THE UNIVERSITY of ADELAIDE

Investigating the Service Quality of Artificial Intelligence Service Agents

A thesis submitted to the Business School,
The University of Adelaide,
in fulfilment of the requirements for the degree of
Doctor of Philosophy

May 2021

Nurhafihz Bin Noor

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

THESIS DECLARATION

I certify that this work contains no material which has been accepted for the award of any other degree or diploma in my name, in any university or other tertiary institution and, to the best of my knowledge and belief, contains no material previously published or written by another person, except where due reference has been made in the text. In addition, I certify that no part of this work will, in the future, be used in a submission in my name, for any other degree or diploma in any university or other tertiary institution without the prior approval of the University of Adelaide and where applicable, any partner institution responsible for the joint-award of this degree.

I acknowledge that copyright of published works contained within this thesis resides with the copyright holder(s) of those works.

I give permission for the digital version of my thesis to be made available on the web, via the University's digital research repository, the Library Search and also through web search engines, unless permission has been granted by the University to restrict access for a period of time.

Nurhafihz Bin Noor
01 May 2021

ACKNOWLEDGMENTS

It is hard to describe the cloud of thoughts, emotions and experiences that goes into the PhD journey. Further complicating this mix were several unexpected events including COVID-19. However, what is clear are the many people I owe a great debt of gratitude to for making this path possible, and complete.

First, I would like to express my deep appreciation to my principal supervisor, Associate Professor Sally Rao Hill, and co-supervisor, Associate Professor Indrit Troshani. Thank you for holding me to your high standards and sharing your wisdom. I have been fortunate to experience a masterclass in academic mentorship and pragmatism. I am grateful for your guidance, warmth and patience.

Thank you to the University of Adelaide and the people who made this scholarship possible. Many thanks to the Adelaide Business School, academics and university friends, support staff, research participants, reviewers and the many others whom I have crossed paths in the office, corridors, lifts, cafeterias, campus, classrooms, seminars and emails. Thanks to Rosemary Peers for proofreading the thesis. I am also appreciative to those back home who have made a difference: teachers, colleagues, friends, postal workers who tirelessly weighed the many boxes bound for Adelaide Australia as we began this journey. I hope this thesis is representative of the high esteem I hold all of you to.

Finally, I will never be able to fully repay the sacrifices made by my family: mother, siblings, wife, and daughter. In the final analysis, while curiosity, intellect, resilience, and grit are key for PhD success, this journey would not be possible without your love. This PhD is yours too.

Update: Two weeks after the first submission of this thesis, my mother passed away. My mother taught me grit, acceptance, and life. Thank you, mother.

ABSTRACT

This research was undertaken to investigate the impact of artificial intelligence service agents (AISA) on service quality and its outcomes as perceived by consumers. Using chatbots and virtual assistants as suitable exemplars of AISA, three studies were conducted and are reported in this thesis. Study 1 establishes the domain of AISA service quality. Through qualitative in-depth interviews with AISA users and experts, a conceptual framework is developed, synthesising the relationships between consumers' perceptions of AISA service quality and its antecedents, outcomes and moderators. 12 service quality dimensions are proposed based on the qualitative evidence, two of which are new and represent a key contribution to the service quality literature. Study 1 also provides a research agenda. Study 2 seeks to empirically validate the AISA service quality dimensions identified in Study 1. Accordingly, Study 2 constructs, refines and validates a multidimensional AISA service quality scale (AISAQUAL) using established scale development techniques. AISAQUAL contains 26 items across six dimensions: efficiency, security, availability, enjoyment, contact and anthropomorphism. Anthropomorphism is established as a new service quality dimension. Study 2 also confirms AISAQUAL's predictive influence on the outcomes of satisfaction, perceived value and loyalty intentions in the AISA context. Finally, based on the research agenda in Study 1 and the new AISAQUAL scale developed in Study 2, Study 3 investigates other outcomes of service quality in the AISA context beyond those tested in Study 2. Shifting focus towards important affective service quality outcomes on the consumer, Study 3 investigates the link between AISA service quality and the consumer's subjective well-being through the mediating role of the parasocial relationship. A new theoretical model is developed and tested. Findings also suggest significant differences between male and female users. Overall, studies in this thesis extend our understanding of service quality in the AISA context.

STATEMENT OF AUTHORSHIP

I would like to acknowledge the contribution of my supervisors in each of the studies and papers in this thesis. While I am the principal and lead author for all studies and corresponding articles, I have been assisted in the writing of journal papers by Associate Professor Sally Rao Hill and Associate Professor Indrit Troshani. The contribution ratio of authors is outlined below.

Recasting Service Quality for AI-Based Service

Nurhafihz Bin Noor	- 70%
Sally Rao Hill	- 15%
Indrit Troshani	- 15%

Developing a Service Quality Scale for Artificial Intelligence Service Agents

Nurhafihz Bin Noor	- 70%
Sally Rao Hill	- 15%
Indrit Troshani	- 15%

In Pursuit of Happiness with AI: The Role of Service Quality and Parasocial Relationships

Nurhafihz Bin Noor	- 70%
Sally Rao Hill	- 15%
Indrit Troshani	- 15%

CHAPTER 1. INTRODUCTION

1.1 Background

The service industry continues to be transformed by artificial intelligence service agents (AISA) (Huang & Rust 2018; Rust 2019). AISA are autonomous technology agents in the form of software applications, machines and robots that can provide customer service by responding to the unique conditions and circumstances of individual consumers (Russell & Norvig 2016; Wirtz et al. 2018). The ability of AISA to deeply integrate into service provisioning (De Keyser et al. 2019; Robinson et al. 2019) has resulted in continued growth forecasts for different applications in the AISA industry (Mordor Intelligence 2020; Androit Market Research 2020).

In the light of these developments, existing research has focused on how to better understand AISA acceptance (Colby, Mithas & Parasuraman 2019; Gursoy et al. 2019; Paluch et al. 2019; Wirtz et al. 2018; Xu et al. 2020), the continued use of AISA (Han & Yang 2018; Moussawi 2016) and the overall impact of AI on services (Bock, Wolter & Ferrell 2020; Huang & Rust 2020; Wirtz et al. 2018). However, there appears to be limited research examining how AISA impacts the important domain of service quality.

Service quality refers to the overall excellence or superiority of a service as perceived by consumers (Zeithaml 1988). Significant changes in the service environment due to AISA can consequently affect service quality perceptions (Rust & Oliver 1993). Accordingly, while various scales have been developed to better measure service quality across contexts involving different types of service agents (Ladhari 2009; Seth, Deshmukh & Vrat 2005), to the best of my knowledge no studies have focused on better understanding the measurements that adequately capture AISA service quality (cf. Meyer-Waarden et al. 2020; Morita et al. 2019). A key question that arises is whether the composition of AISA service quality dimensions contains new dimensions unique to AISA and not found in the existing literature (Bock, Wolter & Ferrell 2020; Lu et al. 2020). A natural extension of this line of enquiry pertains to how the

use of AISA affects outcomes associated with emotions and well-being (Davenport et al. 2020; Kiron & Unruh 2019; Lu et al. 2020), and if these outcomes may be activated by AISA service quality.

The following sections highlight the significance of addressing the above-mentioned gaps in the literature and describe the three studies.

1.2 Significance

While existing research has illuminated our understanding of service quality in the context of traditional service agents (Ladhari 2009, 2010), AI potentially introduces significant changes to the way services are provided with implications for service theory and practice including service quality (Bock, Wolter & Ferrell 2020). Thus, the insights of this thesis are crucial for researchers, practitioners and consumers involved with AISA.

First, emerging research involving the use of AI in services requires an accurate understanding of how consumers perceive service quality in the AISA context. However, existing service quality measurements in the literature do not fully account for the AISA service context. This lack of deep understanding of the AISA service quality domain (Bock, Wolter & Ferrell 2020; Lu et al. 2020) and corresponding measurement deficiencies are particularly pernicious in the context of research where theory-building involving AISA service quality is required.

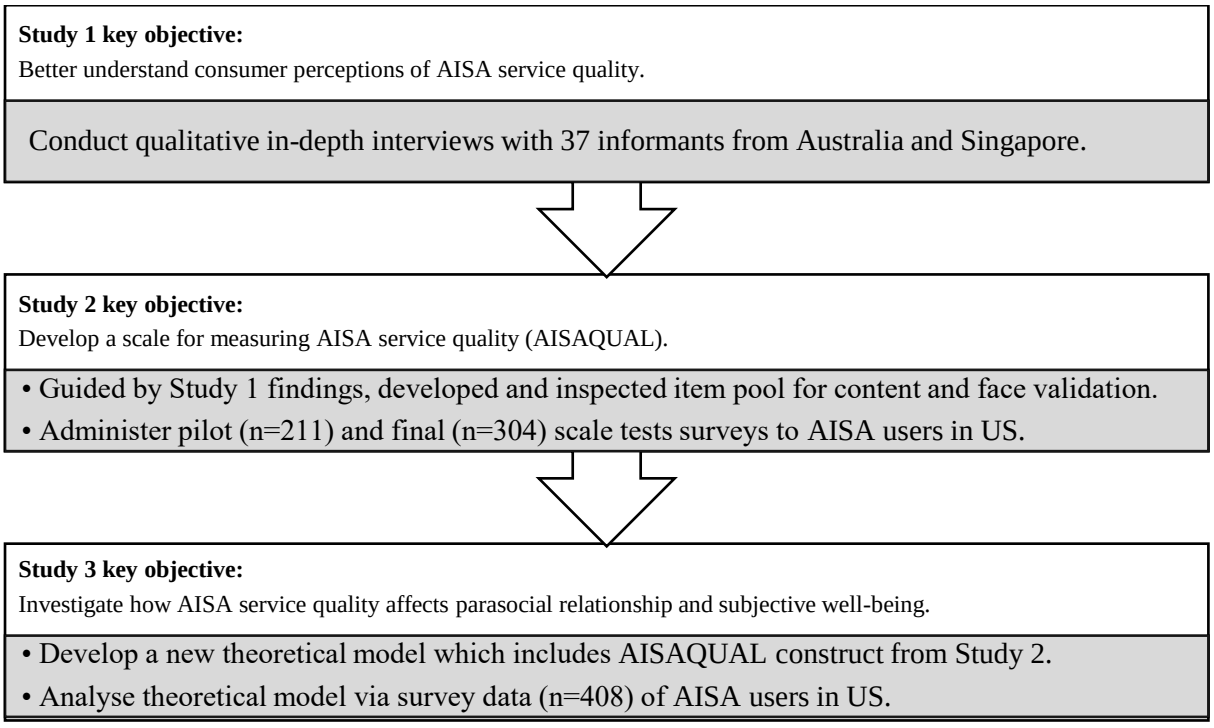
For practitioners, insights as to how consumers assess AISA service quality are essential in developing more effective AISA to improve service provisioning for consumers. Accordingly, consumer relationships can be better managed by optimising AISA service quality based on the attributes that are valued by consumers. Overall, a better understanding of AISA service quality can lead to the continued use of AISA by consumers and assist in sustaining the growth of the service sector.

Finally, findings from this thesis will also bring direct benefits to consumers. In addition to experiencing better service quality with AISA, consumers can make more informed decisions about which AISA best meets their service needs. In addition, they can better assess how AISA can also help to improve their overall emotional state and sense of well-being.

1.3 Studies in the thesis

This thesis contains three studies which collectively examine the impact of AISA on service quality and its outcomes as perceived by consumers. Accordingly, the scope of this thesis is based on the implementation of AISA in consumer service environments as opposed to industrial sectors such defence (Wang et al. 2020) and manufacturing (Lee et al. 2018). A formal ethics approval was secured for these three studies from the university (see Appendix A). Figure 1-1 illustrates the three broad objectives for the thesis and the key research approaches used for each of the three studies.

Figure 1-1 Key research objectives and approaches in thesis



Study 1 seeks to better understand consumer perceptions related to AISA service quality. In Study 1, service quality literature within the marketing and information systems literature was analysed to better understand and define the domain of AISA service quality. Study 1 proceeded to conduct in-depth interviews with 37 informants consisting of 28 AISA users and nine AISA experts residing in Australia and Singapore. The Gioia methodology was used to analyse the interview data in a systematic manner (Gioia, Corley & Hamilton 2013). Study 1 concludes with a framework categorising the various interview insights into the antecedents, dimensions, outcomes and moderators of AISA service quality. A research agenda is also proposed to advance research on AISA service quality.

Study 1 highlights the need to further investigate the dimensions of AISA service quality and validate them empirically. In response, Study 2 seeks to construct, refine and validate a multidimensional scale for AISA service quality (AISAQUAL) using established scale development techniques (Churchill Jr. 1979). An item pool containing potential measures of AISA service quality is developed based on the findings from Study 1. The item pool was subsequently tested for content and face validation by six experts from Australia, New Zealand, Singapore and the US. Through a further series of quantitative pilot (n=211) and final (n=304) scale tests conducted with AISA consumers from the US, six AISA service quality dimensions emerged consisting of 26 measure items. AISA service quality is also found to affect customer satisfaction, perceived value and loyalty.

A research agenda from Study 1 encourages the exploration of emotional bonds with AISA, the well-being of AISA consumers, and their relation to AISA service quality. A better understanding of how AISA may affect consumers' well-being has also become urgent due to the COVID-19 pandemic (Henkel et al. 2020). Thus, extending beyond investigating traditional outcomes of service quality such as satisfaction, perceived value and loyalty (Anderson & Ostrom 2015; Cronin Jr, Brady & Hult 2000) which lean towards the interests of companies,

Study 3 (n=408) investigates and empirically supports how AISA service quality affects the consumer's subjective well-being through the parasocial relationship (PSR). PSR describes the illusionary bond that viewers form with characters played by performers such as those in media and television (Horton & Wohl 1956) while subjective well-being is defined as the evaluation that people give to their own lives (Diener 1984). The link between AISA service quality and PSR is proposed and tested by examining the effects of each of the six AISA service quality dimensions from the AISAQUAL scale developed in Study 2 on PSR.

1.4 Contributions

The three main studies conducted in this thesis culminate in several key contributions to the field of service quality. Overall, these contributions extend our understanding of service quality measurement and its impact on consumers' affective states in the AISA context.

Study 1 establishes that consumer perceptions of AISA service quality consist of a unique combination of 12 dimensions. Most of them have been found in human service quality scales and non-AI technology service quality scales. Two new service quality dimensions emerge from the qualitative evidence in Study 1: proactiveness and anthropomorphism. The qualitative evidence also suggests that there were several antecedents, moderators and outcomes of AISA service quality. To the best of my knowledge, this is the first study in the literature to explore consumer service quality perceptions of AISA, and provides the industry with general guidance on effective AISA design and implementation through the 12 AISA service quality dimensions.

Study 1 lays the foundation for Study 2 which empirically develops and validates AISAQUAL. As a result of the scale refinement process, six dimensions of AISA service quality emerged, of which anthropomorphism was validated as a new service quality dimension in the literature. With AISAQUAL, researchers are equipped with a proper scale which they

can use for more accurate theory development in studies involving AISA service quality (Ranjan & Read 2016). In addition, the industry can use the parsimonious AISAQUAL scale with confidence to benchmark and improve AISA service quality through produce design and customer feedback.

Finally, in Study 3, PSR is established as a new outcome of AISA service quality, and AISA service quality as a new antecedent to PSR. PSR was also found to mediate the relationship between AISA service quality and subjective well-being. With this knowledge, consumers now have an added option to improve their overall affective states through the use of AISA. Service providers can also be more upfront about the added service benefits their AISA can have to improve the well-being of their consumers.

1.5 Thesis structure

This thesis is a portfolio of papers with chapters 2 to 4 representing the complete papers 1 to 3. Following the thesis introduction and overview in Chapter 1, Chapter 2 presents the first study which collects and analyses qualitative evidence from 37 AISA users and experts before concluding with a conceptual framework and a research agenda. Building upon the key findings from Chapter 2, Chapter 3 proceeds to develop an empirical AISA service quality scale through a series of qualitative and quantitative experiments. Using this new scale, Chapter 4 presents the final study for this thesis where an analysis was conducted to better understand how AISA service quality can affect the user's subjective well-being through the mediating effect of PSR. Finally, Chapter 5 concludes the thesis by providing an overarching discussion of the main research findings as well as the overall theoretical and managerial implications. Research limitations and opportunities are also presented in Chapter 5, concluding this thesis.

References

Anderson, L & Ostrom, AL 2015, 'Transformative service research: Advancing our knowledge about service and well-being', *Journal of Service Research*, vol. 18, no. 3, pp. 243-249.

Androit Market Research 2020, *Intelligent virtual assistant (iva) market to grow at 33% cagr during forecast period (2020-2025) - insights on growth drivers, size and share analysis, key trends, leading players, and business opportunities: Adroit market research*, GlobeNewswire, viewed 26 February 2020, <https://www.globenewswire.com/news-release/2020/02/24/1988963/0/en/Intelligent-Virtual-Assistant-IVA-Market-to-grow-at-33-CAGR-during-forecast-period-2020-2025-Insights-on-Growth-Drivers-Size-and-Share-Analysis-Key-Trends-Leading-Players-and-Busin.html>.

Bock, DE, Wolter, JS & Ferrell, O 2020, 'Artificial intelligence: Disrupting what we know about services', *Journal of Services Marketing*.

Churchill Jr., GA 1979, 'A paradigm for developing better measures of marketing constructs', *Journal of Marketing Research*, vol. 16, pp. 64-73.

Colby, C, Mithas, S & Parasuraman, A 2019, 'Service robots: Trends in acceptance and factors behind readiness to adopt', paper presented at Frontiers in Service 2019, Singapore.

Cronin Jr, JJ, Brady, MK & Hult, GTM 2000, 'Assessing the effects of quality, value, and customer satisfaction on consumer behavioral intentions in service environments', *Journal of Retailing*, vol. 76, no. 2, pp. 193-218.

Davenport, T, Guha, A, Grewal, D & Bressgott, T 2020, 'How artificial intelligence will change the future of marketing', *Journal of the Academy of Marketing Science*, vol. 48, no. 1, pp. 24-42.

De Keyser, A, Köcher, S, Alkire, L, Verbeeck, C & Kandampully, J 2019, 'Frontline service technology infusion: Conceptual archetypes and future research directions', *Journal of Service Management*, vol. 30, no. 1, pp. 156-183.

Diener, E 1984, 'Subjective well-being', *Psychological Bulletin*, vol. 95, no. 3, pp. 542-575.

Gioia, DA, Corley, KG & Hamilton, AL 2013, 'Seeking qualitative rigor in inductive research: Notes on the gioia methodology', *Organizational Research Methods*, vol. 16, no. 1, pp. 15-31.

Gursoy, D, Chi, OH, Lu, L & Nunkoo, R 2019, 'Consumers acceptance of artificially intelligent (AI) device use in service delivery', *International Journal of Information Management*, vol. 49, pp. 157-169.

Han, S & Yang, H 2018, 'Understanding adoption of intelligent personal assistants: A parasocial relationship perspective', *Industrial Management & Data Systems*, vol. 118, no. 3, pp. 618-636.

Henkel, AP, Čaić, M, Blaurock, M & Okan, M 2020, 'Robotic transformative service research: Deploying social robots for consumer well-being during covid-19 and beyond', *Journal of Service Management*.

Horton, D & Wohl, RR 1956, 'Mass communication and para-social interaction: Observations on intimacy at a distance', *Psychiatry*, vol. 19, no. 3, pp. 215-229.

Huang, M-H & Rust, RT 2018, 'Artificial intelligence in service', *Journal of Service Research*, vol. 21, no. 2, pp. 155-172.

Huang, M-H & Rust, RT 2020, 'Engaged to a robot? The role of AI in service', *Journal of Service Research*, p. 1094670520902266.

Kiron, D & Unruh, G 2019, 'Even if AI can cure loneliness - should it?', *MIT Sloan Management Review*, vol. 60, no. 2, pp. 1-4.

Ladhari, R 2009, 'A review of twenty years of servqual research', *International Journal of Quality and Service Sciences*, vol. 1, no. 2, pp. 172-198.

Ladhari, R 2010, 'Developing e-service quality scales: A literature review', *Journal of Retailing and Consumer Services*, vol. 17, no. 6, pp. 464-477.

Lee, J, Davari, H, Singh, J & Pandhare, V 2018, 'Industrial Artificial Intelligence for industry 4.0-based manufacturing systems', *Manufacturing letters*, vol. 18, pp. 20-23.

Lu, V, Wirtz, J, Kunz, W, Paluch, S, Gruber, T, Martins, A & Patterson, P 2020, 'Service robots, customers, and service employees: What can we learn from the academic literature and where are the gaps?', *Journal of Service Theory and Practice*, vol. 30, no. 3, pp. 361-391.

Meyer-Waarden, L, Pavone, G, Poocharoentou, T, Prayatsup, P, Ratinaud, M, Tison, A & Torné, S 2020, 'How service quality influences customer acceptance and usage of chatbots?', *SMR - Journal of Service Management Research*, vol. 4, no. 1, pp. 35-51.

Mordor Intelligence 2020, *Social robot market - growth, trends and forecasts (2020-2025)*, Mordor Intelligence, viewed 22 October 2020, <https://www.mordorintelligence.com/industry-reports/social-robots-market>.

Morita, T, Kashiwagi, N, Yorozu, A, Suzuki, H & Yamaguchi, T 2019, 'Evaluation of a multi-robot cafe based on service quality dimensions', *The Review of Socionetwork Strategies*, pp. 1-22.

Moussawi, S 2016, 'Investigating personal intelligent agents in everyday life through a behavioral lens', Ph.D. thesis, 10165530 thesis, City University of New York, Ann Arbor, ProQuest Dissertations & Theses Global.

Paluch, S, Wirtz, J, Kunz, W, Patterson, P, Gruber, T, Lu, V & Martin, A 2019, 'Does c3po really understand me? - extending the service robots acceptance model', paper presented at Frontiers in Service 2019, Singapore.

Ranjan, KR & Read, S 2016, 'Value co-creation: Concept and measurement', *Journal of the Academy of Marketing Science*, vol. 44, no. 3, pp. 290-315.

Robinson, S, Orsingher, C, Alkire, L, De Keyser, A, Giebelhausen, M, Papamichail, KN, Shams, P & Temerak, MS 2019, 'Frontline encounters of the AI kind: An evolved service encounter framework', *Journal of Business Research*.

Russell, S & Norvig, P 2016, *Artificial intelligence: A modern approach*, Third edn, Pearson, Malaysia.

Rust, RT 2019, 'The future of marketing', *International Journal of Research in Marketing*.

Rust, RT & Oliver, RL 1993, *Service quality: New directions in theory and practice*, Sage Publications.

Seth, N, Deshmukh, SG & Vrat, P 2005, 'Service quality models: A review', *International Journal of Quality & Reliability Management*, vol. 22, no. 9, pp. 913-949.

Wang, W, Liu, H, Lin, W, Chen, Y & Yang, J 2020, 'Investigation on works and military applications of artificial intelligence', *IEEE Access*, vol. 8, pp. 131614-131625.

Wirtz, J, Patterson, PG, Kunz, WH, Gruber, T, Lu, VN, Paluch, S & Martins, A 2018, 'Brave new world: Service robots in the frontline', *Journal of Service Management*, vol. 29, no. 5, pp. 907-931.

Xu, Y, Shieh, C-H, van Esch, P & Ling, I-L 2020, 'AI customer service: Task complexity, problem-solving ability, and usage intention', *Australasian Marketing Journal (AMJ)*.

Zeithaml, VA 1988, 'Consumer perceptions of price, quality, and value: A means-end model and synthesis of evidence', *Journal of Marketing*, pp. 2-22.

APPENDIX A Human research ethics approval

Our reference 33549

16 April 2019

Associate Professor Sally Rao Hill
Adelaide Business School

RESEARCH SERVICES
OFFICE OF RESEARCH ETHICS, COMPLIANCE AND INTEGRITY
THE UNIVERSITY OF ADELAIDE

LEVEL 4, RUNDLE MALL PLAZA
50 RUNDLE MALL
ADELAIDE SA 5000 AUSTRALIA

TELEPHONE +61 8 8313 5137
FACSIMILE +61 8 8313 3700
EMAIL hrec@adelaide.edu.au

CRICOS Provider Number 00123M

Dear Associate Professor Rao Hill

ETHICS APPROVAL No: H-2019-057
PROJECT TITLE: Investigating the Service Quality of Artificial Intelligence Service Agents

The ethics application for the above project has been reviewed by the Low Risk Human Research Ethics Review Group (Faculty of Arts and Faculty of the Professions) and is deemed to meet the requirements of the *National Statement on Ethical Conduct in Human Research 2007 (Updated 2018)* involving no more than low risk for research participants.

