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Is an Open-Floor Office plan the right decision for your company?

An Analysis of Traditional Office v. Open-Floor Office Environments

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Abstract

This study conducted an analysis of traditional office versus open-floor office environments. The literature surrounding this topic mostly found a decrease in worker satisfaction, motivation, and productivity when transitioning to an open office space. A survey was sent out to 187 respondents in a corporate healthcare setting asking questions about their happiness, productivity, demographic information, organizational position, aesthetics, and time spent at work to expand on existing studies. The survey was sent out in November 2018 and was left open for three weeks resulting in a 39.25 percent response rate. We conducted four simple linear regression models with self-estimated happiness and productivity as the dependent variables. Additionally, four ordered logistic regressions were run with margins commands to understand better how individuals with specific demographics were answering on the Likert scale for productivity and happiness. The most significant findings were that aesthetics had a significant impact on self-estimated productivity and satisfaction, introverted individuals were counterintuitively happier in the new space, males were consistently happy across all regressions, and that married individuals were noticeably happier after the move.

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Introduction

This paper examined the impact of office environment on employee happiness and productivity and contributed to existing studies that analyze open floor office spaces versus traditional cubicle office spaces. Companies around the nation have been considering the transition from a conventional cubicle office to an open floor office environment. Zalesney and Farace (1987) defined cubicle office spaces as the more traditional option where individuals in higher positions (managers, VPs, some associates) have offices and those in lower positions (clerical, administrative) have cubicles. Open office spaces are a modern option where individuals of all positions work in an open area with no barriers or walls. The literature surrounding this topic has mixed findings. However, a lot of the studies are dated, and also negate some variables I have included in my model. Therefore, through my research, I intend to contribute to existing studies by attempting to answer the question of which office environment has a higher payoff in terms of happiness and productivity. The following essay will include a review of previous literature on this topic and a methodology section describing the participants and procedure of the study as well as descriptions of each variable and how they were measured. I will then move on to explain my models, coefficient sign predictions, and my regression results. Finally, I will conclude with suggestions for future research, policy recommendations, and the limitations of my study.

Literature Review

The literature examining traditional office environments versus open-floor office plan environments was full of evidence suggesting open-floor office plans decreased employee satisfaction and productivity (Bergstrom, Miller, and Horneij, 2013; Oldham and Brass, 1979;

Zalesny and Farace, 1987). These findings came as a surprise considering open-floor offices are

expected to have the opposite effect on those employee characteristics. Zalesny and Farace

(1987) cited empirical evidence that signified adoption of open-office plans in the workplace was

not consistent. For example, they found it increased communication and positive attitudes toward

work environment among employees and at the same time led to decreased work satisfaction,

motivation, and involvement. Overall, they found the change affected mid-level employees such

as associates the most and affected those in clerical and managerial positions the least.

Additionally, Zalsney and Farace (1987) provided substantial suggestions for future research.

One thing, in particular, was the recommendation to incorporate the aesthetic of the workplace

before the relocation to open-floor offices. Since the population I examined for this study

included a sample of people who moved from an old traditional office building to a new

open-floor office, aesthetics was an essential variable to investigate.

Bergstrom, Miller, and Horneij (2013) investigated perceived health, environment, and

productivity one month before and three, six, and twelve months after the switch. Employees

reported a decrease in perceived health over the time-period of the study, as well as a reduction

of their work environment. The work environment was measured based on individual

experiences and their support system. Support included whether the environment was a good

atmosphere, happiness in the environment, and whether or not they received good feedback. The

study found a decrease in all of the subcategories.

Additionally, there was also a decrease in perceived performance among employees.

Bergstrong, Miller, and Horneij (2013) mentioned that when asked about whether or not their job

position would change, 7% of participants reported yes before the move, and 18% reported yes

after the move. The authors assumed this finding was negative because it suggested employees leaving the company. However, the authors failed to distinguish between whether or not the employee would be changing job positions within the company or without. This distinction is important when conducting a new study because changing job positions within a company versus outside of a company could alter the previous findings to be positive.

To further investigate traditional versus open-floor-plan office environments, Zalesny and Farace (1987) included organizational position in their regression. Their study had three approaches, including social relations, sociotechnical, and symbolic meaning approaches. Within the umbrella of the symbolic meaning approach, the study predicted interactions between the shift from traditional to open, and organizational position would impact job and environment perceptions. It found that organization position indeed had a significant effect. Employees in more clerical positions reported higher work-related communication and an increase in perceived privacy. However, even though the employees saw a rise in those variables, they decreased in their overall job satisfaction and receiving feedback about their work. In contrast, employees in more managerial positions reported decreased satisfaction with their work areas as well as a decrease in perceived privacy. They did, however, see an increase in knowing what they had to do at work. Overall, Zalesney and Farace (1987) got mixed results with a general rise in clerical staff and a decrease with employees in higher positions. However, they pointed out these results could vary depending on one's job characteristics and whether they perceived themselves as a professional. Also, this study failed to analyze whether the perception of status symbols changed within the organization. In other words, how do managers look at their employees and how do employees look at their managers?

