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The New "Covid-19" Home Office Worker: Evolving Computer-Human Interactions and the Perceived Value of Workplace Technology

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Abstract. The context for this paper is the ongoing Covid-19 Global Pandemic and the guidance from the majority of nation-state governments for all central office based type workers to completely shift to working from home, advice which business and organisations adopted. Recent European research has established that 85% [1] of knowledge workers up to the Covid-19 Pandemic worked 80% or more of their time in a central office environment. Suddenly these office workers had to relocate their work into their homes without any opportunities for their employers to plan this move. Part of the challenge was access to the right technology. This problem was quickly resolved by the purchase of the relevant technology but not necessarily the new human-computer interaction mode. The focus of the field research was to assess the evolving human-computer of the office-based worker before the Covid-19 Pandemic. The paper has two intended outcomes. First, to provide short term insights to better understand the impact of rapid change of physical and technology-centric workspaces, due to Covid-19 on user behaviours and experience. Second to use the research to deliver better user experience design and collaboration and how technologies such Augmented Reality could enhance that experience.

Keywords. User Behaviour Analysis, Covid-19 Home Working, Human-Computer Interaction and Covid-19, Home Office Collaboration And Interaction Design, 3D Immersive Workspaces.

1.Introduction

The nature of the workforce and workplace is complex and highly dynamic where there has been very little research that examines specifically the impact of the physical space on the individual knowledge worker [2].

Researchers have undertaken Dephi [3] and PRISMA lead research [4] analysing hundreds of existing related publications, papers and industry reports to digest down to critical thematic narratives and conclusions. The same study [4] established that the focus for assessing workplace productivity and worker efficiency came from researchers in the fields of psychology 34%, architecture 33%, management 10%, real estate 8%, engineering 7%, building physics 8%, health 4%.

Additionally, other systematic research reviews [2] find there are a gap and lack of research on productivity measurement in the knowledge worker areas certainly over the last ten years with a focus mainly on technology in the workplace with little in-depth analysis flowing out of initial studies [5].

Finally to today given the continuously evolving nature of today's workplaces with most of all traditional office workers now working from home, a direct consequence of the ongoing Covid-19 global pandemic, there is an even more significant gap in research. The research presented here is one stage of a broader trans-disciplinarian longitudinal study on the impact of physical space on knowledge workers.

The specific contextual lens this element of the longitudinal research study being the very recent and rapid change in workplace environments due to Covid-19 resulting in a complete shift to working from home and impact upon the perceived importance of technology and the changing Human-Computer Interaction implications for the future.

1.1. Why is this so important now?

Workforce productivity reported only a 1-2% increase in in the United States labour force during the whole Tech Boom 2005-2015 [6]. A new approach and insight are needed to understand how to develop human potential and productivity in a tech-saturated world we live in today.

In Europe the workplace what is referred to in the media as the workplace of the future is increasingly discussed as being of significant economic and cultural importance with the European Commission setting future strategic development goals relating to the future of work [7] which only has further increased as a result of the Covid-19 Pandemic.

The World Economic Forum recently increased their research focus into remote working after establishing that 98% [8] of people surveyed said they would like the option to work remotely in their own chosen workspace for the rest of their careers.

1.2. The Questions to be answered?

This paper sets out to address three questions. The three questions posed are to enable future research, and new approaches beyond the Covid-19 pandemic in terms of the evolved natured of Human-Computer Interaction throughout 2020. The three questions are

1. When an individual office worker is removed from a familiar centralised office environment quickly and for an indefinite period, how does this affect their perceived level of personal worker productivity?
2. How have workers attitudes to workplace technology evolved, if at all since the onset of the Covid-19 Pandemic restrictions in European (March 2020)?
3. How can emerging technologies help enable the worker to at least have the same/more perceived levels of human-computer interaction?

1.3. Why is this research Novel?

This moment in global history, given the rapid and enforced manner where centralised office knowledge workers have had to pivot to working 100% of the time from their homes. This research provides a unique research opportunity to test the impact of this shift to an entirely distributed workforce. The focus of this research paper is that of the evolving change in human perception to the value of technology. The ongoing broader longitudinal research outside the scope of this paper is to support post-Covid-19 Human-Computer Interaction understandings that focused on an applied model to enable better human connected and productive workplaces in a distributed remote environment.

