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Diplomarbeit

An examination of the factors influencing future workplace attractiveness as perceived by current students of business & engineering in Vienna

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Wien, im Januar 2023

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Ich habe zur Kenntnis genommen, dass ich zur Drucklegung meiner Arbeit unter der Bezeichnung

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Linus Fraundorfer

"*La libertad es mental.*"

-Anonymous

"*He who makes a beast of himself gets rid of the pain of being a man.*"

-Samuel Johnson

To the one who left the cave. And those that return.

Acknowledgements

I would like to express my sincere gratitude and deepest love to all those who have, directly or indirectly, helped in the writing of this thesis.

My family, often confused, but always supportive. Thanks for letting me grow into someone I love.

My girlfriend Sarah, who knows me best and with whom I feel like I can overcome any challenge. You pick me up when I am down – I can't wait for our future together.

My friends, there when I needed them. Happy alone, happier with you.

Those who have come before me, on whose shoulders I can sit. Those who come after me, to whom I offer my own to sit on.

Dig deep.

Kurzfassung

Mit dem stetig zunehmenden Wettbewerb zwischen den Unternehmen um die bestqualifizierten Talente aus dem Pool potenzieller Mitarbeiter hat Employer Branding sowohl in der praktischen Anwendung als auch in der theoretischen Forschung wachsendes Interesse erfahren. Die vorliegende Studie untersucht die Attraktivität eines Unternehmens oder Arbeitsplatzes, das ultimative Ziel hinter Employer Branding, wie sie von Studierenden der Wirtschaftswissenschaften und des Ingenieurwesens in Wien während des Untersuchungszeitraums wahrgenommen wurde. Eine zufällig ausgewählte Stichprobe dieser demografischen Gruppe wurde mittels eines Fragebogens befragt, um jene Attribute der Arbeitsplatzattraktivität zu ermitteln, die für potenzielle Mitarbeiter in Büroberufen am wichtigsten sind. Mittels einer deskriptiven Analyse wurden Unterschiede in den gegebenen Antworten je nach Studienrichtung ermittelt, und mit einer explorativen Faktoranalyse der gesamten Daten zugrundeliegende Korrelationen erhoben. Jene acht Faktoren, welche die Attraktivität eines Arbeitsplatzes in den Augen von Wirtschafts- und Ingenieursstudenten maßgeblich beeinflussen, wurden ermittelt und beschrieben. Der theoretische Hintergrund wird durch einen Überblick über die bestehende Forschung zu diesem Thema erweitert. Zudem werden die Implikationen der Forschung erörtert, Beschränkungen detailliert beschrieben und mögliche zukünftige Forschungsrichtungen vorgeschlagen.

Abstract

With steadily increasing competition between companies to hire the top talent among the pool of prospective employees, employer branding has seen a surge in interest both in practical application as well as in theoretical research. This study investigates organizational or workplace attractiveness, the ultimate goal behind employer branding, as perceived by students of business and engineering in Vienna during the time of research. A randomly selected sample of that demographic group was subjected to a questionnaire in order to discern those attributes of workplace attractiveness that matter most to potential employees in office jobs. The collected data was subjected to both a descriptive analysis to compare responses given between the two fields of study as well as an exploratory factor analysis to unveil underlying correlations in the entire data set. Eight factors were found to significantly influence workplace attractiveness as perceived by business and engineering students in Vienna, which will be described. Furthermore, the theoretical background is expanded upon by giving an overview of existing research in this subject matter. Finally, implications of the research are discussed, limitations detailed, and possible future research directions suggested.

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1 Introduction

Graduating from university is, by a large proportion of graduates, considered one thing primarily: a reason to celebrate. As the theoretical knowledge obtained during their studies opens seemingly countless opportunities to apply it, these freshly minted academics soon face a tough choice: Which company is most suited for their future career? This question, in today's job market, implies a much wider spectrum of decisions than a mere match between the skills of the future employee and the requirements of the company. Whereas it used to be the employer who had the say in the hiring process, especially in knowledge-based industries the bargaining power now lies in the hands of the job seeker. In the "war for talent", it is the prospective employee whose set of requirements must be matched. Unless these are fulfilled to a satisfying degree, he or she will continue searching for a work environment in which his or her criteria are met (Hadi & Ahmed, 2018).

1.1 The problem & research questions

What specific items constitute the criteria an employer considers when it comes to deciding for or against a specific employer? What is it that tomorrow's employees value in the design of their work environment? These questions are of interest not only to researchers, but also to any company aiming to hire the cream of the crop from a pool of applicants. Two concurrent developments combine to imbue these questions with importance: first, the ease of switching to a position that is perceived to be more suitable to an employee's own criteria and second, companies' need for elite talent to succeed in today's rapidly changing business world.

Superiorly qualified staff members are valuable to conquer the challenges posed by the rapidly changing and ever-adapting environment businesses find themselves in. Furthermore, top talent is necessary to overcome any hurdles that might have to be faced in the future (Chhabra & Sharma, 2014). Therefore, today's businesses are just as focused on attracting customers as they are on attracting those potential employees that show the highest promise for success (Alshathry, Clarke & Goodman, 2017).

Highly educated people constitute a group that is characterized by a disproportionately large number of job changes. One reason for this was found to be the increase in salary that can be gained from switching employers (Lam, Ng & Feldman, 2012). What is more, due to technological advances in telecommunications, today's employees are not as bound to one geographical location as they were in the past (Dabirian, Paschen & Kietzmann, 2019). This transformation towards a more flexible, digitally minded workspace environment was

accelerated by the COVID-19 pandemic and its often externally, i.e., governmentally, imposed remote work periods (Nagel, 2020). For companies, this leads to increased competition as they see themselves vying for the attention of competent future staff (Dabirian, Paschen & Kietzmann, 2019). It is not only the hiring process that is affected by this shift in power in the labor market, however. Replacing knowledgeable, trained, and productive members of the workforce is a costly and time-consuming endeavor. Thus, the retention of these very same workers is high on the list of priorities of today's employers (Craig, 2015).

Taken together, the two developments described – easier job changes and increased job market competitiveness – enable prolifically talented potential employees to be able to select from a wide range of positions available to them when looking for a place of employment. In short, the issue can be summarized as follows: in an ever-changing world, how does a company ensure to hire only the top candidates from the global pool of applicants? The author sought not only to ask employees what specific criteria influence their choice of employer, but also to identify correlations between the responses given. The goal was to extract a set of meta-criteria that explain the underlying motivation behind the answers.

Therefore, the following two-part research question is discussed in this thesis: **"Which specific criteria influence the workspace attractiveness of the offices of future employers as seen by students of engineering and business studies in Vienna in the year 2022 and which underlying factors can be distilled from these criteria?"**

1.2 The process of answering the research questions

In order to answer these questions, the author undertook a multi-step process, the nature of which is also reflected in the order of the chapters of this thesis. This chapter serves as a brief overview on how the research questions above were answered.

1.2.1 Methodology

First, the most adequate tools to answer the questions were chosen, which amounted to a quantitative analysis in the form of a questionnaire and an exploratory factor analysis. The second chapter of this thesis, titled "Methodology", delves into detail regarding this choice and why these methods were selected from the ample toolset available to the researcher.

1.2.2 Literature review

Subsequently, the existing literature was reviewed in order to gain an understanding of the status quo of research on this topic, as is described in the chapter “State of the art: Review of existing literature”. This also reinforced the knowledge that the above research questions had not been answered in previous works. Furthermore, the author gathered data that formed the basis for the items included in the questionnaire from existing studies on related subject matters.

1.2.3 Data collection via questionnaire

The author of this thesis set out to answer these questions by means of subjecting a representative sample of the population relevant to the research to a questionnaire. The sample was selected from among Viennese students pursuing an education in one of two academic fields: engineering & business.

This decision was driven by two factors. The first is the relatively comparable future work environment. Not all future workspaces are alike - one cannot easily compare the requirements of graduates employed in a laboratory to those working in a school. Most graduates in the fields mentioned will work in an office. A question pertaining to this matter was asked as part of preliminary questions during the interview process. The author wanted to exclude those students headed for a career in laboratories, education, or other non-office environments. In this way, the study allows comparison between the two student groups. Secondly, these two fields represent two of the four most populated choices in higher education in Vienna, Austria, as of the writing of this thesis (Statistik Austria, 2022), which facilitated data gathering.

A questionnaire was completed by the selected sample. During the questionnaire, participants were asked to rate the subjective importance of several items describing their future workplace on a Likert scale. The attractiveness of a work environment is comprised of a large variety of influences running the gamut from non-financial benefits to the social climate. Hence, further specification was necessary to conduct research that did not exceed the scope of this thesis.

Since the author aimed to analyze the requirements that future office workers in the fields mentioned above pose to their employers, it was decided to emphasize those variables that can be altered by the company offering a particular position. They will be detailed further on in this thesis. They are comprised of tangible items such as the layout of the office, whether there are fixed sitting arrangements, and the possibility of remote work.

1.2.4 Evaluating the data

Following data collection, the responses were subjected to two kinds of quantitative analyses: first, a descriptive analysis was employed to distill the individual responses down to statistical measures of what was perceived as attractive workplace criteria. For increased clarity, the results were visualized by means of tables and diagrams. In a second step, an exploratory factor analysis was conducted. This process is a mathematical method to extract underlying factors from a set of correlated items. A Python program was written by the author for the purpose of analysis. The results and reasoning behind the selection of these evaluative methods are given in the corresponding chapter.

1.2.5 Implementing the findings

In the exploratory factor analysis, eight factors were found to influence the perceived attractiveness of an office job. In this chapter, the author suggests ways of implementing these factors through facility design. This serves as a way of giving actionable recommendations to any employer seeking to attract high-potential business and engineering graduates.

1.2.6 Limitations & further research

Any results of academic research are inherently subject to limitations in the matters of study design, execution, and analysis. The limitations that are relevant to the correct interpretation of the results of thesis are described. Additionally, additional lines of research that could be followed based on the data collected and the findings of this study are detailed.

1.2.7 Conclusion

A summary of the research process and the most important findings are briefly presented to conclude the thesis.

2 Methodology

This chapter serves a twofold purpose: first, the author will review the literature to lay out which methods of research could have been employed to address the research question. Following this, the pool of tools will be compared with regards to their suitability for the topic at hand. From this discussion, the optimal methodology will be selected. The researcher employed a questionnaire based on existing literature that was specifically tailored to collect quantitative data to answer the research questions. Additionally, exploratory factor analysis, which is a tool to distill underlying correlations from the data, will be introduced. The collected data was subjected to this procedure in order to resolve the second part of the research question. It will be shown why these methods were chosen and why they were seen as appropriate to answer the questions.

2.1 Comparison of research methods

Generally, research methods can be categorized into a dichotomy of qualitative and quantitative methods. Additionally, there are so-called “mixed methods” which constitute a hybrid of elements stemming from both approaches. Owing to its versatility, qualitative research is not easily defined, but a working definition is offered by Corbin and Strauss (2014, pp. 10-11): “(…) any type of research that produces findings not arrived at by statistical procedures or other means of quantification”. Quantitative research, on the other hand, can be defined as “research that explains phenomena according to numerical data which are analyzed by means of mathematically-based methods, especially statistics” (Yilmaz, 2013, p. 311). As such, this type of empirical research tests a theory or answers a question comprised of numerically measured variables which are then subjected to statistical analysis (Creswell & Creswell, 2017).

For the purpose of answering the research question of this thesis, the author decided on employing two quantitative methods, namely a Likert-scale-based survey and exploratory factor analysis. To justify this choice, one needs to consider the nature of the research, as the different methods have distinct advantages and disadvantages which will briefly be sketched.

Quantitative research aims to gather a comparatively small amount of information about a large number of respondents, which is then extrapolated to represent the general view of an overarching, larger segment of the population (Bridgmon & Martin, 2012). Structured mathematical procedures are employed to collect objective, comprehensive findings that can be generalized and replicated (Creswell, 2013). It is most appropriately used when one can collect quantifiable measures of variables

from samples of a population, using an instrument such as a survey (Queirós, Faria & Almeida, 2017).

Qualitative methods, on the other hand, are based on a smaller number of participants, whose individual statements are analyzed in-depth (Taherdoost, 2022). The objective is to understand and explore the dynamics of individuals' values, their motives, and attitudes, which are seen to correspond to a deeper space of phenomena that cannot be operationalized as variables (Maxwell, 2012). Statistical analysis is rarely used, as the social realities of respondents do not lend themselves to being numerically categorized (Melkert & Vos, 2010).

A mixed approach can be considered when the research questions at hand cannot be answered by merely employing one of the two methods mentioned (Taherdoost, 2022). Mixed research methods offer the advantages of quantitative and qualitative research and are often used in interdisciplinary studies (Creswell, 2013). A disadvantage, however, is that due to the combination of different methods, the expertise of the researcher must be correspondingly well-developed in all the methods involved (Waysman & Savaya, 1997). Therefore, it is recommended to collaborate with other researchers to combine skills and to deal with the inherently longer and more complex process of data collection and analysis (Rossman & Wilson, 1994).

2.2 Selection of research method & tools

Given the nature of the research question, the fact that the author was alone, and the intended scope of this thesis, a purely quantitative approach was selected. As Patten and Newhart (2017, p.26) note, there is a type of research question that is preferably subjected to quantitative approaches, because the involved “variables are generally numerical, and the question generalizes to a large group”. It could also be argued that a mixed methods approach was utilized since the author of this paper began his research by perusing literature regarding the topic. This, however, is a vital part of both qualitative and quantitative scientific research and forms the basis for concretizing the subject matter to be investigated (Patten & Newhart, 2017).

Not only can workplace attractiveness be quantified easily, but in order to conduct an exploratory factor analysis, one requires quantitative data. Furthermore, as the goal was to extrapolate the findings to the population from which the sample was collected, a survey – being a quantitative instrument – was seen as the most appropriate instrument. It offers advantages such as cost- and time-effectiveness, ease-of-use and the potential to collect and analyze data points from a statistically significant and representative sample of a population (Queirós, Faria & Almeida, 2017).

In order to convert the attractiveness of a workplace into a quantitative measure, the survey included a Likert scale on which respondents were asked to rank specific items. Ever since its conception in 1932, this scale has been widely accepted as a valid choice for measuring subjective attitudes towards a particular set of statements. A Likert scale can be used to quantify the subjective preferences and feelings of the respondents involved (Joshi et al., 2015). This is what the author set out to do to have a mathematical expression of participants' attitudes towards workplaces.

2.3 Software and other tools used

During the study, various programs and devices were employed for data gathering, analysis and visualization. Initially, the author perused Google Scholar in search of academic research on related topics. From the data collected during this step, the questionnaire was created as a Microsoft Word document and the research questions were concretized. This Word document was then printed out and presented to the participants in physical form. An iPad (tablet device) was employed in the survey due to its ease of use and portability. A Microsoft Excel worksheet was prepared, in which the author noted the responses given by the participants as they were given to him.

This worksheet was then further processed in Anaconda, a Python 3 distribution, for the purposes of descriptive and exploratory factor analysis. The source code of the self-developed program can be found in the Appendix. Finally, the results were described using Microsoft Word, with diagrams created in Microsoft Excel.

2.4 Survey design

As will be discussed in a later chapter, it was a mathematical necessity to collect data from a sample of the population that exceeded a certain size. What was needed to gather data to answer the research question was a snapshot of the current beliefs of a specific population. To this end, a survey was employed which asked participants about their subjective perception of the importance of numerous items related to workplace attractiveness. An anonymous questionnaire was seen as the best-suited tool for the study at hand. It enabled the author to gather data related to the research question at a large scope in a time-efficient and budgetarily non-invasive way. These two aspects were critical, as the study was carried out by the author alone.

2.4.1 Constructing the questionnaire

The questionnaire, while partially based on existing research, was created anew by the author of this paper for the purpose of this study. There were a number of guidelines that had to be followed in the creation of the instrument. These guidelines ensure that the questionnaire is a valid scientific instrument which gathers the data it

is supposed to collect in a way that enables the responses to be used in a scientifically valid analysis.

The first step in creating a questionnaire is to gather items or variables that pertain to the research questions. This can be achieved by means of a literature review, which helps the researcher identify the most important dimensions of the topic (Acharya, 2010). Furthermore, it establishes the status quo of knowledge and can lead to a first draft of the survey tool (Parfitt, 2013). Items that are included in this draft must operationalize the main concepts contained within the research questions (Rattray & Jones, 2007).

When drafting the survey instrument, the wording of the questions should follow the maxim of being easy to understand, yet concise (Brace, 2018). The demographics of the intended participants should be kept in mind, which influence choices of wording and grammar (Lietz, 2010). Specific, short and closed questions are preferable (Acharya, 2010; Brislin, 1986; Holbrook, Cho & Johnson, 2006).

The creator of the questionnaire is also advised to keep in mind how the concepts will be quantified, which influences the design of the responses that participants can give. Due to the reasons outlined above, a Likert scale was chosen as being appropriate to evaluate the data collected. The commonly used seven-point scale offers a mixture of reliability and precise mapping of respondents' actual attitudes without artificially increasing differentiation (Alwin, 1992; Cronbach, 1951; Porst, 2000). Furthermore, it is an odd number of responses, therefore a neutral "middle" option is present, which increases reliability and validity (Saris & Gallhofer, 2007).

These two terms, reliability and validity, are of utmost importance to a scientifically valid research questionnaire. Reliability is a measure for the internal consistency, stability, or repeatability of a questionnaire (Jack & Clarke, 1998). A typical way to determine whether a questionnaire is reliable is Cronbach's coefficient α, which determines whether the items (questions) contained in the tool measure the same domain via inter-item correlations (Bryman & Cramer, 1997; Cronbach, 1951). For a developing (new) questionnaire, α should exceed 0.7 (Bowling, 2014). The value for the questionnaire at hand, when applied to the items rated on the 7-point Likert scale, was 0.947 (with a 95% confidence interval of [0.939, 0.954], as calculated by the "cronbach_alpha()" function of the Python "pingouin" library.

Validity, on the other hand, is used to establish whether a questionnaire measures what it was designed to measure (Bryman & Cramer, 1997). One kind of validity, called content validity, is expressed by expert opinion on whether the scale items are a valid representation of the proposed concepts the questionnaire is intended to assess (Rattray & Jones, 2007). Content validity was examined by means of

presenting the questionnaire in draft form to a university professor heading an academic institute, the research of which investigates workplace design.

This initial process, however, is not sufficient to ensure validity (Rattray & Jones, 2007). A further aspect of validity, construct validity, is concerned with how well the items in the questionnaire represent the underlying concept. This can be determined by factor analysis, which the author employed to answer the second part of the research question and to check the validity of the questionnaire in the process.

2.4.2 Sample size

As will be explained in the chapter that details the actual data collection process, the author took meticulous care to ensure the sample was of adequate size for exploratory factor analysis. The descriptive analysis, which precedes the factor analysis, is characterized by certain ramifications concerning sample selection and size as well. Not only does one have to ensure that the sample was selected with minimal bias and at random, but the number of valid responses needs to exceed a certain value (Parfitt, 2013).

What exactly this value is depends on the estimation of the levels of risk and precision one is willing to accept. This is expressed by the margin of error and the level of confidence. The margin of error expresses how precise the results are, meaning how much the values differ from the actual values present in the general population – put simply, it is “the plus or minus figure reported in newspaper poll results” (Taherdoost, 2017, p. 237). Usual recommendations for social research deem a 5% margin of error acceptable (Bell, Bryman & Harley, 2022; Krejcie & Morgan, 1970).

However, this can be varied in accordance with the availability of resources – primarily the time and cost necessary to survey a large number of participants – and the practicality of said questioning (Kotrlik & Higgins, 2001; Story & Tait, 2019). Due to time constraints, the practicality of gathering a relevant sample within the time frame available, and the fact that the author of this study undertook the research on his own, the acceptable margin of error was set at 7%. This represents an acceptable compromise between precision and practicality.

The level of confidence expresses the accuracy of the results of the sampling process. It is based on the Central Limit Theorem, the key idea of which is that when a population is sampled repeatedly, “the average value of the attribute obtained by those samples is equal to the true population value” (Israel, 1992, p.1). Additionally, the quantities that are derived from the repeated sampling process follow a normal distribution about the true (i.e., the one that would be found when questioning the entire population) value (Hazra, 2017). Simply put, it is the degree to which

estimations regarding the distribution of the characteristics of the overarching population are accurate. Typical values for social science research are 95% (Z equal to 2.57) or 99% (with Z=1.96), as in a normal distribution, around 95% of the sample values are within an area described by two standard deviations of the true mean (Taherdoost, 2017).

Cochran (1977) proposes the following formulae for calculating the necessary sample size in a population of a given size:

$$n_0 = \frac{p * (1 - p) * Z^2}{E^2}$$

$$n = \frac{n_0}{1 + \frac{(n_0 - 1)}{N}}$$

Variable	Description	Value
p	Estimated proportion of the attribute that is present in the population	0.5
Z	Critical value from the standard normal distribution for the desired confidence level	1.96
E	Margin of error	0.07
n_0	Sample size (for large populations)	196
N	Population size TU: 14831 students WU: 20848 students (in the relevant disciplines)	35679
n	Corrected sample size (for smaller populations)	195

Figure 1 - Variables used in calculating sample size (author's own work, 2022)

The table above explains the variables introduced in the above formulae and their respective values as used in this case. For the value of “p”, the author followed the common recommendation (see for example Israel, 1992; Kotrlik & Higgins, 2001) of 0.5 to allow for maximum variance, producing the maximum sample size.

Of note is that the total population consists of students from two different universities. From the entire student body, only a select number of disciplines were seen as being relevant to the study. The reasons for this selection and the selected disciplines themselves can be found in the chapter treating the demographic composition of the student population. Briefly, the research questions focus on students who seek to work in an office environment. However, not all offered study programs traditionally lead to employment in such settings. Hence, the author excluded several degrees from the study and did not include participants pursuing these in the survey.

From each of the two subpopulations (TU & WU students from relevant disciplines), 200 students were submitted to the questionnaire. Substituting the subpopulation size for N in the above formulae, one arrives at a minimum sample size of 193 (TU) and 194 (WU) respondents. The number of participants was therefore sufficient to extrapolate to the student population of the degrees included. The study design was in line with the recommendations in the literature, loosening the restriction of a 5% margin of error to one of 7% to allow for the constraints described above.

2.4.3 Data cleaning

The numbers mentioned in the preceding chapter that refer to the sample size reflect not individuals asked, but valid responses collected. It is quite possible that a participant might give an answer which due to its nature does not lend itself to analysis. Furthermore, the researcher could have committed errors when transposing the replies. Examples include, but are not limited to, missing values, inconsistent or zero-variance ratings on the Likert scale, duplicate entries, entries of the wrong data type (e.g., a string instead of a number) and entries that are outside the scope of the Likert scale. To work on a valid dataset, the data must be analyzed and cleaned. This process will be described in the following.

As a first step, the data was read in from the Microsoft Excel sheet in which it had originally been collected into a Python Pandas dataframe (a matrix-like object). This made the following procedures, adapted from Malhotra & Dash (2010), a matter of simple code lines instead of error-prone manual methods. Since the questionnaire was not handed out in print form to the participants to be filled in – in order both to save cost and paper, as well as to avoid issues of legibility – some errors might have been introduced in the process of noting down the responses. Unfortunately, these cannot be remedied ex-post if present.

The dataframe was checked for any values that were outside of the valid range (1-7) as well as any missing values. Additionally, any duplicate rows were eliminated. No instances of any of these errors were found. A phenomenon called “satisficing” is often present in questionnaires. Originally introduced by Krosnick & Alwin (1987) and further expanded on by Krosnick (1991), it describes a participant’s tendency to employ the minimum amount of effort possible to generate a response that is seen as satisfactory (Roberts et al., 2019).

In general, satisfaction occurs under conditions that facilitate it, such as when the task is perceived as difficult, when the respondent's ability is low, or when his or her motivation is low (Krosnick, 1991). One subcategory of satisficing is known as non-differentiation, in which respondents select the same rating for multiple items with the same response options. It was observed that 12 participants marked “7” (“extremely important”) as the rating for over 40 of the 44 Likert-type items, applying a principle

called “straightlining” (Pollien, Herzing & Antal, 2020). Comparing this to all the other rating alternatives, the maximum was 32 occurrences of “4”, which does not indicate satisficing to the degree that the 12 outliers do. In accordance with the recommendations given in the literature (see e.g.: Iarossi, 2006; Vriesema & Gehlbach, 2021), satisficing was seen as not impacting data quality to a significant degree, thus these 12 responses were kept as-is.

One viable alternative to the method employed in this study would have been a series of interviews. However, as statistical inferences about the larger population represented by the sample were to be drawn, a questionnaire was deemed the most appropriate choice. It resulted in numerical values that could easily be subjected to statistical analysis and visualized in an appealing way to make conclusions simple to derive.

2.5 Descriptive analysis

To extract underlying trends and statistical data from the individual participants’ responses, the data collected was subjected to descriptive analysis. Results were visualized through tables and diagrams and some statistical measures were calculated from the data. These include the mean, standard deviation, skew, and kurtosis. The meaning of these terms is explained in the chapter that details descriptive analysis.

2.6 EFA: Evaluating validity and reducing complexity

Workplace attractiveness is a multifaceted concept that appears to be highly complex. To understand what makes a potential future employer attractive to business and engineering students, it is vital to distill those factors that significantly influence the appeal of a company from the large number of possible perks and design decisions regarding the workplace environment. Only if these are clearly understood can companies focus on adapting the layout and furnishing of their workers’ environment to suit the largest number of applicants. Then, they can select the top tier of talent from that group to perform optimally.

One tool that enables academic researchers to “explain the most with the least” (Henson & Roberts, 2006, p.393) is factor analysis. The term parsimony denotes the search for the explanation of the largest amount of common variance in a correlation matrix with the smallest number of latent (hidden) dimensions (Tinsley & Tinsley, 1987). The goal of factor analysis is to reduce a large group of j measured variables to a smaller set of k latent dimensions with the aim of explaining a significant part of the variance in the j x j correlation matrix of associations with the dimensions (factors) being used in lieu of the observed variables (Henson & Roberts, 2006).

Simply put, a researcher applying EFA (exploratory factor analysis) attempts to reduce interrelated variables by discerning connections between them that might not seem obvious at first. Conclusions that are parsimonious are, as a general rule, more likely to be replicated as they possess greater external validity (Knekta, Runyon & Eddy, 2019). According to the Standards for educational and psychological testing (AERA, 2018, p.11), “Validity refers to the degree to which evidence and theory support the interpretations of test scores for proposed uses of tests”. It is therefore not a property of the instrument (in this case, the questionnaire), but is closely intertwined with its proposed interpretation and usage.

A simple analogy serves to illuminate this concept more clearly: a basic addition and subtraction exercise can serve as an appropriate instrument to measure the mathematical capabilities of twelve-year-olds but would not suffice when employed to measure these same skills in college-aged adults (Kane, 2016). Methods for evaluating validity always refer to a specific interpretation of any given test scores (AERA, 2018).

Validity can be divided into a dichotomy as follows: on the one hand, there is external validity, meaning that results can be generalized to other populations, settings, and times. On the other hand, there is internal validity, which is a measure of the lack of bias in the answers to the research questions (Andrade, 2018; Campbell & Stanley, 2015). In this thesis, EFA is used both to ascertain the external validity of the questionnaire, as well as to determine which of the items that form workplace attractiveness as rated by the study participants “go together” (DeCoster, 1998).

To summarize, the author decided to employ a quantitative questionnaire, which is an objective tool to gather data about participants’ beliefs, knowledge, attitude, and behavior (Boynton & Greenhalgh, 2004; Oppenheim, 2000). This method has been employed to answer research questions that are similar or related to the one posed by this thesis previously and thus was seen as adequate within the constraints imposed by time, cost, and practicability (see e.g.: Broek, 2015; Santiago, 2019).