Other theoretical approaches to this topic have been used to explain why a switch to an open-plan office would be either detrimental or beneficial to a company. These two approaches are the Social Relations Approach and the Sociotechnical Approach. The social relations approach argues that removing interior walls and barriers within an office facilitates the development of social relationships between employees. This development results in increased interaction between employees in consequence of their new physical environment. The increased interaction will produce high task performance and increase employee motivation and satisfaction. The socio-technical approach suggests somewhat the opposite. It theorizes the lack of privacy causes an adverse change in several job characteristics that limit meaningful communication between employees due to a decrease in autonomy, task identity, supervisor feedback, and friendship.

Oldham and Brass (1979) conducted an empirical study to find which of these theoretical approaches would hold up when tested using regression analysis. Their sample included about 75 employees from a newspaper company that made a move from a conventional office building to a completely open office. They included several variables such as work satisfaction, motivation, autonomy, and feedback to gauge their question. In their results, Oldham and Brass (1979) found that there was more support for the sociotechnical approach than for the social relations approach. In other words, there was a decrease in satisfaction and motivation with employees reporting less significance in their job and a lack of private space. This outcome follows the trend seen so far in the literature: open-floor office plans have an overall negative impact on employees. However, limitations to this study included not accounting for design elements in the new space, the type of organization, and the social needs of each employee. To clarify the

meaning of social needs, it means some people are more naturally extroverts, and some are

introverts. Therefore, addressing these limitations, specifically the aspect of social needs, was

important in my study.

To continue examining the worth of an open-floor office environment, I looked at the

concept of territoriality. In their cross-sectional study, Kasuganti and Purang (2016), looked at

the idea of territoriality in open-plan offices and what effect that had on situated learning. They

surveyed 112 professionals from IT and consultancy companies, to study whether or not

territorial behavior in open offices supported situated learning. To put this into context,

Kasuganti and Purang (2016) defined territorial behavior as an attachment to a space through

personalization and a feeling of ownership. In reference to situated learning, they said it "occurs

in action and involves knowledge sharing, resulting in the exchange of tacit knowledge and the

development of common or shared understanding." They hypothesized territorial behavior in

open-office environments positively influenced situated learning and therefore also had a

positive influence on learning in action, knowledge sharing, and collective understanding. The

theory was that feelings of comfort and control in open offices supported interactions with others

due to a sense of community and commitment to the organization as a whole.

To test their hypothesis, Kasuganti and Purang (2016) sent out a survey to 160 people and

ended up using 112 of the observations. The study consisted of 29 items pertaining to

demographics, age, gender, role, department, team size, and whether or not they worked in an

open-plan office. Other things were related to reflection while learning, problem-solving through

discussion, and common understanding. After running their regression, Kasuganti and Purang

(2016) found that there was a positive relationship between perceived territoriality, situated

learning, and its dimensions, learning in action, knowledge sharing, and common understanding. So, this supported the idea that in open offices, territorial behavior develops, leading to feelings of belongingness in the organization fostering a positive collaborative outcome. However, even though they found a positive result, they also found that demographic variables (age, gender, and job level) did not have a significant impact. The limitations to the study included the limited time-period it was conducted in, as well as the fact that other studies chose to narrow in on the negative aspects while theirs chose to focus on the positive. When I ran my regression, it was interesting to see if demographic variables had an impact, as well as if I found positive results. Also, since I conducted my study almost two years later, it was interesting to see if the small-time difference had an impact. Kasuganti and Purang (2016) provided a positive contribution with their study in contrast to other existing literature. Furthermore, despite Kasuganti and Purang's (2016) positive findings, the abundance of the rest of the research found negative relationships between open-floor office spaces and worker satisfaction and productivity (Bergstrom, Miller, and Horneij, 2013; Oldham and Brass, 1979; Zalesny and Farace, 1987).

Methodology

Participants & Procedure: Data analyzed in the study were collected using a survey questionnaire I created that was administered online to participants. Participants included employees from a corporate healthcare total rewards department. I established initial contact via email listserv to the human resources team, and the email included a link to a Google form containing the questionnaire. The questionnaire was accompanied by a brief note explaining the purpose of the survey and assured confidentiality. I also obtained informed consent and gave a brief description of the differences between open and traditional offices. Questions pertained to

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self-estimated happiness and productivity, aesthetics, likelihood to remain at the company, and

the number of hours worked. Demographic information collected included marital status, gender,

position type, personality type, and the number of children. Open-ended questions included the

length of time working at the company, age, and hours spent at work. All other questions were

close-ended. Responses were received online and stored directly in an MS Excel worksheet to be

later inputted into a Stata data file. The Google form was kept active for a period of three weeks.

The total number of individuals who received the link was 186, out of which 73 answered and

completed the questionnaire resulting in a response rate of 39.25%. Fifty-eight of these responses

were considered valid. Participants were deemed invalid if they failed to adequately respond to

all of the survey questions resulting in missing data. Demographic details including position,

gender, and marital status of each valid participant are displayed in Tables 1, 2, and 3 below.

Table 1: Job Position

Position:	Frequency:	Percent:
Associate/Coordinator	38	65.52
Clerical/Administrative	7	12.07
Managerial/Director/VP	13	22.41

Table 2: Gender

Gender:	Frequency:	Percent:
Female	42	72.41
Male	16	27.59

Table 3: Marital Status

Marital Status:	Frequency:	Percent:
No	29	50.00
Yes	29	50.00

Measures: Instruments to measure self-estimated happiness and productivity were developed based on the literature review and grew to include factors not found in the literature. I scored happiness and productivity, and aesthetics using a 10-point Likert scale. For happiness the scaled ranged from 1 = 'least happy' to 10 = 'most happy' and for productivity, it ranged from 1 = 'less productivity' to 10 = 'more productive.' Importance of aesthetics ranged from 1 = 'not very important' to 10 = 'very important'. Out of those variables, our happiness and productivity regress on our independent variables.

