A Tool for Assessing User Experience
of Fit of a Virtual Workplace

Ursula Hyrkkänen[1]([✉]), Suvi Nenonen[2], and Carolyn Axtell[3]

[1] Turku University, Turku, Finland
`ursula.hyrkkanen@tuas.fi`
[2] Aalto University, Helsinki, Finland
[3] Sheffield University, Sheffield, UK

Abstract. The aim of this article is to formulate theoretical premises for a virtual workplace fit/misfit assessment tool as well as pilot the tool with a preliminary study. The theoretical basis lies in the environment-person fit theory applied in the field of worker-workspace relationship. The categories of Frequency, Atmosphere, Familiarity, Functionality, Narrative and Meaning of the place were developed and used for assessing the fit of a virtual workplace. The pilot research showed that the categories systematically sorted out the features of the virtual workplace in a way that might be useful for illustrating the differences of various virtual workplaces and thus assessing the fit of various virtual workplaces.

Keywords: Virtual workplace · Fit and misfit of virtual workplace · Person–environment fit theory · Worker – workspace relationship

1 Introduction

Working anytime and anywhere is a reality which will become more and more prevalent [1–3]. Mobile employees work many hours per week outside of the primary workplace and constantly use information and communication technologies for collaboration and have a requirement to be connected to shared resources for achieving joint goals [e.g. 4–6]. Because mobile work happens in ever-changing situations and bears the need to collaborate with other workers and customers, it expands the working environment as well as the need to master and control both many physical and virtual spaces used for work [5]. According to Bailey, Leonardi and Barley [7], virtuality occurs when digital representations stand for, or in some cases completely substitute, the physical objects, processes or people they represent. The virtual workplace provides connectivity through different sizes of devices and is accessed by different interfaces when supporting the performance of both individual and collaborative work activities [8].

However, the research considering virtual space as a working place is still rare. There is research connected to the performance of a virtual team [9, 10], the management of the virtual team [11, 12], and developing the virtual team processes [13]. But when talking about the virtual workplace, virtual workplace development or the management of it, the research is almost lacking or takes only the tools or interfaces into consideration. For example Popma [3] states that place-independent screen work

which is a characteristic feature of New Ways of Working (NewWoW) is more than the workstation. The environment around the station should also be taken into account when ensuring the healthiness and safety of work: behind the screen, there is a new world with its features and behavioral demands.

Whilst the contemporary literature shows that the most research concerning the fit between the person and the work environment has been approached from the psychosocial point of view [14] a growing number of studies on virtuality approach it from the technology- or system-oriented views [15]. In the technology-oriented approach, virtuality is usually measured as the amount, frequency and quality of ICT-mediated communication. In addition to technology, the system-oriented research takes into account the intra-group processes and work processes generating the need to collaborate virtually [16].

The interest of this article is to initiate the definition for virtual workplace fit and formulate a structure for virtual workplace fit assessment. The aim is to formulate theoretical premises for a virtual workplace assessment tool as well as pilot the idea with a preliminary study. The theoretical basis lies in the environment-person fit theory applied in the field of worker-workspace relationship [17–20]. In prior studies Hyrkkänen, Nenonen and Kojo [21], Hyrkkänen and Nenonen [22] have used Visher's [18, 19] model of fit or misfit in worker-workplace relationship and expanded it to also cover virtual work. The other premise of this article is in the field of assessing user experiences of workplace and especially in the studies where Diller's et al. [23] classification for workplace assessment has been modified and modelled to six dimensions of workplace experience assessment [24, 25].

The article will proceed as follows. The background section will present the prior research where Vischer's model of a three-level assessment of fit and misfit of workplace has been modified for virtual workplace assessment as well as Diller's et al. classification modified for assessing experiences of the workplace. Section three deals with the methodology. Section four deals with the piloting and the results. The final section includes the conclusions, the limitations of this research and suggestions for future steps for enhancing the assessment of virtual workplace fit or misfit.