The data gathered was split into answers given by business and engineering students and both segments were submitted to descriptive analysis. Furthermore, to reduce the complexity of the data derived and to reveal any latent (hidden) dimensions that the answers to the study might contain, exploratory factor analysis was performed. Due to EFA being a procedure requiring a large data set, this procedure was applied to the entire data without splitting it along the fields of study. This choice, as will be seen, was also supported by the results of descriptive analysis.

3 State of the art: Review of existing literature

3.1 Definitions and key concepts

During the research phase that preceded the collection of data this thesis is based on, the author found works discussing workplace attractiveness from a large number of countries. Furthermore, the topic at hand can be seen from a multitude of perspectives such as through the eyes of prospective employees, employers, or even current staff. To help the reader get a clearer picture of the status quo, this chapter serves an introductory role by establishing the vocabulary that will be used throughout the study. The purpose is to avoid confusion.

3.1.1 Potential employee

In this thesis, the term “potential employee” refers to any student at the Technical University of Vienna (TU Wien) or Vienna University of Economics and Business (WU Wien) enrolled in a business or engineering degree as of the time of data collection (June and July 2022). This includes these students who are simultaneously working, whether full-time or part-time, and enrolled in the Bachelor’s as well as the Master’s study programs. Male and female students were surveyed regardless of their age, current semester of enrollment and previous working history. These demographic distinctions were recorded for the sake of possible statistical evaluation and comparison of subsegments of the sample, however.

One requirement that each participant had to adhere to in order to be included in the study was the pursuit of any of the degrees as described above. In addition, they had to have the intent of working in an office. Students aiming to become engineers can find themselves employed in a variety of different workplaces, ranging from laboratories to oil drilling platforms. Since the working environment in these non-conventional workplaces is not easily compared to that of an office job, the decision was made in advance to limit inclusion in the study to future office workers. This gave the results a certain degree of comparability and allowed for a more concise and targeted questionnaire.

3.1.2 Workplace attractiveness

If the customer is king, what does that make the employee? Successful companies value not only the opinion of their clients, but also that of the people working for them (Kashive & Kanna, 2017). A positive attitude towards the workplace positively impacts employee loyalty. It also serves the dual purpose of retaining highly talented members of the workforce and making a particular employer more attractive in the eyes of applicants (Eger et al., 2019). The potential benefits and negative effects of

word-of-mouth by employees are significant (Corcoran, Datcher & Duncan, 1980). Today, they are exacerbated by social media and dedicated websites such as Kununu and Glassdoor. These websites are designed to lend a megaphone to persons interested in giving their employers feedback. Interested readers may find further information about these two companies on their web presences: www.kununu.com and www.glassdoor.com.

In the context of this thesis, workplace or organizational attractiveness is defined as the perks that prospective workers anticipate from starting employment at a particular company (Alniacik et al., 2014; Bi, Suher & Altinbasak, 2009). A working definition would be "the degree to which a respondent would personally seek a company as an employer and would recommend the company as an employer" (Newburry, Gardberg & Belkin, 2006, p.667). As this concept bequeaths benefits both to the employer as well as to the employee, it has been the subject of a copious number of studies (e.g., Bas & Ertan, 2020; Berthon, Ewing & Hah, 2005; Joo & McLean, 2006).

A scale to quantify organizational attractiveness, known under the moniker EmpAt ("Employer Attractiveness") scale, has been suggested. This rating method identifies five dimensions of employer attractiveness: economic benefits, interest value, social value, development value and application value (Berthon, Ewing & Hah, 2005). The EmpAt scale has seen application in various studies on the concept of employer branding (e.g., Ronda, Valor & Abril, 2018; Sivertzen, Nilsen & Olafsen, 2013).

When investigating workplace attractiveness, one needs to keep in mind that attributes influencing this concept are subjective and can vary based on the characteristics of the person rating it, such as cultural and demographic properties (Eger et al., 2019; Reis & Braga, 2016). It is for this reason that the author of this study decided to record basic demographic data such as gender and year of birth in his questionnaire. Furthermore, previous work experience was considered as this also influences perceived organizational attractiveness (Arachchige & Roberts, 2013). The sample was taken from students at Austrian universities and there was no question pertaining to the cultural background of participants. While this may have an influence on perceived attractiveness, it was not within the scope of this study.

3.1.3 Employer branding

From the above, it is clear that being a reputable and attractive organization is considered a competitive advantage when it comes to attracting highly talented, motivated and loyal employees. In this context, the concept of "employer brand" has been introduced by Ambler & Barrow (1996), being defined as "the package of functional, economical, and psychological benefits provided by employment and identified with the employer" (Eger et al., 2019, p. 520). Human resources management research has in recent years developed an increasing amount of

interest in how to operationalize this approach to recruitment (Eger, Mičík & Řehoř, 2018; Mičík & Mičudová, 2018).

The recruiting process can be seen as being constituted of four distinct parts: first, several prospective applicants have to be identified and attracted by raising interest among a group of persons with specific attributes and qualifications. Following this, these characteristics must be evaluated and compared among respondents. Ultimately, the most qualified person should be recruited to fill an open position (International Organization for Standardization, 2016). Employer branding intervenes in the attraction phase, allowing companies to market themselves to targeted applicants. Additionally, developing a positive employer brand also aids with retention and engagement of existing staff (Gilani & Cunningham, 2017). This aspect of the concept of employer brand is not the subject of this thesis, as it focuses on potential instead of current employees.

3.2 A review of existing literature

The concept of workplace attractiveness has been explored by numerous authors in myriad contexts. In this chapter, the author will give a brief overview of the existing literature regarding the topic of workplace attractiveness. It is an addition to the existing research from a distinct standpoint, comparing intranational differences between students in two distinct fields of study, other demographic indicators not being considered.

This perspective is worthy of being investigated in detail as what is being compared in this study are the subjective preferences of future colleagues. Even a business “built by engineers for engineers” (Harvard Business Review, 2013) ultimately needs managers once the company reaches a certain size. Interaction and collaboration between the engineering and business departments of companies is part of the everyday workplace experience that both sides of the equation share. It is therefore desirable to design the working environment in a way that increases the efficiency and efficacy of employers in both business and engineering related work by elevating performance, positively impacting the amount of turnover and absenteeism among employees (Cooper et al., 2001).

To achieve this, a comparison was necessary which would use the current field of study as the only distinguishing factor between the groups. It is to be expected, albeit not valid in all cases, that a graduate of engineering will seek employment in engineering companies and likewise for business students. If any significant differences in the necessary design for an optimal working experience were to come to light, this study could form the basis of a redesign of office environments in a large company. It is known that the perception of the workplace an employer has is

relativistic and that companies must keep the latent preferences of prospective hires in mind when designing efficient job offers (Ronda & de Gracia, 2022).

A large portion of existing studies have analyzed workplace attractiveness among single demographic groups, such as German students at a vocational school of design and arts or employees in various Vietnamese enterprises (Ha, Luan & Trung, 2021; Krummel, Siegfried & Michel, 2020). Studies on the differences within a larger group have been carried out, such as the analysis by Bas & Ertan (2020) of a diverse range of Turkish professionals, differing in age, gender, and hierarchical standing within their respective organizations. In the same vein, Brazilian professionals were divided into three generational groups, namely Gen X, Gen Y and Baby Boomers, and the attributes that define organizational attractiveness among these elements of the population were examined (Reis & Braga, 2016).

For an analysis of adults in two different nations, see Alniacik et al. (2014) for their comparison of Latvian and Turkish employees and students. Another aspect is the difference between undergraduate and graduate students. As the latter group is usually closer to completing their education and proceeding to the workplace and has had the chance of gathering a substantially larger amount of work experience, this distinction can provide interesting insights. One such study was conducted by Sri Lankan researchers (Arachchige & Robertson, 2013).

Due to its complexity, organizational attractiveness has been the focus of studies in several academic fields. For example, Danielsson (2015) reports on the positive influence of aesthetically pleasing architectural elements in the workplace environment on the perception of employees. From an innovation management standpoint, research has been done on workplace design choices that can potentially boost creativity (Meinel et al., 2017). Additionally, a topic that is constantly growing in its influence, diversity management, appears to be of significance to US college students considering a job opening (Villamil, 2007).

As can be seen from the above overview, organizational attractiveness has been the subject of intensive research. As an addition to what has already been discerned, the author of this study intended to synthesize the existing research into a single questionnaire. It attempts to provide a holistic summary of the variables constituting workplace attractiveness. This questionnaire was then submitted to prospective employees from two different academic disciplines in order to investigate workplace attractiveness in a novel light. This study will enhance the status quo of research by combining the research aspects of several previous works into one thesis.

3.3 Findings in previous research

The list of criteria that make an office more appealing in the eyes of prospective and current employees is extensive and covers findings from different academic disciplines. The following is a summary of some of the research that has been done by others on this topic.

Employees look for offices in which they feel welcome and accepted as part of the group of workers (Klein & D'Aunno, 1986). Therefore, employers that implement measures to improve the sense of togetherness, such as communal sports, are perceived as more attractive (Spaaij, 2013). Furthermore, the informal exchange of information as provided by relaxation rooms within the office contributes to this bonding and improves workplace attractiveness (Meinel et al., 2017). The very same non-work-related conversations can also be induced by minimizing the distance between individual workspaces (Kılıç Çalğıcı, Czerkauer-Yamu & Çil, 2013; Sailer & McCulloh, 2012).

It is not only the cohesion between employees of the same hierarchical rank that is key here, but also how supervisors behave towards their subordinates. Regular feedback on performance, especially when given in person, is another aspect that makes employees rate their position as desirable (Chur-Hansen & McLean, 2006; Zhou, Hong & Liu, 2013).

A sense of well-being and health is positively correlated with the perception of a workplace: Whenever workers feel healthy, they are not only more productive, but also more satisfied with their place of employment (Seppanen, Fisk & Lei, 2006). The aforementioned sports promote physical and mental health, which leads to increased workplace attractiveness as expressed by staff (Cox, Shephard & Corey, 1981; Emerson et al., 2017). Workplaces are also rated on the basis of an appropriate, that is, low noise level (Kwon, Remøy & Van Den Dobbelsteen, 2019).

The psychological benefit thereof stems from reduced stress, which can also be achieved by turning the office into a "green" place. An office that contains houseplants or offers views of nature through the windows is rated as being more attractive and provides higher employer satisfaction (Dravigne et al., 2008; Kaplan et al., 1996; Lottrup et al., 2015). That the interior design of a work environment is closely interlinked with its perceived desirability is also shown in the fact that artworks and the ability to decorate your own desk with personal artifacts positively influence workplace attractiveness (Bjerke & Ind, 2015; Sari, 2020; Smiraglia, 2014).

Having at least some measure of control over when and where one can work is also positively correlated with how attractive one rates his or her place of employment (Lahtinen, 2021). Flexible working arrangements are seen as bestowing benefits on interaction, communication and exerting an influence on time and space, which are

factors of a desirable place to work (Gajendran & Harrison, 2007; Engelen et al., 2019). This ties in with remote working, which leads to a higher quality of life, increased workplace satisfaction and time saved for private activities (Skalski et al., 2020).

There are numerous other factors that define an attractive workplace. For obvious reasons, the author could not include all findings in this study. The studies mentioned were some of the ones that the questionnaire was based on. Due to their ubiquity in research, they were seen as most relevant and actionable by employers. The extensive amount of research that has been conducted on “workplace attractiveness” and its numerous facets makes a selection necessary. The author concentrated on those aspects of an attractive place of employment that were perceived as being relevant to the particular research question that this thesis is based on.

This limits it to criteria that influence the attractiveness of the future workspace as seen by office employees with a background in engineering and business, located in Vienna at the time of research. During the research phase of this thesis, it was found that the items included in the questionnaire represented the most salient items. In Chapter 4.3 of this thesis, the underlying studies are listed. Additionally, in order to achieve a sufficiently high level of completion and participation, the questionnaire had to be limited in length. To keep it concise and easy to complete, the author excluded certain factors that were not deemed essential to the research question or objective.

In the initial stages, the research tool was reviewed by a university professor heading an institute researching workplace design. The review further strengthened the argument that the items selected represented a valid choice. Naturally, different researchers might come to divergent conclusions, especially when applying a questionnaire to a disparate target demographic. A possible further line of research might be an examination of whether questionnaires composed of other items would lead to a similar factor structure of workplace attractiveness as derived by this thesis.

4 Survey

In this part of the thesis, the author will explain the demographics of the participants in the study. He will also explain why it can be considered to be a representation of the entire relevant sector of the population. Details on the selection of the sample, the questionnaire itself and a general outline of the time & place of the interviews will be given. This will provide context for the answers. Additionally, ethics will be discussed.

As described in the chapter on methodology, a questionnaire was selected to be the appropriate tool for the research. This questionnaire was created by the author based on existing literature as detailed in the corresponding section. It was presented to a sample of the population the research questions pertain to. To properly answer the research questions, the sample was carefully selected from students pursuing a degree in either business or engineering at the time of questioning. The participants' adherence to one of these groups was verified by the author during the preliminary discussion with each individual.

4.1 Design of the questionnaire

4.1.1 Likert scale

All sections subsequent to the first section of the questionnaire had the participants give their answers on a Likert scale from 1 ("not particularly important") to 7 ("extremely important"). The sole exception was the final, open-ended question. The number of points on the scale was chosen to be seven instead of five as this reduces the difference between adjacent items. This allowed the students to pick their most-preferred option instead of opting for a "nearby" option, thus representing their true attitude more accurately (Boone & Boone, 2012). It has been shown in previous research that on a five-point scale, users can vary the answers given to those questions where they see themselves forced to choose between two equally undesirable points on the scale (Finstad, 2010).

4.1.2 Ethical considerations

In the introductory chat held before each individual interview, the study and its goals were described so that informed consent to take part could be given. Participation was entirely voluntary, non-compensated and anonymous. This was vital not only to protect the privacy of each respondent, but also to ensure the ethics of the questionnaire (Asai, Nakayama & Naito, 2003). The students were told that they could skip any questions they did not feel comfortable answering. This was done to

prevent them from providing false information that does not actually represent their subjective opinion (Hammer, 2017). While this can lead to gaps in the collected data, it is essential to strike an equilibrium between each individual's human rights and furthering the scientific knowledge of society.

4.1.3 Sampling method and sample size

The interviews were conducted in person by the author in the months of June and July 2022, on the campuses of Technical University of Vienna (TU Wien) and Vienna University of Economics and Business (WU), respectively. Answers were gathered using a tablet and data was only stored locally on that specific device. To grant the data gathered from a sample the validity necessary for it to be considered representative of the overarching larger population, the sample size has to exceed specific numerical values (Rahi, Alnaser & Abd Ghani, 2019).

As a rule of thumb, Hair et al. (2007) and Rahi (2018) state that research involving factor analysis should be conducted on a sample that is between five and ten times larger than the number of questions contained in the questionnaire. As that number amounts to 48 in the present study, the number of participants should not be less than 240 and not exceed 480. Other authors suggest 300 valid responses to be able to conduct factor analysis on a given data set (Tabachnik & Fidell, 2007). Conforming to these criteria, the author collected data from 400 participants.

As a means of deducing subjectively held beliefs or attitudes prevalent in a large population towards a particular topic, researchers employ the method of sampling (Hair et al., 2003). In an appropriately designed survey, a small subgroup of a specific demographic can explain phenomena in the entire target population without having to ask every member of that group individually (Malhotra, Nunan & Birks, 2017). This has the positive effects of reducing the work load, making data collection faster and more cost efficient, while still retaining a degree of accuracy for inferences about the entire population (Cooper, Schindler & Sun, 2006).

Roughly, sampling methods can be differentiated into two distinct forms: probability sampling and non-probability sampling (Acharya et al., 2013). For technical reasons, a mixture of two methods belonging to the second group was employed by the author: convenience sampling and snowball sampling. The former refers to collecting a sample that the researcher can easily access (Emerson, 2015). In this case, it was students on the respective campuses. Snowball sampling is a method in which participants who have already given their response are asked whether they can refer the researcher collecting data to any other potentially willing persons (Vehovar, Toepoel & Steinmetz, 2016).

By choosing these two approaches, participants of various ages, genders, and from a variety of subjects could be included in the collection of responses in an efficient manner. As a result, the data are drawn from a diverse population. The exact composition will be detailed in the chapter concerned with evaluating the data. When analyzing the data gathered, there are a few caveats to keep in mind, however. These will be explained in the following section.

4.1.4 Caveats and potential biases

First and foremost, there are biases present as the students who participated were those who were on campus at the same time as the author. Due to the COVID-19 pandemic, which was still ongoing during the time of research, the percentage of students being on campus on a given day (with the most likely intent being studying or socializing) was hypothesized to be affected negatively for fear of infection.

Furthermore, presence on campus is generally expected to be less likely for those students who are already employed. This is because they are, at least some of the time, busy in the office instead of on campus. In this sense, the sample is heavily skewed towards students who are present on their respective campuses at least some of the time. While Austria had, for some time, introduced mandatory “distance learning” (online classes without physical attendance being required), during the months of data collection this restriction was no longer in place.

When analyzing the results of this study, the bias that was introduced by the non-probability sampling methods employed should be kept in mind. However, the population that was the subject of this study is comprised of university students. The author holds the opinion that the selected sampling methods did not, under the constraints of time availability and allowing for the budget, impact the validity of the data. This is because surveying was done at intervals varying both weekday and time of the day. Students are expected to be on campus at least some of the time.

An additional bias was introduced by the fact that the questionnaire was only available in German. Most classes at both TU and WU are taught in that language. Still, the sample can be seen as showing a lack of international students or those not as linguistically proficient. As German is the official language of Austria, the country the research focuses on, this was seen as justified. Keeping in line with the recommendations given by Rowley (2014), the wording and formatting were kept as simple as possible to make the content easy to understand. This design decision was taken with the intent of minimizing the biases of responses and measurement error (Cooper, Schindler & Sun, 2006).

4.1.5 Pre-testing and expert comments

Prior to the actual data collection phase of the quantitative research, the questionnaire was subjected to a pre-test. In the course of this, it was established whether the respondents felt that the questionnaire contained any ambiguities or mistakes (Zikmund et al., 2013). This test phase consisted of a preliminary run using a significantly smaller sample from the same population. Data collected was not kept, and the intent was made clear to participants that they could and should give feedback if there was any concern regarding the comprehensibility of the questions asked.

The purpose of a pre-test is to modify the survey instrument to eliminate problems such as “unclear question[s], unfamiliar word[s], ambiguous syntax, missing time-frame, lack of an appropriate answer” (Perneger et al., 2015, p.1; plural added by the author). It was necessary to eliminate issues even with a low prevalence due to the size of the actual sample, which exacerbates less common issues. Following the recommendations given by Perneger et al. (2015), 30 participants were chosen to be part of the pre-testing sample. This did not result in any necessary modifications since all questions were rated to be clearly formulated and easy to understand. This sentiment was also mirrored in the larger sample, where no negative feedback regarding comprehensibility was given.

The lack of a need for altering the questionnaire before being able to apply it probably stems from the fact that research regarding its contents was extensive and detailed. Since the questions under investigation are part of a larger-scale analysis of workplace attractiveness, the available research is copious (see also the chapter on existing literature). Using this as a jumping off point, questions were adapted from previous questionnaires to fit the specific setting of this study, but the wording remained similar. Therefore, the content of the survey was based on questions that had already been subjected to pre-tests and feedback rounds.

As other authors note, receiving comments from an expert in the subject matter to be analyzed is an essential foundation for creating a clear, concise and meaningful questionnaire (Zikmund et al., 2013). These experts possess the knowledge necessary to assess whether a particular questionnaire is suitable to add to existing research on their subject of expertise. In the case of this study, the authority to whom the questionnaire was submitted for review was a university professor who heads an academic institute whose research deals with workplace design. It was only after his approval that the survey started, beginning with the pre-test followed by the actual run.

4.2 Demographical composition of the student population

This chapter shall serve as an overview of the actual make-up of the student population from which the data was gathered. Since it was focused on persons studying engineering and business, the data will be presented split along this dichotomy.

4.2.1 WU (Vienna University of Economics and Business)

Field of study	Number of students	Percentage of total student population (WU)
Business/Economics (BWL, IBWL, VWL)	10,623	50.72 %
Business Law (Wirtschaftsrecht)	6,095	29.10 %
Other Business Related Subject	3,538	16.13 %
Business and Economics (BBE)	592	02.80 %

Figure 2 - Demographic distribution of WU students (author's own work based on WU Wien, 2021)

In the table above, the demographic composition of the student population at WU Wien as of the winter semester 2020 is described. There are 20 distinct fields of study that students at the university can enroll in. However, as the data shows, the majority of students pursue one of two educational paths: they are either students of Business/Economics or of Business Law. As for the latter option, Bachelor's and Master's students are combined under this header. BBE (Business and Economics) is a relatively recently (2019) inaugurated Bachelor's degree. Therefore, only a small sliver of the general student population is currently pursuing it.

As for the "other Business related subjects", this encompasses every other possible choice that WU offers. This summary was done based on the fact that the single biggest contributor in that segment is the Marketing Master's degree. It encompasses 02.17 % of the entire population, placing it below BBE in popularity. For the sake of legibility and validity of the data, the decision was made to not dissect the sample any further. It could not be guaranteed that a large enough number of participants from each of the fragments of the subset of WU students could be gathered.

4.2.2 TU (Vienna Technical University)

Field of study	Number of students	Gender distribution	Percentage of total student population (TU)
Software Engineering (Informatik and Wirtschaftsinformatik)	5,571	82.97 % male 17.03 % female 0 % other	20.90 %
Other Engineering related subject (Bauingenieurwesen, Biomedical Engineering, Wirtschaftsingenieurwesen-Maschinenbau)	4,438	74.22 % male 25.78 % female 0 % other	16.65 %
Electrical Engineering (Elektrotechnik)	2,416	84.46 % male 13.53 % female 0% other	09.06 %
Mechanical Engineering (Maschinenbau)	1,835	88.94 % male 11.06 % female 0% other	06.88 %
Chemical/Process Engineering (Verfahrenstechnik)	571	73.38 % male 26.62 % female	02.14 %

Figure 3 - Demographic distribution of TU students (authors own work based on TU Wien, 2021)

As can be seen in the table above, the student population of TU Wien was divided into five distinct groups for the sake of this thesis. The decision was made to leave out certain fields of study such as architecture (accounting for 20.05 % of students) and Technical Physics, Mathematics and Chemistry (17.40 % combined). Contextually, it seemed to be the most reasonable choice in order to focus on only those students who expect to work in an office doing engineering-related work. Due to the immense diversity of potential fields of employment for physicists, mathematicians and chemistry, this group was left out. This is because any sample would not have been representative of the respective student population. Architecture can be seen to not strictly fall under the definition that describes the field of engineering and was excluded for that reason.

4.3 Content of the questionnaire

The questionnaire used in the data collection phase of this study was split into nine sections. Each of these asked about attributes of workplace attractiveness that were considered to have a degree of coherence with each other. These segments will be presented in the order in which they were asked. The reasons for why these particular questions were selected will be detailed based on previous literature. Existing research studies focusing on a similar research questions, but applied in a

variety of contexts, were fielded as reference points in order to select which questions to include in the survey (Bangwal & Tiwari, 2018; Bjerke & Ind, 2015; Danielsson, 2015; Henniges, 2021; Hoffmeister et al., 2015; Ianeva et al., 2015; Krummel, Siegfried & Michel, 2020; Lottrup et al., 2015; Meinel et al., 2017; Ronda & de Gracia, 2022; Sadick & Kamardeen, 2020).

The final questionnaire as utilized in the study was created using a combination of questions stemming from the above works by other authors as well as original questions as derived by the author. In total, 48 questions pertaining to attributes influencing workplace attractiveness were presented to participants. Additionally, there were seven questions about demographic characteristics and one open-ended question. The following subchapters will serve as a detailed listing of the parts of the questionnaire, providing context and explaining their intent.

4.3.1 Demographics and preliminary questions

After the introductory presentation explaining the goals of the study and the intended use of the data, respondents were prompted explicitly for their consent to participate. After this, they were asked to respond to the questions in the table below. Please note that the questions were originally asked in German but are translated into English for use in this chapter. Interested readers can find the original version of the questionnaire in its entirety in the appendix to this thesis.

Please tick or mark the correct answer. For empty fields, please enter the correct answer.

i.	Gender:	M | W | Other
ii.	Field of study:	Engineering | Business
iii.	Specialization (WU) or enrolled degree (TU):	
iv.	Current semester:	
v.	Current age:	
vi.	Previous work experience:	__ years full time/part time
1.	-The expected starting salary in EUR (gross, per month):	2,000 - 2,500 2,500 - 3,000 3,000 - 3,500 3,500 - 4,000 From 4,000
2.	-The maximum travel time to the company (one way) should not exceed the following value:	15 minutes 30 minutes 45 minutes 1 hour

3. - How many hours per week would you like to work after graduation?	8-16 hours 16-24 hours 24-32 hours 32-40 hours More than 40 hours
4. -What percentage of your work time would you like to be able to work from home?	100% 75% 50% 25% 0%

Figure 4 - First section of the questionnaire (own work, 2022)

These questions provided vital information on the personal characteristics of each individual respondent. Additionally, any basic questions that followed a single choice answering scheme were included here for easier comprehensibility and to keep potential confusion at a minimum.

4.3.2 Basics

The following section explored a number of the basic attributes of a workplace that can influence its perceived attractiveness in the eyes of potential employees. Among the infrastructure considerations was accessibility via public transportation, which was rated from moderately important to important in other studies (Broek, 2015). The value of this does depend on the setting in which a company is situated. For more rural areas public transport is not as viable a means of traveling as it is for infrastructurally well-developed metropolitan areas.

5. -The office is easy to reach with public transportation	1 2 3 4 5 6 7 (1...not particularly important // 7...extremely important)
6. -The office should be located centrally (close to infrastructure such as shops and restaurants)	1 2 3 4 5 6 7 (1...not particularly important // 7...extremely important)
7. -Parking facilities should be available for employees (Krummel et al., 2020)	1 2 3 4 5 6 7 (1...not particularly important // 7...extremely important)
8. - The technical equipment available to me is sufficient to perform my work tasks efficiently	1 2 3 4 5 6 7 (1...not particularly important // 7...extremely important)
9. - The office is set up to be barrier-free	1 2 3 4 5 6 7 (1...not particularly important // 7...extremely important)
10. - There is a mandatory dress code for employees (Ronda & de Gracia, 2022)	1 2 3 4 5 6 7 (1...not particularly important // 7...extremely important)

Figure 5 - Second section of the questionnaire (own work, 2022)

4.3.3 Working environment

Respondents were asked to rate variables that pertain to the contact and interaction between their colleagues and supervisors in this segment. Today's climate is still dominated by the COVID-19 pandemic and its impact on the working day. There is a trend towards online meetings and governments worldwide still recommend keeping distance between each other as much as possible (CDC, 2022; Hameed et al., 2021). This is why it was of interest to evaluate responses given by future employees as to whether this modality suits them or if this negatively influences perceived workplace attractiveness.

