Does working from home work? That depends on the home.

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Abstract

Working from home has risen in popularity during and after COVID-19. There is an ongoing debate about the productivity implications of work from home, but the physical climate of the home office has gained only limited attention. This paper investigates the effect that home office hardware and environment satisfaction have on productivity and burnout propensity when working from home (WFH). We surveyed over 1,000 Dutch individuals working from home. Participants report on the physical climate of their home office and the office characteristics satisfaction, their self-reported productivity and burnout propensity, as well as their willingness to continue working from home. Our results reveal that the individual differences in WFH productivity relate to the heterogeneity in the physical home office environment and its satisfaction. First, we find that self-reported productivity is higher at work compared to working from home. Second, participants prefer the indoor environment (e.g. temperature, air quality, lighting) at home over the environment in the work office, but prefer the work office hardware (e.g. screen, chair, Wi-Fi). Third, higher satisfaction with home environment factors significantly predicts increased productivity and decreased burnout propensity. Fourth, we connect real behavior with satisfaction scores and productivity. A structural equation model shows that more ventilation (the percentage of time the home office is ventilated) during working hours increases productivity and the willingness to continue WFH, whilst decreasing burnout propensity. This effect is fully mediated by satisfaction with the home office factors. This paper shows that the physical climate of the home office affects the success of WFH. The move from the work office to the home office needs to be accompanied by careful design and investment in the quality of the office, as well as its climate.

Introduction

The COVID-19 pandemic, in combination with recent technological advancements, has quickly elevated the status of working from home (WFH) from “occasionally” to “the new normal”[1]. Earlier uncertainty about the quantity and quality of work produced at home had hampered large-scale corporate acceptance [2,3]. However, these doubts were simply overturned by the COVID-19 pandemic, which forced most knowledge-based employees to work online. Negative stigmas that were previously associated with working from home diminished drastically, at least temporarily [1]. In addition, prior technological complications were quickly overcome following a pandemic-driven surge in technological innovations, such as the advent of Teams and Zoom calls. This involuntary litmus test pushed working from home out of its infancy. However, what has gained limited attention in explaining the impact of the rise of working from home is the physical climate in which daily work takes place – the home office. Thus, this study investigates the effect that home office hardware and environment satisfaction have on self-reported productivity and burnout propensity.

Work from home impact

The rising popularity of work from home in the last decade has been well-reported: a recent report by buffer.com [8] amongst 2,300 workers showed that over 97% would like to continue to work from home, at least partially. Employees are, on average, willing to take a 5% pay cut for 2-3 days of work from home [9]. Employees working from home report being as productive as they were at the office before the pandemic [10]. These positive experiences have led to the prediction that, after the pandemic, 20% of all office work will be carried out from home. This continuation of work from home is expected to boost productivity by almost 5%, although largely unobservable by standard measures, as it stems mainly from a reduction in commuting [1].

Working from home has clear advantages as well as disadvantages for both job performance and human health and well-being. Multiple studies show positive effects on job satisfaction and turnover intent [11–13]. Bloom et al. [14] report that work from home leads to less commuting and fewer distractions. In addition, exhaustion leading to burnout is negatively related to work from home [15]. Perceived autonomy seems to be one of the main drivers of these positive effects: the degree to which employees can choose a location and time to work, independently of their supervisors, both predict the intensity of working from home, as well as job performance, mental burnout, and job dedication, even during the pandemic [14–17].

More recently, Bloom et al. [18] found only modest self-reported and realized productivity increases for work from home during COVID-19, whereas others identified productivity decreases for those who did not work from home before the pandemic, suggesting selection bias in previous studies [19]. Moreover, output assessments amongst ICT workers suggest productivity actually drops at home [20]. In the past, the positive relationship between work from home intensity and productivity has repeatedly been found to be non-linear. According to Golden & Vega [21], the optimal intensity to work from home is limited to about 16 hours per week. Work from home more and job satisfaction and performance could decrease. A survey by State of the Work in 2022 found that, amongst 2,000 respondents, 45% think career growth will be at risk with increased work from home [22]. Unsurprisingly, it is coworkers' relationships that suffer most from working from home, leading to professional isolation, which in turn has the potential to escalate into decreased performance and turnover intent [13]. Offline or online communication could mitigate these negative effects, but possibly only partially [17,23]. For instance, Yang et al. [24] find that firm-wide remote work inevitably lowers communication quality, as less communication leads to a worsening of information sharing.

Beyond having implications for coworker relationships, work from home may bring new interpersonal problems to light. Felstead & Henseke [25] suggest that homeworkers are burdened by the "social exchange theory": they work harder, longer, and work unpaid hours in order to justify their freedom to work from a preferred location. Workers thus (over)compensate for the perception that they might work less when not being observed. The resulting work exhaustion has the ability to offset all positive effects of work from home on productivity, and may even lead to burnout symptoms [26]. In addition, research shows that people working from home find it hard to detach from work, disrupting their established work-life balance [17]. Interestingly, the work-family conflict was previously considered to decrease with work from home, supposedly due to increased autonomy [13]. The current perception of work from home having a negative impact on work-life balance could also be a pandemic-specific challenge.

Work from home heterogeneity

Although overall perspectives on work from home vary, it is also important that beyond the average effects, substantial heterogeneity has been documented across jobs and individuals. To our knowledge, this heterogeneity has solely been explained by work and personal characteristics. For instance, the degree to which a job is suitable for work-from-home strongly predicts productivity [10]. A job previously executed from behind a desk (e.g. financial services) is more easily shifted to a home office as compared to a manual, labor-orientated occupation. A heavy workload and the degree of monitoring by supervisors also negatively impact the work effectiveness from home [17]. Jobs that have high levels of interdependence with colleagues, or are outcome-oriented, suffer when work from home intensity increases [27]. Overall, limited support and inadequate feedback by the employer mitigate the positive effects of work from home [15,17].

At the individual level, self-discipline seems to be a key factor for an efficient work from home [17]. The degree to which an individual is able to ignore distractions that they do not have at the office is important, especially without the same level of social control by coworkers. Additionally, women seem to suffer more from work from home as compared to men [10]. Women state their job to be less suitable for work from home in general and the presence of children affects work from home productivity for women more negatively as compared to men [28–30]. Finally, the pandemic showed that young workers seem to appreciate work from home more, and opted for work from home more often as compared to older workers [31]. These results, however, are not stable per se. Another study shows opposite results, where both women and older workers reported being more productive when working from home [32].

Work from home physical office

What has gained limited attention in explaining individual differences in work from home satisfaction is the physical climate in which the daily work takes place. The COVID-19 pandemic has led to increased attention to the effect of indoor space on pathogen spreading. Specifically, ventilation has become the spearhead combating the airborne spreading of the COVID-19 virus at public and private indoor gatherings [33,34]. The attention to air quality reinforces an existing trend where workplace quality is more and more important. In the office, employers aim to facilitate a healthy and comfortable work environment for employees, with the goal of promoting productivity [4,6,35]. Bad air and light quality, temperature, and noise have all been shown to negatively affect productivity and increase sick building symptoms, such as headaches in the office [7,36–38]. Hence, ergonomics, temperature, and noise pollution are all considered by modern employers in order to minimize interference with comfort and wellbeing in the office [39].

For the move to the home office, a trade-off is to be expected. On the one hand, suboptimal ergonomics at home are not as easily mitigated [40]. For instance, not having a dedicated office negatively influences productivity at home [32]. On the other hand, research suggests that controlling the thermostat at home might benefit the work from home satisfaction

[41,42]. Looking at indoor environmental quality more broadly, Tahmasebi et al. [43] show that people working at home during the pandemic close their windows more often as compared to before the lockdown. Combined with CO_2 data, they conclude that working from home often leads to worse indoor air quality. Generally, the professionalism or quality of the environment might suffer, but the workers' experienced control over these conditions at home might increase.

The remainder of our paper is organized as follows. In the next section, we provide an overview of the current state of the literature and the background of working from home. Section 3 provides an overview of the metrics we included in our survey design. In section 4 we describe our sample and also explore the difference in reported scores for the home office compared to the work office. Section 5 discusses the model used to estimate our findings. The results of our regression models, as well as our mediation models, are presented in section 6. Finally, section 7 concludes.