Firstly, the broader research adopted to answer the stated questions centres on the principles of inclusive design principles [9]. This methodology is increasingly being adopted in a multitude of process, building and engineering design to identify the margins of where improvements can be made in terms of how remote office home users can best engage with the technology they have available to them.

Secondly, the psychological dimension also drives response moderators [10] that revolve around personal preference across ambient conditions, spatial layout and functionality, all of which are a contributory element to any form of human or computer interaction [11].

2.The Starting Point – The Evolving Workplace.

Workplace technology tools and how humans engage is not one size fits all. One dimension of significance is the age of the user. Generation Y (20-34 years in age) are more than twice as likely to prefer open offices than baby boomers (51-69 years in age) or Gen X (35 – 50 years and millennials (25- 38 years in age) want physical HQ office interactions [12]. Amongst the most widespread reason for dissatisfaction in the same study was the lack of private space (43%) with 46% stating that the area they work in had an impact on their productivity.

Increasingly two converging trends are coming out of cross-generational research. Firstly the challenge that despite the increase in workplace technology, there is not a proportional increase in workplace productivity or satisfaction [13]. Offering more flexible work from home or remote hubs, coupled with more immersive technology tools, maybe part of the answer. Secondly, despite considerable investments in the modern centralised workplace in terms of facilities, technology and communication tools, productivity is not increasing [14], [15]. New research found that 55% [16] of home workers stating that collaboration with other team members is now more difficult than when they worked in a centralised office.

3.The Research Approach!

The research approach taken in this paper focused on user-centric task requirements with the home office workers technology identified in advance of the field research. The objective of this was to ensure a standard baseline level of access to an ecosystem of computer, communication and collaborations tools, detailed in Table 1.

Table 1. Surveyed Office workers and access to technology.

Technology Ecosystem access	Available
Laptop Personal Computer	Yes 100%
Additional Display Monitor	Yes 100%
High-speed Broadband	Yes 100%
Productivity Software, e.g. Microsoft office	Yes 100%
Collaboration software (either Skype, Zoom, Microsoft Teams)	Yes 100%

In total, 89 (pre Covid-19 Pandemic) central office workers were targeted from a broad range of companies based and headquartered in the Republic of Ireland and England. The companies were from industries and different in employees number. Two phases of field research took place

- **Phase 1** – Randomised short interview calls to 25% of the total targeted group to establish what technology ecosystem access they had in their new distributed, home setting
- **Phase 2** – An online survey sent to all 89 knowledge workers using online professional survey software, Type form.

4. The Research Methodology

A mixed-method approach was adopted in the field research supported with a sensitivity power analysis [17] to establish

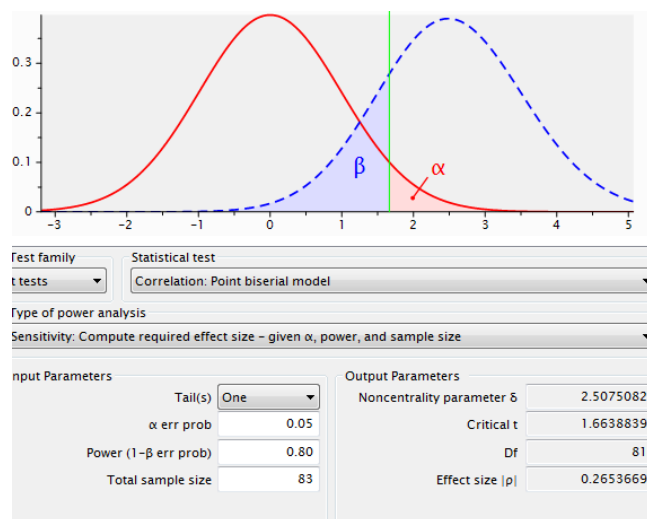
- **Effect Size** - measures the strength of the result and is solely magnitude-based. It does not depend on sample size
- **P-Value** - Enables the assessment of the likelihood that any findings are not due to chance. P-values very much depend on the sample size

An ANOVA "t-test" using G Power software program established the effect size [18] to assess if the participants represented a sufficient sample size to warrant a high correlation and trend of the data results. The "P" was set at 0.80 as standard practice [18] with the results illustrated in Figure 1.

Standard ANOVA "mean" range benchmark values were used as Small Effect 0.1 to Medium Effect 0.25 to Large Effect 0.4 (34).

