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A literature survey and qualitative analysis on work-from-home research before and during the COVID-19 pandemic

THESIS

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by

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I would like to thank my parents for supporting me and my education and for their unconditional love.

I would like to thank Professor David Redmiles for his enthusiasm, support, and guidance on my research journey.

ABSTRACT OF THE THESIS

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Alissa Powers

Master of Science in Software Engineering

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The COVID-19 pandemic shook the world into a frenzy of Zoom meetings and online activity. In one month, more people began working from home than at any other point in history. This major shift poses a question: Did the increase in the number of people and extent of work occurring from home change studies on this activity? I conduct a literature survey and use qualitative coding and analysis methods to compare the research on working from home conducted in the 20 years prior to the COVID-19 pandemic to the studies conducted during the COVID-19 pandemic. I find that the research methods remain largely the same, but the scope and topics change. The scope decreases during the COVID-19 pandemic to focus more on the individual instead of on the organization or society. Meanwhile, the topics shift to focus more on health, well-being, and empathy in challenging times. I discuss my results and potential directions for future research. I also provide key insights for future researchers to keep in mind as they continue researching working from home during a pandemic.

Chapter 1

Introduction

Working from home became normal for many people around the world as the dangers and risks of the COVID-19 pandemic forced people to stay home. However, working from home is not a new concept. The idea of working away from an office started growing around the 1070s, when Jack Nilles is thought to have coined the term, "telecommuting" [2]. While this working style has been increasing in popularity ever since, it has also suffered some major set-backs and fallen short of initial utilization expectations. In 2012, multiple large technical companies that pioneered some of the first major telecommuting programs suddenly halted them, calling all employees back to the office. Even when employees were able to work remotely, it was often for only one day out of a week, and the rest of their team or organization were usually still working in the office. Were it not for the COVID-19 pandemic, most people would still not be working from home, and certainly not full-time. Now that more companies and people have been forced stay home, it is expected there will be more evidence for continuing or halting such programs in the future. At the very least, each individual will have their own experiences to draw from in deciding if they want to continue working from home after the pandemic. It is important that researchers take advantage of this opportunity and conduct studies while the world is still in a situation with so many

people working from home. However, they must also be wary of how other pandemic factors (e.g. lock downs, remote schooling) affect the current work-from-home experience.

This study uses a systematic literature survey of research on working from home before and during the COVID-19 pandemic [74][47]. I query two major online libraries (ACM Digital Library and IEEE Xplore), use snowball sampling, and manually add papers based on expert recommendations. After reading each paper in full and applying specific inclusion and exclusion criteria, I include 58 papers from 2000 - 2020 and 15 papers from the COVID-19 pandemic in the study. I then apply qualitative coding and analysis methods (coding, code mapping, and code landscaping) to the literature review results in order to obtain topics, categories, and themes from both sets of research [61].

My results include a codebook of 17 codes, two code landscapes (diagrams) to help visualize and analyze the codes, and word maps of methods to easily see which were the most popular. Qualitative methods, such as surveys and interviews, were the most common research methods used across all the research. Research conducted before the COVID-19 pandemic had a broader range of participants and scope than research conducted during the COVID-19 pandemic. The previous research included participants who were only working from home once in a while and people who were working from home when the rest of their team was in an office. It also had a broader scope, looking at effects on individuals, organizations, and society. This differed from the research completed during the COVID-19 pandemic, which focused solely on working from home and how it was affecting individuals. There was also a shift in the topics. Previous research focused on whether or not to start working from home, how to plan to work from home, and how it might affect the environment, while the research during the pandemic focused on the health and wellness of employees and the need to grant grace and understanding when conflicts arise.

The remainder of the thesis is organized as follows. In Chapter 2, I discuss the background, including the definition of working from home and the history of telecommuting. The lit-

erature survey process and qualitative methods are provided in Chapter 3. In Chapter 4, I present the results from the qualitative coding, including explanations and examples of each code, code landscapes, and the common methods used in the previous research. In Chapter 5, I discuss the results in relation to the research questions and the threats to validity. The study is concluded in Chapter 6.

Chapter 2

Background

2.1 Defining Working from home

Research over the past 40 years has included many different terms and definitions to refer to working away from the typical office workplace, most of which are very broad or vague in specifications of frequency or location of work [2].

For the purposes of this thesis, the definition of working from home is as follows:

> *Working from home*: A work practice in which members of an organization perform all of their work from home.

I crafted this definition based on my own experiences working from home and the studies conducted on working from home during the COVID-19 pandemic. Unfortunately, very little previous research has been done on this specific definition. However, the definition I created actually falls under the umbrella of some of the broader definitions and terms from previous research, so we can include these broader terms for research relevant to this topic.

For a better understanding of how working from home evolved from these broader terms, let us look at the history of one of the most popular terms, namely telecommuting, and its transition into the definition of working from home that I provided above.

2.2 History of telecommuting

Telecommuting has been gaining popularity since the 1970s, when the oil crisis led to a concern over the affordability and feasibility of the entire workforce commuting to work every day. Jack Nilles is believed to be the first person to coin the term "telecommuting" in his 1973 in his book titled, "Telecommunications-Transportation Tradeoff: Options for Tomorrow" [51]. His idea on how to lighten the reliance on oil and reduce traffic and energy use was to move the jobs to the people by having people work from home, rather than move the people to the jobs by having them commute.

Over the next couple decades, improvements in information and communication technology (ICT) allowed telecommuting to become feasible for more people. By 1995, IBM started reducing office space due to success with telecommuting. Government support through the National Telecommuting initiative in 1996 and the 1999 amendments to the Clean Air Act further led to an increase in telecommuting, as states were required to put regulations in place to meet air-quality standards [2]. Researchers began studying the effects and how to improve telecommuting. Olson and Olson focused a lot of their work on the impact that distance has on remote teams [52]. Schmidt encouraged technical communicators to work from home and went over many of the benefits that telecommuting offers for the individual and for the company [63]. Nonetheless, the telecommuting population was growing more slowly than some expected.

However, two new crises stepped up to cause more of a buzz around working from home.

The 2008 recession led to a need for companies to downsize and save money. One way for them to do that was to reduce office space and have more employees telecommute. The 2009 H1N1 pandemic also led to a widespread need to accommodate telecommuting. During this time, some companies realized that implementing more regular telecommuting arrangements would allow their business to continue without interruption in the midst of crises.

In 2013, Baremetrics, a data analytics company, and Groove, a support software company, were both formed as fully remote companies. While these companies were leaping forward with telecommuting, other companies were pulling back. Yahoo halted their telecommuting program, leading to an uproar and a lot of backlash from employees. Other companies soon followed, despite the strong negative responses from employees. By 2017, IBM, one of the first big companies to embrace telecommuting, announced the end of their telecommuting programs.

Despite the ups and downs of telecommuting's history over the past 40 years, recent events have once again showed that companies need telecommuting, specifically working from home, in order to continue production during times of crisis. In the next section I will discuss the COVID-19 pandemic and the flood of employees that had to start working from home in response.

2.3 Today: The COVID-19 Pandemic

The COVID-19 pandemic has led to a surge of people working from home. From March 2020 to April 2020, with hardly any time to prepare, about 35.5% of employed Americans began working from home instead of commuting to a workplace [13]. Adding in the 15% who reported working from home before the pandemic started, over 50% of the employed population in America was working from home in early April of 2020 [13]. This percentage is

higher than any other time in America's history. Although it is not a perfect representation, this sudden increase is apparent just by looking at the Google search trend history for "work from home." Figure 2.1 is a snapshot of the Google search trend history for "work from home" and other related terms from 2004 - present day. The highest peak of people searching for "work from home" was in March 2020, which coincides with the lockdown orders of the COVID-19 pandemic. The smaller peak in 2016 is a false positive for this topic, as it was due the release of a song and music video titled "Work From Home."

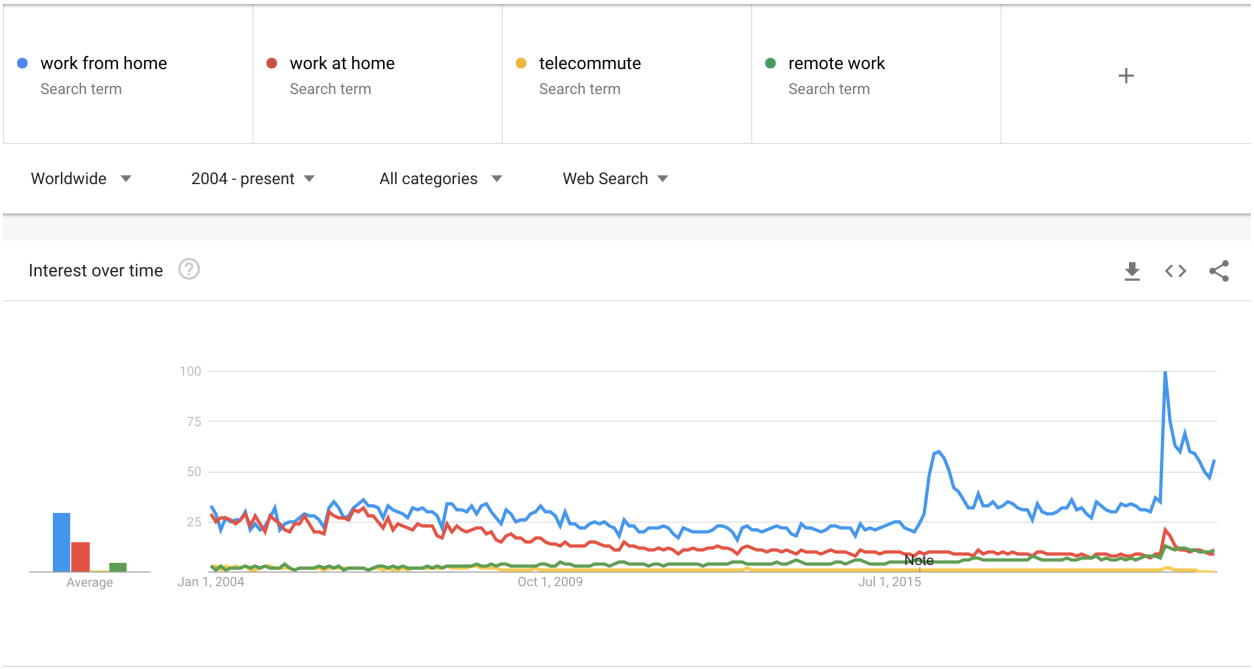

Figure 2.1: Google search trend history for "work from home" and related key words from 2004-2020.