Methods

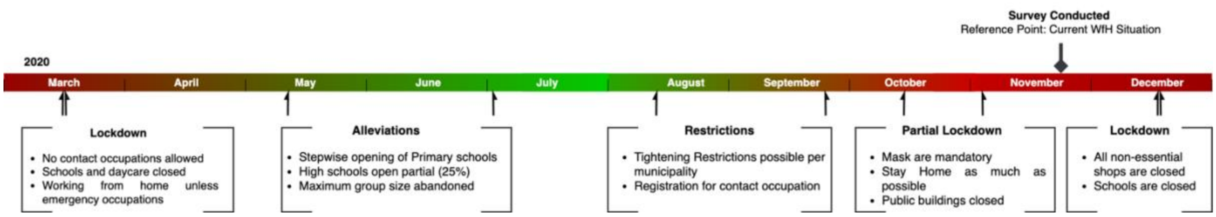
Participants

We surveyed 1,002 Dutch individuals via the Flycatcher panel. Flycatcher is an academically-orientated research organization that established a high-quality panel representing the Dutch population (for example, see [44–46]) for well-published studies using the Flycatcher panel). Flycatcher randomly selected participants from their panel for an online survey, where participation was reimbursed. All Flycatcher participants receive written informed consent, are allowed to drop out at any time, and included participants have actively consented to participation ('double-active-opt-in'). For the purpose of our research, we included only office workers (with a minimum age of 18 years old), who worked at least part-time from home at the time of the survey. People without work, previously without work, or working exclusively from the office were excluded from our sample. All data was collected unanimously and thus cannot be traced to an individual in the panel. The research setup was reviewed and approved by Maastricht University's Ethical Review Committee Inner City Faculties (ERCIC_195_09_06_2020).

Empirical setting

The data collection took place in November 2020. At that time, the Netherlands had been in some form of lockdown for over 8 months due to the COVID-19 pandemic, since March 2020. Fig 1 provides a colorized overview of the timing data collection with respect to the Dutch restriction's development. Working from home was strongly recommended by the government, with some exceptions including workers in healthcare and essential shops. During this time, employers were not allowed to force their employees to come to the office. All other social activities were severely limited. A selection of questions was answered based on two moments in time: "current" (i.e. November 2020, working from home) and one year ago (working from the office).

Fig 1. Working from Home and Survey Timeline



It is relevant to point out that we utilize the COVID-19 restrictions to eliminate the selection problems hampering previous research. Before the pandemic-related restrictions, the success and satisfaction of working from home could potentially be explained by self-selection following the request to (voluntarily) move to work from home. Inherent intrinsic motivation, personal characteristics, and ability to adjust to the physical environment could all be omitted factors in that request. From a company perspective, those previously offering WFH must have had job characteristics that fit (at least partially) WFH. Due to the pandemic, this selection bias susceptibility is fully eliminated in this research.

Material and variable construction

The survey included multiple previously validated modules. First, in order to measure productivity and work satisfaction, the survey included the Health and Work Questionnaire (see [47–49]. Following an evaluation and confirmatory cluster analysis, a revised version was validated specifically fitting the working-from-home situation (WFH-HWQ) [50]. This easily-administered questionnaire allows for the assessment of various factors of workplace performance: productivity, productivity by others, peer relationships, nonwork satisfaction, and stress and irritability.

The survey further included single-scale estimations of WFH productivity and satisfaction, such as self-reported productivity, satisfaction (with work in general, and with the WFH situation), and happiness. Additionally, participants stated their willingness to continue with WFH. These items were all measured on a 10-point Likert scale, ranging from absolutely not (1) to completely (10).

The survey also included a short module estimating burnout propensity, comparable to Bloom et al [12]. Adopted from the Maslach burnout inventory [51], 6 questions were scored on a 7-point Likert scale, ranging from never (1) to always (7), capturing emotional exhaustion. In addition to these six items, we added a 7-point Likert scale for sick days as well as break time during office hours

To assess the conditions in the home office, we included two separate modules. The UC Berkeley center for building environment module assesses the perceived indoor environmental quality and satisfaction [52]. This survey has been extensively used in peer-reviewed research [7,53,54] and measures satisfaction on all relevant indoor environment factors such as indoor temperature, air quality, lighting, and noise. We also included relevant office hardware factors of the building environment module. These factors focus on the physical attributes in the office, pertaining to the desk, chair, screen, hardware, and Wi-Fi satisfaction. . All factors are measured on a 7-point Likert scale, ranging from very dissatisfied (1) to very satisfied (7).

Next, we used a combination of work and office characteristics in the survey. These factors help to gain a complete picture of the WFH conditions and identify individual differences, potentially crucial factors influencing WFH outcomes. The office characteristics include the room (open versus closed), lighting (natural light versus no natural light), and ventilation (mechanic versus manual). Additionally, participants are asked to estimate the surface of their office (length and width in squared meters), and how often they ventilated their office (in percentage of time spent in the office). The work characteristics included the ability of the respondent to perform their work from home (1-10 scale), the company size (1-5, 5-15, 15-50, 50+ employees), length of the workweek in hours, and job category (e.g., governmental, non-governmental, self-employed, or on-call).

Finally, demographic information included age, gender, income, family size, and daily household situation. The daily household situation factors could support or hamper productivity when compared to the office situation. The house that participants reside in could interfere with the perceived WFH office characteristics. Matched on their 4-digit postcode, we added average urbanicity ('stedelijkheid'; STED), address-density ('omgevingsadressendichtheid'; OAD), and house value ('waarde van onroerende zaken'; WOZ) per participant.

Empirical models

Linear Regression models

We use multiple linear regression to formally assess the relationship between home office hardware and home office indoor environment satisfaction on productivity and burnout propensity using the following models:

$$y_i = \alpha_0 + \alpha_1 \text{hardware satisfaction}_i + \alpha_2 GC_i + \varepsilon_i \qquad (1a)$$

$$y_i = \beta_0 + \beta_1 \text{indoor environment satisfaction}_i + \beta_2 GC_i + \varepsilon_i \qquad (1b)$$

where y_i is the predicted value of either productivity or burnout propensity for each participant i. Model 1a isolates the effect of home office hardware ($\text{hardware satisfaction}_i$), whereas model 1b isolates the effect of the home office environment ($\text{indoor environment satisfaction}_i$) on our dependent variables. Both models include a set of carefully selected general controls (GC_i) that could otherwise confound the estimators. Specifically, these include demographic characteristics (gender and age), job characteristics (company size, job suitable for working from home, type of work, income, and working hours), and household characteristics (household size, children at home, partner at home, and pets).

Model 2 shows the combined model including both the effect of home office hardware and home office indoor environment on our dependent variable y_i .

$$y_i = \delta_0 + \delta_1 \text{hardware satisfaction}_i + \delta_2 \text{indoor environment satisfaction}_i + \delta_3 GC_i + \delta_4 OC_i + \varepsilon_i \qquad (2)$$

This model also stepwise adds physical characteristics of the home office controls (OC_i), including lighting, means of ventilation, and the room plan. In the appendix, an additional model is shown, for which we match our participants on postcode level to mean house characteristics. Running model 2 with and without home office controls, we estimate four models in total for both productivity and burnout propensity.

For all models, we standardized all continuous variables since they are originally measured on different Likert scales, to simplify the interpretation of the coefficients (coefficients are standardized unless specifically mentioned otherwise). As a result, the coefficients are z-scores and must be interpreted such that each coefficient indicates the change in the dependent variable for each standard deviation increase of the independent variable. By further inspection, correlation S2 Table in the appendix shows that both desk and chair, as well as screen and the hardware factor, have an internal correlation (r) exceeding 0.70. Since the correlations between these variables are intuitively not surprising, they are comfortably specified as a combined variable model. Thus, for any further analysis, the scores on these two pairs are combined and averaged per participant.

Structural Equation model

We implement a mediation analysis through structural equation modeling in order to understand how the home office environment influences productivity. This analysis assesses the impact of the physical environment on productivity, mediated by hardware and indoor environment satisfaction factors. For the analysis, we construct two latent variables, 'Office Hardware' and 'Office Indoor Environment' which each consists of all individual hardware and indoor environment satisfaction variables (see appendix S1 Fig for the loadings per latent variable). The factors are loaded by the marker variable identification approach. By doing so, the estimators of the latent variables on the dependent variable are fixed on the original 7-point satisfaction. In other words, the estimators indicate the effect per point estimate increase on a 7-point scale identical to the scales of the underlying variables.

Following model specification analysis, we declare covariance between the latent variables 'Office Hardware' and 'Office Indoor Environment', and indicator items desk and chair as well as screen and hardware. Since the correlations between these variables are intuitively not surprising, they are comfortably specified in a saturated model. This saturated model, containing additional parameters estimating those correlations, indeed fits the data better than the restricted model with these correlations fixed to zero (chi-squared difference = 568, DF difference = 3; $p<.000$; note that we do not combine the pairs desk & chair and screen & hardware pre-analysis in contrast to the multivariate regression, but enter them individually whilst declaring covariance in the SEM model. Doing so increases the Cronbach alpha of both models with 0.05 and improves the overall model fit).