Independent variables from the survey included organizational position, amount of time working there, children, marital status, gender, age, hours spent at work, personality type, and aesthetics. I included demographic variables (children, marital status, gender, age) and organizational position because existing literature included them in their studies (Bergstrom, Miller, and Horneij, 2013; Kasuganti and Purang, 2016; Oldham and Brass, 1979; Zalesny and Farace, 1987). Additionally, per the suggestion from Zalesney and Farace (1987), I included aesthetics as a variable. I added time and personality type because these variables were omitted in previous studies.

To begin, marital status and gender were both asked as 'yes' or 'no' questions in the survey. They were subsequently turned into categorical variables using Stata 14 MP and were labeled as 'male' (Male = 1, Female = 0) and 'marr' (Married = 1, Not Married = 0). Other categorical variables included organizational position, personality type, and whether or not the

person has children. The organizational position was broken down into three separate indicator variables for each position offered as an answer on the survey. The position variables were labeled 'coor' (Associate/Coordinator = 1, Not an Associate/Coordinator = 0), 'admin' (Clerical/Administrative =1, Not Clerical/Administrative = 0), and 'manager' (Managerial/Director/VP = 1, Not Managerial/Director/VP = 0). Personality type was measured by asking respondents to indicate whether they considered themselves an 'extrovert' or an 'introvert.' From the responses, I constructed the categorical variable 'intro' (Introvert = 1, Extrovert = 0). I also generated the variable 'child' (Has children = 1, Does not have children = 0). Age was measured as both a continuous and categorical variable with the youngest age recorded as 21 and the oldest as 63. As a categorical variable, age was broken up into four age groups (21-30, 31-40, 41-50, 51-63) to see if there was a significant difference between the younger and older age groups as a whole. The age group variables were labeled 'agegroup1' (21-30 = 1, other = 0), 'agregroup2' (31-40 = 1, other = 0), 'agegroup3' (41-50 = 1, other = 0), and 'agegroup4' (51-63 = 1, other = 0). I decided to keep age as a continuous variable as well to further compare with the various age groups. Having age as a continuous and categorical variable provided me with additional information in my study to see how both are regressed upon. Other continuous variables included the amount of time working there (measured in months) and hours spent at work. Hours spent at work was asked as two questions to capture both hours spent per day and per week. I labeled these variables as 'time,' 'hrperday,' and 'hrperweek.'

Model and Hypothesis

To find out which of the independent variables had significance in studying open-floor versus traditional office environments, I decided to construct four simple linear regression models to determine how organizational position, amount of time working there, children, marital status, gender, age, hours spent at work, personality type, and aesthetics affected the dependent variables. Each model contained different dependent variables and ran against the same independent variables. Dependent variables included happiness before the move, happiness after the move, productivity before the move, and productivity after the move. Additionally, since this model included mostly categorical variables as dependent and independent variables, I also ran an additional four ordered logistic regressions. I did this because Likert scale data are, in fact, a set of ordered categories, despite being made up of numbers. The ordered logistic regression was used along with the simple linear model to capture the dependent variables effect as both a continuous and a categorical variable. However, since ordered logistic regressions are generally harder to understand in comparison to simple linear regression models, I ran a margins command on each regression to make the results easier to interpret. Therefore, in the following section, I isolate the dependent variables into pairs (happiness before/after, productivity before/after), and provide predictions for the independent variable coefficients.

Self-estimated happiness was included as a measure of the quality of the office environment because the satisfaction of the employees is one of the leading indicators of whether or not moving to this new office was a good decision. The logic is simple: if the majority of employees were happier before rather than after the move, it is an indicator of whether or not open-floor office plans are a viable option for companies. All of the studies I read found that moving to an open office resulted in a decrease in worker satisfaction. So, I expected similar

results. The independent variables helped me to understand how much of the variance in

happiness was being explained by other factors and thus how they themselves contributed to an

employee's overall satisfaction in the workspace.

First, let's look at the organizational position variables (corr, admin, manager). I

expected the coefficients on 'corr' and 'manager' to be positive before the move and negative (or

significantly less) after the move. I expected the 'admin' variable to be both positive before and

after. The reasoning behind this prediction was that people with an office (coordinators and

managers) would be upset that in the new space they had to adjust to not having one (Zalesney

and Farace, 1987). People in clerical positions were used to not having an office and would not

be as affected by the move (Zalesney and Farace, 1987). I expected there to be a positive

coefficient on the aesthetics (aes) variable after the move and a negative one before. Since the

new space was very new and modern compared to the old space, someone who weighed the

aesthetics of the office heavily when determining their happiness would most likely be happier in

the new space.

As for my age variables (age, agegroup1, agegroup2, agegroup3, agegroup4), I expected

the coefficient to be positive in the old space and negative in the new space when looking at age

as a continuous variable. As for categorical, I expected the younger age groups to have positive

coefficients in the new space and the older age groups to have negative ones. I made this

assumption because I expected older employees to be happier in a traditional office space and

less susceptible to change. This assumption led me to my estimation of the coefficient for the

amount of time working there (time). Regarding age, I expected the coefficient to be positive

after the move and negative before because I expected someone who has worked at the company

for a long time to be less satisfied with the change.

