirical study, I have operationalized virtuality as both the distance among team members (categorical variable) and the number of face-to-face meetings (continuous variable). Different measurements lead to different results with a significant relationship between the team member's identification with the team and virtuality only when a number of face-to-face meetings were considered: the stronger the identification with a group among female participants, the more frequently the whole team meets face-to-face.

In summary, I am convinced that it is reasonable to talk about the virtuality or dispersion of the team as a characteristic feature of any team. Also, a feature that can be displayed on the continuum, ranging from the teams whose members are all collocated and meet face to face regularly (not at all virtual/ not dispersed team) to the teams whose members all work in different locations and who have never meet in person (purely virtual team).

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## **Biographical note**

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