2 Background

The Person–Environment (PE) fit theory states that fit or compatibility between an individual and work environment occurs when their characteristics are well matched. The match i.e. fit has alternatively been conceptualized as equilibrium between needs and satisfaction or between demands and abilities [26]. The fit may be complementary or supplementary. The PE theory asserts that the fit between individual characteristics such as needs, abilities and values and environmental characteristics such as job supplies, job demands and organizational values affect employees' attitudes and behaviors such as satisfaction, commitment and turnover [14].

Based on the ideas of PE fit, Vischer [17–20] has formulated a model of worker–workspace relationship according to which the elements in the physical workspace can affect fit or misfit between a person and the environment at work. In her studies, fit or misfit is the cause of the relationship between the physical environment and users'

needs, or in the demands which environment places on users. When the environment sets inappropriate or excessive demands to users, in spite of their adaptation and adjustment behaviours, it manifests the concept of misfit. In a good fit there is a balance between a person's abilities, skills, degree of control and decision latitude and the work environment's demands, complexity, expectations and challenges. The nature of person–environment transactions arouses the sensation of either comfort or stress. Comfort may be considered as the fit of the user to the environment in the context of work [17, 18, 27]. The fit or misfit which originates from the transaction between an employee and her/his work environment can be observed from three different levels, i.e. physical, functional and psychological [17–20]. Physical comfort of physical space includes basic human needs such as safety, hygiene and accessibility. Functional comfort is defined in terms of support for users' performance in work-related tasks and activities. Psychological comfort contains feelings of belonging, ownership and control over workspace.

Hyrkkänen, Nenonen and Kojo [21, 22], expanded Visher's model of fit or misfit to cover also virtual work and explored the elements of the virtual workplace that either hinder or enable productive mobile virtual work [22]. Physical fit consisted of physical features of ICT tools and applications for the virtual work as well as the physical places where the virtual work was executed, including ergonomics. Physical fit was also determined from the appropriateness of the virtual place to the human sensory system. The functional fit consisted of connectivity issues such as the availability, speed and functionality of the internet connection. Hyrkkänen et al. [21, 22] concluded that the substantial threshold of virtual work lies at the functional fit level. The work of an employee stops completely if the worker has connectivity problems, i.e. problems at the functional level. The discourse concerning the psychosocial fit of virtual places dealt with the concepts of territoriality, privacy and control. Territoriality was related to the need of belonging and the proper selection of interactive communication tools and channels. The need of privacy was challenged with dual and multi-presence demands arising from simultaneous use of many virtual places as well as also physically being in some social space. Need of control emerged from the demand of being continuously virtually available. The fit at the psychosocial level was found to be a mixture of physical and virtual worlds [21].

Nenonen and Kojo [24, 25] modified and tested a framework for assessing the user experience of workplace through abductive reasoning of Diller's et al. (2005) classification of experience. The developed model was aimed as a physical workplace assessment tool and it has six dimensions: the frequency, atmosphere, familiarity, functionality, narrative and meaning of the place.

According to the researchers, the frequency experience of a place refers to activities happening at a certain rhythm and tempo in the place [24]. The dimension of the frequency of the place is connected with the use of time, sense of time and rhythm of time in the place. The atmosphere is related to how the solutions fit and affect humansenses, e.g. seeing and different cognitive symbols (such as signs) relate to this dimension [24]. The dimension of familiarity [24] of the place refers to the ease of use of the place and how to learn to use the place. The dimension of the functionality [24] of the place indicates how the place supports the activities and the performance. The dimension of narrative [24] of the place means the constancy and coherency of the

story of the place, e.g. identity, brand and purpose of the place. The dimension of meaning [24] expresses the significance of the place for its users. It relates to tangible and intangible values as part of the place experience, e.g. ownership. Nenonen and Kojo [24] conclude that the six dimensions of experience of place can be clustered according to Vischer's [18–20] model of physical, functional and psychological levels of fit or misfit of the working place, as in Table 1. Frequency and atmosphere can be used for assessing the physical features of the place; familiarity and functionality for studying the functional features of the place, and the dimensions of narrative and meaning for assessing the psychosocial features of the place.