Other variables included personality type (intro), hours spent at work per day (hrperday),

and hours spent at work per week (hrperweek). I expected the coefficient for 'intro' to be positive

before the move and negative after the move. I made this prediction because I assumed

introverted employees would be less happy in an open office environment meant to increase

social interaction. Additionally, I expected the coefficients for 'hrperday' and 'hrperweek' to be

positive before the move and negative after. This is because I anticipated employees who worked

longer hours would prefer a more private space to work. As for the gender ('male'), marital status

('marr'), and children ('child') variables, I expected the coefficient signs could go either way due

to Kasuganti and Purang's (2016) study which found demographics had no significance. Married

people with kids could potentially be happier in the new space because they had more of an

opportunity to socialize during work. On the other hand, they could have been happier in the old

space because they had a more private area (cubicle or office) to unwind from their home life.

However, to solely make coefficient estimations, I predicted married people to have a negative

coefficient before and a positive coefficient after the move. The same coefficient estimation was

used for gender and children.

Self-estimated productivity was included as a measure of office environment because

rationally speaking, whichever environment displays higher productivity, would be the

preferable environment for employers to implement in their organizations. The literature behind

productivity was very mixed with some reporting negative and positive findings. The

independent variables helped me grasp how much of the variance in productivity was explained

by the variables and also how much was not being explained by the study. Both statistics contributed to comparing open floor and conventional office environments in the productivity-based model.

With the productivity models, I expected the coefficients for 'corr' and 'manager' to be positive before the move and negative after the move. This prediction stemmed from the assumption that employees in higher positions who used to work in an office may have trouble adjusting to an open environment. Additionally, associates and managers may need private space for meetings, conference calls, and working with confidential information. Thus, working in an open-office environment had the potential to hinder their productivity. Clerical/Administrative workers most likely did not need as much privacy for work-related reasons and thus would not be affected in that way. Also, because their managers may be working in the open space within eyesight of them, this may have led these employees to feel more accountable for their work. Hence, I expected the coefficient for 'admin' to be positive after the move and either non-changing or negative before the move.

I expected aesthetics (aes) to have a negative coefficient before moving and a positive one after. I made this assumption because since the new space was more aesthetically pleasing compared to the old space, individuals who ranked aesthetics as very important most likely were much more productive in the new space. As for the 'hrperday' and 'hrperweek' variables, I expected similar coefficients as the happiness model, with a negative coefficient on the variables after the move and a positive one on the variables before. With personality type (intro), I expected the coefficient to be positive before the move and negative after the move because I assumed more introverted individuals would not thrive in an open, collaborative space. Lastly, I

expected the coefficients for marital status (marr), gender (male), and children (child) could go either way based on the same reasons given previously. However, like the happiness model, I made the same predictions for the coefficients. The same goes for the amount of time working there (time) and age variables (age, agegroup, agegroup2, agegroup3, agegroup4) because the same reasoning from the happiness model applies to productivity. To see a full table with all of the coefficient estimations for each dependent variable along with a full model, please refer to Table 4.

Table 4: Expected Coefficient Signs

	Happiness Before	**Happiness After**	**Prod. Before**	**Prod. After**
Time	Positive	Negative	Positive	Negative
Age	Positive	Negative	Positive	Negative
Hrperday	Positive	Negative	Positive	Negative
Hrperweek	Positive	Negative	Positive	Negative
Aes	Negative	Positive	Negative	Positive
male	Negative	Positive	Negative	Positive
intro	Positive	Negative	Positive	Negative
marr	Negative	Positive	Negative	Positive
coor	Positive	Negative	Positive	Negative
admin	Positive	Positive	Positive	Positive
manager	Positive	Negative	Positive	Negative
agegroup1	Negative	Positive	Negative	Positive
agegroup2	Negative	Positive	Negative	Positive

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agegroup3	Positive	Negative	Positive	Negative
agegroup4	Positive	Negative	Positive	Negative
child	Negative	Positive	Negative	Positive

Happiness and Productivity Before and After Full Model:

$y = \beta_0 + \beta_1\, time + \beta_2\, age + \beta_3\, hrperday + \beta_4\, hrperweek + \beta_5\, aes + \beta_6\, male + \beta_7\, intro + \beta_8\, marr$

$+ \beta_9\, corr + \beta_{10}\, admin + \beta_{11}\, manager + \beta_{12}\, agegroup1 + \beta_{13}\, agegroup2 + \beta_{14}\, agegroup3 + \beta_{15}$

$agegroup4 + \beta_{16}\, child + E$

Regressions and Results

Simple Linear Regressions: Several simple linear regression models were conducted to determine if factors such as the amount of time at a company, age, organizational position, aesthetics, hours spent at work, marital status, gender, children, and personality type affected the dependent variables in my models. The results of those regressions are displayed below in Table 5. Note that 'admin' and 'agegroup1' were omitted due to collinearity with their corresponding categorical variables.