Results

Descriptive Findings

The survey was completed by 1,002 participants of which 58.1% are male and the mean age is 43.89 (SD=12,54). All participants had work that was at least partially executed from home, with 57.9% of the respondents exclusively working from home. Table 1 shows further demographic characteristics. 54.6% of our sample enjoyed higher education (as compared to just over 40% for the Netherlands more broadly in 2019[57]) and 53.6% earned more than the modal income in the Netherlands. These metrics support the notion that cognitively demanding (desk) jobs are more likely to be suitable to be performed from home [10]. Considering the home office, we find that they are relatively spacious (M=25.14 m^2, SD=17,40) and predominantly illuminated by natural light (82,6%). Note that we use the estimated length and width of the office (in meters) to calculate the total surface in m^2. Extreme values (potential mistakes) for either metric ultimately led to unrealistic outliers. As a result, we truncated the office surface from 2 to 100 m^2 (46 data points excluded).

Table 1. Summary Statistics of Sample Demographics

		Mean (SD) or N (%)			Mean (SD) or N (%)
Demographics			**Work Characteristics**		
Age (years)		43.89 (12.54)	Income		
Gender (Female %)		420 (41.9%)		Modal wage (23-34k)	184 (18.4%)
Education Level				Minimum wage (less than 11,000)	23 (2.3%)
	Low	65 (6.5%)		Below modal (11-23k)	106 (10.6%)
	Middle	390 (38.9%)		1-2x modal (34-56k)	318 (31.7%)
	High			2x modal or more (56k)	219 (21.9%)
Family Characteristics				Don't know/ don't want to say	152 (15.2%)
Household Members		2.61 (1.21)	Company size (employees)		
Children Home during Office Hours				1-5	101 (10.1%)
	No Kids	482 (48.1%)		5-15	70 (7.0%)
	Always	33 (3.3%)		15-50	131 (13.1%)
	Sometimes	333 (33.2%)		50+	700 (69.9%)
	Never	154 (15.4%)	Work Sector		
Partner Home during Office Hours				Governmental	195 (19.5%)
	No Partner	240 (24.0%)		Non-governmental	654 (65.3%)
	Always	234 (23.4%)		Temp/ on-call worker	32 (3.2%)
	Sometimes	244 (24.4%)		Self-employed	121 (12.1%)
	Never	284 (28.3%)	Contract hours		
Pets				36+ hours	610 (60.9%)
	Dog	188 (18.8%)		20-35 hours	303 (30.2%)
	Cat	268 (26.7%)		12-19 hours	49 (4.9%)
				Less than 12 hours	40 (4.0%)
Home Office Characteristics			**Work from Home Characteristics**		
Home Office Floor Plan			Working from home currently		
	Open	377 (37.6%)		Exclusively from home	530 (57.9%)
	Average	139 (13.9%)		Partially from home	386 (42.1%)
	Closed	486 (48.5%)		Missing	86
Home Office Lighting				Work suitable to perform from home (0-10)	7.59 (2.39)
	Natural	828 (82.6%)	Work suitable to perform from home (0-10)		7.59 (2.39)
	Average	140 (14.0%)	**House Characteristics**		
	No Natural	34 (3.4%)	Real-estate value (WOZ; x €1.000))		274.64 (88.32)
Home Office Ventilation			Address-density (OAD; per 1 kilometer radius)		2118.10 (1749.55)
	Mechanic	135 (13.5%)	Urbanicity (STED; Categorical Address-density)		
	Manual	825 (82.3%)		Extremely High Urbanicity	199 (25.8%)
	None	42 (4.2%)		High Urbanicity	248 (32.2%)
Home Office Surface (m^2)		25.14 (17.40)		Average Urbanicity	154 (20.0%)
				Low Urbanicity	104 (13.5%)
				Non-Urban	66 (8.6%)
				Missing	231

Home office versus the work office

Performance differences

Table 2 compares the home office scores with the work office scores by applying nonparametric Wilcoxon signed-rank tests on paired samples' median differences. For example, the average WFH-HWQ factor productivity score at home is 6.84 out of 10 (SD=1.28 with a maximum of 9.90). Compared to the work office, the WFH-HWQ factor productivity scores higher at work (p<.001), whereas self-reported productivity does not differ (p >.06). The overall trend for the other WFH-HWQ factors (excluding Stress) shows a higher score for the work office. The single-question estimations of productivity and satisfaction show a slightly higher, yet similar, trend. Since Appendix S1 Table shows that the WFH-HWQ factor productivity estimator is strongly correlated with its single-question counterpart (r=.73, p<.0001), we solely refer to the WFH-HWQ productivity factor when we discuss productivity scores.

Table 2: Satisfaction and Productivity Non-Parametric Comparison Tests: Home Office versus Work Office

	Home Office (N=1002)	Work Office (N=1002)	*p*-value
Office Indoor Environment Satisfaction *(scale: 1-7)*			
Temperature	5.13 (1.28)	4.59 (1.24)	0.00***
Air Quality	5.41 (1.12)	4.61 (1.27)	0.00***
Lighting	5.37 (1.20)	5.07 (1.30)	0.00***
Noise	5.36 (1.32)	4.63 (1.34)	0.00***
Office Hardware Satisfaction *(scale: 1-7)*			
Desk	4.41 (1.55)	5.46 (1.12)	0.00***
Chair	4.50 (1.58)	5.37 (1.14)	0.00***
Screen	4.86 (1.53)	5.52 (1.09)	0.00***
Hardware	5.19 (1.32)	5.44 (1.07)	0.00**
WiFi	5.23 (1.32)	5.52 (1.15)	0.00***
	Home Office (N=1002)	Work Office (N=1002)	*p*-value
WFH-HWQ Factor Scores *(scale: 1-10)*			
Productivity	6.84 (1.28)	7.11 (0.93)	0.00***
Productivity by Others	7.55 (1.24)	7.78 (1.04)	0.01*
Stress and Irritability	3.82 (1.63)	3.95 (1.55)	1.00
Peer Relations	6.65 (1.59)	7.41 (1.23)	0.00***
Non-work Satisfaction	5.99 (1.59)	7.59 (1.06)	0.00***
Single-Item Scale Scores *(scale: 1-10)*			
Satisfaction Work Situation	6.82 (1.90)	7.22 (1.62)	0.00***
Happy with Work Situation	6.76 (1.96)	7.30 (1.56)	0.00***
Self-Reported Productivity	7.16 (1.72)	7.47 (1.35)	0.06
Burnout Propensity *(scale: 1-7)*			
Burnout Metric	2.87 (1.25)	2.64 (1.10)	0.00***

Note. *p<0.1, **p<0.05, ***p<0.01.

The average burnout score suggests that the majority of our sample shows limited signs of burnout during the home office (on a 7-point scale; M=2,87, SD=1,25). This score, however, does not deviate far from similar reports of a larger Dutch sample, which uses the same measurement [59]. Yet, relative to home, the work office performs better: at home, burnout propensity is significantly higher compared to the work office ($p<.01$).

Importantly, participants score 6.25 out of 10 (SD=2,93) on their willingness to continue with homework in the current situation (see Table 2). Although not low in absolute terms, this score seems relatively low in contrast to the optimistic sentiment stated by many polls following the COVID-19 WFH obligations. In addition to the 97% of 2,300 state to at least partially switch to WFH [8], under over 3,500 U.S. workers, 68% would choose to work from home over the office in general, with 61% even prepared to accept a pay cut to maintain that WFH situation [60]. This 68% preference for WFH over the office signals that our average willingness to continue of 6.25 is an accurate estimation. In sum, the burnout score and willingness to continue to appear to accurately estimate the population, which help us generalize our results to the general population.