Research on working from home is now more important than ever. If working from home is found to be beneficial to individuals, organizations, and society beyond the scope of just stopping the spread of a virus, then it has the potential to become a much more common work form long after the pandemic is over. On the other hand, if people are unsuccessful at working from home or experience too many challenges, it could cause more people and companies to avoid it in the future.

The purpose of this study is to review the past 20 years of research on working from home and

compare it to the recent COVID-19-related research on working from home and to identify gaps for future research.

2.4 Prior Work

There have been many studies that analyze the telecommuting research, mainly looking at benefits and challenges of telecommuting and increasing utilization of telecommuting programs. Kroese looked at the relation of formalism in companies to the success of telecommuting and found that more less formalized companies had a smoother, more successful transition [42]. Osman and Rashdan looked at the technology required for telecommuting in order to decide if it was possible to implement a program at a specific location [54]. Day and Burbach looked at the benefits of telecommuting and analyzed the low utilization rate of telecommuting for government employees [21] [22]. Blount discussed challenges of working anywhere while pushing for a framework to implement it successfully [12]. Morrison-Smith and Ruiz discussed many challenges on virtual teams and called for a lot of new technology to be built in order to more effectively support remote collaboration [47]. As one of more recent studies, the technology request are still relevant and need to be explored further. And finally, Hook took a systematic approach to reviewing all of the research on the environmental impact of teleworking [31]. Unfortunately most of the environmental research is vague, contradictory, or noncommittal, so the results from the systematic review were that the results are unclear and more research is needed.

This study differs from the previous literature surveys, in that it specifically focuses on working from home, as opposed to general remote work. It is also different in that it is comparing more recent research to previous research, rather than focusing on just one aspect of remote work.

2.5 My experience working from home

Because I will be using qualitative coding methods in this study, it is important that I discuss my own experience with working from home, so that you have an idea of the lens through which I interpret and analyze information.

I am a software engineer on an agile development team that was co-located before the pandemic. We were occasionally allowed to work from home under special circumstances, but we mostly worked in shared offices with a common room for team meetings. As an agile scrum team, we held a lot of in person, collaborative meetings. However, we were also already using collaborative technologies such as GitHub, Slack, and Zoom. About half of our team members wanted to be allowed to work from home more regularly, but doing so was not supported by upper management at that time.

In March 2020, with rumors of a state-wide shut down looming, we were told to practice working from home one day to work out any challenges that might arise before we were required to stay home for a longer period of time. However, our practice day was cut short by the news that we were actually not allowed to return to the office until further notice, except for at scheduled times to pick up necessary items.

Despite the short notice, lack of practice, and the generally stressful situation, my team figured out how to accomplish all of our meetings and collaborative work online rather quickly. My teammates and I feel more productive and satisfied when working from home, so we were very relieved when we found out that we would most likely be allowed to continue working from home indefinitely.

I believe that there were multiple reasons for our success, including previous reliance on collaborative technologies, a pre-existing process focused on iterative improvement, and personalities that fit well with the work from home environment.

Although I enjoy working from home, I recognize that it comes with certain challenges and that it is not for everyone or every job. I have spoken with many software engineers on other teams who are aching to return to the office for various reasons.

I embarked on this research because of my passion for working from home. My personal experiences and conversations with others who are working from home color the lens through which I interpret and analyze the existing research on working from home. In the next section, I will talk about my research questions and the methods that I use.

Chapter 3

Approach

3.1 Research Questions

I set out to answer two research questions, each with sub-questions. The first focuses on previous research about working from home. The second focuses on comparing that research to the more recent COVID-19 pandemic-related research.

Q1: What is the state of previous (pre-COVID-19) research on working from home?

Q1-A: What high-level topics and themes are covered by existing research?

Q1-B: What methods have been used to study working from home?

Q2: How does the previous research relate to the sudden shift to working from home for employees due to the COVID-19 pandemic?

Q2-A: What high-level topics or themes are covered by the research that occurred during the COVID-19 pandemic?

Q2-B: How do the COVID-19 research topics compare or relate to the topics from the previous research?

Q2-C: What additional research could be done in order to better support the extent of remote work caused by the COVID-19 pandemic?

In order to answer the first question and sub-questions, I completed a systematic literature survey and then used qualitative methods in order to pull out topics, categories, and themes from previous research. I detail the process for each of these in the next section.

3.2 Literature Survey

I designed a literature survey based on frameworks that have been successful in previous works [47] [74]. The process that I detail in this section can also be viewed in a diagram in Figure 3.1.

Queries:

- The ACM Guide to Computing Literature: ("work from home" OR "telework" OR "remote work" OR "work at home") in Abstract or Title, from 2000 to 2020
- IEEEXplore: ("work from home" OR "telework" OR "remote work") in All Metadata, from 2000 to 2020

I created these queries from common terms used in relevant articles, synonym searches, as well as through trial and error of which terms found relevant articles. I found that looking specifically in the metadata rather than in the body of the article was the most effective, because many articles that did not actually focus on remote work mention one of the terms in the body of the text, whereas most articles focusing on remote work mention one of the terms

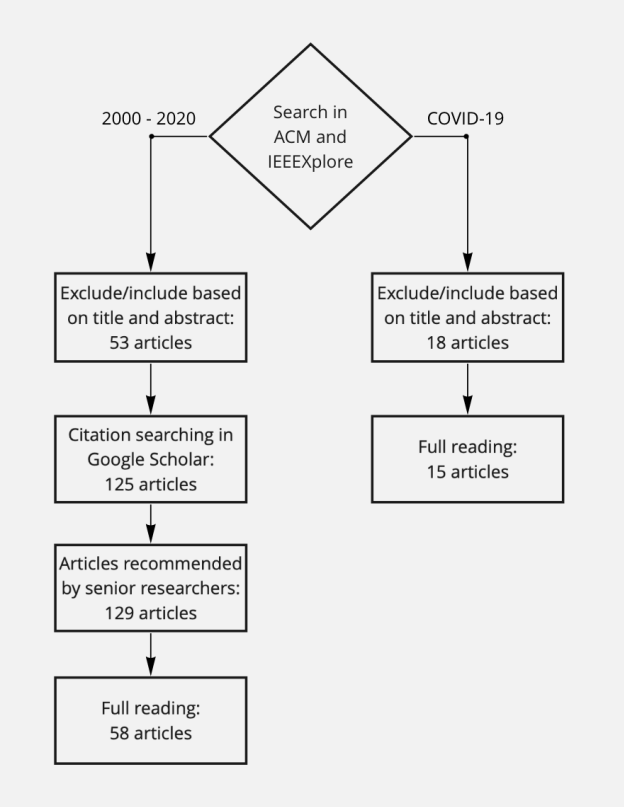

Figure 3.1: Diagram of the literature review process.

in the title or abstract. I also decided to set the lower limit for the search to the year 2000, because after reading some articles on working from home from the 1900s, I realized that it was extremely different from the modern experience, given that home internet and computers were rare, and would not provide relevant results to compare to the current situation.

On the first iteration, I ran the queries, looked at the title and abstract of every article that was returned by the query, and saved every article that seemed somewhat relevant, removing articles that were obviously false alerts based on the title and abstract. I then also read the intro and conclusion to see if they were relevant to the research questions. This resulted in 53 articles saved.

The next step was snowball sampling (citation searching). Using Google Scholar, I searched every article that I collected in the first step and found all of the papers that cited them. I considered the metadata, intro, and conclusion of each paper that cited one of the existing

papers to decide if it should be added to the set. This resulted in 72 articles saved from the snowball sampling, which totaled to 125 papers.

Additional relevant papers, recommended by senior researchers, were also added to the study.

I then organized the papers by the year they were published and started reading each paper in full, deciding whether to include or exclude it from the study, based on the exclusion criteria.

Exclusion Criteria:

- Not freely available under standard university licenses
- Not focused on working from home (working from home does not fit under the umbrella of the article's definition)
- Focused on freelance or self-employed home workers (because these were more often about starting a business or finding jobs instead of working from home)

If an article was included in the study, then I recorded the research methods that the article used as well as writing preliminary jottings, which will be described in the next section. The result was a total of 58 articles included in the study.

3.3 Qualitative Coding

In order to pull out the high level topics and themes from the papers collected in the literature review, I decided to use a qualitative method, inductive coding. A code is "a word or short phrase that symbolically assigns a summative, salient, essence-capturing, and/or evocative attribute for a portion of language-based or visual data" [61]. The process I followed for

qualitative coding was derived from recommendations in Saldaña's "The Coding Manual for Qualitative Researchers" [61]. The process that I will detail in this section can be viewed in Figure 3.2.

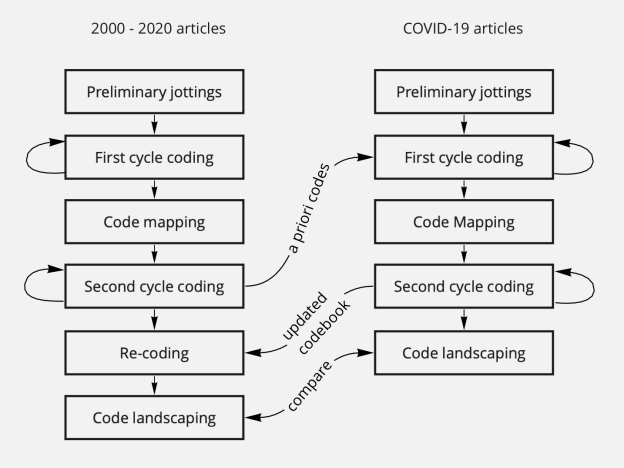

Figure 3.2: Diagram of the qualitative coding process.