The result is as shown in Figure 1 where the effect size is 0.26 indicating a medium effect and therefore, a mid-level of correlation using the sample size of workers as part of the research sample.

Figure 1 – G Power software "t-test" result.



5. The Research Outcomes

The completion rate was 93.3% of the total targeted list of research participants.

The survey had been designed to be completed within 5 minutes or less to ensure the maximum number of fully completed responses. Pre-testing by an independent panel of 3 non-recipients of the study was used to test that the target time of 5 minutes or less was achievable. The overall average completion time was 4 minutes and 31 seconds.

In total, 10 questions posed different dimension and categories in terms of quantitative and qualitative responses required. An open feedback section was added for any additional comments inputs. The summary is detailed below in Table 2.

Table 2. Results of the research survey completed

Q1	Female/Male?	53% of female	47% male
Q2	Age Group?	47.1% 25 to 38 years (Millennials) 24.3% 39 to 45 years (Gen X) 4.3% 46-50 years (Early Boomers) 24.3% 51plus years (Baby Boomers)	

Q3	Level of the challenge to adapt to a home office fulltime?	3% Highly challenging 36.1% Some moderate challenge 70% Little or no challenge
Q4	The two main challenges faced?	48.6% loss of feeling of a physical team 36% loss of my physical built office space
Q5	Dedicated office space at home already?	51% yes 49% no
Q6	Perception change since having to work from home fulltime?	61.4% now more positive in their view of working from home 38.6% now less positive in their view of working from home
Q7	Potential most positive influence/factor on productivity	62% stated the Technology PC ecosystem and collaboration tools
Q8	Most negative influence/factor on productivity	63% stated the physical space and lack of cognitive connection with the space they work
Q9	Change in value of having the right physical working space?	32% now thought it was now the more important element than previously thought 41% always thought it was important 27% see technology more important
Q10	What do you now think of the value Immersive Workspace tools that you could use?	45.7% Will have no impact on my productivity 31.4% Will increase my collaboration with others 17.1% Will increase my want and ability to work from home 5.7% Will increase my productivity

The research survey results show several insights from what would have been traditionally held beliefs around the value of new technology to workplace productivity from previous research referenced in this paper [15]. The headline points of reference are detailed below

- 61% of those researched are optimistic about the move to working from home. What will be interesting is how this will evolve over the next 3 months (Question 6).
- 62% of the researched participants still see technology as the "fix" to their productivity challenge. In parallel more "functional" (reporting, conference calls) had also increased (which became evident from the telephone interviews with a sample of the research participants) where personal computer software such as Microsoft Office and conference platforms such as Zoom work best to keep the user operational and completing task by task rather than ideation or creativity tasks (Question 7).
- The research results established that only 17% of centralised office workers (Pre-Covid-19 workplace restriction) think (at least with one month working from home) that technology could have a significant impact on their productivity, at least in a home office environment (Question 10).
- 32% consider the physical workspace that they work is more critical to their productivity than that of technology. The specific dimension of the effects of the physical design of workspaces is to be explored as part of the broader ongoing research as previously referenced outside of this paper (Question 9).
- 31% stated that they did think that future emerging VR type technology could provide them with better team experiences working from home (Question 10).

6. Implications for Further Research

There are potentially multiple implications for further research in terms of focus, whether that be on workspace productivity or collaboration technology. A new insight into the research survey in this paper has been that of the value place by traditional central office workers on immersive and VR type tools that could enhance physical workspace productivity and user experience. Immersive virtual experiences could provide adequate representations of physical

environments, specifically office environment [18], that enables more immersive human-computer interaction.

The focus on the future of workplaces digitised environments could provide this with 32% of the survey respondents being optimistic about the use of more immersive VR type tools as a means to continue to work from home [3].

7. Conclusions

The focus of this paper was to gain further insights into the human attitude, value and impact of technology versus other elements of the research participant work from home space. These attitude, values and the overall human-computer interaction will continue to evolve over the next months. The next stage of this specific researched as per detailed in this paper will be to track how these attitudes and values over the next three months.

Overall this novel research aims to produce ongoing insights for organisations that are now highly distributed and home-based in terms of their workforce. These remote workplaces could better enable and support workers who may have to continue to work from home beyond the impact that the current Covid-19 Pandemic.

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