11. - My supervisor appreciates me	1 2 3 4 5 6 7 (1...not particularly important // 7...extremely important)
12. - The social climate at work is cohesive and friendly	1 2 3 4 5 6 7 (1...not particularly important // 7...extremely important)
13. -Teamwork and communication	1 2 3 4 5 6 7 (1...not particularly important // 7...extremely important)
14. -Open minded company values	1 2 3 4 5 6 7 (1...not particularly important // 7...extremely important)
15. -Meetings should be held in person	1 2 3 4 5 6 7 (1...not particularly important // 7...extremely important)
16. -Being able to reach my supervisor easily in person (Henniges, 2021)	1 2 3 4 5 6 7 (1...not particularly important // 7...extremely important)
17. - The office is set up to facilitate face-to-face communication between employees	1 2 3 4 5 6 7 (1...not particularly important // 7...extremely important)

Figure 6 - Third section of the questionnaire (own work, 2022)

4.3.4 Working time

Ng, Schweitzer & Lyons (2010), in their study of undergraduate students in Canada, note that one of the aspects that was valued most was work-life balance. Private obligations, commitment to one's family or hobbies can be seen as being impeded by a fixed working schedule. This makes a certain degree of liberty in configuring the workday around the individual's needs necessary. This section of the questionnaire serves to investigate to what extent this was seen as influencing workplace attractiveness in the context of this study.

18. -Being able to choose when I work over having fixed starting and end times	1 2 3 4 5 6 7 (1...not particularly important // 7...extremely important)
19. -Not being able to be reached after working hours	1 2 3 4 5 6 7 (1...not particularly important // 7...extremely important)
20. -Having the opportunity to work from home	1 2 3 4 5 6 7 (1...not particularly important // 7...extremely important)

Figure 7 - Fourth section of the questionnaire (own work, 2022)

4.3.5 Agile workplace

In the wake of the NewWoW ("new ways of working") movement, research showed a link between the type of office one works in and perceived satisfaction with the workplace (De Been & Beijer, 2014). Preferences are highly subjective and depend not only on the workers' personality but also on the working method that is prevalent in the workplace (Fraundorfer, 2019). This section is intended to evaluate a few characteristics that define a so-called "agile" workplace.

21. - Fixed seating arrangement in which I have a desk/workspace which only I can use	1 2 3 4 5 6 7 (1...not particularly important // 7...extremely important)
22. - Flexible seating arrangement in which I can pick a workspace according to my current needs	1 2 3 4 5 6 7 (1...not particularly important // 7...extremely important)
23. - Workspace setup in which I am spatially separated from the workspaces of my colleagues	1 2 3 4 5 6 7 (1...not particularly important // 7...extremely important)
24. - Workspace setup which is open and in which I am not spatially or visually isolated from my colleagues	1 2 3 4 5 6 7 (1...not particularly important // 7...extremely important)

Figure 8 - Fifth section of the questionnaire (own work, 2022)

4.3.6 Spatial design of the workplace

Creativity and productivity are closely linked to the spatial design of the environment in which tasks are accomplished (Meinel et al., 2017). Jobs in both engineering and business require a great deal of concentration and creativity to be managed successfully. Therefore, the author included questions about what type of architectural amenities students in these fields rate as attractive.

25. - "Focus rooms" in which I can work alone (Iaeneva et al., 2015)	1 2 3 4 5 6 7 (1...not particularly important // 7...extremely important)
26. - Meeting rooms (Iaeneva et al., 2015)	1 2 3 4 5 6 7 (1...not particularly important // 7...extremely important)
27. - To have access to generous, non-shared personal space at my workplace	1 2 3 4 5 6 7 (1...not particularly important // 7...extremely important)
28. -A low noise level in the office (Ronda & de Gracia, 2022)	1 2 3 4 5 6 7 (1...not particularly important // 7...extremely important)
29. - Relaxing space/hangout area (Meinel et al., 2017)	1 2 3 4 5 6 7 (1...not particularly important // 7...extremely important)
30. - Cafeteria/restaurants	1 2 3 4 5 6 7 (1...not particularly important // 7...extremely important)
31. - Kitchen	1 2 3 4 5 6 7 (1...not particularly important // 7...extremely important)

32. - Smoking area	1 2 3 4 5 6 7 (1...not particularly important // 7...extremely important)
33. -Areas to be used by one person at a time only	1 2 3 4 5 6 7 (1...not particularly important // 7...extremely important)
34. -Clean sanitary rooms (toilets etc.)	1 2 3 4 5 6 7 (1...not particularly important // 7...extremely important)

Figure 9 - Sixth section of the questionnaire (own work, 2022)

4.3.7 Office equipment

Researchers have noted that the aesthetic appeal of a workplace is one of the motivating factors when it comes to choosing among various options for a place of employment (Ronda & de Gracia, 2022). Furthermore, hygiene and ergonomic attributes were evaluated based on their subjective importance to each individual respondent.

35. -I can decorate my own workplace	1 2 3 4 5 6 7 (1...not particularly important // 7...extremely important)
36. - The office contains art (Bjerke & Ind, 2015)	1 2 3 4 5 6 7 (1...not particularly important // 7...extremely important)
37. - The furniture is ergonomic, e.g. by offering furniture such as standing desks and height-adjustable desks (Hoffmeister et al., 2015)	1 2 3 4 5 6 7 (1...not particularly important // 7...extremely important)
38. - Clean working environment (Krummel et al., 2020)	1 2 3 4 5 6 7 (1...not particularly important // 7...extremely important)
39. - The office is set up with cooling systems/heaters	1 2 3 4 5 6 7 (1...not particularly important // 7...extremely important)

Figure 10 - Seventh section of the questionnaire (own work, 2022)

4.3.8 Contact with nature

Man has only relatively recently diverged from the line of apes. Therefore, it comes as no surprise that the influence of nature on well-being, the ability to do one's job to a satisfactory degree and workplace satisfaction is quite noticeable (Danielsson, 2015; Lottrup et al., 2015; Sadick & Kamardeen 2020). Since the presence of natural elements can take various forms, there was a number of questions pertaining to this influence on workplace attractiveness.

40. - There are indoor plants at or near my workspace (Danielsson, 2015)	1 2 3 4 5 6 7 (1...not particularly important // 7...extremely important)
41. - I can see nature through the window from my workspace (Lottrup et al., 2015)	1 2 3 4 5 6 7 (1...not particularly important // 7...extremely important)
42. -I can spend my breaks outside (in nature) (Sadick & Kamardeen, 2020)	1 2 3 4 5 6 7 (1...not particularly important // 7...extremely important)
43. - The office is illuminated by some degree of natural light (Bangwal & Tiwari, 2018)	1 2 3 4 5 6 7 (1...not particularly important // 7...extremely important)

Figure 11 - Eighth section of the questionnaire (own work, 2022)

4.3.9 Benefits

The questions in this penultimate part of the questionnaire relate to any additional perks other than salary. These perks can potentially sway a prospective worker's opinion or add to the degree of loyalty perceived towards his or her job. As such, these bonus perks influence workplace attractiveness.

44. -Free snacks (fruit, chocolate,..) and/or drinks	1 2 3 4 5 6 7 (1...not particularly important // 7...extremely important)
45. -Meal vouchers	1 2 3 4 5 6 7 (1...not particularly important // 7...extremely important)
46. -Fitness vouchers	1 2 3 4 5 6 7 (1...not particularly important // 7...extremely important)
47. -Educational leave	1 2 3 4 5 6 7 (1...not particularly important // 7...extremely important)
48. -Office supplies	1 2 3 4 5 6 7 (1...not particularly important // 7...extremely important)

Figure 12 - Ninth section of the questionnaire (own work, 2022)

4.3.10 Additional factors

The last question was posed in an open way. Respondents could freely add any other comment regarding workplace attractiveness that they felt needed adding. There was a prompt, but no other suggestions were given by the author in order not to influence or limit responses. The prompt was: "If you have any other requirements for the future workplace that were not collected as part of the questionnaire, please let me know in the section below" and answers were recorded manually in free-form format. However, possibly owing to the ample scope of the survey, no participant gave a response to this question.

5 Evaluation of the data collected

5.1 Descriptive analysis

This chapter analyzes the responses given by the sample of participants descriptively. During the interviews, respondents were asked to provide some demographic data. These data will be presented in the form of statistics and diagrams to be as concise as possible.

5.1.1 Demographics and non-Likert data

A total of 400 students were involved in the study, of whom 200 were business students and 200 engineering students. This even split was intentional, as the author sought to compare the two populations with regards to their expectations of a potential future employer. Furthermore, all the answers included in the below analysis were given by those with the intent of working in an office. This was the focus of the research question. Other than obeying these two conditions, students were picked at random.

5.1.1.1 Data relating to participants' studies

Out of the two hundred business students that offered information to the researcher, 101 were enrolled in a Master's degree program. The remaining 99 were undertaking a Bachelor's degree at the time of questioning. 104 identified as male, 94 as female and two either declined to answer or responded with "Other". The average semester that students were enrolled in was given as 3.755 (in their specified degree program) with a standard deviation of 1.9, a minimum of 1 and a maximum of 12. Of note here is that the Bachelor's and Master's degrees are of different scope in credit points to be earned. Nonetheless, 3.75 semesters is within the range of what is considered the normal duration of both programs (6 semesters for the Bachelor's and 4 semesters for the Master's degree). Regarding the age of respondents, the mean year of birth was 1996, standard deviation 4.06, minimum 1982 and maximum 2003.

There were 110 Bachelor's students and 90 Master's students who responded to the author's query among engineering students. 104 were male, 94 identified as female and the remaining 2 either gave no answer or replied with "Other". Mean semester was 3.96, with a standard deviation of 1.86, minimum 1 and maximum 12. The same caveat regarding differences in duration of study time for Bachelor's and Master's degrees applies here. Mean year of birth was 1996, standard deviation 4.41; the oldest participant was born in 1965 and the youngest in 2005. For the sake of brevity and clarity, the remaining information will be given in graphical form, with a brief summary following each comparative illustration.

Specialisation (Business Students)	Absolute	Relative
Business/Economics (BWL, IBWL, VWL)	80	40.0 %
Business and Economics (BBE)	63	31.5 %
Other Business related subject	30	15.0 %
Business Law	27	13.5 %
Specialisation (Engineering Students)	**Absolute**	**Relative**
Mechanical Engineering	85	42.5 %
Software Engineering	56	28.0 %
Electrical Engineering	25	12.5 %
Chemical/Process Engineering (Verfahrenstechnik)	20	10.0 %
Other Engineering related subject	14	07.0 %

Figure 13 - Fields of study of student sample (own work, 2022)

The composition related to demographic data of the students involved in the sample deviated from that of the actual student population (see previous chapter). This could be explained by the relatively low number of selected students as compared to the respective sizes of the entire student bodies at the two universities. In addition, it could be influenced by the time and/or place of the questioning. In spite of this, there was a distribution of specializations among each sampled population. The sampling methods (convenience and snowball sampling) that were employed were detailed in a previous chapter. Applied diligently, they allowed for the collection of a random and valid sample within the constraints imposed by time, practicality and financial means. Exploratory factor analysis should be interpreted with this fact in mind.

The near-even split between Master's and Bachelor's students and male and female participants reduces the bias that might have been introduced by either of these characteristics considerably. It is quite conceivable that answers are influenced by the student's background, including their gender. Illuminating these tendencies was outside of the scope of this thesis, however. While the specialisations that are offered by the two universities are tied together by a common thread (engineering and business as the common denominator), there are significant differences in the actual work that will be done by graduates. As such, an attractive workplace as seen by a software engineer might differ from its equivalent as perceived by a mechanical engineer. The reader is advised to keep in mind that the nature of the research question aggregates all students of TU under the header "engineer" and vice versa for "business" students.

5.1.1.2 Year of birth

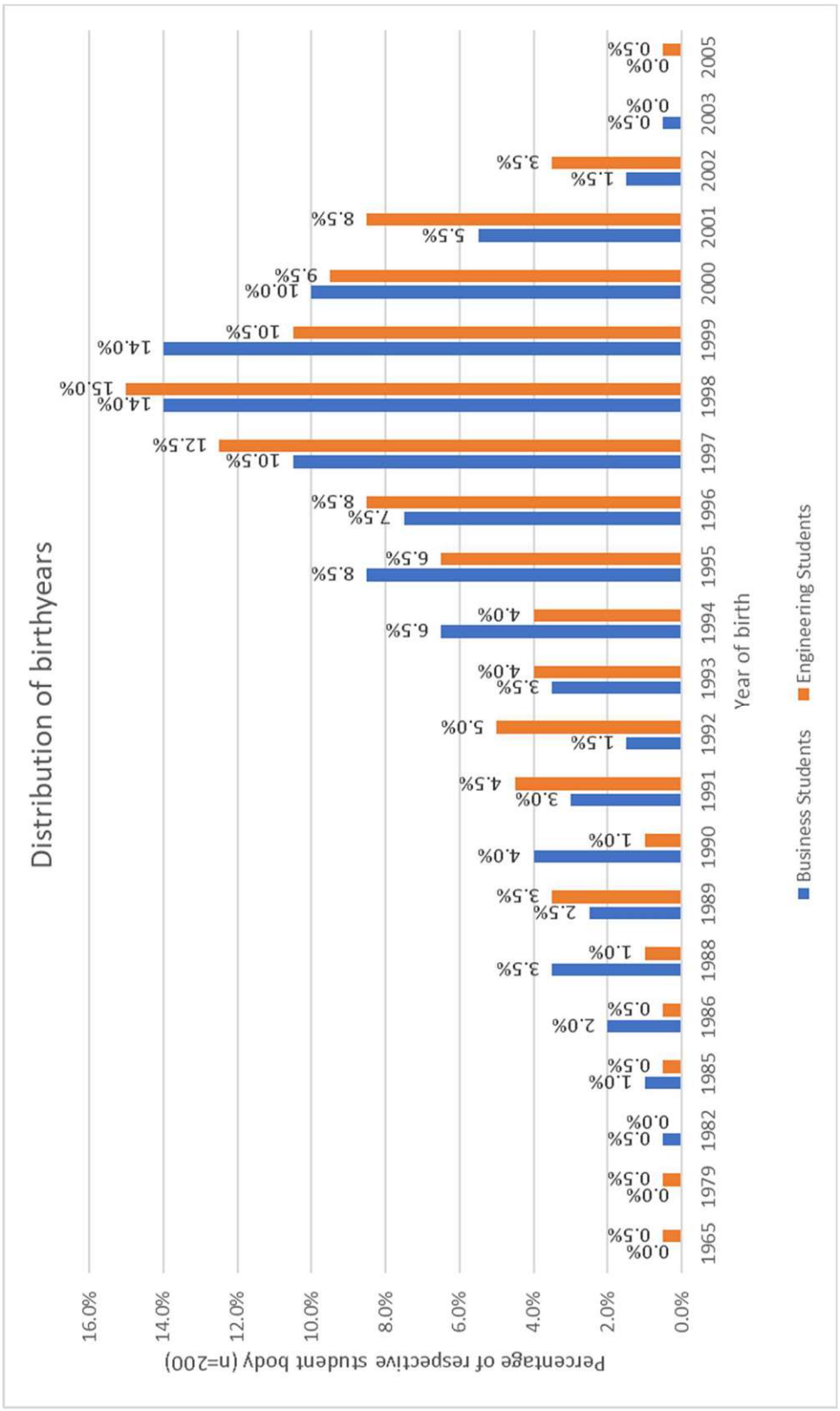

Figure 14 -Years of birth of student sample (own work, 2022)

As might be expected from sampling participants from a student population, the age distribution is rather similar and leans towards younger persons. Both those who study business and those who pursue engineering tend to be born in proximity to the mid- to end-1990s. Outliers are the oldest participant, an engineering student born in 1965, and the youngest – born in 2005. Further analysis could dissect the population in more detail and analyze responses based on age. People who are older might have a lifestyle that requires a higher salary to sustain. Another possibility is that they have already had the chance to gain more working experience and thus possess a clearer understanding of what to expect from their future employers.

A peak can be seen for both populations around the years of 1997-1999, which translates to a participant in their mid-20s. As university studies usually follow a high school diploma, a research question focused on a student population heavily implies such a demographic. Therefore, the analysis of the birth year shows that the questionnaire was answered by participants that, in this aspect, form part of the expected age group. This, in conjunction with the other answers given regarding demographic data, lends credibility and validity to the representativeness of the answers given.

5.1.1.3 Working experience

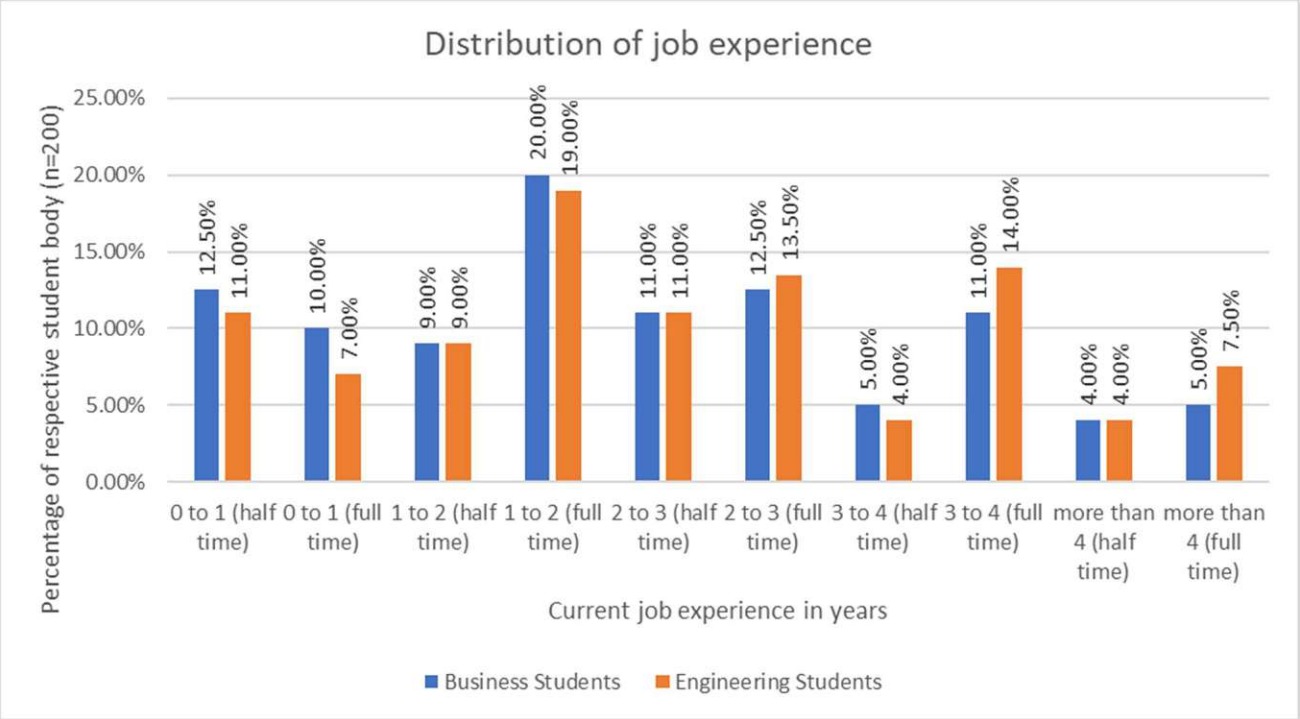

Figure 15 - Current job experience of student sample (own work, 2022)

As stated in the description of the age distribution, the student population is made up mostly of younger people (the sample was skewed towards the ages of 21 to 27). It seems to make intuitive sense that this demographic segment will not yet have had the chance to have worked longer than a few years in their life. This could explain

why the tail end of the working experience graph diminishes in size. Whether those with a larger amount of job experience gave different responses was not subject to analysis, but research could be done in future studies.

This thesis aims to analyze the workplace attractiveness not of current, but of future employees in office environments. It was not asked whether the participants that were part of the workforce as of the time of research had a position in an office. Previous, real-life contact with the attributes of a workplace could potentially sway the perceived importance of the items asked in later parts of the questionnaire. Over three quarters of the respondents stated having been employed for more than 0 to 1 years, in various combinations of half time and full time schedules. It remains unanswered whether the rating of importance of items contributing to workplace attractiveness would be influenced significantly, even going so far as to change the factorial structure of the answers, by including only those with office experience.

5.1.1.4 Remote work preference

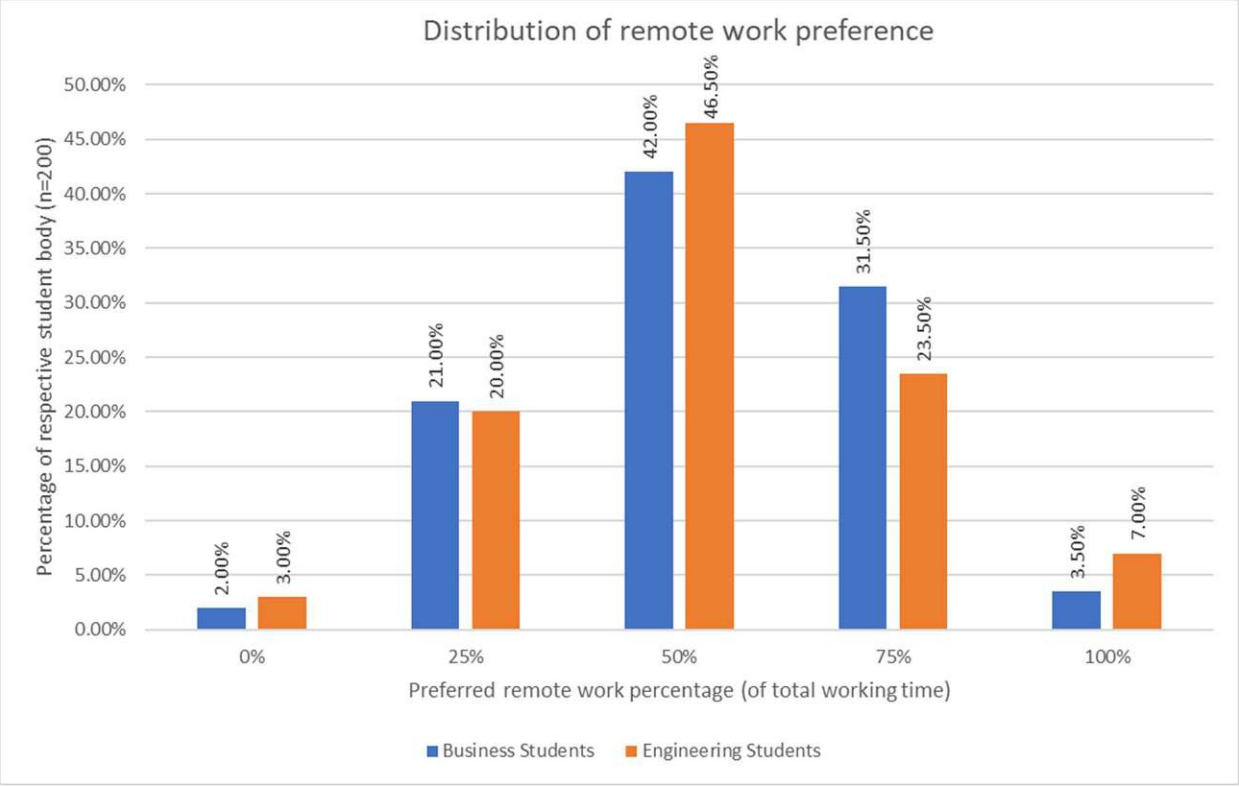

Figure 16 - Preferred remote working percentage of student sample (own work, 2022)

Since the study was conducted in the wake of the COVID-19 pandemic in Vienna, remote working was still vividly on the minds of the respondents. After seeing themselves forced to implement “home office” classes into their daily life as students, the miniscule number of participants stating that they did not wish to at least have the option to spend part of their working life remotely connected is not surprising. Distributions looked similar among the two student populations. Therefore, employers are advised – whenever possible – to set up their communication networks and

technologies to allow for at least some degree of remote work. A lack of this option could deter the most qualified potential employers from joining a specific company.

While the extremes, 0% and 100%, were quite insignificant, almost all of the participants pertaining to both populations want at least some degree of control in deciding their actual place of work. As will be seen in the factor analysis, autonomy is one of the factors that constitute workplace attractiveness for the target population. It includes not only freedom in the location, but also in the schedule as decided on by the employee themselves.

5.1.1.5 Starting salary expectations

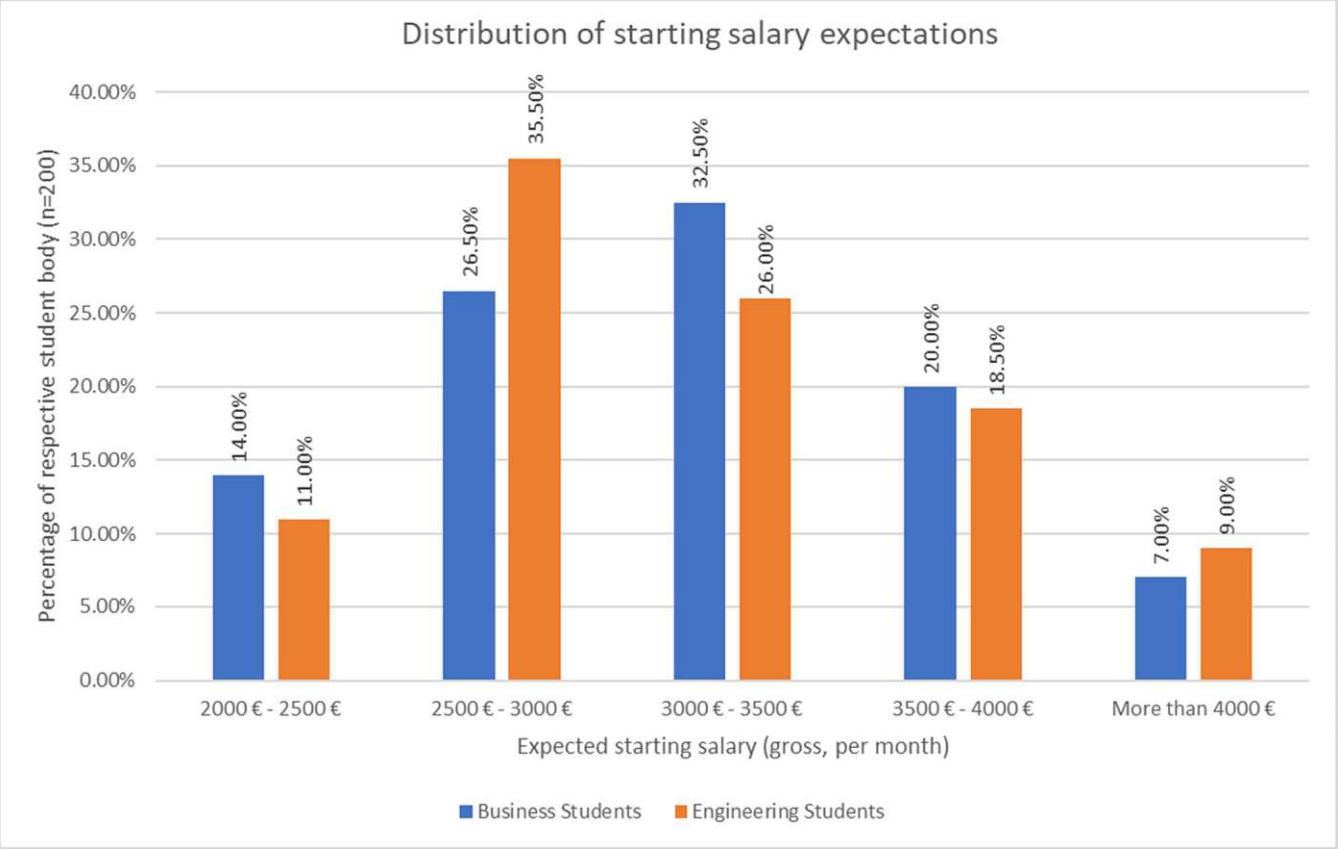

Figure 17 - Expected starting salary of student sample (own work, 2022)

A rather unexpected finding was that business students, for whom salaries tend to be below the level of their MINT counterparts, do not reflect this fact when questioned about what starting salary they expect to receive. Although one could chalk this up to optimism or ignorance, expectations do not have to match reality. Rephrasing the question from the perspective of how much employers would be willing to pay could lead to a different conclusion. Future researchers are advised to keep this in mind when creating their own questionnaires.