Table 1. Clustered dimensions of the experience of place (mod. Nenonen & Kojo 2013)

Experiences related to physical features of the place	Experiences related to functional features of the place	Experiences related to psychosocial features of the place
Frequency	Familiarity	Narrative
Atmosphere	Functionality	Meaning

In this study the clustered themes combining the theories of fit and physical workplace experience assessment were modified as categories for assessing the virtual workplace fit or misfit. Further the formulated themes were tested against the interview data concerning virtual meeting in virtual settings.

3   Method

Because the aim was to develop a framework and structure of themes for virtual workplace fit assessment a constructive study was used as a methodological frame for this preliminary case study [28]. The case study was commenced as an iterative process between empirical interview data and the selected theory bases of PE-fit as well as Diller's classification of user experiences.

The experience category related themes for virtual work place assessment were developed based on the above-mentioned theories and results of prior studies [21, 22, 24] in focus group sessions. The participants of the three focus group sessions represented researchers from ICT science, constructed environment science, facility management science, work and organisational psychology and ergonomics.

For testing the developed frame semi-structured interview data was gathered. Because user experience is a holistic and all-encompassing concept including the user, the product and the contexts of use [30], the interviews (N=10) were carried in the physical workplace of each interviewee while she/he was working in the virtual workplace, i.e. when she/he used the programme and the virtual meeting place for collaboration. The interviewees were selected purposively. They all worked either in international R&D projects or arranged international eLearning sessions and used the same software meant for a Web conferencing platform for Web meetings, eLearning, and webinars. The platform allows creating, customising and branding digital meetings

according to you or your organisation's needs. With the software it is possible to securely store files, documents, layouts and notes in a consistent manner. eLearning sessions may be conducted in virtual classes across devices. In webinars it is possible to communicate a message with, for example, dynamic multimedia content, social media integration and real-time engagement monitoring. The interviewees used the programme and virtual space for conducting meetings or collaborative eLearning sessions and had prepared the virtual place as a meeting or learning room (Table 2).

Table 2. Themes used for coding

	Experience category	Themes	Example
Physical	Frequency	Use of time, sense of time and time in the place.	*When there is a discursive lecture where the participants can chat, write and ask questions all the time, there are so many things you must constantly be aware of that you become exhausted after 60 min.*
	Atmosphere	Sense-experience of the place, sight, hearing and also cognitive symbols.	*If there are many participants, your voice easily starts to echo. That quickly makes you feel nervous and annoyed. On the other hand, people are somehow a bit reserved here because they know that there are buzzing microphones…*
Functional	Familiarity	Ease of entering and using the place.	*I gave instructions on the functions of the meeting application, about how to behave, what is allowed and what you should not do. Then I gave them time to try out things on their own. Still they were nervous about coming here…*
	Functionality	Ease of operating in the place for achieving the purposes of the session.	*You can also share presentations and documents. This means that when somebody has prepared a paper, you can view it through here. We can discuss a paper, but we cannot actually work on it here together.*

(Continued)

Table 2. (*Continued*)

	Experience category	Themes	Example
Psychosocial	Narrative	Story of the identity, brand and purpose of the place.	*I do not long for organisation symbols. It is in line with constructivism that when people are globally present in a workspace in different countries, the more familiar the workspace appears, the better people will adapt to it.*
	Meaning	Significance and meaning through belonging, ownership, control and privacy	*When using the system, you somehow feel that everybody is working together in the same space. The time when you come together is devoted to shared work. I think it is important in that sense.*

The interviews were recorded, transcribed and encoded according to six dimensions with the help of the AtlasTi programme. Accordingly the categories and category-related themes were further shaped and the examples for guiding the interpretation were derived (see examples taken from the transcribed texts). Then the focused coding was then used to extract passages related to these six main themes. The coding was an iterative process between the two researchers in order to increase validity.