The first time that I read the articles all the way through, I did preliminary jottings, which are "tentative ideas for codes, topics, and noticeable patterns or themes" [61]. After reading all of the articles in full and writing preliminary jottings, I moved on to the first cycle coding, where I began looking for patterns and labeling topics within articles in order to create codes. The unit of analysis was a portion of a paper, which could be anywhere from one paragraph to the whole paper. I recorded the codes along with their definitions, descriptions of when to use them, and example quotes from the articles in a codebook that I created using Notion, an all-in-one productivity software tool that allows users to create customized databases to manage work. This iterative process involved a lot of back and forth between the articles and the codebook. As newer codes were added to the codebook, articles I already coded were re-coded to ensure that they were not missed.

After first cycle coding, I performed code mapping, a process of categorizing and organizing codes, in order to obtain categories for the codes. This step was completed using digital sticky notes in Miro, an online visual collaborative platform that's good for creating diagrams,

flowcharts, and other visuals. Each code was written on a sticky note and added to a board. I then was able to move the sticky notes around on the screen and group similar codes together. This process allowed me to find code categories, merge codes where necessary, or split codes into a parent code with sub-codes. Figure 3.3 shows an in-progress example from this step.

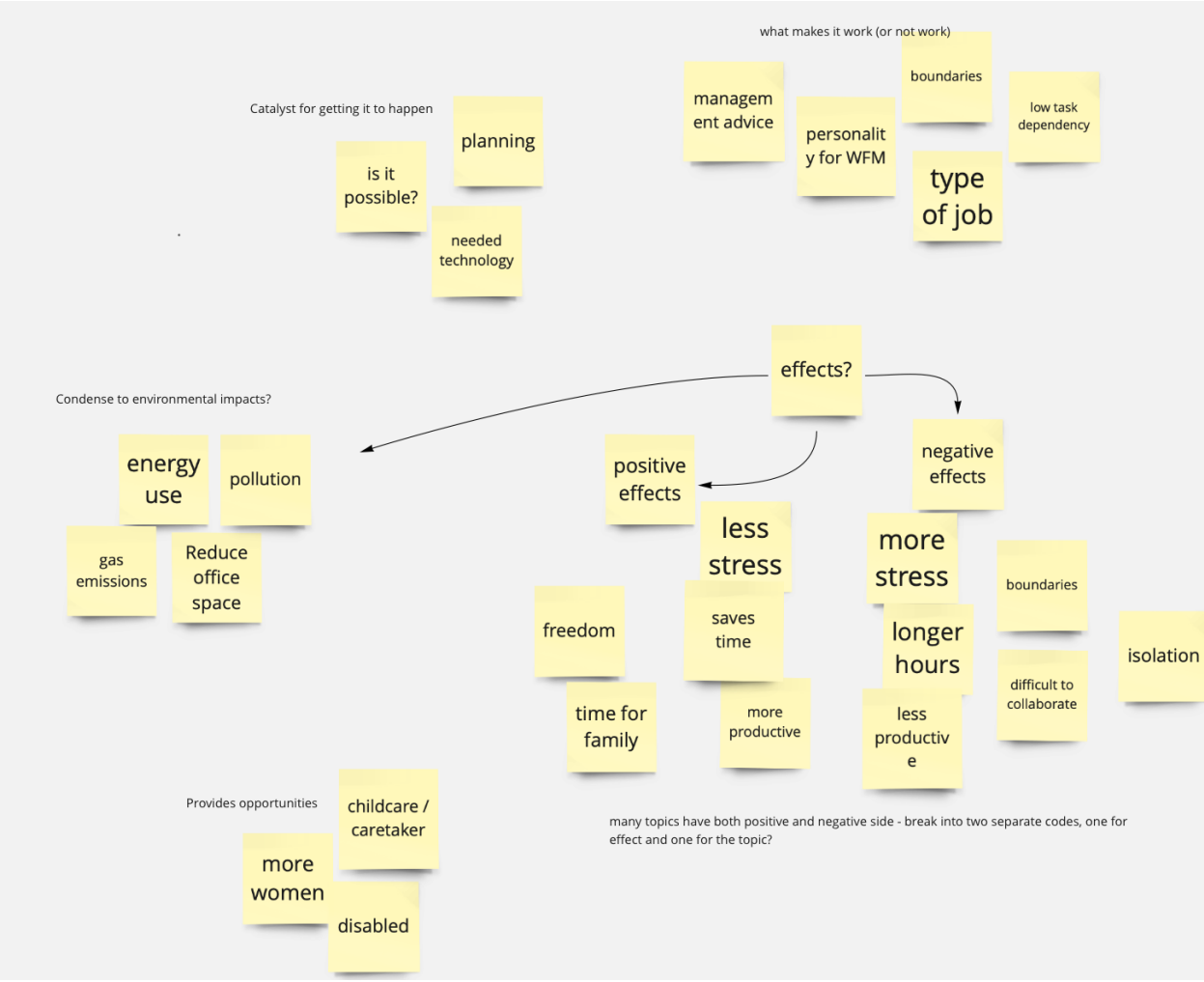

Figure 3.3: In-progress work from the code mapping process using a Miro board.

I then performed second cycle coding in order to better clarify and apply codes based on the results from the first cycle coding and code mapping. This was another iterative process that involved updating the codebook and re-coding articles to ensure that all articles were coded with the same standards.

Finally, I used code landscaping, which "integrates textual and visual methods to see both the forest and the trees", in order to better visualize the codes and categories and in order to pull out themes [61]. This involved creating a flow diagram of the codes within their categories, which helped me to identify new categories and themes.

3.4 Re-applying Everything to the COVID-19 Articles

After performing the literature survey and qualitative coding on the past research, I began searching for and then coding the research on working from home during COVID-19. I repeated the queries from the literature survey, adding in "covid" OR "pandemic" as additional search terms and limiting the search to articles published after February 2020. I read each article in full, used the same inclusion/exclusion criteria in order to decide if the article belonged in the study, and did preliminary jottings. The literature survey process is visualized following the right side branch on Figure 3.1.

I then performed the same qualitative coding process (visualized in 3.2) as discussed previously but on the COVID-19 articles. The difference in this part of the process is that I started with my existing codebook and codes as a priori codes going into the first cycle coding in order to assist with the coding process. Two new codes emerged from the COVID-19 articles and were added to the codebook.

When I was finished coding the COVID-19 research, I then went through all of the past research for a third time to see if any of the new codes applied to any of the articles.

Finally, I used a similar code landscaping approach as for the previous research, but plugged in the data from the COVID-19 articles. This allowed me to better visualize the codes and draw out themes, and also compare the COVID-19 results to the previous research.

I concluded the literature survey and qualitative coding with 58 past articles, 15 COVID-19 articles, 17 codes, and 2 code landscapes. I discuss my results in the next chapter.

Chapter 4

Results

4.1 Codes and Code Landscapes

Table 4.1 shows the high level mappings of codes to articles, specifically in relation to the type of article. Articles usually approached their topics from one of three angles: calling for more research, discussing the effects of working from home, or discussing things that influenced the success (or failure) of working from home. The codes for these different angles are "Call to Action," "Effects," and "Influencers."

Each code has corresponding subcodes that are one level deeper than their parent code. For example, an article coded as "Influencers" might discuss the catalyst for a company pushing their employees to work from home, while another article might focus on steps that a manager can take to ensure that their employees succeed when working from home. Both of these articles discuss things that contribute to the eventual success or failure of working from home, but they are different enough to separate into two different subcodes under the parent code. The first article would be coded as "Influencer: Catalyst" and the second article would be coded as "Influencer: Key to Success."

Code	Subcode(s)	Articles
Call to Action	Understanding New Tools	**Past:** [20] [12] [2] [27] [31] [47] **COVID-19:** [9] [11] [18] [16] [57] [79]
Effects	Positive Negative Inconclusive/Dependent Individual Organizational Global/Communal	**Past:** [75] [39] [78] [32] [37] [38] [59] [58] [21] [41] [56] [76] [1] [28] [12] [2] [77] [43] [50] [4] [53] [26] [25] [64] [23] [31] **COVID-19:** [18] [7] [33] [55] [10]
Influencer	Catalyst Key to Success	**Past:** [75] [14] [19] [8] [60] [40] [29] [78] [32] [42] [54] [24] [34] [59] [49] [5] [71] [36] [21] [41] [15] [56] [6] [72] [22] [12] [2] [73] [69] [50] [30][3] [67] [45] [62] [4] [35] [70] [46] [47] **COVID-19:** [18] [68] [44] [48] [17] [66] [9]

Table 4.1: Codes and subcodes that signify the angles that an article takes in approaching a topic and the corresponding articles for each code.

It is important to note that articles could be assigned multiple codes. Many articles sectioned out topics into different groups, resulting in multiple points being made within the same paper. For example, an article discussing the effects of working from home might start by discussing effects on the individual employee before discussing how the agreement affects the organization. In this case, the article would be coded as both "Effects: Individual" and "Effects: Organizational."

Table 4.2 shows the mappings of topics to articles. In addition to having one of the three angles already discussed, the articles also have topics. Topics relate to angles in that the articles discussed the topic from one of the three angles. For example, the code "Collaboration" was sometimes paired with "Call to Action," as researchers discussed that more tools were needed in order to better support remote collaboration.

For the full codebook including detailed definitions, usage guidelines, and examples, please see the Appendix A.

Code	Articles
Collaboration	**Past:** [71] [67] [45] [36] [21] [41] [72] [76] [22] [2] [77] [50] [3] [4] [70] [47] [23] [12] **COVID-19:** [11] [7] [68] [44] [10] [17] [79]
Environmental Impact	**Past:** [40] [78] [39] [37] [38][58] [31] [21] [28] [2] [25]
Freedom	**Past:** [75] [32] [59] [5] [21] [41] [56] [20] [28] [2] [50] [4]
Grace	**Past:** [41] **COVID-19:** [68] [33]
Health & Safety	**Past:** [75] [32] [41] [15] [56] [20] [76] [22] [12] [2] [77] [50] [4] [25] **COVID-19:** [57] [68] [33] [16] [55] [48] [9]
Home Boundaries	**Past:** [60] [20] [59] [12] **COVID-19:** [18] [10]
Management	**Past:** [29] [42] [24] [21] [15] [41] [56] [72] [22] [12] [50] [30] [47] **COVID-19:** [66] [68]
Necessary Technology	**Past:** [14] [75] [8] [78] [34] [45] [59] [36] [15] [56] [72] [50] [62] [4] [47] **COVID-19:** [7]
Opportunities	**Past:** [26] [14] [15] [6] [28] [12] [2] [50] [25]
Personal Alignment	**Past:** [59] [71] [22] [12] [69] [50] COVID-19: [7]
Productivity	**Past:** [59] [21] [71] [1] [2] [12] [50] [53] **COVID-19:** [7] [16] [55] [48] [10] [44]
Trust	**Past:** [35] [24] [21] [41] [72] [50] [3]
Willingness	**Past:** [54] [24] [49] [5] [46] [19] [64]

Table 4.2: Codes that pertain to the topic of an article and the corresponding articles for each code.