According to https://www.karriere.at/gehalt/, the actual gross monthly salary of an Austrian graduate of engineering and of business are within the bounds of 2,642-4,403 € and 2,564-4,273 € (as of January, 2023). The answers given to the

questionnaire therefore represent reality, again lending a certain degree of representativeness to the findings of this study. Since the thesis treats current students, the nature of the research question focuses on the first “proper”, post-graduation, employment. It is not surprising that the expected salary for such a job is skewed towards the lower end of the interval that graduates are actually paid.

5.1.1.6 Maximum commute

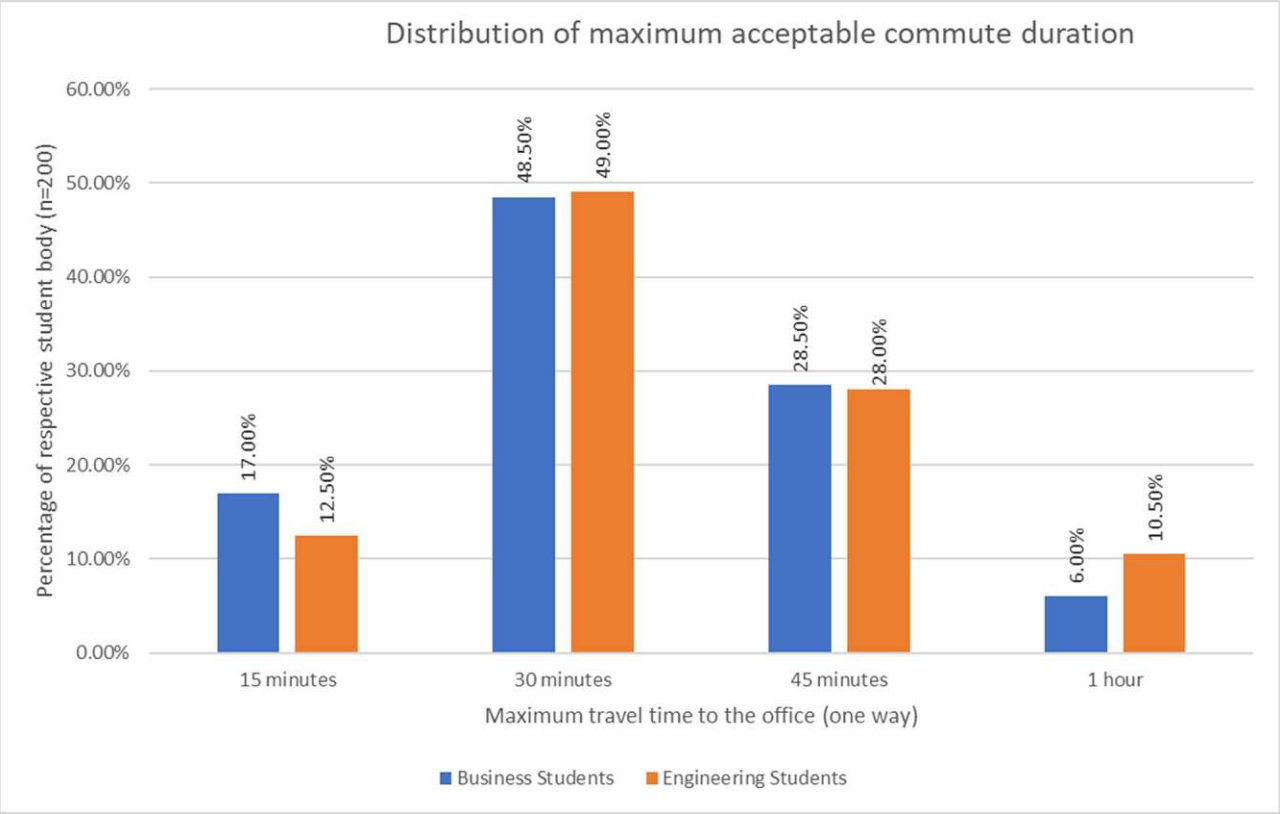

Figure 18 - Maximum one-way travel time of student sample (own work, 2022)

The amount of time prospective employees are willing to spend commuting does not appear to be influenced by the sector that the person belongs to. 30-45 minutes was the most common answer, regardless of whether one considers business or engineering students. Employers therefore do not have the entire pool of high potential applicants to choose from, but rather are limited to a geographical area within a given radius. Locating in an area of well-developed infrastructure, offering remote work possibilities and/or offering bonuses for staff willing to relocate could be an approach towards ensuring that one hires the highest-qualified members, without having to rely on local talent.

According to a study conducted by Vienna’s public transport network, the average duration of a one way trip, regardless of the means of transport, lies between 18 and 37 minutes (Stadt Wien, 2015, p.22). As the respondents studied in Vienna, they are part of that demographic. The peak at a maximum of thirty minutes, with a quarter of

all participants willing to accept a commute of up to 45 minutes, is an accurate depiction of the average travel behavior of inhabitants of Vienna. Especially in a full-time employment with its 8 hour workday, the low percentage of students that would endure 2 hours of total commuting to their future place of environment is understandable.

5.1.1.7 Weekly working time

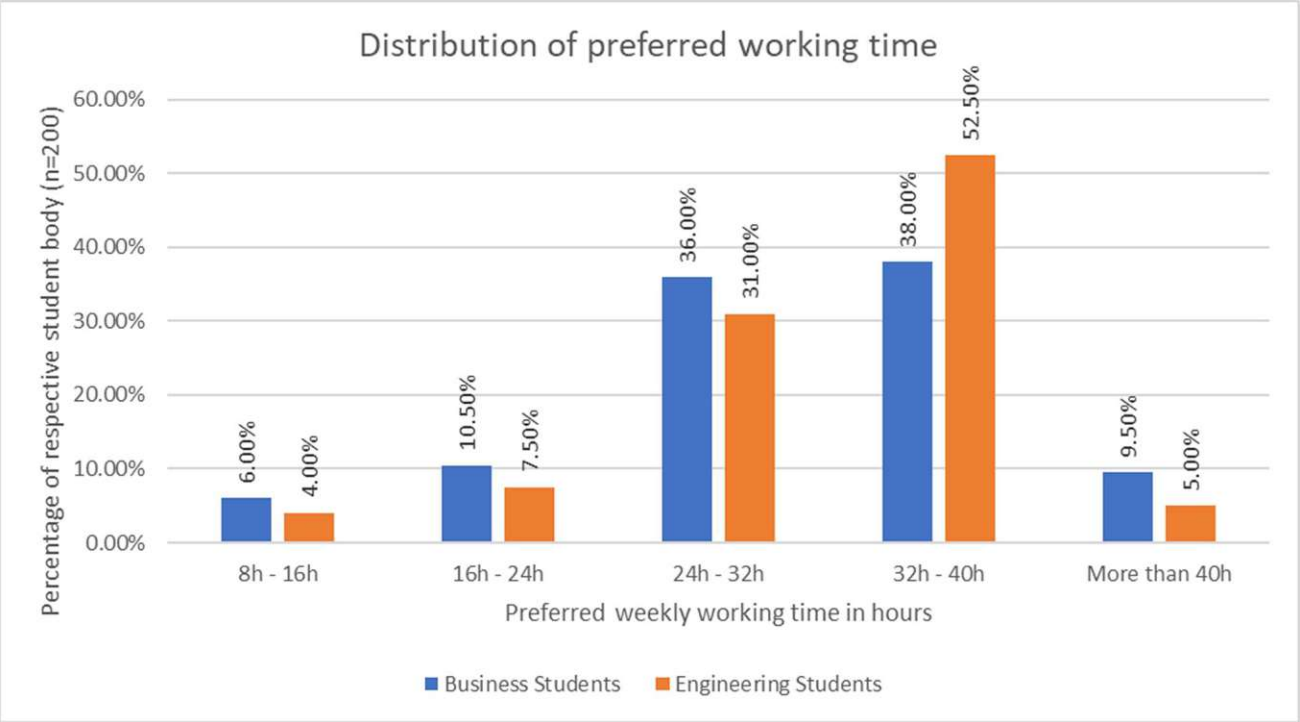

Figure 19 - Preferred working time per week of student sample (own work, 2022)

Significant differences were observed regarding the preferred working time in the sample. There is a sizeable segment of business students who lean towards working a half-time position, which is not the case with engineering students. This group would rather work a standard, full-time schedule, or even more than 40 hours. While this is purely conjecture by the author, this might be influenced by the workload that engineering students already experience during their time as students. From personal experience as both a business and an engineering student, the average work week tends to be more time-intensive in technical fields.

5.1.2 Distributive properties of the answers given

This subchapter will give the most significant statistical measures for each of the items (questions) evaluated during the data collection phase. Due to the extent of the questionnaire, data is given in table form to be as precise and informative as possible.

Understanding the tables below requires a quick introduction into the meaning of the values that are contained therein. While the mean is simply a measure of the average answer and should not require further explanation, “std” here is an abbreviation for the standard deviation. This measure of variance can be explained simply as showing whether the data lies close to the mean (low standard deviation) or is more spread out. Commonly used in statistical analysis, the highest standard deviation was found regarding the question of the availability of a smoking area. An intuitive explanation would be that non-smokers do not care at all about the existence thereof, hence giving it a low score, and vice versa for smokers. This would be valid if the proportion of smokers is about even, but there are most likely non-smokers who also gave it a medium score, indicating that they do not care about the item particularly.

The third statistical quantity, skewness, indicates whether the distribution shape is skewed to the right (positive “skew”), symmetrical (skewness equal to 0), or left-skewed (Blanca et al., 2013). Skew can assume any real value, with larger absolute values indicating more skewness. In simple terms, it informs one of the direction of outliers, so a positively skewed distribution would have more outliers with a value higher than the mean. Most people would therefore rate the workplace attractiveness attribute in these questions as lower than the extreme outliers would. For both business and engineering students, all but one item (“The office is set up to facilitate face-to-face communication between employees”) were negatively skewed, meaning the tail towards lower values is longer or fatter. Simply put, the mean rating of these items tended to lean towards the higher end of the Likert scale.

Kurtosis, on the other hand, makes the tails of a given distribution heavier and the peak larger when compared to a normal distribution (positive kurtosis), or the other way around (DeCarlo, 1997). The concept can be expressed in a variety of ways. In this case, the so-called “excess kurtosis” is given, which is equal to 0 for a normal distribution. A positive value of kurtosis means outliers are more common, while a low (negative) value signifies that outliers are infrequent, so values are centered more close to the mean. Excess kurtosis can assume both positive and negative values. See also the graph below for an easier understanding. Kurtosis varied between the items and no trend or pattern could be discerned.

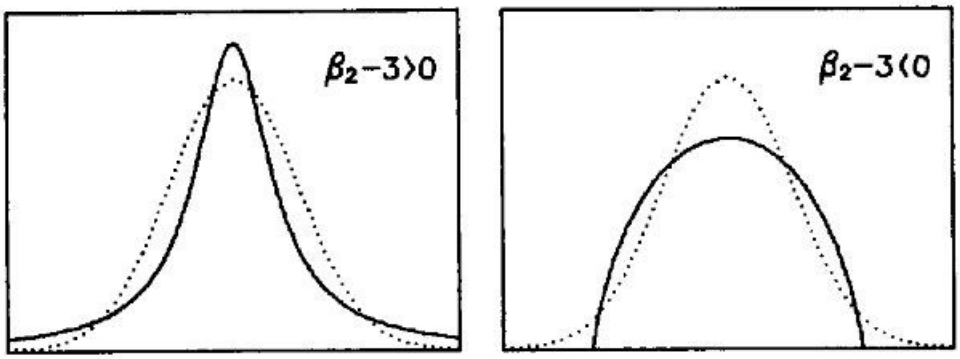

Figure 20 - Positive kurtosis (left) vs. negative kurtosis (right), compared to normal distribution (dotted lines) (DeCarlo, 1997)

Business Students	Public transportation	Located centrally	Parking facilities	Tech. equipment	Barrier-free	Mandatory dresscode	S.visor appreciation	Social climate	Teamwork & communication	Open-mindedness	Personal meetings	S.visor reachable	Face-2-face comm.	Flexible working times	Unavailability in free time	Work from home	Fixed seating arrangement	Flexible seating setup	Spatial separation	Open setup	Focus rooms	Meeting rooms	Personal space	Low noise level	Hangout space	Cafeteria/restaurants	Kitchen	Smoking area	Private areas	Clean sanitary rooms	Workplace decoration	The office contains art	Ergonomic furniture	Clean working environment	Cooling and heating	Indoor plants	Visible nature	Outside breaks	Natural light	Free snacks/ drinks	Meal vouchers	Fitness vouchers	Educational leave	Office supplies
Mean	5.30	4.95	5.11	5.70	5.13	4.05	5.46	5.72	5.69	5.70	4.61	5.22	3.51	5.01	4.42	4.98	5.05	4.50	4.77	4.51	5.10	5.28	4.88	5.61	5.21	4.88	4.69	4.05	4.73	5.80	4.57	4.61	5.44	5.86	5.96	5.08	5.09	5.33	5.61	5.11	4.75	4.59	5.18	5.73
Standard deviation	1.49	1.45	1.72	1.43	1.60	1.92	1.50	1.35	1.41	1.35	1.54	1.40	1.75	1.47	1.53	1.53	1.56	1.62	1.55	1.65	1.54	1.56	1.49	1.36	1.47	1.65	1.76	2.08	1.71	1.44	1.78	1.67	1.48	1.38	1.25	1.60	1.60	1.41	1.29	1.51	1.56	1.66	1.37	1.25
Skew $\in \mathbb{R}$	-0.56	-0.67	-0.79	-1.19	-0.85	-0.14	-0.80	-0.99	-0.98	-0.94	-0.37	-0.73	0.05	-0.48	-0.28	-0.48	-0.57	-0.52	-0.40	-0.42	-0.54	-0.81	-0.63	-0.89	-0.62	-0.44	-0.48	-0.19	-0.43	-1.08	-0.32	-0.49	-0.82	-1.26	-1.38	-0.82	-0.81	-0.78	-0.87	-0.60	-0.38	-0.27	-0.46	-0.86
Excess kurtosis $\in [-2;\infty]$	-0.55	0.07	-0.05	1.08	0.29	-1.14	-0.19	0.34	0.22	0.35	-0.32	0.26	-1.33	-0.49	-0.34	-0.51	-0.12	-0.43	-0.55	-0.55	-0.47	-0.08	-0.31	0.14	-0.22	-0.66	-0.70	-1.27	-0.71	0.38	-0.83	-0.58	0.04	1.10	1.68	0.08	-0.08	0.27	0.22	-0.23	-0.41	-0.62	-0.42	0.25
Engineering Students	Public transportation	Located centrally	Parking facilities	Tech. equipment	Barrier-free	Mandatory dresscode	S.visor appreciation	Social climate	Teamwork & communication	Open-mindedness	Personal meetings	S.visor reachable	Face-2-face comm.	Flexible working times	Unavailability in free time	Work from home	Fixed seating arrangement	Flexible seating setup	Spatial separation	Open setup	Focus rooms	Meeting rooms	Personal space	Low noise level	Hangout space	Cafeteria/restaurants	Kitchen	Smoking area	Private areas	Clean sanitary rooms	Workplace decoration	The office contains art	Ergonomic furniture	Clean working environment	Cooling and heating	Indoor plants	Visible nature	Outside breaks	Natural light	Free snacks/ drinks	Meal vouchers	Fitness vouchers	Educational leave	Office supplies
Mean	5.49	5.36	5.23	5.91	5.48	4.33	5.63	5.99	6.08	5.83	4.85	5.31	3.37	5.16	4.61	4.92	5.25	4.84	4.97	4.64	4.94	5.43	5.00	5.66	5.41	4.95	4.81	4.33	4.77	5.90	4.65	4.67	5.65	6.04	6.06	5.33	5.36	5.22	5.59	5.27	5.01	4.90	5.37	5.83
Standard deviation	1.46	1.31	1.72	1.32	1.48	1.97	1.44	1.23	1.17	1.46	1.59	1.35	1.75	1.37	1.61	1.55	1.51	1.53	1.50	1.62	1.61	1.43	1.52	1.30	1.40	1.61	1.72	2.07	1.70	1.37	1.76	1.64	1.39	1.22	1.18	1.46	1.30	1.38	1.30	1.47	1.63	1.62	1.40	1.29
Skew $\in \mathbb{R}$	-0.68	-0.63	-0.84	-1.62	-0.88	-0.28	-0.85	-1.28	-1.51	-1.22	-0.50	-0.64	0.05	-0.44	-0.39	-0.31	-0.87	-0.61	-0.60	-0.52	-0.51	-0.77	-0.58	-0.87	-0.77	-0.61	-0.57	-0.36	-0.36	-1.15	-0.47	-0.34	-1.03	-1.46	-1.39	-0.85	-0.94	-0.79	-1.19	-0.63	-0.44	-0.40	-0.63	-1.18
Excess kurtosis $\in [-2;\infty]$	-0.35	-0.13	-0.09	2.72	0.24	-1.13	-0.17	1.51	2.59	0.70	-0.52	0.23	-1.34	-0.43	-0.49	-0.73	0.45	-0.16	-0.09	-0.60	-0.66	-0.23	-0.39	0.13	0.16	-0.39	-0.53	-1.18	-0.83	0.40	-0.74	-0.86	0.55	1.83	1.78	0.20	1.37	0.60	1.41	-0.24	-0.66	-0.55	-0.42	1.19

Figure 21 - Statistical properties of items for student sample, n=200 each (own work, 2022)

The table above shows the statistical properties of all items for the participants in the study. Of note is that for both populations, 43/44 items were negatively skewed. Furthermore, the mean was higher than a “neutral” 3.5 out of 7 on the Likert scale for all of the variables. It could therefore have been concluded that all items were seen as important influences on workplace attractiveness. In order to answer the research question parsimoniously, the author conducted a factor analysis on the data. This revealed an underlying factorial structure which excluded some of the items due to their non-correlation with the other items.

Exploratory factor analysis was chosen as no hypothesis had been stated in advance. The data was examined to reveal what drives makes an office attractive in the eyes of the student population. Due to the extent of the questionnaire and the multi-faceted nature of the concept of “workplace attractiveness”, a mere descriptive analysis was not seen as sufficient to answer the research question. While some items, as also evidenced by the structure of the questionnaire, were seen as relating to each other thematically, it was the stated goal of the author to eliminate items that do not contribute significantly to an office’s appeal.

While different visualizations could be applied to the statistical data, the interpretation and reduction to sensible factors is not part of the toolset of descriptive analysis. Therefore, to achieve explanatory power, exploratory factor analysis was conducted. The process and results of this method are detailed in the following chapter.

The following diagrams present the answers given by the participants graphically, in order to visualize their distribution and make the above data easier to interpret. One can easily observe the negative skewness and the non-normality which stem from the fact that the mean is not centrally located on the Likert scale and both kurtosis and skewness do not equal 0.

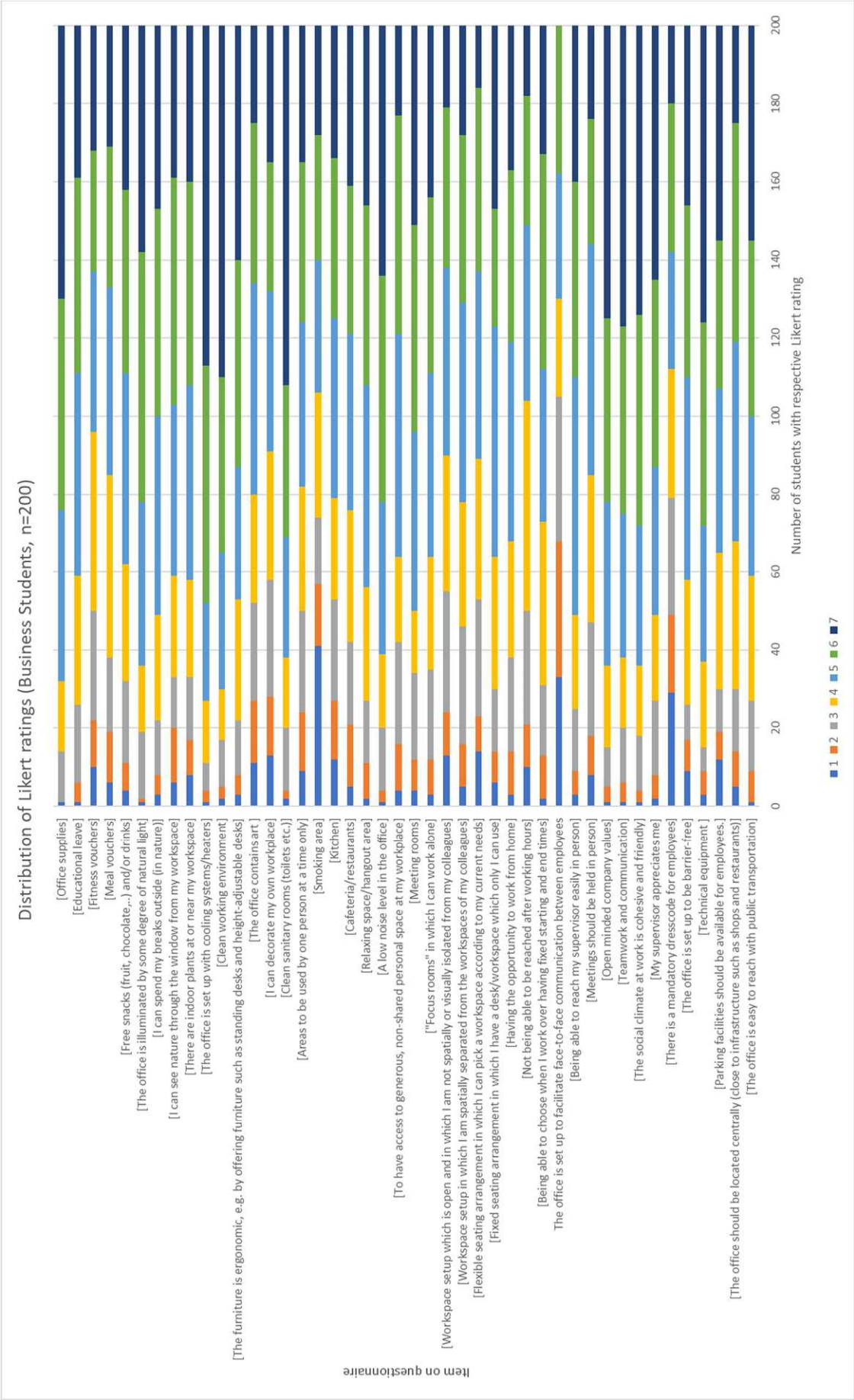

Figure 22 - Distribution of business student responses (own work, 2022)

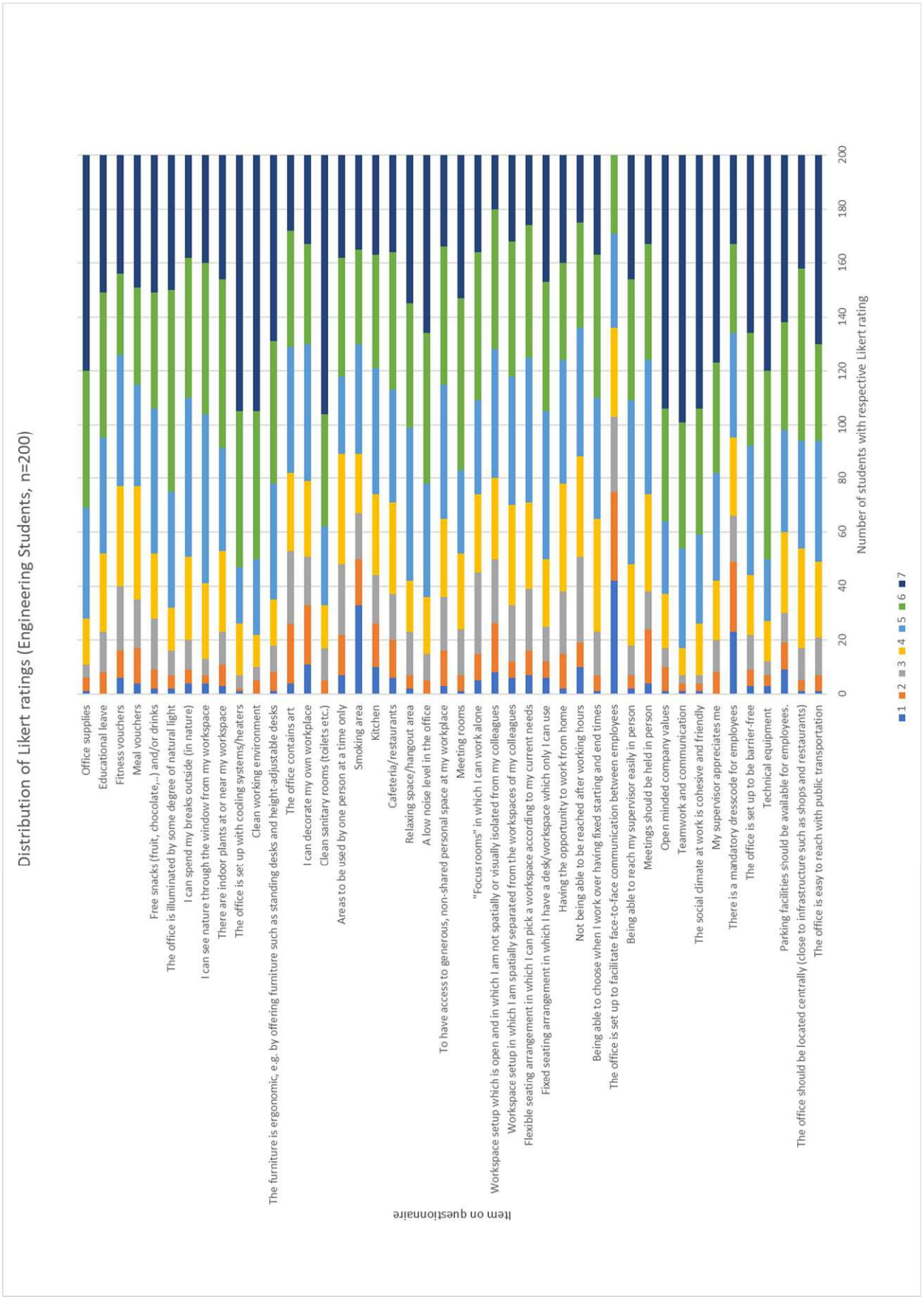

Figure 23 - Distribution of engineering student responses (own work, 2022)

As another aid to visualizing the results of the questionnaire, the means of the non-demographic questions were evaluated. Business and engineering students were treated separately, so as to show any differences that might appear in the average ranking of a given attribute. The following diagrams serve to illustrate the results of this statistical analysis. One can easily conclude that while all items were ranked high, there was no significant difference between the two populations. The item with the lowest mean for both subpopulations was the attribute: “The office is set up to facilitate face-to-face communication”. The perceived low importance of this characteristic of an office workplace is of no relevance to further analysis, though, as this item was excluded from analysis (see the chapter on factor loading).