Table 5: Empirical Results

	(1)	(2)	(3)	(4)
	HappinessBefore	HappinessAfter	ProdBefore	ProdAfter
Time	-0.00446	-0.00206	0.00240	-0.00588
	(0.418)	(0.688)	(0.503)	(0.255)
Age	-0.0806	-0.0985	0.0218	**-0.158****
	(0.343)	(0.219)	(0.693)	(0.050)
Hrperday	-0.0315	-0.0887	-0.00358	-0.0199
	(0.597)	(0.115)	(0.926)	(0.720)
Hrperweek	0.0409	**-0.0725***	-0.0157	-0.0137

	(0.302)	(0.055)	(0.542)	(0.710)
Aes	-0.205	**0.591****	-0.0848	**0.671****
	(0.173)	(0.000)	(0.385)	(0.000)
male	**1.712****	**1.105***	0.0987	0.897
	(0.007)	(0.058)	(0.804)	(0.119)
intro	**-1.292****	0.00396	-0.491	0.184
	(0.029)	(0.994)	(0.196)	(0.732)
marr	-0.426	0.300	0.474	0.135
	(0.511)	(0.620)	(0.265)	(0.822)
Coor	-0.767	-0.230	-0.396	-1.142
	(0.420)	(0.807)	(0.523)	(0.201)
admin	0	0	0	0
	(.)	(.)	(.)	(.)
manager	0.456	1.013	-0.0203	-0.300
	(0.675)	(0.350)	(0.977)	(0.768)
agegroup1	0	0	0	0
	(.)	(.)	(.)	(.)
agegroup2	-0.257	0.911	-0.315	0.575
	(0.815)	(0.378)	(0.661)	(0.576)
agegroup3	1.142	1.812	0.0785	2.372
	(0.526)	(0.283)	(0.947)	(0.162)
agegroup4	1.629	3.247	-0.700	**5.033***
	(0.568)	(0.228)	(0.707)	(0.064)
child	0.454	**-1.267***	-0.425	-0.142
	(0.532)	(0.068)	(0.371)	(0.834)
_cons	**10.97****	**9.191****	**8.972****	**8.330****
	(0.001)	(0.004)	(0.000)	(0.008)
N	58	57	58	58

p-values in parentheses

* *p* < .10, ** *p* < .05, *** *p* < .01

In equation 1, the R^2 and adjusted R^2 were 0.39 and 0.19 respectively which means that

the independent variables explained 39 percent of the variance in an employee's happiness before

the move. This percentage was adjusted to 19 percent to account for the number of independent

variables in my model. Since these two numbers are rather far apart, it suggested there may be

much inflation of R^2 occurring from the independent variables. This should not be a cause for

concern because as mentioned before, this could be a result of multiple factors including the fact

that our dependent variable is comprised of Likert scale data and the model is comprised of

several categorical variables.

Even with the low R^2 statistics, there is still some significance in the model. The gender

(male) and personality type (intro) variables were both significant at the 5% level. This suggests

those variables did have an impact on employee happiness before the move to the new

open-floor office space. The coefficients for each significant variable were 1.712 (male), and

-1.292 (intro). Also, the constant equated to 10.97. This value means that with all independent

variables held constant, a person's happiness measured at 10.97 (quantified by the Likert scale

from 1-10). The constant exceeded the scale barriers suggesting a person's happiness was very

high with everything held constant. Therefore, in the parsimonious model, for every one point

higher recorded in the aesthetics variable, a person's happiness decreased by 0.205. Additionally,

if someone identified as male in the survey, their happiness resulted in a 1.712 increase before

the move.

In equation 2, the R^2 and adjusted R^2 for this model were 0.465 and 0.287 which depicted

that the independent variables explained 46.5 percent of the variance in happiness after the move.

This percentage was adjusted to 28.7 percent to adjust for the number of variables in the model. In comparison with my first model, the R^2 and adjusted R^2 were significantly higher, and the spread between them was smaller, indicating this may be a better model. The significant variables in this model were the hours spent at work during the week (hrperweek), gender (male), and aesthetics (aes). 'Male' and 'hrperweek' were significant at the 10% level. Moreover, 'aes' was significant at the 5% level. This significance indicated these variables had some impact on individual happiness after the move. The coefficients for the variables were -0.0725 (hrperweek), 0.591 (aes), and 1.105 (male). Also, the constant equated to 9.191 suggesting that with all other independent variables held constant, a person's happiness measured at 9.191. With that base value in mind, for every additional hour a week spent at work, a person's happiness decreased by 0.0725 in the new office space. Also, for every one-point increase in the aesthetics variable, an individual's happiness increased by 0.591. Lastly, if someone identified as male on the survey, their happiness increased by 1.105.

Overall, the findings from both happiness regressions provided some exciting results to compare with my initial predictions. In equation 1, the coefficients for the significant variables (male, intro, aes) varied in their predictions and outcomes. Aesthetics was in line with my initial prediction and carried a negative coefficient. This result supported the theory that someone who places high importance on aesthetics may not have been as happy in the older office environment before moving to the new and modern space. As for 'male' and 'intro,' both variables carried opposite signs on their coefficients than what was initially expected. 'Male' turned out to carry a positive coefficient. The reasoning for this might have been that men thrive more in a conventional office centered environment, or because the sample of men surveyed just happened

to answer that way. Additionally, as for the 'intro' variable, it also carried a positive coefficient. This finding came as counterintuitive to my original prediction. Perhaps instead of feeling anxious or overwhelmed, the new space allowed introverted individuals to break out of their comfort zones and foster more social interaction.