After collecting the codes, I performed code landscaping. I created diagrams of the codes on a Miro board, which helped me to visualize groupings and recognize patterns and themes. This resulted in further categorization of the codes. For example, I did not start with any high-level categories for the topics, but after diagramming them, I was able to organize them into four categories: "Getting Started," "Personal," "People Interactions," and "Environmental Impact." I also added the count of articles for each code so that I could easily identify which codes had the most articles, and could compare the number across the past articles and the COVID-19 articles. Figure 4.1 and Figure 4.2 show the diagrams for the past articles and for the COVID-19 articles.

In the next section, I will discuss each code and relevant articles in further detail.

4.2 Code Descriptions

In this section, I will go over definitions and explanations of the codes as well as some of the articles that relate to them. I will start by discussing codes that relate to the angle that an article takes when approaching its topics.

4.2.1 Influencers

The **"Influencer"** code was applied to articles that focused on things that affect the work from home experience. This included factors that caused a shift to working from home or best practices to improve or succeed with working from home. "Catalyst" and "Key to Success" were the two subcodes under "Influencer."

The **"Catalyst"** code was applied to articles that discussed causes of an organization's choice to implement work from home programs or an individual's choice to work from home.

This included catalysts such as successful pilot programs, caretaker responsibilities, or a desire to avoid commuting. For example, Osman and Rashdan looked at the possibility of implementing a telecommuting program at the University Utara Malaysia, while Baard and Thomas looked at factors that led to telework adoption in South Africa [54] [5]. Osman and Rashdan found that people wanted to work from home and felt that they would be successful working from home, so they would mainly just need upper management to support the program and create policies and regulations for it [54]. Baard and Thomas found that job characteristics were the most influential factor in adopting work from home programs. Surprisingly, trust was not found to significantly increase adoption of telework programs, which led them to question the validity of their results given the strong indication from previous research that trust plays and important role [5].

The **"Key to Success"** code was applied to articles that discussed how to improve or succeed with working from home. This included articles that learned from failure and feedback, provided recommendations for managers, or listed ideal personal characteristics. Cho et al. conducted a case study in order to investigate how much and what type of information needed to be shared between co-workers in order to lead to a successful work from home experience [17]. They had co-workers answer questions about their work, whereabouts, availability, and more throughout the day and tracked which questions were answered and which questions were accessed. They then interviewed the participants to see why they chose to disclose or access information in order to understand the importance of their choices. They found that availability was useful, but was already integrated into other systems, such as Slack. They also found that status was only important when at least one person was working from home; if everyone met in person, nobody needed to check the online statuses, but if one person was working from home, everyone's online status became important [17]. Meanwhile, Limoncelli, a manager at Stack Overflow, publicized some of his own and Stack Overflow's recommendations for a successful work from home program, as it has been a part of their culture for years [44]. Limoncelli recommended treating everyone like they were working

from home if even one person was working from home, keeping chat statuses accurate and up to date, having a quick process for starting up a brief video/audio chat, working together in a videoconference room even if everyone is just working on their own things silently, and having social events remotely to maintain some level of socialization [44].

4.2.2 Effects

The **"Effects"** code was applied to articles that discussed effects of working from home. This included effects at different levels and included both positive and negative effects. The codes within this section are classified in two different groups: scope and measurement.

Scope

The scope of the effects were measured or discussed at the individual, organizational, community, or global level. Community and global effects were often combined in article discussion, so they received one combined code.

The **"Individual"** code was applied to articles that discussed effects on an individual employee or manager.

The "**Organizational"** code was applied to articles that discussed effects on the organization or company as a whole. This includes benefits, such as employee retention rates and monetary savings, as well as overhead and new requirements, such as providing training, tools, and support.

The **"Global/Communal"** code was applied to articles that discussed effects on the community and broader. This often included environmental impacts and benefits for the community, such as decreasing traffic congestion and reducing greenhouse gas emission.

Nicklin et al., in explaining why people should work from home, actually took on all three of the scopes. They first discussed how it helped society, including helping the environment, by bringing more people into the workforce and allowing the world to continue working through a disaster [50]. They then discussed how it benefited the organization, mentioning decreased costs, increased profits, lower turn-over rates, and a wider talent pool [50]. Finally, they discussed the benefits to the individual, including saving time and money, increased autonomy, increased job satisfaction, and decreased work-family conflict [50]. Their next section discussing why people should not work from home only covered the organizational and individual scopes, but included things such as losing control over employees, social isolation, and difficulties maintaining work-life balance [50].

Measurement

In addition to finding the scope of the effects, articles also often measured effects and found them to be positive, negative, or inconsistent. Some inconsistent results were simply inexplicable in the existing research, while others were tied to the change of a specific variable. The code for this is "Inconsistent/Dependent" to accommodate the articles that have strong, opposite results as well as the articles that claim that the results depend on implementation or other factors.

The **"Positive"** code was applied to articles that claimed that the effects of working from home, either in general or on a specific topic, were positive. This does not necessarily mean that the overall outcome was a good experience, just that it was less negative than the same effect when working in an office. Ahmed et al. looked at the effects on productivity that working from home had in Pakistan [1]. They used surveys and discovered that working from home had a positive impact on productivity. They briefly mentioned that it needed to be implemented correctly, so there was some room to consider coding this article under "Inconclusive/Dependent" instead, but I kept it here because that caveat was more for

maintaining validity of the study, as they could not say that it was positive for all cases all of the time. However, there was a strong enough positive relationship that the overall stance of the article was that working from home had a positive effect.

The **"Negative"** code was applied to articles that claimed that the effects of working from home, either in general or on a specific topic, were negative. This does not necessarily mean that the overall outcome was a bad experience, just that it was less positive than the same effect when working in an office. Weiss et al., while investigating teleworkers' use of company-wide social platform, surveyed and interviewed people who were working from home [77]. Although they were specifically looking at how these employees adopted and used the social platform, they ended up also uncovering some of the more generic negative effects of working from home. People felt like there were gaps in communication and did not feel very closely connected to their co-workers. Often times this was simply because they did "not have the opportunity for 'water cooler,' or hallway, conversations[, so they had] to find other ways to engage" [77].

The **"Inconclusive/Dependent"** code was applied to articles that could not make a claim about whether an effect was positive or negative, because the results were either contradictory or dependent on some other variable, and it was also applied to articles that made a strong claim about an effect that contradicted other article's classification of the same effect. Allen et al., in a critical analysis of telecommuting research, discussed potential reasons for the inconsistent results across different studies on working from home. They claimed that the "varied definitions and conceptualizations of telecommuting employed within the existing literature" had "significantly hindered our understanding of this work mode" [2]. They also reported that many studies did not provide details on the extent to which participants telecommuted, which could cause "inappropriate conclusions to be drawn from scientific findings" [2]. This could result in contradictory results across studies, or even within studies.

4.2.3 Call to Action

The **"Call to Action"** code was applied to articles that focused on a need for future work or research. This included a call for more research in order to understand a topic or a call for more research and development of new or better tools and technology.

The **"Understanding"** code was applied to articles that called for more research in order to gain knowledge or understanding about a topic, event, action, or outcome. It was also applied when articles pointed out that more research was needed in order to get more consistent results when measuring effects of working from home. Morrison-Smith and Ruiz completed a literature review on the challenges that virtual teams face and identified many gaps for future research [47]. Some of the gaps included understanding how tightly coupled work affects collaboration, the costs of temporal distance in addition to physical distance, and whether or not remote teams have more difficulty with work-culture related conflicts than in-person teams do[47].

The **"New Tools"** code was applied to articles that called for additional research in order to develop new or better tools to improve the work from home experience or contribute to its success. Cho and Voida pointed out the need for new productivity tools in light of the major shift to working from home due to the COVID-19 pandemic [16]. They proposed a new way of designing productivity tools specifically for the home that account for the plurality of productivity that comes from working at home. They called for tools that are designed to help people critically reflect on their time management practices in order to build their own perspective on how to split their time between domestic and work requirements, rather than forcing office productivity practices on them [16].

All of the codes discussed so far described the angles that articles took when reporting on topics. In the following sections, I will discuss the codes that relate to the actual topics that articles focused on or highlighted. These topics are broken into three high-level categories:

Getting Started, Personal, People Interactions, and Environmental Impact.

4.2.4 Getting Started

"Getting Started" is not a code, as it is not in the codebook and it was not applied to any articles, but it is a category that I grouped some of the codes into after diagramming them and looking for patterns. The codes in this category all relate to a company or person getting started with working from home. It involves a willingness to begin working from home, having the necessary technology to be able to start working from home, and the employment opportunities provided to those who would be otherwise unable to work.

The **"Necessary Technology"** code was applied to articles that discussed the technology and tools that were needed in order to work from home. This included everything from network connectivity across countries to office supplies in the home. Many of the articles with this code pointed out a deficiency that made it impossible to begin working from home, while others pointed out the things a company would need to ensure their employees had before implementing a work from home program. Sanchez and Carro discuss the current state of video conferencing technology, which they deem as a necessary technology in order to work from home successfully. [62]. Factors contributing to successful video conferencing technology include having enough connectivity and having the necessary hardware and software. They point out that connectivity is a disappearing barrier as high-speed networks with plenty of bandwidth are becoming more common in residential areas. They were writing in 2017, but three years later, despite all of the improvements, individuals still experience issues with connectivity during video conferencing meetings, and people in more rural or remote areas still struggle to obtain connectivity. An area that has improved further is the available software for videoconferencing. Sanchez and Carro in 2017 already list Skype, Google Hangouts, Zoom, and many more software options, but the list of options today would be much

longer, and each tool would be able to boast a larger feature-set. With the sudden jump to working from home in the COVID-19 pandemic, these companies, most notably Zoom, began supporting many more people working from home as well as people using the tools outside of work for socialization with people outside of their household. In order to support all of the users and new use cases, these tools have released a lot of updates in the past year, especially around security and customization.