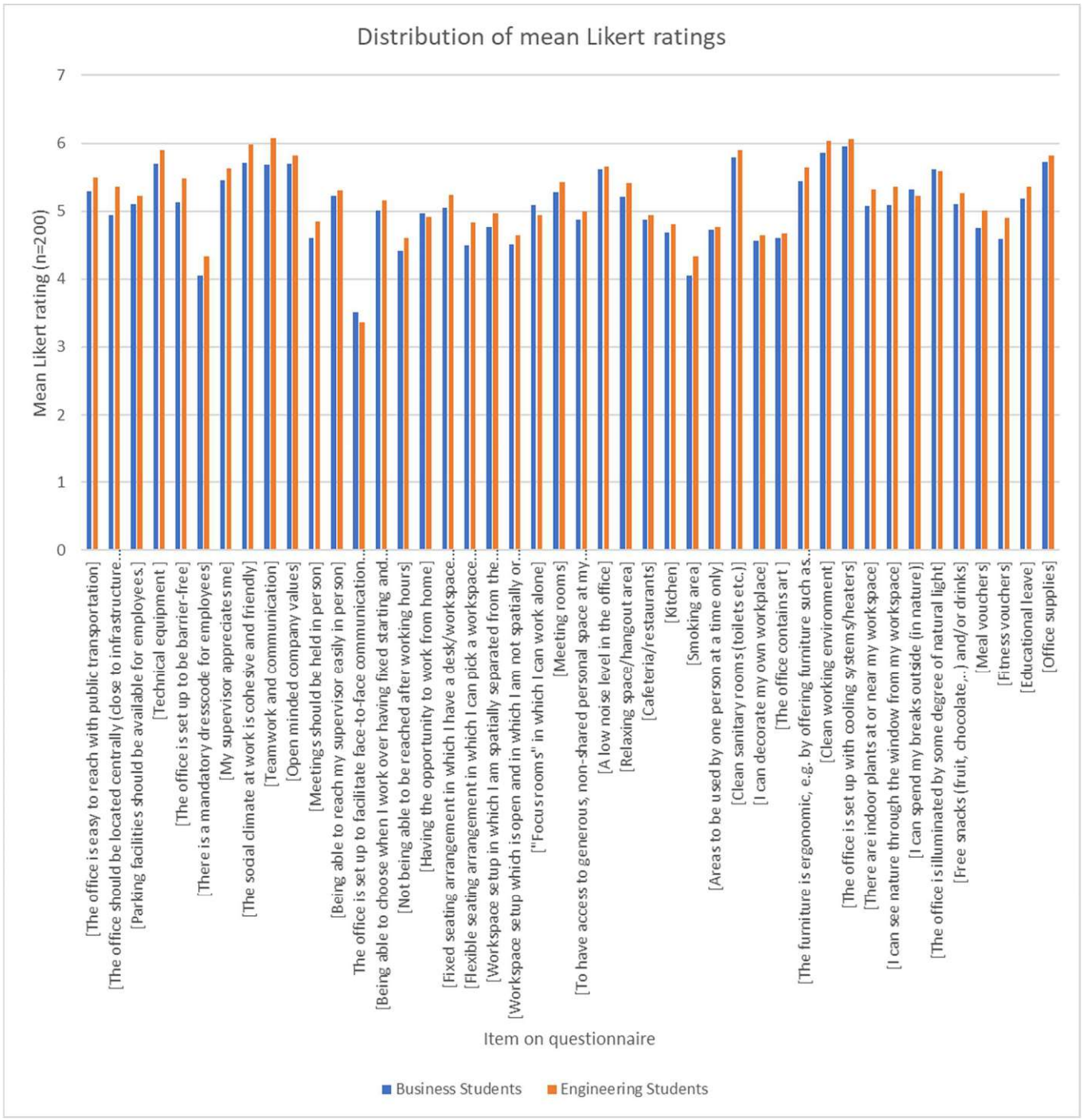

Figure 24 - Mean ratings for all items (own work, 2022)

5.2 Exploratory factor analysis

One of the goals of data analysis is to achieve parsimony, i.e., reducing the variables to an underlying, smaller set of factors. The author submitted the responses collected to an Exploratory Factor Analysis (EFA) with the aim of achieving just that. To this end, an implementation of the relevant mathematical procedures was written in Python. The source code can be found in the appendix to this thesis. In the course of this chapter, the process of reducing the complexity of the dataset will be described in detail.

When it comes to factor analysis, there is a distinction to be made between confirmatory and exploratory variants. The former refers to a set of mathematical procedures that are applied in order to test a theory proposed by a researcher. Therefore, assumptions or expectations regarding the expected outcome – in the form of a priori models or theories – exist. Confirmatory factor analysis is conducted in order to most closely match one of these theories to the data. On the other hand, EFA is applied when the theoretical basis for determining the number and nature of the underlying factors is scarce (Williams, Onsman & Brown, 2010). The author deviated from existing theoretical models and scales by a significant amount by constructing the questionnaire used in this thesis himself. Hence, EFA was considered to be appropriate.

A brief outline of the mathematical background of EFA serves to better understand the procedures and various tests that will be introduced in the forthcoming section. Essentially, factor analysis is based on the correlation between each possible pair of variables. It is assumed that there exist underlying factors for which the observed variables can be expressed as a linear function of the factors and a residual value. The ultimate goal is to find factors that, when extracted, account for all intercorrelations between any given two variables. (Yong & Pearce, 2013) Exploratory factor analysis is a linear procedure in that there are steps to be followed in a specific order. The following diagram serves as an illustration of the sequence which will be described in detail in the subsequent chapters.

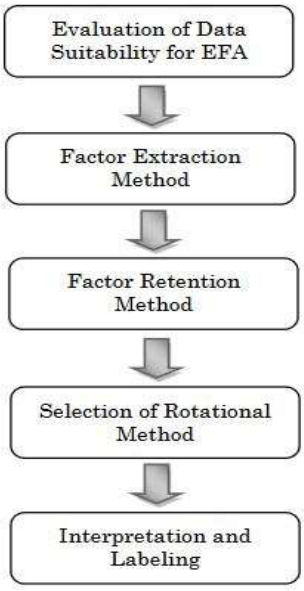

Figure 25 - Steps of Exploratory Factor Analysis (Taherdoost et al., 2022)

5.2.1 Evaluation of data suitability for EFA

The first step to be followed is to establish whether the data (in this case, “data” refers to the answers collected by participants via the questionnaire) can be used in exploratory factor analysis. Several tests were conducted in accordance with the established protocol. These will be described in the following.

5.2.1.1 Sample Size

As was described in an earlier chapter, the number of participants from whom answers were gathered was 400. This is considered to be a suitable sample size for exploratory factor analysis. The exact size necessary to conduct EFA is still a topic of discussion. Recent research, however, points to the procedure being one that requires a large sample (Yong & Pearce, 2013).

5.2.1.2 Sample-to-variable-ratio

Another way of determining the number of participants to include is the so-called N:p ratio, “where N refers to the number of participants and p refers to the number of variables” (Williams, Onsman & Brown, 2010, p. 5). Due to the nature of the questionnaire, which also contained questions about demographics, only the 44 Likert-type variables were submitted to EFA. Keeping this in mind, the N:p ratio is 400:44 or 9.09:1, which is very much in agreement with the rules of thumb that indicate suitable ratios to be between 3:1 and 20:1 (Everitt, 1975; Hair, 2019; p.133). Whether N:p is a valid measure of data suitability is still a matter of discussion among researchers (Rouquette & Falissard, 2011). The author decided to include it here to further strengthen the argument that the sample size was adequate for EFA.

5.2.1.3 Correlation matrix

The data was read from an Excel file containing the answers given by the participants. Subsequently, it was converted into matrix form via a Pandas dataframe of dimensions 400 x 44 and the native Pandas function “corr” was then applied. This calculates the pairwise correlation between all columns of a given matrix, returning a Pearson correlation matrix.

Following the recommendations given in the literature pertaining to exploratory factor analysis, the matrix was then investigated. A count was applied to all columns (each one corresponding to one item / variable / question – these terms will be used interchangeably in the following sections – of the questionnaire) of the matrix. It is considered common practice to eliminate those items that show a large number of pairwise correlations below 0.3 (Shrestha, 2021, p.6; Tabachnik & Fidell, 2013; p. 667; Yong & Pearce, 2013; S. 87f.). As the goal of factor analysis is to find underlying factors that explain the data, this procedure excludes those items that do not appear to have any strong link with other items. Questions that are not linked to other questions cannot be grouped together into a common factor and should be

disregarded when conducting exploratory factor analysis. The matrix is displayed in Figure 27, in which the author highlighted the problematic items.

The value of 0.3 is not based on robust mathematics but rather a rule of thumb. All items exhibited a varying amount of inter-item correlations that did not exceed this threshold. The author therefore made a decision to remove all those items that met the elimination criteria in 29 or more cases. This arbitrary cut-off represents 2/3 (66.67%) of all pairwise correlations and therefore was deemed suitable by the author. The following table details which items were eliminated from further analysis in this step.

Item	Occurrences
Smoking area	30
Workspace setup in which I am spatially separated from the workspaces of my colleagues	30
To have access to generous, non-shared personal space at my workplace	31
There is a mandatory dresscode for employees	31
Not being able to be reached after working hours	32
The office is set up to facilitate face-to-face communication between employees	43

Figure 26 - Items excluded via correlation matrix (own work, 2022)

Figure 27 - Correlation matrix (own work, 2022)

	Public transportation	Located centrally	Parking facilities	Tech. equipment	Barrier-free	Mandatory dresscode	S.visor appreciation	Social climate	Téamwork & communication	Open-mindedness	Personal meetings	S.visor reachable	Face-2-face comm.	Flexible working times	Unavailability in free time	Work from home	Fixed seating arrangement	Flexible seating setup	Spatial separation	Open setup	Focus rooms	Meeting rooms	Personal space	Low noise level	Hangout space	Cafeteria/restaurants	Kitchen	Smoking area	Private areas	Clean sanitary rooms	Workplace decoration	The office contains art	Ergonomic furniture	Clean working environment	Cooling and heating	Indoor plants	Visible nature	Outside breaks	Natural light	Free snacks/drinks	Meal vouchers	Fitness vouchers	Educational leave	Office supplies	Cross-Correlations < 0.3
Public transportation	1.00	0.46	0.20	0.48	0.28	0.06	0.47	0.50	0.51	0.44	0.25	0.34	0.01	0.45	0.39	0.46	0.34	0.26	0.22	0.20	0.18	0.40	0.21	0.35	0.33	0.31	0.27	0.09	0.10	0.51	0.23	0.14	0.44	0.48	0.48	0.32	0.26	0.30	0.40	0.22	0.26	0.15	0.42	0.38	20
Located centrally	0.46	1.00	0.38	0.37	0.38	0.25	0.36	0.35	0.32	0.36	0.33	0.33	-0.01	0.32	0.37	0.31	0.26	0.42	0.29	0.32	0.30	0.35	0.31	0.40	0.37	0.32	0.29	0.24	0.33	0.30	0.28	0.32	0.44	0.36	0.36	0.30	0.29	0.28	0.27	0.33	0.23	0.20	0.34	0.31	14
Parking facilities	0.20	0.38	1.00	0.34	0.37	0.32	0.28	0.26	0.29	0.36	0.43	0.38	0.04	0.32	0.15	0.18	0.51	0.36	0.34	0.32	0.21	0.38	0.31	0.34	0.29	0.17	0.05	0.36	0.14	0.26	0.38	0.33	0.29	0.26	0.35	0.36	0.31	0.23	0.24	0.31	0.22	0.19	0.26	0.35	20
Technical equipment	0.48	0.37	0.34	1.00	0.37	0.09	0.59	0.64	0.65	0.59	0.24	0.32	-0.02	0.36	0.25	0.28	0.40	0.25	0.26	0.12	0.37	0.56	0.27	0.41	0.45	0.36	0.32	0.10	0.24	0.60	0.31	0.22	0.49	0.63	0.64	0.34	0.22	0.35	0.51	0.36	0.35	0.23	0.49	0.68	14
arrier-free	0.28	0.38	0.37	0.37	1.00	0.26	0.41	0.35	0.43	0.43	0.40	0.38	-0.04	0.35	0.31	0.25	0.33	0.42	0.30	0.35	0.36	0.41	0.30	0.37	0.39	0.32	0.14	0.30	0.32	0.27	0.42	0.43	0.44	0.47	0.43	0.49	0.40	0.37	0.32	0.43	0.31	0.28	0.43	0.31	8
Mandatory dresscode	0.06	0.25	0.32	0.09	0.26	1.00	0.05	0.05	0.06	0.14	0.37	0.25	0.05	0.19	0.24	0.05	0.37	0.47	0.36	0.42	0.16	0.26	0.28	0.09	0.21	0.23	0.10	0.52	0.26	-0.02	0.36	0.44	0.04	0.00	0.02	0.31	0.30	0.19	0.10	0.30	0.29	0.34	0.21	0.11	31
Supervisor appreciation	0.47	0.36	0.28	0.59	0.41	0.05	1.00	0.68	0.61	0.55	0.25	0.31	-0.05	0.32	0.29	0.29	0.32	0.20	0.18	0.19	0.28	0.57	0.25	0.40	0.49	0.41	0.34	0.00	0.22	0.49	0.37	0.25	0.54	0.59	0.58	0.37	0.29	0.45	0.47	0.37	0.38	0.29	0.49	0.56	16
Social climate	0.50	0.35	0.26	0.64	0.35	0.05	0.68	1.00	0.73	0.64	0.22	0.34	0.01	0.35	0.24	0.32	0.32	0.21	0.22	0.14	0.30	0.54	0.24	0.41	0.48	0.39	0.33	0.03	0.15	0.58	0.30	0.21	0.49	0.68	0.66	0.36	0.28	0.40	0.52	0.41	0.35	0.25	0.50	0.59	15
Teamwork & communication	0.51	0.32	0.29	0.65	0.43	0.06	0.61	0.73	1.00	0.64	0.29	0.37	0.00	0.38	0.21	0.29	0.33	0.25	0.22	0.17	0.27	0.52	0.20	0.40	0.49	0.37	0.26	0.11	0.13	0.57	0.27	0.21	0.50	0.65	0.65	0.38	0.33	0.39	0.46	0.33	0.30	0.22	0.46	0.55	18
Open mindedness	0.44	0.36	0.36	0.59	0.43	0.14	0.55	0.64	0.64	1.00	0.36	0.36	0.00	0.37	0.21	0.32	0.32	0.29	0.25	0.23	0.39	0.46	0.26	0.38	0.48	0.37	0.29	0.12	0.21	0.48	0.37	0.30	0.43	0.54	0.60	0.36	0.29	0.36	0.50	0.39	0.33	0.26	0.50	0.51	12
Personal meetings	0.25	0.33	0.43	0.24	0.40	0.37	0.25	0.22	0.29	0.36	1.00	0.62	0.00	0.34	0.33	0.14	0.38	0.35	0.27	0.41	0.13	0.35	0.18	0.32	0.26	0.09	0.07	0.36	0.11	0.08	0.34	0.36	0.32	0.24	0.26	0.30	0.25	0.20	0.18	0.30	0.19	0.25	0.20	0.18	25
Supervisor reachable	0.34	0.33	0.38	0.32	0.38	0.25	0.31	0.34	0.37	0.36	0.62	1.00	-0.04	0.37	0.32	0.20	0.36	0.31	0.26	0.31	0.15	0.38	0.21	0.38	0.23	0.10	0.06	0.28	0.16	0.25	0.28	0.30	0.38	0.35	0.33	0.37	0.32	0.26	0.27	0.27	0.19	0.25	0.30	0.32	19
Face-2-face communication	0.01	-0.01	0.04	-0.02	-0.04	0.05	-0.05	0.01	0.00	0.00	0.00	-0.04	1.00	0.03	-0.03	-0.02	-0.03	0.06	0.03	-0.01	0.06	0.03	-0.06	-0.04	0.05	-0.01	0.03	0.03	-0.03	-0.04	-0.02	0.03	-0.01	0.00	-0.02	0.00	0.05	0.05	0.05	0.00	0.04	0.02	-0.02	0.06	43
Flexible working times	0.45	0.32	0.32	0.36	0.35	0.19	0.32	0.35	0.38	0.37	0.34	0.37	0.03	1.00	0.38	0.45	0.35	0.31	0.35	0.25	0.20	0.37	0.30	0.33	0.29	0.16	0.16	0.15	0.15	0.32	0.30	0.28	0.39	0.38	0.38	0.32	0.28	0.25	0.31	0.25	0.22	0.19	0.32	0.25	17
Unavailability in free time	0.39	0.37	0.15	0.25	0.31	0.24	0.29	0.24	0.21	0.21	0.33	0.32	-0.03	0.38	1.00	0.37	0.29	0.28	0.20	0.30	0.18	0.22	0.25	0.27	0.21	0.18	0.23	0.15	0.28	0.19	0.27	0.22	0.34	0.23	0.22	0.33	0.26	0.25	0.23	0.31	0.27	0.28	0.26	0.15	32
Work from home	0.46	0.31	0.18	0.28	0.25	0.05	0.29	0.32	0.29	0.32	0.14	0.20	-0.02	0.45	0.37	1.00	0.23	0.19	0.17	0.17	0.22	0.22	0.30	0.33	0.32	0.36	0.31	0.07	0.21	0.43	0.20	0.15	0.39	0.34	0.34	0.14	0.18	0.21	0.35	0.30	0.19	0.17	0.33	0.23	26
Fixed seating arrangement	0.34	0.26	0.51	0.40	0.33	0.37	0.32	0.32	0.33	0.32	0.38	0.36	-0.03	0.35	0.29	0.23	1.00	0.16	0.48	0.23	0.22	0.36	0.31	0.34	0.31	0.11	0.12	0.33	0.16	0.33	0.43	0.31	0.31	0.30	0.37	0.36	0.24	0.20	0.24	0.31	0.28	0.23	0.22	0.32	17
Flexible seating setup	0.26	0.42	0.36	0.25	0.42	0.47	0.20	0.21	0.25	0.29	0.35	0.31	0.06	0.31	0.28	0.19	0.16	1.00	0.29	0.55	0.28	0.36	0.29	0.23	0.38	0.39	0.16	0.41	0.31	0.21	0.25	0.40	0.24	0.23	0.15	0.38	0.34	0.25	0.23	0.30	0.32	0.33	0.29	0.21	25
Spatial separation	0.22	0.29	0.34	0.26	0.30	0.36	0.18	0.22	0.22	0.25	0.27	0.26	0.03	0.35	0.20	0.17	0.48	0.29	1.00	0.18	0.45	0.25	0.47	0.40	0.25	0.25	0.10	0.36	0.39	0.18	0.39	0.39	0.23	0.18	0.21	0.36	0.28	0.24	0.23	0.29	0.23	0.17	0.30	0.26	30
pen setup	0.20	0.32	0.32	0.12	0.35	0.42	0.19	0.14	0.17	0.23	0.41	0.31	-0.01	0.25	0.30	0.17	0.23	0.55	0.18	1.00	0.20	0.32	0.32	0.19	0.29	0.33	0.21	0.44	0.28	0.14	0.31	0.38	0.29	0.18	0.15	0.37	0.34	0.27	0.17	0.29	0.36	0.35	0.21	0.14	25
cus rooms	0.18	0.30	0.21	0.37	0.36	0.16	0.28	0.30	0.27	0.39	0.13	0.15	0.06	0.20	0.18	0.22	0.22	0.28	0.45	0.20	1.00	0.25	0.44	0.35	0.37	0.42	0.41	0.24	0.65	0.28	0.34	0.34	0.39	0.31	0.30	0.19	0.23	0.40	0.32	0.33	0.33	0.29	0.41	0.35	21
Meeting rooms	0.40	0.35	0.38	0.56	0.41	0.26	0.57	0.54	0.52	0.46	0.35	0.38	0.03	0.37	0.22	0.22	0.36	0.36	0.25	0.32	0.25	1.00	0.30	0.36	0.52	0.36	0.29	0.17	0.20	0.47	0.33	0.25	0.41	0.50	0.47	0.31	0.27	0.29	0.40	0.30	0.32	0.24	0.33	0.47	14
Non-shared personal space	0.21	0.31	0.31	0.27	0.30	0.28	0.25	0.24	0.20	0.26	0.18	0.21	-0.06	0.30	0.25	0.30	0.31	0.29	0.47	0.32	0.44	0.30	1.00	0.38	0.26	0.28	0.21	0.28	0.51	0.25	0.42	0.37	0.29	0.27	0.24	0.26	0.24	0.30	0.22	0.29	0.24	0.22	0.33	0.24	31
Low noise level	0.35	0.40	0.34	0.41	0.37	0.09	0.40	0.41	0.40	0.38	0.32	0.38	-0.04	0.33	0.27	0.33	0.34	0.23	0.40	0.19	0.35	0.36	0.38	1.00	0.29	0.21	0.09	0.11	0.20	0.39	0.17	0.16	0.42	0.46	0.45	0.32	0.37	0.37	0.34	0.27	0.20	0.22	0.31	0.37	15
Hangout space	0.33	0.37	0.29	0.45	0.39	0.21	0.49	0.48	0.49	0.48	0.26	0.23	0.05	0.29	0.21	0.32	0.31	0.38	0.25	0.29	0.37	0.52	0.26	0.29	1.00	0.55	0.43	0.21	0.31	0.46	0.30	0.29	0.46	0.44	0.40	0.32	0.34	0.41	0.41	0.39	0.41	0.36	0.38	0.40	13
Cafeteria/restaurants	0.31	0.32	0.17	0.36	0.32	0.23	0.41	0.39	0.37	0.37	0.09	0.10	-0.01	0.16	0.18	0.36	0.11	0.39	0.25	0.33	0.42	0.36	0.28	0.21	0.55	1.00	0.58	0.29	0.38	0.46	0.32	0.34	0.39	0.34	0.29	0.31	0.32	0.41	0.43	0.41	0.51	0.40	0.47	0.41	13
Kitchen	0.27	0.29	0.05	0.32	0.14	0.10	0.34	0.33	0.26	0.29	0.07	0.06	0.03	0.16	0.23	0.31	0.12	0.16	0.10	0.21	0.41	0.29	0.21	0.09	0.43	0.58	1.00	0.07	0.38	0.35	0.23	0.20	0.39	0.26	0.25	0.18	0.20	0.35	0.38	0.32	0.46	0.42	0.34	0.25	27
oking area	0.09	0.24	0.36	0.10	0.30	0.52	0.00	0.03	0.11	0.12	0.36	0.28	0.03	0.15	0.15	0.07	0.33	0.41	0.36	0.44	0.24	0.17	0.28	0.11	0.21	0.29	0.07	1.00	0.29	0.03	0.36	0.43	0.15	0.12	0.07	0.34	0.40	0.21	0.15	0.27	0.27	0.33	0.21	0.15	30
vate areas	0.10	0.33	0.14	0.24	0.32	0.26	0.22	0.15	0.13	0.21	0.11	0.16	-0.03	0.15	0.28	0.21	0.16	0.31	0.39	0.28	0.65	0.20	0.51	0.20	0.31	0.38	0.38	0.29	1.00	0.15	0.38	0.42	0.30	0.17	0.13	0.23	0.29	0.37	0.19	0.32	0.32	0.37	0.36	0.20	27
Clean sanitary	0.51	0.30	0.26	0.60	0.27	-0.02	0.49	0.58	0.57	0.48	0.08	0.25	-0.04	0.32	0.19	0.43	0.33	0.21	0.18	0.14	0.28	0.47	0.25	0.39	0.46	0.46	0.35	0.03	0.15	1.00	0.19	0.03	0.46	0.58	0.58	0.30	0.18	0.26	0.54	0.37	0.35	0.22	0.44	0.47	19
Workplace decoration	0.23	0.28	0.38	0.31	0.42	0.36	0.37	0.30	0.27	0.37	0.34	0.28	-0.02	0.30	0.27	0.20	0.43	0.25	0.39	0.31	0.34	0.33	0.42	0.17	0.30	0.32	0.23	0.36	0.38	0.19	1.00	0.69	0.37	0.28	0.32	0.40	0.28	0.27	0.29	0.37	0.26	0.26	0.42	0.33	18
The office contains art	0.14	0.32	0.33	0.22	0.43	0.44	0.25	0.21	0.21	0.30	0.36	0.30	0.03	0.28	0.22	0.15	0.31	0.40	0.39	0.38	0.34	0.25	0.37	0.16	0.29	0.34	0.20	0.43	0.42	0.03	0.69	1.00	0.34	0.20	0.22	0.45	0.42	0.33	0.22	0.36	0.24	0.26	0.34	0.25	20
Ergonomic furniture	0.44	0.44	0.29	0.49	0.44	0.04	0.54	0.49	0.50	0.43	0.32	0.38	-0.01	0.39	0.34	0.39	0.31	0.24	0.23	0.29	0.39	0.41	0.29	0.42	0.46	0.39	0.39	0.15	0.30	0.46	0.37	0.34	1.00	0.57	0.52	0.37	0.25	0.32	0.39	0.47	0.35	0.27	0.44	0.41	11
Clean working environment	0.48	0.36	0.26	0.63	0.47	0.00	0.59	0.68	0.65	0.54	0.24	0.35	0.00	0.38	0.23	0.34	0.30	0.23	0.18	0.18	0.31	0.50	0.27	0.46	0.44	0.34	0.26	0.12	0.17	0.58	0.28	0.20	0.57	1.00	0.70	0.33	0.24	0.34	0.41	0.33	0.29	0.22	0.44	0.55	18
Cooling and heating	0.48	0.36	0.35	0.64	0.43	0.02	0.58	0.66	0.65	0.60	0.26	0.33	-0.02	0.38	0.22	0.34	0.37	0.15	0.21	0.15	0.30	0.47	0.24	0.45	0.40	0.29	0.25	0.07	0.13	0.58	0.32	0.22	0.52	0.70	1.00	0.34	0.25	0.36	0.47	0.37	0.31	0.17	0.40	0.57	15
loor plants	0.32	0.30	0.36	0.34	0.49	0.31	0.37	0.36	0.38	0.36	0.30	0.37	0.00	0.32	0.33	0.14	0.36	0.38	0.36	0.37	0.19	0.31	0.26	0.32	0.32	0.31	0.18	0.34	0.23	0.30	0.40	0.45	0.37	0.33	0.34	1.00	0.65	0.44	0.52	0.40	0.35	0.31	0.38	0.29	8
Visible nature	0.26	0.29	0.31	0.22	0.40	0.30	0.29	0.28	0.33	0.29	0.25	0.32	0.05	0.28	0.26	0.18	0.24	0.34	0.28	0.34	0.23	0.27	0.24	0.37	0.34	0.32	0.20	0.40	0.29	0.18	0.28	0.42	0.25	0.24	0.25	0.65	1.00	0.61	0.44	0.26	0.34	0.32	0.32	0.26	25
Outside breaks	0.30	0.28	0.23	0.35	0.37	0.19	0.45	0.40	0.39	0.36	0.20	0.26	0.05	0.25	0.25	0.21	0.20	0.25	0.24	0.27	0.40	0.29	0.30	0.37	0.41	0.41	0.35	0.21	0.37	0.26	0.27	0.33	0.32	0.34	0.36	0.44	0.61	1.00	0.48	0.26	0.37	0.36	0.47	0.37	20
tural light	0.40	0.27	0.24	0.51	0.32	0.10	0.47	0.52	0.46	0.50	0.18	0.27	0.05	0.31	0.23	0.35	0.24	0.23	0.23	0.17	0.32	0.40	0.22	0.34	0.41	0.43	0.38	0.15	0.19	0.54	0.29	0.22	0.39	0.41	0.47	0.52	0.44	0.48	1.00	0.42	0.43	0.32	0.51	0.47	16
Free snacks and/or drinks	0.22	0.33	0.31	0.36	0.43	0.30	0.37	0.41	0.33	0.39	0.30	0.27	0.00	0.25	0.31	0.30	0.31	0.30	0.29	0.29	0.33	0.30	0.29	0.27	0.39	0.41	0.32	0.27	0.32	0.37	0.37	0.36	0.47	0.33	0.37	0.40	0.26	0.26	0.42	1.00	0.55	0.47	0.48	0.39	15
Meal vouchers	0.26	0.23	0.22	0.35	0.31	0.29	0.38	0.35	0.30	0.33	0.19	0.19	0.04	0.22	0.27	0.19	0.28	0.32	0.23	0.36	0.33	0.32	0.24	0.20	0.41	0.51	0.46	0.27	0.32	0.35	0.26	0.24	0.35	0.29	0.31	0.35	0.34	0.37	0.43	0.55	1.00	0.68	0.43	0.38	19
Fitness vouchers	0.15	0.20	0.19	0.23	0.28	0.34	0.29	0.25	0.22	0.26	0.25	0.25	0.02	0.19	0.28	0.17	0.23	0.33	0.17	0.35	0.29	0.24	0.22	0.22	0.36	0.40	0.42	0.33	0.37	0.22	0.26	0.26	0.27	0.22	0.17	0.31	0.32	0.36	0.32	0.47	0.68	1.00	0.41	0.24	28
Educational leave	0.42	0.34	0.26	0.49	0.43	0.21	0.49	0.50	0.46	0.50	0.20	0.30	-0.02	0.32	0.26	0.33	0.22	0.29	0.30	0.21	0.41	0.33	0.33	0.31	0.38	0.47	0.34	0.21	0.36	0.44	0.42	0.34	0.44	0.44	0.40	0.38	0.32	0.47	0.51	0.48	0.43	0.41	1.00	0.51	11
Office supplies	0.38	0.31	0.35	0.68	0.31	0.11	0.56	0.59	0.55	0.51	0.18	0.32	0.06	0.25	0.15	0.23	0.32	0.21	0.26	0.14	0.35	0.47	0.24	0.37	0.40	0.41	0.25	0.15	0.20	0.47	0.33	0.25	0.41	0.55	0.57	0.29	0.26	0.37	0.47	0.39	0.38	0.24	0.51	1.00	17

5.2.1.4 Kaiser-Meyer-Olkin Measure of Sampling Adequacy

Following the elimination of the items mentioned above, the remaining items were subjected to the Kaiser-Meyer-Olkin (KMO) test. This criterion evaluates the degree to which the sample is adequate for exploratory factor analysis. It represents the proportion of variance that can be explained by common variance (as in variance shared among the items). The freely available "factor_analyzer" Python module (https://pypi.org/project/factor-analyzer/), which is based on the "psych" R library, includes a built-in "calculate_kmo" function. When called, the KMO statistic is returned, which was equal to 0.934, well exceeding the threshold of 0.9 – which Kaiser (1970) called, in his rather prosaic verbiage, "marvelous". A larger numeric KMO value means a higher degree of suitability of the data for factor analysis.