You are authorised to commence your research on: 16/04/2019
The ethics expiry date for this project is: 30/04/2022

NAMED INVESTIGATORS:

Chief Investigator:	Associate Professor Sally Rao Hill
Student - Postgraduate Doctorate by Research (PhD):	Mr Nurhafihz Bin Noor

CONDITIONS OF APPROVAL: Thank you for your responses to the matters raised. The revised ethics application provided on the 9th of April, 2019 has been approved.

Ethics approval is granted for three years and is subject to satisfactory annual reporting. The form titled Annual Report on Project Status is to be used when reporting annual progress and project completion and can be downloaded at http://www.adelaide.edu.au/research-services/oreci/human/reporting/. Prior to expiry, ethics approval may be extended for a further period.

Participants in the study are to be given a copy of the information sheet and the signed consent form to retain. It is also a condition of approval that you immediately report anything which might warrant review of ethical approval including:

- serious or unexpected adverse effects on participants,
- previously unforeseen events which might affect continued ethical acceptability of the project,
- proposed changes to the protocol or project investigators; and
- the project is discontinued before the expected date of completion.

Yours sincerely,

Dr Jungho Suh
Convenor

Dr Anna Olijnyk
Convenor

The University of Adelaide

CHAPTER 2. STUDY 1: RECASTING SERVICE QUALITY FOR AI-BASED SERVICE

Chapter 2 features the first study in this thesis – *Recasting Service Quality for AI-based Service.* With uncertainties as to how traditional service quality evaluations are affected by AISA, the aim of this study is to better understand consumer perceptions related to AISA service quality. The research methodology in this chapter involves the use of qualitative in-depth interviews and a thematic analysis of the interviewees' responses.

This first study evolved from a preliminary version presented at the Frontiers in Service 2019 conference held in Singapore. At the time of the submission of this thesis, Study 1 has been accepted for publication by the *Australasian Marketing Journal*. Accordingly, this chapter is presented in a journal article format. The contribution ratio of all authors of this paper is highlighted on the following page, before the abstract of the main paper.

Statement of ownership

Statement of Authorship

Title of Paper	Recasting service quality for AI-based service
Publication Status	☐ Published ☑ Accepted for Publication ☐ Submitted for Publication ☐ Unpublished and Unsubmitted w ork w ritten in manuscript style
Publication Details	Preliminary study presented at Frontiers In Service 2019 conference in Singapore. Accepted for publication: Noor, N., Rao Hill, S. and Troshani, I. (2021) 'Recasting Service Quality for AI-Based Service', Australasian Marketing Journal. doi: 10.1177/18393349211005056.

Principal Author

Name of Principal Author (Candidate)	Nurhafihz Bin Noor		
Contribution to the Paper	I conceptualized the research paper, designed and conducted experiments for data collection and analysis, interpreted data and wrote manuscript.		
Overall percentage (%)	70%		
Certification:	This paper reports on original research I conducted during the period of my Higher Degree by Research candidature and is not subject to any obligations or contractual agreements with a third party that would constrain its inclusion in this thesis. I am the primary author of this paper.		
Signature		Date	01/5/2021

Co-Author Contributions

By signing the Statement of Authorship, each author certifies that:

i. the candidate's stated contribution to the publication is accurate (as detailed above);
ii. permission is granted for the candidate in include the publication in the thesis; and
iii. the sum of all co-author contributions is equal to 100% less the candidate's stated contribution.

Name of Co-Author	Sally Rao Hill		
Contribution to the Paper	Associate Professor Sally Rao Hill supervised the development of work and assisted in data interpretation, manuscript evaluation and revision. Percentage of contribution: 15%		
Signature		Date	01/5/2021

Name of Co-Author	Indrit Troshani		
Contribution to the Paper	Associate Professor Indrit Troshani supervised the development of work and assisted in data interpretation, manuscript evaluation and revision. Percentage of contribution: 15%		
Signature		Date	01/5/2021

Please cut and paste additional co-author panels here as required.

STUDY 1: RECASTING SERVICE QUALITY FOR AI-BASED SERVICE

Abstract

Artificial intelligence service agents (AISA), such as chatbots and virtual assistants, are becoming increasingly pervasive in service. Research to date has not adequately addressed how the unique nature of AISA shape consumers' service quality expectations. A deeper understanding of AISA service quality is important for their successful deployment in the service sector. To address this gap, we reviewed the marketing and information systems literatures and conducted qualitative in-depth interviews with 37 informants, inclusive of 28 AISA users and nine AISA experts. We developed a conceptual framework for how consumers use and evaluate AISA. 12 service quality dimensions emerged from the qualitative evidence representing AISA service quality, two of which align with AISA's unique characteristics. The study extends the service quality theory to a new context and offers fresh insights for theory and practice. It culminates with a research agenda to advance research on AISA service quality.

Keywords

Service quality; artificial intelligence; anthropomorphism; proactiveness

2.1 Introduction

The service industry is experiencing radical transformation due to artificial intelligence (AI), as evidenced by the growing reliance of companies on AI service agents (AISA) (Davenport et al. 2020; Huang & Rust 2018). AISA are autonomous technology agents in the form of software applications, machines and robots that can provide customer service by responding to the unique conditions and circumstances of individual consumers (Russell & Norvig 2016; Wirtz et al. 2018). AISA can engage with consumers in many ways, including addressing queries via chatbots, greeting them at the frontline with social robots and managing health care needs with assistive robots (Huang & Rust 2018). From a service provider's perspective, the implementation of AISA can facilitate cost-effective service provisioning (Davenport et al. 2020).

A key feature of AISA is the ability to simulate human-like service for consumers facing the AISA (Huang & Rust 2020; Wirtz et al. 2018). Relative to other forms of technology-based self-service, AISA's learning capability enables them to effectively perform increasingly more complex service tasks (Huang & Rust 2020). Specifically, there is early evidence that AISA can perform services better than humans and non-AI self-service technology (Wirtz et al. 2018; Xu et al. 2020). On the one hand, AISA can perform certain aspects of service more effectively than service employees since they are not constrained by human limitations of unintended biases and relative inefficiency (Wirtz et al. 2018). On the other hand, relative to non-AI self-service technologies which are generally pedantic in following prescribed interaction rules, AISA can adapt and consequently offer greater scope for customised social engagement with personalisation to consumers in service encounters (Van Doorn et al. 2017; Wirtz et al. 2018). Overall, AISA-based service constitutes a significant shift for service provisioning.

There is consensus that AI will play an increasingly important role in services. Meanwhile, interest in AI in marketing research has grown in recent years (Feng et al. 2020; Mustak et al. 2021). In services marketing, emerging research has predominantly looked at AISA acceptance (Colby, Mithas & Parasuraman 2019; Gursoy et al. 2019; Lu, Cai & Gursoy 2019; Paluch et al. 2019; Wirtz et al. 2018; Xu et al. 2020) and continued use (Han & Yang 2018; Moussawi 2016). Recent conceptual studies have also examined the scope of the AI impact on services. For example, Wirtz et al. (2018) suggested to investigate the use of service robots at the micro-, meso- and macro-levels. Huang and Rust (2020) examined the effects of different types of AI intelligence on consumer behaviour, services and society at large. Other studies have also proposed frameworks addressing public policy considerations and guidelines to address safety and social desirability concerns associated with AI applications (Dwivedi et al. 2019). While these studies offer a foundation for further research in this rapidly evolving field, there appears to be no research focusing on the important research area of how the use of AISA may influence consumer evaluations of service quality.

To fill this gap, in this study, we develop an AISA service quality framework by examining AISA service quality, including its dimensions, antecedents and outcomes. Based on the definition of service quality (Zeithaml 1988), we define AISA service quality as the overall excellence or superiority of the service by the AISA as perceived by the consumer. While the service quality construct has undergone significant developments over the last three decades, there is paucity of research concerning if and how well the construct works to explain service quality when service is provided by AISA (Bock, Wolter & Ferrell 2020; Lu et al. 2020; Ng, Sweeney & Plewa 2020). This shortcoming is problematic because how consumers assess AISA service quality is influenced by their experiences with AISA and the understanding of this assessment is, by implication, critical for AISA development, adoption and continued use by the consumers. Additionally, since broader trends in the service industry suggest that AISA

are likely to replace or play a greater role in facilitating delivery of traditional forms of service, it remains unclear if and how AISA might affect service outcomes (Bock, Wolter & Ferrell 2020; Lu et al. 2020). Hence, a key research objective that is of interest to researchers, practitioners and consumers is to better understand consumer perceptions related to AISA service quality and if there are any new service quality perceptions which are unique to AISA.

To achieve this objective, we first review and synthesise key literature, including service quality models based on traditional, non-AISA service contexts. The synthesis forms an important foundation which we use as a starting point for identifying key service quality attributes. We subsequently assess these attributes in the context of AISA services. We find that the identified attributes are loaded with meaning which necessitate further qualitative validation. For this purpose, we conducted 37 in-depth interviews to both understand how the identified attributes are perceived by consumers when evaluating AISA service quality and also to potentially identify new attributes representing dimensions arising from the consumers' nuanced experiences with AISA-based services that have not been previously captured. Our analysis and development culminate in a conceptual framework to improve understanding of consumers' perceptions, beliefs and attitudes related to services performed by AISA that is based on a thematic validation of the qualitative evidence.

This study makes the following three key contributions to the literature. First, it extends the service quality knowledge into the AISA context and advances the service quality model. Second, it identifies dimensions of AISA service quality which overall can be used as a diagnostic tool to assess effectiveness of current AI-based services and to inform the design and development of AISA with improved quality and features that are expected by consumers who use them. Third, it develops a research agenda for AISA service quality from the perspectives of consumers, service firms and the broader society.

The remainder of this paper is structured as follows. In the next section, we review related literature on service quality including several service quality scales for varying contexts and analyse their applicability to AISA. We then describe the qualitative research conducted in our study before proceeding with an analysis of our interviews. A conceptual framework is proposed to integrate the insights from the evidence and their interrelationships. We conclude with a discussion of the theoretical and managerial implications from our study and propose a research agenda centred on AISA service quality.

2.2 Service quality and the impact of AISA

Service quality research offers a significant body of knowledge comprising detailed frameworks and models that have been developed, refined, extended and validated in different service environments (Seth, Deshmukh & Vrat 2005). There is general consensus that service quality is a global assessment and type of attitude[1] that is more enduring than transaction-specific evaluations (Cronin Jr & Taylor 1994; Parasuraman, Zeithaml & Berry 1994b). Based on the disconfirmation theory, one perspective of service quality compares service-level expectations against actual performance (Brady & Cronin Jr 2001; Parasuraman, Zeithaml & Berry 1985). Accordingly, consumers compare both instrumental (functional) and expressive (psychological) performance outcomes against expectations as a means of assessing service quality (Grönroos 1984). A more specific measure of expectations considers a tolerance zone between desired *versus* minimum expectation levels in which service performance is deemed to be satisfactory (Parasuraman, Berry & Zeithaml 1993; Parasuraman, Zeithaml & Berry 1994a).

[1] The literature recognises service quality as a long-term global judgement at an attitude level (Cronin Jr & Taylor 1994; Parasuraman, Zeithaml & Berry 1994b). This attitude can be formed by the sum of transaction-specific customer satisfaction evaluations (Parasuraman, Zeithaml & Berry 1994b).

The subjectivity of service assessments (Zeithaml, Parasuraman & Berry 1985) led scholars of early studies to improve the understanding of service quality for face-to-face service contexts. Accordingly, the majority of human service quality research occurred in the 1990s, with technology-enabled service quality research taking place in the 2000s. With advances in service innovation using technology (Huang & Rust 2018), insights from the information systems (IS) literature were integrated with the services management literature to develop scales that address self-service technologies and applications that run on distributed infrastructures, such as the internet (e.g. Ding, Hu & Sheng 2011; Loiacono, Watson & Goodhue 2007; Yang, Jun & Peterson 2004).

Research involving service quality remains relevant in the literature. The seminal SERVQUAL scale by Parasuraman, Zeithaml and Berry (1988) continues to be featured in studies involving consumer evaluations of human service environments (e.g. Hussain et al. 2019; Rosenbaum & Russell-Bennett 2020) as well as those investigating technology-based service environments (e.g. Xiao & Kumar 2019). Recent empirical studies have also adapted SERVQUAL in the context of AISA (Morita *et al.*, 2019, Meyer-Waarden *et al.*, 2020).

Consumer evaluations of service quality can change based on the uniqueness of the service agent, the nature of service delivery and the overall service environment (Rust & Oliver 1993). Accordingly, Parasuraman, Zeithaml and Malhotra (2005) asserted that an adaptation of SERVQUAL (Parasuraman, Zeithaml & Berry 1988) for the online service environment was not appropriate. Thus, new dimensions not captured in SERVQUAL, but relevant for website-based services (e.g. 'system availability'), were introduced in the new E-S-QUAL scale. The service quality models and respective dimensions developed for various service environments are summarised in Table 2-1[2].

[2] Based on a review of seminal service quality scales and key studies from 1988 to 2020, with consumers as end users. Scales were selected based on their significance in tapping into the different service environments relevant to AISA.

Table 2-1 Service quality dimensions in service environments

Research context (Human services)	Representative study	Dimensions	Applicability to AISA service context
Service quality of general service environments	Parasuraman, Zeithaml and Berry (1988)	Reliability, Responsiveness, Assurance, Empathy, Tangibles	AISA can provide human-like service performance to users in the context of various service industries. However, scale items are related to human service personnel and not for technology/online service environments represented by AISA.
Interpersonal service quality	Mittal and Lassar (1996)	Reliability, Responsiveness, Personalisation, Tangibles	Users may require AISA to communicate with social characteristics such as politeness and courtesy. However, similar to SERVQUAL, these scale items focus on human service interactions in the offline context and do not capture customisations which need to be performed in a technology/online context with AISA.
Retail (goods and services) service quality	Dabholkar, Thorpe and Rentz (1996)	Physical Aspects (Appearance, Convenience), Reliability (Promises, Doing it Right), Personal Interaction (Inspiring Confidence, Courtesy / Helpful), Problem Solving, Policy	User interaction with AISA may involve a variety of experiences found similarly in the retail context (e.g. interaction, fulfilment to problem solving). However, scale items are limited to offline retail store service experiences.
Call centre representative quality	Burgers et al. (2000)	Adaptiveness, Assurance, Empathy, Authority	Usage with AISA may contain dynamic voice-to-voice service enquiries, requests and interactions. However, input methods with AISA may also include text input (e.g. chatbots). Also, scale items are related to human call centre representatives.
Interaction quality, physical environment quality and outcome quality of service encounter with human service agent	Brady and Cronin Jr (2001)	Interaction Quality (Attitude, Behaviour, Expertise), Physical Environment Quality (Ambient Conditions, Design, Social Factors), Outcome Quality (Waiting Time, Tangibles, Valence)	Users may evaluate AISA based on dimensions related to interaction, environment and outcome factors at different stages of the usage experience. However, scale items are only relevant in an offline service context and not dependent on technology.
Research context (Technology services)	Representative study	Dimensions	Applicability to AISA service context
Self-service technology quality via cognitive or affective assessments	Dabholkar (1996)	Attribute-based: Speed of delivery, Ease of Use, Expected Reliability, Expected Enjoyment, Expected Control. Overall-affect: Attitude Towards using Technology Products, Need for Interaction with Service Employee	Users may obtain services by AISA independent of direct contact with human service agent. Also, they may evaluate AISA based on attribute and/or affective routes. However, AI advancements via machine learning can result in less-rigid service experiences compared to past self-service technologies relying on preprogramed outputs.
Online service quality involving variety of service processes (e.g. online banking)	Yang, Jun and Peterson (2004)	Reliability, Responsiveness, Competence, Ease of Use, Product Portfolio, Security	Users may require AISA such as a chatbots and virtual assistants to perform a variety of online service processes (including banking via chatbots). However, AISA are used in a variety of contexts beyond online banking.

Web portal quality	Yang et al. (2005)	Usability, Usefulness of Content, Adequacy of Information, Accessibility, Interaction	AISA such as chatbots and virtual assistants are internet-connected applications that provide information and communicate with users. However, scale items are limited to the web portal platform.
E-commerce service quality	Parasuraman, Zeithaml and Malhotra (2005)	Efficiency, System Availability, Fulfilment, Privacy	AISA are internet-connected digital applications that can facilitate user transaction via websites (e.g. chatbots). However, AISA can also provide information which may not relate to any commerce transactions. Also, scale items are limited to the e-commerce service context.
E-commerce service recovery quality	Parasuraman, Zeithaml and Malhotra (2005)	Responsiveness, Compensation, Contact	AISA may perform service recovery during or after service interaction to better deliver task performance. However, scale items focus on the service recovery context after an e-commerce transaction.
Website quality involving variety of tasks (i.e. information gathering, transacting, entertainment)	Loiacono, Watson and Goodhue (2007)	Informational Fit-to-Task, Tailored Information, Trust, Response Time, Ease of Understanding, Intuitive Operations, Visual Appeal. Innovativeness, Emotional Appeal, Consistent Image, On-line Completeness, Relative Advantage	Users may seek specific information, perform transactions and/or engage AISA for its entertainment value in a digital context. However, scale items are limited to the website service environment.
E-retailing self-service quality	Ding, Hu and Sheng (2011)	Perceived Control, Service Convenience, Customer Service, Service Fulfilment	AISA are internet-connected self-service applications that can provide information and perform service delivery independent of direct contact with human service agent. However, scale items are limited to retailing experiences in an online context.
Self-service technology quality across various service industries	Lin and Hsieh (2011)	Functionality, Enjoyment, Security, Assurance, Design, Convenience, Customisation	Users may obtain services by AISA independent of direct contact with human service agent. Also, AISA as a form of self-service technology may be used across a range of service industries. However, service experiences by AISA are more flexible compared to past self-service technologies relying on preprogramed outputs.
Mobile commerce quality	Huang, Lin and Fan (2015)	Virtual products: Contact, Responsiveness, Fulfilment, Privacy, Efficiency Physical products: Contact, Responsiveness, Fulfilment, Efficiency	AISA are internet-connected digital applications that can facilitate user transaction via mobile platforms (e.g. virtual assistants). However, scale items are limited to commerce services via mobile platforms.
Telematics service quality	He et al. (2017)	Efficiency, System Reliability, Information Quality, Security, Customisation, Call Centre Service	AISA are internet-connected digital applications that can be used for a variety of support services similar to telematics services (e.g. navigation, traffic situation, hands-free calling, driving supervision and diagnostics). However, beyond GPS navigation via smartphones or smart/autonomous vehicles, AISA can be found in other non-automotive service contexts (e.g. chatbots).

Table 2-1 highlights the potential of AI as the next wave of technology advancement in service innovation. As can be seen from our synthesis in Table 2-1, AISA can perform in a wide variety of human and technology service environments (see e.g. last column of Table 2-1). For instance, the technology-based self-service nature of AISA is captured by Dabholkar (1996), Ding, Hu and Sheng (2011) and Lin and Hsieh (2011), with its ancillary role highlighted by TeleServQ (He et al. 2017). The ability of AISA to provide human-like personalised service can also be inferred through service quality scales involving human service agents, such as Mittal and Lassar (1996). In addition, the need for AISA to respond dynamically to various voice service requests parallels that of call centres (Burgers et al. 2000).

However, none of the service quality measures are readily applicable to AISA. Empirical evidence from recent service quality studies investigating different types of AISA have also concluded that SERVQUAL was unable to adequately capture the service performance of robots in cafes (Morita et al. 2019) and chatbots (Meyer-Waarden et al. 2020). Indeed, the uniqueness of AISA has changed the nature of service delivery, the overall service environment, with implications for consumer evaluations of AISA service quality (Rust & Oliver 1993). Using a variety of techniques, such as speech recognition, natural language processing and machine learning[3] to achieve intelligence (Jordan & Mitchell 2015), AISA can perform autonomously in diverse service environments (Legg & Hutter 2007). Indeed, AISA feature significant improvements in performing well-defined, automated tasks (Davenport et al. 2020), and are already showing the potential to become capable of performing more intuitive and empathetic tasks in the future (Huang & Rust 2018).

Another key distinctive characteristic of AISA is the degree of anthropomorphism (Bartneck et al. 2009; Goudey & Bonnin 2016; Moussawi 2016). A consumer interacting with

[3] Machine learning is an algorithm-based process which enables the AI application to automatically improve its task performance by learning from data patterns and experience as opposed to pre-programmed responses (Jordan & Mitchell 2015).

an anthropomorphic AISA, whether in abstract psychological form, such as virtual assistants and chatbots or in more physical forms such as humanoid robots, can develop perceptions of social presence (Qiu & Benbasat 2009; Van Doorn et al. 2017) which increase trust and enjoyment from service interactions with AISA (Qiu & Benbasat 2009; Troshani et al. 2020).

It is clear that AISA can provide human-like service which in turn creates customer experiences that are likely to be somewhere between the experiences derived from human-based services and experiences derived from the interaction with technology-based service systems. What is less clear is which service quality dimensions that have been traditionally used to assess human- or technology-based service experiences are important for consumers in their evaluation of AISA and the extent to which such dimensions are important (Bock, Wolter & Ferrell 2020; Lu et al. 2020). Additionally, given the unique features of AISA (e.g. intelligence and anthropomorphism) and the new capability that is associated with these features, it is reasonable to expect the possibility that there might be new service quality attributes that operate within the AISA service environment that were not present in traditional service environments (Bock, Wolter & Ferrell 2020).

2.3 Method

To investigate how consumers use and evaluate AISA, we adopted an exploratory qualitative approach by using semi-structured in-depth interviews. We used this approach to gain a deeper understanding of the perceptions and concerns that individuals have about AISA. Interviewees were comprised of active AISA users and experts, including researchers and specialists. As recommended by Malhotra, Nunan and Birks (2017), in addition to the user-group, expert views from researchers and specialists can be useful in understanding perspectives relevant to AISA service quality. All interviews were conducted by the lead author following a standard interview protocol for all interviewees.

The interview protocol was developed based on extant literature and the research questions and was subjected to multiple iterations of refinements by the co-authors. The protocol guided discussion pertaining to (1) consumers' perceptions of key service quality attributes involving AISA, (2) concerns associated with AISA's provisioning of quality service, (3) how services performed by AISA affect consumers. Protocol wording was adapted to suit interviewee roles. Overall, protocol questions were designed with the common objective of uncovering the key attributes that mattered to consumers when evaluating AISA service quality.

2.3.1 Choice of AISA

Chatbots and virtual assistants were deliberately used as representative AISA types in the interviews. Chatbots are used by individuals via company websites, messaging applications and standalone apps to facilitate product/service-related queries and processes specific to a business. In response to the user's text-based messages, chatbots can typically provide service solutions using text, images and supporting links (Zarouali et al. 2018). Virtual assistant applications are predominantly voice-based and widely available in smartphones and internet-connected devices (Hoy 2018). In addition, virtual assistants can connect with other third-party applications and allow users to perform routine tasks such as reading emails, sending text messages or facilitating phone calls for the users (Siddike et al. 2018).

Overall, chatbots and virtual assistants are becoming increasingly popular (Androit Market Research 2020), and the scope of tasks they can perform is growing rapidly. We deliberately focused on both chatbots, used in different industries, and virtual assistants since the differences between these applications as used by consumers can provide additional context for testing the robustness of a service quality scale for AISA (Parasuraman, Zeithaml & Berry 1985; Parasuraman, Zeithaml & Malhotra 2005; Zeithaml, Parasuraman & Malhotra 2000).

Additionally, these types of AISA have been available for some time and are widely accessible to consumers. The goal was that, with the right informants, we could tap into extensive experience that would enable us to collect meaningful qualitative evidence for the purpose of this study.

2.3.2 Interviewees

Interviewees were purposely selected as individuals who had used chatbots and/or virtual assistants during the three months prior to the interview. A total of 28 users, split evenly by gender and each AISA type (chatbots/virtual assistants), were interviewed between May and July 2019. The interviewees' ages ranged between 24 and 52 years of age. Half of the interviewees who identified themselves as predominantly chatbot users had used chatbots in website and messenger platforms related to accessories, beauty, food, finance, government, hospitality, mobile and IT services. The remaining 14 interviewees identified themselves primarily as users of virtual assistants.

