The impact of a professional social robot implementation on guest perception in a hotel front office environment

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Preface

During the final phase of Hotelschool The Hague, LYCar, students apply the theoretical knowledge gained during their studies in their final internship. Two professional products, the company project report and the career portfolio, must be delivered and defended by the student to obtain the bachelor's degree in Hospitality Management successfully.

As I experienced staff shortages and the negative effect on employees and guests in the hotel industry, I am particularly proud to contribute a small part to the knowledge pool of social robots as process facilitators.

Firstly, I would like to thank the two owners of WELBO, Roeland van Oers and Roel Noort, for their continuous support, confidence, and trust in me and the professional opportunities offered.

Secondly, I sincerely appreciate the conversations and knowledge exchange with Klaas Koerten about his experiences with the hardware component Temi running with WELBO software at the Hotelschool The Hague campus Amsterdam and about research on social robotics in hospitality businesses.

Lastly, I express my gratitude toward Mr Villanueva, who continuously offered group and individual sessions outside the standard office hours and showed great fascination and knowledge of digital transformation and innovative technologies. Furthermore, I am pleased to have Mr Govender as a second assessor since I know of his interest in disruptive technologies such as VR and AR and their application possibilities in the hospitality sector.

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Executive Summary

Given the hospitality industry's quick rebound and volume growth in most OECD nations following the Great Recession, the hotel sector in the Netherlands is currently experiencing a severe labour shortage that predates the Covid-19 epidemic (Joppe, 2012). Staff shortages and cost-cutting measures in the industry have increased stress amongst the remaining workforce and forced HR departments to investigate alternative recruitment methods and social robots.

The commissioner, a Netherlands-based software start-up called WELBO, is committed to making the use of social robots in service-oriented sectors as simple as possible and facilitating human-robotic co-creation. WELBO assigned the students, later referred to as the researcher, to identify the main barriers for hospitality businesses not to employing social robots in their operations and to validate whether their OpEx sales approach, which includes an initial implementation, is the most suitable for the product.

Through secondary literature, internal company data and interviews with three industry experts, six different barriers were identified and weighted according to the level of impact. As the industry increasingly uses more disruptive technologies to compensate for routine operational tasks, shareholders are interested in understanding the underlying benefits of social robots. Since this technology is a standalone device and the complexity of an initial implementation differs between the hardware-software combinations, skilled employees, so-called professionals, are needed to exploit all possible capabilities. The following MRQ was therefore formulated:

To what extent does a professionally implemented social robot impact the guest perception in a hotel front office environment?

The research setup was based on the field experiment of Martijn Boogert, who investigated the difference in guest perception between human-to-human and human-to-robot interactions through a non-professional implementation in the front office environment of HTH campus in Amsterdam. The researcher used his professional experience from the internship at WELBO BV to design a new application, including information provided through an advanced interaction flow and guiding possibilities. Thereupon, the robot Temi was professionally implemented in the exact location. The 'Experience of Hospitality Scale' was used to measure the guest perception of 167 interactors.

Through the use of SPSS version 29, differences between the new and old experiments, as well as the new dataset of human vs robot services, were tested. Boogerts found a significantly more negative guest perception for 5 of 7 factors of the human-to-robot interaction. The new experiment revealed no significant differences between human and robot services, hence a comparable guest perception. When comparing both experiments' human and robot service scores, surprisingly, a decrease was identified for all seven factors. However, human services decreased on average by nearly 4% more than robot services. The research additionally revealed that human services at HTH reception cannot be described as constant and that students somewhat feel restricted from approaching humans when asking repetitive questions due to the fear of being defamed.

Variables such as weather and noise pollution and their impact on both interaction types were examined.

Two solutions for knowledge sharing were created based on the knowledge gained through initial research and the conducted field experiment. A presentation aims to

inform all employees of WELBO sufficiently, and an infographic was created to spark interest in purchasing 'Sprints' and a high subscription level amongst current and potential customers.

The solution was disseminated to various stakeholders, including representatives of the HTH research centre, the industry expert Peter J. Leitgeb and fellow LYCar students.

To conclude, professionally implemented social robots have a measurable impact on guest perception in a hotel front office environment. Despite HTH not being a hotel-only environment and scores in the second experiment being consistently lower than in the first by Boogert, the impact can be evaluated as positive and the interaction more human-like. The new application increases the interaction time and uses more capabilities of the software-hardware combination. Since only one professional made modifications to the application and implemented the robot independently, observing the results of a team implementation by WELBO BV would be interesting.

As an increasing number of hardware suppliers is currently entering the social robotics market for hospitality industries, future research must perform field experiments with the upcoming technological advancements. It would be further interesting to measure the effect of various external variables, such as weather conditions, on both the human-to-human and human-to-robotic service encounters to identify how influenceable they are.

List of Abbreviations

Abbreviation	Full form
HRI	Human Robotic Interaction
MRQ	Main research question
SRQ	Sub research question
GM	General Manager
F&B	Food and Beverage
BOD	Board of Directors
FTE	Full-Time Employee
EH-Scale	Experience of Hospitality Scale
OpEx	Operational Expenditures
IoT	Internet of Things
HR	Human Resources
AI	Artificial Intelligence
PR	Public Relations
UX Research	User Experience Research
HTH	Hotelschool The Hague
E.g.	Exempli Gratia
API	Application Programming Interface
IC	Innovation Capability
SOP	Standard Operating Procedure

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1 Problem Definition

1.1 Context

The hospitality sector in the Netherlands is suffering from a severe labour shortage that has its origin long before the outbreak of the Covid-19 pandemic, as the rapid recovery and volume increase in the tourism sector of most OECD countries surpassed the GDP growth of most economies after the great recession (Joppe, 2012).

Gehrels and de Looij explored that the labour shortage partly developed as a consequence of the industry's poor reputation among the higher educated young professionals (2011). They concluded that talents graduating from internationally accepted Hospitality Schools often changed industries because of the collective bargaining agreement of the hospitality industry in the Netherlands. Governmental restrictions and travel bans fuelled the hospitality industry's financial instability and forced many businesses to temporarily close or reduce their workforce. Lower stress levels, better working hours, higher payments, and employment availability motivated large quantities of operational hotel employees to change industries (Chen and Chen, 2021; Zheng, Wu and Zhao, 2022).

As occupancy in hotels and gastronomy slowly approaches pre-Covid levels, staff shortages have an impact on the guest experience during service encounters (Global Data, 2022). As Bajrami et al. further elaborated through a case study in Serbia, the increase in job insecurity is positively correlating with the turnover intentions of hospitality employees and eventually leading to a higher staff-shortage (2021). Current efforts to recruit or maximize work efficiency by Human Resource departments have not been able to sufficiently fill the employment gaps. According to Morosan and Bowen, social robots spark the interest of the industry, however, only a few are implemented in the daily operations of hospitality businesses (2022). The launch of 'Plato', by URG former Softbank Paris, and the overall representativeness of social robotic developers and suppliers on internationally leading trade shows indicate a steadily increasing demand for disruptive technologies in the hospitality industry (Equip Hotel, 2022).

As part of the research funnel, suitable scientific articles were identified to detect the most important barriers hindering hotel businesses from employing social robotics in the daily operations. The barriers listed in table 1 were confirmed by organizational data and discussed with Roeland van Oers, founder of WELBO B.V. to further validate their relevance (Appendix 7.1). In a third stage, three business professionals were interviewed about their perspectives on social robots and the present state of employment in the hospitality industry. The color-coding scheme was applied to the transcribed interviews and used to identify remarks about the barriers (Appendix 7.1/7.3/7.4/7.5).

Collins and Leitgeb independently agree, that most hospitality staff is working at their absolute limit and would appreciate support in any form (2020;2022). Additionally, Sailer-Burckhardt states that the staff shortage is severely affecting the flawlessness of operations and employees are interested in alternative methods to reduce their own workload (2022). Hence the barrier 'employees' unwillingness of change' as well as the 'fear of replacement' was discarded for the research. Since the commissioner offers social robots as a service, there is little need for employees to interact with new technology (van Oers, 2022).

Since customer types differ in its core, 'unwillingness to interact' might apply only to a few but as soon as customers experience shortcomings in service due to insufficient staff coverage, barrier two will slowly disappear (Sailer-Burkhardt, 2022).

Ivanov, Webster and Berezina provided valuable research on the adoption of social robots in hospitality businesses and discovered associated costs and benefits (2017). It was however identified that a missing cost-benefit analysis is not the main argument not to employ social robots within a company rather than the underlying reason that create benefits for the client (Morosan and Bowen, 2022).

"If the staff shortage is so severe, then barriers such as rentability do not count as much as making the operations run again" Sailer-Burkhardt emphasises (2022). Heck argues that it is crucial for social robots to compensate and streamline procedures partly. Many times, decision-makers just see their possible uses in entertainment. Both Leitgeb and Heck independently agree that a "representative case study" would be needed to evaluate the use of social robotics in a hotel environment since shareholders are hesitant to agree on investments without seeing the benefits (2022;2022). Furthermore, it needs to be proven that guest satisfaction is not negatively influenced by the employment of innovative technology. Sailer-Burkhardt states that customers will happily adapt to the new technology once they see benefits such as reduced waiting times (2022)

The trustworthiness of all three experts was approved and justified (Appendix 7.3.)

Barrier	Relevance
Employees' unwillingness to change	(Ivanov, Webster and Berezina, 2017, 2017; Collins, 2020)
Customers unwillingness to interact	(Ivanov, Webster and Berezina, 2017; Merkle, 2019; Abou-Shouk, Gad and Abdelhakim, 2021)
Employees fear of replacement	(Ivanov, Webster and Berezina, 2017; Collins, 2020; Abou-Shouk, Gad and Abdelhakim, 2021)
Employees fear of interacting with new technology	(Kieslich, Lünich and Marcinkowski, 2021)
Social Robotics just as entertainment for guest/ lacking effectiveness	(Korn *et al.*, 2019; Io and Lee, 2020) (Pitardi *et al.*, 2021)
Missing cost-benefit analysis/ financial barrier	(Pinillos *et al.*, 2016; Kuo, Chen and Tseng, 2017; Morosan and Bowen, 2022)

Table 1: Overview identified barriers

1.2 Company Introduction

The commissioner WELBO B.V. is a software Start-Up from Amsterdam in the Netherlands, dedicated to simplifying the usage of social robotics within service-orientated industries. Founded in 2016, WELBO started with the developing a software application that enables customers without a technical background to integrate self-created content for two hardware variants of social robotics in their daily operations. Through additional compatibility with various 'Visitor Management' and 'Queue Management' software, such as 'Axxerion' and 'Qmatic', as well as various IoT devices, the integration possibilities at site are enhanced (van Oers, 2022). Since the end of March 2022, the campus Amsterdam of Hotelschool The Hague (HTH), located in the Jan Everstenstraat 171, has employed the social robot Temi on a subscription base for two years.

1.3 Problem Statement

The practical employment of social robots in guest services is yet mainly researched on a theoretical level and lacks representative case studies to prove its effectiveness in daily operation, as Tuomi et al. state (2020). The urgent need for empirical evidence aside from hypothetical scenarios was further emphasized by Choi et al. and verified by Seyitoğlu (2020;2021). Researchers explored the theoretical effect of social robotics on the perceived guest experience (Lu, Gursoyc and Cai, 2019).

An additional case study has been performed by Martijn Boogert at HTH Amsterdam that investigated the difference of human-to-human and human-to-robot interactions in a front office environment for the social robot Temi. The case study however did not entail a professional implementation which might have a significant influence of the outcome (Boogert, 2022). This is supported by the studies from Ivanov, Webster and Berenzina that emphasize on the importance of various factors (size/ safety aspects/ purchase model etc.) that differ between different software companies and social robotics hardware suppliers (2017). Unprofessional implemented social robots do not only display a current problem for the industry but also for WELBO, since it reflects badly on them. The researcher identified the need to add a field experiment of a professionally implement hardware-software combination to the knowledge pool and the following MRQ was created:

> **To what extent does a professionally implemented social robot impact the guest perception in a hotel front office environment?**

1.4 Research Objectives

The commissioner WELBO B.V. has an interest in verifying the effectiveness of their sales approach that entails a subscription model with an initial implementation from social robot professionals and implementation sprints as an additional offer A sprint can be explained as follows: a focus week of 3 or more skilled employees at site to improve the use cases for a customer. A repetition of the case study by Martijn Boogert under slightly different circumstances aims to identify the impact of a professional implementation of social robots on the guest experience during service encounters in a front office environment (Boogert, 2022). The primary distinction is the advanced flow imbedded in the application and the initial mapping procedure. WELBO B.V. will use the research depending on the outcome to either promote their current business model or to modify the sales and marketing process. All possible outcomes provide valuable insights for the commissioner. The insights may also be used by hardware manufacturer Temi to create recommendations for clients' implementation.

Importance	Description
High	Verifying the sales approach
High	Measuring impact of a professional implementation
Medium	Gaining marketing content
Low	Create recommendations for hardware manufacturer

Table 2: Objectives

2 Analysis and Diagnosis

2.1 Internal Data

2.1.1 Hardware Partnerships

WELBO has strong hardware partnerships with three different robotic manufacturers that empower the company to be supplied with the most recent production developments (Appendix 7.7). The close contact on a B-to-B level and the bilateral communication creates continues improvement to supporting end customer satisfaction (van Oers, 2022). This research only explores the guest perception for one specific hardware type, Temi, from Temi robotics.

Temi USA inc.

Temi Robots was founded in Tel Aviv and has recently released the third version of its award-winning social robot specialized in navigation, information provision and voice recognition, Temi. As support surpasses its competitors and software compatibility for future releases such as the Temi Go in Q1 2023 is guaranteed, the commissioner evaluates this partnership as most valuable (temi Robots, 2022; van Oers, 2022). In cooperation with HTH, this social robot was the optimal solution do perform research in a front office environment. An overview of benefits and application possibilities for the hotel industry was created by the researcher in cooperation with WELBO (Appendix 7.8).

2.1.2 Business Model

For the employment of social robots, WELBO is offering an OpEx option on subscription base, enabling clients to remain an asset-light structure (van Oers, 2022). The customer can choose from the three different hardware components.

As displayed in the subscription overview in Appendix 7.6, the hardware type, the duration of the agreement, the level of support and the quantity of hardware components can influence the amount of the monthly subscription. The higher the subscription level, the more professional support is provided during the implementation and duration of the contract. The academic package is exclusively offered for Pepper and Temi and only available for educational institutions (van Oers, 2022).

2.2 Background information

Boogert performed an experiment as part of his master thesis in 'Leading Hotel Transformation' at HTH to add practical evidence to the mainly theoretical research about robotics in the hospitality sector. The social robot hardware as well as the software interface are identical with the experiment performed during this research. The way, information was delivered to both students and guests differs substantially, since Boogert had no professional knowledge about the capabilities of this specific social robot and can therefore not be described as 'highly educated worker' in the field, as defined by Lichtenberg and Bartel (1987).

Boogert created 30 different presentations to provide location specific information that were previously verified by both instructors and employees of the reception at HTH Amsterdam. Four different chatbots were added and together placed in the respond only lane of the application. Temi was enabled to detect human activity in a distance of three meters and approaches them to spark an interaction. Boogert programmed the robot in a way that it greeted the interactor always with the same phrase: '<GOODDAY>, welcome to Hotelschool The Hague' when approached. The interactor is from this moment onwards in the driver's seat. If his demand or question aligns with the predetermined trigger word, a presentation or chatbot will be started. This resulted in very short human-to-robot interactions that do not resemble a typical 'conversation' in a reception setting. The average interaction duration was only 29 seconds (Appendix 7.12). Only if programmed trigger words were detected by the robot, a conversation chatbot was activated and provided a location unspecific interaction.

2.3 Literature Review

Staff shortage in the hospitality industry

Corona and its impact on the economic stability can be evaluated as the main driver of unemployment in hospitality businesses in the 2020s according to Godinic et al. (2020). building up on the general shortage that emerged from the great recession in 2007 (Joppe, 2012).

The downsizing of hospitality businesses during the Covid-19 pandemic due to a decrease in occupancy and customer demand resulted further in the departure of qualified personnel, as Mitrofanova *et al*. identified (2022). According to Baum et al, especially young talented hospitality employees that have changed industries are very unlikely to return to their educational origin leading to an increase in skill shortage as a structural future recruitment issue (2020). As hospitality robotics aim to partially solve this issue, staff shortage and its related cost could be the compelling argument to employ social robotics (Baum *et al.*, 2020).

The developed staff shortage can be further showcased by comparing the increase in hotel industry related jobs in Amsterdam and the total number of beds available. In between 2010 and 2019, the number of hotel beds increased by over 70% and hotel related jobs only by 53% (Statista Research Department 2021).

Stress-related costs in hospitality businesses

Adding to the impact of missing employees, Ma, Ren and Zhaos research on stress related coping mechanisms conclude that jobs in frontline positions of hospitality businesses are evaluated as highly stressful due to the intensity of emotional labour, staff shortages, inconsistent working hours and lack of skilled co-workers (2021). More absenteeism, higher turnover rates and workplace accidents are an effect of job stress and lead to critical financial expenditures for hospitality employers according to Koc and Bozkurt (2017). Social robotics fitted with AI can contribute to a more diverse work environment with an impact on productivity which enhances staff effectiveness (Tongkachok *et al.*, 2022).

The Covid-19 pandemic has further intensified the stress level for employees and hospitality businesses are investigating in work-related stress-reduction methods such as alternative recruitment approaches and social robotics, as Ma, Ren and Zhao discovered (2021).

Cost effective service excellence

Wirtz describes that implementing new technologies within hotel businesses has been used to reduce costs in various cost centres whilst simultaneously aiming for service excellence (Wirtz, 2020).