5.2.1.5 Bartlett's Sphericity

In conjunction with the KMO test, suitability for factor analysis should be investigated using Bartlett's test of sphericity. This tests the data against the null hypothesis that the variables are completely uncorrelated with each other (Bartlett, 1950). In that case, the correlation matrix is an identity matrix. If the p-value is significant ($p < 0.05$; meaning a less than 5% chance that the observed result was derived purely by chance), then there exists a patterned relationship between the individual answers to the questionnaire. The sample can then be subjected to exploratory factor analysis (Yong & Pearce, 2013, p. 88).

The "calculate_bartlett_sphericity" submodule of "factor_analyzer" was applied to the post-elimination data and returned a p-value of 0, proving statistical significance and hence the suitability of the data for factor analysis. The author then selected a suitable factor extraction method.

5.2.2 Factor extraction method

There is a plethora of methods available to extract the underlying factors from a suitable data set. Each offers a distinct set of advantages and can be employed in different situations. Therefore, there is no single best method that fits every situation. For an overview of the most commonly used methods, the reader is invited to refer to Pett, Lackey & Sullivan (2003, p. 88-114). It is a topic of debate among academics and the choice is ultimately left to each researcher.

The author decided on the MinRes ("Minimum Residual") method, which is integrated into the Python "factor_analyzer" module. MinRes produces results that are identical to ULS ("Unweighted Least Squares") extraction (Harman & Jones, 1966). This in turn is equivalent to iteratively applying Principal Axis Factoring, or PAF (Joreskög, 2003). ULS is the most popular method for extracting factors in use today (Flora, LaBrish & Chalmers, 2012). As such, MinRes was deemed appropriate for the

purpose of this thesis. Upon extracting the factors using MinRes, the next step was to decide on the number of factors to retain.

5.2.3 Factor retention method

The ultimate goal of exploratory factor analysis is to reduce a set of variables to a smaller number of factors. This part is essential in order to achieve parsimony. In this phase, the researcher is confronted with the decision about how many and which factors are to be retained. Errors can be made in both directions: over- and underestimating the amount of factors. However, the latter is more severe. It was demonstrated to cause poor factor loadings, leading to false interpretations, and thereby nullifying the result of an EFA (Ledesma & Valero-Mora, 2007). There are several criteria to achieve a significant and sensible result, the most relevant of which the author applied.

5.2.3.1 Kaiser-Guttman criterion

As an initial step, the dataset was submitted to the Kaiser-Guttman criterion (also known simply as the "Kaiser criterion"). It was first proposed by Guttman (1954) and expanded upon and popularized by Kaiser (1961). This was done with the intent of getting a preliminary idea of the number of factors. While the Kaiser criterion is considered by some researchers to be antiquated, it still finds application as a rule of thumb for estimating the number of factors.

The Kaiser-Guttman criterion is based on the concept of eigenvalue: The number of factors retained is equal to the number of factors having an eigenvalue greater than 1. Translated from mathematical terms, an eigenvalue of 1 means that a given factor contributes as much variance as an average observed variable. Simply put, it "explains as much" as a single variable. Hence, if the eigenvalue is larger than 1, that suggests that the factor explains more than a single variable and therefore contributes more the explanation of the data and should therefore be retained (Kaiser, 1960, p.145). An eigenvalue of 10 would mean that a given factor explains as much variance as would 10 variables on average (Kanyongo, 2005).

Factor	Eigenvalue
0	13.832
1	2.890
2	2.352
3	1.387
4	1.344
5	1.241
6	1.089
7	1.018
8	0.905
9	0.832

Figure 28 - Eigenvalues as determined by Kaiser-Guttman criterion (own work, 2022)

In the above table, an abbreviated version of the results of applying the Kaiser criterion to the dataset is depicted. It is cut off briefly after the eigenvalues fall below 1. The number of factors that would explain the data according to Kaiser-Guttman is 8, with the ninth factor just barely missing the mark. The cumulative variance explained by these 8 factors is 0.662, or just above 66% of the entire variance. The total sum of the eigenvalues is 25.15 – meaning that these 8 factors contribute as much variance as 25 variables on average.

5.2.3.2 Cattell's scree plot

For a more intuitive understanding of the result of the Kaiser criterion, a tool known as a scree plot was developed by Cattell (1966). The underlying principle is that the eigenvalues of random numbers are considered to be constant. The scree diagram plots the eigenvalues of prospective factors in descending order. This illustrates the amount of variance explained by each factor. There is a point at which the variance explained by introducing an additional factor does not differ from the variance that would be explained by a random variable. This point is called the "elbow" of a scree plot owing to its visual form and is indicated by the vertical line at an eigenvalue equal to 1. The number of factors to be retained is quickly discerned by counting those that lie above the elbow (Kanyongo, 2005).

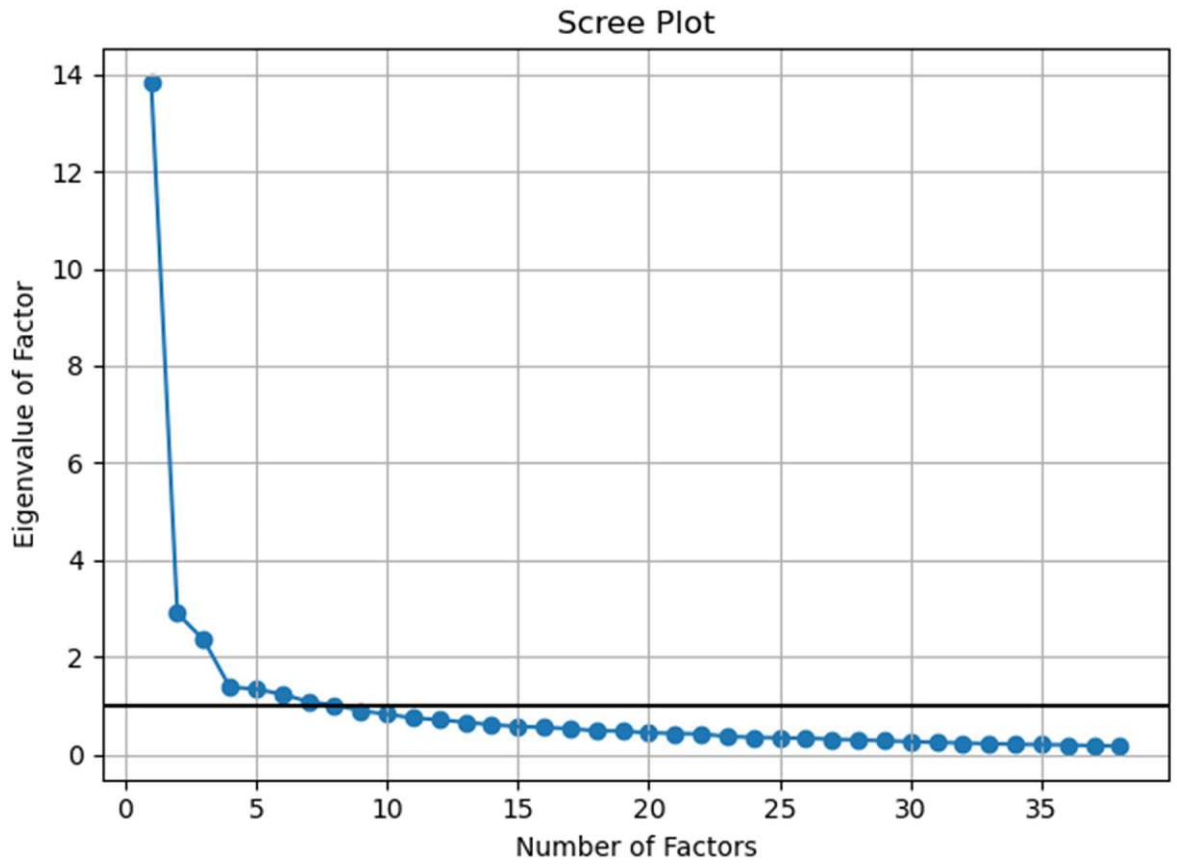

Figure 29 - Scree plot (own work, 2022)

The Kaiser criterion and the scree plot are easy to apply and can give a preliminary idea of the number of factors to retain. However, they are no longer seen as optimal to extract the number of factors in an EFA (Costello & Osborne, 2005). Current literature (see for example Lloret-Segura et al., 2014) recommends additionally employing other procedures such as Parallel Analysis as proposed by Horn (1965).

5.2.3.3 Horn's Parallel Analysis

This mathematical procedure generates a random data set with the same dimensions (i.e., number of participants and questions) as the one collected by the researcher. Parallel Component Analysis (one of the aforementioned factor extraction methods) is then applied to this matrix. The resulting eigenvalues are stored. One repeats this process for a minimum of 100 iterations. The average of the resulting eigenvalues is taken and compared with the factors that were extracted from the real data. Finally, the eigenvalues that exceed the randomly generated ones are used as a measure of the number of factors that explain the real data (Watkins, 2018).

The author implemented Horn's Parallel Analysis in his Python program using code based on the "psych" R library (stackoverflow, 2021), modifying it to run for 200 iterations. The result was identical to that given by Kaiser-Guttman's criterion with 8 factors being suggested. Therefore, the following steps were conducted with this

number of preliminary factors as a basis. Parallel Analysis is considered to be an accurate, albeit not widely used, procedure for factor retention in an EFA (Zwick & Velicer, 1986). Therefore, it seemed a reasonable decision.

5.2.4 Selection of rotational method

The penultimate step is selecting the rotational procedure as the data is rotated to calculate factor loadings. Following is a diagram that will serve as the basis for explaining what rotation is and what it aims at.

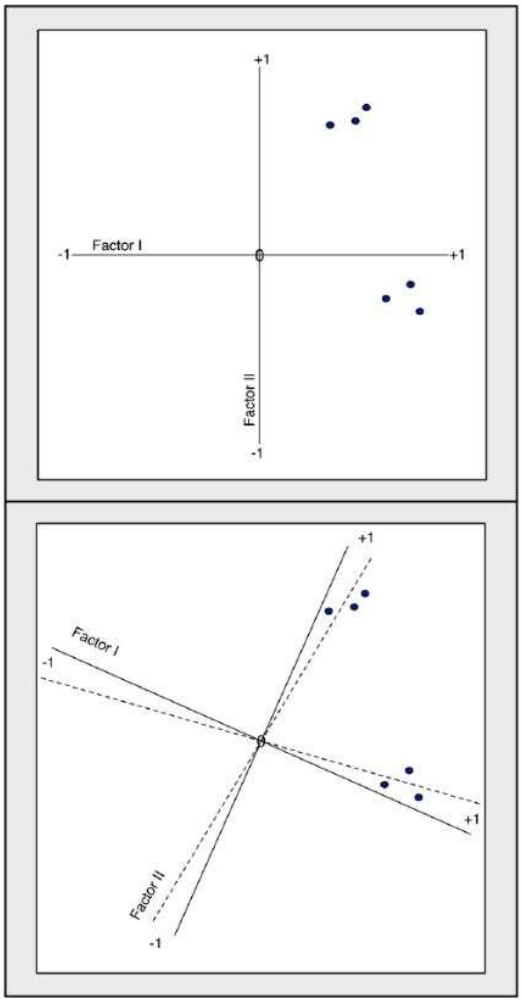

Figure 30 - Factor Rotation (Watkins, 2018, p. 232)

Factor retention methods such as Parallel Analysis produce results that are useful for further computation. They do not consider the clarity of interpretation (Fabrigar & Wegener, 2011, p. 124). Interpretation is done by humans and cannot be reduced to a mathematical formula. This is where rotation comes into play: As seen in the two-dimensional example above, the axes within factor space are rotated towards the variables (indicated by the dots). This reduces the distance between the variables and the factor axes. In this way, the factor loadings as calculated by the least-squares method are increased.

Just as with extraction methods, various alternatives exist and should be considered. They can be divided into oblique and orthogonal rotations. Orthogonal rotation leaves a 90° angle between the axes (solid lines in the above example). This means that the factors are assumed not to correlate at all (DeCoster, 1988, p.3). Oblique rotational methods do not adhere to this assumption. According to the dashed lines, there is a less than 90° angle between the two lines, which means the two factors correlate. For studies conducted in the realm of social sciences, this is the more reasonable approach, as human behavior is the result of interlinked motivations. Using an orthogonal method of rotation would lead to a loss of information if the factors were correlated. If they are not, then both groups of rotation should lead to the same result (Osborne, 2015, p.5). For these reasons, the author decided on using an oblique rotational method.

Commonly used options in this realm are known as quartimin, oblimin and promax (Park, Dailey & Lemus, 2002, p. 566). As all three of these are available in the "factor_analyzer" package, the author applied all three to the data set. As with other steps in an exploratory factor analysis, the choice is up to the researcher conducting the study (Lloret-Segura et al., 2014, p. 1163). The intent is to choose the rotation that gives the clearest factor loadings, as in the one with the simplest interpretation. One attempts to achieve three simultaneous goals:

a) minimize cross-loadings, which is items that load significantly to more than one factor (Watkins, 2018, p.235)
b) construct meaningful factors, which means those that are constituted by at least two or three variables (Henson & Roberts, 2006, p. 408)
c) keep factor loadings as high as possible – the minimum threshold is around .30 (Tabatchnik & Fidell, 2013). The author chose 0.32 as a threshold, as this resulted in clearer factors.

These three guidelines create a result that is easy to interpret and explains the inter-item correlations with the smallest number of factors possible. Should the criteria not be fulfilled, it is recommended to exclude the relevant item or items one-by-one and re-run the EFA on the reduced data set (Bandalos & Finney, 2018). For the sake of brevity, the author of this thesis will summarize the results briefly, as a total of 24 factor loading matrices were produced (8 steps x 3 rotational methods).

5.2.5 Settings selected for EFA

In order to increase the replicability of the findings, the following is a list of the settings as they were selected for the EFA in the author's Python program.

Variable	Value
Cutoff for correlation matrix	>= 66.6% pairwise item correlations > 0.3
KMO threshold	> 0.9
Bartlett's Sphericity p-value	< 0.05
Factor Extraction Method	minres (Minimum Residual)
Kaiser criterion Eigenvalue threshold	> 1
Horn Parallel Analysis iterations	200
Rotational method	Oblimin
Mimimum factor loading	0.32
Number of factors for initial run	8

Figure 31 - Settings for EFA (own work, 2022)

5.2.6 Factor loadings and interpretation

The following items were excluded, in order, with the reason for their inclusion being given after the dash:

1. "The office should be located centrally (close to infrastructure such as shops and restaurants)" – did not load significantly on any factor for all rotations
2. "The office is set up to be barrier-free" – did not load significantly on any factor
3. "Educational leave" – did not load significantly on any factor for all rotations
4. "The office is easy to reach with public transportation" – inter-item correlation criterion was not met for a sufficient number of pairs
5. "Cafeteria/restaurants" – did not load significantly on any factor for oblimin and quartimin rotations

6. “Parking facilities should be available for employees” – inter-item correlation criterion was not met for a sufficient number of pairs
7. “Fixed seating arrangement in which I have a desk/workspace which only I can use” – did not load significantly on any factor for all rotations
8. “The office is illuminated by some degree of natural light” – exhibited cross-loading
9. “Meeting rooms” – exhibited cross-loading

The reason for exclusion was based on the mathematical criteria described above. The author provides here an interpretation of why these items did exhibit the loading problems they did. The study was conducted on students enrolled in universities in Vienna. A central location was natural since the city has good infrastructure, making this item readily available. This also could have negatively influenced the perceived importance of public transportation and/or parking facilities, as these might be seen as a given. The latter could well have been caused by the nature of the sample. Students are not typically a demographic group that has the means to purchase a car.

Random selection of the sample by chance resulted in no participants with reduced mobility being included. Having an office that is barrier-free might not be valued strongly by those who are not confronted with the challenges involved in the lack of this characteristic. The item relating to educational leave might have exhibited low loadings because, as the author found out in the course of collecting data, the term “Bildungskarenz” (educational leave) is simply not well-known among students. Multiple participants asked for the meaning of this term, which was a problem that was not present in the preliminary testing of the questionnaire. As such, clarity might have been low, and the questionnaire could be modified with this fact in mind if the study were to be repeated.

Items that cross-loaded significantly onto more than one factor were excluded from further analysis to facilitate interpretation. This is the recommended procedure (Williams, Onsman & Brown, 2010). However, the items in question could have been modified to see whether the issue was based on the content of the question or whether it was structural.

After these elimination steps, the following factor loading matrix was derived. This was the same for all rotations. This is in accordance with the claim by Fabrigar & Wegener (1999, p. 283) that all oblique methods tend to lead to comparable results. In the table below, the factors are already named, a procedure that is very subjective and aims to imbue the factor constructs with sense (Pett, Lackey & Sullivan, 2003, p. 210). The author intended to represent the general, connecting sense of the items included in each factor.

Item	Office Climate	Provisions	Nature	Aesthetics	Interpersonal communication	Solitary work	Open plan office	Autonomy
The social climate at work is cohesive and friendly	0.818							
Teamwork and communication	0.799							
Technical equipment	0.791							
The office is set up with cooling systems/heaters	0.748							
Clean working environment	0.723							
Office supplies	0.703							
My supervisor appreciates me	0.659							
Open minded company values	0.610							
Clean sanitary rooms (toilets etc.)	0.596							
Relaxing space/hangout area	0.344							
The furniture is ergonomic, e.g. by offering furniture such as standing desks and height-adjustable desks	0.323							
Meal vouchers		0.822						
Fitness vouchers		0.736						
Free snacks (fruit, chocolate,..) and/or drinks		0.450						
Kitchen		0.421						
I can see nature through the window from my workspace			0.956					
I can spend my breaks outside (in nature)			0.521					
There are indoor plants at or near my workspace			0.479					
The office contains art				0.795				
I can decorate my own workplace				0.751				
Meetings should be held in person					0.793			
Being able to reach my supervisor easily in person					0.675			
A low noise level in the office					0.332			
"Focus rooms" in which I can work alone						0.845		

Areas to be used by one person at a time only						0.645		
Flexible seating arrangement in which I can pick a workspace according to my current needs							0.992	
Workspace setup which is open and in which I am not spatially or visually isolated from my colleagues							0.346	
Having the opportunity to work from home								0.790
Being able to choose when I work over having fixed starting and end times								0.406

Figure 32 - Factor loading matrix (own work, 2022)

5.2.7 Interpretation and labeling

Thus, eight factors were found to influence the attractiveness of potential employers as seen by engineering and business students in Vienna. While the loading matrix is provided "as is", the author of this thesis will provide his own, subjective interpretation below. The names given are purely hypothetical, named according to "what their most salient manifest variables have in common" (Watkins, 2018, p. 236). The reader is advised that these names are purely given to make verbal communication easier and do not necessarily correspond to a real concept (Kline, 2015, p. 300).

Office Climate: The items that constitute this factor relate to two characteristics a potential employer provides. One set of items contributing to this factor relates to the social climate, as in well-being due to having colleagues that they enjoy spending time with, are appreciated by and can collaborate with well. As man is a social animal, this makes intuitive sense and does, in the eyes of the author, not merit further discussion.

The second set of variables included here describes the office per se, which should be well-equipped both architecturally as well as from an equipment standpoint. Ergonomic furniture, a clean and well-tempered office, and the appropriate supplies to fulfill tasks quickly and with ease – these variables are attractive to prospective employees. Companies looking for highly qualified staff would do well to keep this in mind and provide the appropriate aspects.

Provisions: The participants in the study saw the attractiveness of their prospective employers influenced by the availability of a kitchen, snacks, meal vouchers and fitness vouchers. All these items relate in one way or another to the diet of the student. An interesting aside is that one additional item, "There is a possibility to buy and eat lunch in the office (cafeteria, restaurants,...)", which also relates to nutrition,

did not load to any factors for two of the three rotational methods. The reason for this could be sought in the wording of the question, a test for which could be re-running the questionnaire with a differently formulated item. Or, possibly, participants' behavior simply is not influenced significantly by the content asked in this particular item.

Furthermore, the factor loadings – while significant for all items that make up this factor – were higher for the two items that are indirect salary increases (in the form of vouchers). This leaves room for the interpretation that it is not solely the provisional aspect that seems attractive to potential employees, but rather the financial gains. As stated above, the interpretation is left to the reader.

Nature: Students of business and engineering value the availability of natural elements in their working environment, be it in the form of plants or vistas. Employers are advised to keep this fact in mind when decorating their offices and when planning the location of their buildings. Proximity to some sort of park or other natural area both provides the desired views as well as the option of spending their breaks surrounded by vegetation.

Aesthetics: While this factor consists of only two items, the factor loadings exhibit a large amount of significance and are conceptually intertwined. Employers should strive to provide a workplace that contains some form of art and enable their staff to customize their close environment.

Interpersonal communication: This factor is made up of variables that relate to being able to exchange information with colleagues in person. One of the three items loading significantly is correlated to a significantly lower degree than the others ("A low noise level in the office"). This intuitively makes sense - while a quiet workplace can facilitate conversating with other employees, it is not a direct contributor. However, the author did not exclude the item from the factor, as it persisted through the rigorous mathematical process of eliminating factors according to the criteria mentioned further above.

Solitary work: In rather stark contrast to the preceding factor, the answers given by participants in the underlying study suggest that prospective employees value the opportunity to work by themselves. This is not necessarily a logical fallacy - it is quite possible that one and the same worker sees the need to focus on thought-intensive tasks on his own and then communicate the results or brainstorm with other workers in person. Furthermore, as both business and engineering students working in an office will likely execute a wide gamut of different tasks. Therefore, a variety of environments could be sought during the workday.

On a personal note, the author thinks back on his time as both a business and engineering student and can relate to this apparent conundrum. For some mentally

challenging tasks, it was deemed necessary to focus completely in a quiet room without distractions. Group projects or open questions were better discussed among a group of like-minded individuals. It is the subjective interpretation of the author that participants had similar experiences and therefore seek the same possibility in their future offices.

Open plan office: Being able to choose where they work within a given office, influences the workplace attractiveness in the eyes of respondents. In conjunction with the absence of isolating setups, the author suggests that this means being able to choose colleagues within one's proximity either for reasons of collaboration or purely for sympathy. Both exchanging work-related or personal information can be seen as important. Forging bonds and friendships with colleagues over small talk and/or trading vital information related to the task at hand contributes to productivity and enjoyment of work.

Autonomy: As the participants in the study were students, from a personal standpoint it seems obvious that flexibility in the schedule, both geographically as well as temporary, is sought after. During the COVID-19 pandemic, which has induced drastic changes in the studying conditions, remote work has seen a significant increase. Both business and engineering students had, at the time the interviews were conducted, participated in mandatory and voluntary virtual classrooms. This experience could easily have influenced the perceived attractiveness of the "work from home" option.

As described in an earlier chapter, studies have shown that employees value the work-life balance provided by their workplace to a significant degree. This can also mean not having to adapt to an externally imposed rhythm, especially in office environments where tasks might have a deadline which is set in weeks rather than hours. Even in group projects, when one's contribution is not time-critical, but rather forms a part of the whole output, employees often do not see the need to conform to a 9-to-5 schedule. Rather, they want to be able to work whenever they feel most productive or when it most fits their personal schedule. Hence, being able to choose the beginning and end times (within the limits of whatever the agreed number of working hours is, obviously) is an item that is valued highly by prospective office workers.

5.2.8 Reliability of the factors

As a final step, the author submitted the factors to a test of their reliability. This term is used to represent internal consistency, meaning how dependably a measurement scale measures what it should measure (Polit & Beck, 2004, pp. 35-36). In the context of the application proposed in this part of the thesis, reliability refers to how well the factors measure one and the same underlying, latent construct. One of the

most employed mathematical tests for reliability is known as Cronbach's coefficient alpha (Cronbach, 1951; Vaske, Beaman & Sponarski, 2017). For a two-item scale, which four of the eight factors represent, this is not seen as an appropriate method, and the use of the Spearman-Brown statistic is recommended (Brown, 1910; Eisinga, Grotenhuis & Pelzer, 2013, p. 8; Spearman, 1910).

For this reason, the author used Cronbach's alpha for the factors that contain more than two items and Spearman-Brown for the rest. Their interpretation is similar: a value closer to 1 is equivalent to a higher degree of reliability. Specifically, for the alpha the existing literature considers values between .65 and .80 to be adequate in research on human dimensions (Vaske, 2008). As an additional test, the author calculated the "alpha if deleted" of the factors, a test that shows whether the coefficient alpha would increase for a given factor if a particular item is increased. If deletion would lead to a higher alpha, then that item could be eliminated from the factor.

5.2.8.1 *Cronbach's coefficient alpha*

In this subchapter, tables showing the "alpha if deleted" for factors containing more than two items and an interpretation of the values contained therein will be given. As explained above, alpha measures the amount of variance that is systematic (or consistent) in a given set of items (i.e. responses to a survey). Alpha usually varies between the values of 0 to 1, but with negative correlation among items, negative alpha is possible (Vaske, Beaman & Sponarski, 2017, p.165). DeVellis & Thorpe (2021) introduce the following scale to interpret alpha:

Value	Interpretation
<0.6	Unacceptable
0.60 to 0.65	Undesirable
0.65 to 0.70	Minimally acceptable
0.70 to 0.80	Respectable
0.8 to 0.9	Very good
>.90	Consider shortening the scale (i.e. multicollinear[4]).