In addition to the 28 user interviewees, nine AISA experts consisting of researchers and specialists were also interviewed. Their ages ranged between 25 and 35, and they comprised academic researchers in Applied AI, AI consultants, AI data scientists and a machine learning engineer. These AISA experts could give deeper insights into AISA which apply across both chatbots and virtual assistants. Their views were triangulated against the user interviewees to provide a better understanding of the technical and organisational considerations surrounding AISA service quality. Table 2-2 summarises the profiles of all interviewees. To maintain promised confidentiality and conditions of ethics approval, specific details about the interviewees are not disclosed in the paper.

Table 2-2 Profile of interviewees

Identifier	Age	Gender	Location	Type	AISA familiarity context
CUA 1	38	M	Singapore	User	Chatbot user – Accessories
CUBF 1	24	F	Australia	User	Chatbot user – Beauty and food
CUF 1	35	M	Australia	User	Chatbot user – Finance
CUF 2	28	M	Australia	User	Chatbot user – Finance
CUF 3	35	M	Singapore	User	Chatbot user – Finance
CUF 4	34	M	Singapore	User	Chatbot user – Finance
CUF 5	40	F	Singapore	User	Chatbot user – Finance
CUF 6	35	M	Singapore	User	Chatbot user – Finance
CUF 7	32	F	Singapore	User	Chatbot user – Finance
CUGPS 1	37	F	Singapore	User	Chatbot user – Government and public services
CUH 1	52	F	Singapore	User	Chatbot user – Hospitality
CUH 2	29	F	Singapore	User	Chatbot user – Hospitality
CUMIT 1	43	F	Singapore	User	Chatbot user – Mobile and IT
CUMIT 2	28	M	Singapore	User	Chatbot user – Mobile and IT
VAUA 1	28	F	Singapore	User	Virtual assistant user – Alexa
VAUB 1	35	M	Singapore	User	Virtual assistant user – Bixby
VAUGA 1	30	M	Australia	User	Virtual assistant user – Google Assistant
VAUGA 2	49	M	Singapore	User	Virtual assistant user – Google Assistant
VAUGA 3	45	F	Singapore	User	Virtual assistant user – Google Assistant
VAUGA 4	36	M	Singapore	User	Virtual assistant user – Google Assistant
VAUGA 5	35	M	Singapore	User	Virtual assistant user – Google Assistant
VAUGA 6	31	F	Singapore	User	Virtual assistant user – Google Assistant
VAUGHM 1	43	F	Singapore	User	Virtual assistant user – Google Home Mini
VAUGHM 2	28	F	Singapore	User	Virtual assistant user – Google Home Mini
VAUS 1	28	F	Singapore	User	Virtual assistant user – Siri
VAUS 2	36	F	Singapore	User	Virtual assistant user – Siri
VAUS 3	37	M	Singapore	User	Virtual assistant user – Siri
VAUS 4	27	M	Singapore	User	Virtual assistant user – Siri
ARAAI 1	32	M	Australia	Expert	Academic researcher in applied AI
ARAAI 2	31	M	Australia	Expert	Academic researcher in applied AI
AIC 1	32	M	Singapore	Expert	AI consultant
AIC 2	33	F	Singapore	Expert	AI consultant
AIDS 1	35	M	Singapore	Expert	AI data scientist
AIDS 2	25	M	Singapore	Expert	AI data scientist
AIDS 3	25	F	Singapore	Expert	AI data scientist
AIDS 4	28	M	Singapore	Expert	AI data scientist
MLE 1	25	M	Australia	Expert	Machine learning engineer
Total interviewees					**37**

2.3.3 Data collection and analysis

All interviewees were recruited via snowball sampling through mainly colleagues and professional networks. These interviewees resided in Australia and Singapore – both countries scoring high in terms of their current AISA adoption (Kinsella 2019; Yang 2018) and readiness for future AISA services (Insights 2019). Where traditional face-to-face interviews were not feasible (e.g. due to distance), online interviews (e.g. via Skype) were used instead. The same interview protocol was used for all interviewees in both Australia and Singapore. Interviewees

were given a $20 gift voucher, based on their respective home currencies, as a symbolic reward for their participation. Interviewees were also informed of a formal ethics approval secured for the study from the university with which the co-authors are affiliated. All interviews were digitally recorded and transcribed. Interviewees were also given a copy of their own transcripts to verify the responses given. Transcripts were then formatted and analysed by the co-authors.

Transcripts were subjected to a thematic analysis in an incremental fashion using the 'Gioia methodology' (Gioia, Corley & Hamilton 2013). This qualitative analysis methodology shows how the informants' perspectives (first order concepts) are taken into account by the researchers before being organised and transformed into theory-centric themes (second order themes) and aggregated dimensions (Gioia, Corley & Hamilton 2013). Accordingly, transcripts were subjected to two rounds of coding using NVivo (version 12), a widely-used computer-assisted qualitative analysis tool (Sotiriadou, Brouwers & Le 2014). The first round consisted of coding words and phrases in the transcript while the second round involved grouping the codes (captured as nodes) into themes and dimensions (Gioia, Corley & Hamilton 2013; Sotiriadou, Brouwers & Le 2014). To increase the accuracy of our findings, dimensions were triangulated against service quality dimensions in the extant literature (i.e. data triangulation) and also among the different researchers in this study (i.e. investigator triangulation) (Patton 2002). As for reliability, the use of NVivo assisted in establishing a chain of evidence (Yin 2009), as it was possible to efficiently trace our research findings and codes back to the source data interviews (Bonello & Meehan 2019). Through a process of axial coding (Strauss & Corbin 1998), several salient perceptions of AISA service quality emerged. Table 2-3 illustrates the frequency of the final codes captured in NVivo.

Table 2-3 Frequency of nodes coded in NVivo

Node	Frequency		Node	Frequency	
	Interviewees	Mentions		Interviewees	Mentions
Antecedents			*Outcomes: Cognitive*		
Design and technical aspects	18	28	Perceived value	5	8
Service quality dimensions			Brand image	9	18
Reliability	37	269	Psychological well-being	19	35
Responsiveness	34	116	*Outcomes: Affective*		
Availability	17	40	Satisfaction	6	10
Aesthetics	21	54	Subjective well-being	10	17
Personalisation	33	106	*Outcomes: Behavioural*		
Security	18	74	Continued use	10	17
Control	8	19	Good habits	3	7
Ease of Use	25	86	Laziness	5	5
Enjoyment	15	26	Productivity	22	46
Contact	10	23	*Moderators: Situational*		
Proactiveness	28	84	Urgency	14	25
Anthropomorphism	24	60	Perceived risk	30	65
			Social norms	11	23
			Moderators: Consumer-related		
			Technology readiness	31	78
			Need for interaction	34	76

Note: Table 2-3 reports the frequency of nodes by the number of interviewees (out of a total 37 interviewees) who mentioned the nodes and the total number of node mentions by all interviewees as coded in NVivo.

In the following section, we first define the domain of AISA service quality before discussing its antecedents, dimensions, outcomes and moderators based on our findings. We then develop a framework integrating these components before discussing implications.

2.4 Analysis and findings

The findings of this study recognise AISA service quality as the extent to which AISA facilitate an overall perception of excellence or superiority by consumers. Based on extant research, we also conceptualise AISA service quality as a global assessment and a long-term attitude rather than a short-term judgement towards a specific service encounter with AISA.

AISA service quality consists of dimensions based on the perceptual attributes of services performed by AISA as mapped in the means-end framework (Parasuraman, Zeithaml & Malhotra 2005). Developing the dimensions of AISA service quality based on the perceptual level effectively captures the abstract nature of service-quality comparisons which consumers make across categories (Zeithaml 1988). Evaluations at the attribute level also lead to a more global assessment of service quality as opposed to transaction-specific assessments

(Parasuraman, Zeithaml & Malhotra 2005). Accordingly, AISA service quality is a form of attitude (Parasuraman, Zeithaml & Berry 1988).

We posit that AISA service quality is shaped by consumer perceptions of AISA, AISA characteristics, service features and attitudes towards AISA. Service performance perceptions of AISA can be formed by consumers who have been regular recent users of AISA. These perceptions are influenced by the design and technical aspects of AISA which form its antecedents. These performance perceptions can also produce various consumer outcomes. In addition, the relationship between AISA service quality and its outcomes are also moderated by situational and consumer-related factors.

These components and their interrelationships – which describe how consumers use and evaluate AISA-based services as well as the attributes which matter to them – are discussed in detail in the following sections.

2.4.1 Antecedents of AISA service quality

The antecedents are factors that can influence the dimensions of AISA service quality. These include its design and technical aspects (cf. Parasuraman, Zeithaml & Malhotra 2005). For instance, AISA design can be comprised of size and shape attributes in the physical (e.g. smart speakers) or virtual form (e.g. appearance of chatbot window). Antecedents can also include more functional design aspects such input, interface and output methods (Kepuska & Bohouta 2018) or technical aspects such as hardware and software capabilities that affect both chatbots and virtual assistants. As noted by AIDS 1: *"As quantum computing matures, I think that we might see something that can help ingest those vast amounts of information".*

While advances in technology such as natural language processing continues to improve AISA performance (MSV, 2019), it is also important that current applications including chatbots and virtual assistants be trained correctly to avoid biases which can affect

service performance. As commented by AIC 2: *"About the bus service… so, this particular model is trained in the white district area... But then, it will leave out the black kids behind and even forget to pick up those kids".*

Unlike the dimensions of AISA service quality which are based on the perceptual attributes that constitute the components of service quality measurement, the above antecedents are causal factors which may differ across various AISA or change in time. For instance, while chatbots and virtual assistants often rely on different input methods (i.e. text or voice respectively), future dialogue systems may become more interactive and integrate other forms such as gestures and user movements (Kepuska & Bohouta 2018).

2.4.2 Perceptions of AISA service quality

From the literature review as well as qualitative interviews with AISA users and expert informants, 12 aggregated dimensions of AISA service quality have emerged as shown in the data structure (Gioia, Corley & Hamilton 2013) built in Table 2-4. We now define each dimension and discuss them in relation to the service quality literature. We provide supporting evidence by using illustrating quotes for each dimension in Table 2-4.

Table 2-4 Data structure containing key constructs and illustrative quotes

First order concepts	Second order themes	Aggregate dimension	Illustrative quotes
AISA correctly recognises user command.	Command Recognition	Reliability	"Because maybe it doesn't recognise my enunciation well, or maybe in terms of who I have in my contact list… so, it called the wrong person... that was quite odd. So, I had to cancel the call pretty quickly." (VAUS 2)
AISA understands command meaning.	Intent Recognition		"You must make it be able to understand intent very quickly and give it the agency to resolve the intent." (AIDS 2)
AISA delivers the service as promised.	Task Fulfilment		"By the end of the month, I actually received my bill. And it shot up to about two to three times. And I was informed that actually the chatbot didn't give me the correct recontract deadline. So, it didn't end really well for me because I had to pay two times more than what I have to pay every month." (CUMIT 2)
AISA is responsive when invoked.	Prompt Response	Responsiveness	"I expect them to respond in a timely manner… about one to two seconds… so that is an expectation of them as an AI." (VAUA 1)
AISA completes the task quickly.	Quick Resolution		"The number one thing is speed; to resolve your query as soon as possible. Because a lot of the times AI has to ask ten surrounding questions before they can pinpoint the correct path to the user or whatever. So, I think speed and efficiency, that's probably the key characteristics that's good service on the consumer's side." (MLE 1)

AISA is available on demand 24/7.	Time Availability	Availability	"But chatbots - 24/7. So, it basically bridges the time gap in globalisation, in a globalised world. Irrespective of what time zones you are, chatbots are there." (CUF 1)
AISA can be accessed in many places.	Place Availability		"Perhaps in the future…it needs to everywhere right… maybe in the cars… maybe be in public transport services. So, the technology can be everywhere." (VAUS 1)
AISA is appealing to users.	Aesthetical Appeal	Aesthetics	"Interface wise, as long as it tells you this is a chatbot. But you don't really have to put a lady there or a very huge figure to tell me this is a chatbot; this is a quite irritating, actually." (AIC 2)
The clarity of information due to the interface design of the AISA.	Aesthetical Functionality		"The noise…And then I just hear a 'Bing' and I'm like 'Where did that come from?'. And then sometimes you leave the website open and the chatbot, within five minutes, asks you 'Can I help? Can I help?'. So, and that's a little bit of... if I need your help, I will type something." (CUBF 1)
AISA adapts according to context.	Adaptiveness	Personalisation	"More towards like it can read my mind…maybe if it's towards the night, then if I call it out… then it knows that I'm looking out for some alarm…" (VAUB 1)
AISA gives warm attention to user.	Empathy		"I want the person to tell me or make me feel comfortable why I should hear to the doctor - why that ointment is really good and what I'm not looking at; AI can't do that according to me." (CUF 1)

User comfort in sharing personal information to AISA.	Privacy		"I think if it's more sensitive I'd rather speak to someone because I don't want to give all these details online through a chatbot." (CUF 7)
User confidence in how personal data will be used and protected by AISA.	Data Access and Protection	Security	"Everything is being captured. So how would you know what is being protected in there?... What are you revealing to the company?" (AIC 2)
No unwelcomed performance anomalies by AISA.	Intrusion		"If it starts promoting random things to me or giving me information that necessarily I didn't ask, but is meant to influence me, I would potentially immediately get rid of it… Now you're trying to get to influence my behaviour instead of actually trying to aid it in some way possible." (VAUGA 1)
User feels in control of AISA.	User Control	Control	"Another one is maybe if we have a choice... if we can amend its settings to sync with certain sources of data that we prefer?" (VAUGA 3)
User can command AISA in different ways.	Command Methods		"I feel like if the chatbot is multilingual, then it is an added value." (AIC 1)
User knows how to use AISA.	Usage Knowledge	Ease of Use	"Or maybe it's the way I use it is wrong, but I don't know. I've been trying to figure this out for a long time." (VAUGHM 2)
AISA can be used with other applications.	Technology Interaction		"But because of the brand being tied to certain integrations...so, I have a disconnected home... I wish I can just tell Siri 'Hey Siri, turn on my Dyson'; I can't do that, because Dyson only works with Alexa." (VAUS 3)
User finds the AISA interesting to use.		Enjoyment	"I think the Winston-like capability is interesting simply because I think there's a lot of experiential opportunities that we, as a person walking down the street, we miss out simply because we are not aware." (VAUGA 2)

User has ability to contact human service agent when required.	Contact by User	Contact	"If the AI service agent chatbot cannot quite answer our questions satisfactorily, what happened here is that they should have a button 'Does the chatbot answer your question satisfactorily or not?' You can click yes or no. Then if you click no, they must give us an option to speak directly with a human being." (CUF 4)
Human service agent contacts user to offer better resolution related to service task.	Contact by Organisation		"If the chatbot is smart enough to say 'Okay, I think agent X will call you to help you on this'... And the agent calls and knows all the information that has been given to the chat engine. And he just directly tries to address the query... the customer is happy with that." (AIC 1)
AISA is resourceful in offering relevant information and alternatives.		Proactiveness	"I really appreciated the time when I actually asked for A and then they also gave me A and B after… which at that time, I didn't think about it… so being able to anticipate was something that I appreciated. And I would call it service performance." (CUF 7)
AISA feels like a human.	Abstract Anthropomorphism	Anthropomorphism	"So that was a very pleasant experience because I really thought that it was a human being doing that. Only then did I realise that it was literally a whole ecosystem of chatbots - there was no human being behind it." (CUA 1)
AISA appears like a human.	Non-Psychological Anthropomorphism		"She does speak to me like a personal assistant. But with a face on it, it feels like you're talking to a real person. So that makes it more real-life like… would give me an assurance." (VAUS 4)

Reliability refers to the ability of the AISA to perform the service dependably and accurately (Parasuraman, Zeithaml & Berry 1988). Three themes emerged as important when assessing the reliability of AISA: command recognition, intent recognition and task fulfilment; and correspond with the sequential order in which AISA process commands that are given to them (Ng 2019). Consumers expect the AISA to support them in accomplishing their activities with little informational or functional lapses (Tan, Benbasat & Cenfetelli 2016). The reliability dimension also appears frequently in extant service quality literature involving both human- (e.g. Parasuraman, Zeithaml & Berry 1988) and technology-based service scales (e.g. Dabholkar 1996). Not surprisingly, the interviewees emphasised reliability to be one of the key dimensions they use to assess the service performance of AISA.

Responsiveness refers to the prompt response of the AISA to consumer requests and the speed in resolving consumer problems (Yang, Jun & Peterson 2004). Like reliability, responsiveness was found to be a prevalent service quality attribute that users seek in both human- (e.g. Brady & Cronin Jr 2001) and technology-based service contexts (e.g. Loiacono, Watson & Goodhue 2007). For AISA users, responsiveness also includes minimising the waiting time needed to activate the AISA to perform the service task (cf. Dabholkar 1996). Such delays in access constitute a system failure that can lead to frustration (Tan, Benbasat & Cenfetelli 2016).

Availability refers to the ability of AISA to be ready for use anytime, anywhere (Lin & Hsieh 2011; Parasuraman, Zeithaml & Malhotra 2005). As with human- (e.g. Dabholkar, Thorpe & Rentz 1996) and technology-based service environments (e.g. Yang et al. 2005), this is a fundamental systems requirement (Tan, Benbasat & Cenfetelli 2016) that is appreciated by consumers. However, unlike virtual assistant users who can easily access their AISA via mobile

phones, the accessibility of AISA was stressed by chatbot users who wanted more industries to adopt such AISA in their websites.

Aesthetics refers to the appeal and clarity associated with the AISA interface design (Dabholkar, Thorpe & Rentz 1996). The aesthetic consideration extends beyond visual assessments commonly used in other human- (e.g. Brady & Cronin Jr 2001) and technology-based service quality scales (e.g. Loiacono, Watson & Goodhue 2007) to include other properties relevant for AISA such as speech and audio (Kepuska & Bohouta 2018). This aesthetical assessment can also be affected by the surrounding interface design in which the AISA operates.

Personalisation refers to the ability of the AISA to meet the consumers' individual preferences (He et al. 2017). This can come in the form of adapting to the context of the task or providing warm attention (Burgers et al. 2000). To compensate for the reduction in human empathy once offered by human service agents in the service environment (e.g. Mittal & Lassar 1996), technology-based service systems focused on delivering service information that can be customised (e.g. He et al. 2017) and tailored (e.g. Loiacono, Watson & Goodhue 2007) to fit user requirements. Advances in technology including the availability of big data have also helped to enhance service personalisation (Rust & Huang 2014). With AISA, a spectrum of personalisation capabilities can now be better realised from technology-based systems as AISA can learn and adapt to user behaviour based on available data (Thomaz et al. 2020). Continued technological innovation will increase this level of customisation (Pantano & Pizzi 2020) and improve AISA's system performance (Tan, Benbasat & Cenfetelli 2016).

Security refers to the perceived safety of the AISA from intrusion, fraud and loss of personal information and privacy (He et al. 2017). Sensitivity about relinquishing one's personal data and its security began to gain prominence as an important dimension as service environments moved from human to technological contexts (e.g. Parasuraman, Zeithaml & Malhotra 2005). On the one hand, these privacy concerns will continue to become more prevalent in the IS domain with emerging AISA technologies (Conger, Pratt & Loch 2013; Dwivedi et al. 2019) and the need to make AISA's decision making processes more transparent (Rai 2020). On the other hand, AISA such as chatbots can also facilitate service provisioning for users with varying privacy concerns (Thomaz et al. 2020). Although interviewees understood that personal information is required by the AISA to personalise its performance for the user, they still desired a level of protection with regards to their privacy and personal information.

Control refers to the degree of control that consumers feel they have over the process or outcome of the service encounter with AISA (Dabholkar 1996). This dimension is prevalent for new system implementation (Baronas & Louis 1988) and became more important as consumers began using more technologies to perform the services for themselves (Ding, Hu & Sheng 2011). In line with AISA being self-service platforms, our interviewees expressed the importance of their desire to have some control over AISA and reduce the AISA influences.

Ease of use refers to the degree to which using AISA would be free of effort (Davis 1989). This dimension became relevant in the service quality literature with the introduction of self-service technologies in contexts such as touch screens in fast food restaurants (Dabholkar 1996) and website services (Yang, Jun & Peterson 2004). Treating AISA as an extension of a form of self-service technology, interviewees expected the use of AISA to be easy and provide a seamless integration into their everyday lifestyle.

Enjoyment refers to the extent to which using the AISA is perceived to be enjoyable in its own right, apart from any performance consequences that may be anticipated (Davis, Bagozzi & Warshaw 1992). In this regard, the use of AISA extends beyond pure utilitarian performance to include hedonic perceptions of enjoyment. Such an entertainment value was also assessed by consumers for past technology-based service environments (e.g. Dabholkar 1996; Lin & Hsieh 2011; Loiacono, Watson & Goodhue 2007). Similarly, the enjoyment can come from the interaction with AISA or from the novelty of being associated with service innovations such as AISA (Dabholkar 1996).

Contact refers to access to human assistance (Parasuraman, Zeithaml & Malhotra 2005). Like several technology-based self-service environments such as the internet (e.g. Parasuraman, Zeithaml & Malhotra 2005), mobile (e.g. Huang, Lin & Fan 2015) and telematics (e.g. He et al. 2017), users expect AISA to provide the option for human support. In this regard, the user may decide to initiate contact during or after service interaction. The organisation too can increase its level of service by following up with the consumer when required.

Proactiveness refers to AISA displaying self-started, long-term-oriented, and persistent service behaviour beyond explicitly prescribed commands (Rank et al. 2007). Beyond just reacting to every user command, the ability of AISA to be proactive can be important when users may have overlooked tasks which need to be done or which they are unaware of due to the unfamiliar service context. This dimension can include assisting consumers with alternatives (Tan, Benbasat & Cenfetelli 2016). Proactiveness represents a new service quality dimension.

Anthropomorphism refers to the attachment of human-like characteristics, motivations, intentions, or emotions to AISA (Epley, Waytz & Cacioppo 2007). Anthropomorphism could come in an abstract form via an experience the user has with AISA or by way of other distinct cues. These anthropomorphistic design cues can assist in reducing privacy concerns about AISA (Benlian, Klumpe & Hinz 2019). However, consumers may also experience a negative side-effect, termed 'counterfeit service', which is when they realise that the service was performed by AISA and not humans (Robinson et al. 2019). Anthropomorphism represents another new service quality dimension in the literature.

2.4.3 Consumer outcomes

After the formation of service quality perceptions, several outcomes such as consumer satisfaction, perceived value and continued use of AISA were indicated (Cronin Jr, Brady & Hult 2000). As VAUS 1 noted: *"So, I think what would make me satisfied is when the virtual assistant reaches a point where it's no longer intrusive… but it becomes an ally"*.

In terms of behavioural outcomes, informants also indicated that the frequent use of AISA can lead to good habits due to the devices' ability to monitor user behaviour patterns and send reminders. As VAUA 1 commented: *"But when it's a manual habit you're trying to inculcate, it's more challenging compared to when you have a tool, a device that will do it on your behalf... so it's good habits being inculcated"*.

Such a dependency also caused informants to worry that they were becoming lazy. However, many indicated that they did appreciate the productivity aspects that AISA brought to their lives (cf. Parasuraman 2002). CUF 4 stated: *"Because just by inputting details, they can somehow create a report for us. Where if I were to do it on my own, it will take a bit of time for me to consolidate all the info"*.

Beyond the behavioural outcomes of service quality (Zeithaml, Berry & Parasuraman 1996), consumers also experienced cognitive and affective impacts that AISA might have on them. In terms of the link between the brand image of AISA and the company it represented, it was unclear how informants would associate the brand attributes of the company with the AISA (cf. Wu, Yeh & Hsiao 2011). As CUF 2 noted: *"XYZ Bank is a secured banking site… I've never had issues with banking online and things like that. But I don't have a lot of experience with chatbots and I don't want to be one of the unlucky ones for example if there's an issue with the chatbot"*.

Interviewees also indicated that the use of AISA can affect psychological well-being (cf. Mogaji, Soetan & Kieu 2020) and subjective well-being (Diener 1984) in several ways. For instance, although AISA can help facilitate personal growth, they may also cause a dependency on the technology and affect the quality of relationships with others. VAUGA 5 commented *"If you talk about emotional – look at the sheer number of instances in Japan where the guy's married a pillow, married a digital entity, married a game and they have companionship… in my mind, that's just scary"*.