Morosan and Bowen agree, that AI technology such as ChatBots are used to minimize time-consuming guest communication hence contribute to diminishing the overall labour cost while optimizing the respond time to guests (2022). Internal communication tools such as 'Hotelkid' are enhancing the interdepartmental knowledge exchange but aiming at the same time to decrease the communication errors and reduce labour-intense interactions (Prikshat, Rajesh and Rajaguru, 2021). Internet of Things (IoT) are increasingly implemented in hospitality businesses for various purposes such as connectivity in hotel rooms through smart devices, smart locks or self-check-in (Banerjee, 2021). Only well integrated IoT devices enhance the level of personalization, the effectiveness of electronic devices or customer insights gained from reservation procedures.

A unique questionnaire called the 'Experience of Hospitality Scale' (EH-Scale) was created by Pijls et al. to assess hospitality in a service context from the perspective of the customer (2017). It evaluates three hospitality-related experience characteristics: "the experience of inviting (open, inviting, freedom), the experience of care (servitude, empathy and acknowledgement), and the experience of comfort (feeling at ease, relaxed and comfortable)" (Pijls *et al.*, 2017).

Influence of shareholders on investments

According to Global Data, the ten biggest hotel brands account for nearly 75% of the total number of hotels in the Netherlands, leaving only 25% independently managed which decision making is not influenced by corporate shareholders (Global Data, 2022).

Kuo, Chen and Tseng evaluate the influence of shareholders on new implementations as high since the 'cost of business operations for social robots' are one of the biggest contra arguments for implementation. The studies, however, gave a promising outlook for future investments once prices are "reasonable and acceptable" (Kuo, Chen and Tseng, 2017)*.*

As expenses through employment, training and personnel management steadily increase, the financial interest in alternative HR solutions such as social robotics further grow (Morosan and Bowen, 2022). The study concludes that "*the assessment of cost and profit modes and new innovative services with new technology must be financially calculated before the implementation"* , supporting the need for a cost-benefit analysis for decision making purposes (Kuo, Chen and Tseng, 2017).

Revenue losses as result of the COVID-19 pandemic have negatively affected the ROI of shareholders which expect thereupon all efforts by operational management to be concentrated on cost cutting interventions, specifically with regards to payroll expenditures (Diorisio, Chen and McCain, 2007).

Disruptive technology and their implementation in the hospitality industry

According to a review by Smith, innovation is mainly defined through the 'implementation of new processes, products, organizational changes or marketing changes' which was supported by Vaughan's book 'Technological Innovation' stating that "innovation is a change in […] an organization" including its processes and products (2012,2013).

Disruptive technologies and their often innovative approach have helped to reshape the hotel industry by "transforming how hotels manage their operations and value chains" as Iranmanesh et al. state (2022). Christensen et al. add, that disruptive innovations are often underestimated by long established companies while simultaneously enabling new market entrants with fewer resources to challenge incumbent businesses (2018). Pascual-Fernández et al. additionally point out the importance for hospitality businesses to possess a high innovation capability (IC) after the Covid-19 pandemic to gain a competitive advantage on the short-term (2021).

According to a review by Smith, innovation is mainly defined through the 'implementation of new processes, products, organizational changes or marketing changes' which was supported by Vaughan's book 'Technological Innovation' stating that "innovation is a change in […] an organization" including its processes and products (2012,2013). The definition of disruptive innovations are "advanced technologies which give rise to a new market or a new avenue of business or research", could give an outlook on the importance of social robotics in the hotel industry, as Munawar et al. conclude (2022).

According to Morosan and Bowen, the hotel industry is increasingly using disruptive technologies to optimize routine operational tasks and gain a possible future competitive advantage (2022). They further state that compared to applications that are built to be incorporated with the hotels' PMS or ERP system, social robotics are standalone devices of high complexity that require professional integration by trained employees or third-party integrators (Ibid). Due to the innovative component of disruptive technologies, IT staff of both large and single hotel operators are lacking specific knowledge to exploit its full potential, Morosan and Bowen conclude (2022).
As stated by Ivanov, Webster and Berenzina, social robotics composed of unique hardware software combination are leading to different skillsets required to fully utilize all its capabilities (2017). Wynn and Jones validate that hotels were reluctant to make full use of information technology' in the past, confirming the need of exploring the effects of a professional implementation of disruptive technologies in the hotel industry (2022). Lichtenberg and Bartel described in 1982 already that 'highly educated workers have a comparative advantage with respect to the adjustment and to the implementation of new technologies' and further emphasized the importance of skill in the early maturity phases of a disruptive technology (1987). In their paper on the successful implementation of computer-based technology in palliative care, André et al. discovered the urgent 'need for specially trained people stationed at the unit who had both skills and motivation, which was seen as a key to successful implementation' (2008).

The following **MRQ** and **RQs** were formulated:

> **To what extent does a professionally implemented social robot impact the guest perception in a hotel front office environment?**

RQ1	What are the factors that make an implementation considered professional?
RQ2	How can guest perception be measured and benchmarked to detect a positive or negative impact?

To conclude this paragraph, the following hypothesis for the research are proposed:

H1: The professional implementation of a social robot with a specific hardware-software combination in a hotel front-office environment leads to less difference in guest perception between human-to-robot and human-to-human interactions compared to the non-professional implementation.

H2: It is assumed that the human services remain constant over time and that there is a positive difference in guest perception of experiences between a professional and a non-professional implementation of a social robot with a specific hardware-software combination in a hotel front-office environment.

2.4 Methodology

The research tries to answer the question whether the professional implementation of social robots could contribute to fight the staff shortage currently experience in the Dutch hospitality industry as one of many alternative recruiting methods (Ma, Ren and Zhao 2021). As guest perception is of high importance for the industry, the influence of an interaction with a social robot needs to be evaluated (Sailer-Burkhardt, 2022). Benchmarking guest perception and how measure it will be elaborated on to critically evaluate the impact of the professional implementation based on the EH scale of Pijls et al. (2017). A recommendation whether the implementation of disruptive technologies in different industries can be applied in a similar way to social robotics is intended (Ivanov, Webster and Berezina, 2017).

2.4.1 Application Design

The conceptual framework for this field experiment is based on a previously conducted research by Martijn Boogert and mainly differs through the different approach on application building to provide information (Boogert, 2022).

It was further decided in accordance with Dr Alexander Schmidt and Mr. Klaas Koerten, two researchers of HTH, that the information provided should not differ significantly from the previous experiment. The informative content was developed by Boogert and slightly extended or altered when needed based on professional experience of the researcher. All content was previously checked and controlled by Front Office employees to increase the level of reliability.

The interface of WELBO B.V. offers content creators to build up an application containing of various modules (van Oers, 2022). These modules are questionnaires, presentations and chatbots. The application itself contains of priority and respond-only lanes (Appendix 7.11). According to the head developer of WELBOs interface, Roel Noort, the priority lane actively suggests two different pieces of content to interactors. The respond-only lane only reacts on trigger words. An important feature is the possibility to connect different modules in the priority lane to a 'group' in the form of a decision tree. This advanced flow enables content creators to guide the interactor to a specific piece of content or information. This will be further elaborated in the following chapter.

A field experiment was performed in the front office area of HTH in Amsterdam, the Netherlands. The social robot Temi was placed clearly visible at the entrance of the university in front of a banner that signalized guests and students its availability for an interaction.

The researcher, Paul Werner, was employed by WELBO B.V. for over three months before starting the experiment at the HTH. His role as intern consisted of multiple operational tasks including customer journey mapping, installation, content creation and fine-tuning applications at site. These experiences as well as additional visits of trade shows such as the Equip Hotel in Paris provided the researcher with enough information and skills to lead a professional integration on its own. Being able to make full use of the technological capabilities of social robot firstly required a mapping of the ground floor. As explained in 2.1.1, Temi's strength is to provide information and guide people. In cooperation with Front Office employees of HTH, 12 locations were set on the map, including guest toilets, hotel room elevator and flex offices to name a few (Appendix 7.14). The interactions at the front desk were observed to gain insights on how to shape the interaction.

Temi was capable of guiding interactors to a location of their choice and return to the welcome position. The researcher was supported during the data collection by the student Malgorzata Pielka.

Due to the noise pollution and the frequency of humans passing by in the reception area, it was decided not to activate the 'human detection' and 'approach people' settings of the application. Receptionists explicitly complained about the needlessness of these features. Instead, participants needed to 'tap to engage', which was placed as message on the screen (Appendix). The voice recognition during an interaction was activated, to simplify the usage. In accordance with the findings of Yang et al., it was decided to start the interaction with 11 different humorous sentences, more specifically compliments, to spark joy at the start of the interaction and to minimize frustration in case of failure (2022). The full list of greetings can be found in Appendix 7.16. It was decided to create a single content application with multiple questionnaires after the greeting. The purpose was to guide the interaction to a specifically demanded content. The questionnaires became more detailed, the longer the interactor was engaged with the social robot.


Picture 1: Experiment setup at HTH

To showcase the effectiveness of guiding questionnaires within the human-to-robot interaction, the following example is displayed: We assume a guest approaches the robot with the need to find the entrance of 'Le Debut' restaurant at Campus Amsterdam.

The first question: 'Are you a guest or a student of Hotelschool The Hague' aims to classify the type of interactor. If a guest was identified, the robot asks whether information provision about the Hotelschool or the city of Amsterdam was needed. When the guest requests information about the location, the robot triggers the answer: Hotelschool The Hague Campus Amsterdam.

In the following, Temi asks which information precisely is requested and offers the following options to select upon: Parking Facilities, Wi-Fi, Reservation at Le Debut, Wayfinding, Newspapers, settling an Invoice, Hotelschool Heritage and Breakfast. If the guest selects the wayfinding option, 10 different locations are displayed. The wish to be guided to Le Debut-Restaurant is specified by the interactor and Temi says and displays: Please follow me to Le Debut Restaurant. After arriving at the destination, Temi wishes the guest a joyful evening and returns to the welcome position to start a new interaction. This specifc human-to-robot interaction can be seen in screenshot 1 and a snippet of the entire decision tree flow can in Appendix 9.17.
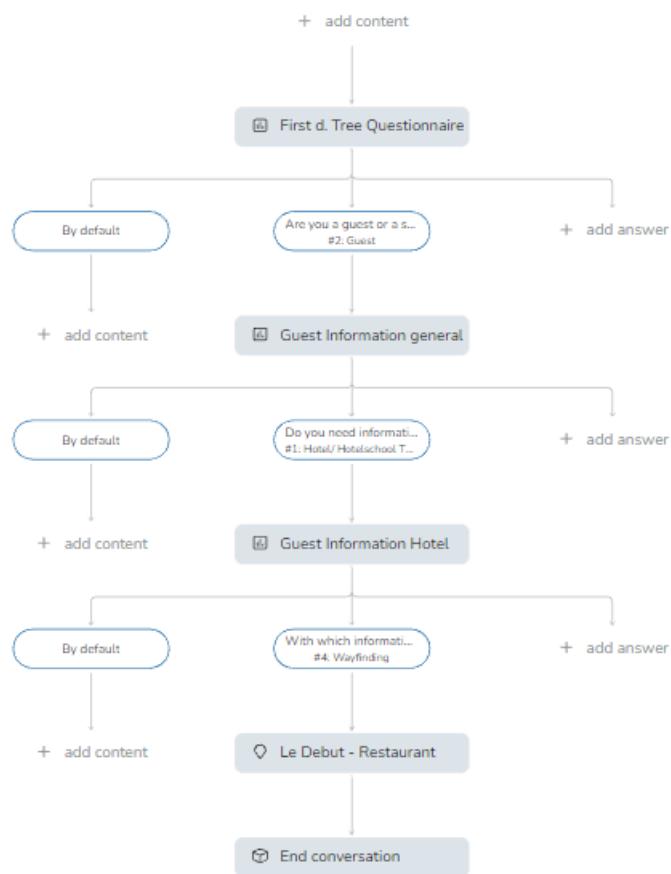
Screenshot 1: Human-to-robot interaction Le Debut wayfinding

2.4.2 Data collection

A quantitative approach was chosen to analyze the differences in guest perception for both the human-to-human and human-to-robot interaction with regards to a professional or non-professional implementation in a hotel front office environment. The human-to-human interaction functions as control group. As stated in the previous chapter, the data collection was mainly based on the conceptual framework of Boogerts experiment to improve comparability and validate the research outcomes (2022).

A questionnaire was distributed to students and hotel guests between the 14.11 and the 04.12.2022 to gather data for measuring the perceived guest experience after both interaction types. The questionnaire was developed for the purpose of primary data collection and in cooperation with the researchers Dr. Alexander Schmidt and Mr. Klaas Koerten from HTH, who will use the data for a separate research project. This resulted in a total of 35 questions, measured through a 7. Likert scale. The data gathering process for the questionnaire exceeded the planned duration of 2 weeks by 8 days. To speed up the gathering process after the first week, lecturers of technology related subjects at HTH were approached. The researcher was able to collaborate with Mr. Salat, lecturer of *'Aligning Business Information'* and *'Data Analytics'*. His classes were divided into groups of five students and guided into a separate room, where the social robot was placed previously (Appendix 7.18). After been given the opportunity to interact with Temi, students were asked to fill out the questionnaire. The project and the purpose of the research were explained afterwards. The lecturer, Mr. Ramon Salat, was not present in the breakout room to avoid students from being cognitively biased through social and academic pressure.

To assist gathering respondents for the human-to-human interaction, employees of the reception area were contacted to promote the survey after an interaction took place. A Canva was created to inform the respondent about the purpose of the survey and increase the response rate (Appendix 7.19). Data confidentiality was maintained at any given moment. The survey was accessible via a QR code and needed to be filled out on the respondent's own device. The time of assessing the guest experience is crucial, according to Becker and Jaakkola since *experience* can be described as a spontaneous response (2020). To increase the validity, answers were gathered right away following the engagement with either the robot or a human employee. The population of the research consisted of all students and guests of HTH entering the campus Amsterdam building through the front entrance. Employees were excluded since the application was initially not built to provide relevant information for this group of people.

To estimate the population size, the researcher received historical data from front desk employees containing the skotel's occupancy for 3 weeks in November 2019. With an average occupancy of 95% and a total of 20 hotel rooms, 145 different guests were reported. The number was double to include students as possible interactors, since they are expected to have a similar number of interactions per day as guests. According to Taherdoost, a suitable sample size for a population of roughly 300, a confidence interval of 95% and 5 as a margin of error is around 166 (2016).

The first approach was to fully cover the necessary sample size through probability sampling. Since the interactors voluntarily choose whether they want to have an interaction with the robot or the human, the data collection can be defined as cluster sampling (Taherdoost, 2016). Since the data gathering was very time consuming, as mentioned previously, the researcher had to use convenience sampling.

2.4.3 Methods for analyzing data

To draw comparable conclusions between the two experiments, it was decided to form equivalent variables as used during Boogerts experiment.

The 13-item EH-Scale by Pijls. et al was applied to evaluate the three key pillars of guest experience, namely *inviting, care and comfort* (2017). The inviting component of the experience was obtained by asking three different questions: *"The interaction felt inviting"*, *"I experienced openness during the interaction"* and *"I experienced freedom during the interaction"*. To examine the level of care, seven different questions were asked, including *"The robot/reception employee did it's best to take care of me"* and *"I felt treated like a V.I.P. during the interaction"*. The three questions *"I felt at ease during the interaction"*, *"I felt comfortable during the interaction"* and *"I felt relaxed during the interaction"* helped to determine the level of comfort during the interaction. The number of questions per factor were expanded previously by the researchers to increase the level of reliability of the study, however not used during the testing of differences between the two test groups. The variables care and inviting are the unweighted averages of two out of three questions mentioned, as Boogert only used two questions to form the variable, and only one question for the factor comfort. The overall *Touchpoint Experience* score was determined by using the unweighted average of the three variables *Inviting, Care*, and *Comfort*. For the variable evaluative outcome, the unweighted average of the questions: *"I felt treated like a V.I.P. during the interaction", "Overall, I am satisfied with the interaction"* and *"I would recommend the interaction to others"*. The time of assessing the guest experience is crucial, according to Becker and Jaakkola since *experience* can be described as a spontaneous response (2020).

Firstly, the reliability of the different questions of each factor were tested by using Cronbach's Alpha. All statistical tests were performed using the SPSS version 29. A Cronbach's Alpha of at least 0,7 was set as a benchmark to ensure a certain level of consistency for multiple responses of one factor.

Secondly, the data was cleaned, and all incomplete responses were removed from the data set.

Researchers don't always make the same conclusions since there is no solid empirical foundation for conclusively defining the "correct" amount of answer possibilities for scales used in UX research. This doesn't exclude comparing studies with various amounts of answer options. Therefore, the 7. Likert scale was transformed into a 5. Likert scale through linear interpolation (Morse, 2021).

In the final step, a total of three independent sample t-tests were performed. The first test examines the differences between the human-to robotic and human-to-human score on the above elaborated variables only for the experiment conducted during this research. The second and third sample t-test compares the scores of the two experiments with each other

2.4.4 Ethics & Data Management

All information received through the unstructured interviews and observation are treated highly confidential and only published with the consent of all participants. All respondents approached at HTH to fill out the questionnaire were informed about the anonymity of their responses and gave consent.

Data gathered through the social robotics analytic section will be stored in accordance with the GDPA standards, guaranteed by WELBOs ISO certification (Appendix 7.10).

3 Findings

3.1 Results

In total, 100 respondents filled out the questionnaire for the human-to-human interaction and 101 respondents for the human-to-robot interaction. It took the respondent an average answer time of over 6 minutes to complete the survey. In the first week of data gathering, respondents were able to skip single questions during filling out the questionnaire. This was corrected from week two onwards. The incomplete survey responses were included in the reliability testing of *inviting*, *care* and *comfort* and later excluded in the statistical testing. The sample size after deducting the invalid responses was in total 167, 72 robot-to-human interactions and 95 human-to-human interactions.

The reliability testing for the factor *Inviting* revealed a Cronbach's Alpha of 0,868, which can be interpreted as strong (Appendix 7.24). With a Cronbach's Alpha of 0,926, the factor *Care* was the highest. The factor *Comfort* was not included in the testing, since only one question was asked.