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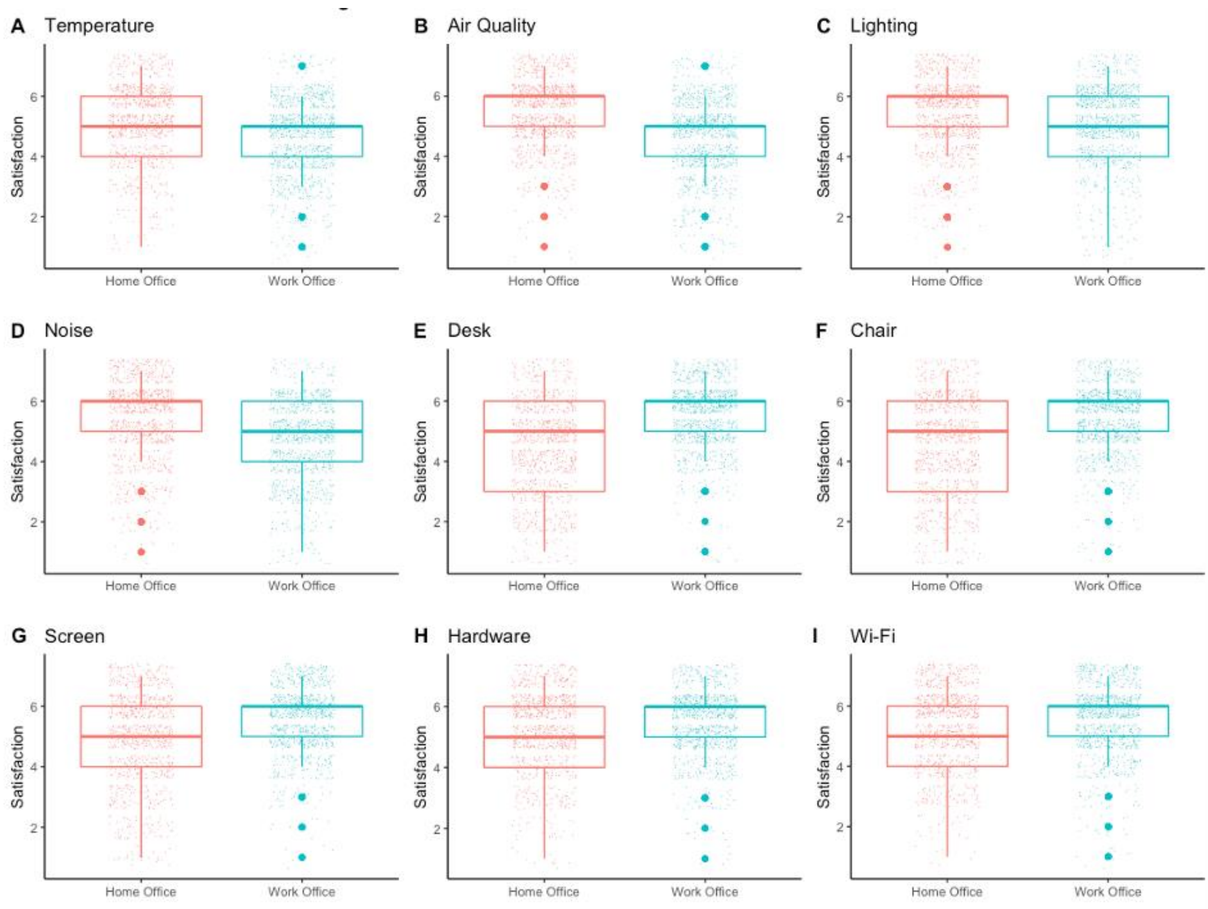
Office characteristics differences

The office hardware and office indoor environment factors are investigated for both the home office and work office. Fig 2 shows the distribution plots of both office indoor environment (A-D) and office hardware (E-I) scores. WFH increased the satisfaction of all office indoor environment factors: Temperature (A), Air Quality (B), Lighting (C), and Noise (D) all scored higher as compared to the work environment (mean scores range between 5.37 and 5.13 for the home office, compared to 5.07 and 4.59 for the work office; on a 7-point Likert scale). For office hardware, we observe the opposite trend: overall office hardware satisfaction at the work office is higher. The satisfaction for the desk (E), chair (F), screen (G), hardware (H), and Wi-Fi (I) range between 5.23 and 4.41 at home, whereas the work office hardware satisfaction levels range between 5.52 and 5.37. Table 2 shows that all differences are statistically significant, using the non-parametric Wilcoxon rank sum test and Bonferroni multiple comparison corrections. These observations support the notion that at home, optimizing ergonomics (e.g office hardware factors) remains challenging [40] while increased individual control over office indoor environment is preferred [41].

Fig 2. Office Hardware and Indoor Environment Satisfaction boxplot for Home Office and Work Office



It is important to confirm that participants are considering and rating the home office as distinctly different from their work office. We correlate each variable's score at home and at the office. As shown in appendix S2 Table, scores correlate moderately with different variables within the same environment (home office or work office), but correlate low with the same variables in the other environment. For instance, the correlation between temperature and noise at home is r=0.41, which is considered a moderately strong correlation [61]. Comparatively, the correlation between the temperature at the work office and the home office is negligible (r=0.06). This observation supports the divergent validity of the survey responses.

In conclusion, our comparison indicates that our sample seems to fare better at the work office: their productivity, non-work satisfaction, and peer relations are all higher compared to the home office. Burnout propensity increases during home office. Generally, happiness and satisfaction with the work situation are higher for the work office. The assessment of the physical office shows that the office hardware and office indoor environment display contrasting satisfaction trends: hardware is preferred at the work office, whereas the indoor environment is preferred at home. In the next section, we will investigate how these results relate to each other. Whilst controlling for an array of relevant factors, we examine whether physical office satisfaction affects productivity-related scores.

Explaining Productivity and Burnout in the Home Office

Office Characteristics

Table 3 shows the estimated standardized coefficients and standard errors of the home office hardware and home office indoor environment variables on the productivity factor. All office hardware variables at home are positively associated with productivity, such that increased satisfaction with each office hardware variable is associated with an increase in productivity when working from home (coefficients ranging from 0.18 to 0.15; SD = .03 to .05). For example, a 1.32 increase of Wi-Fi satisfaction on a 0-7 satisfaction scale translates to a 0.23 increase on a 0-10 productivity scale. This effect is relatively strong and comparable in strength to moving from sometimes having children at home during working hours to having no children at all (see Appendix S3 Table). Home office indoor environment variables show a similar pattern: without exception, all variables are associated with increased productivity (coefficients ranging from 0.21 to 0.08; SD = .04). Combining both home office hardware and indoor environment variables in model 3 decreases the coefficients intensity for some variables in the productivity model. Additionally adding controls in model 4 hardly affects the model further: all office hardware variables are relevant predictors of productivity, as well as temperature and noise satisfaction (indoor environment).

Table 3: Regressions of office hardware and indoor environment satisfaction on productivity

	Productivity			
	(1)	(2)	(3)	(4)
Desk & Chair	.15 (.04)***		.09 (.04)**	.09 (.04)**
Screen & Hardware	.18 (.05)***		.11 (.05)**	.11 (.05)**
WiFi	.18 (.03)***		.10 (.04)***	.10 (.04)***
Temperature		.14 (.04)***	.09 (.05)**	10 (.05)**
Air Quality		.08 (.04)*	.03 (.04)	.04 (.04)
Lighting		.11 (.04)***	.07 (.04)*	.06 (.04)
Noise		.21 (.04)***	.16 (.04)***	.16 (.04)***
General Controls	Yes	Yes	Yes	Yes
Home Office Controls	No	No	No	Yes
Observations	1,002	1,002	1,002	956
R^2	.25	.27	.30	.30
Adjusted R^2	.23	.25	.28	.27
Residual Std. Error	.88 (df = 972)	.87 (df = 971)	.85 (df = 968)	.85 (df = 915)
F Statistic	11.41*** (df = 29; 972)	12.16*** (df = 30; 971)	12.79*** (df = 33; 968)	10.01*** (df = 40; 915)

Note. **p*<0.1, ***p*<0.05, ****p*<0.01. For the full model including all controls, see Appendix S3 Table

Table 4 shows the coefficients for the same home office hardware and home office indoor environment satisfaction on burnout propensity. For the burnout models, the association is negative, meaning that an increase in satisfaction on either variable's satisfaction is associated with a decrease in the individual level of feeling burnout. The most robust predictors of burnout propensity are desk & chair and Wi-Fi satisfaction (home office hardware), as well as air and noise satisfaction (home office indoor environment).

Table 4: Regressions of office hardware and indoor environment satisfaction on burnout propensity

	Burnout Propensity			
	(1)	(2)	(3)	(4)
Desk & Chair	−.14 (.04)***		−.10 (.04)**	−.11 (.05)**
Screen & Hardware	− .09 (.05)*		−.04 (.05)	−.03 (.05)
WiFi	−.12 (.04)***		−.07 (.04)*	−.07 (.04)*
Temperature		−.07 (.04)*	−.04 (.04)	−.06 (.04)
Air Quality		−.11 (.04)**	−.08 (.04)*	−.09 (.04)**
Lighting		−.05 (.04)	−.02 (.04)	.01 (.04)
Noise		−.13 (.04)***	−.10 (.04)***	−.09 (.04)**
General Controls	Yes	Yes	Yes	Yes
Home Office Controls	No	No	No	Yes
Observations	1,002	1,002	1,002	956
R^2	.18	.19	.21	.21
Adjusted R^2	.16	.17	.18	.17
Residual Std. Error	.92 (df = 972)	.91 (df = 971)	.91 (df = 968)	.90 (df = 915)
F Statistic	7.60*** (df = 29; 972)	7.71*** (df = 30; 971)	7.70*** (df = 33; 968)	6.06*** (df = 40; 915)

Note. *p<0.1, **p<0.05, ***p<0.01. For the full model including all controls, see Appendix S4 Table

Comparing both tables shows that, on average, office hardware and indoor environment coefficients and significance levels are generally higher in the productivity models. For example, noise satisfaction is meaningful for both productivity as well as burnout propensity, yet the coefficient is roughly 50% higher for productivity for all models (0.21 to 0.16 versus -0.13 to -0.09, for productivity and burnout, respectively).