4   Outcomes

4.1   Frequency of the Usage of the Place Was Short, Intended and Scheduled

The interviewees arranged either a meeting or learning sessions in the virtual meeting room. The frequency they used the place for varied from weekly to once a month. All the interviewees had used the tools and the virtual meeting programme for at least two years.

The use was characterised as intended, planned and scheduled carefully before-hand. The virtual meeting or learning place was not used unsystematically, such as asking for help for an acute or sudden problem. The preparation phase before the session was done thoroughly and for that reason it was time-consuming (several hours, even days).

The actual session was then straightforward, intense and brief. The interviewees described the rhythm of the virtual workplace as hasty and filled with no nonsense issues. Compared with face to face meetings there were no normal minor breaks

caused, for example, by normal body motions. The rhythm of the meetings and learning sessions was altered also due to a minor amount of non-verbal communication. The lack of non-verbal communication and dominance of verbal official communication gave the impression of formality. Due to the intense character of the session, the leaders explained that time felt long and they felt nervous when there was too long a silence or they had to wait for somebody writing a comment. They also had to remind other participants to take it easy when there were activities other than talking going on.

All the interviewees thought that they had to concentrate on the virtual meetings in a way that exhausted them in an hour. So for that reason also the meetings or learning sessions lasted typically no longer than an hour. They also explained that the nature of the virtual session was fact-oriented and as they had prepared it carefully, the hour was enough to meet fact-oriented goals. There were no normal breaks caused by informal communication—or they were very minor, normally at the beginning or at the end of the session. After the meeting, the leaders also spent some time in the virtual place arranging, saving and sending documents and other meeting or learning material to participants. Others had then already left the place.

4.2 The Atmosphere of the Place Based on Official Grey Rectangles and Texts

The layout of the place is divided into rectangles, where there is a space for video which participants send (mainly a video of the participant's face), a place for shared documents (e.g. slides), a board for notes and shared ideas and plans and a space for chat. The layout can be modified according to the needs of the session or according to the preferences of the leader or the participants. During the meeting participants could talk, make notes, chat, raise a hand to take the floor and different polling activities could also be organised.

The pertinence was a dominant feature whereby the interviewees described the physical characteristics of the virtual meeting or learning place. A grey background colour, rectangles for different activities and functions and only minor marks illustrating the organisation moulded the feeling in the space as business-like. Some of the interviewees were satisfied with the simplified, even dull, official look of the place. They respected the simple look so as not to get one's interest in unnecessary secondary matters. A plane look was preferred because it does not cause visual interruptions.

The interviewees could see the texts and fonts properly. The problem with the view was in perceiving simultaneous and different functions taking place in the multiple rectangles on the screen (e.g. simultaneous chat and sharing notes going on and you have also to act as a moderator). The audio-talking connections sometimes acted up and that was a substantial problem, which even hindered participation in the session.

Sharing the facial video picture was considered important—a shared face manifested active involvement in the meeting or learning session. If somebody was not sending video, other participants felt that she/he was not actively in attendance and sometimes she/he was thought to be even disrespecting the meeting. However, sending facial video overloaded the connection and caused disturbances. The facial video helped participants read a little non-verbal communication. Mainly, however, they used it to determine who was willing to talk next.

The leaders advised the participants to use the hand raising function when asking to address the meeting, especially when there tended to be an echo due to multiple talking connections. They then instruct participants to mute the line and after raising a hand turn the line on for talking. However, muting the line if not talking changed the atmosphere of the place. Interviewees thought that it was more difficult to reach the feeling of shared space because of not hearing others, such as "hmmm" – sighs for approval or encouragement for the speaker.