2.4.4 Moderators of AISA service quality

The direction and/or strength of the relationship between AISA service quality and its outcomes can be affected by a range of factors in relation to the situation and the AISA consumer. In terms of situational factors, first, informants indicated that time pressures and the perceived urgency of the service may affect their future decisions about the use of AISA, including chatbots and virtual assistants (Dabholkar & Bagozzi 2002). As stated by AIDS 4: *"But if it's urgent, I need to file my tax returns in 10 minutes before the deadline is over, I'm not going to go through a chatbot. I want to go straight to the person"*.

Informants also indicated a level of uncertainty about the use of AISA to perform services traditionally performed by humans. This perceived risk (Dowling & Staelin 1994) can result in consumers becoming more uncertain of future service performances (Aldas-Manzano et al. 2011) which may constrain future use. VAUS 4 commented: *"I think that could lead to some detrimental results; Siri could have possibly booked a flight which I don't desire".*

While AISA can lead to new habits being formed, previous consumer habits and social norms can also play a role in moderating future usage of AISA service quality. As noted by VAUS 1: *"... it's not socially normal to be talking to your phone".*

In terms of consumer-related factors, the level of technology readiness of informants to accept and utilise AISA – consisting of motivating (optimism and innovativeness) and inhibiting (discomfort and insecurity) factors (Parasuraman 2000; Parasuraman & Colby 2015) – was also found to be significant in the AISA context. CUBF 1 commented: *"I like the whole technological advancements. I really like engaging with new technology, and just testing the limits… Because I think technology will get us somewhere, but if people keep rejecting it, it would just take so much longer".*

Finally, informants also indicated that they will avoid AISA for specific services where the interaction with a human being is deemed critical for a successful service performance (Dabholkar & Bagozzi 2002). As VAUS 1 noted: *"If you're talking about people who are going to enrich lives, who are going to be with him for four years, or six years, or ten years – I think there still needs to be a person with complex emotions, complex thinking, with years of experience".*

2.5 Discussion

Our qualitative interviews provided rich insights into the dimensions that consumers use in evaluating AISA service quality as well as other antecedents, outcomes and moderators surrounding AISA service quality. We developed a conceptual framework based on our findings which we present in Figure 2-1. The framework synthesises the relationships between the identified factors.

Figure 2-1 Conceptual framework of AISA service quality

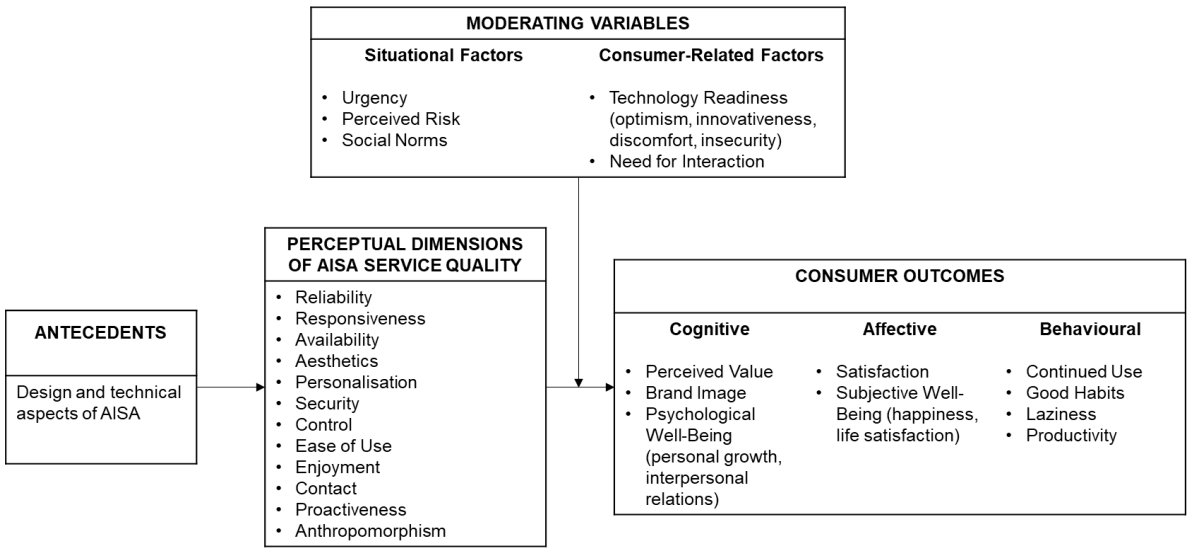


Figure 2-1 shows a unique combination of dimensions from extant human- and technology-based service quality scales which are relevant to the AISA service quality environment: reliability, responsiveness, availability, aesthetics, personalisation, security, control, ease of use, enjoyment and contact. These dimensions demonstrate the ability of AISA to tap into a wide spectrum of human and technology service quality dimensions and support the notion of AISA as a significant, promising new wave of technology-driven advancement in service innovation. Of these, human contact continues to remain important, even for an advanced self-service technology, such as AISA, in increasing customer satisfaction among AISA consumers (Barrett et al. 2015; Shell & Buell 2019). However, the future relevance of

human contact in service quality is questionable as AISA continues to provide more advanced human-like service (Huang & Rust 2018; Huang & Rust 2020).

In addition, two new dimensions in service quality were identified which are unique to AISA services. The first dimension, proactiveness, is closely related to the intelligence trait of AISA and its predictive ability to anticipate future needs. Compared to human service agents, proactiveness is also more likely to be realised in the AISA service environment as there is no risk of additional effort or cost being required on the part of AISA to be proactive (Wirtz et al. 2018). However, with a greater exercise of initiative from AISA also comes the question of perceived control, and the extent to which the consumers might feel comfortable with AISA having a greater control in the service environment.

Anthropomorphism represents another new dimension that our study contributes to the service quality literature. Specifically, our study shows how consumers may use different forms of anthropomorphic cues to assess AISA service quality (cf. Go & Sundar 2019). As it is reasonable to surmise that continued AI innovation will result in future AISA having more anthropomorphic potential, greater clarity is required to better understand how consumers anthropomorphise AISA (Novak & Hoffman 2019), and the contexts to which anthropomorphism leads to user discomfort (i.e. the 'uncanny valley') (Bakpayev et al. 2020; Davenport et al. 2020; Lu, Cai & Gursoy 2019; Mori, MacDorman & Kageki 2012; Troshani et al. 2020).

With reference to Figure 2-1, many service quality studies have looked at satisfaction, perceived value and continued use outcomes to test the predictive validity of their constructed scales (e.g. Ding, Hu & Sheng 2011; Loiacono, Watson & Goodhue 2007; Parasuraman, Zeithaml & Malhotra 2005; Yang, Jun & Peterson 2004). Our framework supports the use of these outcomes for the nomological validation of a future empirical scale developed for AISA service quality. Such a validation of the relationship between AISA service quality and the

variable of continued use can be particularly important to show how AISA service quality can promote the growth and sustainability of AISA in service (Seth, Deshmukh & Vrat 2005).

Of the various moderators of AISA service quality in Figure 2-1, the level of technology readiness of consumers was found to affect their decision to use AISA in the long run. This supports the proposition of Zeithaml, Parasuraman and Malhotra (2002) who posited the moderating role of technology readiness on website service quality. As for perceived risk, informants did not express perceived risk as a switching barrier (Tam 2012) but rather as having an inverse moderating effect on loyalty due to unstable satisfaction levels with current AISA (Tuu, Olsen & Linh 2011). Overall, these insights support the recent call by scholars to better understand consumers' resistance to digital innovations including AISA (Talwar et al. 2020).

2.6 Conclusion

2.6.1 Theoretical implications

Despite a rich tradition of assessing service quality in various service environments, current service quality research has yet to investigate the fast-emerging AISA service that consumers are experiencing, and their perceptions and expectations when services are performed by AISA. Our research takes a first step to go beyond conceptualising AI-based services, which has been the subject of emerging research in the use of AI in service (Bock, Wolter & Ferrell 2020; Huang & Rust 2020; Wirtz et al. 2018). We investigate the current state of consumer experiences with AISA to advance the service quality model. Through an interdisciplinary review of the services marketing and IS literatures and in-depth interviews with AISA users and experts, our framework provides a nuanced understanding of the key antecedents, dimensions, outcomes and moderators of AISA service quality as perceived by consumers.

A key objective of our study was to answer the question of how well traditional service quality dimensions apply to the AISA context and if there are any new unidentified dimensions that were relevant for AISA (Bock, Wolter & Ferrell 2020; Lu et al. 2020; Ng, Sweeney &

Plewa 2020). With reference to Table 2-1, 10 of the 12 AISA service quality dimensions identified suggest a confirmation of past service quality dimensions found in extant service quality measurements. Further scrutiny of these 10 dimensions in relation to extant human service quality scales suggests that consumers evaluate AISA service quality, in part, along six service quality dimensions salient to human service agents: reliability, responsiveness, availability, aesthetics, personalisation and security. This highlights the potential of AISA to substitute human service quality performances within these six dimensions.

By contrast, all 10 service quality dimensions are captured in extant technology-based service quality scales (see Table 2-1). While this may suggest that consumers evaluate AISA service quality in a similar fashion to other non-AI based technologies, the uniqueness of AISA service quality is evidenced by two factors: first, the presence of two new service quality dimensions found in our study – proactiveness and anthropomorphism – and second, the unique combination of the 12 dimensions which is representative of the gestalt of consumer perceptions of AISA service quality.

Upon further inspection, when we compared the AISA service quality dimensions (except proactiveness and anthropomorphism) to the 11 dimensions of electronic service quality as identified by Zeithaml, Parasuraman and Malhotra (2000) (which were subsequently reduced to four dimensions during the empirical development of E-S-QUAL), almost all dimensions were similar to one another. The exceptions were enjoyment (from AISA service quality) and price knowledge (from electronic service quality). This suggests that AISA consumers place importance on the hedonic attribute of enjoyment of AISA when evaluating AISA service quality.

It is also worth highlighting the theoretical significance of the anthropomorphism dimension in our study. In addition to its novel introduction as a perceived attribute of service quality, our findings provide support for the emerging theme in the literature that emphasise

the important role of anthropomorphism in AISA service (e.g. Benlian, Klumpe & Hinz 2019; Sheehan, Jin & Gottlieb 2020; Troshani et al. 2020). In addition, our study provides a new basis for leveraging the impetus for exploring this new dimension in AISA service quality.

Overall, these findings extend the theory of service quality and contributes to the foundation for the development of an empirical AISA service quality scale which can be used to ascertain the generalisability of our 12 dimensions across different AISA types and industries as used by consumers, and to streamline the dimensions accordingly (cf. Parasuraman, Zeithaml & Malhotra 2005).

2.6.2 Managerial and social implications

Our findings provide managerial and social insights that can inform the strategies of service providers, business leaders and policy makers. First, in addressing proactiveness as a new service quality dimension, it is important to ensure that the development of AISA includes specifications for the AISA to be able to interact with multiple applications (e.g. facilitated via the Internet of Things (IoT)) (Huang & Rust 2018) to enhance the AISA's proactive range in recommending a variety of solutions for users. Users should also be aware of the ability to control AISA settings and choose the level of personalisation vis-à-vis privacy trade-offs with which they are comfortable.

Second, as anthropomorphism is important and unique to AISA service, consumer involvement needs to be facilitated in the development and design process of AISA (Bitner, Brown & Meuter 2000; Steinhoff & Palmatier 2020) to understand public sentiment and test the effectiveness of new anthropomorphic attributes in improving AISA service experience (Benlian, Klumpe & Hinz 2019; Steinhoff & Palmatier 2020). It should also be made clear to consumers if and when they are interacting with AISA as some may be misled into thinking that their interaction was with a human service agent rather than AISA (Robinson et al. 2019).

This might be a critical uptake consideration given the possible implications of the phenomenon of the 'uncanny valley'.

Our study also highlights the importance of careful implementation of AISA, particularly in services traditionally performed exclusively by human service agents. In the early phases of piloting AISA, human service support should continue to be readily available to consumers. In this service environment, AISA should be used to complement human service agents to provide an overall positive service experience for consumers.

Overall, while service professionals can continue to manage human-to-human service provisioning using measurements such as SERVQUAL, and website services with E-S-QUAL, with AISA they now have a means to improve AISA service quality using the proposed 12 dimensions. Development and continuous improvement of AISA can also be facilitated through consumer feedback of the overall AISA service quality or based on specific dimensions.

2.6.3 Future research: a research agenda for AISA service quality

The field of AI-based services is developing fast. There are research opportunities arising from our findings, in terms of its impact on AISA users, AISA service providers and society at large. Drawing on the range of issues discussed, the proposed research agenda shown in Table 2-5 identifies important research questions which would extend our understanding of the opportunities and challenges involved in AISA service quality.

Table 2-5 Illustrative research questions pertinent to AISA service quality

AISA Service Quality Factors	Consumers	Service Firms	Society
Perceived AISA Service Quality Dimensions	• How do consumers feel about incorporating more AISA in their lives and under what conditions will consumers trust AISA more in providing service? • How is the 'uncanny valley' phenomenon manifested in service settings, what are the implications for AISA service quality, and how do they change across types of services and AISA? • How does the relative importance of the different AISA service quality dimensions differ across various types of services for consumers? (E.g. would they differ for high involvement decision making such as healthcare services?)	• What is the role of human service employees where AISA are used for service? How has the role of human service employees changed with greater presence of AI in services? • How can service firms effectively improve AISA service quality (e.g. training AISA) continuously? • Will pervasive use of AISA entail the emergence of service quality standards, and if so, how can service firms measure and improve how their AISA meet these standards? • How should service firms communicate their data policies to the consumers to counter privacy issues?	• To what extent can society influence service quality expectations and performances of AISA? • Should the governance of AISA service quality be left to service firms alone or involve other stakeholders? • What are the implications of AISA for privacy since extent to which AISA achieves outcomes depends on how much data it has been given?
Consumer Outcomes of AISA Service Quality	• How is customer satisfaction affected when consumers transition from human service providers to AISA service providers (i.e. when tasks once performed by humans are now provided by AISA)? • How and to what extent does anthropomorphism in AISA influence trust, loyalty and well-being? • Do consumers form emotional bonds with AISA and if so, how are they affected by AISA service quality?	• How does AISA service quality influence the branding (e.g. brand image, brand personality, brand attachment) of the service firm? • How can service firms responsibly facilitate the use of AISA by consumers? • What are the alternative uses of the data that is captured and created by AISA, and how can service firms use the data more effectively?	• Do AISA exhibit bias and/or inequality? How do we minimise ensuing consumer vulnerability? • As the knowledge of AISA and use grows, how will established traditional views of expertise and wisdom change? • What are the broader externalities (e.g. social cost) that are associated with the greater use of AISA? • What are the unanticipated consequences of the broader use of AISA?

AISA Service Quality Factors	Consumers	Service Firms	Society
Antecedents /Moderators of AISA Service Quality	• How do the different representations of AISA (i.e. physical or virtual forms) affect AISA service quality? • In what contexts are humanlike qualities of AISA valued by consumers? • How does consumers' evaluation of AISA service quality differ for different types of consumers (e.g. demographic, psychographic and technographic characteristics)? • What hopes and fears do consumers have about greater availability of AISA in service?	• How will the nature of AI technology affect the manner in which service firms adopt it for service provisioning? • How can service firms enhance consumer trust to increase AISA service quality perceptions?	• Under what conditions will the use of AISA become a social norm? • How will society's attitudes towards AISA change and how will this affect AISA service quality expectations?

References

Aldas-Manzano, J, Ruiz-Mafe, C, Sanz-Blas, S & Lassala-Navarré, C 2011, 'Internet banking loyalty: Evaluating the role of trust, satisfaction, perceived risk and frequency of use', *The Service Industries Journal*, vol. 31, no. 7, pp. 1165-1190.

Androit Market Research 2020, *Intelligent Virtual Assistant (IVA) Market to grow at 33% CAGR during forecast period (2020-2025) - Insights on Growth Drivers, Size and Share Analysis, Key Trends, Leading Players, and Business Opportunities: Adroit Market Research*, GlobeNewswire, viewed 26 February 2020, <https://www.globenewswire.com/news-release/2020/02/24/1988963/0/en/Intelligent-Virtual-Assistant-IVA-Market-to-grow-at-33-CAGR-during-forecast-period-2020-2025-Insights-on-Growth-Drivers-Size-and-Share-Analysis-Key-Trends-Leading-Players-and-Busin.html>.

Bakpayev, M, Baek, TH, van Esch, P & Yoon, S 2020, 'Programmatic creative: AI can think but it cannot feel', *Australasian Marketing Journal (AMJ)*.

Baronas, A-MK & Louis, MR 1988, 'Restoring a sense of control during implementation: How user involvement leads to system acceptance', *MIS Quarterly*, pp. 111-124.

Barrett, M, Davidson, E, Prabhu, J & Vargo, SL 2015, 'Service innovation in the digital age: Key contributions and future directions', *MIS Quarterly*, vol. 39, no. 1, pp. 135-154.

Bartneck, C, Kulić, D, Croft, E & Zoghbi, S 2009, 'Measurement instruments for the anthropomorphism, animacy, likeability, perceived intelligence, and perceived safety of robots', *International Journal of Social Robotics*, vol. 1, no. 1, pp. 71-81.

Benlian, A, Klumpe, J & Hinz, O 2019, 'Mitigating the intrusive effects of smart home assistants by using anthropomorphic design features: A multimethod investigation', *Information Systems Journal*, pp. 1-33.

Bitner, MJ, Brown, SW & Meuter, ML 2000, 'Technology infusion in service encounters', *Journal of the Academy of Marketing Science*, vol. 28, no. 1, pp. 138-149.

Bock, DE, Wolter, JS & Ferrell, O 2020, 'Artificial intelligence: Disrupting what we know about services', *Journal of Services Marketing*.

Bonello, M & Meehan, B 2019, 'Transparency and coherence in a doctoral study case analysis: Reflecting on the use of nvivo within a 'framework' approach', *The qualitative report*, vol. 24, no. 3, pp. 483-498.

Brady, MK & Cronin Jr, JJ 2001, 'Some new thoughts on conceptualizing perceived service quality: A hierarchical approach', *Journal of Marketing*, vol. 65, no. 3, pp. 34-49.

Burgers, A, de Ruyter, K, Keen, C & Streukens, S 2000, 'Customer expectation dimensions of voice-to-voice service encounters: A scale-development study', *International Journal of Service Industry Management*, vol. 11, no. 2, pp. 142-161.

Colby, C, Mithas, S & Parasuraman, A 2019, 'Service robots: Trends in acceptance and factors behind readiness to adopt', paper presented at Frontiers in Service 2019, Singapore.

Conger, S, Pratt, JH & Loch, KD 2013, 'Personal information privacy and emerging technologies', *Information Systems Journal*, vol. 23, no. 5, pp. 401-417.

Cronin Jr, JJ, Brady, MK & Hult, GTM 2000, 'Assessing the effects of quality, value, and customer satisfaction on consumer behavioral intentions in service environments', *Journal of Retailing*, vol. 76, no. 2, pp. 193-218.

Cronin Jr, JJ & Taylor, SA 1994, 'Servperf versus servqual: Reconciling performance-based and perceptions-minus-expectations measurement of service quality', *Journal of Marketing*, pp. 125-131.

Dabholkar, PA 1996, 'Consumer evaluations of new technology-based self-service options: An investigation of alternative models of service quality', *International Journal of Research in Marketing*, vol. 13, no. 1, pp. 29-51.

Dabholkar, PA & Bagozzi, RP 2002, 'An attitudinal model of technology-based self-service: Moderating effects of consumer traits and situational factors', *Journal of the Academy of Marketing Science*, vol. 30, no. 3, pp. 184-201.

Dabholkar, PA, Thorpe, DI & Rentz, JO 1996, 'A measure of service quality for retail stores: Scale development and validation', *Journal of the Academy of Marketing Science*, vol. 24, no. 1, pp. 3-16.

Davenport, T, Guha, A, Grewal, D & Bressgott, T 2020, 'How artificial intelligence will change the future of marketing', *Journal of the Academy of Marketing Science*, vol. 48, no. 1, pp. 24-42.

Davis, FD 1989, 'Perceived usefulness, perceived ease of use, and user acceptance of information technology', *MIS Quarterly*, pp. 319-340.

Davis, FD, Bagozzi, RP & Warshaw, PR 1992, 'Extrinsic and intrinsic motivation to use computers in the workplace', *Journal of Applied Social Psychology*, vol. 22, no. 14, pp. 1111-1132.

Diener, E 1984, 'Subjective well-being', *Psychological Bulletin*, vol. 95, no. 3, pp. 542-575.

Ding, DX, Hu, PJ-H & Sheng, ORL 2011, 'E-selfqual: A scale for measuring online self-service quality', *Journal of Business Research*, vol. 64, no. 5, pp. 508-515.

Dowling, GR & Staelin, R 1994, 'A model of perceived risk and intended risk-handling activity', *Journal of Consumer Research*, vol. 21, no. 1, pp. 119-134.

Dwivedi, YK, Hughes, L, Ismagilova, E, Aarts, G, Coombs, C, Crick, T, Duan, Y, Dwivedi, R, Edwards, J & Eirug, A 2019, 'Artificial intelligence (AI): Multidisciplinary perspectives on emerging challenges, opportunities, and agenda for research, practice and policy', *International Journal of Information Management*, p. 101994.

Epley, N, Waytz, A & Cacioppo, JT 2007, 'On seeing human: A three-factor theory of anthropomorphism', *Psychological review*, vol. 114, no. 4, p. 864.

Feng, CM, Park, A, Pitt, L, Kietzmann, J & Northey, G 2020, 'Artificial intelligence in marketing: A bibliographic perspective', *Australasian Marketing Journal (AMJ)*.

Gioia, DA, Corley, KG & Hamilton, AL 2013, 'Seeking qualitative rigor in inductive research: Notes on the gioia methodology', *Organizational Research Methods*, vol. 16, no. 1, pp. 15-31.

Go, E & Sundar, SS 2019, 'Humanizing chatbots: The effects of visual, identity and conversational cues on humanness perceptions', *Computers in Human Behavior*, vol. 97, pp. 304-316.

Goudey, A & Bonnin, G 2016, 'Must smart objects look human? Study of the impact of anthropomorphism on the acceptance of companion robots', *Recherche et Applications en Marketing (English Edition) (Sage Publications Inc.)*, vol. 31, no. 2, pp. 2-20.

Grönroos, C 1984, 'A service quality model and its marketing implications', *European Journal of Marketing*, vol. 18, no. 4, pp. 36-44.

Gursoy, D, Chi, OH, Lu, L & Nunkoo, R 2019, 'Consumers acceptance of artificially intelligent (AI) device use in service delivery', *International Journal of Information Management*, vol. 49, pp. 157-169.

Han, S & Yang, H 2018, 'Understanding adoption of intelligent personal assistants: A parasocial relationship perspective', *Industrial Management & Data Systems*, vol. 118, no. 3, pp. 618-636.

He, Z, Yang, X, Wang, W & Zhang, M 2017, 'Measuring service quality in telematics service: Development and validation of multidimensional teleservq scale', *Total Quality Management & Business Excellence*, vol. 28, no. 9-10, pp. 1166-1182.

Hoy, MB 2018, 'Alexa, siri, cortana, and more: An introduction to voice assistants', *Medical Reference Services Quarterly*, vol. 37, no. 1, pp. 81-88.

Huang, EY, Lin, S-W & Fan, Y-C 2015, 'M-s-qual: Mobile service quality measurement', *Electronic Commerce Research and Applications*, vol. 14, no. 2, pp. 126-142.

Huang, M-H & Rust, RT 2018, 'Artificial intelligence in service', *Journal of Service Research*, vol. 21, no. 2, pp. 155-172.

Huang, M-H & Rust, RT 2020, 'Engaged to a robot? The role of AI in service', *Journal of Service Research*, p. 1094670520902266.

Hussain, K, Jing, F, Junaid, M, Bukhari, FAS & Shi, H 2019, 'The dynamic outcomes of service quality: A longitudinal investigation', *Journal of Service Theory and Practice*, vol. 29, no. 4, pp. 513-536.

Insights, O 2019, *Government artificial intelligence readiness index 2019*.

Jordan, MI & Mitchell, TM 2015, 'Machine learning: Trends, perspectives, and prospects', *Science*, vol. 349, no. 6245, pp. 255-260.

Kepuska, V & Bohouta, G 2018, 'Next-generation of virtual personal assistants (microsoft cortana, apple siri, amazon alexa and google home)', in *2018 IEEE 8th Annual Computing and Communication Workshop and Conference (CCWC)*, IEEE, pp. 99-103.

Kinsella, B 2019, *Australia leaps past u.S. In smart speaker adoption, google home establishes dominant market share*, Voicebot.ai, viewed 7 November 2019, <https://voicebot.ai/2019/03/19/australia-leaps-past-u-s-in-smart-speaker-adoption-google-home-establishes-dominant-market-share/>.