Individual Heterogeneity

Factors other than hardware and indoor environment (e.g. household characteristics), used in the regressions of tables 3 and 4 as control variables, are consistently associated with productivity and burnout propensity. These factors give insight into the baseline propensity for WFH productivity and burnout levels, beyond hardware and indoor environment. Both models 3 of Appendix Tables A3 and A4 show that the degree to which work can be performed from home does not add predictive value to our model Women tend to report higher levels of productivity (δ = 0.15, SD= .07). Not living alone, i.e. having a larger household, decreases burnout score and increases productivity (δ = -0.10, SD=.04; δ = 0.11, SD= .04, respectively).

Having a partner that is not (or only sometimes) home during office hours increases productivity (δ = 0.14 - 0.15, SD=.08) compared to the baseline of having no partner at all. In that sense, having a partner is good for productivity, as long as they are not constantly present during office hours. For children, a more predictable, strong, and linear pattern emerges: burnout propensity increases and productivity decreases when potential children spend more time at home during office hours. Interestingly, having a dog increases the burnout score significantly (δ = 0.17, SD=.08).

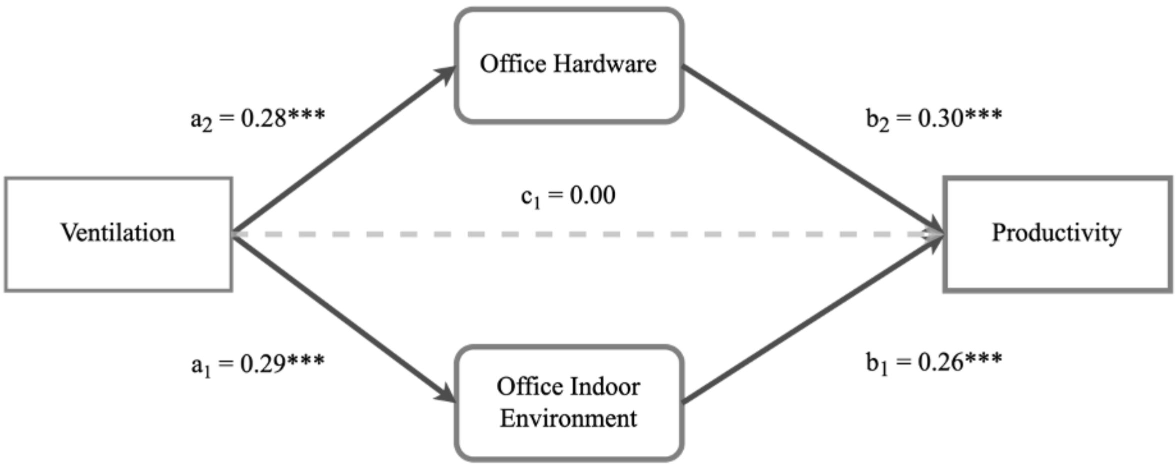
Finally, previous research indicated that during the pandemic, young workers seem to appreciate WFH more, and opted for it more often compared to older workers [31]. We find that moving from 20 years old to 40 years old increases WFH productivity score with roughly 0.25 out of 10. In strength, this example's effect is double as strong as the gender effect or the individual office conditions effect on productivity. We finally find older responders reporting a stronger willingness to continue to work from home (0.01 standard deviation increase per year of age, SD = .003; see Appendix S5 Table). Together, our results reflect that older workers not only report to be more productive at home and at the office than younger workers, but also seem to have an overall higher willingness to continue to work from home.

Mediation Analysis

We extend our analysis by exploring whether human behavior itself predicts satisfaction with hardware and indoor environment. Although office characteristics are fixed or dependent on capital expenditures, the indoor environment can be manipulated to a large extent by human actions. Specifically, we measure the behavior of respondents working from home through active ventilation, both at the extensive and intensive margin.

We implement a mediation analysis through structural equation modeling in order to understand how the home office environment influences productivity. Our model specifications show that the 'Office Hardware' and 'Office Indoor Environment' items loadings are meaningful per latent factor. Further reliability calculations confirm the factor's consistency, with both factors showing a Cronbach alfa above 0.8 (a=0.80 and a=0.85, for 'Office Hardware' and 'Office Indoor Environment', respectively). Additional model fit tests confirm that our saturated model fits the data well (CFI/TLI > .95, RMSEA close to .05, and SRMR < .05).

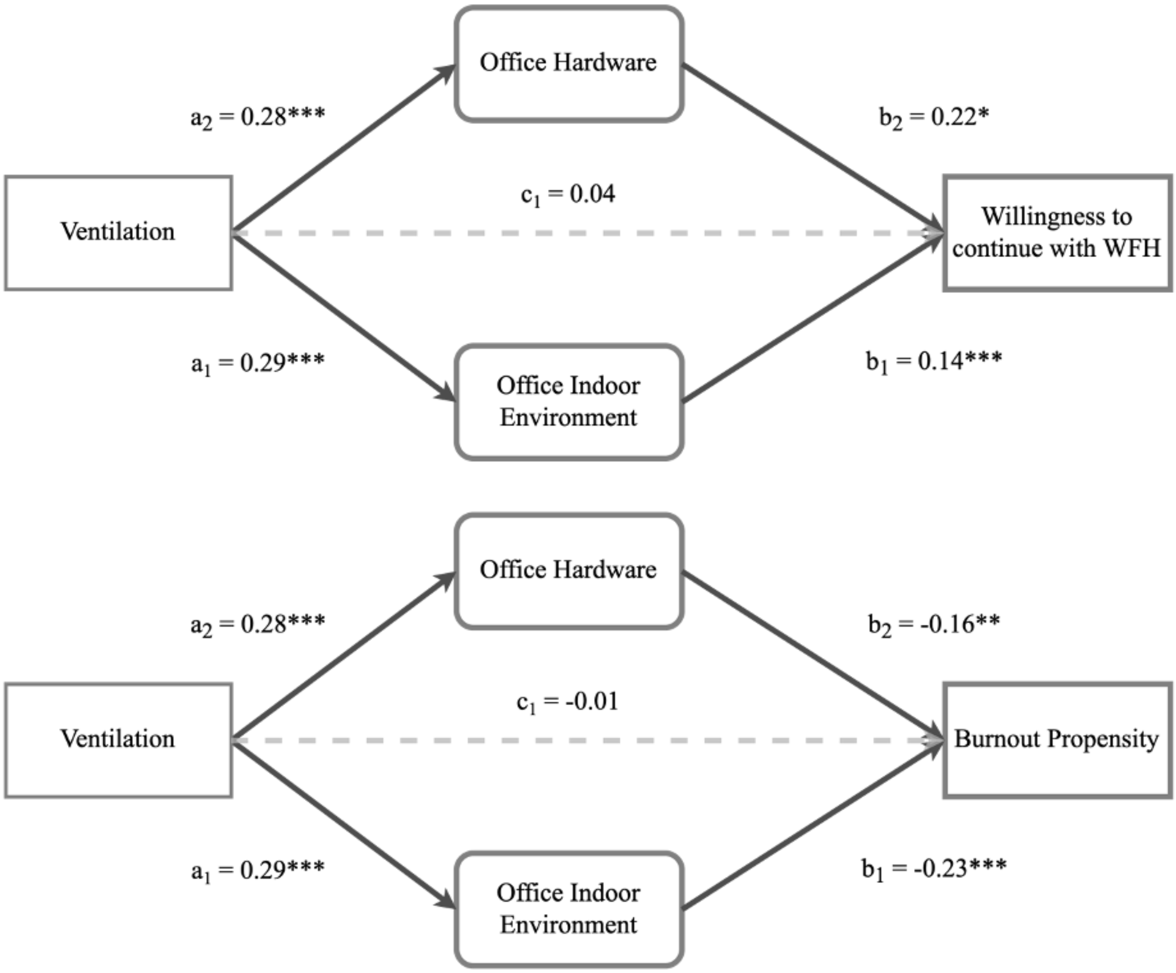
Fig 3: Structural Equation Model Graphs on Productivity



First, the latent variables 'Office Hardware' and 'Office Indoor Environment' have a strong and distinct direct effect on WFH productivity, as can be seen in Fig 3. For both factors, a standard deviation increase is associated with around a 0.3 standard deviation increase in productivity. Second, the percentage of ventilation is significantly associated with both increased hardware and indoor environment satisfaction. Each standard deviation increase in ventilation of the office increases satisfaction with .29 and .27 points, respectively. Third, ventilation no longer shows a direct association with productivity, which is not captured by its relation to hardware or indoor environment satisfaction (p=.88). Hence, the effect of ventilation on productivity is fully mediated by hardware or indoor environment satisfaction. Both indirect unstandardized parameters via the latent variables are estimated at 0.002, with a total estimated effect of ventilation on productivity of 0.004. Thus, moving from 0% to 100% ventilation of the office increases productivity with .4 on the 10-point scale by increasing hardware or indoor environment satisfaction. Considering that the average productivity score is 6,11 (SD=1,06), the magnitude of this effect is not trivial. This effect equates to 8.18% of the mean and 47% of the standard deviation of the productivity variation in our sample.