The interviewees described situations where one cannot get rid of one's physical existence. Some of them felt that they could not sit still for a long time and they preferred to move when they were talking. A wireless headset allows movement during a meeting, but then you have to send only a still picture of your face. Problems with following, for example, shared documents also arose. These problems affected the atmosphere.

4.3   Familiarity of the Place as the Responsibility of the Other Participants

Those interviewed quite frequently used the virtual meeting or learning space. The leaders of meetings or learning sessions felt that the virtual working place was easy to access, but they had to struggle to teach other attendees to use the place as well as to behave in the place. The interviewees worked a lot beforehand and after the meetings or learning sessions. Before the session, they ensured that the participants had proper devices (e.g. headsets) and that the participants knew how to enter the meeting room and how to use the programme properly during the meeting. They informed the participants on how to test entering and participating actions and provided help for them, if they had difficulties or questions. After the virtual session, they took care of the notes and delivered them to participants. Often the interviewees felt stress before and during the sessions, because they had to be able to quickly react to whatever kind of problem came up.

The interviewees criticised the unfamiliar symbols used in the drag down menus of the space. For adding familiarity, the need for standardised symbols was expressed. The interviewees also found fault with the programme for not giving enough instructions on how to use it.

4.4   The Functionality of the Place was Threatened by a Lack of IT Support

The meeting or learning room was a place for sharing information as well as for checking and agreeing that the work is in progress. It was not used for collaborative developmental work or sketching out ideas.

It is possible to modify the layout of the place according to, for example, the preferences of the leader, the needs or aims of the session or the wishes of the participants. The interviewees, however, had made only minor modifications, mainly with the places of rectangles for different activities.

The interviewees were able to build up the meeting or learning session – they knew how to bring documents to a meeting, they were able to start sharing the voice and

video, they were able to make minor repairs with the connections during the meeting and they could save the meeting or learning documents as well as the whole session to the programme for later views. However, they felt bad ICT support to be the main threat to functionality. Due to distributed and global work or eLearning, the session times did not follow office hours and it was not possible to get any help. The interviewees felt tense from the expectation to manage the tools, the programme and the virtual space by themselves. Multiple demands to be able to prepare the virtual session, check the functioning of the tools, the programme, find the best layout, etc., and solve the problems occurring during the meeting stressed the users a lot. All of the interviewees expressed the need for virtual place management.

4.5   The Narrative of the Place Represented the Software not the Organisation

The interviewees arranged the virtual room layout and, for example, the documents and pictures needed for the windows of the place beforehand. The shared documents reflected the meaning of the place for the participants: it was for meeting or learning. The official preparation duties took so much time from the leaders that they seldom thought about the narrative nature of the place. Only a tiny and unnoticeable logo was communicating about the organisation. Because of the international character of the sessions, the interviewees felt the neutral look was good.

However, advantage was taken of infiltrating features from the physical place to the virtual place. Because of the simple and official look of the virtual place, the interviewees used the signs from the physical place for moulding the atmosphere of the session and the narrative of the meeting or learning room. They might have a cup of coffee in the meeting for signalling the informality and intimacy of the session. They took notice of how they were dressed and what was seen in the background of the shared video, they used tried to highlight the culture of the town or country or identify the features of season. They also struggled with placing the camera in such a way that it would mediate the feeling of talking face to face and meet other participants' eyes.

4.6   Meaning of the Place Mediated Equal Belonging Over the Meeting Span

The value and meaning of the place related strongly to the distributed working or learning mode. Because there were only rare opportunities for face to face meetings, the virtual meeting place was really needed for achieving the goals set for the joint project or learning. The meeting room was a place for checking and agreeing that the work was in progress. After checking and commenting on the work, the reconstructions and reforms were done in the "physical world". The concept of meaning is further analysed through the concepts of belonging, control and privacy.