The **"Willingness"** code was applied to articles that discussed whether or not a company, manager, or employee wanted to work from home. Sometimes an employee wanted to work from home but their company did not allow it, and other times a company was pushing for more employees to work from home, but the employees did not want to. Articles with this code explored why people and companies did and did not want to work from home. Nicholas and Guzman specifically looked at the willingness of Millennials ("born 1981 - 1999") in working from home [49]. They hypothesized that because of greater autonomy, work/life balance, and computer competency, Millennials would be more likely to favor working from home than non-Millennials. However, in their survey of 263 students, staff, and faculty, they found that non-Millenials actually had a higher preference for working from home than Millenials did. They also found that Millenial males were more likely to prefer working from home than Millenial females. The issue with this study is that the Millenials were mostly students, as they were not yet old enough to be the faculty or staff in the survey. Students who have not had years of work experience would have a different perception of full-time work, might not know exactly what they would or would not prefer without having experienced it, or might want to meet people before they get older. People who have been working many years and already have a stable job and network might better understand the benefits that working from home would provide and would no longer need the benefits of working in person that someone earlier in their career might need. Therefore, the qualities attributed specifically to Millenials might be mis-categorized and should be instead be attributed to students or people early in their careers rather than a certain generational group. Those

same Millenials might show a preference for working from home once they've had some years of experience in the workforce.

The **"Opportunities"** code was applied to articles that discussed how working from home provided job openings to people who would have otherwise been unable to work. This included articles on the inclusion of women, transgenders, people with disabilities, foreigners, and other minority groups into the workforce. Ford et al. interviewed transgender software developers and found that they were able to succeed in remote work positions more easily than in person positions, because they had more control over how they were perceived and were able to more easily disengage from toxic situations [26]. Transgenders' "ability to be perceived as presented is a means of security in tech" because it allows them to "say what they really mean without fearing for their safety or worrying about being stared at" [26]. Although it was a preliminary paper with little evidence or participants, it gave insight to the opportunities that more work from home positions could provide for the LGBTQ+ community and paved the way for future research.

4.2.5 Personal

The "Personal" category contains codes that pertain to one individual employee.

The **"Personal Alignment"** code was applied to articles that discussed an individual employee's likelihood to be good at working from home and enjoy working from home. This was often attributed to both personality and experience, such as being a goal-oriented, disciplined introvert and having more years of experience working in the field. Turetken et al. surveyed 80 North American telecommuters to see how "employee tenure, work experience, communication skills, task interdependence, work output measurability, and task variety impact telecommuter productivity, performance, and satisfaction" [71]. Tenure, work experience, and communication skills specifically fall under the "Personal Alignment" code,

so I will discuss only the results from those sections here. Turetken et al. hypothesized that employees with longer tenure, longer work experience, and better communication skills would have more success working from home, but found that tenure and communication skills had little to no effect on success other than higher job satisfaction. However, years of work experience had a strong effect on success.

The **"Health and Safety"** code was applied to articles that discussed an individual's physical, mental, or emotional health and safety. This included discussions of ergonomics in a home office, social isolation, work-life balance, and stress. Weinert et al. surveyed 57 IT professionals to investigate the psychological and behavioral strain of working from home after multiple companies (e.g. Yahoo) stopped their work from home programs [76].They hypothesized that four stressors, work overload, work-home conflict, information underload, and social isolation, contribute to increased behavioral strain and increased psychological strain. Behavioral strain was measured through "discontinuous intention towards teleworking" and psychological strain was measured through "exhaustion due to teleworking" [76]. The survey results showed that all four of the stressors directly influenced exhaustion, while social isolation and exhaustion directly influenced discontinuous intention, and they concluded that working from home had some negative effects on employee's health and well-being [76].

The **"Freedom"** code was applied to articles that discussed an individual's freedom to be independent and flexible while working from home. This included having some level of autonomy over one's work, including what to work on at any given time, as well as control over one's schedule or space. Watkins interviewed 11 professionals who worked from home in order to learn of the benefits and drawbacks of the arrangement and to see why they decided to work from home. Many people enjoyed working from home because of the various freedoms it provided them [75]. "Better control of the environment" contributed to the experience being "more comfortable, as one is in control of heating and ventilation [and] one can listen to music if one wants" [75]. There was also more control of how time was allocated.

Multiple people mentioned that "time can be arranged to suit family requirements" [75]. This autonomy outweighed the additional stress and challenges of working from home for most of the interviewees.

The **"Productivity"** code was applied to articles that discussed an individual's productivity when working from home. This was often a self-reported "perceived productivity," as work output rates are not always clearly measurable for all jobs. Onyemaechi et al. hypothesised that working from home would have no impact on productivity, measured as speed of service and quality of work [53]. In order to test their hypothesis, they looked at survey responses of 88 telecommuters in Nigeria. They found that there was a weak positive relationship between working from home and quality of work and a strong positive relationship between working from home and speed of service, concluding that working from home led to improved productivity. However, due to the quality of work relationship being weak, they noted that there could have been other factors contributing. The main issue with this study is that the reports of productivity, both quality and speed, were self-reported in a survey rather than directly measured. People may have a warped opinion of their own work, which could bias the results.

The **"Home Boundaries"** code was applied to articles that discussed an individual's boundaries between work and home life when working from home. This included things such as separating personal space from work space in the home, setting working hours, and juggling responsibilities. Salazar studied "how workers in a home environment define their space, time and environment" as well as the "relationship between work and home and the influence each has on the other in setting up a place and in choosing a time to do work" [60]. Structured interviews revealed that a focus on six boundaries were required to be successful when working from home. These included "space, time, roles, working tasks, psychological boundaries and electronic boundaries" [60]. Most of the interviewees had a separate office or some designated space in their homes specifically for work. They also often chose to work

at times when other members of the household were either asleep or away from the home in order to ensure that they did not have interruptions. When this option was not available, they had to clarify to their families when they were or were not available. People with older children had an easier time of this than people with younger children, as the younger children would "often come in and say 'Why?'" because they did not understand the difference between working or non-working time [60]. Despite this focus on setting boundaries, many people blurred the boundary between work and home in order to do household chores while working on tasks that did not require very much concentration. The study concluded that boundaries were more complicated and more blurry than previous research suggested, and that more research should be done in order to better understand the topic.

4.2.6 People Interactions

The **"People Interactions"** category contains codes that involve multiple people's interactions. This includes interactions between co-workers, interactions with managers, and familial interactions.

The **"Home Boundaries"** code, which was discussed in the previous section on individuals, also falls into this category, because part of defining work-home boundaries involves interacting with the family or other members of the household. The code was therefore also applied to articles that discussed negotiating physical space and working hours, as well as navigating family conflict. Ciolfi et al. studied interview excerpts from 74 knowledge workers who worked from home and found that a lot of negotiation occurred between people within the household in regards to time, space, and conflict resolution [18]. In one case, the interviewee got "pushed out of the office that she [had] designed" and was "displaced to the kitchen table" so that her office could turn into a den for her children [18]. More commonly there was the need to manage interruptions - "they are not necessarily negative, but need

management" [18]. In some instances, tension between people in the house was intensified by the work from home situation. One employee was annoyed that their spouse would watch videos or check sports scores in the kitchen when she had to work in there, while another person felt pressure to handle all of the housework and childcare while still delivering value at work, since her spouse was not very supportive of her career choices [18].

The **"Collaboration"** code was applied to articles that discussed interactions between employees or between employees and their manager. This included working directly together, navigating task dependence, and manager wellness or progress check-ins. It also included communication, which could be directly work related or could be just to maintain social ties and group unity. Alsharo et al. surveyed software engineers at "major IT firms [...] (e.g. Microsoft, Google, IBM . . . etc.)" in order to test their hypothesized conceptual model of the potential "relationship between knowledge sharing, trust, collaboration, and team effectiveness" while working from home [3]. They found that knowledge sharing improved trust and collaboration and that increased trust led to better collaboration.

The **"Management"** code was applied to articles that discussed how to manage teams that work from home or how management style and choices affected the success an employee working from home. This included articles that provided tips and best practices for managers. Burbach and Day conducted semi-structured interviews with managers of teams working from home in both the public and private sector in order to understand the challenges and requirements of managing such teams [22]. Managers agreed that technical competencies were essential for communication, in addition to strong communication and active listening skills. They also agreed that "openness, honesty and approachability, and the ability to facilitate social team activities" were essential for increasing camaraderie within the team and gaining the trust of their employees [22]. Challenges that the managers faced included developing and managing employees who were seen as "misfits" by their co-workers, motivating employees who were not self-starters, and assisting employees with feelings of isolation.

The study concluded with a series of recommendations for managers in order to succeed when working from home, including improving their own communication skills, getting to know team members individually, leading by example, actively looking out for issues, both with the work and with individuals, and helping their employees to grow [18]. In general, the management recommendations for remote teams seem like amplified versions of what managers should be doing for in-person teams.

The **"Trust"** code was applied to articles that discussed depending on other employees for support or to complete an interdependent task and generally giving everyone the benefit of the doubt. This included articles on employees trusting co-workers as well as managers trusting employees to work efficiently and securely from home. It also included articles that discussed a lack of trust, which contributed to an inability to begin working from home or caused issues while working from home. Dickson and Clear used surveys and interviews to understand issues in the adoption of telework in companies across Europe and found that lack of trust was a major factor for companies failing at or avoiding the implementation of telework programs [24]. Many companies relied on "physical oversight" of their employees and were concerned that employees would be less responsible when working without supervision. They were also concerned that employees would find it hard to be motivated to work from home when they were accustomed to their home being a place of leisure [24]. Some companies also did not trust their employees to properly protect "sensitive and confidential data" [24]. In order to overcome these difficulties, it was noted that companies would need to change from monitoring input, or hours worked, to measuring output, as this would remove the need to physically oversee the employees sitting in their desks in the office, but would still require that the employees finish their work at the speed and quality required of them. They also would need to provide better security training programs and software to ensure that data would stay protected.