Legg, S & Hutter, M 2007, 'Universal intelligence: A definition of machine intelligence', *Minds and Machines*, vol. 17, no. 4, pp. 391-444.

Lin, J-SC & Hsieh, P-L 2011, 'Assessing the self-service technology encounters: Development and validation of SSTQUAL scale', *Journal of Retailing*, vol. 87, no. 2, pp. 194-206.

Loiacono, ET, Watson, RT & Goodhue, DL 2007, 'Webqual: An instrument for consumer evaluation of web sites', *International Journal of Electronic Commerce*, vol. 11, no. 3, pp. 51-87.

Lu, L, Cai, R & Gursoy, D 2019, 'Developing and validating a service robot integration willingness scale', *International Journal of Hospitality Management*, vol. 80, pp. 36-51.

Lu, V, Wirtz, J, Kunz, W, Paluch, S, Gruber, T, Martins, A & Patterson, P 2020, 'Service robots, customers, and service employees: What can we learn from the academic literature and where are the gaps?', *Journal of Service Theory and Practice*, vol. 30, no. 3, pp. 361-391.

Malhotra, NK, Nunan, D & Birks, DF 2017, *Marketing research: An applied approach*, Fifth edn, Pearson, New York.

Meyer-Waarden, L, Pavone, G, Poocharoentou, T, Prayatsup, P, Ratinaud, M, Tison, A & Torné, S 2020, 'How service quality influences customer acceptance and usage of chatbots?', *SMR - Journal of Service Management Research*, vol. 4, no. 1, pp. 35-51.

Mittal, B & Lassar, WM 1996, 'The role of personalization in service encounters', *Journal of Retailing*, vol. 72, no. 1, pp. 95-109.

Mogaji, E, Soetan, TO & Kieu, TA 2020, 'The implications of artificial intelligence on the digital marketing of financial services to vulnerable customers', *Australasian Marketing Journal (AMJ)*.

Mori, M, MacDorman, KF & Kageki, N 2012, 'The uncanny valley [from the field]', *IEEE Robotics & Automation Magazine*, vol. 19, no. 2, pp. 98-100.

Morita, T, Kashiwagi, N, Yorozu, A, Suzuki, H & Yamaguchi, T 2019, 'Evaluation of a multi-robot cafe based on service quality dimensions', *The Review of Socionetwork Strategies*, pp. 1-22.

Moussawi, S 2016, 'Investigating personal intelligent agents in everyday life through a behavioral lens', Ph.D. thesis, 10165530 thesis, City University of New York, Ann Arbor, ProQuest Dissertations & Theses Global.

Mustak, M, Salminen, J, Plé, L & Wirtz, J 2021, 'Artificial intelligence in marketing: Topic modeling, scientometric analysis, and research agenda', *Journal of Business Research*, vol. 124, pp. 389-404.

Ng, A 2019, *AI for everyone*, deeplearning.ai, viewed 9 August 2019, <https://www.deeplearning.ai/ai-for-everyone/>.

Ng, SC, Sweeney, JC & Plewa, C 2020, 'Customer engagement: A systematic review and future research priorities', *Australasian Marketing Journal (AMJ)*.

Novak, TP & Hoffman, DL 2019, 'Relationship journeys in the internet of things: A new framework for understanding interactions between consumers and smart objects', *Journal of the Academy of Marketing Science*, vol. 47, no. 2, pp. 216-237.

Paluch, S, Wirtz, J, Kunz, W, Patterson, P, Gruber, T, Lu, V & Martin, A 2019, 'Does c3po really understand me? - extending the service robots acceptance model', paper presented at Frontiers in Service 2019, Singapore.

Pantano, E & Pizzi, G 2020, 'Forecasting artificial intelligence on online customer assistance: Evidence from chatbot patents analysis', *Journal of Retailing and Consumer Services*, vol. 55, p. 102096.

Parasuraman, A 2000, 'Technology readiness index (tri) a multiple-item scale to measure readiness to embrace new technologies', *Journal of Service Research*, vol. 2, no. 4, pp. 307-320.

Parasuraman, A 2002, 'Service quality and productivity: A synergistic perspective', *Managing Service Quality: An International Journal*, vol. 12, no. 1, pp. 6-9.

Parasuraman, A, Berry, LL & Zeithaml, VA 1993, 'More on improving service quality measurement', *Journal of Retailing*, vol. 69, no. 1, pp. 140-147.

Parasuraman, A & Colby, CL 2015, 'An updated and streamlined technology readiness index: Tri 2.0', *Journal of Service Research*, vol. 18, no. 1, pp. 59-74.

Parasuraman, A, Zeithaml, VA & Berry, LL 1985, 'A conceptual model of service quality and its implications for future research', *Journal of Marketing*, pp. 41-50.

Parasuraman, A, Zeithaml, VA & Berry, LL 1988, 'Servqual: A multiple-item scale for measuring consumer perceptions of service quality', *Journal of Retailing*, vol. 64, no. 1, p. 12.

Parasuraman, A, Zeithaml, VA & Berry, LL 1994a, 'Alternative scales for measuring service quality: A comparative assessment based on psychometric and diagnostic criteria', *Journal of Retailing*, vol. 70, no. 3, pp. 201-230.

Parasuraman, A, Zeithaml, VA & Berry, LL 1994b, 'Reassessment of expectations as a comparison standard in measuring service quality: Implications for further research', *Journal of Marketing*, pp. 111-124.

Parasuraman, A, Zeithaml, VA & Malhotra, A 2005, 'E-s-qual: A multiple-item scale for assessing electronic service quality', *Journal of Service Research*, vol. 7, no. 3, pp. 213-233.

Patton, MQ 2002, 'Qualitative research and evaluation methods. Thousand oaks', *Cal.: Sage Publications*.

Qiu, L & Benbasat, I 2009, 'Evaluating anthropomorphic product recommendation agents: A social relationship perspective to designing information systems', *Journal of Management Information Systems*, vol. 25, no. 4, Spring2009, pp. 145-181.

Rai, A 2020, 'Explainable AI: From black box to glass box', *Journal of the Academy of Marketing Science*, vol. 48, no. 1, pp. 137-141.

Rank, J, Carsten, JM, Unger, JM & Spector, PE 2007, 'Proactive customer service performance: Relationships with individual, task, and leadership variables', *Human Performance*, vol. 20, no. 4, pp. 363-390.

Robinson, S, Orsingher, C, Alkire, L, De Keyser, A, Giebelhausen, M, Papamichail, KN, Shams, P & Temerak, MS 2019, 'Frontline encounters of the AI kind: An evolved service encounter framework', *Journal of Business Research*.

Rosenbaum, MS & Russell-Bennett, R 2020, 'Editorial: Service research in the new (post-covid) marketplace', *Journal of Services Marketing*.

Russell, S & Norvig, P 2016, *Artificial intelligence: A modern approach*, Third edn, Pearson, Malaysia.

Rust, RT & Huang, M-H 2014, 'The service revolution and the transformation of marketing science', *Marketing Science*, vol. 33, no. 2, pp. 206-221.

Rust, RT & Oliver, RL 1993, *Service quality: New directions in theory and practice*, Sage Publications.

Seth, N, Deshmukh, SG & Vrat, P 2005, 'Service quality models: A review', *International Journal of Quality & Reliability Management*, vol. 22, no. 9, pp. 913-949.

Sheehan, B, Jin, HS & Gottlieb, U 2020, 'Customer service chatbots: Anthropomorphism and adoption', *Journal of Business Research*, vol. 115, pp. 14-24.

Shell, MA & Buell, RW 2019, 'How necessary is the human touch?', *Harvard Business Review*, vol. 97, no. 4, pp. 28-28.

Siddike, MAK, Spohrer, J, Demirkan, H & Kohda, Y 2018, 'People's interactions with cognitive assistants for enhanced performances', in *51st Hawaii International Conference on System Sciences*, pp. 1640-1648.

Sotiriadou, P, Brouwers, J & Le, T-A 2014, 'Choosing a qualitative data analysis tool: A comparison of nvivo and leximancer', *Annals of Leisure Research*, vol. 17, no. 2, pp. 218-234.

Steinhoff, L & Palmatier, RW 2020, 'Commentary: Opportunities and challenges of technology in relationship marketing', *Australasian Marketing Journal (AMJ)*.

Strauss, A & Corbin, J 1998, *Basics of qualitative research techniques*, Sage publications Thousand Oaks, CA.

Talwar, S, Talwar, M, Kaur, P & Dhir, A 2020, 'Consumers' resistance to digital innovations: A systematic review and framework development', *Australasian Marketing Journal (AMJ)*, vol. 28, no. 4, pp. 286-299.

Tam, JLM 2012, 'The moderating role of perceived risk in loyalty intentions: An investigation in a service context', *Marketing Intelligence & Planning*.

Tan, C-W, Benbasat, I & Cenfetelli, RT 2016, 'An exploratory study of the formation and impact of electronic service failures', *MIS Quarterly*, vol. 40, no. 1, pp. 1-29.

Thomaz, F, Salge, C, Karahanna, E & Hulland, J 2020, 'Learning from the dark web: Leveraging conversational agents in the era of hyper-privacy to enhance marketing', *Journal of the Academy of Marketing Science*, vol. 48, no. 1, pp. 43-63.

Troshani, I, Rao Hill, S, Sherman, C & Arthur, D 2020, 'Do we trust in AI? Role of anthropomorphism and intelligence', *Journal of Computer Information Systems*, pp. 1-11.

Tuu, HH, Olsen, SO & Linh, PTT 2011, 'The moderator effects of perceived risk, objective knowledge and certainty in the satisfaction-loyalty relationship', *Journal of Consumer Marketing*.

Van Doorn, J, Mende, M, Noble, SM, Hulland, J, Ostrom, AL, Grewal, D & Petersen, JA 2017, 'Domo arigato mr. Roboto: Emergence of automated social presence in organizational frontlines and customers' service experiences', *Journal of Service Research*, vol. 20, no. 1, pp. 43-58.

Wirtz, J, Patterson, PG, Kunz, WH, Gruber, T, Lu, VN, Paluch, S & Martins, A 2018, 'Brave new world: Service robots in the frontline', *Journal of Service Management*, vol. 29, no. 5, pp. 907-931.

Wu, PC, Yeh, GY-Y & Hsiao, C-R 2011, 'The effect of store image and service quality on brand image and purchase intention for private label brands', *Australasian Marketing Journal (AMJ)*, vol. 19, no. 1, pp. 30-39.

Xiao, L & Kumar, V 2019, 'Robotics for customer service: A useful complement or an ultimate substitute?', *Journal of Service Research*, p. 1094670519878881.

Xu, Y, Shieh, C-H, van Esch, P & Ling, I-L 2020, 'AI customer service: Task complexity, problem-solving ability, and usage intention', *Australasian Marketing Journal (AMJ)*.

Yang, R 2018, *Artificial intelligence in singapore: Pervasive, powerful and present*, Singapore Press Holdings, viewed 7 November 2019, <https://www.businesstimes.com.sg/opinion/artificial-intelligence-in-singapore-pervasive-powerful-and-present>.

Yang, Z, Cai, S, Zhou, Z & Zhou, N 2005, 'Development and validation of an instrument to measure user perceived service quality of information presenting web portals', *Information & Management*, vol. 42, no. 4, pp. 575-589.

Yang, Z, Jun, M & Peterson, RT 2004, 'Measuring customer perceived online service quality: Scale development and managerial implications', *International Journal of Operations & Production Management*, vol. 24, no. 11, pp. 1149-1174.

Yin, RK 2009, *Case study research: Design and methods*, Sage Publications, Thousand Oaks, Calif.

Zarouali, B, Van den Broeck, E, Walrave, M & Poels, K 2018, 'Predicting consumer responses to a chatbot on facebook', *CyberPsychology, Behavior & Social Networking*, vol. 21, no. 8, pp. 491-497.

Zeithaml, VA 1988, 'Consumer perceptions of price, quality, and value: A means-end model and synthesis of evidence', *Journal of Marketing*, pp. 2-22.

Zeithaml, VA, Berry, LL & Parasuraman, A 1996, 'The behavioral consequences of service quality', *Journal of Marketing*, pp. 31-46.

Zeithaml, VA, Parasuraman, A & Berry, LL 1985, 'Problems and strategies in services marketing', *Journal of Marketing*, pp. 33-46.

Zeithaml, VA, Parasuraman, A & Malhotra, A 2000, 'Conceptual framework for understanding e-service quality: Implications for future research and managerial practice', *Marketing Science Institute*, no. 00-115.

Zeithaml, VA, Parasuraman, A & Malhotra, A 2002, 'Service quality delivery through web sites: A critical review of extant knowledge', *Journal of the Academy of Marketing Science*, vol. 30, no. 4, p. 362.

APPENDIX B Interview protocol

Introduction

1. What do you usually use chatbots for?

General Questions

Theme 1: AISA service quality attributes (What do consumers perceive to be the key attributes of quality in services involving AI service agents?)

2. Can you share instances when you've used a chatbot and it performed well?
3. In general, what do you expect from a chatbot?
4. What does high service quality mean for a chatbot?
5. What type of human-like service characteristics would you want from a chatbot?
6. How can AISA service quality be improved?

Theme 2: AISA service challenges and contexts (What problems and tasks are involved for AI service agents to provide high quality service?)

7. Can you describe a situation where using a chatbot didn't go as well as you had expected?
8. What negative experiences have you faced when using chatbots?
9. Can you share instances when you'd choose human service-support over a chatbot? Why?
10. What type of services might it be difficult to replace a human with a chatbot? Why?
11. In general, under what circumstances you would resist using chatbots? Why?

Theme 3: AISA service quality outcomes (How do services performed by AI service agents affect consumers?)

12. In what way would you be happy with the service provided by a chatbot?
13. Do you find chatbots valuable in satisfying your needs? How so?
14. What is preventing you from using chatbots more frequently than you currently do?
15. How else has the use of chatbots affected you? (i.e. thoughts/feelings/behaviour – positive/negative)

Closing

16. Is there anything else you'd like to share? Is there anything you were surprised I didn't ask you?
17. Can I follow-up with you if I require further clarification on any of your responses?

CHAPTER 3. STUDY 2: DEVELOPING A SERVICE QUALITY SCALE FOR ARTIFICIAL INTELLIGENCE SERVICE AGENTS

Chapter 3 features the second study in this thesis – *Developing a Service Quality Scale for Artificial Intelligence Service Agents*. Building upon the 12 conceptual AISA service quality dimensions established from the qualitative evidence in Chapter 2, the aim of this study is to construct, refine and validate these dimensions into an empirical AISA service quality scale (AISAQUAL). The research methodology in this chapter involves the use of multiple qualitative and quantitative surveys consistent with established scale development techniques (Churchill Jr. 1979).

At the time of the submission of this thesis, Study 2 was under review by the *European Journal of Marketing*. Accordingly, this chapter is presented in a journal article format. The contribution ratio of all authors of this paper is highlighted on the following page, before the abstract of the main paper.

Statement of ownership

Statement of Authorship

Title of Paper	Developing a service quality scale for artificial intelligence service agents
Publication Status	☐ Published ☐ Accepted for Publication ☑ Submitted for Publication ☐ Unpublished and Unsubmitted w ork w ritten in manuscript style
Publication Details	Currently under review stage in a journal publication (ABDC ranking: A*).

Principal Author

Name of Principal Author (Candidate)	Nurhafihz Bin Noor		
Contribution to the Paper	I conceptualized the research paper, designed and conducted experiments for data collection and analysis, interpreted data and wrote manuscript.		
Overall percentage (%)	70%		
Certification:	This paper reports on original research I conducted during the period of my Higher Degree by Research candidature and is not subject to any obligations or contractual agreements with a third party that would constrain its inclusion in this thesis. I am the primary author of this paper.		
Signature		Date	18/1/2021

Co-Author Contributions

By signing the Statement of Authorship, each author certifies that:

i. the candidate's stated contribution to the publication is accurate (as detailed above);
ii. permission is granted for the candidate in include the publication in the thesis; and
iii. the sum of all co-author contributions is equal to 100% less the candidate's stated contribution.

Name of Co-Author	Sally Rao Hill		
Contribution to the Paper	Associate Professor Sally Rao Hill supervised the development of work and assisted in data interpretation, manuscript evaluation and revision. Percentage of contribution: 15%		
Signature		Date	18/1/2021

Name of Co-Author	Indrit Troshani		
Contribution to the Paper	Associate Professor Indrit Troshani supervised the development of work and assisted in data interpretation, manuscript evaluation and revision. Percentage of contribution: 15%		
Signature		Date	18/1/2021

Please cut and paste additional co-author panels here as required.

STUDY 2: DEVELOPING A SERVICE QUALITY SCALE FOR ARTIFICIAL INTELLIGENCE SERVICE AGENTS

Abstract

Service providers and consumers alike are increasingly using artificial intelligence service agents (AISA) in the service environment. Yet no service quality scale exists that can fully capture how consumers evaluate AISA-enabled services. In addition, an AISA service quality scale would not only facilitate theory development by providing a reliable scale that can be used for future research in AISA services, but it would also enable service managers to accurately monitor, diagnose and improve AISA-enabled services. Building on extant service quality research and established scale development techniques, we address this gap by constructing, refining and validating a multidimensional scale for measuring AISA service quality (AISAQUAL). AISAQUAL contains 26 items across six dimensions: efficiency, security, availability, enjoyment, contact and anthropomorphism. Our study establishes anthropomorphism as a new and significant dimension for service quality measurement. The new scale demonstrates good psychometric properties and can be used to evaluate consumer service quality across AISA applications such as chatbots and virtual assistants. Our findings also confirm the relationships between service quality and satisfaction, perceived value and loyalty intentions in the AISA context. Managerial implications for the service industry and directions for further research using AISAQUAL are also provided.

Keywords

Artificial intelligence service agents; service quality; scale development; customer service

3.1 Introduction

Artificial intelligence (AI) continues to transform the service industry (Huang & Rust 2018; Rust 2019). Indeed, the technology is becoming increasingly integral to the service function in business (De Keyser et al. 2019; Robinson et al. 2019). AI service agents (AISA) are technology agents in the form of software applications, machines and robots that can perform service tasks autonomously by adapting to the specific needs of the customer while also accounting for the customer's historical behaviours (Russell & Norvig 2016; Wirtz et al. 2018). Common examples of AISA include chatbots (Zarouali et al. 2018) and virtual assistants (Hoy 2018).

On the one hand, AISA are being used by service providers in various sectors for a range of service tasks including improving understanding of customer preferences, performing service tasks and managing customer relationships (Shankar 2018). On the other hand, consumers are benefiting from AISA services in terms of greater efficiency and customisation (Huang & Rust 2020) and are responding by rapidly adopting them. For example, chatbots and virtual assistants are becoming increasingly popular among consumers for service and their market value is expected to increase with a compound annual growth rate of over 33% from 2020 to 2025 (Androit Market Research 2020).

To ensure the longer-term market adoption of AISA, it is important to assess and improve AISA service quality which to a large extent is based on consumer evaluation. Service quality is a key construct that has been used for over three decades in service research. Service quality refers to the overall excellence or superiority of the service performance by a service agent as perceived by consumers (Zeithaml 1988). Various scales have been developed to better measure service quality across contexts involving different types of service agents (Ladhari 2009; Seth, Deshmukh & Vrat 2005). These scales include those associated with human service agents (e.g. Parasuraman, Zeithaml & Berry 1988) or with technology-based

services (e.g. performed online) (e.g. Parasuraman, Zeithaml & Malhotra 2005). Some service quality dimensions, such as reliability, feature in many of the existing scales (Ladhari 2010). These dimensions are combined with others in service quality scales, and the resulting combinations can vary across different types of service agents (Ladhari 2010). A reliable combination of service quality dimensions that matter to consumers for a given service environment is important to facilitate efforts of the service sector to achieve customer satisfaction and loyalty (Cronin Jr, Brady & Hult 2000).

Despite the importance of service quality and the growing prevalence of AISA in the service sector, the literature remains silent on empirical service quality scales developed for AISA. Existing service quality scales are also ineffective in capturing the new service experiences consumers have with AISA (Meyer-Waarden et al. 2020; Morita et al. 2019). In one study, Morita et al. (2019) argued that SERVQUAL, designed primarily for human service agents, was inadequate in capturing the service performance of robots in cafes. Meyer-Waarden et al. (2020) also reached a similar conclusion regarding the ineffectiveness of SERVQUAL for a service context with chatbots and found that the empathy dimension in SERVQUAL did not show significant effects.

Unique to AISA is the inherent capacity of a non-human entity to provide human-like service interaction, which is likely to produce unique reactions and customer experiences (Wirtz et al. 2018). Accordingly, consumers may form an overall attitude toward AISA service quality based on similar attributes found in existing human or traditional non-AI technology service quality dimensions (Bock, Wolter & Ferrell 2020). But consumers may also evaluate AISA based on new dimensions relating to characteristics unique to AISA, which are not applicable in traditional service environments, and which might therefore contribute to the overall service quality perceptions in the context of AISA-enabled services (Bock, Wolter & Ferrell 2020).

To the best of our knowledge, no research has been undertaken to fully develop a scale for AISA service quality. This remains a critical gap in the service quality literature (Bock, Wolter & Ferrell 2020; Lu et al. 2020) and impedes the development of new theoretical insights surrounding the novel but growing domain of AISA service quality – including empirical tests for antecedents, outcomes and moderators – due to the lack of a proper scale (Ranjan & Read 2016).

As studies concerning AISA service quality gain momentum (e.g. Prentice, Sergio & Wang 2020), it is important to accurately and systematically assess AISA service quality using a psychometrically validated instrument. A reliable service quality scale specifically developed for AISA could better inform or explain theoretical findings and conclusions from emerging research in this area. This would also provide a robust tool which service providers could use with greater confidence to enable the continued and effective adoption of AISA in the competitive service sector. Accordingly, our study aims to construct, refine and validate a multiple-item scale for measuring AISA service quality (AISAQUAL) using the scale development process that is consistent with established, proven scale development techniques (Churchill Jr. 1979).

The remainder of this paper proceeds as follows. In the next section, we review the literature on service quality measurement and the recent research concerning AISA service quality. We then proceed to discuss the development of AISAQUAL, before concluding with the theoretical and managerial implications.

3.2 Related literature

3.2.1 Service quality measurement

Service quality is generally considered a long-term global judgement of service performance by consumers operationalised at an attitude level (Cronin Jr & Taylor 1994; Parasuraman,

Zeithaml & Berry 1994a). Since its early conceptualisation by Grönroos (1984), many models have been proposed in the literature to help understand service quality (Seth, Deshmukh & Vrat 2005). SERVQUAL by Parasuraman, Zeithaml and Berry (1988) established a scale to measure service quality and has gained much popularity in the service marketing literature. This scale consists of five dimensions – tangibles, reliability, responsiveness, assurance and empathy – which consumers use to assess the service quality of human service agents. The model has been validated and shown to be robust across many service industries, including education, health, banking and retail (Ladhari 2009).

Since the development of SERVQUAL, technology has emerged and continued to play a growing, integral role in service provision, influencing the way consumers experience services (Parasuraman 2000). Periodic leaps in technological innovation have resulted in the introduction of new types of service agents, further expanding the service industry (Rust 2019). These technologies include self-service machines, such as bank ATMs, vending machines (Fitzsimmons 2003), and the internet with many online services (Yang, Jun & Peterson 2004).

Changes to the service environment due to new types of service agents with unique interface designs and service delivery processes can affect both service and how service quality is perceived by consumers (Rust & Oliver 1993). There are different combinations of service quality dimensions applicable to different service environments, although some dimensions are more universal than others in terms of their perceived role by consumers in service quality. For example, responsiveness appears frequently for human- (e.g. Brady & Cronin Jr 2001; Mittal & Lassar 1996) and technology-based services (Ladhari 2010). However, attributes such as security and privacy are more salient for technology-based services including websites (e.g. Yang, Jun & Peterson 2004), mobile services (e.g. Huang, Lin & Fan 2015) and self-service technologies (e.g. Lin & Hsieh 2011). Accordingly, researchers have developed different service quality scales for different contexts over the years. For example, SSTQUAL is

applicable for self-service technologies (Lin & Hsieh 2011) and E-S-QUAL for online service quality (Parasuraman, Zeithaml & Malhotra 2005). However, these scales are not readily applicable for AISA as both self-service technologies and website services rely on preprogrammed outputs based on anticipated standardised user inputs. In addition, both SSTQUAL and E-S-QUAL do not capture the anthropomorphic dimension which was found to be meaningful to consumers in their perceptions of AISA service quality (Study 1).