Replacing productivity with burnout propensity or willingness to continue WFH in the model shows the same mediation effect. Both models, shown in Fig 4, are well fitted (both show CFI/TLI > .95, RMSEA close to .05, and SRMR < .05), and for both models, the association runs fully through the latent variables. The total estimated effect of ventilation on burnout propensity is -0.004, with comparable mediation through both factors. Moving from 0% to 100% ventilation of the office decreases burnout propensity with .4 on the 7-point scale. For the willingness to continue with WFH, the significance and strength of association are stronger for hardware compared to the indoor environment (a=0.003, p=0.016; a=0.005, p<.000, respectively). Hence, moving from 0% to 100% ventilation of the office increases the willingness to continue WFH propensity with 1.2 on the 10-point scale.

Fig 4: Structural Equation Model Graphs on Burnout Propensity and Willingness to Continue WFH



Discussion

The success of working from home, and the likelihood of its survival after the pandemic, is dependent on sustained productivity in the home office environment. This study investigates the effect that home office hardware and environment satisfaction have on productivity and burnout propensity. Through a survey design, we gather data from 1,002 Dutch homeworkers. Comparing compare working from home with working from the office first shows that the self-reported productivity is lower at home compared to previously at the office of those that worked from home during the COVID-19 pandemic. This is in contrary to earlier findings based on self-report, but consistent with multiple non-self-reported outcome analysis [10,19,20]. When looking at the physical office, we find that the indoor environmental satisfaction appears higher at home, whereas physical hardware satisfaction like desks and chairs are preferred at the office.

This implies that optimizing ergonomics at home remains challenging [40] while individually being in control of the indoor environment at home is preferred [41]. Overall, we find a relatively low score for the willingness to continue working from home, in contradiction to many recent reports, which supports a deeper investigation into factors facilitating successful WFH [8,60].

The association between the both home office hardware as well as indoor environment satisfaction and productivity is profound. Higher satisfaction in both these domains is associated with higher WFH productivity and lower burnout propensity. The vast majority (with the exception of air quality) of all indoor environment and hardware factors included in this paper are associated with increased productivity and decreased burnout tendency. We find further WFH heterogeneity effects, such as women and larger households seem to be more productive at home, having children decreases productivity and increases burnout scores. Having partners increases productivity, but only when they are not always around during office hours. Finally, where the correlation between age and WFH has been inconsistent in the past [31,32], we find older workers report being more productive, having a low burnout propensity, and stating to be more willing to continue to work from home compared to younger workers.

To show the influence real behavior could have on WFH success, we investigate the effect of ventilation on productivity. By means of mediation analysis, we confirm that the amount of time a home office is ventilated is not only directly associated with increased satisfaction but also indirectly with increased productivity score. Practically, we find that changing from not ventilating at all to ventilation all the time (moving from 0% to 100%), will indirectly increase productivity with .5 points on the 10-point productivity scale. The magnitude of this estimate on productivity is comparable to moving from no children to always having children at home during working hours (.7-point decrease of productivity). Given the same example, moving from 0% to 100% ventilating time will decrease the burnout propensity by .4

points on a 7-point scale, and increase the willingness to continue with WFH with 1.2 points on a 10-point scale. Hence, we find that ventilating your home office is a crucial underlying factor predicting overall satisfaction and is indirectly associated with increased productivity, increased willingness to work from home, and decreased burnout propensity

Implications

The main contribution of this paper is to show that the physical climate influences employee productivity and satisfaction when working from home. Specifically, we not only connect the outcomes of work from home to self-reported climate satisfaction, but also to indoor environment-influencing behavior. The move from the work office to the home office needs to be combined with careful design and investment in the quality of the office *and* its climate. Failure to do so is not only likely to be associated with decreased productivity, but also decreased willingness to work from home, and increased burnout propensity. The physical climate is a determining factor in successful work from home prolongation. As such, this paper reaffirms that the effect of a healthy indoor climate affects productivity, related to previous research that shows significant health effects of indoor climate [4–7].

Additionally, our results also suggest it is crucial that the physical environment is objectively measured, as merely collecting self-reported satisfaction scores might paint an incomplete or even incorrect picture. This is not only shown by the fact that unrelated satisfaction scores are influenced by improved ventilation, but also by the fact that self-reported air quality satisfaction, the closest subjective measure related to ventilation, was not at all associated with productivity. Thus, solely based on self-report analysis, ventilation would have been an unlikely factor considered to improve the success of work from home. Since the general working from home evaluation, as well as indoor quality assessments, are heavily reliant on self-reported scores, this conclusion is not trivial.

Limitations

Our results have some limitations. First, the use of self-reported data may introduce common method variance, potentially affecting the relationships between predicting, mediating, and outcome variables. We have attempted to counter these effects by deemphasizing the compartmentalization of the work conditions and characteristics with productivity (outcome) measures, yet we cannot exclude that the inherent subjectivity of such data could have led to biases or inaccuracies. Moreover, although we use an elaborate and implicit measure for productivity and burnout, we do not measure objective productivity. Self-reported metrics suffer from demand effect and accuracy biases that might hamper the accuracy of our result in the general population [42]. We have attempted to at least partially alleviate this concern by using an extensive validated questionnaire, yet caution to generalize to actual behavior is warranted. Second, we report on differences between the current situation and before COVID-19 (at the work office). To do so, we did not ask our participants at that time, but rather asked them recollect. Unfortunately, recollection itself is less accurate than asking the current situation [65]. The current situation could even influence the recollected score, as it serves as a reference point [50,66]. Either in contrast or regress, it influences the absolute score. As this is already normally the case, we ask our participants to recollect pre-COVID-19. This means that not only the working from home sentiment can pass over to the recollection, but the general sentiment as a whole. The mere fact that WFH is mandatory could put the productivity previously performed at work in a more generous daylight that it truly was, as well as life in general. Taken together, our data quality would have improved if we had foreseen the pandemic, and pretested our subject before the outbreak.

Second, while our sample was carefully selected, its representativeness may not encompass the broader population, thus limiting the generalizability of our results. We selected our sample to accurately represent a cross-section of the Dutch population. However, we exclude workers who are not able to work from home, slightly skewing our sample to higher educated participants. Furthermore, the unique circumstances surrounding the COVID-19 pandemic enabled us to uniquely avoid selection bias (e.g. working-from-home independent of participants' prior personal attitude towards WFH), yet the pandemic itself could be reflected in our subjective scores. As such, the behaviors, attitudes, and outcomes observed during this period may not be wholly representative of remote work under more typical circumstances (mood-as-information theory[64]). While our research provides valuable insights into the work-from-home experience during the pandemic, caution should be exercised when generalizing these findings to other contexts or periods where such extraordinary conditions do not prevail.

Conclusion

The success and willingness to continue with work from home are related to home office quality and satisfaction. We show that higher hardware and/or indoor environment satisfaction predict higher productivity, lower burnout propensity, and higher willingness to continue working from home. In turn, satisfaction, productivity, burnout propensity, and willingness to continue all improve when homeworkers ventilate their home office for a longer period of time. In sum, our results underline the effect of a holistic perspective on working from home productivity. A healthy and objectively measured physical climate is a key aspect of the success and widely proposed bright future of working from home [9,62,63].

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Supporting Information

S1 Table: Correlation Table of different measurements of Productivity and Stress.

	WFH-HWQ Productivity	Self-Reported Productivity	WFH-HWQ Stress & Irritability Factor
Self-Reported Productivity (Single-item Scale)	.73		
WFH-HWQ Stress & Irritability Factor	-.55	-.37	
Burnout Propensity (MBI Scale)	-.50	-.31	.71

S2 Table: Correlation Table of home office hardware and indoor environment Factors

	Desk Home	Chair Home	Screen Home	Hardware Home	Wi-Fi Home	Temperature Home	Air Quality Home	Lighting Home	Noise Home
Panel 1: Home Satisfaction									
Chair Home	.70								
Screen Home	.57	.58							
Hardware Home	.50	.52	.72						
Wi-Fi Home	.36	.39	.46	.55					
Temperature Home	.36	.33	.36	.39	.43				
Air Quality Home	.35	.38	.39	.45	.42	.60			
Lighting Home	.36	.32	.35	.37	.37	.53	.60		
Noise Home	.35	.36	.37	.40	.37	.41	.48	.41	
Panel 2: Work Satisfaction									
Desk Work	.09	.21	.18	.24	.21	.14	.23	.14	.21
Chair Work	.12	.17	.19	.25	.22	.19	.25	.18	.20
Screen Work	.07	.17	.17	.25	.27	.19	.27	.19	.22
Hardware Work	.14	.22	.26	.37	.32	.21	.29	.19	.26
Wi-Fi Work	.17	.24	.23	.33	.28	.18	.24	.18	.25
Temperature Work	.10	.14	.11	.15	.13	.06	.14	.12	.05
Air Quality Work	.13	.15	.15	.17	.13	.13	.17	.13	.08
Lighting Work	.10	.17	.20	.19	.15	.19	.24	.17	.16
Noise Work	.06	.08	.12	.12	.14	.15	.18	.13	.04