In equation 2, the coefficients for the significant variables (hrperweek, male, aes, child) also varied in their predictions and outcomes. Hours per week was in line with my prediction and had a negative coefficient. Although rather small, it still supported the theory that the more someone works, the less happy they will be in an open office environment. This result may be due to several factors, but I infer it is because of the lack of privacy. The coefficient for 'male' was also in line with my estimate as it was positive. The coefficient before (1.105) was higher than the coefficient after (suggesting that men were happier before the move). Overall the coefficients showed a positive reaction from men in any office environment. This may mean women are less happy in both environments. However, this could potentially have been because there was a higher number of women in the sample compared to men. The coefficient for 'child' went against my estimated sign and was negative. It tells me individuals with children are potentially less happy in an open office environment because they do not have privacy to unwind from their home life. Lastly, there was 'aes' which also followed my initial prediction with a positive coefficient. The size of the coefficient suggested this variable had a big impact on someone's feelings toward an open office environment.

I will briefly mention the variables that were not significant in the 10%, 5%, and 1% thresholds from both happiness models. However, even though they did not meet those thresholds, it does not mean they're insignificant. Variables in equation 1 that had rather high

coefficients and not too high p-values included 'marr' (-0.426), 'coor' (-0.767), 'agegroup3'

(1.142), 'agegroup4' (1.629), 'aes' (-0.205), and 'child' (0.454)[1]. The 'marr' variable has a

negative coefficient (in line with my estimations) which supported my prediction that married

people would be happier in an open office environment because they would have more of an

opportunity to socialize. However, since the coefficient for 'child' was positive in my happiness

model and was negative in my happiness after model, it suggested people with kids are not

happy in the new space. This supported the idea that people with kids may prefer a more

conventional office because it gives them privacy to unwind from their home lives. Then, of

course, there is the 'agegroup3' and 'agegroup4' variables which also were in line with my

predictions, supporting the idea that people in older age groups may be happier in a traditional

office. Aesthetics was in line with my initial prediction and carried a negative coefficient. This

result supported the theory that someone who places high importance on aesthetics may not have

been as happy in the older office environment before moving to the new and modern space. The

last variable to mention, coordinator or 'coor,' was not in line with my estimates. It was negative

which could potentially mean the loss of an office (or cubicle) did not have much an impact on

their work satisfaction. However, that does not necessarily mean they were happier in the new

space. To conclude, the variables 'time', 'age,' 'hrperday,' 'hrperweek,' 'manager,' and 'agegroup'

carried either extremely low coefficients or very low p-values suggesting they did not have much

of an impact on employee happiness before the transition.

Variables in equation 2 not found to be statistically significant, but that still had decently

high coefficients and lower p-values included, 'hrperday', 'manager,' 'agegroup2', 'agegroup3',

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[1] The values in parenthesis are the variables coefficient estimations from the regression.

and 'agegroup4'. Something interesting is that all three age groups carried a positive coefficient. For 'agegroup2', this is in line with my estimates, but for 'agegroup3' and 'agegroup4' it was different. These results are compelling because the older age groups showed positive coefficients before the move as well as displaying that overall, they are happy in both spaces. The variable 'hrperday' was in line with my prediction and had a negative coefficient. Although rather small, it still supported the theory that the more someone works, the less happy they will be in an open office environment. The 'manager' coefficient was positive, the opposite of my estimation. This finding may be because managers were happier because they were more engaged with their teams rather than in their offices. It is noteworthy however that although the 'manager' variable was not significant in happiness before, it did carry a positive coefficient as well, suggesting individuals in higher positions are overall happy regardless of the type of office. Furthermore, the variables 'time', 'age,' 'intro,' 'marr,' and 'coor' carried either extremely low coefficients or very low p-values suggesting they did not have much of an impact on happiness after the move.

The R^2 and adjusted R^2 for equation 3 were 0.224 and -0.028 meaning that the independent variables explained 22.4 percent of the variations in measured productivity before the move. This percentage adjusted to -0.03 percent, statistically means this particular model is not a good representation of the data — the only variable that showed slight statistical significance in equation 3 was 'intro'. However, it was not within the 10 percent threshold, so I do not consider it technically significant in the context of this study.

Equation 4 had an R^2 and adjusted R^2 of 0.489 and 0.323 signifying a decent model in comparison to the others. The significant variables were 'age' (-0.158), 'aes' (0.671), 'male' (0.897), 'agegroup3' (2.372), and 'agegroup4' (5.033). The age variables all went against my

coefficient estimates and were positive. 'Aes' and 'male' fell in line with my predictions and were both positive. Additionally, the constant for this model was 8.330. That value then was the baseline productivity value. Therefore, with every year increase in age, productivity rose by 0.158 in the new space. Along with that, with every one-point increase in aesthetics, productivity rose by 0.671. If someone identified as male, they were 0.897 more productive. If someone was between the ages of 41-50, they were 2.372 more productive in the new space. Moreover, if someone was between the ages of 51-63, they experienced a 5.033 increase in productivity. I assumed the reasoning behind these coefficient estimates to be approximately the same as the reasoning in the happiness model because the coefficients and the logic match.