There has been vigorous discussion and rigorous validation of the service quality dimensions in varying service settings. While some scholars have treated service quality dimensions as antecedents (e.g. Dabholkar 1996; Dabholkar, Shepherd & Thorpe 2000), the majority conceptualise these dimensions as components of the multi-dimensional service quality construct (Brady & Cronin Jr 2001). There is ongoing debate as to whether the construct is reflective as suggested in the majority of the service quality scale development literature or whether it contains formative higher-orders (see e.g., Ladhari 2009, 2010; Martínez & Martínez 2010; Parasuraman, Zeithaml & Malhotra 2005). Scholars also advise caution in considering the formative specification (Hair et al. 2019). In this study, we argue that measures related to attitudes, such as AISA service quality, are more reflective, latent and not an index (Hair et al. 2019). This is because the dimensions of AISAQUAL would be "expressions of the complexity" (Caro & Garcia 2008, p.716) of AISA service performance by consumers.

Another issue that has been debated in the service marketing literature concerns the empirical advantages of a performance-only assessment of service quality over the performance-expectations comparison approach[4] (Cronin Jr & Taylor 1992, 1994; Parasuraman, Berry & Zeithaml 1993; Parasuraman, Zeithaml & Berry 1994b). In a longitudinal study, Dabholkar, Shepherd and Thorpe (2000) concluded that a performance-

[4] While the performance-only measurement approach is originally attributed to Cronin Jr & Taylor (1992) in their development of SERVPERF as an alternative model to SERVQUAL, subsequent service quality scale development studies have adopted this performance-only measurement method (e.g. Lin and Hsieh 2011).

only measurement measures service quality better than performance-expectation measurements, and is more suitable when the objective is to determine factors contributing to service quality. Similarly, in a meta-analysis study of 17 empirical service quality studies spanning 17 years, Carrillat, Jaramillo and Mulki (2007) found no significant advantage of using performance-expectation indicators in determining overall service quality. In addition, they highlighted the advantage of the performance-only method requiring half as many items as the performance-expectation approach. By contrast, the longer and more time consuming disconfirmation measurement method is more suitable for a gap analysis (Dabholkar, Shepherd & Thorpe 2000), and offers more in-depth diagnostics of service quality (Carrillat, Jaramillo & Mulki 2007; Parasuraman, Berry & Zeithaml 1993). As such, the perception-based measurement method was adopted for our study as it is most suitable for our purpose in determining the AISAQUAL dimensions (Dabholkar, Shepherd & Thorpe 2000).

Having highlighted in the above discussion how extensive research on the various aspects of the service quality construct has contributed to a rich body of knowledge, we now discuss how AISA are shaping service provisioning and must consequently be accounted for in service quality measurement.

3.2.2 Measures related to AISA service quality

Currently, AISA are showing great promise in transforming service provisioning (Huang & Rust 2018; Rai, Constantinides & Sarker 2019), given their ability to play a key role in the service process (De Keyser et al. 2019; Robinson et al. 2019). For instance, consumers are increasingly interfacing with chatbots (Zarouali et al. 2018) and virtual assistants (Hoy 2018). However, AISA are likely to have repercussions on the nature of service provisioning which necessitates the accurate measurement of how consumers perceive service quality in settings

where AISA are used (Paluch & Wirtz 2020). This requires a reliable service quality scale developed specifically for AISA.

There are implications for services and related consumer experiences when AISA, representing a non-human entity, provide human-like service (Huang & Rust 2018; Wirtz et al. 2018). Accordingly, it is reasonable to posit that AISAQUAL may include relevant dimensions that were developed to capture service quality in settings where services are provided by human employees and traditional, non-AI technology service platforms (Bock, Wolter & Ferrell 2020).

Table 3-1 summarises service quality dimensions from key representative studies representing human and traditional technology service platforms, published from 1988 to 2020 with consumers as end-users, which generally contain measure items that might be applicable to AISAQUAL. For instance, dimensions and items related to ‘assurance’ (Burgers et al. 2000; Parasuraman, Zeithaml & Berry 1988) and ‘privacy’ (Huang, Lin & Fan 2015) can be adapted to describe the degree of security that AISA is perceived to provide to consumers. However, other dimensions not suitable for adaptation to AISAQUAL, such as ‘attitude’ (of service employees) from Brady and Cronin Jr (2001), were omitted from Table 3-1.

Table 3-1 Applicability of extant service quality dimensions to AISAQUAL

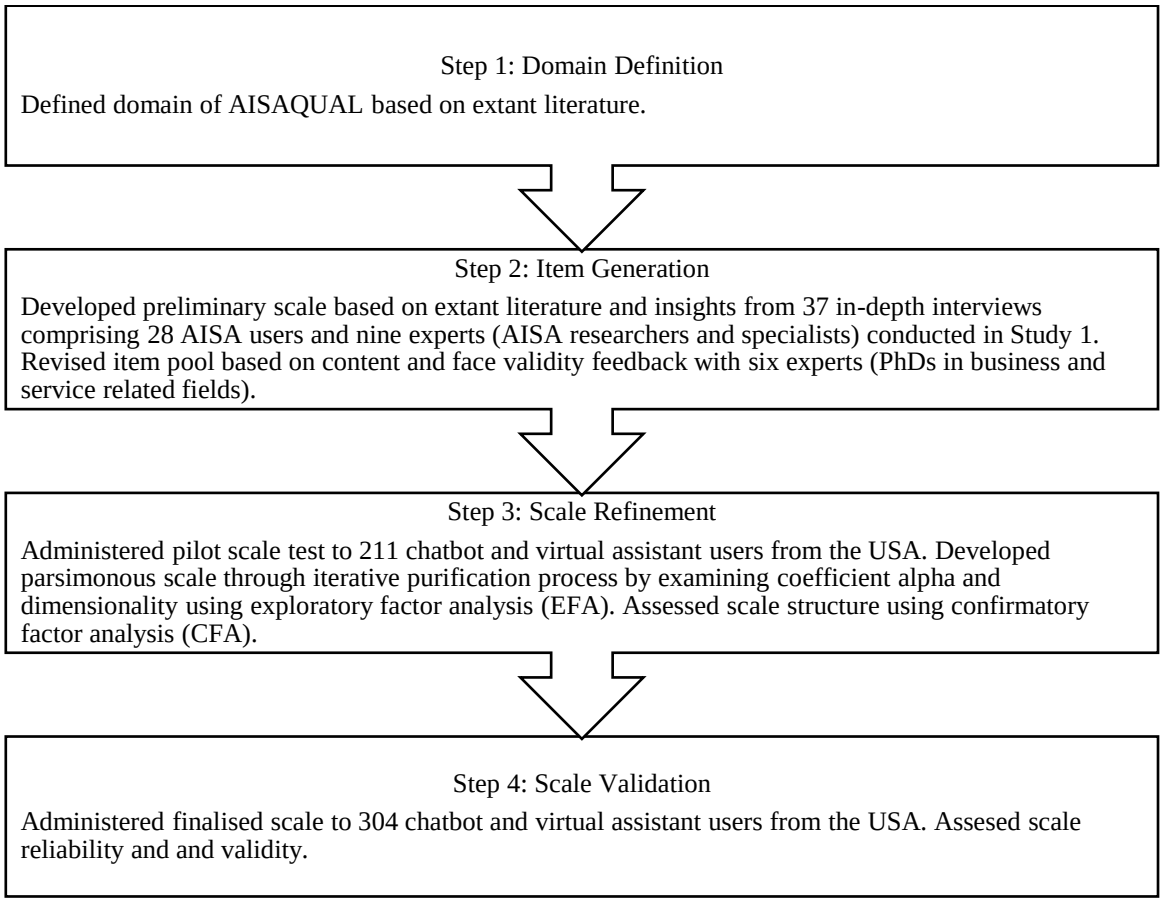
Research context	Representative study	Service context	Service quality dimensions applicable to AISAQUAL
Human services	Parasuraman, Zeithaml and Berry (1988)	General service environments	Reliability, Responsiveness, Assurance, Empathy, Tangibles
	Mittal and Lassar (1996)	Person-processing services involving interpersonal interactions	Reliability, Responsiveness, Personalisation, Tangibles
	Dabholkar, Thorpe and Rentz (1996)	Retail services (goods and services)	Appearance, Convenience, Promises, Doing it Right, Courtesy / Helpful, Problem Solving, Policy
	Burgers et al. (2000)	Call centre representatives	Adaptiveness, Assurance, Empathy, Authority
	Brady and Cronin Jr (2001)	Service encounters involving interaction, physical environment and outcome evaluations	Behaviour, Expertise, Ambient Conditions, Design, Waiting Time, Tangibles
Technology services	Dabholkar (1996)	General self-service technologies involving cognitive or affective assessments	Speed of delivery, Ease of Use, Expected Reliability, Expected Enjoyment, Expected Control
	Yang, Jun and Peterson (2004)	Online services involving variety of service processes (e.g. online banking)	Reliability, Responsiveness, Competence, Ease of Use, Product Portfolio, Security
	Yang et al. (2005)	Web portals	Usefulness of Content, Adequacy of Information, Accessibility, Interaction
	Parasuraman, Zeithaml and Malhotra (2005)	E-commerce	Efficiency, System Availability, Fulfilment, Privacy
	Parasuraman, Zeithaml and Malhotra (2005)	Service recovery in e-commerce	Responsiveness, Compensation, Contact
	Loiacono, Watson and Goodhue (2007)	General websites used for information gathering, transacting, entertainment	Informational Fit-to-Task, Tailored Information, Trust, Response Time, Ease of Understanding, Intuitive Operations, Visual Appeal. Innovativeness, Emotional Appeal, On-line Completeness, Relative Advantage
	Ding, Hu and Sheng (2011)	E-retailing self-services	Perceived Control, Customer Service, Service Fulfilment
	Lin and Hsieh (2011)	Self-service technologies across various service industries	Functionality, Enjoyment, Security, Design, Convenience, Customisation
	Huang, Lin and Fan (2015)	Mobile commerce	Contact, Responsiveness, Fulfilment, Privacy, Efficiency
	He et al. (2017)	Telematics	Efficiency, System Reliability, Information Quality, Security, Customisation, Call Centre Service

AISA-related attributes may also affect consumer perceptions of AISA service quality (Bock, Wolter & Ferrell 2020). Thus, our study turned to measure items in the literature which might represent the unique characteristics of AISA. As few constructs have been developed for this purpose (Bartneck et al. 2009), similar to extant technology-based service quality scales (e.g. Loiacono, Watson & Goodhue 2007; Tan & Chou 2008), we look at measures from the consumer technology acceptance literature in the information systems (IS) field. Specifically, we draw upon studies focusing on the continued use of AISA for the development of AISAQUAL. This is because consumer attitudes present in post-adoption stages can overlap with service quality perceptions for AISA which are formed through the regular use of the technology service system. For example, the scant research on the continued use of AISA provides insights into the 'perceived intelligence' and 'perceived anthropomorphism' of AISA (Han & Yang 2018; Moussawi 2016). Conceptually, the intelligence dimension is similar to the reliability attribute of service quality (Dabholkar 1996; Parasuraman, Zeithaml & Berry 1988), while anthropomorphism is similar to personalisation in SERVQUAL-P (Mittal & Lassar 1996). As such, the corresponding measurement items from Han and Yang (2018) and Moussawi (2016) have been considered in the development of the new AISAQUAL scale.

3.3 Scale development

The research process used to develop the AISAQUAL construct is consistent with the established approach for scale construction (Churchill Jr. 1979; Netemeyer, Bearden & Sharma 2003). A summary of the process we followed in the study is shown in Figure 3-1. Each step is elaborated upon in the sections that follow.

Figure 3-1 Research approach



Step 1: domain definition

Consistent with the literature on the definition of service quality (Zeithaml 1988), we define AISA service quality as the extent to which AISA facilitate an overall perception of excellence or superiority by consumers. It is a global assessment and attitude consisting of consumer judgements of AISA service performance. Developing AISA service quality dimensions based on measure items at the perceptual-level effectively captures the abstract nature of service quality comparisons which consumers make across categories (Zeithaml 1988). These service quality perceptions can be formed through regular AISA usage and in turn affect various outcomes such as customer satisfaction and loyalty (Cronin Jr, Brady & Hult 2000).

Step 2: item generation

Based on the theoretical foundations in service quality from the extant literature, in Study 1 of this thesis, 37 in-depth qualitative interviews were conducted to identify the preliminary relevant measure items for AISAQUAL. The interviewees comprised 28 AISA users and nine experts (AISA researchers and specialists) to better understand consumer perceptions related to AISA service quality. Interviewees were diverse in terms of their gender, age and AISA usage context (i.e. virtual assistant/chatbot users); and resided in Australia and Singapore which score high in terms of their current and future growth of AISA adoption (Insights 2019; Kinsella 2019; Yang 2018). Chatbots and virtual assistants were used as suitable representative technology types for the development of AISAQUAL in this study due to their wide popularity and availability at the time of this study. In addition, data pooled from responses across chatbot and virtual assistant users from both qualitative and quantitative phases of our study can assist in developing a scale generalisable across different types of AISA (Parasuraman, Zeithaml & Berry 1988; Parasuraman, Zeithaml & Malhotra 2005). Guided by an interview protocol, interviewees were asked for their perceptions of key AISA service quality attributes with questions including: "In general, what do you expect from the chatbot?" and "What does high service quality mean for a chatbot?".

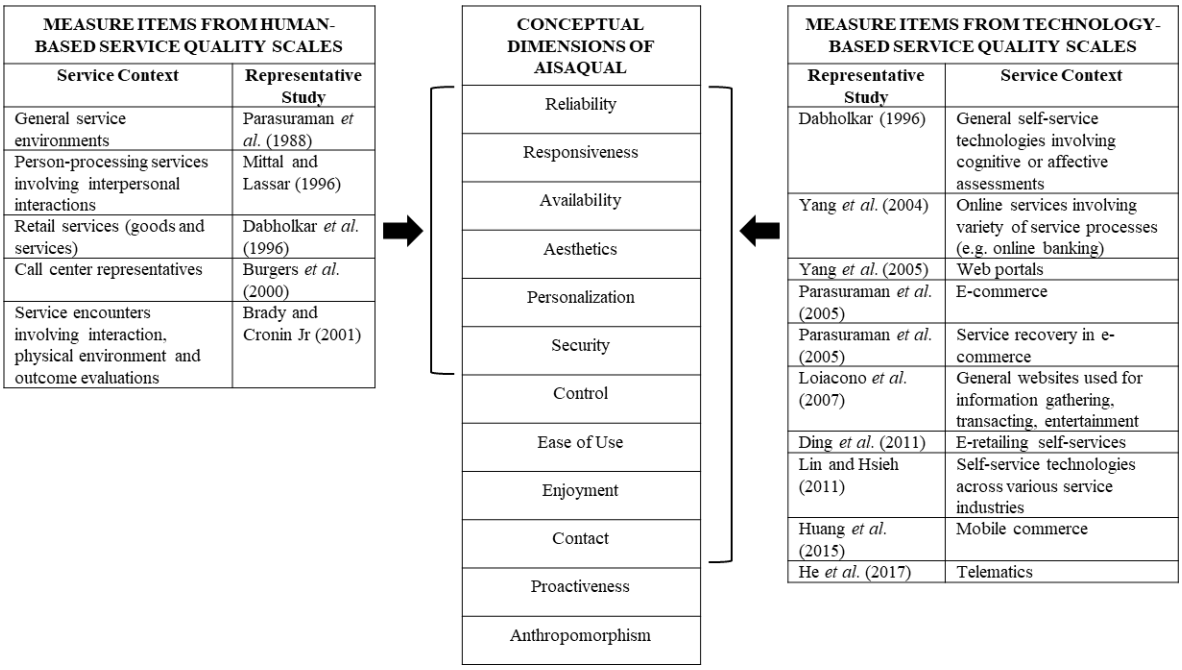
Through a systematic coding of their interviews using NVivo (version 12) and theme analysis using the 'Gioia methodology' (Gioia, Corley & Hamilton 2013), 12 conceptual dimensions of AISA service quality emerged. We found that two of these dimensions, namely proactiveness and anthropomorphism, were new to the service quality literature.

1. *Reliability*: Ability of the AISA to perform the service dependably and accurately (Parasuraman, Zeithaml & Berry 1988).
2. *Responsiveness*: Prompt response of the AISA to customer requests and the speed in resolving customer problems (Yang, Jun & Peterson 2004).

3. *Availability*: Ability of the AISA to be ready for use anytime, anywhere (Lin & Hsieh 2011; Parasuraman, Zeithaml & Malhotra 2005).
4. *Aesthetics*: Appeal and clarity associated with the AISA interface design (Dabholkar, Thorpe & Rentz 1996).
5. *Personalisation*: Ability of the AISA to meet the customer's individual preferences (He et al. 2017).
6. *Security*: Perceived safety of the AISA from intrusion, fraud and loss of personal information and privacy (He et al. 2017).
7. *Control*: Degree of control that the customer feels over the process or outcome of the service encounter with the AISA (Dabholkar 1996).
8. *Ease of Use*: Degree to which using the AISA would be free of effort (Davis 1989).
9. *Enjoyment*: Extent to which using the AISA is perceived to be enjoyable in its own right, apart from any performance consequences that may be anticipated (Davis, Bagozzi & Warshaw 1992).
10. *Contact*: Access to human assistance (Parasuraman, Zeithaml & Malhotra 2005).
11. *Proactiveness*: AISA displaying self-started, long-term-oriented, and persistent service behaviour beyond explicitly prescribed commands (Rank et al. 2007).
12. *Anthropomorphism*: Attachment of human-like characteristics, motivations, intentions or emotions to the AISA (Epley, Waytz & Cacioppo 2007).

Next, to generate the item pool for the 12 conceptual dimensions, measures from key scales identified in our literature review which capture different facets of the AISAQUAL environment were used. As seen in Figure 3-2, measure items from service quality scales in human service contexts were found to generally capture half of the 12 conceptual AISAQUAL dimensions (i.e. reliability, responsiveness, availability, aesthetics, personalisation and security), whereas item measures from technology-based service quality scales were able to tap into all dimensions except proactiveness and anthropomorphism.

Figure 3-2 Extant service quality scales used to form initial AISAQUAL item battery



MEASURE ITEMS FROM HUMAN-BASED SERVICE QUALITY SCALES	
Service Context	**Representative Study**
General service environments	Parasuraman *et al.* (1988)
Person-processing services involving interpersonal interactions	Mittal and Lassar (1996)
Retail services (goods and services)	Dabholkar *et al.* (1996)
Call center representatives	Burgers *et al.* (2000)
Service encounters involving interaction, physical environment and outcome evaluations	Brady and Cronin Jr (2001)

CONCEPTUAL DIMENSIONS OF AISAQUAL
Reliability
Responsiveness
Availability
Aesthetics
Personalization
Security
Control
Ease of Use
Enjoyment
Contact
Proactiveness
Anthropomorphism

MEASURE ITEMS FROM TECHNOLOGY-BASED SERVICE QUALITY SCALES	
Representative Study	**Service Context**
Dabholkar (1996)	General self-service technologies involving cognitive or affective assessments
Yang *et al.* (2004)	Online services involving variety of service processes (e.g. online banking)
Yang *et al.* (2005)	Web portals
Parasuraman *et al.* (2005)	E-commerce
Parasuraman *et al.* (2005)	Service recovery in e-commerce
Loiacono *et al.* (2007)	General websites used for information gathering, transacting, entertainment
Ding *et al.* (2011)	E-retailing self-services
Lin and Hsieh (2011)	Self-service technologies across various service industries
Huang *et al.* (2015)	Mobile commerce
He *et al.* (2017)	Telematics

As proactiveness and anthropomorphism represented two new dimensions from our interview findings, we turned to non-service quality scale studies which contained similar constructs that can capture these dimensions. Specifically, item measures for proactiveness were adapted from Rank et al. (2007), whereas those for anthropomorphism were from Bartneck et al. (2009), Han and Yang (2018) and Moussawi (2016). Finally, additional measure items were introduced where necessary to better capture the intended dimensions (Netemeyer, Bearden & Sharma 2003). After screening for irrelevant, redundant, ambiguous and double-barrel statements, an initial battery of 85 items was produced.

This set of item statements was subsequently assessed by a panel of six senior, expert academics who are active researchers with an extensive publications track record in service and in emerging AI in business literature. These academics[5] were based in top-ranked universities in Australia (3), New Zealand (1), Singapore (1), and the USA (1). Through an

[5] Identity of the academics are not disclosed in the paper for confidentiality.

online questionnaire sent to each expert via Qualtrics, item statements were assessed for their representativeness (i.e. content validity) and appearance to be relevant (i.e. face validity) to the target construct (Netemeyer, Bearden & Sharma 2003). The following scale was used: 1=‘not representative’, 2=‘somewhat representative’, 3=‘clearly representative’ (Bearden, Hardesty & Rose 2001). Only items which scored 2 (i.e. ‘somewhat representative’) or 3 (i.e. ‘clearly representative’) by at least 80% of the panel were retained in the item pool (Lin & Hsieh 2011). After this trimming, we reviewed the qualitative suggestions which experts made to improve item wordings for better inclusion into the item pool. In addition, we further assessed the remaining items for redundancy and added measures to ensure a sufficient item pool per dimension in the subsequent scale refinement process (Netemeyer, Bearden & Sharma 2003). This content and face validation process reduced the number of items from 85 to 75.

Step 3: scale refinement

The next phase of scale development involved the testing of the preliminary 75-item AISAQUAL scale. A self-administered questionnaire was constructed and consisted of two sections. The first section contained demographic and AISA usage questions. The second section contained the AISAQUAL scale and consisted of item statements related to performance perceptions. Items for the second section were measured using a seven-point Likert scale anchored from 1 = strongly disagree to 7 = strongly agree, which is an established practice for scale reliability and validity (Netemeyer, Bearden & Sharma 2003).

Surveys were distributed by the online panel company Qualtrics using purposive sampling to users of chatbots and virtual assistants. A condition of participation in the survey was the use of these service agents in the previous three months. We asked respondents to choose the AISA type (i.e. chatbots or virtual assistants) with which they were most familiar. To clarify our definitional differences between chatbots and virtual assistants and establish a

common language to ensure applicability of responses, examples of each type were provided in the survey introduction in the form of images, basic definitions and textual descriptions. In addition to improving the generalisation of the scale with the sample in Study 2 now originating from a different region as opposed to Australia and Singapore (used in Study 1), the US was deliberately sourced since it represents one of the top 10 countries with a significant number of AISA users (PwC 2018) and is expected to continue to occupy the largest global market share of chatbots and virtual assistants (Androit Market Research 2020).

The final sample consisted of 211 respondents with an almost even gender split within each category of chatbot (male=50.5%, female=49.5%) and virtual assistant (male=50.9%, female=49.1%) users. The sample size of 211 complied with requirements of approximately 200 for an initial test stage of a new scale (Clark & Watson 1995; Parasuraman, Zeithaml & Berry 1988). Almost two-thirds of respondents (67.3%) were aged 25 to 44. Table 3-2 summarises the profiles of respondents for the scale refinement phase.

Table 3-2 Profile of respondents for scale refinement phase

Category	Frequency	Percentage
Gender		
Male	107	50.7
Female	104	49.3
Total	211	100.0
Age		
18-24	21	10.0
25-34	70	33.2
35-44	72	34.1
45-54	30	14.2
55-64	11	5.2
65 and above	7	3.3
Total	211	100.0
Chatbot usage context		
Accommodation and food services	8	7.6
Administrative and support services	7	6.7
Arts and recreation services	5	4.8
Education and training	4	3.8
Electricity, gas, water and waste services	21	20.0
Financial and insurance services	15	14.3
Health care and social assistance	5	4.8

Category	Frequency	Percentage
Information media and telecommunications	16	15.2
Professional, scientific and technical services	7	6.7
Public administration and safety	3	2.9
Rental, hiring and real estate services	3	2.9
Retail trade	4	3.8
Transport, postal and warehousing	7	6.7
Total	105	100.0
Virtual assistant		
Alexa	31	29.2
Bixby	2	1.9
Google Assistant	42	39.6
Google Home Mini	4	3.8
Siri	27	25.5
Total	106	100.0

As recommended by Churchill Jr. (1979), to better prepare the core items for factor analysis, we first categorised the 75 item measures into the 12 a priori conceptual dimensions of AISA service quality before examining the reliability Cronbach Alpha score for each dimension. We found that removing two items, one from the security dimension and the other from anthropomorphism, improved these dimensions' respective reliability scores.