S3 Table: Complete Regression Table of Productivity

	Dependent variable: Productivity				
	(1)	(2)	(3)	(4)	(5)
Desk & Chair	.15 (.04)***		.09 (.04)**	.09 (.04)**	.12 (.05)**
Screen & Hardware	.18 (.05)***		.11 (.05)**	.11 (.05)**	.12 (.05)**
WiFi	.18 (.03)***		.10 (.04)***	.10 (.04)***	.07 (.04)
Temperature		.14 (.04)***	.09 (.05)**	.10 (.05)**	.10 (.06)**
Air Quality		.08 (.04)*	.03 (.04)	.04 (.04)	.08 (.05)
Lighting		.11 (.04)***	.07 (.04)*	.06 (.04)	.04 (.05)
Noise		.21 (.04)***	.16 (.04)***	.16 (.04)***	.13 (.04)***
Age (years)	.01 (.003)***	.01 (.003)***	.01 (.003)***	.01 (.003)***	.01 (.003)***
Income (Baseline: Modal)					
Mininum wage (less than 11,000)	-.68 (.24)***	-.56 (.24)***	-.58 (.23)***	-.58 (.24)***	-.46 (.28)**
below modal (11-23k)	-.10 (.10)	-.03 (.10)	-.04 (.10)	-.06 (.10)	-.05 (.11)
1-2x modal (34-56k)	-.12 (.08)	-.10 (.08)	-.10 (.08)	-.09 (.08)	-.08 (.09)
2x modal or more (56k)	-.14 (.09)	-.11 (.09)	-.12 (.09)	-.12 (.09)	-.02 (.10)
don't know/ don't want to say	.01 (.09)	.04 (.09)	.01 (.09)	-.01 (.09)	-.01 (.10)
Female	.21 (.07)***	.10 (.07)	.15 (.07)**	.14 (.07)**	.15 (.08)**
Household Members	.10 (.04)**	.12 (.04)***	.11 (.04)***	.09 (.04)**	.07 (.05)
Children Home during Office Hours (baseline: no children)					
Always	-.70 (.19)***	-.65 (.18)***	-.63 (.18)***	-.63 (.18)***	-.74 (.21)***
Sometimes	-.22 (.10)**	-.23 (.10)**	-.22 (.09)**	-.17 (.09)*	-.17 (.10)
Never	-.07 (.10)	-.07 (.10)	-.07 (.10)	-.06 (.10)	-.07 (.11)
Partner Home during Office Hours (baseline: no Partner)					
Always	.06 (.09)	.06 (.09)	.06 (.09)	.06 (.09)	.02 (.10)
Sometimes	.17 (.09)*	.11 (.09)	.15 (.08)*	.13 (.09)	.13 (.10)
Never	.20 (.09)**	.11 (.09)	.14 (.08)*	.15 (.09)*	.10 (.10)
Pet (Baseline: No pets)					
Dog	.10 (.07)	.09 (.06)	.07 (.06)	.07 (.07)	.08 (.08)
Cat	-.02 (.06)	-.01 (.07)	-.02 (.06)	-.04 (.06)	-.01 (.08)
Company size (Baseline: 0-5)					
5-15	.01 (.17)	-.04 (.16)	-.05 (.16)	-.09 (.17)	-.16 (.20)
15-50	.10 (.15)	.02 (.14)	.02 (.14)	-.02 (.15)	-.12 (.18)
50+	-.003 (.14)	-.03 (.14)	-.04 (.14)	-.08 (.14)	-.14 (.18)
Work Sector (Baseline: Governmental)					
Yes, non-governmental	-.03 (.07)	.02 (.07)	.0005 (.07)	-.01 (.07)	-.01 (.08)
Yes, temp/ on-call worker	.03 (.17)	.14 (.17)	.09 (.16)	.09 (.17)	.05 (.17)
Yes, self-employed	-.04 (.15)	.01 (.14)	-.03 (.14)	-.10 (.15)	-.14 (.17)
Contract hours (Baseline: Full time (36+)					
20-35 hours	-.02 (.07)	-.03 (.07)	-.03 (.07)	-.01 (.07)	.004 (.08)
12-19 hours	.20 (.13)	.16 (.13)	.18 (.13)	.20 (.13)	.19 (.14)
less than 12 hours	-.05 (.13)	-.18 (.12)	-.12 (.12)	-.11 (.13)	-.01 (.13)
Work suitable to perform from home	.05 (.03)	.07 (.03)**	.04 (.03)	.04 (.03)	.06 (.04)*
Home Office Floor plan (Baseline: Average)					
Open				.02 (.10)	.05 (.11)
Closed				-.07 (.09)	-.02 (.11)
Home Office Lighting (Baseline: Average)					
Natural				.02 (.09)	.01 (.11)
No Natural				-.01 (.17)	-.11 (.21)
Home Office Ventilation (Baseline: None)					
Mechanic				-.07 (.16)	-.17 (.18)
Manual				-.08 (.14)	-.11 (.16)
Home Office surface (m^2)				-.03 (.03)	-.05 (.03)
Real-estate value (x€1,000)					-.01 (.04)
Address-density (per kilometer radius)					-.06 (.07)
Urbanicity (Baseline: Extremely high)					
High					-.10 (.13)
Moderate					-.06 (.16)
Low					.0003 (.18)
None-Urban					-.04 (.21)
Observations	1,002	1,002	1,002	956	734
R2	.25	.27	.30	.30	.30
Adjusted R2	.23	.25	.28	.27	.26
Residual Std. Error	.88 (df = 972)	.87 (df = 971)	.85 (df = 968)	.85 (df = 915)	.83 (df = 687)
F Statistic	11.41*** (df = 29; 972)	12.16*** (df = 30; 971)	12.79*** (df = 33; 968)	10.01*** (df = 40; 915)	6.50*** (df = 46; 687)

Note. **p*<0.1, ***p*<0.05, ****p*<0.01.