The virtual place was not used for adding the feeling of belonging. However, the way the attendees were joined to the meeting showed the belonging to the project or learning group: the invited got the address beforehand and they had to sign in with their

names—and the leader accepted them as participants in the session. The place was not meant for outsiders. Belonging lasted for the session time, but also the stored materials —which may be used beforehand—highlighted the feeling of belonging to the group.

In spite of the feeling of equality, the host had control over the place and this was pointed out by minor signs in the place. The host might, after some consideration, give rights to other attendees to control the place. Assignment of the place to other participants was made interim.

In this software, there were no private virtual rooms for participants—the place and its areas were shared. If they wanted to, for example, make private notes, they had to simultaneously use other software. However, in a broader sense, the interviewees executed the need for privacy during the meeting by muting the microphone and camera and escaping from the screen to, for example, get some coffee from the kitchen. Privacy was found in the physical environment.

Table 3. Summary of experiences of a virtual workplace and factors of fit in each category

The comfort and fit of the workplace	Experience category	Experience of the virtual workplace	Fit of the examined virtual workplace
Physical	Frequency	Verbalism shapes the time brief.	Brief sessions
	Atmosphere	Shared texts shape the atmosphere official.	Official sessions
Functionality	Familiarity	Familiarity is host-related.	Competent host
	Functionality	Functionality is help- and support-related.	Support available
Psychosocial	Narrative	Stick to issues in international sessions. Narratives of physical places in background	Pertinence in international collaboration, point in affairs.
	Meaning	A shared place for checking and agreeing for defined group	Distant belonging to project or learning group

5   Conclusions

By categorizing the experiences according to the six-dimensional model, it is possible to show the differences and idiosyncrasies of virtual workplaces provided by different software. In Table 3, there is a summary of the experiences related to the virtual meeting and learning place created by the assessment selected software. The table shows the experience categories, the tense experience of the virtual place and the main ensemble illustrating the experience of fit. Physical environment-related experiences were frequency and atmosphere [24]. The examined software provided the virtual place, which emphasized the short time frequency of the use of the place and the official atmosphere in the place. Familiarity was very much dependent on the abilities of the host for the session. Her/his duty was to familiarize the other participants with

the place and direct the behavior of others in the place. The possibility to get ICT support affected greatly the experiences of functionality of the place. Psychosocial features that characterized the virtual place were multifaceted. The main and, from interview to interview, repetitive factor of the narrative of the place was the minor indications of the host organization communicating to the international participants "keep to the issues, stick to the point". The factor of the meaning of the place highlighted the equality of the international participants in the virtual place. During the meeting or learning session, the place was equally owned although the host had the main responsibility for ensuring that everything was proceeding smoothly during the meeting. So the place was mainly permitted and controlled by the host. The place was used for checking and agreeing that the work was progressing with those belonging to the group.

So it can be concluded that this software provided the virtual workplace with a fit for brief and official sessions, if the host is competent and if there is ICT support available. The virtual room encouraged participants to stick to the point and showed them that they belong to a group, which had to meet the objectives of learning and developing.

Limitations and suggestions for future research. The categories systematically sorted out the features of the virtual workplace in a way that might be useful for illustrating the differences of various virtual workplaces. However, in this study the categories and their descriptions were tested only using one software programme provided for the virtual workplace. There is a need to gain more test-based information and knowledge with different virtual places for ensuring the validity of the categorization [see 30]. Only after analyzing many different virtual workplaces by using the categories will it be possible to judge the validity and power of the categories.

Because this study was the first pilot, there is work to do in ensuring and validating the categories of the used model. From this research perspective the names and the spheres of each category of the used model [24, 25] should be further developed and studied for ensuring the concept validity of each category [e.g. 31]. As the ergonomic demands of the physical workplace are well known, there is a need to gain understanding and development of the ergonomics of the virtual workplace. Structured outcomes of user experiences in virtual workplaces are needed and may be used as first steps in developing the ergonomics of virtual places as well as the competencies of self-management.

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