The **"Grace"** code was applied to articles that encouraged managers to grant employees

grace in regards to maintaining work-life balance, making schedule adjustments, taking time off to handle personal responsibilities, and handling unexpected events. Iqbal et al. surveyed people working from home due to the COVID-19 pandemic in order to "understand the effects of remote work and mandated work-from-home measures" [33]. Their most notable findings were the effects on employee well-being and their recommendations for supporting employees who were working from home. They recommended that companies tailor their support of health and well-being to the individual's needs, granting grace, acceptance, and understanding in times of unexpected interruptions and necessary time off, and working with the individual employee to navigate boundaries that they do not have much control over. They recommended allowing flexible time and "normalizing integration of family needs during work time" [33].

4.2.7 Environmental Impact

"Environmental Impact" is a code that was large enough and different enough from the others to be in its own category, so it is both a code and a category. It was applied to articles that discussed the environmental impacts of working from home, which included discussions on physical office space consumption, energy consumption, greenhouse gas emission, pollution, and traffic congestion. Hook et al. performed a systematic review of the environmental impacts of working from home and found that most studies found a slight positive indication that working from home would save energy, but that researchers should be wary of actually drawing that conclusion due to various concerns [31]. One concern was that studies did not have a consistent way of calculating the results, and some studies did not even disclose what percentage of the population would need to be working from home or how many days per week those employees would need to work from home in order to experience the savings. Another concern was that the studies with positive results had smaller scopes than the studies that had inconclusive or negative results. This could mean that studies only had positive

results because their scopes were too narrow. Due to these concerns, Hook et al. concluded that they could not definitively state whether or not working from home would save energy, as it could depend on implementation and other factors, and they called for more research in this area.

In the next section, I will discuss the methods that the studies used.

4.3 Methods

The research methods that the articles used were mostly qualitative. The three most common methods in the previous research were surveys, interviews, and models (which includes developing models or experimenting with them), and the three most common methods in the COVID-19 research were surveys, interviews, and reports. These results are visible in Figure 4.3.

In the next section, I will discuss these results in relation to my initial research questions, as well as discuss limitations of the research.

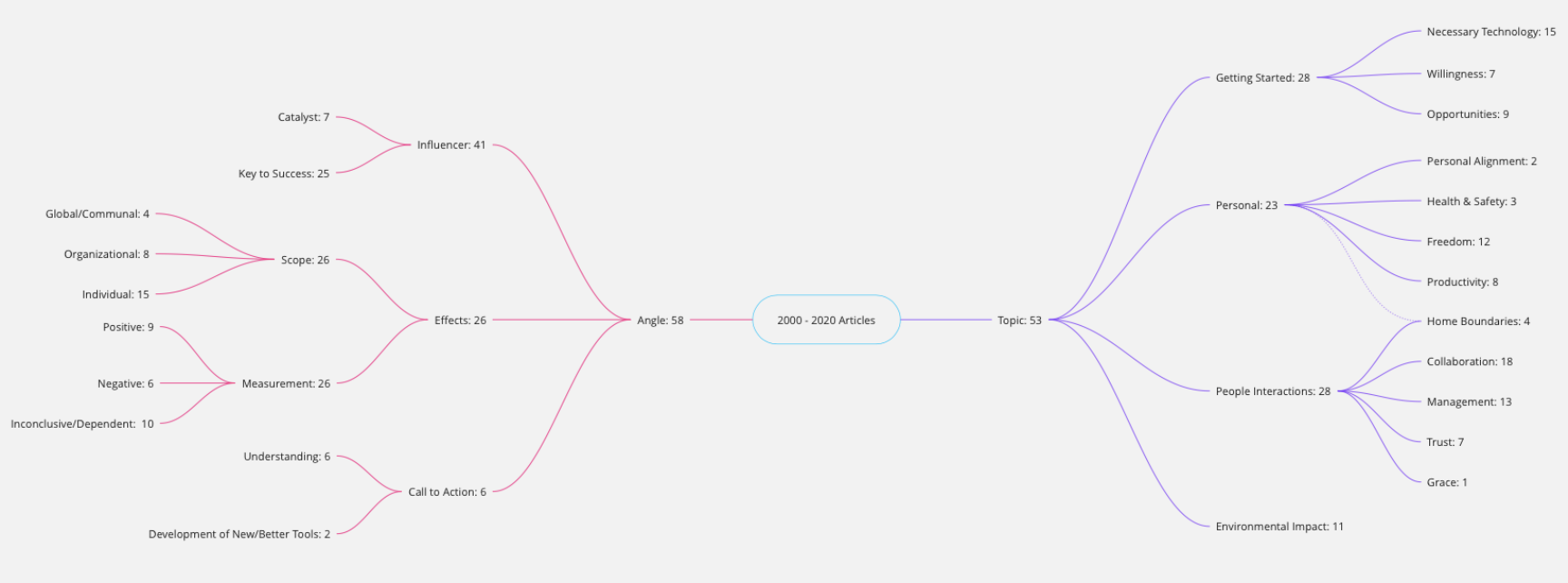

Figure 4.1: Categorization of codes for articles from 2000 to 2020.

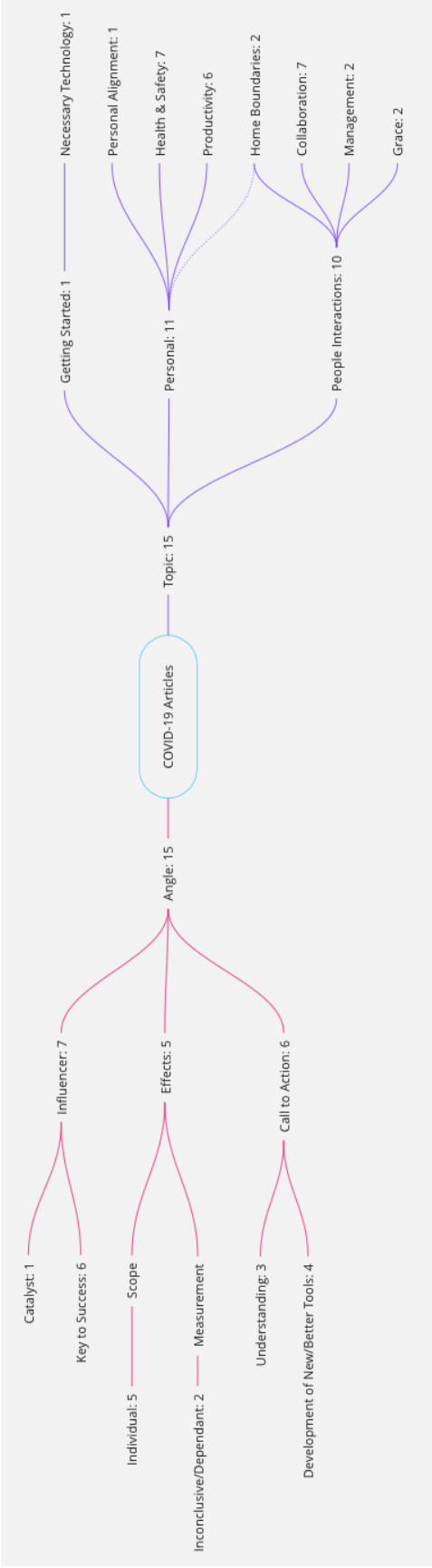

Figure 4.2: Categorization of codes for COVID-19 articles.

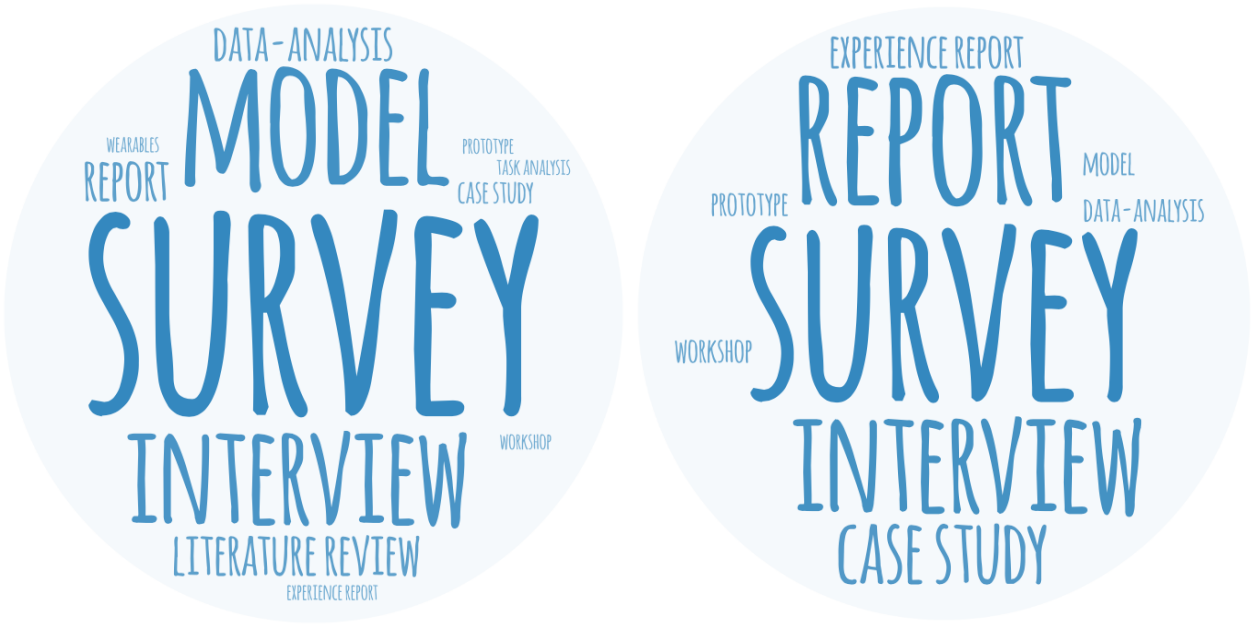

Figure 4.3: Word clouds visualizing the methods and their frequencies in the research. Results from the 2000 - 2020 research are shown on the left and results from the COVID-19 research are shown on the right.