Figure 33 - Levels of alpha and their interpretation (DeVellis & Thorpe, 2016, pp. 136-137)

Factor „Office Climate“, α = 0.930816	**Cronbach's Alpha if Item Deleted**
Relaxing space/hangout area	0.930582227
The furniture is ergonomic, e.g. by offering furniture such as standing desks and height-adjustable desks	0.928726938
Clean sanitary rooms (toilets etc.)	0.926119669
Office supplies	0.926018866
Open minded company values	0.924852176
My supervisor appreciates me	0.92347397
The office is set up with cooling systems/heaters	0.922638638
Clean working environment	0.922064151
Technical equipment	0.921805297
Teamwork and communication	0.921325756
The social climate at work is cohesive and friendly	0.920679088

Factor „Interpersonal Communications“, α = 0.706509	**Cronbach's Alpha if Item Deleted**
A low noise level in the office	0.763219248
Meetings should be held in person	0.554678949
Being able to reach my supervisor easily in person	0.484766563

Factor „Provisions“, α = 0.784392	**Cronbach's Alpha if Item Deleted**
Kitchen	0.795126074
Free snacks (fruit, chocolate,..) and/or drinks	0.759215637
Fitness vouchers	0.697188168
Meal vouchers	0.663996008

Factor „Nature“, α = 0.795181	**Cronbach's Alpha if Item Deleted**
I can spend my breaks outside (in nature)	0.786920131
There are indoor plants at or near my workspace	0.753313106
I can see nature through the window from my workspace	0.607935196

Figure 34 - Cronbach's coefficients for the various factors (own work, 2022)

As can be seen, the reliability of the factors as measured by Cronbach's coefficient is "very good", meaning that the items contained therein measure the same latent construct. This bolsters the argument for the eight factors that were derived to be representative of the sentiments of the respondents. One observation is that two factors, "Interpersonal communications" and "Provisions", could be even more internally reliable if one item were removed. It seems intuitively reasonable that these items do not explain the same factors as the other two items (as the author mentioned in the interpretation): a low noise level does not correspond to interpersonal communication as much as the other two. If this item were deleted, the labeling would seem even more fitting. The author decided not to drop this item, though, as the alpha value still is rather significant with a value of 0.7065.

For the factor "Provisions", the item that is related to the availability of a kitchen in the office has a negative influence on the internal consistency of the factor. While this might seem baffling at first, the author proposes that the item could be renamed "Non-fiscal bonuses". The interpretation would be that employees seek an indirect salary increase. The food aspect is not one of the perks they value highly. As the increase in alpha is not very significant, this factor was left "as-is" as well.

The factor "Office Climate", which is made up of 11 items, has an alpha value that suggests that it could be shortened, meaning some items might be removed. However, Cronbach's coefficient would exceed the threshold of 0.9 even if all but one item were to be dropped. One could interpret this as the factor being overloaded with items. This opens the possibility of rerunning the EFA with a different (that is, a larger) number of factors. One could then see if this particular factor would be split up into two separate ones. The items contained in this factor can be divided somewhat loosely into the equipment provided in a place of work and the social climate in this workplace. The author suggests that further division could potentially lead to two new factors along those lines. However, as factors are always a matter of personal interpretation, it was chosen to keep the factor as is and leave any interpretation up to the reader.

5.2.8.2 *Spearman-Brown prediction formula*

Four (i.e., half) of the factor consist of two variables only. For this reason, and as described above, Spearman-Brown was applied in lieu of Cronbach's alpha. This formula was originally developed to predict reliability when the number of items on the scale is changed (Brown, 1910; Spearman, 1910). Unfortunately, there is no consensus on what values of Spearman-Brown are still considered acceptable. It is recommended to compare the values with those of Cronbach. One rule of thumb is that even scales with a low value of this statistic can be included if it seems more sensible than excluding them (Eisinga, Grotenhuis & Pelzer, 2013). The author decided to do just that, but it is up to the reader to decide whether further EFA, or re-formulating the questionnaire, seems reasonable.

Factor	Spearman-Brown statistic
Aesthetics	0.6768
Solitary work	0.6601
Open plan office	0.5649
Autonomy	0.4675

Figure 35 - Spearman-Brown predictions for the various factors (own work, 2022)

6 Designing an attractive workplace

To reiterate, the research question was as follows: "*Which specific criteria influence the workspace attractiveness of the offices of future employers as seen by students of engineering and business studies in Vienna in the year 2022 and which underlying factors can be distilled from these criteria?*" The answer can be found in the factors that were found during the exploratory factor analysis, displayed in the Factor loading matrix (see Figure 32).

Therefore, what can employers do to design an office environment that is perceived as attractive to business or engineering students? Companies seeking to hire the elite are advised to keep the eight factors that were identified during this thesis in mind. They are an expression of what potential employees value highly. Thus, they increase the chance of hiring and retaining the most-qualified prospects, which is an essential goal of workplace strategy (Redlein, Höhenberger & Turnbull, 2020). This chapter is meant to give practical advice on how to devise an office that adheres to the findings of the author's research.

6.1 Implementing the factor „Office Climate"

The social climate at work is cohesive and friendly
Teamwork and communication
Technical equipment
The office is set up with cooling systems/heaters
Clean working environment
Office supplies
My supervisor appreciates me
Open minded company values
Clean sanitary rooms (toilets etc.)
Relaxing space/hangout area

Figure 36 - Items constituting the factor "Office Climate" (own work, 2022)

An employer that aims to create an office environment in line with this factor of workplace attractiveness has to follow a two-pronged approach. First, a socially cohesive, open-minded climate needs to prevail. Management can help establish open-mindedness by encouraging employees to carry out project activities in a flexible manner that allows changes during the process (Thomke & Reinertsen, 1998). Failure should not be seen as a negative outcome, but rather as part of learning a new skill or habit (Schein, 1993). Social cohesion can be improved through

teambuilding exercises such as group sport activities (Spaaij, 2013). Relaxing spaces contribute to this by enabling social interaction and improving creativity (Meinel et al., 2017).

Furthermore, the employer should make sure that appreciation by the supervisor is openly expressed to employees and teamwork and communication are fostered. One way to make employees feel appreciated is by giving feedback regularly, verbally or in written form, on the behavior observed (Chur-Hansen & McLean, 2006). Supervisor feedback should come in the form of helpful information based on which the individual can develop and improve his or her work performance (Zhou, Hong & Liu, 2013).

Communication and teamwork, on the other hand, are strongly correlated with the spatial layout of the office (Sailer & McCulloh, 2012). Distances between the individual desks should be kept small and appropriate tools for working with colleagues, such as meeting rooms with whiteboards and other office supplies, provided (Zamani & Gum, 2019). This can in turn facilitate the formal and informal exchange of information, which increases the sense of community and collaboration (Kılıç Çalğıcı, Czerkauer-Yamu & Çil, 2013). Technical equipment that is suitable for both individual and group work needs to be made available as well, so that workers can fulfill their tasks efficiently and effectively.

The second subset of items deals with the cleanliness and temperature of the office environment and its facilities. Links have been reported between cleanliness and learning performance, productivity, and health (Campbell & Bigger, 2008; Chan & Liu, 2018; Horrevorts Van Ophem & Terpstra, 2017; Mahbob et al., 2011). Facility managers should therefore ensure that the office is regularly cleaned. Adequate cooling/heating systems should be installed, since temperature influences the well-being, fatigue, and productivity of employees (Seppanen, Fisk & Lei, 2006; Tanabe, Nishihara & Haneda, 2007).

6.2 Implementing the factor „Provisions”

Meal vouchers	0.822
Fitness vouchers	0.736
Free snacks (fruit, chocolate,..) and/or drinks	0.450
Kitchen	0.421

Figure 37- Items constituting the factor "Provisions" (own work, 2022)

To meet the criteria that are found under this umbrella, an employer should provide meal and fitness vouchers as well as snacks and possibly a kitchen. Appropriate

nutrition is directly correlated with health and well-being, which is a fundamental aspect of learning (Levinger, 1992). It also reduces absenteeism, leading to reduced medical costs. Furthermore, the employer can rely on his workforce more and does not need to worry about being forced to find interim replacements for highly talented employees. The social aspect cannot be ignored. Eating can be a communal element in the workplace and lead to increased exchanges of informal and formal information (Sharma & Singh, 2020).

Exercise can also serve as a social outlet to further enhance the feeling of belonging. Additionally, it has been shown that truancy decreases when a fitness program is available to employees (Cox, Shephard & Corey, 1981). Not only does regular exercise have palpable physical benefits, it is also a net positive for employee mental health (Emerson et al., 2017).

Snacking, on the other hand, helps employees to take a micro-break away from tasks to relieve frustration and fatigue and boost their energy (Sonnentag, Pundt & Venz, 2017). Due to the productivity increase, this is a positive effect for both the employer as well as the employee. Providing healthy snacks such as fruits prevents the negative effects of increased caloric, sugar and salt intake (WHO, 2019).

6.3 Implementing the factor „Nature”

I can see nature through the window from my workspace	0.956
I can spend my breaks outside (in nature)	0.521
There are indoor plants at or near my workspace	0.479

Figure 38 - Items constituting the factor "Nature" (own work, 2022)

Offices can often be perceived as stressful environments that lead to increases in stress and fatigue (Chang & Chen, 2005). Full-time employees are expected to spend a third of their day in these environments. Studies have shown that green surroundings positively influence job satisfaction, employee performance and turnover (Kaplan et al., 1996; Leather et al., 1998). This can be achieved by window views of nature or spending time outside (Lottrup et al., 2015). Companies are urged to consider this finding when selecting the location of their office buildings.

Additionally, or alternatively, including live plants in the office can serve a similar purpose. Employees working in workplaces that are equipped with houseplants report higher quality of life, less frustration, and being more satisfied with their job (Dravigne et al., 2008). The availability of nature is one of the factors that influence

workplace attractiveness, so competitive employers should consider going "green" in their interior design decisions.

6.4 Implementing the factor „Aesthetics”

The office contains art	0.795
I can decorate my own workplace	0.751

Figure 39 - Items constituting the factor "Aesthetics" (own work, 2022)

Business and engineering students were shown to value the items making up this factor when rating workplace attractiveness. The findings are consistent with existing research: When employees are allowed to express their individual identities through personal decoration and artifacts, their output becomes higher quality, they are more satisfied with their work, and they collaborate better with others (Sari, 2020; Sundstrom & Altman, 1989; Town, 1982). Desk décor is also a means of representing one's status within the organization. This leads to better communication among employees by subconsciously establishing a social ranking system (Steele, 1973). Personalizing one's own immediate office surroundings should therefore be allowed by employers looking to appear as attractive as possible.

The physical surroundings are not only comprised of the desk and its decorations, but also of aspects such as art and design. Several researchers have concluded that employee satisfaction and the aesthetics of their environment are interlinked (see e.g. Bjerke & Ind, 2015). Furthermore, artwork can generate conversation, enhance personal connections, and improve the perception of the office environment in general (Smiraglia, 2014). It was also shown to prevent burnout and reduce stress (Italia et al., 2008; Rollins, 2011). Therefore, an attractive workplace is one that includes some sort of artwork, which employers should take into consideration.

6.5 Implementing the factor „Interpersonal Communication”

Meetings should be held in person	0.793
Being able to reach my supervisor easily in person	0.675
A low noise level in the office	0.332

Figure 40 - Items constituting the factor "Interpersonal Communication" (own work, 2022)

“No man is an island” – Donne's poem also seems applicable to the modern office environment. Employees long for frequent face-to-face communication with their bosses. This mode of interaction gives them higher perceived job satisfaction, ratings of their leaders' effectiveness increase, and they identify more with their teams

(Braun et al., 2019; Mishra, Boynton & Mishra, 2014). Despite the – as of the time of this writing - ongoing COVID-19 pandemic, employers should therefore establish regular “office hours” in which they are personally present and available to their subordinates. Personal meetings are another way to help establish trust among employees and enhance their engagement with the tasks at hand (Saks, 2006). Therefore, to appear more attractive as an employer, in-person meetings are strongly recommended.

The noise level of workers’ surroundings is correlated with the ability to concentrate and remain productive at a high level (Sundstrom et al., 1994). With appropriate acoustic modifications, or noise-cancelling headphones, a level of background noise can be maintained that does not negatively affect work satisfaction (Kwon, Remøy & Van Den Dobbelsteen, 2019). Separate quiet rooms and “talking areas” are another architectural method of creating an attractive office.

6.6 Implementing the factor „Solitary Work”

"Focus rooms" in which I can work alone	0.845
Areas to be used by one person at a time only	0.645

Figure 41 - Items constituting the factor "Solitary Work" (own work, 2022)

As mentioned in the preceding chapter, sonic disturbances can be perceived as a nuisance that distracts from work tasks. These can come in the form of telephones, people talking, ventilation systems or office equipment such as printers (Sundstrom et al., 1994). While being able to collaborate easily with colleagues is perceived as beneficial, the stress level increases along with the increased sound of conversations. This, however, can be mitigated by giving employees access to quiet rooms (Haapakangas et al., 2018).

In light of the fact that study participants rated the respective criteria as attractive, employers and office architects should design their workplaces accordingly. A so-called “activity-based office” (offering different work environments for different activities) with an appropriate number of quiet, solitary rooms is preferred over the alternative, traditional setup and makes for a more attractive office in the eyes of business and engineering students (Rolfö, Eklund & Jahncke, 2018).

6.7 Implementing the factor „Open Plan Office”

Flexible seating arrangement in which I can pick a workspace according to my current needs	0.992
Workspace setup which is open and in which I am not spatially or visually isolated from my colleagues	0.346

Figure 42 - Items constituting the factor "Open Plan Office" (own work, 2022)

Flexibility is an aspect of the workplace that elicits a large positive response from office employees (Lahtinen, 2021). It promises to be beneficial for interaction, communication and the ability to control time and space among and by office workers (Engelen et al., 2019). These positive effects need to be weighed against the drawbacks including reduced productivity and possible negative influences on health through mental stress (Evans & Johnson, 2000). The criteria described in the factor “Solitary Work” offer some counterweights to these disadvantageous effects.

This study’s participants did prefer a flexible seating arrangement, which is why employers seeking to target business and engineering students in Vienna might benefit from implementing such a setup. Furthermore, the sampled population also preferred an open office, in which partitions between employees and their workstations do not exist. Privacy concerns, which are often mentioned in the literature (see e.g.: De Been & Beijer, 2014), do not seem to influence the attractiveness of a potential employer negatively.

6.8 Implementing the factor „Autonomy”

Having the opportunity to work from home	0.790
Being able to choose when I work over having fixed starting and end times	0.406

Figure 43 - Items constituting the factor "Autonomy" (own work, 2022)

Remote work has been shown to lead to increased workplace satisfaction and a higher quality of life through saving time that can be spent with family or friends (Kaduk et al., 2019; Skalski et al., 2020). Having some control over one’s working time is another aspect of job satisfaction (Gajendran & Harrison, 2007). Both allowing remote work as well as giving workers some influence over working times should therefore be considered by employers who wish to be perceived as attractive. A hybrid model is quite possible, as routine tasks might want to be performed in the office, while work requiring more focus might want to be shifted to the home setup, at least by some employees (Redlein & Thrainer, 2022).

7 Limitations & further research

Naturally, the results of any study are subject to limitations in the matters of study design, execution, and analysis. The limitations of this thesis will be described in this chapter. Furthermore, the author will sketch a few possible lines of research that could be followed from the data collected and the findings of this study.

The first step, data collection, was conducted by the author himself using the questionnaire provided in this thesis. Whenever one employs such a tool, one needs to keep in mind that there are some innate problems that are introduced: First of all, the wording of the questions, while clear to the author, could be perceived as misleading. When combined with an expert's input, the a priori test of the questionnaire can help minimize these issues, but they can still lead to inaccurate results. This is a problem especially for those who do not speak the language natively but is not limited to this group. Unclear prompts might have been the cause of exclusion of some of the items that did not load on the factors found in the course of the EFA.

The cultural background of participants could also be sampled during the questionnaire phase, which then opens up the possibility of sub-segmenting the answers along these lines. Cultural expression extends to the workplace. The conclusion might be drawn that members of various social groups could potentially weigh the important aspects of their prospective workplaces differently.

Additional analysis along this line of thought could conduct research as to what demographic markers influence which factors most significantly. The sample size for each population group (business and engineering students, respectively) is conducive to answering these questions. If an employer seeks to hire staff from a wide array of demographic sectors, they are well advised to keep in mind the possible differences in perceived workplace attractiveness.

As for exploratory factor analysis, it is a procedure in which a researcher has to make decisions that can influence the results of the analysis. For a detailed description, the reader can refer to the relevant chapter. The author of this study chose a rotational method and a factor extraction method based on what were deemed valid reasons. Due to the subjective nature of EFA, other researchers may choose alternative options at these bifurcations. The mathematics vary, which could lead to different factors, allowing for an interpretation that is in disagreement with the one presented in this thesis.

Furthermore, during EFA a few items were excluded due to cross- or zero-loading, or due to a low level of pairwise correlations with other variables. As the literature does not agree on a rigorous exclusion criterion, but rather states rules of thumb, repeat

analysis of the data does not necessarily lead to the exact same factor loadings, and hence to different factors. Some sources even recommend not excluding the factors but re-doing the data collection phase with a questionnaire in which the wording is changed for these critical items. This would have exceeded the scope of this thesis but presents itself as an opportunity for further research.

The final step of EFA, interpretation and labelling of these self-same factors, is the one that is most heavily influenced by the researcher as a person. As the name suggests, the procedure explores what factors could influence human behavior, so different interpretations are possible. It was for this reason that the factor loading matrix was presented “as-is” and each step was detailed, so any researcher reading this thesis can come to his own conclusions. The particular factors chosen by the author represent his idea of what the data means and are not set in stone, nor should they be taken as such.

8 Conclusion

To answer the research question of this thesis, the author collected data from a relevant sample by means of a multi-item questionnaire. This questionnaire contained demographic questions as well as items related to workplace attractiveness as perceived by prospective future employees. Related research was used to create the questionnaire. The literature review also helped the author gain an understanding of the status quo of research in the realm of workplace attractiveness.

In a further step, the data was subjected to both descriptive analysis as well as exploratory factor analysis. Briefly, the results can be summed up as showing that there are eight factors that influence the attractiveness of a potential workplace for business and engineering students in Vienna: Office Climate, Provisions, Nature, Aesthetics, Interpersonal Communication, Solitary Work, Open Plan Office, and Autonomy. The names are expressions of what items constitute the factor, and for detailed descriptions the reader is referred to the relevant chapters.

The items that are contained in these factors were rated similarly by participants from the two subpopulations. There were no significant differences between what made a potential workplace attractive to business or engineering students. Restricting the research to those students who intend to work in an office might have influenced this result. The working environment within an office is quite homogenous and not as discipline-dependent and different as the content of the two curricula is. Therefore, an attractive workplace can be designed that satisfies applicants from both disciplines, who will, after all, often find themselves employed alongside each other in the same office. Naturally, it follows that the factors derived from the criteria are also identical for both populations.

Employers are advised to consider the findings presented in this thesis when designing their offices and when faced with hiring decisions. It is only when there is a match between the expectations of a potential employee and the office environment presented by the company that both sides are satisfied. If one aims to hire elite talent, one needs to adapt to their needs. The days when employees meekly accepted any open position are gone – workers now are more demanding than ever. As this thesis shows, they have a clear image of what they expect in a workplace, and are willing to select jobs that fulfill their criteria. Companies that value employer branding are well-advised to integrate research such as this study into their strategies. Designing the workplace of the future should be done with the findings of this thesis in mind – design for the best, or hire the rest.

9 Appendix

9.1 Original version of the questionnaire

Interested readers can find the original version of the questionnaire in its entirety in this sector of this thesis. It is presented “as is”, meaning it was this exact version that was presented to the participants.

Fragebogen

Liebe TeilnehmerInnen der Umfrage,

mein Name ist Linus Fraundorfer, und als Student der TU Wien führe ich diese Umfrage im Rahmen meiner Masterarbeit durch. Sie zielt darauf ab, die Anforderungen potenzieller ArbeitnehmerInnen an ihren zukünftigen Arbeitsplatz zu analysieren.

Die einzige Voraussetzung ist, dass Sie ein/e angehende/r Angestellte/r für einen Bürojob sind und derzeit an der Wirtschaftsuniversität (WU) oder der Technischen Universität (TU) Wien studieren.

Das Ausfüllen der Umfrage sollte ca. 5-7 Minuten in Anspruch nehmen.

Die Teilnahme ist völlig anonym und freiwillig. Sollten Fragen auftauchen, zögern Sie bitte nicht, mich unter folgender E-Mail-Adresse zu kontaktieren: e0753092@student.wien.ac.at

Ich danke Ihnen im Voraus für Ihre Zeit und wünsche Ihnen einen schönen Tag!

DEMOGRAFISCHE/ VORLÄUFIGE DATEN:

Bitte kreuzen Sie an oder markieren Sie die richtige Antwort. Bei leeren Feldern geben Sie bitte die richtige Antwort ein.

vii.	Geschlecht:	M | W | Sonstige
viii.	Studienrichtung:	Ingenieurswissenschaften | Betriebswirtschaft
ix.	Spezialisierung (WU) oder inskribiertes Studium (TU):	
x.	Aktuelles Semester:	

xi.	Aktuelles Alter:	
xii.	Bisherige Berufserfahrung:	XX Jahre Vollzeit/Teilzeit

1. -Das erwartete Anfangsgehalt in EUR (brutto, pro Monat):	2.000 - 2.500 2.500 - 3.000 3.000 - 3.500 3.500 - 4.000 Ab 4.000
2. -Die maximale Anfahrtszeit zum Unternehmen (einfache Strecke) sollte folgenden Wert nicht überschreiten:	15 Minuten 30 Minuten 45 Minuten 1 Stunde
3. - Wie viele Stunden pro Woche möchten Sie nach Ihrem Studienabschluss arbeiten?	8-16 Stunden 16-24 Stunden 24-32 Stunden 32-40 Stunden Mehr als 40 Stunden
4. -Welchen Prozentsatz Ihrer Arbeitszeit würden Sie gerne von zuhause arbeiten können?	100% 75% 50% 25% 0%

Für alle Fragen, in denen eine Skala angegeben ist (1 2 3 4 5 6 7): Bitte bewerten Sie auf einer Skala von 1 bis 7, wobei 7 der höchste Wert ist, wie wichtig Ihnen der jeweilig angegebene Aspekt Ihres zukünftigen Arbeitsplatzes ist.

Grundlagen (1…nicht besonders wichtig // 7…äußerst wichtig)

5. -Das Büro ist leicht mit den öffentlichen Verkehrsmitteln erreichbar	1 2 3 4 5 6 7 (1…nicht besonders wichtig // 7…äußerst wichtig)
6. -Das Büro sollte zentral gelegen sein (in der Nähe von Infrastrukturen wie Geschäften und Restaurants)	1 2 3 4 5 6 7 (1…nicht besonders wichtig // 7…äußerst wichtig)

7. -Für Angestellte stehen ausreichend Parkplätze zur Verfügung	1 2 3 4 5 6 7 (1…nicht besonders wichtig // 7…äußerst wichtig)
8. - Die technische Ausrüstung, die mir zur Verfügung steht, ist ausreichend, um meine Arbeitsaufgaben effizient zu erfüllen	1 2 3 4 5 6 7 (1…nicht besonders wichtig // 7…äußerst wichtig)
9. - Das Büro ist barrierefrei eingerichtet	1 2 3 4 5 6 7 (1…nicht besonders wichtig // 7…äußerst wichtig)
10. - An meinem Arbeitsplatz gibt es eine verbindliche Kleiderordnung für Arbeitnehmer	1 2 3 4 5 6 7 (1…nicht besonders wichtig // 7…äußerst wichtig)

Arbeitsumfeld: (1…nicht besonders wichtig // 7…äußerst wichtig)

11. - Ich fühle mich von meinem Vorgesetzten für meine Arbeit wertgeschätzt	1 2 3 4 5 6 7 (1…nicht besonders wichtig // 7…äußerst wichtig)
12. - Ich empfinde das soziale Klima am Arbeitsplatz als kohärent und freundlich	1 2 3 4 5 6 7 (1…nicht besonders wichtig // 7…äußerst wichtig)
13. -Zwischen den Angestellten wird Teamwork und aktive Kommunikation praktiziert	1 2 3 4 5 6 7 (1…nicht besonders wichtig // 7…äußerst wichtig)
14. -Das Unternehmen pflegt eine aufgeschlossene („open minded“) Firmenphilosophie	1 2 3 4 5 6 7 (1…nicht besonders wichtig // 7…äußerst wichtig)
15. -Meetings sollten persönlich stattfinden und nicht über Onlinetools wie zB Zoom, Webex,..	1 2 3 4 5 6 7 (1…nicht besonders wichtig // 7…äußerst wichtig)
16. -Ich kann meine/n Vorgesetze/n einfach persönlich kontaktieren	1 2 3 4 5 6 7 (1…nicht besonders wichtig // 7…äußerst wichtig)
17. - Das Büro ist so eingerichtet, dass die Kommunikation zwischen den Mitarbeitern von Angesicht zu Angesicht erleichtert wird	1 2 3 4 5 6 7 (1…nicht besonders wichtig // 7…äußerst wichtig)

Arbeitszeit: (1…nicht besonders wichtig // 7…äußerst wichtig)

18. -Ich möchte Beginn und Ende meiner Arbeitszeit frei wählen können	1 2 3 4 5 6 7 (1…nicht besonders wichtig // 7…äußerst wichtig)
19. -Ich möchte nach Ende der Arbeitszeit nicht mehr für meine Arbeitskollegen/Chefs erreichbar sein können	1 2 3 4 5 6 7 (1…nicht besonders wichtig // 7…äußerst wichtig)
20. -Es besteht die Möglichkeit, von zuhause arbeiten zu können	1 2 3 4 5 6 7 (1…nicht besonders wichtig // 7…äußerst wichtig)

Agiler Arbeitsplatz: (1…nicht besonders wichtig // 7…äußerst wichtig)

21. - Ich bevorzuge eine feste Sitzordnung, bei der ich einen Schreibtisch/Arbeitsplatz habe, den nur ich nutzen kann	1 2 3 4 5 6 7 (1…nicht besonders wichtig // 7…äußerst wichtig)
22. - Ich bevorzuge eine flexible Sitzordnung, bei der ich den Arbeitsplatz nach meinen aktuellen Bedürfnissen auswählen kann (Zusammenarbeit, Ruhe, Arbeitsmittel,...)	1 2 3 4 5 6 7 (1…nicht besonders wichtig // 7…äußerst wichtig)
23. - Ich bevorzuge eine Arbeitsumgebung, in der ich räumlich von den Arbeitsbereichen meiner Kollegen getrennt bin	1 2 3 4 5 6 7 (1…nicht besonders wichtig // 7…äußerst wichtig)
24. - Ich bevorzuge eine offene Arbeitsumgebung, in der ich weder räumlich noch visuell von meinen Kollegen isoliert bin	1 2 3 4 5 6 7 (1…nicht besonders wichtig // 7…äußerst wichtig)

Räumliche Gestaltung des Arbeitsplatzes: (1…nicht besonders wichtig // 7…äußerst wichtig)