I will briefly discuss variables that lacked statistical significance in both productivity models. Therefore, variables in equation 3 that had decent size coefficients and lower p-values included 'marr,' 'corr,' and 'child.' The coefficient for 'marr' was positive, going against my initial estimate. This finding could be because married individuals felt more productive in the open space because they did not have as much privacy to contact their spouse throughout the day. The coefficient for 'corr' was negative which also goes against my prediction. It was also negative in equation 4 which suggested individuals in mid-level company positions were less productive across the board. Lastly, the coefficient for 'child' was -0.425. It was also negative in equation 4 suggesting people with kids were less productive in general which makes logical sense because children can be a big stressor in life. Furthermore, to continue with other variables in the productivity after model, variables with high coefficients and lower p-values included 'corr' and 'agegroup2'. 'Corr' was previously explained, but 'agegroup2' carries a positive coefficient which remains in line with my initial estimates.

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Ordered Logistic Regressions: Although the simple linear regression models provided compelling information, they did not capture the whole picture. There was a lack of significance which may be attributed to the use of Likert scale data and categorical data. This result makes sense because an individual's happiness and productivity based on a number scale are difficult to measure. For example, the number '8' may not hold the same value of happiness as it could for someone else. Another individual may value the same '8' as a '6'. Therefore, it is through the implementation of ordered logistic regressions that I hoped to expand my study further. By using the margins commands in Stata 14 MP, it made the results of the regressions easier to interpret, and I was able to see how specific demographics answered on each part of the scale.

Furthermore, I will begin discussing the ordered logistic regressions for the happiness dependent variables and then for the productivity dependent variables. The purpose of running the ordered logistic regression and margins commands was for me to see how people with individual characteristics answered on each of the dependent variable survey questions. It is worthy to note I omitted continuous variables from the discussion in this section due to the focus on categorical variables. Additionally, 'manager' and 'agegroup4' were deleted due to collinearity with their corresponding categorical variables. Probability data from the margins command is displayed in Tables 6, 7, 8, and 9 located in Appendix A. The data is meant to be examined by looking at whether the coefficients are positive or negative, rather than the actual value itself. Additionally, if a value is negated, it is because no one chose that value as an answer. By looking at the coefficients of the probabilities, we can see how specific demographics most likely answered on the Likert scale. If the coefficients were positive versus negative across the scale, it is indicative of where that group was most likely to answer.

In the happiness margins, married people were found to be more likely to select 1-7 on the Likert scale for happiness before the move rather than values 8-10 based on the results from the margins data. To contrast this with after the move, they were more likely to select 8-10. This stark difference begs the question of why married people valued their happiness less before the move. Men were found to be more likely to select 8-10 for happiness before the move and 9-10 after the move. In both instances, men were pretty consistent in their happiness. Introverted individuals were more likely to select values 1-7 before and 1-8 after making their happiness also pretty consistent. Individuals who fell under the 'corr' category were more likely to answer 1-7 before the move and 1-8 after the move which also shows happiness to remain steady. The same goes for individuals who fell under the 'admin' category. They were more likely to answer 1-7 before the move and 1-7 after.

Individuals with children were more likely to answer 8-10 before the move, but 1-8 after the move. This contrasts with married folk who had the opposite results. These findings were interesting because I assumed most of the people who had kids were married so I predicted those results would be similar. However, it is possible that was not the case. As for the age group variables, their findings were all the same with each age group being more likely to answer 1-7 before the move, and 1-8 after.

In the productivity margins, married people were found to most likely answer between 9-10 before and after the transition to the new space. For men, they were also more likely to answer 9-10 before and after the transition to the new space. For individuals who identified as introverts, they were most likely to answer 4-8 before and 1-8 after the transition. Coordinators were more likely to choose 4-8 before and 1-8 after. Individuals in administrative/clerical

positions were more likely to answer between 4-8 before the move and 9-10 after the move.

People with children were more likely to answer 4-8 before and 1-8 after the move. All of the

age groups were more likely to answer 9-10 before the move and more likely to answer 1-8 after

the move.

The biggest takeaways from the happiness ordered logistic regression models came from

the married individuals and the individuals who had children. It was interesting their response

probabilities were on opposite ends of the Likert scale. This variation was interesting because I

expected the individuals with children also to be married, but in this sample that was not the

case. It may be indicative that people with children were less happy in the new space (more

likely to answer 8-10 before and 1-7 after) because they had less privacy and were not able to

bring their children into work anymore. For married folk, they might be happier in the new space

(more likely to answer 1-7 before and 8-10 after) because they had more of an opportunity to

socialize at work. As for the productivity ordered logistic regression, interesting outcomes were

found with the individuals in administrative positions (more likely to answer 4-8 before the move

and 9-10 after). The results suggested people in administrative positions were more productive

in the new space. This may be because they felt more accountable to do their work because their

bosses more easily could see when and how they work. Lastly, the age groups were more likely

to answer 9-10 before the move and 1-8 after suggesting everyone was more productive before

the move.

Conclusion

Many have written on the subject of open-floor office spaces in conjunction with

traditional cubicle office environments. My study expanded on this subject by running

regressions with a new sample. Overall, my findings went against most of the literature by finding positive effects on self-estimated happiness and productivity. To see this, look at the positive coefficients in the 'after' dependent variables in Table 5. Significant findings in the happiness models were the aesthetics, gender, and hours spent at work variables. Males were consistently happy before and after. Those who weighted aesthetics highly were much happier in the new space (most likely due to the new modern area).