The independent sample t-test performed on the new dataset to test whether there is a difference between the human-to-robot interaction and the control group with regards to certain factors revealed no significant differences. As seen in table 2, no p-value was below the required significance level of 0,05 to reject the H0 hypothesis. No means were compared.

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						95% Confidence Interval of the Difference	
		F	Sig.	t	df	Significance One-Sided p	Two-Sided p	Mean Difference	Std. Error Difference	Lower	Upper
Care	Equal variances assumed	.448	.504	-.109	165	.457	.914	-.01558	.14332	-.29856	.26740
	Equal variances not assumed			-.108	146.988	.457	.914	-.01558	.14475	-.30164	.27048
Inviting	Equal variances assumed	6.747	.010	-.964	165	.168	.337	-.14055	.14584	-.42849	.14739
	Equal variances not assumed			-.939	135.811	.175	.350	-.14055	.14973	-.43666	.15556
Comfort	Equal variances assumed	6.781	.010	-.873	165	.192	.384	-.13617	.15596	-.44410	.17177
	Equal variances not assumed			-.859	143.145	.196	.392	-.13617	.15844	-.44935	.17701
Touchpoint Experience	Equal variances assumed	4.718	.031	-.662	165	.254	.509	-.09000	.13596	-.35844	.17844
	Equal variances not assumed			-.649	140.657	.259	.517	-.09000	.13862	-.36405	.18405
Overall experience of hospitality	Equal variances assumed	1.484	.225	-.724	165	.235	.470	-.11171	.15432	-.41642	.19299
	Equal variances not assumed			-.718	148.239	.237	.474	-.11171	.15555	-.41911	.19568
Overall Satisfaction	Equal variances assumed	3.810	.053	-.206	165	.418	.837	-.03240	.15710	-.34259	.27778
	Equal variances not assumed			-.203	142.840	.420	.839	-.03240	.15966	-.34802	.28321
Behavioural Intention	Equal variances assumed	6.174	.014	-.830	164	.204	.408	-.14654	.17656	-.49517	.20208
	Equal variances not assumed			-.815	141.067	.208	.417	-.14654	.17983	-.50206	.20897
Evaluative Outcome	Equal variances assumed	2.869	.092	-.759	165	.224	.449	-.10989	.14478	-.39575	.17596
	Equal variances not assumed			-.750	145.780	.227	.454	-.10989	.14649	-.39942	.17963

Table 2: Independent Sample t-test new dataset

The second sample t-test compares only the human-to-robotic interaction between the first dataset of Boogert, referred to as *non-professional* implementation type, and the new dataset from Werner, referred to as *professional*. All seven factors included in the testing revealed a significant difference between the two experiments, enabling the researcher to compare means. The most relevant results are marked bold in the group statistics. The factor *Comfort* shows with 0,7 the biggest actual change in means which can be translated in a relative percentage difference of -17,27% (Appendix 7.27). *Overall Hospitality* was for both experiments the highest score with a mean of 4.22 for the non-professional and 3.71 for the professional implementation. The means of *Care* are the closest in scores between the two experiments, a total difference of 0,38 and a relative percentage difference of 10,11%. All means of the second experiment are lower compared to the first experiment of Boogert. The new experiment consistently displays a higher standard deviation than the previous experiment setup.

Group Statistics human-to-robot interaction

	Implementation Type	N	Mean	Std. Deviation
Comfort	Non-Professional	69	**4.07**	.95976
	Professional	72	**3.37**	1.06178
Overall Satisfaction	Non-Professional	69	4.04	1.04930
	Professional	72	3.59	1.07133
Overall Hospitality	Non-Professional	69	**4.22**	.78346
	Professional	72	**3.71**	.99713
Behavioural Intention	Non-Professional	69	4.06	1.13609
	Professional	72	3.46	1.21377
Evaluative Outcome	Non-Professional	69	4.11	.84307
	Professional	72	3.59	.97090
Inviting	Non-Professional	69	4.04	.82578
	Professional	72	3.42	1.03206
Care	Non-Professional	69	**3.72**	.88067
	Professional	72	**3.34**	.95427

Table 3: Group Statistics human-to-robot interaction

Independent Samples Test

| | | Levene's Test for Equality of Variances | | t-test for Equality of Means | | | | | | | |
		F	Sig.	t	df	Significance One-Sided p	Significance Two-Sided p	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference Lower	95% Confidence Interval of the Difference Upper
Comfort	Equal variances assumed	7.871	.006	4.120	139	<,001	**<,001**	.70316	.17068	.36568	1.04063
	Equal variances not assumed			4.129	138.534	<,001	**<,001**	.70316	.17032	.36640	1.03991
Overall Satisfaction	Equal variances assumed	1.669	.199	2.528	139	.006	**.013**	.45167	.17868	.09839	.80495
	Equal variances not assumed			2.529	138.932	.006	**.013**	.45167	.17860	.09855	.80480
Overall Hospitality	Equal variances assumed	5.758	.018	3.336	139	<,001	**.001**	.50517	.15145	.20573	.80461
	Equal variances not assumed			3.353	133.915	<,001	**.001**	.50517	.15068	.20714	.80319
Behavioural Intention	Equal variances assumed	5.085	.026	3.005	139	.002	**.003**	.59547	.19819	.20362	.98732
	Equal variances not assumed			3.009	138.925	.002	**.003**	.59547	.19791	.20417	.98677
Evaluative Outcome	Equal variances assumed	5.343	.022	3.373	139	<,001	**<,001**	.51744	.15341	.21412	.82075
	Equal variances not assumed			3.383	137.684	<,001	**<,001**	.51744	.15295	.21501	.81987
Inviting	Equal variances assumed	7.566	.007	3.947	139	<,001	**<,001**	.62292	.15783	.31087	.93498
	Equal variances not assumed			3.965	134.755	<,001	**<,001**	.62292	.15709	.31225	.93360
Care	Equal variances assumed	.686	.409	2.426	139	.008	**.017**	.37566	.15482	.06954	.68177
	Equal variances not assumed			2.431	138.806	.008	**.016**	.37566	.15456	.07007	.68124

Table 4: Independent sample t-test human-to-robot interaction

The third and last independent sample t-test only compares the human-to-human interactions of both experiments performed at different points in time of the year 2022. With all p-values below 0,05, the test reveals a significant difference in means for all factors. The highest mean for both implementation types was achieved with the factor *Overall Hospitality*, 4.53 for the first experiment of Boogert, and 3.51 for this research experiment. With -21,04%, the biggest relative percentage difference was identified for the factor *Comfort* which is expressed through a total difference of 0.93 score points in means. The lowest difference was identified in *Care* with a total change of 0.47 and relative percentage difference of -12,42%. The means of all seven factors are lower for the second experiment performed at the later point in time. The new experiment consistently displays a higher standard deviation than the previous experiment setup.

Group Statistics human-to-human interaction

	Implementation Type	N	Mean	Std. Deviation
Comfort	Werner	95	**3.51**	.94721
	Boogert	66	**4.44**	.68228
Overall Satisfaction	Werner	95	3.62	.95258
	Boogert	66	4.32	.82572
Overall Hospitality	Werner	95	**3.69**	.96275
	Boogert	66	**4.53**	.61318
Behavioural Intention	Werner	95	3.62	1.05364
	Boogert	66	4.33	.75107
Evaluative Outcome	Werner	95	3.65	.88648
	Boogert	66	4.39	.58736
Inviting	Werner	95	3.56	.85118
	Boogert	66	4.36	.64179
Care	Werner	95	**3.36**	.88826
	Boogert	66	**3.83**	.87413

Table 5: Group Statistics human-to-human interaction

Independent Samples Test

| | | Levene's Test for Equality of Variances | | t-test for Equality of Means | | | | | | | | |
		F	Sig.	t	df	Significance One-Sided p	Significance Two-Sided p	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference Lower	95% Confidence Interval of the Difference Upper
Comfort	Equal variances assumed	3.426	.066	14.597	161	<,001	**<,001**	1.96136	.13437	1.69600	2.22671
	Equal variances not assumed			15.401	160.998	<,001	**<,001**	1.96136	.12736	1.70985	2.21286
Overall Satisfaction	Equal variances assumed	.317	.574	14.945	161	<,001	**<,001**	2.08855	.13975	1.81258	2.36452
	Equal variances not assumed			15.226	153.181	<,001	**<,001**	2.08855	.13717	1.81756	2.35954
Overall Hospitality	Equal variances assumed	4.472	.036	16.898	161	<,001	**<,001**	2.23875	.13248	1.97712	2.50038
	Equal variances not assumed			18.150	158.846	<,001	**<,001**	2.23875	.12335	1.99513	2.48236
Behavioural Intention	Equal variances assumed	7.504	.007	13.208	161	<,001	**<,001**	1.96957	.14912	1.67509	2.26405
	Equal variances not assumed			13.954	160.995	<,001	**<,001**	1.96957	.14115	1.69083	2.24832
Evaluative Outcome	Equal variances assumed	9.582	.002	17.140	161	<,001	**<,001**	2.09896	.12246	1.85712	2.34079
	Equal variances not assumed			18.267	160.345	<,001	**<,001**	2.09896	.11490	1.87204	2.32588
Inviting	Equal variances assumed	7.810	.006	15.843	161	<,001	**<,001**	1.93611	.12221	1.69477	2.17744
	Equal variances not assumed			16.606	160.655	<,001	**<,001**	1.93611	.11659	1.70585	2.16636
Care	Equal variances assumed	.110	.740	8.563	161	<,001	**<,001**	1.19555	.13962	.91983	1.47128
	Equal variances not assumed			8.599	146.656	<,001	**<,001**	1.19555	.13903	.92080	1.47030

Table 6: Independent sample t-test human-to-robot interaction

3.2 Discussion

All observations and findings of the robot's effectiveness need to be treated cautiously, since not all use cases were yet implemented and not all capabilities exploited by the researcher. Additionally, the entrance of Skotel does not only serve as a hotel reception but has mainly an educational purpose.

The results of the first independent sample t-test display that guests and students perceive human and robotic services provided in the front office environment of HTH as comparable. Since no significant differences between the two groups were discovered, it can be assumed that the difference in service provision is not large enough to be measured. Consequently, hypothesis H1 is accepted.

> **H1:** The professional implementation of a social robot with a specific hardware-software combination in a hotel front-office environment leads to less difference in guest perception between human-to-robot and human-to-human interactions.

As this study aims to contribute to the knowledge pool of social robots in the hospitality industry, the researcher tries to integrate and evaluate the findings in the academic context presented in the literature review. It is further important to examine the reasons for the change in results between the two experiments.

The old application from Boogert detected significant differences for 5 of 7 factors. In all five cases, the human-to-robot interaction was evaluated lower than the interaction with a human employee. The newly build application for HTH is more elaborate and exploits more capacities of the robot-hardware combination, since it is implemented and build by a professional. The researcher is equipped through the extensive work at the software company WELBO with a particular skillset, which is essential to fully utilize all capabilities of the social-robot (Ivanov, Webster and Berezina, 2017). This aligns with Bartels and Lichtenberg's' conclusion that if skilled personnel is responsible for the 'adjustment and implementation of new technologies' a comparative advantage can be achieved (1987). The researcher can be counted to the group of 'specially trained people' and positively impacted the implementation of the social robot, confirming Andrés' research (2008).

The robot was enabled to guide students and guests to various locations which was recommended by Boogerts in his study and agrees with the opinion of Roel Noort, a founder of WELBO B.V.. Some features were not incorporated in the new application but still requested by students that knew the robot from the first experiment, which resulted in disappointment.

In general, the researcher was more aware of the possibilities than Boogert while creating the application, since he could use his expertise from more than 8 implementations at customers on site. This resulted in an advanced application flow that guides the interactor with questionnaires to the required information, enabling HTH to 'make full use of information technology' (Wynn and Jones, 2022).

The second independent sample t-test included not only the newly gathered data but compares them with the original dataset from Boogert. The human-to-robot responses were extracted from both datasets. The testing revealed a significant difference for 7 out of 7 factors. All difference displayed a decrease in means which consequently rejects hypothesis 2.

> **H2:** It is assumed that the human services remain constant over time and that there is a positive difference in guest perception of experiences between a professional and a non-professional implementation of a social robot with a specific hardware-software combination in a hotel front-office environment.

The researcher assumed the difference to be positive but was confronted with the opposite result. All 7 factors were evaluated higher for the first experiment than the second, which might suggest that the first application was a better fit for the HTH environment. Based on the results of the first independent t-test however, it is known that the difference between both test groups in the new dataset became smaller. This led to the assumption, that the scores for the human-to-human interaction must have dropped even more drastically.

To validate this finding, a third test was performed with the extracted human-to-human responses. The calculation of the relative percentage difference was performed and confirms the previous finding. By sticking to a strict curriculum as well as consistent training for both instructors and students, HTH manages to perform a consistent service at the front desk throughout the year.

The biggest drop was measured for both interaction types for the factor *Comfort* which was very likely influenced by the weather conditions. Boogert gathered his responses between the 7th and 17th of June 2022, a month with a comparably small number of rainy days and a total precipitation of 3,7 mm or 3,7 litre per square meter. The second experiment took place between the 15th of November and the 9th of December. In this timespan a total of 74,4 litre per square metre were measured in total (Appendix 7.28). In a recently published study by Brandes and Dover, over 300.000 online reviews were compared with the geographically applicable weather data over a duration of 12 years. It concluded that bad weather "induces negative consumer mood" and damagingly affects rating scores post consumption (2022). Since Boogert experienced significantly less rain on average per day (0,33 litre per m^2) compared to this experiment (3,1 litre per m^2) the weather variable is clearly a reason for the low ratings for both interaction types.

Another reason for the, on average, more negative guest perception of both the front office and the robot services might be the reconstruction of *Le Saveur,* the bar at HTH. It is placed directly in front of the reception area. The construction with accompanying noise pollution started shortly before the second experiment and was not existent during Boogerts experiment in June. Research by Levy, Duan and Boo for the *Cornell Hospitality Quarterly* agrees that noise pollution can have a negative effect on online hotel reviews as well as employee mood (2012).

Care experienced the lowest drop for the relative percentage difference. According to instructors at the front office of HTH in Amsterdam, certain SOPs ensure a consistent 'welcome' and 'goodbye' procedures. This increased the level of standardization for this factor and decrease its vulnerability to be affected by external variables. Temi was equipped with a set of new, charming greetings that make the interactor feel appreciated and special which most likely increase the score for the question*: 'I felt treated like a VIP during the interaction'. Care* has remarkably the highest inter-relatedness amongst the combined variables, a score of 0,926. A maximum score of 0,9 is recommended. It is assumed that respondents often just pressed the same score in the Likert scale,

indicating a duplication of the answers. The extensiveness of the questionnaire might be the reason for that.

The standard deviation for the robot-to-robot interaction is consistently higher for both Boggerts' and the new experiment. It can be assumed that the higher amount of dispersion displays less agreement amongst the respondents. The researcher observed that sentiments towards the robot are more extreme than for the human-to-human services. Respondents often expressed their fascination or fear for the new technology after the interaction. Interestingly, the standard deviation of the new experiment is for every factor higher than the old experiment. An explanation could be that the above-mentioned variables also effect the dispersion of responses.

Boogert also emphasized in his paper on the fascination of students, guests and lecturers for Temi since it is technological novelty and of unknown appearance (2022). Many respondents might have been positively influenced through this initial hype. The number of students experiencing the robot for the first time during the second experiment rapidly decreased and so did the impact on the scores.

The above-mentioned uncontrollable variables such as weather and construction have a negative impact on both interaction types.

Since the relative percentage difference of human-to-robot interaction is less negative for all factors, it can be assumed that either the social-robot was better implemented and therefore better perceived by guests or that the variables have more impact on the traditional front office interaction.

3.3 Lessons learned

Many key takeaways can be drawn from the field experiment performed at HTH, which is interesting for future research in the field of social robotics and for customers of these services.

Social robots constantly evolve and reveal unexpected implementation possibilities but must be treated as employment rather than ready-to-use technology. All software-hardware combinations that provide guidance and information provision, such as Temi, from Temi robotics, need extensive work and time to be installed and function constructively for the employer. All involved parties must clearly understand that the employment of a social robot needs to be carefully planned and executed. During employment, it needs to be revised frequently, and certain employees need to take ownership of processes that include robot assistance.

Before the experiment, the reception team had the chance to modify content and add missing information or information that had changed since the first experiment in June. The input from the instructors and students was crucial to provide correct information since false content would have negatively affected the guest's perceptions. In addition, the reception felt part of the experiment and in control of the content provided. It was an increase in acceptance and work ethic observed.

The researcher realized at the start of the experiment that the data collection period needed to be extended. Fewer people interacted with the robot than expected, and many people, especially students, needed to be more open to providing feedback by filling out the questionnaire. That can be traced back to the number of questions and the fact that Temi was not a novelty anymore. Only with the help of the reception team, and the

lecturer Mr. Salat, the required sample size was reached. When performing future field experiments with social robots, full-time employees' hectic and time constraints must be considered more.

Interestingly, students reported that they felt less restricted when talking to the robot since it treats every interactor the same way. The researcher's observations show that reception staff occasionally has more respect for lecturers and guests, especially when instructors are out of hearing distance. Some students are, therefore, hesitant to approach the staff with 'simple' questions since they are afraid to be judged or even defamed.

3.4 Conclusion

As more suppliers currently enter the market of social robotics for hospitality industries, the quality of human-to-robot interactions in service environments is expected to improve alongside with customer acceptance (Equip Hotel, 2022).

A similar experiment was conducted at two different points in time and has proven that different outcomes are measurable and that guest perception is constantly in motion. More precisely, human and robotic services were valued as comparable for the first time. It is impossible to correctly calculate the relevance of the different variables that altered in the period between the two experiments, however, it is doubtful that the performance of the reception staff differed so significantly from each other.