25. - Es gibt "Konzentrationsräume", in denen ich allein oder in kleinen Gruppen ohne Ablenkung arbeiten kann	1 2 3 4 5 6 7 (1…nicht besonders wichtig // 7…äußerst wichtig)
26. - Es gibt Konferenzräume, die im Voraus reserviert werden können	1 2 3 4 5 6 7 (1…nicht besonders wichtig // 7…äußerst wichtig)
27. - Ich habe die Möglichkeit, für etwas Privatsphäre zu sorgen (Trennwände zwischen den Schreibtischen, ein eigenes Schließfach,...)	1 2 3 4 5 6 7 (1…nicht besonders wichtig // 7…äußerst wichtig)
28. -Der Lärmpegel in meiner Arbeitsumgebung ist niedrig	1 2 3 4 5 6 7 (1…nicht besonders wichtig // 7…äußerst wichtig)
29. - Das Büro verfügt über einen Entspannungsraum, in dem ich ein Nickerchen machen oder mich entspannen kann oder in dem ich mit anderen nicht arbeitsbezogenen Aktivitäten nachgehen kann (Cafeteria, Billard, Kaffeemaschinenbereich)	1 2 3 4 5 6 7 (1…nicht besonders wichtig // 7…äußerst wichtig)
30. - Es gibt eine Möglichkeit, das Mittagessen im Büro zu kaufen und zu essen (Cafeteria, Restaurants,…)	1 2 3 4 5 6 7 (1…nicht besonders wichtig // 7…äußerst wichtig)
31. - Im Büro gibt es eine Küche, in der ich mein eigenes Essen zubereiten/aufwärmen kann	1 2 3 4 5 6 7 (1…nicht besonders wichtig // 7…äußerst wichtig)
32. - In meinem Arbeitsbereich stehen Raucherräume / -bereiche zur Verfügung	1 2 3 4 5 6 7 (1…nicht besonders wichtig // 7…äußerst wichtig)

33. -Ich habe Zugang zu einem großzügigen, nicht gemeinsam genutzten persönlichen Bereich an meinem Arbeitsplatz	1 2 3 4 5 6 7 (1…nicht besonders wichtig // 7…äußerst wichtig)
34. -Es stehen ausreichend saubere Sanitäranlagen zur Verfügung	1 2 3 4 5 6 7 (1…nicht besonders wichtig // 7…äußerst wichtig)

Büroeinrichtung (1…nicht besonders wichtig // 7…äußerst wichtig)

35. -Ich kann meinen Arbeitsplatz selber dekorieren (Bilder,..)	1 2 3 4 5 6 7 (1…nicht besonders wichtig // 7…äußerst wichtig)
36. - Das Büro enthält Kunstwerke wie Gemälde	1 2 3 4 5 6 7 (1…nicht besonders wichtig // 7…äußerst wichtig)
37. - Die Möbel sind ergonomisch, z. B. durch das Angebot von Möbeln wie Stehpulten und höhenverstellbaren Schreibtischen	1 2 3 4 5 6 7 (1…nicht besonders wichtig // 7…äußerst wichtig)
38. - Die Arbeitsumgebung wird hygienisch und sauber gehalten	1 2 3 4 5 6 7 (1…nicht besonders wichtig // 7…äußerst wichtig)
39. - Die Belüftung versorgt mich mit ausreichend klimatisierter Luft	1 2 3 4 5 6 7 (1…nicht besonders wichtig // 7…äußerst wichtig)

Kontakt mit der Natur (1…nicht besonders wichtig // 7…äußerst wichtig)

40. - An oder in der Nähe meines Arbeitsplatzes befinden sich Zimmerpflanzen	1 2 3 4 5 6 7 (1…nicht besonders wichtig // 7…äußerst wichtig)
41. - Von meinem Arbeitsplatz aus kann ich die Natur durch das Fenster sehen	1 2 3 4 5 6 7 (1…nicht besonders wichtig // 7…äußerst wichtig)
42. -Ich kann meine Pausen draußen (in der Natur) verbringen	1 2 3 4 5 6 7 (1…nicht besonders wichtig // 7…äußerst wichtig)
43. - Das Büro wird durch ein gewisses Maß an natürlichem Licht beleuchtet	1 2 3 4 5 6 7 (1…nicht besonders wichtig // 7…äußerst wichtig)

Benefits (1…nicht besonders wichtig // 7…äußerst wichtig)

44. -Das Büro bietet mir kostenlose Snacks (Obst, Süßigkeiten,...) und/oder Getränke	1 2 3 4 5 6 7 (1…nicht besonders wichtig // 7…äußerst wichtig)
45. -Ich erhalte von meinem Arbeitgeber Essensgutscheine für Restaurants	1 2 3 4 5 6 7 (1…nicht besonders wichtig // 7…äußerst wichtig)
46. -Ich erhalte durch meine Anstellung Vergünstigungen oder Gutscheine in Sportclubs (Fitnessstudio o.Ä.)	1 2 3 4 5 6 7 (1…nicht besonders wichtig // 7…äußerst wichtig)
47. -Mein Arbeitgeber erlaubt mir, Bildungskarenz oder Fortbildungsurlaube in Anspruch zu nehmen	1 2 3 4 5 6 7 (1…nicht besonders wichtig // 7…äußerst wichtig)

48. -Mein Arbeitgeber stellt mir ausreichend Büromaterial (Papier, Stifte, Ordner,…) zur Verfügung	1 2 3 4 5 6 7 (1…nicht besonders wichtig // 7…äußerst wichtig)

Wenn Sie noch weitere Anforderungen an den zukünftigen Arbeitsplatz haben, die nicht im Rahmen des Fragebogens erhoben wurden, so teilen Sie mir diese bitte im folgenden Bereich mit:

9.2 Source code of Python program

```
##################################################

####Read in pre-processed data

##################################################


##READ IN

df= pd.read_csv("workingQuestionnaire_descTry.csv").iloc[:, 1:]

# df = df.sample(frac=1).reset_index(drop=True)

# df= pd.read_excel("workingQuestionnaire_desc.xlsx").iloc[:, 11:]

##################################################

####Preliminary analysis of correlations via correlation matrix

##################################################


#shows correlation matrix of data

corrMatrix = df.corr()


#counts number of occurrences of correlation <= 0.3 per row

#'how often does each item show a correlation <= 0.3 with other items?'

def count_values_in_range(series):

    return series.le(0.3).sum()
```

```
corrMatrix["n_values_in_range"] = corrMatrix.apply(
    func=lambda row: count_values_in_range(row), axis=1)
corrMatrixSorted = corrMatrix.sort_values('n_values_in_range')
#dropping items with more than a specifc # of occurrences of above criterion
#this cutoff was arbitrarily chosen by author as being 2/3 = 66.6%
#Reason: 30 out of 44 "Likert-type"questions equals 68% of data


#number of occurrences noted as comment
dfPostDrop = df.drop(columns=['[There is a mandatory dresscode for employees]', #32
                              'The office is set up to facilitate face-to-face communication between employees', #43
                              '[Not being able to be reached after working hours]', #35,
                              '[Workspace setup in which I am spatially separated from the workspaces of my colleagues]', #31
                              '[To have access to generous, non-shared personal space at my workplace]', #32
                             '[Smoking area]', #31
                             ], axis = 1)
corrMatrixPostDrop = dfPostDrop.corr()
corrMatrixPostDrop["n_values_in_range"] = corrMatrixPostDrop.apply(
    func=lambda row: count_values_in_range(row), axis=1)


#highest # of occurences is now 25/38 = 65.8%
```

```
##Setting up a class which contains results of EFA

class EFA:

    def __init__(self, name, kmo, bartlett, eigenvalues, kaiser, horn, loadings, cumvar, cronbach):

        self.name = name

        self.KMO = kmo

        self.Bartlett = bartlett

        self.Eigenvalues = eigenvalues

        self.Kaiser = kaiser

        self.Horn = horn

        self.Loadings = loadings

        self.CumulatedVariance = cumvar

        self.Cronbach = cronbach


##################################################

####Factorability of post-drop-data: KMO & Bartlett

##################################################


#Kaiser-Mayer-Olkin-Criterion (KMO)

    def kmo(self, df):

        from factor_analyzer.factor_analyzer import calculate_kmo

        kmo_all,kmo_model=calculate_kmo(dfPostDrop)

        self.KMO = kmo_model

        #Returns value of KMO criterion, should be above 0.8

        # return kmo_model

        print("KMO: (> 0.9?) ", kmo_model, " , ", kmo_model > 0.9)
```

```
#Bartlett's Test of Sphericity
    def bartlett(self, df):
        from factor_analyzer.factor_analyzer import calculate_bartlett_sphericity
        chi_square_value,p_value=calculate_bartlett_sphericity(dfPostDrop)
        chi_square_value, p_value
        self.Bartlett = p_value
        return p_value
    #Returns p-value of Bartlett's test, should be below 0.05
        print("Bartlett Sphericity: (p < 0.05?) ", p_value, " , ", p_value < 0.05)


##################################################
####Factor Retention: number of factors considered
####(Part 1): via Kaiser Criterion, Scree Plot
##################################################
#Kaiser Criterion
    def kaiser(self, df):
        #apply to non rotated data
        fa = FactorAnalyzer(rotation=None)
        fa.fit(df)
        # Check Eigenvalues for those exceeding 1
        ev, v = fa.get_eigenvalues()
        count = sum(1 for i in ev if i > 1)
        print(count, " eigenvalues above 1 - Kaiser")
        big_evs = sum(i for i in ev if i > 1)
        total_evs = sum(ev)
        print(big_evs, " total of EVs - Kaiser")
```

```
        print(float(big_evs/total_evs), " cumulative variance of EVs - Kaiser")
        ev
        self.Eigenvalues = ev

#Scree Plot
##############disabled to speed up

        # plt.scatter(range(1,df.shape[1]+1),ev)
        # plt.plot(range(1,df.shape[1]+1),ev)
        # plt.title("Scree Plot")
        # plt.xlabel("Number of Factors")
        # plt.ylabel("Eigenvalue of Factor")
        # plt.axhline(y=1,c='k')
        # plt.grid()
        # plt.show()
        evCriterion = 0
        for eigenvalue in ev:
            if eigenvalue > 1:
                evCriterion +=1
        self.Kaiser = evCriterion
        return evCriterion
```

```
#Factor Loadings
    def loadings(self, df, numberOfFactors):


        #Comparing results for various rotations
        # fa = FactorAnalyzer(n_factors = numberOfFactors, rotation='promax', method='ml')
        rotationsOrthogonal = ["varimax", "oblimax" , "quartimax" , "equamax" ]
        rotationsOblique = ["promax", "oblimin", "quartimin"]
        factorsOrthogonal = []
        factorsOblique = []
        #Orthogonal rotations
        for rota in rotationsOrthogonal:
            #fitting factor analyzer with various rotations
            fa = fa = FactorAnalyzer(n_factors=numberOfFactors, method='minres', rotation=rota)
            fa.fit(df)
            #getting loadings for data
            loadingsArray= fa.loadings_
            #converting np.array to DataFrame
            loadingsDataframe=(pd.DataFrame(fa.loadings_,index=df.columns))
            ##dropping all values below 0.32 (Lloret)
            loadingsDataframePostDrop = loadingsDataframe.where(abs(loadingsDataframe) > 0.32, np.nan)
            #add empty column with name of rotation for easier overview
            loadingsDataframePostDrop[rota] = ""
            factorsOrthogonal.append(loadingsDataframePostDrop)
```

```
#Oblique rotations
        for rota in rotationsOblique:
            #fitting factor analyzer with various rotations
            fa = fa = FactorAnalyzer(n_factors=numberOfFactors, method='minres', rotation=rota)
            fa.fit(df)
            #getting loadings for data
            loadingsArray= fa.loadings_
            #converting np.array to DataFrame
            loadingsDataframe=(pd.DataFrame(fa.loadings_,index=df.columns))
            ##dropping all values below 0.32 (Lloret)
            loadingsDataframePostDrop = loadingsDataframe.where(loadingsDataframe > 0.32, np.nan)
            #add empty column with name of rotation for easier overview
            loadingsDataframePostDrop[rota] = ""
            factorsOblique.append(loadingsDataframePostDrop)


        self.Loadings = factorsOblique
        return factorsOrthogonal, factorsOblique
#cumulative variance
    def cumvar(self, df, numberOfFactors):
        fa = FactorAnalyzer(n_factors = numberOfFactors, rotation='oblimin')
        fa.fit(df)
        zzz=(pd.DataFrame(fa.get_factor_variance(),index=['Variance','Proportional Var','Cumulative Var']))
        self.CumulatedVariance = zzz
        return zzz
```

```
    #then cronbach alpha
    def cronbach(self, df):

        juw=psy.cronbach_alpha_scale_if_deleted(df)
        ###0: cronbach alpha
        ###1: cronbach alpha if deleted, increase on the added column
        self.Cronbach = juw
        return juw

################################################
####Factor Retention: number of factors considered
####(Part 2): via Horn's Parallel Analysis
################################################
#Horn's Parallel Analysis
####printEigenvalues set to False for now
####repeat 100 times at minimum https://journals.sagepub.com/doi/pdf/10.1177/0095798418771807
def _HornParallelAnalysis(data, K=200, printEigenvalues=False):
    #################
    # Create a random matrix to match the dataset
    #################
    n, m = data.shape
    # Set the factor analysis parameters
    fa = FactorAnalyzer(n_factors=1, method='minres', rotation=None, use_smc=True)
    # Create arrays to store the values
    sumComponentEigens = np.empty(m)
```

```
    sumFactorEigens = np.empty(m)
    # Run the fit 'K' times over a random matrix
    for runNum in range(0, K):
        fa.fit(np.random.normal(size=(n, m)))
        sumComponentEigens = sumComponentEigens + fa.get_eigenvalues()[0]
        sumFactorEigens = sumFactorEigens + fa.get_eigenvalues()[1]
    # Average over the number of runs
    avgComponentEigens = sumComponentEigens / K
    avgFactorEigens = sumFactorEigens / K


    fa.fit(data)
    dataEv = fa.get_eigenvalues()


    #################
    ### Print results
    #################
    if printEigenvalues:
        print('Principal component eigenvalues for random matrix:\n',
avgComponentEigens)
        print('Factor eigenvalues for random matrix:\n', avgFactorEigens)
        print('Principal component eigenvalues for data:\n', dataEv[0])
        print('Factor eigenvalues for data:\n', dataEv[1])
    # Find the suggested stopping points
    suggestedFactors = sum((dataEv[1] - avgFactorEigens) > 0)
    suggestedComponents = sum((dataEv[0] - avgComponentEigens) > 0)
    print('Parallel analysis suggests that the number of factors = ', suggestedFactors , '
and the number of components = ', suggestedComponents)
```

```
##################################################

####Interpretation: calculating clear Factor loadings

####without cross- or zero-loading items

##################################################

#initiate object

print("")

print("Initial run of EFA")

facanal = EFA('Initial EFA', 'kmo', 'bartlett', 'eigenvalues', 'kaiser', 'horn', 'loadings', 'cumvar', 'cronbach')


####Set values to EFA object

facanal.kmo(dfPostDrop)

facanal.bartlett(dfPostDrop)

facanal.kaiser(dfPostDrop)


#run Horn's Parallel Analysis

# _HornParallelAnalysis(dfPostDrop)


###Calculate loadings with number of factors from Parallel Analysis

facanal.loadings(dfPostDrop, 8)

#--------------#

# drop non-loading items one-by-one and re-run EFA


print("")

print("Dropping first item, re-running")

# dropping first item
```

```
dfItemDrop1 = dfPostDrop.drop(columns=['[The office should be located centrally (close to infrastructure such as shops and restaurants)]', #32
                ], axis = 1)
#correlation matrix
corrMatrixItemDrop1 = dfItemDrop1.corr()
corrMatrixItemDrop1["n_values_in_range"] = corrMatrixItemDrop1.apply(
    func=lambda row: count_values_in_range(row), axis=1)


#number of factors?
# _HornParallelAnalysis(dfItemDrop1)


####Set values to EFA object
facanalItemDrop1 = EFA('First non-loading item dropped', 'kmo', 'bartlett', 'eigenvalues', 'kaiser', 'horn', 'loadings', 'cumvar', 'cronbach')
facanalItemDrop1.kmo(dfItemDrop1)
facanalItemDrop1.bartlett(dfItemDrop1)
facanalItemDrop1.kaiser(dfItemDrop1)


###Calculate loadings with number of factors from Parallel Analysis
facanalItemDrop1.loadings(dfItemDrop1, 8)


#--------------#


print("")
print("Dropping second item, re-running")
# dropping second item
dfItemDrop2 = dfItemDrop1.drop(columns=['[The office is set up to be barrier-free]',
```

```
            ], axis = 1)
#correlation matrix
corrMatrixItemDrop2 = dfItemDrop2.corr()
corrMatrixItemDrop2["n_values_in_range"] = corrMatrixItemDrop2.apply(
    func=lambda row: count_values_in_range(row), axis=1)


#number of factors?
# _HornParallelAnalysis(dfItemDrop2)


####Set values to EFA object
facanalItemDrop2 = EFA('Second non-loading item dropped', 'kmo', 'bartlett', 'eigenvalues', 'kaiser', 'horn', 'loadings', 'cumvar', 'cronbach')
facanalItemDrop2.kmo(dfItemDrop2)
facanalItemDrop2.bartlett(dfItemDrop2)
facanalItemDrop2.kaiser(dfItemDrop2)


###Calculate loadings with number of factors from Parallel Analysis
facanalItemDrop2.loadings(dfItemDrop2, 8)
#--------------#
print("")
print("Dropping third item, re-running")
# dropping third item
dfItemDrop3 = dfItemDrop2.drop(columns=['[Educational leave]',
            ], axis = 1)
#correlation matrix
corrMatrixItemDrop3 = dfItemDrop3.corr()
corrMatrixItemDrop3["n_values_in_range"] = corrMatrixItemDrop3.apply(
```

```
    func=lambda row: count_values_in_range(row), axis=1)


##[The office is easy to reach with public transportation]

##this item has a correlation under the threshold (0.3) for 24/35 (68.57%) items

##and will be dropped for this reason

dfItemDrop3PostDrop = dfItemDrop3.drop(columns=['[The office is easy to reach with public transportation]'], axis = 1)

corrMatrixItemDrop3PostDrop = dfItemDrop3PostDrop.corr()

corrMatrixItemDrop3PostDrop["n_values_in_range"] = corrMatrixItemDrop3PostDrop.apply(

    func=lambda row: count_values_in_range(row), axis=1)

#max. number of items surpassing threshold is now 23/35 = 65.71 %


# number of factors?

# _HornParallelAnalysis(dfItemDrop3PostDrop)


####Set values to EFA object

facanalItemDrop3 = EFA('Third non-loading item dropped', 'kmo', 'bartlett', 'eigenvalues', 'kaiser', 'horn', 'loadings', 'cumvar', 'cronbach')

facanalItemDrop3.kmo(dfItemDrop3PostDrop)

facanalItemDrop3.bartlett(dfItemDrop3PostDrop)

facanalItemDrop3.kaiser(dfItemDrop3PostDrop)


###Calculate loadings with number of factors from Parallel Analysis

facanalItemDrop3.loadings(dfItemDrop3PostDrop, 8)

#--------------#
```

```
###item [Cafeteria/restaurants] does not load to any factors for OBLIMIN and QUARTIMIN

#re-run

print("")

print("Dropping fourth item, re-running")

# dropping third item

dfItemDrop4 = dfItemDrop3PostDrop.drop(columns=['[Cafeteria/restaurants]',

            ], axis = 1)

#correlation matrix

corrMatrixItemDrop4 = dfItemDrop4.corr()

corrMatrixItemDrop4["n_values_in_range"] = corrMatrixItemDrop4.apply(

   func=lambda row: count_values_in_range(row), axis=1)

#--------------#x

##[Parking facilities should be available for employees.]

##this item has a correlation under the threshold (0.3) for 23/34 (67.65%) items

##and will be dropped for this reason

dfItemDrop4PostDrop = dfItemDrop4.drop(columns=['[Parking facilities should be available for employees.]'], axis = 1)

corrMatrixItemDrop4PostDrop = dfItemDrop4PostDrop.corr()

corrMatrixItemDrop4PostDrop["n_values_in_range"] = corrMatrixItemDrop4PostDrop.apply(

   func=lambda row: count_values_in_range(row), axis=1)

#max. number of items surpassing threshold is now 22/34 = 64.70 %


#number of factors?

# _HornParallelAnalysis(dfItemDrop4PostDrop)
```

```
####Set values to EFA object

facanalItemDrop4 = EFA('Fourth non-loading item dropped', 'kmo', 'bartlett', 'eigenvalues', 'kaiser', 'horn', 'loadings', 'cumvar', 'cronbach')

facanalItemDrop4.kmo(dfItemDrop4PostDrop)

facanalItemDrop4.bartlett(dfItemDrop4PostDrop)

facanalItemDrop4.kaiser(dfItemDrop4PostDrop)


###Calculate loadings with number of factors from Parallel Analysis

facanalItemDrop4.loadings(dfItemDrop4PostDrop, 8)

#--------------#

###item [Fixed seating arrangement in which I have a desk/workspace which only I can use]

###does not load to any factors

#re-run

print("")

print("Dropping fifth item, re-running")

# dropping fifth item

dfItemDrop5 = dfItemDrop4PostDrop.drop(columns=['[Fixed seating arrangement in which I have a desk/workspace which only I can use]',

            ], axis = 1)

#correlation matrix

corrMatrixItemDrop5 = dfItemDrop5.corr()

corrMatrixItemDrop5["n_values_in_range"] = corrMatrixItemDrop5.apply(

   func=lambda row: count_values_in_range(row), axis=1)


#number of factors?

# _HornParallelAnalysis(dfItemDrop5)
```

```
####Set values to EFA object

facanalItemDrop5 = EFA('Fifth non-loading item dropped', 'kmo', 'bartlett', 'eigenvalues', 'kaiser', 'horn', 'loadings', 'cumvar', 'cronbach')

facanalItemDrop5.kmo(dfItemDrop5)

facanalItemDrop5.bartlett(dfItemDrop5)

facanalItemDrop5.kaiser(dfItemDrop5)


###Calculate loadings with number of factors from Parallel Analysis

facanalItemDrop5.loadings(dfItemDrop5, 8)

#--------------#

###item [The office is illuminated by some degree of natural light]

###shows cross-loading according to

###https://www.researchgate.net/post/How-to-deal-with-cross-loadings-in-Exploratory-Factor-Analysis

###and will therefore be dropped

#re-run

print("")

print("Dropping cross-loading item, re-running")

# dropping cross-loading item

dfItemDrop6 = dfItemDrop5.drop(columns=['[The office is illuminated by some degree of natural light]',

                ], axis = 1)

#correlation matrix

corrMatrixItemDrop6 = dfItemDrop6.corr()

corrMatrixItemDrop6["n_values_in_range"] = corrMatrixItemDrop6.apply(

    func=lambda row: count_values_in_range(row), axis=1)
```

```
#number of factors?

# _HornParallelAnalysis(dfItemDrop6)


####Set values to EFA object

facanalItemDrop6 = EFA('Cross-loading item dropped', 'kmo', 'bartlett', 'eigenvalues',
'kaiser', 'horn', 'loadings', 'cumvar', 'cronbach')

facanalItemDrop6.kmo(dfItemDrop6)

facanalItemDrop6.bartlett(dfItemDrop6)

facanalItemDrop6.kaiser(dfItemDrop6)


###Calculate loadings with number of factors from Parallel Analysis

facanalItemDrop6.loadings(dfItemDrop6, 8)

#--------------#

###item [Meeting rooms]

###shows cross-loading according to

###https://www.researchgate.net/post/How-to-deal-with-cross-loadings-in-
Exploratory-Factor-Analysis

###and will therefore be dropped

#re-run

print("")

print("Dropping second cross-loading item, re-running")

# dropping cross-loading item

dfItemDrop7 = dfItemDrop6.drop(columns=['[Meeting rooms]',

            ], axis = 1)

#correlation matrix

corrMatrixItemDrop7 = dfItemDrop7.corr()
```

```
corrMatrixItemDrop7["n_values_in_range"] = corrMatrixItemDrop7.apply(
    func=lambda row: count_values_in_range(row), axis=1)

#number of factors?
# _HornParallelAnalysis(dfItemDrop7)

####Set values to EFA object
facanalItemDrop7 = EFA('Second cross-loading item dropped', 'kmo', 'bartlett', 'eigenvalues', 'kaiser', 'horn', 'loadings', 'cumvar', 'cronbach')
facanalItemDrop7.kmo(dfItemDrop7)
facanalItemDrop7.bartlett(dfItemDrop7)
facanalItemDrop7.kaiser(dfItemDrop7)

###Calculate loadings with number of factors from Parallel Analysis
facanalItemDrop7.loadings(dfItemDrop7, 8)

##################################################
####Interpretation: naming the Factors
##################################################
#since all rotations give the same results, only varying numerically in factor loadings.
#the author decided on OBLIMIN rotation for the sake of the thesis

#dataframe of factor loadings
factorLoadings = facanalItemDrop7.Loadings[1]
#dropping name of rotation from df
factorLoadings = factorLoadings.drop(columns=['oblimin',
                ], axis = 1)
```

```
#renaming columns

factorLoadings.columns = ['Office climate', 'Provisions', 'Nature', 'Aesthetics',

                          'Interpersonal communication', 'Solitary work', 'Open plan office',
'Autonomy']


##outputting to excel and csv

# factorLoadings.to_excel("FactorLoadingsNew.xlsx")

# factorLoadings.to_csv("FactorLoadingsNew.csv")


####Calculating Cronbach Alpha for Factors

# creating a dataframe per factor

officeClimate = dfItemDrop7[['[Technical equipment ]', '[My supervisor appreciates
me]',

                             '[The social climate at work is cohesive and friendly]', '[Teamwork and
communication]',

                             '[Open minded company values]', '[Relaxing space/hangout area]',

                             '[Clean sanitary rooms (toilets etc.)]',

                             '[The furniture is ergonomic, e.g. by offering furniture such as standing
desks and height-adjustable desks]',

                             '[Clean working environment]', '[The office is set up with cooling
systems/heaters]',

                             '[Office supplies]']]

provisions = dfItemDrop7[['[Kitchen]', '[Free snacks (fruit, chocolate,..) and/or drinks]',

                          '[Meal vouchers]', '[Fitness vouchers]']]

nature = dfItemDrop7[['[There are indoor plants at or near my workspace]',

                      '[I can see nature through the window from my workspace]',

                      '[I can spend my breaks outside (in nature)]']]
```

```
aesthetics = dfItemDrop7[['[I can decorate my own workplace]', '[The office contains art ']]

interpersonalCommunications = dfItemDrop7[['[Meetings should be held in person]',
                                            '[Being able to reach my supervisor easily in person]',
                                            '[A low noise level in the office]']]

solitaryWork = dfItemDrop7[['["Focus rooms" in which I can work alone]',
                            '[Areas to be used by one person at a time only]']]

openPlanOffice = dfItemDrop7[['[Flexible seating arrangement in which I can pick a workspace according to my current needs]',
                              '[Workspace setup which is open and in which I am not spatially or visually isolated from my colleagues]']]

autonomy = dfItemDrop7[['[Being able to choose when I work over having fixed starting and end times]',
                        '[Having the opportunity to work from home]']]


#Cronbach Alpha

cronbachOfficeClimate = psy.cronbach_alpha_scale_if_deleted(officeClimate)

cronbachProvisions = psy.cronbach_alpha_scale_if_deleted(provisions)

cronbachNature = psy.cronbach_alpha_scale_if_deleted(nature)

cronbachInterpersonalCommunications = psy.cronbach_alpha_scale_if_deleted(interpersonalCommunications)

#Spearman-Brown

spearmanAesthetics = scipy.stats.spearmanr(aesthetics)

spearmanSolitaryWork = scipy.stats.spearmanr(solitaryWork)

spearmanOpenPlanOffice = scipy.stats.spearmanr(openPlanOffice)

spearmanAutonomy = scipy.stats.spearmanr(autonomy)
```

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11 Index of figures and tables

12 Index of abbreviations used

TU	Technical University of Vienna
WU	Vienna University of Economics and Business
EFA	Exploratory Factor Analysis
BBE	Bachelor of Business and Economics
MinRes.	Minimum Residual
ULS	Unweighted Least Squares
PAF	Principal Axis Factoring
e.g.	exempli gratia (“for example”)
i.e.	id est („that is“)