S4 Table: Complete Regression Table of Burnout Propensity

	Dependent variable: Burnout Propensity				
	(1)	(2)	(3)	(4)	(5)
Desk & Chair	-.14 (.04)***		-.10 (.04)**	-.11 (.05)**	-.16 (.06)***
Screen & Hardware	-.09 (.05)*		-.04 (.05)	-.03 (.05)	-.001 (.06)
WiFi	-.12 (.04)***		-.07 (.04)*	-.07 (.04)*	-.05 (.05)
Temperature		-.07 (.04)*	-.04 (.04)	-.06 (.04)	-.06 (.06)
Air Quality		-.11 (.04)**	-.08 (.04)*	-.09 (.04)**	-.07 (.05)
Lighting		-.05 (.04)	-.02 (.04)	.01 (.04)	.02 (.05)
Noise		-.13 (.04)***	-.10 (.04)***	-.09 (.04)**	-.09 (.05)**
Age (years)	-.01 (.003)***	-.01 (.003)***	-.01 (.003)***	-.01 (.003)**	-.01 (.003)*
Income (Baseline: Modal)					
Mininum wage (less than 11,000)	.63 (.26)***	.56 (.27)***	.56 (.27)***	.57 (.28)***	.46 (.32)*
below modal (11-23k)	.26 (.14)**	.22 (.14)*	.23 (.14)**	.27 (.14)**	.24 (.17)*
1-2x modal (34-56k)	-.01 (.08)	-.02 (.08)	-.02 (.08)	-.02 (.08)	-.05 (.10)
2x modal or more (56k)	.13 (.10)	.12 (.10)	.13 (.09)	.12 (.10)	.07 (.11)
don't know/ don't want to say	.21 (.11)**	.20 (.11)*	.21 (.11)**	.23 (.11)**	.24 (.13)**
Female	.01 (.07)	.09 (.07)	.05 (.07)	.09 (.07)	.03 (.08)
Household Members	-.10 (.04)**	-.11 (.05)**	-.10 (.04)**	-.09 (.05)*	-.08 (.05)
Children Home during Office Hours (baseline: no children)					
Always	.42 (.22)**	.42 (.22)**	.39 (.22)**	.35 (.21)*	.42 (.24)*
Sometimes	.06 (.10)	.07 (.10)	.06 (.10)	.02 (.10)	-.02 (.11)
Never	-.24 (.09)**	-.23 (.09)**	-.23 (.09)**	-.25 (.09)**	-.26 (.11)**
Partner Home during Office Hours (baseline: no Partner)					
Always	.08 (.09)	.08 (.09)	.08 (.09)	.09 (.10)	.13 (.11)
Sometimes	-.07 (.10)	-.05 (.09)	-.07 (.09)	-.03 (.10)	-.11 (.11)
Never	-.14 (.09)	-.09 (.09)	-.11 (.09)	-.10 (.10)	-.10 (.11)
Pet (Baseline: No pets)					
Dog	.15 (.08)**	.16 (.08)**	.17 (.08)**	.19 (.08)**	.17 (.10)*
Cat	-.002 (.07)	-.01 (.07)	.001 (.07)	.01 (.07)	-.02 (.08)
Company size (Baseline: 0-5)					
5-15	-.03 (.15)	.02 (.14)	.02 (.14)	.02 (.15)	.04 (.19)
15-50	-.15 (.14)	-.10 (.13)	-.10 (.13)	-.06 (.14)	-.10 (.18)
50+	.16 (.14)	.18 (.13)	.18 (.13)	.20 (.14)	.16 (.17)
Work Sector (Baseline: Governmental)					
Yes, non-governmental	.11 (.07)	.07 (.07)	.08 (.07)	.09 (.08)	.15 (.08)*
Yes, temp/ on-call worker	-.05 (.20)	-.15 (.19)	-.11 (.19)	-.12 (.22)	-.10 (.25)
Yes, self-employed	-.09 (.13)	-.14 (.13)	-.10 (.13)	-.05 (.14)	-.09 (.16)
Contract hours (Baseline: Full time (36+)					
20-35 hours	.01 (.07)	.02 (.07)	.02 (.07)	-.02 (.07)	.03 (.08)
12-19 hours	-.15 (.14)	-.14 (.13)	-.14 (.14)	-.16 (.14)	-.03 (.15)
less than 12 hours	-.33 (.14)**	-.25 (.15)	-.29 (.15)*	-.32 (.16)*	-.49 (.17)**
Work suitable to perform from home	-.01 (.03)	-.03 (.03)	-.01 (.03)	-.01 (.03)	.01 (.04)
Home Office Floor plan (Baseline: Average)					
Open				.07 (.10)	.04 (.11)
Closed				.07 (.09)	.04 (.11)
Home Office Lighting (Baseline: Average)					
Natural				-.16 (.10)	-.15 (.12)
No Natural				.10 (.19)	-.01 (.20)
Home Office Ventilation (Baseline: None)					
Mechanic				.17 (.19)	.14 (.22)
Manual				.03 (.17)	.01 (.19)
Home Office surface (m^2)				.03 (.03)	.04 (.04)
Real-estate value (x€1,000)					.01 (.04)
Address-density (per kilometer radius)					-.03 (.06)
Urbanicity (Baseline: Extremely high)					
High					-.02 (.13)
Moderate					-.02 (.16)
Low					-.15 (.16)
None-Urban					-.14 (.20)
Observations	1,002	1,002	1,002	956	734
R2	.18	.19	.21	.21	.21
Adjusted R2	.16	.17	.18	.17	.16
Residual Std. Error	.92 (df = 972)	.91 (df = 971)	.91 (df = 968)	.90 (df = 915)	.91 (df = 687)
F Statistic	7.60*** (df = 29; 972)	7.71*** (df = 30; 971)	7.70*** (df = 33; 968)	6.06*** (df = 40; 915)	3.93*** (df = 46; 687)

Note. *p<0.1, **p<0.05, ***p<0.01.

S5 Table: Complete Regression Table of Willingness to continue working from home

	Dependent variable: Willingness to continue working from home				
	(1)	(2)	(3)	(4)	(5)
Desk & Chair	.14 (.04)***		.11 (.04)**	.11 (.05)**	.09 (.06)*
Screen & Hardware	.0004 (.05)		-.03 (.05)	-.02 (.05)	.05 (.06)
WiFi	.12 (.04)***		.07 (.04)**	.08 (.04)**	.06 (.04)
Temperature		.12 (.04)***	.09 (.04)**	.09 (.04)**	.07 (.05)
Air Quality		.02 (.05)	.004 (.05)	-.01 (.05)	.01 (.06)
Lighting		.08 (.04)**	.06 (.04)*	.08 (.04)*	.03 (.05)
Noise		.05 (.04)	.03 (.04)	.01 (.04)	-.002 (.05)
Age (years)	.01 (.003)***	.01 (.003)***	.01 (.003)***	.01 (.003)***	.01 (.003)**
Income (Baseline: Modal)					
Mininum wage (less than 11,000)	-.17 (.19)	-.14 (.20)	-.13 (.19)	-.06 (.20)	-.01 (.24)
below modal (11-23k)	.03 (.11)	.08 (.11)	.07 (.11)	.08 (.11)	.11 (.12)
1-2x modal (34-56k)	-.11 (.08)	-.10 (.08)	-.11 (.08)	-.10 (.08)	-.09 (.10)
2x modal or more (56k)	-.16 (.09)*	-.14 (.09)	-.14 (.09)	-.15 (.10)	-.08 (.11)
don't know/ don't want to say	-.02 (.10)	-.005 (.10)	-.01 (.10)	-.02 (.10)	.01 (.12)
Female	.09 (.06)	.05 (.06)	.07 (.06)	.06 (.07)	.05 (.08)
Household Members	-.004 (.05)	.01 (.04)	.004 (.04)	.01 (.05)	-.01 (.05)
Children Home during Office Hours (baseline: no children)					
Always	-.23 (.19)	-.24 (.18)	-.21 (.19)	-.28 (.20)	-.32 (.23)
Sometimes	-.10 (.10)	-.12 (.09)	-.10 (.10)	-.13 (.10)	-.07 (.11)
Never	.03 (.09)	.03 (.09)	.03 (.09)	.03 (.09)	-.02 (.11)
Partner Home during Office Hours (baseline: no Partner)					
Always	.07 (.09)	.09 (.09)	.09 (.09)	.11 (.10)	.07 (.11)
Sometimes	.12 (.09)	.11 (.09)	.11 (.09)	.14 (.09)	.11 (.11)
Never	.14 (.09)	.11 (.09)	.12 (.09)	.15 (.09)	.08 (.11)
Pet (Baseline: No pets)					
Dog	.09 (.07)	.09 (.07)	.08 (.07)	.07 (.07)	.03 (.09)
Cat	-.04 (.07)	-.04 (.06)	-.04 (.06)	-.04 (.07)	-.02 (.08)
Company size (Baseline: 0-5)					
5-15	-.25 (.15)	-.28 (.15)*	-.27 (.15)*	-.25 (.16)	-.15 (.18)
15-50	-.31 (.14)**	-.34 (.13)**	-.34 (.14)**	-.29 (.14)**	-.23 (.17)
50+	-.36 (.12)***	-.37 (.12)***	-.37 (.13)***	-.34 (.13)**	-.25 (.16)
Work Sector (Baseline: Governmental)					
Yes, non-governmental	.05 (.07)	.08 (.07)	.08 (.07)	.08 (.07)	.07 (.09)
Yes, temp/ on-call worker	-.03 (.14)	.03 (.15)	-.01 (.14)	-.09 (.16)	-.12 (.21)
Yes, self-employed	.08 (.13)	.09 (.14)	.07 (.14)	.10 (.14)	.04 (.16)
Contract hours (Baseline: Full time (36+)					
20-35 hours	.01 (.07)	.01 (.07)	.01 (.07)	.03 (.07)	.05 (.08)
12-19 hours	-.05 (.14)	-.09 (.14)	-.08 (.14)	-.04 (.15)	.02 (.16)
less than 12 hours	-.01 (.14)	-.09 (.14)	-.06 (.14)	-.05 (.15)	-.24 (.18)
Work suitable to perform from home	.32 (.03)***	.34 (.03)***	.33 (.03)***	.32 (.03)***	.34 (.04)***
Home Office Floor plan (Baseline: Average)					
Open				-.02 (.09)	-.03 (.10)
Closed				-.12 (.09)	-.16 (.10)
Home Office Lighting (Baseline: Average)					
Natural				.01 (.09)	.08 (.11)
No Natural				.21 (.18)	.21 (.21)
Home Office Ventilation (Baseline: None)					
Mechanic				.22 (.18)	.18 (.20)
Manual				.04 (.16)	.03 (.18)
Home Office surface (m^2)				.01 (.03)	-.02 (.04)
Real-estate value (x€1,000)					-.01 (.03)
Address-density (per kilometer radius)					-.02 (.06)
Urbanicity (Baseline: Extremely high)					
High					.21 (.12)*
Moderate					.01 (.15)
Low					.02 (.17)
None-Urban					.05 (.19)
Observations	1,002	1,002	1,002	956	734
R2	.24	.25	.26	.26	.26
Adjusted R2	.22	.22	.23	.23	.21
Residual Std. Error	.88 (df = 972)	.88 (df = 971)	.88 (df = 968)	.88 (df = 915)	.88 (df = 687)
F Statistic	10.65*** (df = 29; 972)	10.63*** (df = 30; 971)	10.13*** (df = 33; 968)	8.03*** (df = 40; 915)	5.24*** (df = 46; 687)

Note. *p<0.1, **p<0.05, ***p<0.01.

S1 Fig: Structural Equation Model Latent Variables Loading and Covariance