The findings offer insightful information for various stakeholders, such as hardware and software suppliers, customers, and researchers. Customers need to get familiar with the thought that social robots are not a one-time purchase solution and need similar attention and care as human employees. Software and hardware suppliers need to offer clients initial professional integration and ongoing support to facilitate or even compensate complex processes. Only if the benefits for hospitality businesses are visible and measurable, shareholders will dare to employ them to a more considerable extent. Since the application building and the social robot implementation were only performed by one professional from WELBO B.V., the impact of a minimum of three employees is assumed to accelerate the results.

The research offered a new perspective on how an advanced flow within an application can reshape the human-to-robot interaction. It is crucial to state the importance of knowledgeable employees during the implementation phase and their impact on content creation since they are a significant component of professional implementation.

4 Solution

4.1 Description of the solution

The solution provided for WELBO B.V. cannot be described as a typical intervention rather than a type of dissemination. Since the commissioner aims to verify its sales approach, whilst simultaneously filling the knowledge gap, the main solution was provided by professionally implementing the robot during the experiment and communicating the findings based on the statistical testing with SPSS.

Therefore, the researcher decided to focus on knowledge sharing as solution to increase the awareness of all Stakeholders on the impact of a professional social robot implementation on the guest perception. As Yang describes, especially internal knowledge sharing is crucial to supply employees with sales responsibilities or/and direct customer contact with additional competencies (2015). These competencies vary depending on the shared knowledge, but overall contribute to the organizational effectiveness, since knowledge is regarded as today's businesses' most valuable resource (Mustafa, 2006; Yang, 2015). Singh et al. identify knowledge sharing a part of knowledge management which can be translated into a four step model, whilst integrating the resource-based theory (2021). All steps are first outlined and later formulated in an executable manner in the solution.

1. The first step entails the gaining of relevant knowledge in either a tacit or explicit manner through an undefined channel. In this specific case, the researcher gained knowledge for WELBO B.V. by combining various sources of data with the conducted field experiment to draw conclusions.
2. In the second step, knowledge is converted into an explicit format. If acquired information does not add to a particular knowledge pool, sharing would have a negative impact on the effectiveness of an organisation, hence unnecessary and irrelevant knowledge remains tacit. (Hajibayova, 2019). The student has proven the knowledge to be relevant, however needs to transform the knowledge into a visual, quickly understandable format. The format needs to differ according to the recipient, as clients e.g., need a visually more attractive knowledge sharing tool.
3. The explicit and additional tacit knowledge must be shared in the third step internally. This will be done in a different manner for clients and staff. Clients will receive an easy to grasp infographic, which aims to spark their interest in the result of the research. Employees of WELBO
4. Lastly, the newly acquired knowledge needs to be applied. For this specific example of knowledge sharing, clients will receive the infographic over the monthly newsletter which is shared by WELBO amongst all customers. For internal purposes, an all-staff meeting will be held.

4.2 Solution

As described in the second step of knowledge management by Singh et al., different products must be created for different shareholders. The student organised an all-staff meeting in mid-February to present the findings, and a presentation will help to share the knowledge gained during the research. The information will likely be part of the upcoming Management letter that Roel Noort sends out.

Potential and current customers obtain the new knowledge via an infographic. It is used to provide information in a visual and easily understandable way, since interest for a purely contextual content is lost rapidly (Taspolat *et al.*, 2017). The infographic aims to spark interest for the story of providing better services through professional implementation.

4.2.1 Internal

The presentation was created by using the typical company colors and fonts to align with other professional products stored on the shared drive. It is mend exclusively for internal purposes but can be easily modified to be included in a client presentation

Screenshot 2: Internal Presentation for knowledge sharing

4.2.2 External

It was decided that an infographic is the most suitable way to share knowledge to customers. Only the second experiment was displayed to deliver the core message of having a comparable guest experience. The infographic is also available via this link:

https://www.canva.com/design/DAFWuUkeW7c/lx2rOJpyxoxQTDSfnO_A9Q/edit?utm_content=DAFWuUkeW7c&utm_campaign=designshare&utm_medium=link2&utm_source=sharebutton

Infographic 1: Guest perception in the new field experiment

4.3 Stakeholders

Stakeholder	Needs & wants	Solution Impact on Stakeholders	Engagement required
WELBO B.V. (All employees)	Staying informed Team alignment Profit Maximization	Additional knowledge on a distributed software-hardware combination Insights for future developments	Participation in all staff meeting Agree on dissemination plan for existing customers
WELBO B.V. (Commercial team)	High customer satisfaction Effective marketing plan for existing products Reaching sales targets	An additional argument during the sales of 'Sprints'. Additional content to precisely advertise the premium and professional subscription	Spare time for brainstorming sessions on how to implement it into the marketing strategy Willingness to use it during the sales process
Existing customers	Smoothly running product Insights about new features, updates or information concerning their social robot Information about the effectiveness of WELBO B.V. products	It helps existing customers to decide whether they want to extend or determine the subscription Might persuade them to purchase an additional 'sprint' It can be used for their own marketing purposes, over tools such as LinkedIn	Attention and time to look at the newsletter Financial funding and willingness to buy a new 'sprint' or to upgrade the subscription.
Potential customers	Suitable product offers	New Business Partner Additional Rental fees	Subscribing to the newsletter on the website Fill in the contact details over the website Follow WELBO B.V. on LinkedIn

Shareholders of WELBO B.V.	Proof, that WELBO has a promising future	Confirmation, that the investment in the company was a good choice Potential additional funding	Carefully reading the Management letter Additional funding budget
Temi Robotics	Customer satisfaction	Use it for own marketing purposes Input for future development needs for Temi	Resharing it on LinkedIn
HTH research center	More knowledge in the field of social robots in hospitality businesses Developed uses cases for the robot at HTH Amsterdam	Upgrade from the academic to the professional subscription Interesting topics for further research	Carefully reading the company project report Budget for additional robot expenditures

Table 7: Stakeholder overview

4.4 Dissemination

4.4.1 Company Newsletter

WELBO publishes a monthly newsletter to disseminate new features and organizational highlights to customers. The students research project was already mentioned in the last newsletter 2022 to tease for the upcoming findings (Appendix 7.30). The infographic will be shared with the customers by the end of February.

4.4.2 WELBO all-staff meeting

A presentation will be held during an all-staff meeting on the 14th of February to disseminate the findings and give additional insights that are relevant for the entire company (Appendix 7.31).

4.4.3 Fellow LYCar students

The results of the research including the infographic were shared with the fellow LYCar students Marije Aarnink and Clara Oterson during an online meeting (Appendix 7.30). The purpose was to receive feedback on the product and inform them about the results of my research.

4.4.4 Interview Partner

The presentation and further information were shared with Peter Leitgeb, one of the interview partners in person. Leitgeb, a successful industry professional, was very interested in the findings and discussed possible impacts for the hospitality industry. He agreed that future research should include exploring the effects of external variables on both the human-to-human and human-to-robot interaction (Appendix 7.33).

4.4.5 Temi Robotics

Once the knowledge is shared with the WELBO team, the student will reach out to Yaron Yoels, Chief Marketing Officer at Temi Robotics to share his insights from the research. Temi Robotics is in a close contact with WELBO B.V. and interested in research related to their product Temi and hospitality as a whole.

4.4.6 Potential customers

It was originally planned to disseminate the infographic as well as other results from the research LinkedIn. After a long conversation with the founder Roel Noort, it was decided to wait after the knowledge sharing event in February since there is no left capacity to handle new requests or leads over this platform. The students will start from February onwards full-time at WELBO and therefore will be in charge of the dissemination

4.4.7 Shareholders WELBO B.V.

The main shareholders of WELBO B.V. will not be informed directly about the research since the student has no direct contact with them. Finding and results will be disseminated over the management letter which is developed by Roel Noort.

4.4.8 HTH research center

The student is in close contact with Klaas Koerten, researcher at HTH specialized in robotics. A draft of the report was disseminated prior the hand in (Appendix 7.32)

4.5 Implementation

The internal solution will be implemented through an all-staff meeting on the 14th of February. Since the student starts as a full-time employee at the beginning of February, he will lead the knowledge-sharing event and send out a protocol for the subsequent brainstorming session.

The external solution will be implemented by the student and the customer success manager of WELBO, Hidde Gruben, by the end of March, as both will be responsible for the commercial distribution of the insights.

5 Evaluation

5.1 Solution Evaluation

The impact of the solution will be monitored in two different ways, since different solutions are developed for different parties. The effect on potential and existing customers is relatively easy to determine. Mailchimp will be used to send out the newsletter which enables the company to examine the number of views and clicks on the 'get in contact' button (Appendix 9.28). Additional request over Linked In are added. The student evaluates the solution as an outward success if 15% more people react on the newsletter as usual. The screenshot below displays the regular reaction on a send out newsletter.

Screenshot 3: Mailchimp Snippet

25% increase would represent an opening rate of at least 42% and a click rate at least 3%. Averages of the last three newsletters were used as a benchmark.

The impact of internal knowledge sharing is difficult to evaluated however will counted as a success if the research results are published in the newsletter, since it would display the interest in the topic from an internal perspective. The student will be responsible to additionally integrate it in the sales process, specifically for 'sprints'.

5.2 Limitations and Implications for future research

The newly conducted experiment based on Boogerts developed framework cannot be described as flawless in its execution, due to multiple factors elaborated in the following chapter.

The entrance of HTH does not entirely represent a hotel reception that is only dedicated to serve guest needs. Due to training purposes, most of the human-to-human interactions took place with comparably unskilled receptionists. It is likely that this had a negative influence on the scores of *Care* and *Comfort*. As most respondents are mainly within an age range of 18-24, it can be assumed that more students than guests filled out the questionnaire. Since younger generations have a more positive attitude towards the usage of disruptive technologies, as explained by Abou-Shouk, Gad and Abdelhakim, this might have positively influenced the human-to-robot evaluation (2021). Furthermore, the interaction with students and guests is different in its core as students are more focused on entertainment than information provision which aligns with the findings of Korn et al. (2019). Future research on the difference in guest perception between human-to-robot and human-to-human interaction in a real hotel setting will have more relevant outcomes. In addition, the experiment was somehow influenced by the previous implementation of Boogert in June 2022, since employees and students had certain expectations towards Temi that could not be fulfilled by the social robot (2022). The request to dance was mainly observed and resulted in disappointed interactors that often lost interest in communicating. Boogert originally used the 'Entertainment chatbot' in the respond only lane, which was removed in the newly programmed application.

The researcher joined forces with two researchers from HTH to create the questionnaire and to speed up the data collection period for the two separate studies. This led to an extensive questionnaire of over 35 questions and an average responding time of over 6 minutes. Compared to the eight questions of Boogerts survey, respondents suffered more often from respondent fatigue leading to a higher cancellation rate.

Even though the implementation of the researcher can be evaluated as professional it somehow differs from the commissioner implementation. The standard processes for either the professional or premium subscription as seen in Appendix 11.8 entail hardware updates and an implementation by the entire company including programmers from the development team. Due to the academic subscription that is currently in place at HTH, integrations with IoT devices such as Phillips Hue light or existing reservation programs were not considered. Based on Godleys dissemination about Singer's professional support services during the implementation of sewing machines, a future systematic review on the effectiveness of professional implementation across industries is recommended (2006). It would be further interesting to measure the effect of various external variables such as weather conditions on both the human-to-human and human-to-robotic service encounters to identify how influenceable they are.

As experienced during the fair Equip Hotel, the industry is currently flooded by various social-robot suppliers such as URG, Keenon, Pudu technologies, Softbank or Sakura, offering similar services with different level of implementation (Equip Hotel, 2022). New hardware-software combinations in the same experimental setup will lead to a different outcome of the research. 'Plato' by United Robotics Group i.e., can be entirely set up without professional background information but is limited in its capabilities (Appendix 11.20). With an increasing market presence of social robotics and a growing number of competitors, the capabilities of this disruptive technology are developing rapidly. The

ongoing releases as well as more robotics employed for service encounters also slowly impact the acceptance of social robotics amongst customers. This might have influenced the outcomes of the experiment.

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7 Appendices

7.1 Identified Barriers

Identified Barriers	Explanation
Resistance to implementation due to unwillingness to change	Rearranging long-established operational processes leads to disruption and insecurities amongst employees in the workplace/ out of the comfort zone/ leading to employees not wanting to engage with the new technology/ sabotaging the implementation process (Ivanov and Webster, 2017) (Collins, 2020).
Customers unwillingness to interact with social robotics	Customers might prefer a high-touch service culture and refuse to interact with social robotics (Ivanov and Webster, 2017; Merkle, 2019; Collins, 2020). Many customers, however, have a positive attitude towards the adoption of new technologies in the hospitality industry, especially younger generations (Abou-Shouk, Gad and Abdelhakim, 2021) According to Io and Lee, customers of the Henna Hotel in Japan were willing to engage, however often disappointed because robotics are not able to compensate human-to-human interaction with the level of need empathy (2020) Pitardi et al. displayed the advantage of not interacting with human staff with regards to delicate questions since they show no judgement and are less likely to 'gossip' (2021).
Fear of replacement	Employees might see the implementation of new social robotics as the first step to fully replacing their duties in the company and therefore becoming an existential threat to their livelihood (Ivanov and Webster, 2017) (Collins, 2020) (Abou-Shouk, Gad and Abdelhakim, 2021). Chinese traveller experiencing the HENNA hotel in Japan felt relieved to hear that most robotic staff was fired since many think that they are a bad replacement of the actual workforce (Io and Lee, 2020)
Financial barriers	Costs of implementing social robotics are currently only researched on a theoretical base rather than insights from actual implementations. Even if practical long-

	term studies are provided, no clear financial evaluation was performed that took all benefits into consideration (Pinillos et al., 2016). The financial cost that might be counteracting an implementation of a social robot is consisting of acquisition costs, installation costs, maintenance costs, costs for altering the service areas to make them accessible for social robotics, and staff training. There is no recent cost-benefit analysis of an implemented hardware software combination available nor its theoretical impact on decision makers (Ivanov and Webster, 2017).
Fear of interacting with social robotics due to lack of technological experience (technophobia):	Especially older Customers (before Gen Y) might be hesitant to engage in a service environment with social robotics since they feel unable to use them adequately (Ivanov and Webster, 2017).
Social Robotics just as entertainment for guest	As guests and hotel employees are often not aware of the capabilities of social robotics, decision makers in the hotel industry might evaluate the implementation as a pure entertainment factor for guests (Korn *et al.*, 2019; Io and Lee, 2020; Pitardi *et al.*, 2021)

Table 8: Identified Barriers

7.2 Color Coding Scheme

Barrier	Color
Employees unwillingness to change	<mark style="background:yellow">Employees unwillingness to change</mark>
Customers unwillingness to interact	<mark style="background:cyan">Customers unwillingness to interact</mark>
Employees fear of replacement	<mark style="background:red">Employees fear of replacement</mark>
Employees fear of interacting with new technology	<mark style="background:teal">Employees fear of interacting with new technology</mark>
Social Robotics just as entertainment for guest	<mark style="background:darkgreen">Social Robotics just as entertainment for guest</mark>
Missing cost-benefit analysis	<mark style="background:green">Missing cost-benefit analysis</mark>

Table 9: Color coding scheme

7.3 Trustworthiness of interview partners

Mr. Peter J. Leitgeb, a hospitality industry expert, was conducted to identify the importance of different barriers within the hospitality industry that hinder businesses from employing social robots for daily operations. The trustworthiness of Peter J. Leitgeb's professional advice as a hospitality industry expert is evaluated as high based on work his experience of over 35 years in the luxury hotel segment. During his career, he was General Manager at the 'Frankfurter Hof', a leading hotel of the world, Board member at Kempinski Hotels responsible for Sales & Marketing as well as President of the 'Leela Palaces, Hotels & Resort' in charge of business development. The following interview was translated from German to English.

Matthias Heck was a key decision maker in the hospitality industry and completed his master's in economics in 1986 and started as 'Group Accounting Manager' at Metallgesellschaft AG followed by a position as 'Group Finance Director' at the Thomas Cook Group. The last 15 years of his career, Mr. Heck was as CFO key financial decision maker at 'Deutsche Hospitality Group' with its grand hotel portfolio including companies such as the 'Steigenberger Hotel Group'.

Mrs. Sailer-Burkhardt is currently the Hospitality & Hotel Industry department head of the educational institution:'Bergiusschule' in Frankfurt am Main, that provides future hospitality professionals with theoretic and practical knowledge. Through her close relationship with representatives of the hospitality industry over the last ten years, she gained fundamental insight into HR-related challenges. Due to her professional experience in the field of education, Mrs, Sailer-Burkhardt was conducted to explore the current challenges of the staff shortage in the industry.

7.4 Interview 1: Mr. Leitgeb

Basic Information

Name Interviewee	Peter J. Leitgeb (L.)
Name Interviewer	Paul Werner (W.)
Date	24.05.2022
Time	3 PM
Source	Telephone
Language	German

W: Dear Mr. Leitgeb, thank you very much for giving me the opportunity to hear your professional opinion about social-robotics and HRI in the hospitality industry.

L: My pleasure Mr. Werner, I am always happy to support young professionals in their career.

W: I am currently in my last phase at Hotelschool The Hague, which is called LyCAR: Launching your career, and am planning on dedicating my research to simplify the application of social robotics in the hospitality industry. How did you experience Social Robotics during your time as Board member of Kempinski Hotels and along other steps of your career?

L: Oh that's interesting, I think it is always nice if the last part of studies are there to integrate students into actual businesses on the market, and what you are doing is very much future driven. In my role as Sales & Marketing responsible, I did not have too many touchpoints with the applications of social robotics in the daily operations. We are talking about a time that lies nearly a decade ago, so the failure rate of both hardware and software was still very high.

W: Did you had more touch points with the new technology during your time as a GM in Frankfurt?

L: Yes, I actually had. Mmh, let me think. Yes, there was the introduction of the Henna Hotel in Japan as the first fully automized operation supported by social robotics. We more or less saw it as a gimmick, and since the 'Frankfurter Hof' is part of the 'Leading Hotels of The World' and in the five-star superior category, we were very hesitant to even think of application possibilities.