Similar to the procedure used in seminal service quality scale development studies (e.g. Lin and Hsieh, 2011, Parasuraman et al., 2005), we next performed an exploratory factor analysis (EFA) on the data from all 211 respondents before conducting a confirmatory factor analysis (CFA) on the entire same sample. Accordingly, a principal components analysis with oblimin[6] rotation (Kaiser normalisation) was first conducted on the remaining 73 items to empirically identify the underlying dimensions. The Kaiser–Meyer–Olkin (KMO) measure of sampling adequacy (.95 > .50) and Bartlett's sphericity test ($p < .001$) were significant and indicated the suitability of using EFA for our data (Field 2018). To determine the number of components, the Kaiser criterion of eigenvalues greater than one was used (Netemeyer, Bearden & Sharma 2003). Next, items were dropped using the commonly used criterion of a

[6] Similar to extant service quality scales (e.g. Ding, Hu & Sheng 2011; Parasuraman, Zeithaml & Berry 1988; Parasuraman, Zeithaml & Malhotra 2005) the oblique rotation – oblimin – was used to allow for correlations between factors and subsequently obtained interpretable components. In addition, several factor correlations after oblique rotation exceeded the suggested threshold of 0.32 by Tabachnick and Fidell (2007).

minimum loading of .40 (Ford, MacCallum & Tait 1986) or those exhibiting cross-loadings over .40 on two or more components (Hair et al. 2019). Remaining items were again factor analysed.

The above process was done iteratively using SPSS 25 till all items and dimensions satisfied the required minimum thresholds. After six extractions, 34 items remained and loaded distinctly onto six dimensions D1 to D6 as shown in Table 3-3. The six components accounted for 66.9% of the variance (Hair et al. 2019) and indicated good internal consistency among items with the reliability coefficients ranging from .85 to .90 (Nunnally 1978).

Table 3-3 EFA and CFA results and final AISAQUAL scale

Dimension after EFA	Item[a]	Original Identifier[c]	EFA Loading	CFA[b] Loading	Final Label
D1	The AISA provides the service as expected.	REL7	.74		Efficiency
(Cronbach's	**The AISA works correctly at first attempt.[a]**	**REL5**	.73	**.72**	
α = .89)	**I can get my task done with the AISA in a short time.[a]**	**RES1**	.66	**.73**	
	The AISA can perform the task quickly.	RES2	.65		
	The AISA interface design provides information clearly.[a]	**AES5**	.63	**.76**	
	I know how long it takes to complete the task with the AISA.	CTL3	.60		
	The AISA adequately meets my requirements.[a]	**REL3**	.52	**.80**	
D2	I trust that my personal information with the AISA is safe.	SEC5	.83		Security
(Cronbach's	**There is no risk of loss associated with disclosing personal information to the AISA.[a]**	**SEC9**	.73	**.78**	
α = .90)	**I feel secure in providing sensitive information to the AISA.[a]**	**SEC3**	.71	**.80**	
	I believe that information that the AISA has about me is protected.[a]	**SEC7**	.65	**.85**	
	I trust that my personal information with the AISA will not be misused.[a]	**SEC6**	.59	**.79**	
D3	**The AISA is always available.[a]**	**AVA2**	.84	**.75**	Availability
(Cronbach's	**The AISA is never too busy to respond to my requests.[a]**	**AVA4**	.71	**.77**	
α = .85)	The AISA launches right away.	RES3	.70		
	The AISA is always accessible.[a]	**AVA1**	.58	**.76**	
	The AISA interface design is innovative.	AES1	.46		
D4	**Using the AISA is fun.[a]**	**ENJ5**	.67	**.79**	Enjoyment
(Cronbach's	**Using the AISA is enjoyable.[a]**	**ENJ3**	.52	**.86**	
α = .88)	**Using the AISA is interesting.[a]**	**ENJ6**	.46	**.74**	
	Using the AISA is entertaining.[a]	**ENJ4**	.43	**.83**	
D5	**Human assistants are available to contact via the AISA.[a]**	**CTC2**	.81	**.81**	Contact
(Cronbach's	**Follow-up services with human assistants are available to me when necessary.[a]**	**CTC5**	.71	**.72**	
α = .87)	**I can speak to a human assistant via the AISA.[a]**	**CTC3**	.65	**.76**	
	Human assistance is easy to access via the AISA.[a]	**CTC1**	.64	**.80**	
	The AISA provides detailed contact information when I need human assistance.[a]	**CTC4**	.60	**.70**	
	A clear privacy policy is accessible before I use the AISA.	SEC1	.45		

Dimension after EFA	Item[a]	Original Identifier[c]	EFA Loading	CFA[b] Loading	Final Label
D6 (Cronbach's α = .89)	**The AISA has humanlike features.[a]**	**ANT1**	.85	**.75**	Anthropomorphism
	The AISA has personality.[a]	**ANT5**	.77	**.75**	
	The AISA gradually gets to know me.[a]	**PER9**	.72	**.75**	
	The AISA is able to behave like a human.[a]	**ANT4**	.64	**.81**	
	The AISA responds in ways that are personalised.[a]	**PER8**	.62	**.77**	
	The AISA is able to communicate like a human.[a]	**ANT3**	.61	**.77**	
	The AISA uses its own 'judgment' to complete a task.	PRO5	.47		

[a] final AISAQUAL items are shown in bold
[b] $\chi^2_{(284)} = 519.79$, $p < .001$; RMSEA = .06, TLI = .92, CFI = .93, SRMR = .05.
[c] REL=Reliability, RES=Responsiveness, AVA=Availability, AES=Aesthetics, PER=Personalisation, SEC=Security, CTL=Control, EAS=Ease of Use, ENJ=Enjoyment, CTC=Contact, PRO=Proactiveness, ANT=Anthropomorphism

As shown in Table 3-3, dimensions D2, D4 and D5 remained reflective of the three original dimensions of security, enjoyment and contact respectively. An exception was the security item SEC1 "A clear privacy policy is accessible before I use the AISA" which loaded with contact items in D5. Conceptually, consumers may relate the availability of such a privacy policy as originating from contact with a human service professional. Removing SEC1 would also marginally lower the coefficient alpha of D5. Thus, at this stage, SEC1 was retained with the other contact items in D5.

The remaining nine dimensions from the original 12 were collapsed into three. D1 – containing several items for reliability, responsiveness, aesthetics and control – was found to be similar in its conceptual item composition to the dimension of efficiency in E-S-QUAL (Parasuraman, Zeithaml & Malhotra 2005) and functionality in SSTQUAL (Lin & Hsieh 2011). D3 – mostly containing items for availability – included an original responsiveness item RES3 which can be conceptually related to the perceived availability of AISA to launch quickly when required. In relation to the loading of an aesthetics item AES1 in D3, conceptually an innovative interface design may signal the competency of AISA to be capable of service anytime. Similar to SEC1, the removal of RES3 and AES1 would lower the coefficient alpha of D3. Thus, we kept these items for further empirical scrutiny in the subsequent CFA stage. Finally, D6 contained items related to anthropomorphism, personalisation and proactiveness. This composition of human and intelligence performance traits expected by AISA consumers

is significant given that AISA is a non-human service agent and past scales involving technology service agents have not featured a service quality dimension of a similar nature.

A CFA of the 34-item, six-dimension model was next conducted using SPSS AMOS 25 to further verify the model. Using indices recommended by Bagozzi and Yi (2012), initial CFA results indicated a significant chi-square value ($\chi^2_{(512)} = 989.76$, $p < .001$); with a Root Mean Square Error of Approximation (RMSEA) = .07 (recommended RMSEA ≤ .07), Tucker and Lewis Index (TLI) = .89 (recommended TLI ≥ .92), Comparative Fit Index (CFI) = .90 (recommended CFI ≥ .93) and the Standardised Root Mean Square Residual (SRMR) = .06 (recommended SRMR ≤ .07).

To improve the model fit, we first looked at the item-to-factor loadings and removed items with loading values below .70 (Hair et al. 2019). Two iterations removed items CTL3, SEC1, PRO5 and RES2 which had item-to-factor loading values of .69, .65, .52 and .69 respectively. Next, we inspected the standardised residual covariance matrices. Although the standardised residual values were less than 2.5, there were observable patterns of fairly large standardised residual loadings across several variables that were worthy of closer inspection (Hair et al. 2019). Accordingly, we removed residuals greater than 2 (Anderson & Gerbing 1988; Bagozzi & Yi 1988). This iterative process deleted items AES1, REL7, SEC5 and RES3, and resulted in an acceptable model fit (Bagozzi & Yi 2012). The final confirmatory model contained six factors and 26 items (see Table 3-3 for bold items) with values of $\chi^2_{(284)} = 519.79$, $p < .001$; RMSEA = .06 (≤ .07), TLI = .92 (≥ .92), CFI = .93 (≥ .93) and SRMR = .05 (≤ .07). This suggests that AISAQUAL is a multidimensional scale with reflective first and second order constructs consisting of six dimensions. Based on the content of the items in each dimension, six labels and definitions were chosen below. Of these, we kept five from the initial 12 conceptual dimensions with efficiency combining several of the other attributes.

1. *Efficiency*: Ease and speed of using the AISA (Parasuraman, Zeithaml & Malhotra 2005).
2. *Security*: Perceived safety of the AISA from intrusion, fraud and loss of personal information and privacy (He et al. 2017).
3. *Availability*: Ability of the AISA to be ready for use anytime, anywhere (Lin & Hsieh 2011; Parasuraman, Zeithaml & Malhotra 2005).
4. *Enjoyment*: Extent to which using the AISA is perceived to be enjoyable in its own right, apart from any performance consequences that may be anticipated (Davis, Bagozzi & Warshaw 1992).
5. *Contact*: Access to human assistance[7] (Parasuraman, Zeithaml & Malhotra 2005).
6. *Anthropomorphism*: Attachment of human-like characteristics, motivations, intentions or emotions to the AISA (Epley, Waytz & Cacioppo 2007).

Step 4: scale validation

Additional empirical research was conducted to confirm the reliability and validity of the 26-item AISAQUAL scale. For this phase, a new self-administered questionnaire was distributed to a new sample using Qualtrics. This sample featured a similar profile to the pilot sample used in the scale refinement phase (MacKenzie, Podsakoff & Podsakoff 2011) and consisted of participants from the USA who had used chatbots and virtual assistants in the previous three months. The questionnaire contained two sections similar to those used in the scale refinement phase. A key difference was the AISAQUAL item battery, now comprised of 26 item measures. Additionally, a section was included featuring several outcome variables (discussed later in this section).

The final sample consisted of 304 respondents which was larger than the pilot sample size (n=211) for the scale refinement phase and which satisfied the requirements for scale validation (Clark & Watson 1995). There was an almost even gender split within each category of chatbot (male=50.3%, female=49.7%) and virtual assistant (male=49.7%, female=50.3%)

[7] While this thesis has focused on consumer perceptions of services performed by AISA as opposed to human-AI teaming services which primarily involve human-AI collaboration (Ezer et al. 2019), the contact dimension in AISAQUAL suggests the importance of such a partnership in AISA service environments when human assistance is required.

users. Almost an equal portion used their AISA on a daily (31.3%) or weekly (31.9%) basis. In addition, the majority of respondents (47.4%) had used their AISA for two to three years. In terms of usage context, most respondents used their chatbots for services related to retail trade (19.9%). This differs from those in the scale refinement phase who dominantly interacted with chatbots for electricity, gas and waste services (20.0%). For virtual assistants, similar to respondents from our scale refinement phase, Google Assistant, Alexa and Siri were the most popular. This is also representative of the overall US customer adoption for virtual assistants (Olson & Kemery 2019). Table 3-4 summarises the profiles of respondents for the scale validation phase.

Table 3-4 Profile of respondents for scale validation phase

Category	Frequency	Percentage	Category	Frequency	Percentage
Gender			*AISA usage frequency*		
Male	152	50.0	Daily	95	31.3
Female	152	50.0	Weekly	97	31.9
Total	304	100.0	Every 2-3 weeks	43	14.1
			Monthly	33	10.9
Age			Every 2-3 months	14	4.6
18-24	54	17.8	Every 4-6 months	10	3.3
25-34	79	26.0	Once a year	12	3.9
35-44	72	23.7	Total	304	100.0
45-54	44	14.5			
55-64	35	11.5			
65 and above	20	6.6			
Total	304	100.0			
Highest education			*AISA usage experience*		
Less than high school	2	0.7	Less than 1 year	85	28.0
High school	50	16.4	2-3 years	144	47.4
Vocational training	13	4.3	4-5 years	51	16.8
Some college	86	28.3	6-7 years	13	4.3
Bachelor's degree	95	31.3	8 years and above	11	3.6
Postgraduate degree	58	19.1	Total	304	100.0
Total	304	100.0			

Category	Frequency	Percentage	Category	Frequency	Percentage
Work industry			*Chatbot usage context*		
Accommodation and food services	10	3.3	Accommodation and food services	10	6.6
Administrative and support services	20	6.6	Administrative and support services	19	12.6
Arts and recreation services	16	5.3	Arts and recreation services	6	4.0
Construction	8	2.6	Construction	2	1.3
Education and training	26	8.6	Education and training	11	7.3
Electricity, gas, water and waste services	8	2.6	Electricity, gas, water and waste services	5	3.3
Financial and insurance services	23	7.6	Financial and insurance services	19	12.6
Health care and social assistance	34	11.2	Health care and social assistance	12	7.9
Information media and telecommunications	18	5.9	Information media and telecommunications	18	11.9
Manufacturing	7	2.3	Professional, scientific and technical services	5	3.3
Professional, scientific and technical services	24	7.9	Public administration and safety	2	1.3
Public administration and safety	9	3.0	Rental, hiring and real estate services	4	2.6
Rental, hiring and real estate services	5	1.6	Retail trade	30	19.9
Retail trade	33	10.9	Transport, postal and warehousing	4	2.6
Transport, postal and warehousing	19	6.3	Others	4	2.6
Other Industries	7	2.3	Total	151	100.0
Retired	19	6.3			
Unemployed	18	5.9			
Total	304	100.0			
Personal annual income (USD)			*Virtual assistant*		
Less than $25,000	62	20.4	Alexa	60	39.2
$25,000 to $49,999	75	24.7	Bixby	5	3.3
$50,000 to $74,999	60	19.7	Google Assistant	36	23.5
$75,000 to $99,999	45	14.8	Google Home Mini	18	11.8
$100,000 and more	62	20.4	Siri	34	22.2
Total	304	100.0	Total	153	100.0

Based on this final sample, CFA results of AISAQUAL indicated a good fit with $\chi^2_{(284)} = 562.94$, $p < .001$; RMSEA = .06 (≤ .07), TLI = .94 (≥ .92), CFI = .95 (≥ .93) and SRMR = .04 (≤ .07). All indicators loaded above the ideal .70 level (Hair et al. 2019) except for item EFF1 "The AISA works correctly at first attempt" which had a loading of .69 (see Table 3-5). Upon inspection, EFF1 contributed to the content validity of its latent variable and its removal did not result in an increase in the composite reliability (CR) score of the efficiency dimension (see Table 3-5) (Hair, Ringle & Sarstedt 2011). Its item loading also fell within the acceptable range of between .50 and .90 (Bagozzi & Yi 1988) and was not below the absolute threshold value of .50 (Hair et al. 2019). Thus, EFF1 displayed sufficient indicator reliability and was retained in the scale.

To assess convergent validity, the CR of all six dimensions of AISAQUAL was found to be between .80 and .90 which was above the recommended value of .70 (Bagozzi & Yi

2012). In addition, the average variance extracted (AVE) of the six factors also ranged from .57 to .68 which was above the acceptable value of .50 (Bagozzi & Yi 1988). Hence, convergent validity was established for AISAQUAL.

Table 3-5 CFA results of AISAQUAL for scale validation phase

Dimension	Item	Final Identifier	CFA Loading	CR	AVE
Efficiency	The AISA works correctly at first attempt.	EFF1	.69	.84	.57
	I can get my task done with the AISA in a short time.	EFF2	.79		
	The AISA interface design provides information clearly.	EFF3	.72		
	The AISA adequately meets my requirements.	EFF4	.82		
Security	There is no risk of loss associated with disclosing personal information to the AISA.	SEC1	.78	.89	.67
	I feel secure in providing sensitive information to the AISA.	SEC2	.81		
	I believe that information that the AISA has about me is protected.	SEC3	.86		
	I trust that my personal information with the AISA will not be misused.	SEC4	.81		
Availability	The AISA is always available.	AVA1	.75	.80	.58
	The AISA is never too busy to respond to my requests.	AVA2	.74		
	The AISA is always accessible.	AVA3	.80		
Enjoyment	Using the AISA is fun.	ENJ1	.85	.89	.68
	Using the AISA is enjoyable.	ENJ2	.80		
	Using the AISA is interesting.	ENJ3	.79		
	Using the AISA is entertaining.	ENJ4	.84		
Contact	Human assistants are available to contact via the AISA.	CON1	.76	.87	.58
	Follow-up services with human assistants are available to me when necessary.	CON2	.76		
	I can speak to a human assistant via the AISA.	CON3	.76		
	Human assistance is easy to access via the AISA.	CON4	.81		
	The AISA provides detailed contact information when I need human assistance.	CON5	.71		
Anthropomorphism	The AISA has humanlike features.	ANT1	.74	.90	.60
	The AISA has personality.	ANT2	.79		
	The AISA gradually gets to know me.	ANT3	.74		
	The AISA is able to behave like a human.	ANT4	.77		
	The AISA responds in ways that are personalised.	ANT5	.80		
	The AISA is able to communicate like a human.	ANT6	.83		

$\chi^2_{(284)} = 562.94$, $p < .001$; RMSEA = .06 (≤ .07), TLI = .94 (≥ .92), CFI = .95 (≥ .93) and SRMR = .04 (≤ .07).

Following the recommendations of Voorhees et al. (2016), the Hetero-Trait Mono-Trait (HTMT) ratio of the correlations was used to test for discriminant validity. The HTMT approach has also been shown to perform better than the Fornell-Larcker criterion in assessing discriminant validity (Henseler et al., 2015). In our test, all HTMT ratios were found to meet the conservative cut-off of .85 (Hair et al. 2019) except for those between Efficiency and

Enjoyment and between Efficiency and Anthropomorphism (see Table 3-6). As their correlation ratio of .86 was within the acceptable threshold of .90 (Zheng et al. 2020) and was supported for conceptually similar constructs (Hair et al. 2019), the discriminant validity of AISAQUAL was verified.

Table 3-6 HTMT analysis of AISAQUAL

Constructs	EFF	SEC	AVA	ENJ	CON	ANT
Efficiency (EFF)						
Security (SEC)	.75					
Availability (AVA)	.78	.50				
Enjoyment (ENJ)	.86	.61	.68			
Contact (CON)	.80	.63	.53	.66		
Anthropomorphism (ANT)	.86	.79	.62	.84	.73	

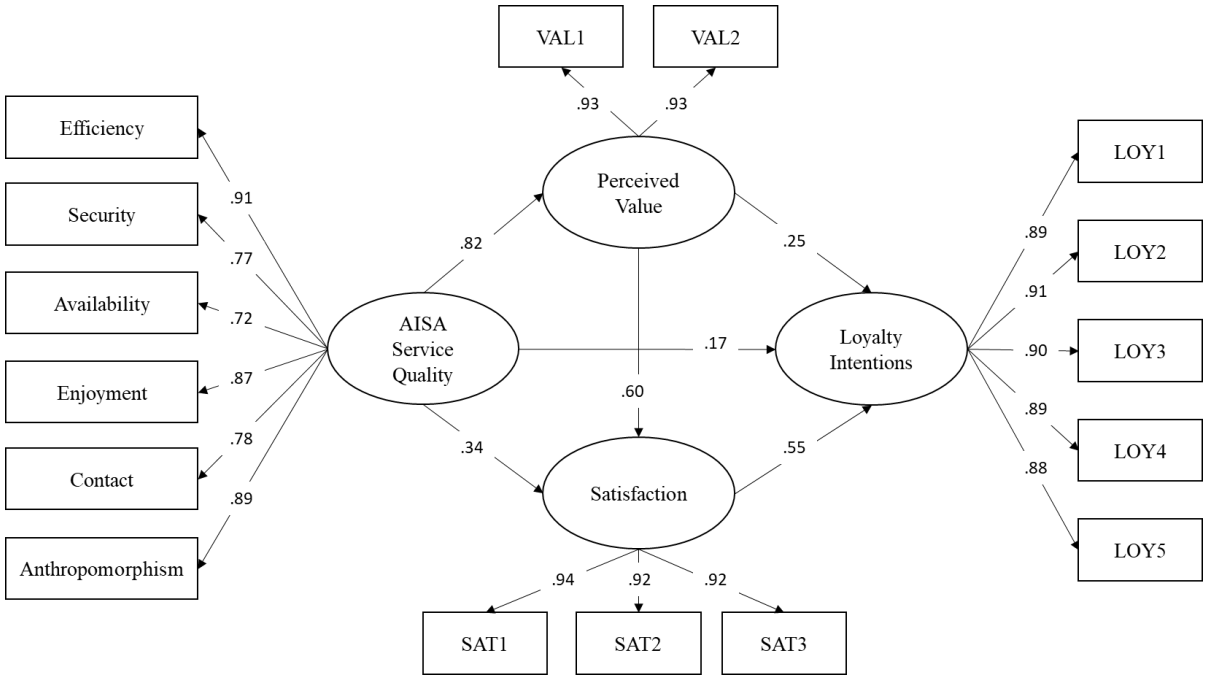
To assess the nomological validity of AISAQUAL, the variables of customer satisfaction, perceived value and loyalty intentions were chosen. Service quality has been shown to affect customer satisfaction (Caruana 2002; Ding, Hu & Sheng 2011) and perceived value (Parasuraman, Zeithaml & Malhotra 2005), and that all three constructs can work together to affect the behavioural outcome of customer loyalty (Cronin Jr, Brady & Hult 2000; Oh 1999). These factors were also found relevant to AISA service quality as detected from our in-depth interviews.

For the assessment of these theoretical relationships in the AISA context, five loyalty intention items were adapted from Zeithaml, Berry and Parasuraman (1996), three customer satisfaction items from Bodet (2008) and two perceived value items from Tam (2004) and Cronin Jr, Brady and Hult (2000). AISAQUAL was modelled as an exogenous variable by aggregating its six dimensions into six indicators using the average score of items per dimension (Ding, Hu & Sheng 2011; Lin & Hsieh 2011).

Results of the theoretical model in Figure 3 show a good model fit of $\chi^2_{(98)} = 260.87$, $p < .001$; RMSEA = .07 (≤ .07), TLI = .96 (≥ .92), CFI = .97 (≥ .93) and SRMR = .03 (≤ .07).

As the use of SPSS AMOS resulted in negative variance estimates, also known as Heywood cases (Rindskopf 1984), and inflated parameter estimates due to the sample size (IBM 2018), the Partial Least Squares (PLS) approach with SmartPLS 3 was an appropriate alternative to test our model (Hair, Ringle & Sarstedt 2011; Henseler, Ringle & Sinkovics 2009). PLS is also suitable for hypothesis testing (Hair et al. 2019) and has been used in other scale development studies for the nomological validation phase (e.g. Guru & Paulssen 2020). For our study, results indicated that all paths were found to be significant at $p < .001$. The effect of AISAQUAL was strongest on perceived value (β=.82, $p < .001$) followed by satisfaction (β=.34, $p < .001$) and loyalty intentions (β=.17, $p < .001$). These path-strength patterns echo findings from extant research in both services marketing (e.g. Cronin Jr, Brady & Hult 2000) and IS (e.g. Kuo, Wu & Deng 2009). The R^2 values of perceived value, satisfaction and loyalty intentions were also .67, .81 and .86 respectively which indicate the model's substantial predictive power (Hair, Ringle & Sarstedt 2011). Thus AISAQUAL demonstrated nomological validity.

Figure 3-3 Theoretical model and results of AISAQUAL nomological validation (All paths significant at $p \leq .001$)



To assess the degree of generalisability of AISAQUAL, we conducted a multi-group analysis using PLS-MGA (Henseler 2012; Henseler, Ringle & Sinkovics 2009). All results for the difference between group-specific path coefficients were found to be non-significant at the 5% probability of error level (see Table 3-7). This suggests that AISAQUAL demonstrates sufficient invariance across chatbots and virtual assistants.