Moreover, the results revealed the more hours someone worked, the less happy they would be in the new space. Significant variables in the productivity models were aesthetics, personality type, age, and age groups. According to the age variable, the older you are, the less productive you will be in the new space. However, the older age groups were more productive in the new space according to the regression. As for the ordered logistic regressions, the biggest takeaways from the happiness models were that married individuals were more likely to answer higher values on the scale after the move and for individuals with children, it was the opposite. For the production models, the most exciting outcomes were that all age groups were more likely to answer higher values on the scale before the move and that those in administrative positions were more likely to answer higher values on the scale after.

Although my study expanded on existing literature, it does have its limitations. It was limited to a corporate healthcare environment and a small sample. Additionally, due to respondents self-reporting on every question, there is self-estimation bias in my study. Also, the Likert scale data makes the simple linear regression results harder to interpret because it is difficult to measure happiness and productivity on a 1-10 scale. Those values may mean different things to different people. Therefore, for future research I recommend expanding the study to

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other disciplines, retrieving a larger sample, as well as finding a true continuous dependent

variable rather than using self-estimated Likert scale data. Such data may include performance

statistics from the employer.

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Appendix A

Table 6: HappinessBeforeMargins

Variable:	1	3	4	5	6	7	8	9	10
marr	0.009	0.023	0.011	0.022	0.016	0.015	-0.022	-0.028	-0.047
male	-0.037	-0.090	-0.046	-0.089	-0.063	-0.060	0.087	0.111	0.187
intro	0.026	0.062	0.032	0.061	0.044	0.041	-0.060	-0.077	-0.129
coor	0.027	0.065	0.033	0.064	0.046	0.043	-0.063	-0.081	-0.135
admin	0.010	0.023	0.012	0.023	0.016	0.015	-0.022	-0.029	-0.048
child	-0.011	-0.027	-0.014	-0.026	-0.019	-0.018	0.026	0.033	0.055
agegroup 1	0.043	0.103	0.053	0.102	0.073	0.069	-0.099	-0.128	-0.214
agegroup 2	0.046	0.110	0.056	0.109	0.077	0.073	-0.106	-0.137	-0.229
agegroup 3	0.021	0.051	0.026	0.050	0.036	0.034	-0.049	-0.063	-0.106

Table 7: HappinessAfterMargins

Variable:	2	4	5	6	7	8	9	10
marr	-0.003	-0.009	-0.007	-0.007	-0.008	-0.005	0.008	0.030
male	-0.017	-0.057	-0.044	-0.042	-0.051	-0.030	0.052	0.190
intro	0.003	0.009	0.007	0.007	0.008	0.005	-0.008	-0.029
coor	0.012	0.040	0.030	0.029	0.036	0.021	-0.036	-0.133
admin	0.013	0.045	0.034	0.033	0.040	0.024	-0.040	-0.148
child	0.019	0.062	0.047	0.046	0.056	0.033	-0.056	-0.207
agegroup1	0.044	0.146	0.112	0.108	0.132	0.078	-0.133	-0.487
agegroup2	0.032	0.106	0.081	0.078	0.095	0.057	-0.096	-0.354

| agegroup3 | 0.018 | 0.058 | 0.044 | 0.043 | 0.052 | 0.031 | -0.053 | -0.193 |

Table 8: ProdBeforeMargins

Variables:	4	5	6	7	8	9	10
marr	-0.016	-0.015	-0.014	-0.122	-0.001	0.081	0.087
male	-0.005	-0.005	-0.005	-0.040	-0.001	0.026	0.028
intro	0.018	0.016	0.016	0.138	0.001	-0.092	-0.098
coor	0.010	0.010	0.010	0.081	0.001	-0.054	-0.058
admin	0.002	0.002	0.002	0.016	0.000	-0.011	-0.012
child	0.017	0.015	0.015	0.129	0.001	-0.086	-0.092
agegroup1	-0.036	-0.033	-0..032	-0.275	-0.002	0.182	0.195
agegroup2	-0.014	-0.013	-0.013	-0.108	-0.001	0.071	0.076
agegroup3	-0.030	-0.028	-0.028	-0.236	-0.001	0.156	0.167

Table 9: ProdAfterMargins

Variables:	1	2	3	4	5	6	7	8	9	10
marr	-0.003	-0.002	-0.002	-0.004	-0.002	-0.008	-0.007	-0.003	0.011	0.019
male	-0.020	-0.015	-0.012	-0.027	-0.019	-0.061	-0.055	-0.021	0.084	0.146
intro	0.002	0.001	0.001	0.002	0.001	0.005	0.004	0.002	-0.007	-0.011
coor	0.014	0.011	0.008	0.019	0.014	0.043	0.039	0.015	-0.059	-0.103
admin	-0.007	-0.005	-0.004	-0.010	-0.007	-0.022	-0.019	-0.007	0.030	0.052
child	0.002	0.002	0.001	0.003	0.002	0.007	0.006	0.002	-0.010	-0.017
agegroup1	0.098	0.074	0.058	0.134	0.094	0.299	0.269	0.102	-0.412	-0.716
agegroup2	0.085	0.064	0.051	0.116	0.082	0.259	0.234	0.089	-0.357	-0.621

agegroup3	0.049	0.037	0.029	0.067	0.047	0.149	0.134	0.051	-0.205	-0.356