W: How does the level of service influence the investment in social robotics in your perspective?

L: Oh, that is a good question. For decades, luxury hotels of the five-star categories have the highest level of service within the hospitality industry. To provide flexible decision making, tailorized services and empathic communication, the number of employees per room or guest is significantly higher than in lower star categories. For example, the 'Frankfurter Hof' where I was GM for over 15 years, had more service staff than actual rooms in the hotel. That enabled us to assure the guests to live up to the Leading Quality Assurance (LQA) standards of leading hotels of the world. But we had struggles to fill all vacancies with well trained staff.

W: Do you think that Hospitality Business nowadays have it easier to find suitable staff for all positions?

L: No, not at all! We have seen the industry becoming more and more uninteresting for apprentices and in general for staff. The working hours are comparably bad and the salary not very gracious. A lot of people were staying because they find the continuously changing work environment so fascinating, but with Corona, a lot changed.

W: How did Corona impact your work as a Hospitality Professional?

L: Since I was in the role of a consultant from my hub in Mallorca, I was just partly affected by the circumstances. Hotels approached me for different reasons, for example how to reduce the overall costs in the operations, since no significant cash inflow was generated. So, I was not negatively affected as a hotel consultant, however the demands of my clients changed. Since the payroll is normally the biggest cost factor in a luxury hotel, many staff members were sent into short time labour, contracts were not renewed and no more staff was employed, even if the occupancy increased significantly.

W: What were the effects of these actions?

L: What the effects were? That we have the biggest staff shortage in the Hospitality Industry since I am active in the business. It is a huge problem, because the business is coming back very strong, and it is not clear what kind of effect this will overall have on the industry. Employees are working at their absolute limit and many are close to a burnout, it is definitely time for change.

W: What are your thoughts when comparing the implementation possibilities of social robotics in the hospitality industry nowadays with the situation 20 years ago?

L: Due to the staff shortage, Hotels are more and more forced to investigate into alternative staffing, employee retention and in ways of maintaining the service level. Also, the capabilities of the social robots have developed rapidly, so they can actually be used as 'worker'. So I can imagine that financial decision maker are more willing to explore the possibilities of this new technology.

W: That is an interesting line of though. Why do you think are there than still not many hospitality businesses employing robotics? What are the biggest hurdles you would consider?

Explanation of the different barriers identified through literature

L: Well, bringing hardware fitted with technology into a hotel is always a gamble. First of all, robotics seems to the average hotelier as a huge investment, which is especially now very difficult to justify to your shareholders. In addition, hardware easily gets damaged in the daily operations and there is no time to call maintenance, to wait until they arrive and to fill the gaps in the operations.

W: I would like to play a little mind experience with you. Imagine you are working as a Chef de Rang in the Restaurant of a five-star hotel. Your GM decides to employ a social robot to support you with purely repetitive tasks such as bringing dirty dishes to the stewarding or picking up food from the kitchen. What are your concerns or hopes as an employee in this situation?

L: Oh ok, sure. Let me quickly think about that […thinks…]. So, I think the most important thing for the employee is if the social robot can actually help me and reduce my workload in the daily operations. If the robot is not able to do this, I would not be willing to work together with it. It should not act as a different co-

worker rather than a supporter of me. I mean the employee, so me [laughs], wants to remain in charge.

W: Do you think that the employee will be scared that the social robotics will take over their jobs and eventually replace them for good?

L: That is a though question. If employees are not aware of the limitations and the supportive way the robot is implemented, I definitely can imagine them being scared of being replaced or that their task become less worthy. I think however if you give the employees the chance to co-create the supportive service procedures based on their needs, I think that they would welcome them with open arms. The staff shortage is, as I already said, driving the people crazy. They need support.

W: And how do you think will the customers perceive the use of social robotics in the service culture?

L: I think that you have to differ between the levels of hospitality. Guests of top-notch properties don't want to speak to a machine and deal with misunderstandings etc. Since they are paying significantly high room rates, they want to be ensnared by the employees. Today we have the issue however that especially F&B outlets always are short on staff. So referring back to your mind game and taking the role of the guest, I would rather like to be served by an empathic employee that takes the time for personal communication but is supported by a social robot in the background then being served entirely by a human employee that has nearly no time to engage. But for that I would need a case study or something comparable. The most important thing from my perspective is: enhance the personal service through supportive social robotics and enable the supported employee to co-create its tasks.

W: That is very interesting to hear, you now only touched upon luxurious properties, how about the lower categories?

L: According to my experience, the number of personal contacts during service needed in a three-star property is far lower in a five-star property. I guess that means more application possibilities with less resistance from the guest, but this is just my opinion.

W: We have talked about various barriers for hospitality business to employ social robotics in their daily operations, but can you maybe point out the most important for you in the role of a key decision maker?

L: The first question that I would always ask the salesperson or the company trying to sell the social robot would be: what is my advantage? Most of them would than talk about the possibilities to fight the staff shortage and the possible cost reduction. As a key decision maker in the hospitality industry, you are however responsible to stand in for your shareholder's financial interest. It must be clear that the initial investment, maintenance support and software integrating still provides me with a cost-saving advantage in the future. And this is where the provider does not have a clear answer: a clear cost-benefit analysis, preferable based on a real life implementation example.

W: We have reached the end of the Interview, thank you very much Mr. Leitgeb for answering all my questions and engaging with the current problems of the industry.

L: No problem, if you have any further questions, please do not hesitate to reach out to me.

7.5 Interview 2: Mr. Heck

Name Interviewee	Matthias Heck (H)
Name Interviewer	Paul Werner (W)
Date	28.05.2022
Time	9 AM
Source	MS Teams
Language	English

W: Good Morning Matthias, thank you very much for giving me the opportunity to hear your opinions, thoughts, and professional expertise with regards to the implementation of social robotics in the hospitality industry.

H: Ah no problem, happy to help!

W: To start of the interview, could you maybe explain your role as Board Member of the Deutsche Hospitality group?

H: Sure, I worked in total 15 years for this company, primarily in the role of the CFO, the Chief Financial Officer. I was responsible to examine new investments for the different chains that we have in our portfolio, such as Steigenberger and Intercity. In order to pursue the purchase of these investments, my task was to stimulate the different stakeholders and realistically display them the advantages amd disatvantages, for example the amortization period, rentability etc. To eventually justify the project. But I obviously predetermined and calculated which ones would be of financial interest to the group.

W: Did you had any investment projects considering the implication of social robotics during your time as CFO?

H: No I honestly did not have any. There was a clear development in the adoption of IT related systems that were entirely cloud based and digitally integrated over nearly a decade. The idea of going back to hardware components that need mechanical support and are vulnerable to failure was never considered.

W: Not even considered as a possibility to fight the ongoing staff shortage?

H: I dropped out of the company in the middle of 2020, which was planned for 1,5 years in advance. There was already a significant staff shortage in the hospitality sector, especially amongst lower-level employees. Since 'Deutsche Hospitality' is a German company and they are traded on the stock market, they have to communicate and justify investments in front of the 'Betriebsrat' which can be translated as 'work council'. This council is elected by the employees to represent them in the BOD and can interfere in the decision making when they see current or future disadvantages for the workforce.

W: Can you give me an example of an investment or change plan that the 'Betriebsrat' would argue against?

H: Oh yes, I have plenty [chuckles]. We were about to purchase a new internal communication system, maybe you know Hotelkid, for our Intercity Hotels in Germany. The work council placed a veto against the implementation since they saw a risk in future workforce reduction due to more efficient work procedures. It

took me and my team nearly half a year to persuade them that this would enhance the wellbeing of the current workforce.

W: I can imagine that the work council would see the implementation of social robotics also as critically?

H: Yes, definitely. I think that if social robotics are integrated for compensating one or multiple FTEs, there is no chance that it will pass through the work council. There are jobs in danger. The circumstances however changed dramatically in the past two years. The corona crisis has enforced the problem of staff shortage and has forced businesses into major challenges. It is all about how you can justify the decision and if there are representatives of the lower-level employees that would vow for a positive effect such as work reduction in the daily operations, than there is a chance. You also have to take into consideration that this is a German system. In countries such as the Netherlands, decision makers in the Hospitality Industry have far less restrictions to face.

W: That is an interesting line of though. Why do you think are there than still not more hospitality businesses in the Netherlands and other European countries employing robotics? What are the biggest hurdles you would consider?

H: First of all, the initial investment of buying the hardware is after the challenging times of Corona a big risk. We are slowly regaining strength in the sector and have not the financial support. Since you have explained the situation during your internship to me, I think there will be no problems with an initial investment. However, I do not clearly see the advantage of social robotics in the daily operations. How many hours can be compensated through the new technology, how is it implemented and what financial return can be expected in the upcoming 5-0 years?

W: Imagine yourself still in the position as CFO 'Deutsche Hospitality', what do you need from the providing company to be fully convinced of an implementation?

H: The financial aspect includes the cost for implementing the system, employee training, maintenance etc. To be convinced of the feasibility of introducing robotic support, at least one representative case study would be needed to validate the financials. Since we are working in a people focuses business, the customer perception is a crucial factor. It needs to be proven that social robotics either enhance the customer satisfaction with the service or at least do not have any negative impact.

W: With all those preconditions proven, would you theoretically be tempted to implement the new technology?

H: I am not sure, to be honest with you: no. I will tell you why. 'Deutsche Hospitality' is rather focused on luxury hospitality that include the highest level of service possible. The clientele is used to top notch personal communication and it will be very difficult to introduce the technology in the front of house operations. Another critical element is the introduction of hardware. As said before, we have been experiencing a development from hardware to cloud-based digitalization in the last decade for a reason. Hardware needs to be well implemented, is vulnerable to failure and outdated easily. In addition, scaling this technology up and receive technical support, implementation etc. on a scale of more than a dozen hotels might be impossible for a Start-Up company.

W: I do understand your hesitation, especially because the technology is currently still in a development process. Do you still see application possibilities in the luxury industry, or do you entirely see the future of social robotics in lower hotel categories?

H: If it is possible for hotels to include them in back-of-house operation or front-of-house operations that do not influence the level of personalization, I also see possibilities in the luxury category. If you would have asked me three years ago, I would have said no way [laughs], but after Corona the staff shortage became even more of a problem. Nevertheless, as a CFO or any key decision maker needs clear evidence to support the decision in front of shareholders and the rest of the BOD.

W: Thank you very much for the interesting interview, Matthias. As promised, I will share my thesis with you as soon as I am finished.

H: No problem, I curious how you results will look like! Best of luck.

7.6 Interview 3: Ms. Sailer-Burkhardt

Name Interviewee	Riccarda Sailer-Burkhardt (S)
Name Interviewer	Paul Werner (W)
Date	04.06.2022
Time	9 AM
Source	MS Teams
Language	English

W: Thank you very much for doing this interview with me and providing insights into the hospitality industry. The focus of this interview more on the micro-cosmos Frankfurt as representative for a prosperous city. As you know my former apprenticeship hotel, the 'Villa Kennedy' as well as the 'Hessische Hof' closed their gates for ever. However, new hotels are still opened and the total number of beds in Frankfurt steadily increases. What do you think is most problematic regarding this development?

S: Hello Paul, I am looking forward to support you. Yes I sadly heard that the Villa Kennedy is closed now forever, what a loss. We have experienced a huge drop in occupancy during the pandemic and a lot of short time labour. Many employees decided to switch industries and are now staying there due to better working hours, higher salaries and useful benefits. The occupancy has gone up to 2018 level by now, but the staff shortage has significantly increased. Many hotels and their employees are at resilience limit and I think that we have to find new ways to cope with that. I am definitely another generation that you are Paul, and I am questioning myself whether I want to be welcomed by a robot and then accommodated to my room. And to be honest, I would always prefer the human interaction. On the hand I think that the younger generation is more used to this kind of check in (as seen in supermarket examples), not because they are unsocial, but because it is more efficient, flawless and faster than the standard procedure. Often, they don't want to have chit-chat.

I think it crucial to first look at the hotel category, since the traditional houses in the five-star category are less suitable. I was last month with the graduating class of hotel economics in the Atlantic Hotel in Hamburg. It is a travel back in time, we felt a bit like going on the Titanic or something equivalent, with a lot of traditional service, glamour etc. It is in my opinion not possible to include social robotics in this kind of establishment.

W: Since this level of service also needs more employees especially in the front-of-house operations, do you think that they are suffering the most from the staff shortage in the industry?

S: I do not specifically think so. It effects every hospitality business. However, you are right with the assumption that due to the higher need for employees, these businesses are more in need of well-trained staff. On the other hand, hotels such as the Atlantic or the Sofitel have another prestige level than a Holiday Inn that attract employees more.

W: **Explanation of my Internship at WELBO and the three different Hardware Types**

How would you feel as a luxury hotel guest if you see that the waiter in the restaurant is supported by social robotics (Bellabot) during the service?

S: I would not liked to be served by a social robot, I don't know, but maybe I am too old fashion for that. I think that it is very much part of the customer experience to have all the different touchpoints with the staff. If, as you said, the robot is just taking over repetitive tasks that have no touchpoints with the customer, I think I could get used to it. The main point is really that it is used for dirty work. I can also imagine Bellabot in the room service department to fulfil transportation and delivery tasks. As I said before, I can think of a robot being implemented everywhere the task don't have any interaction with the guest itself.

W: Yes, I would also agree based on my own experience. The broad topic of my bachelor thesis is to identify the biggest barrier for hospitality businesses to employ social robotics in their daily operations and to design a solution-based approach.

Explanation of the different barriers identified through literature

Based on your insights into the industry, what do you think is currently the biggest barrier to prevent businesses from implementing social robotics in their daily operations?

S: If the pressure is high enough, I mean if the staff shortage has such drastic effects, than the GM would most likely say: let's try it! Even though he or she might not be as convinced of this particular solution. If the shortage is so severe, then barriers such as rentability do not count as much as making the operations run again. You need to know however what you are getting into financially as a key decision maker, even if it is a loss, and we don't have anything like this at the moment. If you are not able to find enough employees in the long run, social robotics can be an alternative to restricting occupancy or outlet services.

I would evaluate the barrier of employees engaging with a new technology as little. The workforce has clearly changed, and it is not usual for employees to stay for 30 years at the same hotel or in the business in general. Especially when lower level employees see the advantage and possible help of such robotic, they are in my opinion happy to engage. They need however enough technical support and guidance maybe even training at the beginning, and the hardware needs to be flawless.

W: And how do you think would feel regarding the fear of replacement?

S: I think that the communication between the employer and the employee must be on point during the integration phase to minimize the concerns within the workforce, because it is a barrier! It is crucial to emphasize that no employee is planned to be replaced, but how the robotics can support with various tasks from multiple FTEs. These tasks should not affect the guest contact rather than taking over dirty tasks.

W: What kind of tasks would you aim to replace and what are good examples for dirty tasks?

S: Definitely no tasks on a managerial level, but tasks that are less paid, time consuming and unpopular amongst employees. This includes tasks with dirty dishes, transportation of plates, amenities or guests requests, if we take only the capabilities of 'Bellabot' into consideration. In general delivery and pick-up tasks.

If the robotic is used in different departments, the fear of replacement will minimize.

W: And how do you think guests will perceive the employment of social robotics?

S: I think it is important to differ between different hotel concepts and their target groups. If you have a futuristic and modern approach with more attractiveness to a younger audience, the acceptance level is much higher than in a conservative hotel concept with an older target group. The willingness is higher, guests have a more playful and open attitude towards new technology and can easily understand how to use it.

W: If you think about a concept where department managers in close contact with the lower-level employees are fully in charge of developing the task performed by the robot, how would this influence the fear of replacement?

S: In such a scenario, the fear of replacement is less. I think the control of what tasks are done should always lie in the hands of the people actually working with it or their direct supervisor/ manager. This is how the support will be most effective. Through responsibility and ownership a feeling of suitable support is created which is in my opinion the biggest driver for acceptance. For me it is clear that a bottom-up approach is the way to go. The initial idea and the financial investment comes obviously from the top management, however the operational employees need to try out the possibilities, opportunities and restrictions.

W: How would you evaluate the problematic of hardware components fitted with software, since the development in hotels was more focused on cloud-based digitalization?

S: I definitely see the difficulties that might occur, however if the staff shortage continues or even intensifies, GMs and CEO will not have much more of a choice than employing alternative workers. We are currently in a stage where we have occupancy back on a pre-covid level and less employees that are trying to cope with the same volume. Also, to argument pro-robotic, we are not letting any people go, contrary, we are still searching. We have the chance here to create a discharge for good employees that are over worked. Otherwise, these few good employees will eventually also lose interest in the hospitality industry. We as vocational school do not see changes on the labour market anytime soon since the job has become more and more unattractive.

Robotics can also be an attractive for new employees to apply to a specific hotel because they see that the management is seeing the grievances and is willing to fight against them.

W: I think it nice to think about the effects of robotics on future employees as well. If the support robotics are well integrated in the daily operation, there might be the chance that new applicants select this hotel especially because of this reason. They know that they are supported in their task no matter how many people call in sick or how many people actually are short in the department.

S: I can imagine that the accessibility of the property has a huge impact on the application possibilities. It would probably be the smartest idea to include the thoughts of implementing robotics during the planning and building period of the hotel.

W: How do you think the tasks of the robot will develop in the future?

S: Oh, that is a tough question. I think that it primarily depends on the continent or country itself. The Asian population, especially China and Japan are far more used to interact with these technologies. As we have seen with the launch of the Henna hotel, consumer and guests are ok with artificial staff. In Europe and Germany, the people are more careful and hesitant. If they see however that the service that they used is not possible with the number of staff, they will adjust more quickly. I think that the actual development of task will take place in the hotel itself. We both do know the hotel business with its different layers and maybe also possible implementation areas. It is something completely different if you work together with those robots, get to know more the capabilities but also the flaws and then used based on your needs.