Chapter 5

Discussion

5.1 Research Questions

In this section, I will discuss my results from the literature survey and qualitative analysis in relation to the research questions.

Q1: What is the state of previous (pre-COVID-19) research on working from home?

There were only 58 relevant articles found between 2000 and 2020. While these articles did focus on working from home, they often included interviews or surveys from people who work the majority of the time in the office; some qualified for the studies by only working one day a week from home or even one day a month from home. There were not many studies that focused solely on people who worked 100% of the time from home. Oftentimes, when the participants were working from home, the majority of their co-workers were still in the office, so it was not a whole team working from home at the same time.

Q1-A: What high-level topics and themes are covered by existing research?

The high-level topics and themes covered by the previous research can be seen in Figure 4.1. Generally articles had one or more topics and one or more angles in their discussions. The angles that articles took were usually asking for more research to be done in the future, discussing the effects of working from home, or looking at how to succeed with working from home.

Overall, the theme of the previous research seemed to be along the lines of "Should we work from home? And if so, how do we do it successfully?"

Common topic categories included getting started with working from home, things that affect or pertain to the individual employee, such as health and productivity, interactions with others both at home and at work, and the environmental impact of working from home.

The most common topics were specifically collaboration and necessary technology. Technology is essential to working from home, so it makes sense that this was one of the most frequent codes. Collaboration is important and is often a struggle when it is occurring over a distance. Many of the articles pointed out struggles, made recommendations for improvements, or discussed existing tools that help or could be built to help with collaboration.

Q1-B: What methods have been used to study working from home?

The majority of methods were qualitative, using interviews and surveys to collect data. Studies were often designed this way on purpose, because they were trying to get at the experience of people who are working from home, which can be self-reported much more easily than measured. However, other studies seemed to rely on these same self-reporting methods even when attempting to measure something that is difficult to self-report. An example of this is when studies attempted to measure productivity, as it was often deemed too complicated or impossible to quantitatively measure productivity. Most of the strictly data-driven studies related to measuring environmental impacts. However, even those were complicated and uncertain due to knock-on effects. Another common method, especially for

measuring environmental impact, was the development or use of models to experiment with different scenarios and analyze the results. This modelling method was necessary given that it was not possible for the researchers to actually measure the true effects, since most people were not working from home.

Q2: How does the previous research relate to the sudden shift to working from home for employees due to the COVID-19 pandemic?

There were 15 articles from February 2020 - December 2020 focused specifically on working 100% from home due the COVID-19 pandemic. This is a notable increase in number of articles per year than the previous research. It is also notable that all of the current research is on people who work 100% from home with all of their co-workers and managers also working from home. This is a big difference from the previous research, and might contribute to some of the differences in the topics and themes discussed. Also, the pandemic itself introduced additional facts. Some of these include the need to home-school children or provide child-care during work hours, more people using the physical home space and network, and additional stress due to health concerns.

Q2-A: What high-level topics or themes are covered by the research that occurred during the COVID-19 pandemic?

The high-level topics and themes in the COVID-19 research can been seen in Figure 4.2. Articles generally focused on how to succeed while working from home and how the individual was effected, but results were mostly inconclusive or called for additional research. This is not surprising given that there has been less than one year for this research to be designed, conducted, and refined, whereas the previous research had over 20 years to build up and improve. It is also not surprising that results were often inconclusive, as many companies and people of all types were suddenly forced to work from home. There was little to no preparation or ability to assess whether working from home was the best option for a job

type or personality, so results might vary as some people, jobs, and teams might be a perfect fit for working from home, while others are not. The research also mainly focuses on the individual, rather than the organization or global effects. This is expected due to the short time-frame, as effects at a wider scope might not be recognizable or measurable until more time has passed.

Q2-B: How do the COVID-19 research topics compare or relate to the topics from the previous research?

Comparing Figure 4.1 and Figure 4.2 we can see that "Environmental Impact" dropped off the diagram and the "Getting Started" category almost dropped off the diagram. Due to the sudden need to work from home, it makes sense that the "Getting Started" category nearly disappeared. There was no need to decide whether or not to work from home or plan for it, because most companies and employees had no choice in the matter and there was simply no time to plan for it. On the other hand, it is surprising that the "Environmental Impact" category disappeared. Given that many previous studies pointed out a need for additional environmental impact measurements once more people were working from home, it seems like now would be the perfect time to study it. However, there is the possibility that this is due to the short time-frame, as more studies on the topic might be published in the future. It is also possible that the measurements would still be inaccurate, as people are also using less energy and gas due to the pandemic than they might if they were working from home during a normal time. For example, many businesses are closed, so their buildings are not using energy throughout the day and many people are not travelling for leisure or for chores as much as they would be otherwise. All of these pandemic-related effects might make it difficult to measure the isolated environmental impacts of working from home.

Another difference between the two sets of research is that certain topics received more attention during the pandemic. Two of the most notable topics are "Grace" and "Health & Safety." "Grace" increased by 100% from previous research and "Health & Safety" increased

by 130%. It is seemingly expected that "Health & Safety" would be discussed more during a pandemic, but it is interesting that companies are more concerned about their employee's wellness in regards to working too hard or not having work-life balance than they were for employees who were working from home before the pandemic. One explanation for this is that there is a more widespread awareness given that everyone is doing it. Another explanation is that working from home was previously considered a perk or benefit, so there was less of a need to worry about those employees working too hard, because it was offset by the fact that they were receiving this perk. Now working from home is required, so companies need to ensure that their employees are maintaining their health and work-life balance. The other topic that was emphasized during the pandemic was "Grace," which is a little surprising in a work context, but makes sense when thinking about the stress that the pandemic causes. Companies have to be understanding when people need time to take care of a sick family member, attend to children who are not able to leave the house, or other unexpected situations that arise.

Q2-C: What additional research could be done in order to better support the extent of remote work caused by the COVID-19 pandemic?

There needs to be more work done focusing specifically on people, teams, and organizations that work fully from home. It is important to take advantage of a time when working from home is so prevalent by conducting research to measure things that researchers would otherwise need to rely on models for. One example of where this is needed is in regards to measuring environmental impact. Previous research was concerned about people using more energy at home than they would have used in the office, but often could not measure it due to a lack of subjects. Another example is in measuring the productivity of people who work from home and other qualities that are difficult to accurately self-report. Rather than relying solely on the surveys and interviews, it would be helpful to use more monitoring tools or wearables to actually measure different aspects of working from home. With so many people

currently working from home, it might be easier to find companies or employees who would be willing to participate.

Another research area to consider is tracking if companies return to the office when it is safe to do so or if they choose to continue work from home programs. It would also be interesting to see if the focus on the individual and their health and safety continues to be a strong driving factor in research going forward, or if the research will shift back to a more similar topic layout as the pre-COVID-19 research.

5.2 Threats to Validity

There are multiple potential threats to validity identified in this study. The first few relate to the content of the literature study. The exclusion criteria specifically excluded any studies that did not directly involve working from home. Other studies, which might actually still apply to the COVID-19 work-from-home situation, might have been excluded from the literature survey if they were only focused on distance teams or general remote collaboration. Also, the pre-COVID-19 articles that were included mostly involved participants who only worked from home once in a while (once a month or more). In addition, they sometimes conducted studies of a mixed group of people, some who work from home and some who work from a different location, such as a coffee shop. This differed from the COVID-19-related articles, which were all focused on working from home full time. This could lead to some issues in comparing the results from the two sets of data. Some of the conclusions regarding the differences between the previous research and the COVID-19 research, might be due to these sampling differences. Finally, the COVID-19-related research is relatively new and underdeveloped, as there has been less than a year to develop, conduct, and build upon it. Differences between the COVID-19 research and previous research might be from a lack of time to develop or expand the studies further. This is why future researchers should

continue to study this topic, as the results might change over time.

The final few threats to validity relate to how my personal background could affect the outcome of the qualitative methods used. Qualitative coding is inherently "a judgement call," so the codes, patterns, categories, and themes that researchers find are influenced by "[their] subjectivities, [their] personalities, [their] predispositions, [and their] quirks" [65]. My own experiences - as an employee who shifted to working from home because of the COVID-19 pandemic - filter into the lens that I use when looking at the data and affect the results. Additionally, the effects of this are amplified by the method of coding solo, because I did not have a team of researchers with different lenses to dilute my biases. Future researchers should consider having a group of people performing team coding in order to reduce this effect.

Chapter 6

Conclusion

In the course of this study, I conducted a literature survey on working from home resulting in 58 papers from the 20 years prior to the COVID-19 pandemic and 15 papers from during the COVID-19 pandemic. I then used qualitative coding and analysis methods to abstract out the topics, categories and themes from the research and compared them across the two time frames. I found that studies before the COVID-19 pandemic did not focus solely on working from home, as they involved a mix of in-person and at-home employees or employees who only worked part of the time from home, while studies conducted during the COVID-19 pandemic focused solely on working from home. I also found that previous research was more broad, focusing on the effects on individuals, organizations, and societies, whereas the COVID-19-related research focused mainly on the effects on individuals. The topics and results also shifted. During the pandemic, research on health and wellness increased, while research on whether or not to start working from home programs and the impacts to the environment decreased. Finally, I found that the need for managers or organizations to meet their employees' challenges and conflicts with grace and understanding became important during the COVID-19 pandemic, but was not focused on in the previous research.

It is important that researchers take advantage of this shift to working from home as there are more people and companies that will qualify for studies and might be willing and able to participate in research at this time. However, researchers also must keep in mind that the existing situation is not exactly the same as working from home would be outside of a pandemic, so there might be additional stressors or other conditions that factor into studies that not be applicable when the pandemic ends.

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Appendix A

Codebook

Work From Home Codebook

Code	Description	When to use	When to not use	Examples (Quotes)
Influencer	Something that affects the experience of working from home.	Use when an article discusses factors that cause people to work from home or factors that contribute to the success or failure of working from home.		