W: Yes, I think that is also important to put into consideration, the business development is for now targeting more the European market, since the staff shortage is the most severe.

S: Interesting that you say that. I recently had a long conversation with the HR Manager of the 'Schlosshotel Kronberg', a five-star hotel. She told me that they had to close two F&B departments because they were not able anymore to staff them properly. They could not be the employer that they were always aiming to be. They are now choosing the strategy of doing less business with less employees because they are scared that those will also go eventually.

W: The Frankfurter Hof also had a related problem and decided to only allow a maximum capacity of 70%.

S: Yes indeed, and this also effects young adults that are about to choose either a study or an apprenticeship. The reputation is pretty bad and nearly none of my students recommends the apprenticeship to friends or family. There are the same keywords mentioned every time: high work pressure, overtime, staff shortage, aggressive guests and so on.

W: Yes, I think that is one of the biggest challenges that we have in the near future: to make the hospitality industry more attractive again and to show the beauty of the job. If the staff shortage is not a severe issue anymore, the advantages of an always changing work environment, challenging events, interesting conversations and interactions and the impact of happy customers will consequently attract new talents.

S: I have more and more the feeling that we are facing a crucial decision as industry: we have to make sure that we don't lose our young talents and let them spread negative news about the hospitality industry. We need to engage with them, to spark the flame for exactly what you have said and why you initially decided to join the industry. I really think that now is a very good time to investigate in alternative HR solutions. On the one hand we have the issue with staff shortage and lack of offspring as well and on the other hand the experience and interaction with technology increase significantly. To be honest with you, I wouldn't call 'Bellabot' a social robotic since it is more of a delivery assistant. Terminology additionally helps with the acceptance since a social robot implied that your personal competences are compensated. Maybe something to think about.

W: Yes, an interesting approach however difficult, since this is the official term on the market. We have reached the end of the interview, thank you very much for your time and the valuable input.

S: You are more than welcome, hope I was of some help. Best of luck with your thesis.

7.7 Hardware components considered

Pudu Technology Inc.

A Chinese manufacturer suppling WELBO with '**Bellabot'**, a social robot specialized in navigation and the transportation of objects. It is currently in action at various customers such as different Hajé restaurant locations in the Netherland (Pudu Robotics, 2022). Bellabot is the only hardware component offered by WELBO that is not fitted with their self-developed software, leading to a limited API (van Oers, 2022).

United Robotics Group (URG)

URG is a subsidiary of the RAG-Stiftung in Bochum, and since April 2022 the parenting company of Softbank Robotics Europe (SBRE), making them the exclusive retailer of the social robotic hardware '**Pepper'** in Europe (URG, 2022). Pepper is a humanoid robot released in 2014 and specialized in mimicking human alike emotions, mainly implemented for reception and entertainment tasks in various companies. There will be no successor for Pepper, which will eventually result in a support stop from Softbank (Lewis, 2021).

7.8 Theoretical application in hotel businesses

Application in Hotel Businesses

TEMI - Feedback and Navigation Expert

Front Office/ Concierge/ Entrance

- Welcoming guests at the hotel entrance
- **Navigating** the guest to the desired outlet
- Appointment facilitator
- Answering **routine questions**:
  Wi-Fi password/ opening hours/ Check Out Times/ Restaurant recommendations etc.
- Checking the proof of vaccination
- Temi can move around, but also be used as a static robot
- Actively approaching people and **facilitating the check-in** procedure by displaying a QR code
- Integrated **Follow Mode**, attraction point for hotel guests
- **Remotely controllable** tool for night managers and receptions that are not able to leave the desk without a cover

Restaurant

- Reservations can be uploaded to Temi and be used to **welcome guests**
- **Host/Hostess** tasks can partly be replaced
- Gathering honest **feedback & gaining insights** (through sentiment analysis or ratings)
- Check upon guests' wellbeing in a restaurant environment
- Explaining the daily or weekly menu specials to the different tables

M&E / Banqueting

- **Welcoming** guests, introducing guests to the venue
- Navigation (guiding guests in the direction of the toilet, bar, wardrobe, selected table, or a meeting room)
- Providing **physical tours** of the meeting rooms with additional information (supporting the M&E department)
- Scanning Tickets for entrance allowance to venues

Housekeeping

- **Navigating** guests to their room
- **Providing information** about cleaning schedules, regular check-out times etc. upon request
- **Remote controllability** of Temi to navigate on the floors/ hallways

7.9 Overview of the OpEx-Model
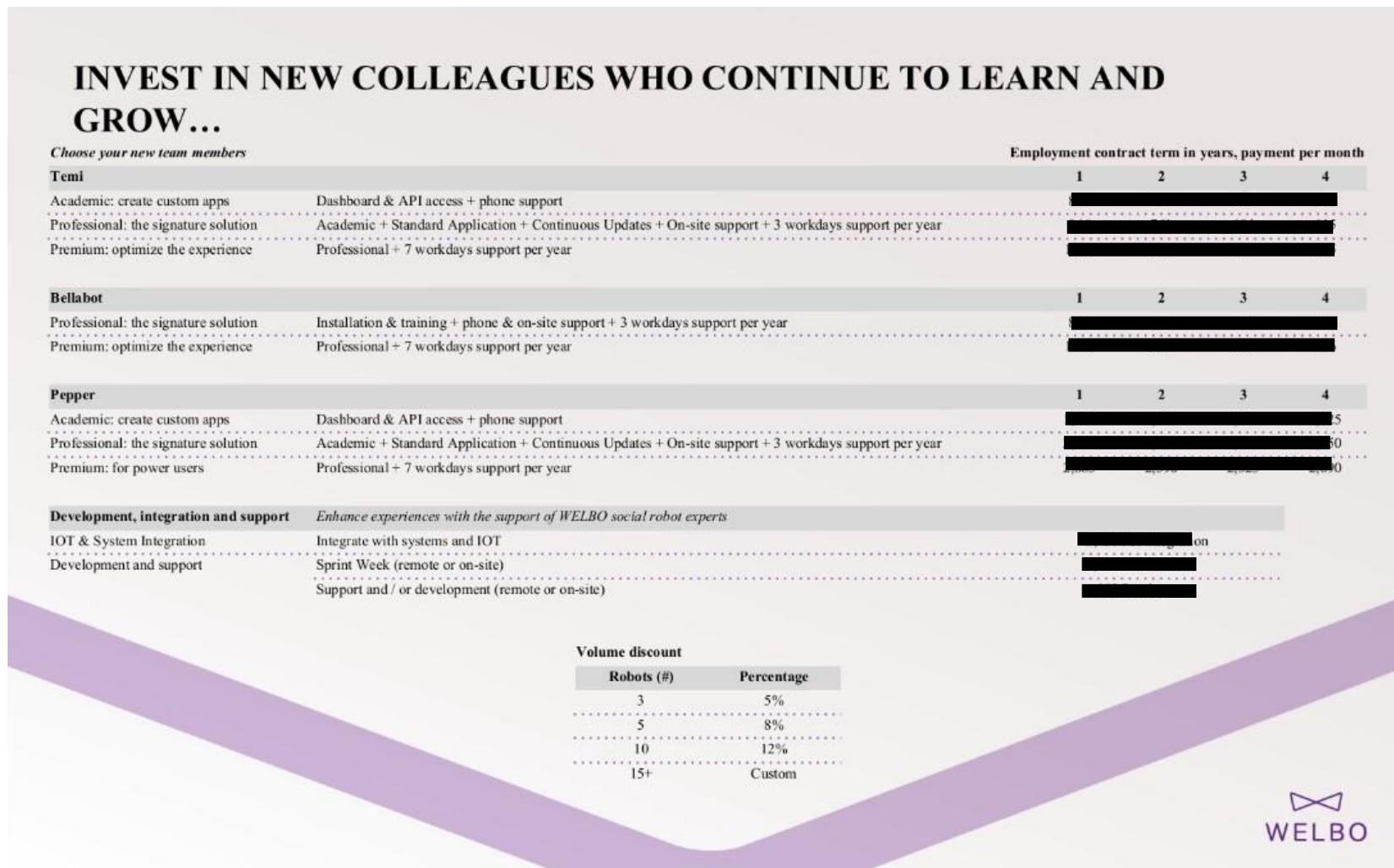
7.10   ISO 27001 Certification

7.11   Old Application Setup


: Old Application Setup

## 7.12   Duration of interactions
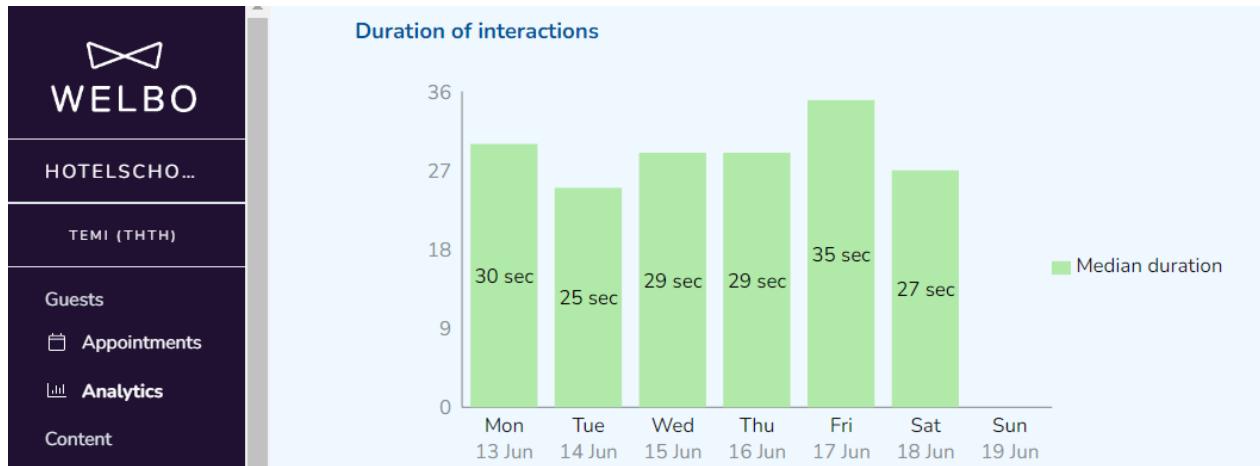
Screenshot 4: Average interaction duration old application
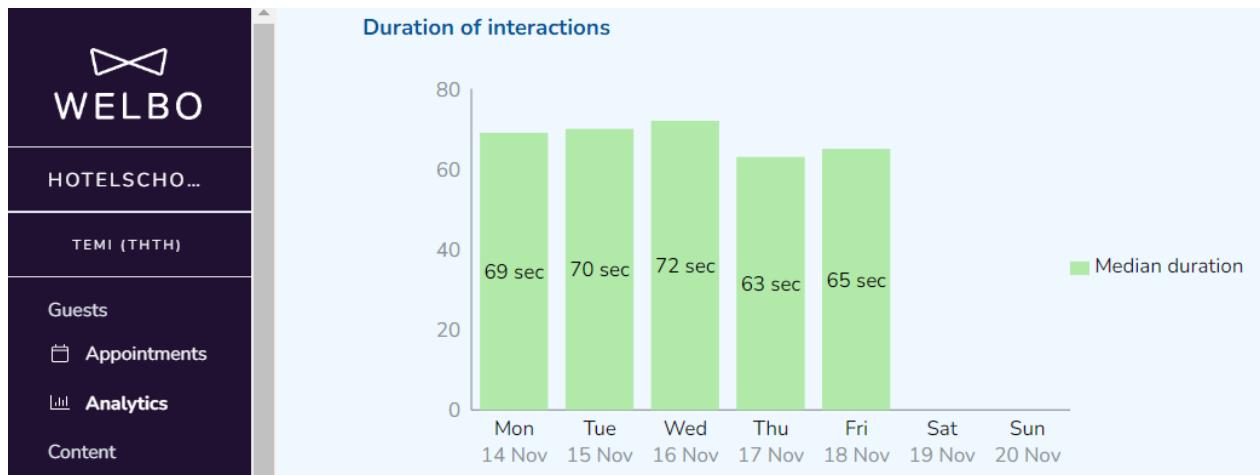

Screenshot 5: Average interaction duration new application

7.13   Mapping old application

Map

Key points on map

Please make sure the following waypoints are present on the map

home base: charger location

welcome: when *approach people* is enabled the robot moves to this location and approaches people within 3 meters. This is also the location the robot returns to after routing people (if it is not defined the robot goes back to the **home base**)

pickup: when using multiple robots for routing, the guidance robot goes here to pick up someone (this should be close to but not the same spot as the other robot)

dropoff: the default drop-off location

elevator: where the robot drops off someone when they have to go to another floor using an elevator or stairs

roam1, **roam2** etc.: when *roam around* is enabled the robot moves randomly between these locations

View Manual

Screenshot 6: Old ground floor map of the Amsterdam HTH campus

7.14   Mapping new Application

Map

Key points on map

Please make sure the following waypoints are present on the map

home base: charger location

welcome: when *approach people* is enabled the robot moves to this location and approaches people within 3 meters. This is also the location the robot returns to after routing people (if it is not defined the robot goes back to the **home base**)

pickup: when using multiple robots for routing, the guidance robot goes here to pick up someone (this should be close to but not the same spot as the other robot)

dropoff: the default drop-off location

elevator: where the robot drops off someone when they have to go to another floor using an elevator or stairs

roam1, **roam2** etc.: when *roam around* is enabled the robot moves randomly between these locations

View Manual

Screenshot 7: New ground floor map of the Amsterdam HTH campus

7.15   Tap to engage

Picture 2: Tap to engange

7.16   Greetings Overview

Decision Tree Application ✏

| General | Content | **Greetings** | Goodbyes | Settings |

Define the greeting texts for the robot. Use the language button to define these for all languages.   **English**

Invite a person to come closer and interact
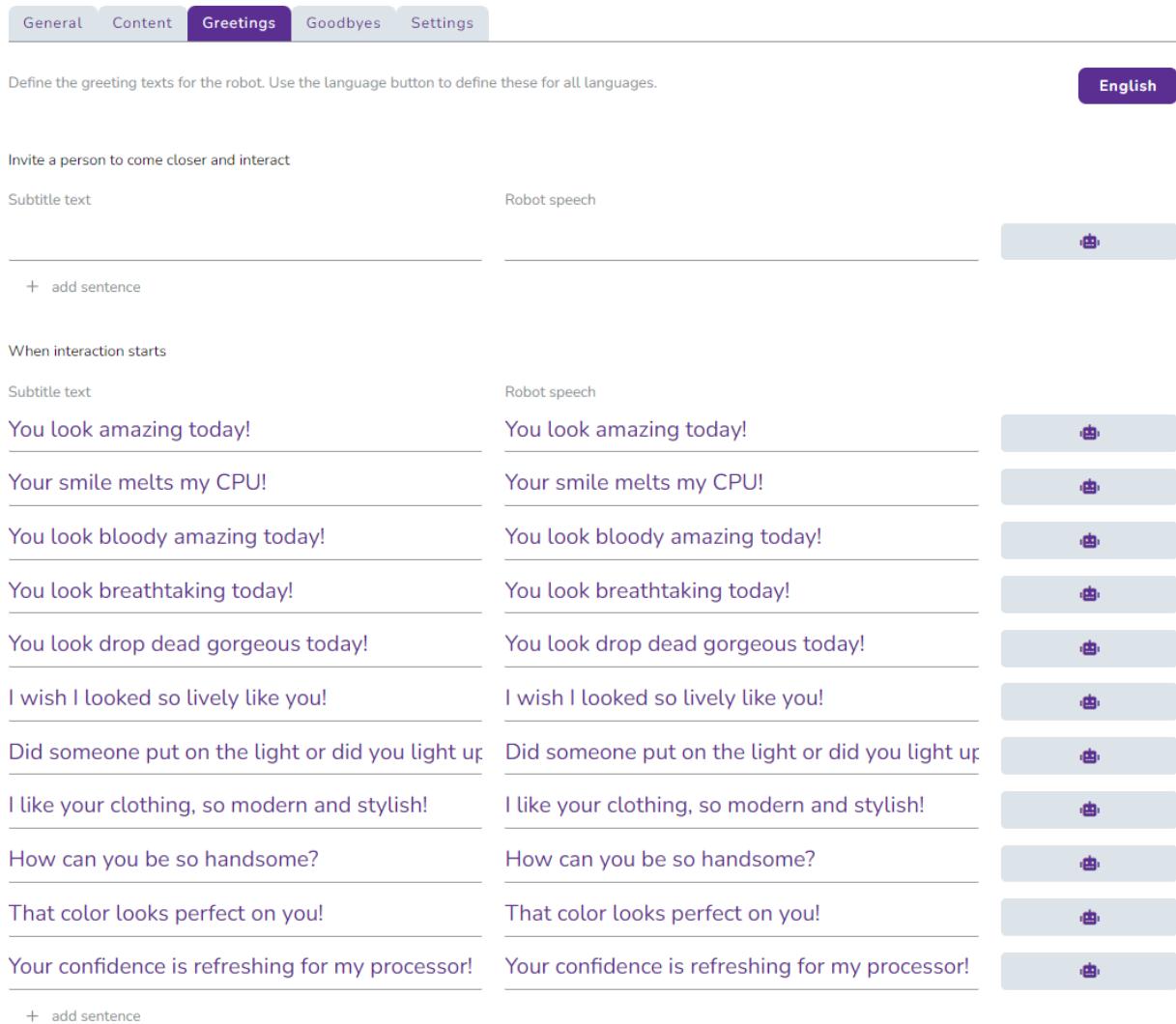
Subtitle text   Robot speech

+ add sentence

When interaction starts

Subtitle text   Robot speech

You look amazing today!	You look amazing today!
You look bloody amazing today!	You look bloody amazing today!
Your smile melts my CPU!	Your smile melts my CPU!
You look breathtaking today!	You look breathtaking today!
You look drop dead gorgeous today!	You look drop dead gorgeous today!
I wish I looked so lively like you!	I wish I looked so lively like you!
Did someone put on the light or did you light up	Did someone put on the light or did you light up
I like your clothing, so modern and stylish!	I like your clothing, so modern and stylish!
How can you be so handsome?	How can you be so handsome?
That color looks perfect on you!	That color looks perfect on you!
Your confidence is refreshing for my processor!	Your confidence is refreshing for my processor!

+ add sentence

Screenshot 8: New greetings overview

7.17   Decision Tree Snippet

Screenshot 9: Decision Tree Snippet

7.18   Improving Engagement

Help us to perform even better in the future!

Please scan this QR code and fill out the questionnaire to support us

Infographic 2: Improving respondents' engagement at the front des

7.19 Cooperation with Hotelschool Front Office Team

Picture 3: Cooperation with the front office employees

Additional response gathering

Picture 4: Data Analytics Class interacting

7.20   Data Consent Ms Sailer-Burckardt

The impact of a professional social robot implementation on guest perception in the front office environment of Hotelschool The Hague

I, the intended research participant, have read the information for this project. I was given the opportunity to ask additional questions. If I had any questions these have been answered to my satisfaction. I have had enough time to decide whether or not I wish to participate.

I understand that my participation is completely voluntary. I understand that I am free to withdraw at any time, without giving any reason.

I understand that some people have access to my personal details. These people have been mentioned (in the information etc.).

I consent to the use of my details, for the purposes that have been mentioned in the information/information letter.

I consent to my details being kept for further analysis (if applicable) for a maximum of 15 years after this research project has ended.

I hereby give my informed consent to take part in this research project.

Name of participant: Riccarda Sailer-Burckhardt
Signature: Date : 04, 01, 2023

I, the researcher, confirm that I have fully informed this participant about the above research project.

If any new information arises in the duration of the research project that could potentially influence the participant's consent, I will inform the research participant.

Screenshot 10: Data Consent Ms. Sailer Burckhardt

7.21   Data Consent Mr. Heck

The impact of a professional social robot implementation on guest perception in the front office environment of Hotelschool The Hague

I, the intended research participant, have read the information for this project. I was given the opportunity to ask additional questions. If I had any questions these have been answered to my satisfaction. I have had enough time to decide whether or not I wish to participate.

I understand that my participation is completely voluntary. I understand that I am free to withdraw at any time, without giving any reason.

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I consent to the use of my details, for the purposes that have been mentioned in the information/information letter.

I consent to my details being kept for further analysis (if applicable) for a maximum of 15 years after this research project has ended.

I hereby give my informed consent to take part in this research project.

Name of participant: Mathias Heck
Signature: Date: 03 /01/2023
Online Signature (03.01.2023)   *Mathias Heck*
---┼---------
I, the researcher, confirm that I have fully informed this participant about the above research project.

If any new information arises in the duration of the research project that could potentially influence the participant's consent, I will inform the research participant.

Screenshot 11: Data Consent Heck

7.22   Data Consent Mr Leitgeb

The impact of a professional social robot implementation on guest perception in the front office environment of Hotelschool The Hague

I, the intended research participant, have read the information for this project. I was given the opportunity to ask additional questions. If I had any questions these have been answered to my satisfaction. I have had enough time to decide whether or not I wish to participate.

I understand that my participation is completely voluntary. I understand that I am free to withdraw at any time, without giving any reason.

I understand that some people have access to my personal details. These people have been mentioned (in the information etc.).

I consent to the use of my details, for the purposes that have been mentioned in the information/information letter.

I consent to my details being kept for further analysis (if applicable) for a maximum of 15 years after this research project has ended.

I hereby give my informed consent to take part in this research project.

Name of participant: Peter Leitgeb
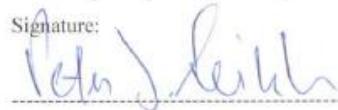
Signature: Date : __/__/__
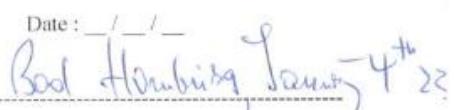
I, the researcher, confirm that I have fully informed this participant about the above research project.

If any new information arises in the duration of the research project that could potentially influence the participant's consent, I will inform the research participant.

Screenshot 12: Data Consent Mr. Leitgeb

7.23　　Newly launched social robots
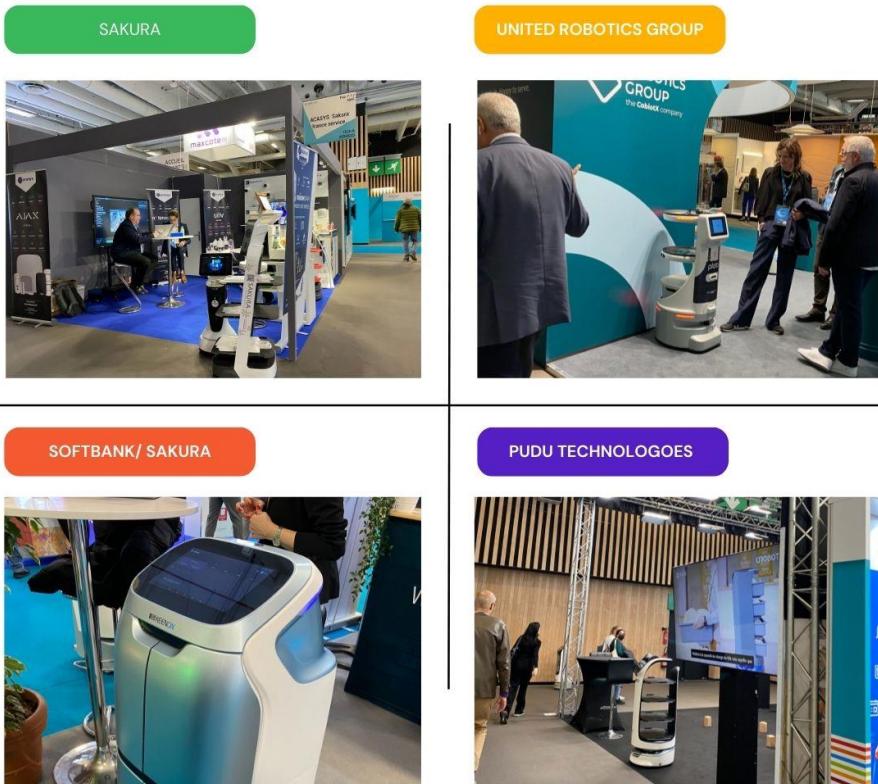
Infographic 3: Newly launched robot hardware (Equip Hotel, 2022)

7.24   Cronbach's Alpha Inviting

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.868	.869	3

Item Statistics

	Mean	Std. Deviation	N
The interaction felt inviting	4.9448	1.28981	181
I experienced openness during the interaction	5.0221	1.29938	181
I experienced freedom during the interaction	5.0663	1.33999	181

Table 10: Cronbach's alpha inviting

7.25　　Cronbach's Alpha Care

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.926	.928	7

Item Statistics

	Mean	Std. Deviation	N
I experienced support during the interaction	5.0052	1.28828	192
I experienced involvement during the interaction	5.0625	1.20046	192
I felt treated like a V.I.P. during the interaction	4.3958	1.62429	192
The Temi robot/reception employee did it's best to take care of me	5.1979	1.35461	192
The Temi robot/reception employee relieves me of tasks or worries	4.7656	1.39643	192
The Temi robot/reception employee is interested in me	4.8594	1.42748	192
I felt important during the interaction	4.8542	1.41776	192

Table 11: Cronbach's alpha care

7.26 Cronbach's Alpha Comfort

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.849	.850	3

Item Statistics

	Mean	Std. Deviation	N
I felt at ease during the interaction	4.8632	1.32626	190
I felt comfortable during the interaction	5.2368	1.24370	190
I felt relaxed during the interaction	5.2632	1.23623	190

Table 12: Cronbach's alpha comfort

7.27 Measuring differences

Human-to-robot interaction

Group Statistics

Implementation Type		N	Mean	Std. Deviation	Difference in %
Comfort	Non-Professional	69	4,07	0,96	
	Professional	72	3,37	1,06	**-17,27%**
Overall Satisfaction	Non-Professional	69	4,04	1,05	
	Professional	72	3,59	1,07	-11,17%
Overall Hospitality	Non-Professional	69	**4,22**	0,78	
	Professional	72	**3,71**	1,00	-11,98%
Behavioural Intention	Non-Professional	69	4,06	1,14	
	Professional	72	3,46	1,21	-14,67%
Evaluative Outcome	Non-Professional	69	4,11	0,84	
	Professional	72	3,59	0,97	-12,60%
Inviting	Non-Professional	69	4,04	0,83	
	Professional	72	3,42	1,03	-15,41%
Care	Non-Professional	69	3,72	0,88	
	Professional	72	3,34	0,95	**-10,11%**

Average difference in % -13,31%

Human-to-human interaction

Group Statistics

Implementation Type		N	Mean	Std. Deviation	Difference in %
Comfort	Werner	95	3,51	0,95	**-21,04%**
	Boogert	66	4,44	0,68	
Overall Satisfaction	Werner	95	3,62	0,95	-16,07%
	Boogert	66	4,32	0,83	
Overall Hospitality	Werner	95	**3,69**	0,96	-18,45%
	Boogert	66	**4,53**	0,61	
Behavioural Intention	Werner	95	3,62	1,05	-16,54%
	Boogert	66	4,33	0,75	
Evaluative Outcome	Werner	95	3,65	0,89	-17,04%
	Boogert	66	4,39	0,59	
Inviting	Werner	95	3,56	0,85	-18,39%
	Boogert	66	4,36	0,64	
Care	Werner	95	3,36	0,89	**-12,42%**
	Boogert	66	3,83	0,87	

Average difference in % -17,13%

Table 13: Measuring differences between the old and new experiment

7.28 Historic weather data
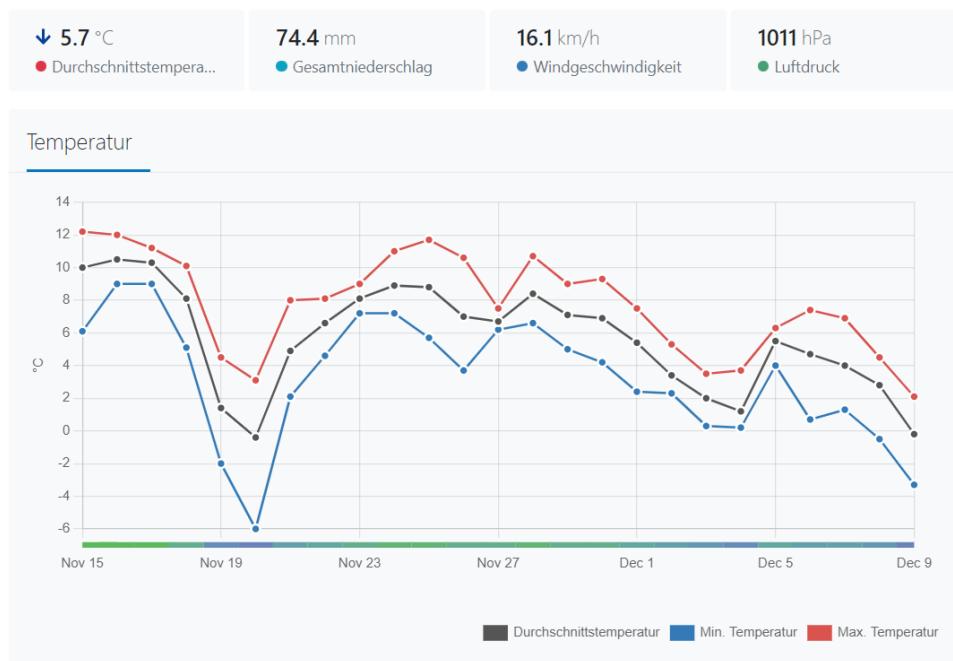
Screenshot 14: Historic Weather Data Amsterdam (Meteostat, 2021)
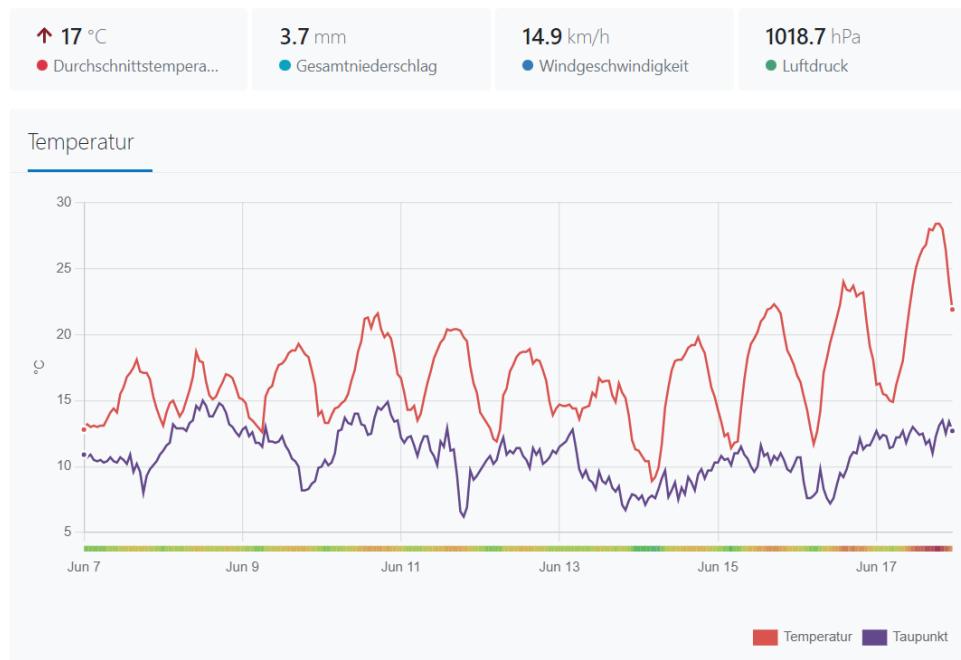
Screenshot 15: Historic Weather Data Amsterdam (Meteostat, 2021)

7.29   Company Newsletter December

Screenshot 16: WELBO December Newsletter

7.30   Dissemination to fellow LYCar students
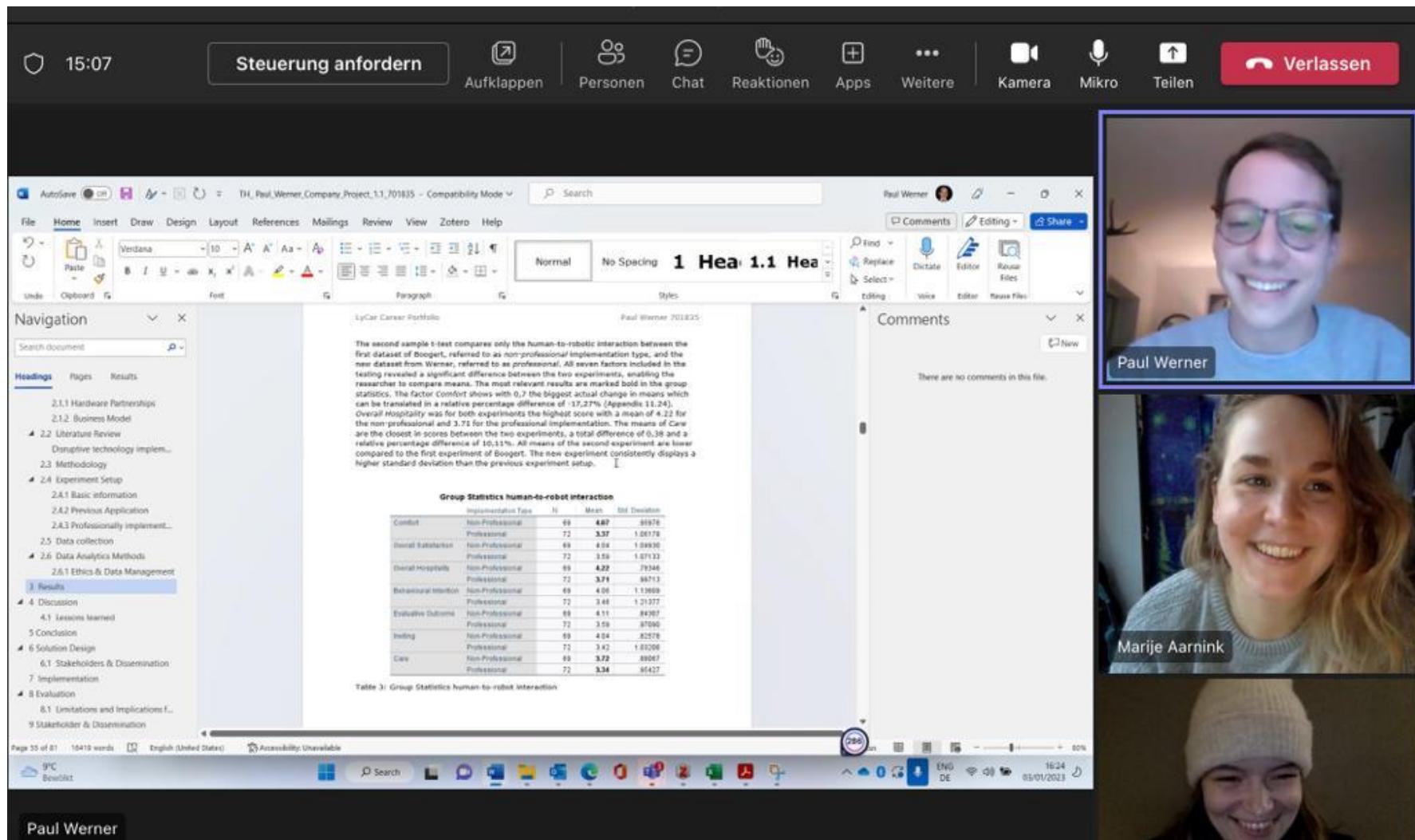
Screenshot 17: Online meeting with fellow student

7.31   Dissemination WELBO all-staff meeting

Screenshot 18: All staff meeting

7.32   Dissemination HTH research center

Paul Werner
To ● Koerten, K. Mr.