Code	Description	When to use	When to not use	Examples (Quotes)
Influencer: Catalyst	Something that causes an individual or organization to begin working from home.	Use when an article mentions reasons why someone chooses to work from home or why an organization decides to implement work from home programs.		"In this paper, we research the potential of information communication technologies (ICTs) for changing our society from a commute-centric to a network-centric environment - Kharitonov2011", "Telecommuting implementation is new in Malaysian Universities, therefore there is a need for pilot project to test the possibility of implementing teleworking, to give people the opportunity to experience teleworking, and thereafter they can express their experienced opinion about this new mode of work. -Osman2005"

Code	Description	When to use	When to not use	Examples (Quotes)
Influencer: Key to Success	Something that causes working from home to be more successful.	Use when an article mentions factors that lead to the success (or lack of success) of telecommuting).		"Knowledge sharing in virtual team settings could be a significant element in establishing social capital and social exchange among virtual team members. - Alsharo2017", "Furthermore, effective leadership can have a positive influence on affection, cognition, and motivation - Morrison2020"
Effects	Something that happens as a result from working from home.	Use when an article discusses outcomes of working from home.		
Effects: Individual	An effect that pertains to the individual employee's experience.	Use when an article discusses things that affect and individual person - this could be a manager or employee.		
Effects: Organizational	An effect that pertains to the organization as a while.	Use when an article discusses things that affect at an organizational level - this might be the attractiveness of the company, retention rate, monetary savings, etc.		

Code	Description	When to use	When to not use	Examples (Quotes)
Effects: Global	An effect that pertains to society as a whole.	Use when an article discusses things that affect society, the world, the environment, anything outside the scope of just an organization/individual.		
Effects: Positive	A positive effect of telecommuting	Use when an effect is positive or when telecommuting leads to more of something good or less of something bad.		"Telework systems have a positive effect on process innovation. - Kyriakou2016", "Surveys by IBM Canada found that their employees are as much as 50 percent more productive when they work in telecommuting environments and HewlettPackard doubled revenue per salesperson after converting its sales force to telecommuting. - Ahmed2014"

Code	Description	When to use	When to not use	Examples (Quotes)
Effects: Negative	A negative effect of telecommuting	Use when an effect is negative or when telecommuting leads to more of something bad less of something good.		"Teleworkers do not have the opportunity for “water cooler,” or hallway, conversations and have to find other ways to engage with their co-workers. - Weiss2015", "The supporting technologies may not be enough to resolve issues such as culture, collaboration, social and professional isolation - Blount2015", "Teleworkers who are treated unequally may feel isolated, unappreciated, or as if they are not part of the team. - Day2011"

Code	Description	When to use	When to not use	Examples (Quotes)
Effects: Inconclusive/Dependent	Something that is unclear whether it is a good or bad effect.	Use when multiple articles provide opposite effects for the same topic, when the article says that the results are inconclusive, or when the article says that it depends on the implementation.		"These uncertainties and complexities suggest that, despite the positive evidence for energy savings that was found across the sample of studies, we should be cautious in drawing conclusions about the scale and consistency of energy savings from teleworking. Context matters, and in many circumstances the savings could be negative or non-existent - Hook2020"
Call to Action	Something that points out a need for future work or research.	Use when an article discusses a need for additional research to better understand or tools to help people work from home.	Do not use if someone is making a call to action for people to change how they are doing things when working from home or managing from home.	

Code	Description	When to use	When to not use	Examples (Quotes)
Call to Action: Understanding	A need for future research to better understand a topic	Use when an article says that more research is needed to clarify or understand something, or to get more consistent results		"There has been surprisingly little research investigating links between telecommuting and health-related behaviors and outcomes. Several topics appear particularly worthy of attention. - Allen2015", "Future research can look at changes over time and assess whether the positive relationship between teleworkers and income continues to hold. - Gallardo2018"
Call to Action: New Tool(s)	A need for future research to build new tools to help telecommuters	Use when an article says that new tools are needed.		"inform the design of technologies that help maintain boundaries between work and home life. - Cox2014", "As a result, it is clear that current technology needs to be updated to better assist the development of trust in distance collaborations. - Morrison2020"

Code	Description	When to use	When to not use	Examples (Quotes)
Collaboration	Interactions between people needed to stay sane or get the job done.	Use when an article discusses the effects of communication, collaboration, task dependence, working together, seeing each other, etc. Any type of interaction between employees/managers.		"It was not until after the meeting and they hung up the phone did they realize I had “left the meeting”. When this happens there needs to be an alternate way of notifying the leader of the meeting there is a technical problem, such as a pager or cell phone -Martin2007", "It can be beneficial to develop a work style based on much more explicit communication. Communication that would often be conducted in a tacit manner in collocated work environments needs to be explicit in distributed team contexts - Koehne2012", "Jobs with tasks that interlink with other team members may not be suitable for anywhere working or at least not all the time. - Blount2015"

Code	Description	When to use	When to not use	Examples (Quotes)
Personal Alignment	One's probability of being good at working from home based on personal factors.	Use when an article mentions that some people are good at working from home and others are not just based on personality, experience, skills.	Do not use when discussing one's willingness to work from home.	"Eight of eleven corporate participants and five of nine state government participants considered having team members who are not self-starters or goaldriven is a challenge to developing and managing teleworkers. - Day2015", "Managers should not make assumptions that all employees want to have an anywhere working arrangement because this is not the case - Blount2015"

Code	Description	When to use	When to not use	Examples (Quotes)
Willingness	When people want to implement working from home.	Use when an article mentions people's willingness to start or allow working from home.		"It is surprising that even this newest generation of workforce entrants, particularly Millennial females, do not embrace the concept of teleworking. - Nicholas2009", "The research established that Perceived Behavioural Control has the most influence on Telework Intention and that it is a predictor of adoption. - Morrison2019"

Code	Description	When to use	When to not use	Examples (Quotes)
Necessary Technology	Technology that is needed in order to start, spread, or successfully continue working from home.	Use when an article discusses the technology that is needed to support working from home. This can be technology needed in the home or networking things needed more nationally/globably.	Do not use when an article is requesting research on new technology.	"Lastly, while considering the teleworkers, organizations need to examine whether that teleworker is properly equipped or not. They should have internet access, particularly high speed broad band service, personal computer and mobile device at the minimum level. - Quoquab2013", "The Service Delivery Manager for Ericsson, for instance, attributes the acceptance of the telecommuting phenomenon to the availability of supporting devices and technology, which include internet and MiFi devices. - Ansong2018"

Aa Code	Description	When to use	When to not use	Examples (Quotes)
Opportunities	A job opening that would be otherwise unavailable if not for working from home.	Use when an article mentions that remote work provides opportunities for those who would otherwise be unable to work for any reason including discrimination, ability, safety, and other responsibilities. (Disabled, transgender, women, elderly)		"remote work technologies can increase the sense of empowerment transgender people have to be authentic and effective in their work. -Ford2019", "A dominating 49% said that they will surely be able to work if they get the choice of working remotely from the safety of their homes, as security has sadly added to the reasons that Pakistani ladies are unable to establish their careers. -Baig2014"

Code	Description	When to use	When to not use	Examples (Quotes)
Trust	Giving each other the benefit of the doubt. Depending on each other.	Use when an article discusses the impact of trust on working from home. This could be when allowing to work from home, between managers and employees and between employees.		"The fear of what individuals might do or not do when 'out of sight' underlines a basic lack of trust in employees, and without trust telework is unlikely to be successful. - Dickson2006", "The data from Company B certainly supports this argument and trust can be considered as an enabler to telework maturity and success. - VanDerMerwe2014"

Code	Description	When to use	When to not use	Examples (Quotes)
Health & Safety	Mental and physical health of those who are working from home.	Use when an article mentions the health of home workers, mental or physical. This includes mentions of isolation and stress.	Do not use if the person is working from home because they are unhealthy or caring for a sick family member.	"First the problem relates to the high levels of emotional stress or anxiety with which in-home workers, especially women, often struggle. -Hori2004", "We theorize that teleworking-induced stressorsinfluence IT personnel's psychological and behavioral strain in the form of exhaustion due to teleworking and discontinuous intention towards teleworking. -Weinert2014"
Home Boundaries	Boundaries between work and home life.	Use when an article mentions keeping work and home life separate while working from home. This includes things like physical space, working hours, family conflict, etc.	Do not use if an article mentions work-life balance that contributes more to health and well-being.	"As telecommuting often involves conducting work within one's domestic space, it erases the physical demarcation between work and home. -Allen2015", "This study shows how the boundary between work and home is not as clear-cut or as sharp as suggested by previous research. -Salazar2001"

Code	Description	When to use	When to not use	Examples (Quotes)
Management	How managers oversee and affect employees who work from home.	Use when an article discusses how management affects home workers or gives advice for how to manage them better.		"These [high performance telework management] strategies include developing an inventory of diverse team skills and competencies, promoting cognitive diversity, utilizing a collaborative management style, promoting trust and unity, facilitating the use of collaborative technology, introducing interdependence to tasks, and implementing a fair reward system. - Day2011", "A management culture in which trust of employees is lacking and dominated by physical oversight of employees (and what the Italian partners term as the 'logic of subordination') will militate against successful teleworking. - Dickson2006"

Code	Description	When to use	When to not use	Examples (Quotes)
Environmental Impact	The effects of working from home on the environment.	Use when an article measures or makes claims about the environmental impact (energy, gas, etc) of working from home.		"In all cases, [telecommuting] has a positive net embodied primary energy impact and transportation impacts dominate. We found that [telecommuting] energy savings increase dramatically with [telecommuting] frequency and when it reaches a scale sufficient for organizations to reduce office floorspace. - Roth2008"

Code	Description	When to use	When to not use	Examples (Quotes)
Freedom	One's freedom to be independent or flexible with their work.	Use when an article mentions how working from home gives employees the ability to be independent or flexible.		"It is more comfortable as one is in control of heating and ventilation. One can listen to music if one wants. There is considerably more flexibility. There are fewer distractions and one can work late at night if one wishes. - Watkins2000", "Thus, it is no surprise that autonomy has been identifi ed as one of the primary reasons for why telecommuting is desired by employees. - Nicklin2016"
Productivity	One's efficiency and rate of output at work.	Use when a n article is focused on measuring or understanding how productivity is affected by working at home.		
Grace	Understanding that there might be family interruptions and schedule shifts and working with that rather than getting upset about it	Use when an article mentions that managers should grant grace or understanding to their employees who are telecommuting regarding schedules, interruptions, and unforeseen absences.		