📄 PaulWerner_701835_Companyproject_Version1_08.01.23.docx
6 MB

↩ Reply   ↩ Reply All   → Forward

Tue 03/01/2023 17:22
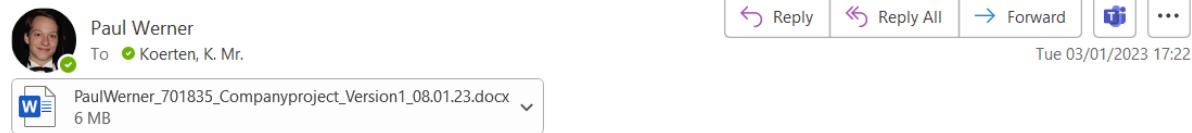
Dear Klaas,

Please find attached the draft of my company project report. The section on building up a solution and dissemination/evaluation is based on the findings and is currently in progress (modified in a different document). I think they are less interesting to you than the rest of the report.

I am very much looking forward to receiving your feedback.

Best regards

Paul

Screenshot 19: Email to Klaas Koerten

7.33   Dissemination Industry Expert

PL **Peter Leitgeb** <peter.johann.leitgeb@googlemail.com>
13:44

To: Paul Werner

Re : Our Meeting today - Your Bachelor Thesis

Dear Paul,

Thoroughly enjoyed our meeting today.Thank you for sharing your Bachelor Thesis with me :

" The impact of a professional social robot implementation on guest perception in a hotel front office environment "

It is truly a very interesting and exciting topic.Having worked myself as Gen.Mgr.V.P and Member of the Board for Kempinski Hotels & Resorts in the US,Hongkong and other key cities - and as CEO / President for the Leela Hotels and the Claridges Hotel Group in New Delhi and Mumbai,I certainly can foresee the positive impact and huge potential of social robot implementation in the Hotel and related service industries.

Again,Congratulations on your Bachelor Thesis.I wish you all the very best and success in your future professional career.
Let,s stay in touch.

Kind regards,

Peter J. Leitgeb
PJL CONSULT
Hotel Management Solutions

Schillerstrasse 2A
61350 Bad Homburg, Germany
Tel: +49 6172 81718
Mob: +49 151 2702 2336

Screenshot 20: Dissemination industry expert

7.34   Proposal Feedback

LYCar Proposal Grading Rubric
v.1.1 (Version LYCar 2020; 16 February, 2021)

Student Name:	Paul Werner	LYCar Coach:	Mr. Villanueva
Student Number:	701835	Primary PLO:	1
Date Submitted:	28/08/2022	Secondary PLO(s):	3

Note: All boxes with red border to be filled by student

Preconditions (required for assessment)	Yes	No	Comments
Checks content and completeness			
Executive Summary is present, concise, can be read independently, contains information about process and content, focuses on results and outcomes	✔	✔	
LYCar Proposal meets formal reporting criteria (according to e.g., LYCar Reading & Writing Guide)			
LYCar Proposal is written in English and is professional, including common basic components such as Intro, ToC, Conclusion etc.- see Reading & Writing Guide	✔	✔	
LYCar Proposal is max. **5.000 words** (counting after Table of Content, incl. text in tables) – visual proof of wordcount is included in Appendices.	✔	✔	
Harvard Referencing Style is used consistently, referencing to primary sources only, List of References is well presented	✔	✔	
Check (technical) formalities and submissions			
Ephorus upload	✔	✔	
LYCar Proposal incl. Appendices are uploaded in Osiris	✔	✔	
Ethics and data management			
Ethical, integrity and data management requirements	✔	✔	
Entitled to assessment? (All yes above required):	✔		

DD1: The student has demonstrated knowledge and understanding in a field of study that builds upon their general secondary education, and is typically at a level that is supported by advanced textbooks

	Excellent	Pass	No Go
1.1 Use of literature and knowledge of the field	Student uses in-depth literature and knowledge of the field throughout the report. The report contains no mistakes and factual incorrectness.	Student uses in most cases literature and knowledge of the field in the report. The report contains some mistakes and factual incorrectness in a limited part of the report.	No sufficient or correct use of literature and knowledge of the field in the report. The report contains mistakes and factual incorrectness.
1.2 Intellectual depth and abstract thinking	Student takes all significant factors into account and looks from different perspectives, sees patterns, relates situations to concepts in order to solve larger problems. The reports show excellent thinking capacity of the student. New unique insights presented in the topic and depth of understanding displayed. Excellent linking between the elements and the underlying issues within the case situation.	Student takes different perspectives into account. The report shows intellectual depth (taking into account all significant factors and looking from different perspectives) in most parts of the report. Some patterns are clear. Some links have been made.	The report lacks intellectual depth (superficial and merely descriptive) in some parts of the report. Patterns are not sufficiently made clear.

Student Feedback:	Pass ✔ Not Yet ☐	

Assessor Feedback:	Pass ✔ Not Yet ☐	Lit review is well scoped, you could make the link more stronger to add the "opinion part" e.g. on how to influence to it.

DD2: The student can apply their knowledge and understanding in a manner that indicates a professional approach to their work or vocation, and has competences typically demonstrated through devising and sustaining feedback and solving problems within their field of study

	Excellent	Pass	No Go
2.1 Application of theories/models to situations at hand	Student uses a range of theories/models appropriate to the problems in the case skilfully and able to add their own unique perspective and insight. They own the model(s).	Student mentions a range of theories/models appropriate to the problems in the case and applying some of them in the correct way.	Mentioning models and theories but not using them in a correct way.
2.2 Possible impact and meaning of own work - dissemination of research	Student plans evaluation of impact and meaning of own work in relation to business and industry with sound underpinning. Identification of all stakeholders and acts of dissemination. Plan on how to effectively disseminate knowledge through different channels fitted for a variety of audiences is also presented.	Student formulates criteria for evaluation. Student describes possible impact and meaning of own work. Identification of stakeholders and planning of dissemination through at least one valuable channel with an audience is presented.	Student fails to describe criteria how to evaluate impact. No identification of stakeholders or realistic plan on dissemination of knowledge through at least one valuable channel with an audience.

Student Feedback:	Pass ✔ Not Yet ☐	

Assessor Feedback:	Pass ✔ Not Yet ☐	Think about a dissemination in terms of publishing it in a trade magazine.

DD3: the student has the ability to devise data gathering events, gather and interpret relevant data (usually within their field of study) to inform judgements that include reflection on relevant social, scientific or ethical issues

	Excellent	Pass	No Go
3.1 The Design Based Research Process	Student sets the research process up in a systematic and well organised way. Student makes sense of a problem mess, analyses a (complex) problem and formulates feasible solutions by using a design-based research approach. Logical flow from Problem definition to Analysis to Solutions Design/methods are well chosen and motivated,	Student analyses the problem, and formulates possible solutions using a design-based research approach. Methods motivated and mostly logically chosen	Insufficient problem analysis and methodology, research cycle not used.
3.2 Analysis and evaluation of data	Student plans analysis and evaluation of data/information well using appropriate (digital) tools and makes data-driven decisions. All statements are underpinned with facts and figures and/or referencing. The appropriate tools are used in all steps. Analysis is sufficiently complex with use of information from more than 2 different dimensions (practioners, scientific literature, the organization and stakeholders).	Student plans analysis and evaluation of solutions clearly, with some flaws or unclarities. Some statements are underpinned with facts and figures and/or referencing, some lacking underpinning. Analysis is sufficiently complex using data from at least one dimension and sufficiently backed up with literature.	Plan of analysis and evaluation of solutions is not clear. Statements are mostly not underpinned with facts and figures and/or referencing; some are contradicting. No tools are used. Lacking or no analysis and not backed up with literature.

Student Feedback:	Pass ✔ Not Yet ☐	
Assessor Feedback:	Pass ✔ Not Yet ☐	Within the implementation you mention marketing and sales; help to shape the objectives, what do you mean exactly?

DD4: the student can communicate information, ideas, problems and solutions to both specialist and non-specialist audiences

	Excellent	Pass	No Go
4.1 Communication to audience making use of professional (business) English	Student divides information effectively in paragraphs/chapters. No noticeable errors in English usage and mechanics. Use of language enhances the argument and avoids abbreviations. Sentence structures are well varied, and voice and tone are highly suitable for the specific audience/s. Style and content complement each other into an appealing, high quality story. Highly skilful organisational strategy. The logical sequence of ideas increases the effectiveness of the argument and transitions between paragraphs strengthen the relationship between ideas. Sub-headings are employed effectively and the links between different sections are reinforced through linking expressions. Shows attention to detail in all parts of the report.	Student divides information in paragraphs/chapters. Errors in English usage and mechanics are present, but they rarely impede understanding. Use of language supports the argument. Sentence structures are varied, and voice and tone are generally appropriate for the intended audience/s. Generally, a clear organisational strategy. The sequence of ideas in most cases supports the argument and transitions between paragraphs clarify the relationship between ideas. The report is mainly comprehensively written and lacks some attention to detail in some parts of the report.	Distracting errors in English usage are present and they impede understanding. Use of language is basic, only somewhat clear and does not support the argument. Word choice is general and imprecise. Voice and tone are not always appropriate for the intended audience/s. Basic organisational strategy, with most ideas logically grouped. Transitions between paragraphs sometimes clarify the relationship among ideas. The report is not comprehensively written and lacks attention to detail in most parts of the report.

Student Feedback:	Pass ✔ Not Yet ☐	
Assessor Feedback:	Pass ✔ Not Yet ☐	Clear structure and logic build up of chapters

100

DD5: the student has developed those learning skills necessary to continue to undertake further study with a high degree of autonomy

	Excellent	Pass	No Go
5.1 Plan on IQ development in PLO: Reflection on product(s)	Student has clear plans on what will be delivered and uses different relevant theory to underpin own work and reflect on it.	Student has a plan on what will be delivered and uses theory to underpin planned own work and reflect on it.	No clear deliverables mentioned and almost no theory to underpin own work and reflection.
5.2 Plan on AQ & EQ Self development	Student devises excellent ability to critically reflect on own developmental goals and demonstrates real growth mindset for life-long learning. Student proposes a demonstration of being able to self-direct, taking initiative in unpredictable situations. Student shows different metrics that can demonstrate development in terms of their EQ/AQ.	Student shows developmental goals and demonstrates growth mindset. There is a plan on how to reflect on values, attitudes and behaviour. Starting levels and desired end levels are described and measurements are provided.	Developmental goals are not concrete, there is no demonstration of growth mindset. Plan on how to reflect is vague and does not give enough substantiation to show growth.
5.3 Plan on EQ Social development	Student provides a plan on how to construct a multitude of proof that shows development as an Intercultural Hospitality Leader. Excellent ability to contribute to the global society/local community as a responsible citizen. Excellent analysis of diversity of people the student will deal with. Possible effective collaboration with all stakeholders in different cultural settings. Hospitality is key to the project or work the student does.	Student provides a plan on how to prove development as an Intercultural Hospitality Leader. Plan on how to contribute to the global society/local community as a responsible citizen. Proposing ideas on how to collaborate with different stakeholders in different cultural settings. Hospitality is a differentiator in the students' project or work.	No clear plan on development as an Intercultural Hospitality Leader. Plan on how to contribute to global society/local community is missing. Ideas proposed on collaboration or hospitality are not sufficient.

Student Feedback:	Pass	✔	
	Not Yet	☐	

Assessor Feedback:	Excellent	☐	specify your goals within the different fields, what would you like to achieve within AQ, EQ and IQ to become a international hospitality leader?
	Pass	✔	
	Not Yet	☐	

Overall Assessor Feedback

Rethink your MRQ in a sense, can it be more simplified? Are all the things mentioned needed in the MRQ.

LYCar Proposal Outcome

Pass	✔	All qualitative criteria awarded a "Pass". "P" registered in Osiris. Student can continue with LYCar execution.
No Go	☐	One or more qualitative criteria graded as "Not Yet". "F" registered in Osiris. Student re-writes LYCar Proposal with incorporated feedback.
Pre-Condition NY	☐	Pre-conditions not met. Student resubmits LYCar Proposal. No grade or feedback provided to the student.

7.35   Prove of CLP/CLT pass and credits

P4 Graduation courses

**Professional Development - Preparing My Career (PRD-PMC-19)**

Credits
3 EC

Progress
Course completed

Final grade
pass

Test date
30 March 2022

Tests

P **Career Launching Plan**
Weight 66
30 March 2022

P **Career Launching Tools**
Weight 34
27 October 2021

Post-Propaedeutic

150/180

Average grade
77.97

Failed courses

Courses to be completed

Courses completed

STUDY PROGRESS OVERVIEW

P4 Graduation courses

Thesis Management Placement - Launching your Career Proposal (LYCAR1-20)

Credits
15 EC

Progress
Course completed

Final grade
pass

Test date
31 August 2022

Tests

P **Final Product**
Weight 100
31 August 2022

7.36   Client Evaluation Form

7.37   Proof of upload

File Upload Notification

N   **noreply <noreply@hotelschool.nl>**
      20:11

To: Paul Werner

Dear Paul Werner,

This is an automatic delivery message to notify you that a new file has been uploaded.

Name : Paul Werner
Student Number : 701835
Email : 701835@hotelschool.nl
LYCar Coach : Mr. Villanueva
Research Number : 2022-837

We kindly request you to forward this email to your LYCar coach as evidence that your data files have been uploaded securely.
Thank You.

File Upload Notification

N   **noreply <noreply@hotelschool.nl>**
      20:03

To: Paul Werner

Dear Paul Werner,

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Name : Paul Werner
Student Number : 701835
Email : 701835@hotelschool.nl
LYCar Coach : Mr. Villanueva
Research Number : 2022-837

We kindly request you to forward this email to your LYCar coach as evidence that your data files have been uploaded securely.
Thank You.

8 Wordcount

Word Count	?	×
Statistics:		
Pages		40
Words		10.190
Characters (no spaces)		57.868
Characters (with spaces)		67.999
Paragraphs		268
Lines		1.254
☑ Include textboxes, footnotes and endnotes		
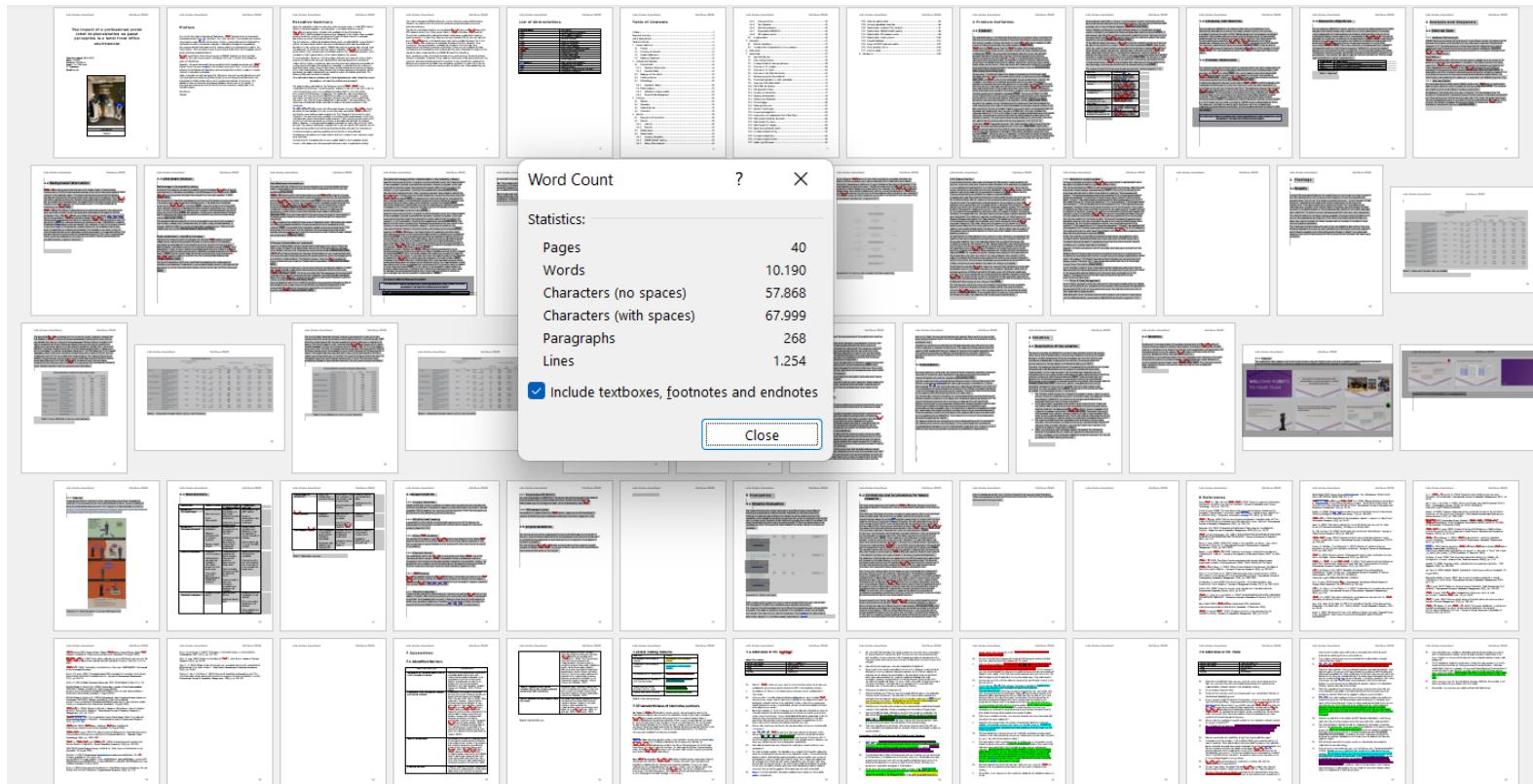
Total word count: 10190 (Main Body) + 785 (in prictures and screenshots) = **10975**