Table 3-7 Multigroup comparison test results of AISAQUAL

Path	Chatbot Users (151)		Virtual Assistant Users (153)		Multigroup Analysis		
	β	t	β	t	β Difference	*p* Difference	Result
AISAQUAL -> Loyalty Intentions	.17	2.62	.16	2.90	.01	.95	Rejected
AISAQUAL -> Perceived Value	.83	29.98	.81	23.85	.01	.81	Rejected
AISAQUAL -> Satisfaction	.37	4.81	.34	5.45	.03	.74	Rejected
Perceived Value -> Loyalty Intentions	.33	3.76	.12	1.18	.22	.11	Rejected
Perceived Value -> Satisfaction	.55	7.22	.62	9.73	-.07	.51	Rejected
Satisfaction -> Loyalty Intentions	.47	5.70	.69	6.15	-.23	.11	Rejected

Note: Multigroup analysis (PLS-MGA) based on 5000 bootstrap. Results are based on two tail test at 5% probability of error level.

3.4 Conclusion

3.4.1 Theoretical implications

The growing research interest in services enabled by AISA and the continued use of AISA in service sectors makes urgent the development of a suitable AISA service quality scale (Bock, Wolter & Ferrell 2020; Lu et al. 2020). Our study directly responds to this call: to the best of our knowledge, it is the first to develop an empirical service quality scale for AISA – AISAQUAL – consisting of six dimensions and 26 item measures. AISAQUAL fills a void and extends current understanding of consumer service quality evaluations for different service environments using validated and generalisable scale instruments.

Our study identifies anthropomorphism as a new service quality dimension in the literature. Anthropomorphism was found to be one of the top factors for consumers in evaluating AISA service quality (β=.89, $p < .001$). Our findings also support emerging research underscoring the importance of considering anthropomorphism in improving user experiences with AISA (e.g. Benlian, Klumpe & Hinz 2019; Lu, Cai & Gursoy 2019; Sheehan, Jin & Gottlieb 2020; Troshani et al. 2020; Wirtz et al. 2018).

Our findings also suggest that the hedonic element of AISA – enjoyment – is important to consumers in the evaluation of service quality. This is consistent with the findings of Lin and Hsieh (2011) and supports the role enjoyment plays in encouraging the use of technologies beyond the initial adoption stage (Davis, Bagozzi & Warshaw 1992). In addition, while efficiency contributes most to AISA service quality (β=.91, $p < .001$) and supports the utilitarian value of AISA (Meyer-Waarden et al. 2020), the significant factor contributions of both enjoyment (β=.87, $p < .001$) and anthropomorphism (β=.89, $p < .001$) also suggest that AISA can perform equally effective roles as both utilitarian and hedonic information systems (Van Der Heijden 2004).

Additionally, these findings add to the emerging research stream of AISA and validate theoretical relationships between service quality and customer satisfaction, perceived value and loyalty intentions in the AISA context. The findings of the current study suggest how the service quality of AISA can be determined and as such will facilitate further theory development through the use of our service quality construct appropriately designed for AISA (Ranjan & Read 2016).

3.4.2 Managerial implications

In spite of the growing popularity surrounding AI (Davenport & Ronanki 2018), companies must not lose sight of the need to develop AISA which are efficient to use for consumers. Given

the significance of the anthropomorphism and enjoyment dimensions, companies should take these factors into consideration in the design phase of their AISA interface with their customers. One way to do this is to test different designs and interaction modes (e.g. speech versus gesture) of the AISA with their target audience at multiple stages (Kepuska & Bohouta 2018). Our study also highlights the prevailing relevance of contact with human service agents in the eyes of consumers. Specifically, managers should ensure that human service agents are an available option for consumers during their AISA interaction (Shell & Buell 2019). In relation to AISA security and governance (Shepardon 2020), companies need to foster greater trust and transparency with users (Bandara, Fernando & Akter 2020) by being forthcoming with regard to their data privacy and protection policies as they continue to access an increasing amount of personal data through AISA. Finally, developers can increase the availability of their AISA to the wider service ecosystem as device interconnectivity matures through the Internet of Things (IoT) (Huang & Rust 2017).

Overall AISAQUAL validates the importance of delivering optimum service quality to AISA consumers as this can lead to perceived value, customer satisfaction and loyalty. AISAQUAL also can serve as an accurate diagnostic tool to improve current AISA service performance based on consumer perspectives. As the AISAQUAL measurement is parsimonious, this helps service managers to administer it to better understand customer perceptions and address service quality concerns in a systematic way. Moreover, AISAQUAL can guide the development of better AISA which specifically cater to the service expectations of consumers served by AISA.

3.4.3 Limitations and future research

Our study contributes to the rich service quality literature by developing a robust service quality scale with good psychometric properties to accommodate the new AISA service environment.

However, as with any scale development study, several caveats should be noted which also represents opportunities for further research.

First, AISAQUAL is developed as both a first and second order reflective construct based on underlying theoretical considerations (MacKenzie *et al.*, 2011). While we have established this position in our study, future research can explore the implications of an alternative formative model (Collier and Bienstock, 2009, Theodosiou *et al.*, 2019) which requires additional reflective indicators to be tested against the proposed formative constructs (Jarvis *et al.*, 2003).

Second, at the time of this study, the AISA types most widely used by consumers are chatbots and virtual assistants. Hence, these software applications were used as suitable representative technology types for the construction of our AISAQUAL scale. An inspection of the measure items of the six dimensions of AISAQUAL suggests that the item measures might also be applicable to other AISA types including machines and robots. We recommend that the AISAQUAL be adapted and tested for these other AISA types, which have more physical features than digital assistants, as they become available in the service sector.

Finally, the effects of AISAQUAL on the outcome variables used in this study was based on a cross-sectional view. As AISA are expected to serve consumers in the long run, understanding possible shifts in attitudes over time (Hussain *et al.*, 2019) and whether these may lead to more positive or negative outcomes is worth further investigation. Hence, we recommend future longitudinal studies assess how the prolonged service performance of AISA can change consumer outcomes.

References

Anderson, JC & Gerbing, DW 1988, 'Structural equation modeling in practice: A review and recommended two-step approach', *Psychological Bulletin*, vol. 103, no. 3, pp. 411-423.

Androit Market Research 2020, *Intelligent virtual assistant (iva) market to grow at 33% cagr during forecast period (2020-2025) - insights on growth drivers, size and share analysis, key trends, leading players, and business opportunities: Adroit market research*, GlobeNewswire, viewed 26 February 2020, <https://www.globenewswire.com/news-release/2020/02/24/1988963/0/en/Intelligent-Virtual-Assistant-IVA-Market-to-grow-at-33-CAGR-during-forecast-period-2020-2025-Insights-on-Growth-Drivers-Size-and-Share-Analysis-Key-Trends-Leading-Players-and-Busin.html>.

Bagozzi, RP & Yi, Y 1988, 'On the evaluation of structural equation models', *Journal of the Academy of Marketing Science*, vol. 16, no. 1, pp. 74-94.

Bagozzi, RP & Yi, Y 2012, 'Specification, evaluation, and interpretation of structural equation models', *Journal of the Academy of Marketing Science*, vol. 40, no. 1, pp. 8-34.

Bandara, R, Fernando, M & Akter, S 2020, 'Managing consumer privacy concerns and defensive behaviours in the digital marketplace', *European Journal of Marketing*.

Bartneck, C, Kulić, D, Croft, E & Zoghbi, S 2009, 'Measurement instruments for the anthropomorphism, animacy, likeability, perceived intelligence, and perceived safety of robots', *International Journal of Social Robotics*, vol. 1, no. 1, pp. 71-81.

Bearden, WO, Hardesty, DM & Rose, RL 2001, 'Consumer self-confidence: Refinements in conceptualization and measurement', *Journal of Consumer Research*, vol. 28, no. 1, pp. 121-134.

Benlian, A, Klumpe, J & Hinz, O 2019, 'Mitigating the intrusive effects of smart home assistants by using anthropomorphic design features: A multimethod investigation', *Information Systems Journal*, pp. 1-33.

Bock, DE, Wolter, JS & Ferrell, O 2020, 'Artificial intelligence: Disrupting what we know about services', *Journal of Services Marketing*.

Bodet, G 2008, 'Customer satisfaction and loyalty in service: Two concepts, four constructs, several relationships', *Journal of Retailing and Consumer Services*, vol. 15, no. 3, pp. 156-162.

Brady, MK & Cronin Jr, JJ 2001, 'Some new thoughts on conceptualizing perceived service quality: A hierarchical approach', *Journal of Marketing*, vol. 65, no. 3, pp. 34-49.

Burgers, A, de Ruyter, K, Keen, C & Streukens, S 2000, 'Customer expectation dimensions of voice-to-voice service encounters: A scale-development study', *International Journal of Service Industry Management*, vol. 11, no. 2, pp. 142-161.

Caro, LM & Garcia, JAM 2008, 'Developing a multidimensional and hierarchical service quality model for the travel agency industry', *Tourism Management*, vol. 29, no. 4, pp. 706-720.

Carrillat, FA, Jaramillo, F & Mulki, JP 2007, 'The validity of the servqual and servperf scales: A meta-analytic view of 17 years of research across five continents', *International Journal of Service Industry Management*, vol. 18, no. 5, pp. 472-490.

Caruana, A 2002, 'Service loyalty: The effects of service quality and the mediating role of customer satisfaction', *European Journal of Marketing*, vol. 36, no. 7/8, pp. 811-828.

Churchill Jr., GA 1979, 'A paradigm for developing better measures of marketing constructs', *Journal of Marketing Research*, vol. 16, pp. 64-73.

Clark, LA & Watson, D 1995, 'Constructing validity: Basic issues in objective scale development', *Psychological Assessment*, vol. 7, no. 3, pp. 309-319.

Collier, JE & Bienstock, CC 2009, 'Model misspecification: Contrasting formative and reflective indicators for a model of e-service quality', *Journal of Marketing Theory and Practice*, vol. 17, no. 3, pp. 283-293.

Cronin Jr, JJ, Brady, MK & Hult, GTM 2000, 'Assessing the effects of quality, value, and customer satisfaction on consumer behavioral intentions in service environments', *Journal of Retailing*, vol. 76, no. 2, pp. 193-218.

Cronin Jr, JJ & Taylor, SA 1992, 'Measuring service quality: A reexamination and extension', *Journal of Marketing*, pp. 55-68.

Cronin Jr, JJ & Taylor, SA 1994, 'Servperf versus servqual: Reconciling performance-based and perceptions-minus-expectations measurement of service quality', *Journal of Marketing*, pp. 125-131.

Dabholkar, PA 1996, 'Consumer evaluations of new technology-based self-service options: An investigation of alternative models of service quality', *International Journal of Research in Marketing*, vol. 13, no. 1, pp. 29-51.

Dabholkar, PA, Shepherd, CD & Thorpe, DI 2000, 'A comprehensive framework for service quality: An investigation of critical conceptual and measurement issues through a longitudinal study', *Journal of Retailing*, vol. 76, no. 2, pp. 139-173.

Dabholkar, PA, Thorpe, DI & Rentz, JO 1996, 'A measure of service quality for retail stores: Scale development and validation', *Journal of the Academy of Marketing Science*, vol. 24, no. 1, pp. 3-16.

Davenport, TH & Ronanki, R 2018, 'Artificial intelligence for the real world', *Harvard Business Review*, vol. 96, no. 1, pp. 108-116.

Davis, FD 1989, 'Perceived usefulness, perceived ease of use, and user acceptance of information technology', *MIS Quarterly*, pp. 319-340.

Davis, FD, Bagozzi, RP & Warshaw, PR 1992, 'Extrinsic and intrinsic motivation to use computers in the workplace', *Journal of Applied Social Psychology*, vol. 22, no. 14, pp. 1111-1132.

De Keyser, A, Köcher, S, Alkire, L, Verbeeck, C & Kandampully, J 2019, 'Frontline service technology infusion: Conceptual archetypes and future research directions', *Journal of Service Management*, vol. 30, no. 1, pp. 156-183.

Ding, DX, Hu, PJ-H & Sheng, ORL 2011, 'E-selfqual: A scale for measuring online self-service quality', *Journal of Business Research*, vol. 64, no. 5, pp. 508-515.

Epley, N, Waytz, A & Cacioppo, JT 2007, 'On seeing human: A three-factor theory of anthropomorphism', *Psychological review*, vol. 114, no. 4, p. 864.

Ezer, N, Bruni, S, Cai, Y, Hepenstal, SJ, Miller, CA & Schmorrow, DD 2019, 'Trust engineering for Human-AI teams', in *Proceedings of the human factors and ergonomics society annual meeting*, SAGE Publications Sage CA: Los Angeles, CA, vol. 63, pp. 322-326.

Field, A 2018, *Discovering statistics using ibm spss statistics*, 5th edn, SAGE, London.

Fitzsimmons, JA 2003, 'Is self-service the future of services?', *Managing Service Quality: An International Journal*, vol. 13, no. 6, pp. 443-444.

Ford, JK, MacCallum, RC & Tait, M 1986, 'The application of exploratory factor analysis in applied psychology: A critical review and analysis', *Personnel Psychology*, vol. 39, no. 2, pp. 291-314.

Gioia, DA, Corley, KG & Hamilton, AL 2013, 'Seeking qualitative rigor in inductive research: Notes on the gioia methodology', *Organizational Research Methods*, vol. 16, no. 1, pp. 15-31.

Grönroos, C 1984, 'A service quality model and its marketing implications', *European Journal of Marketing*, vol. 18, no. 4, pp. 36-44.

Guru, RRD & Paulssen, M 2020, 'Customers' experienced product quality: Scale development and validation', *European Journal of Marketing*.

Hair, JF, Black, WC, Babin, BJ & Anderson, RE 2019, *Multivariate data analysis*, Eighth edn, Cengage Learning EMEA, United Kingdom.

Hair, JF, Ringle, CM & Sarstedt, M 2011, 'Pls-sem: Indeed a silver bullet', *Journal of Marketing Theory and Practice*, vol. 19, no. 2, pp. 139-152.

Han, S & Yang, H 2018, 'Understanding adoption of intelligent personal assistants: A parasocial relationship perspective', *Industrial Management & Data Systems*, vol. 118, no. 3, pp. 618-636.

He, Z, Yang, X, Wang, W & Zhang, M 2017, 'Measuring service quality in telematics service: Development and validation of multidimensional teleservq scale', *Total Quality Management & Business Excellence*, vol. 28, no. 9-10, pp. 1166-1182.

Henseler, J 2012, 'Pls-mga: A non-parametric approach to partial least squares-based multi-group analysis', in *Challenges at the interface of data analysis, computer science, and optimization*, Springer, pp. 495-501.

Henseler, J, Ringle, CM & Sarstedt, M 2015, 'A new criterion for assessing discriminant validity in variance-based structural equation modeling', *Journal of the Academy of Marketing Science*, vol. 43, no. 1, pp. 115-135.

Henseler, J, Ringle, CM & Sinkovics, RR 2009, 'The use of partial least squares path modeling in international marketing', in *New challenges to international marketing*, Emerald Group Publishing Limited.

Hoy, MB 2018, 'Alexa, siri, cortana, and more: An introduction to voice assistants', *Medical Reference Services Quarterly*, vol. 37, no. 1, pp. 81-88.

Huang, EY, Lin, S-W & Fan, Y-C 2015, 'M-s-qual: Mobile service quality measurement', *Electronic Commerce Research and Applications*, vol. 14, no. 2, pp. 126-142.

Huang, M-H & Rust, RT 2017, 'Technology-driven service strategy', *Journal of the Academy of Marketing Science*, vol. 45, no. 6, pp. 906-924.

Huang, M-H & Rust, RT 2018, 'Artificial intelligence in service', *Journal of Service Research*, vol. 21, no. 2, pp. 155-172.

Huang, M-H & Rust, RT 2020, 'Engaged to a robot? The role of AI in service', *Journal of Service Research*, p. 1094670520902266.

Hussain, K, Jing, F, Junaid, M, Bukhari, FAS & Shi, H 2019, 'The dynamic outcomes of service quality: A longitudinal investigation', *Journal of Service Theory and Practice*, vol. 29, no. 4, pp. 513-536.

IBM 2018, *Amos states that some model variance values are negative*, IBM, viewed 28 April 2020, <https://www.ibm.com/support/pages/amos-states-some-model-variance-values-are-negative>.

Insights, O 2019, *Government artificial intelligence readiness index 2019*.

Jarvis, CB, MacKenzie, SB & Podsakoff, PM 2003, 'A critical review of construct indicators and measurement model misspecification in marketing and consumer research', *Journal of Consumer Research*, vol. 30, no. 2, pp. 199-218.

Kepuska, V & Bohouta, G 2018, 'Next-generation of virtual personal assistants (microsoft cortana, apple siri, amazon alexa and google home)', in *2018 IEEE 8th Annual Computing and Communication Workshop and Conference (CCWC)*, IEEE, pp. 99-103.

Kinsella, B 2019, *Australia leaps past u.S. In smart speaker adoption, google home establishes dominant market share*, Voicebot.ai, viewed 7 November 2019, <https://voicebot.ai/2019/03/19/australia-leaps-past-u-s-in-smart-speaker-adoption-google-home-establishes-dominant-market-share/>.

Kuo, Y-F, Wu, C-M & Deng, W-J 2009, 'The relationships among service quality, perceived value, customer satisfaction, and post-purchase intention in mobile value-added services', *Computers in Human Behavior*, vol. 25, no. 4, pp. 887-896.

Ladhari, R 2009, 'A review of twenty years of servqual research', *International Journal of Quality and Service Sciences*, vol. 1, no. 2, pp. 172-198.

Ladhari, R 2010, 'Developing e-service quality scales: A literature review', *Journal of Retailing and Consumer Services*, vol. 17, no. 6, pp. 464-477.

Lin, J-SC & Hsieh, P-L 2011, 'Assessing the self-service technology encounters: Development and validation of SSTQUAL scale', *Journal of Retailing*, vol. 87, no. 2, pp. 194-206.

Loiacono, ET, Watson, RT & Goodhue, DL 2007, 'Webqual: An instrument for consumer evaluation of web sites', *International Journal of Electronic Commerce*, vol. 11, no. 3, pp. 51-87.

Lu, L, Cai, R & Gursoy, D 2019, 'Developing and validating a service robot integration willingness scale', *International Journal of Hospitality Management*, vol. 80, pp. 36-51.

Lu, V, Wirtz, J, Kunz, W, Paluch, S, Gruber, T, Martins, A & Patterson, P 2020, 'Service robots, customers, and service employees: What can we learn from the academic literature and where are the gaps?', *Journal of Service Theory and Practice*, vol. 30, no. 3, pp. 361-391.

MacKenzie, SB, Podsakoff, PM & Podsakoff, NP 2011, 'Construct measurement and validation procedures in mis and behavioral research: Integrating new and existing techniques', *MIS Quarterly*, vol. 35, no. 2, pp. 293-334.

Martínez, JA & Martínez, L 2010, 'Some insights on conceptualizing and measuring service quality', *Journal of Retailing and Consumer Services*, vol. 17, no. 1, pp. 29-42.

Meyer-Waarden, L, Pavone, G, Poocharoentou, T, Prayatsup, P, Ratinaud, M, Tison, A & Torné, S 2020, 'How service quality influences customer acceptance and usage of chatbots?', *SMR - Journal of Service Management Research*, vol. 4, no. 1, pp. 35-51.

Mittal, B & Lassar, WM 1996, 'The role of personalization in service encounters', *Journal of Retailing*, vol. 72, no. 1, pp. 95-109.

Morita, T, Kashiwagi, N, Yorozu, A, Suzuki, H & Yamaguchi, T 2019, 'Evaluation of a multi-robot cafe based on service quality dimensions', *The Review of Socionetwork Strategies*, pp. 1-22.

Moussawi, S 2016, 'Investigating personal intelligent agents in everyday life through a behavioral lens', Ph.D. thesis, 10165530 thesis, City University of New York, Ann Arbor, ProQuest Dissertations & Theses Global.

Netemeyer, RG, Bearden, WO & Sharma, S 2003, *Scaling procedures: Issues and applications*, Sage Publications.

Nunnally, JC 1978, *Psychometric theory*, McGraw-Hill Book Company, New York.

Oh, H 1999, 'Service quality, customer satisfaction, and customer value: A holistic perspective', *International Journal of Hospitality Management*, vol. 18, no. 1, pp. 67-82.

Olson, C & Kemery, K 2019, *Voice report*, Microsoft.

Paluch, S & Wirtz, J 2020, 'Artificial intelligence and robots in the service encounter', *SMR - Journal of Service Management Research*, vol. 4, no. 1, pp. 3-8.

Parasuraman, A 2000, 'Technology readiness index (tri) a multiple-item scale to measure readiness to embrace new technologies', *Journal of Service Research*, vol. 2, no. 4, pp. 307-320.

Parasuraman, A, Berry, LL & Zeithaml, VA 1993, 'More on improving service quality measurement', *Journal of Retailing*, vol. 69, no. 1, pp. 140-147.

Parasuraman, A, Zeithaml, VA & Berry, LL 1988, 'Servqual: A multiple-item scale for measuring consumer perceptions of service quality', *Journal of Retailing*, vol. 64, no. 1, p. 12.

Parasuraman, A, Zeithaml, VA & Berry, LL 1994a, 'Alternative scales for measuring service quality: A comparative assessment based on psychometric and diagnostic criteria', *Journal of Retailing*, vol. 70, no. 3, pp. 201-230.

Parasuraman, A, Zeithaml, VA & Berry, LL 1994b, 'Reassessment of expectations as a comparison standard in measuring service quality: Implications for further research', *Journal of Marketing*, pp. 111-124.

Parasuraman, A, Zeithaml, VA & Malhotra, A 2005, 'E-s-qual: A multiple-item scale for assessing electronic service quality', *Journal of Service Research*, vol. 7, no. 3, pp. 213-233.

Prentice, C, Sergio, DL & Wang, X 2020, 'The impact of artificial intelligence and employee service quality on customer satisfaction and loyalty', *Journal of Hospitality Marketing & Management*, pp. 1-18.

PwC 2018, *Artificial intelligence: Touchpoints with consumers*, Global Consumer Insights Survey.

Rai, A, Constantinides, P & Sarker, S 2019, 'Editor's comments: Next-generation digital platforms: Toward human–AI hybrids', *Management Information Systems Quarterly*, vol. 43, no. 1, pp. iii-ix.

Ranjan, KR & Read, S 2016, 'Value co-creation: Concept and measurement', *Journal of the Academy of Marketing Science*, vol. 44, no. 3, pp. 290-315.

Rank, J, Carsten, JM, Unger, JM & Spector, PE 2007, 'Proactive customer service performance: Relationships with individual, task, and leadership variables', *Human Performance*, vol. 20, no. 4, pp. 363-390.

Rindskopf, D 1984, 'Structural equation models: Empirical identification, Heywood cases, and related problems', *Sociological Methods & Research*, vol. 13, no. 1, pp. 109-119.

Robinson, S, Orsingher, C, Alkire, L, De Keyser, A, Giebelhausen, M, Papamichail, KN, Shams, P & Temerak, MS 2019, 'Frontline encounters of the AI kind: An evolved service encounter framework', *Journal of Business Research*.

Russell, S & Norvig, P 2016, *Artificial intelligence: A modern approach*, Third edn, Pearson, Malaysia.

Rust, RT 2019, 'The future of marketing', *International Journal of Research in Marketing*.

Rust, RT & Oliver, RL 1993, *Service quality: New directions in theory and practice*, Sage Publications.

Seth, N, Deshmukh, SG & Vrat, P 2005, 'Service quality models: A review', *International Journal of Quality & Reliability Management*, vol. 22, no. 9, pp. 913-949.

Shankar, V 2018, 'How artificial intelligence (AI) is reshaping retailing', *Journal of Retailing*, vol. 94, no. 4, pp. vi-xi.

Sheehan, B, Jin, HS & Gottlieb, U 2020, 'Customer service chatbots: Anthropomorphism and adoption', *Journal of Business Research*, vol. 115, pp. 14-24.

Shell, MA & Buell, RW 2019, 'How necessary is the human touch?', *Harvard Business Review*, vol. 97, no. 4, pp. 28-28.

Shepardon, D 2020, *White house proposes regulatory principles to govern AI use*, Reuters, viewed 26 February 2020, <https://www.reuters.com/article/us-tech-ces-ai-white-house/white-house-proposes-regulatory-principles-to-govern-ai-use-idUSKBN1Z60GL>.

Tabachnick, BG & Fidell, LS 2007, *Using multivariate statistics*, vol. 5, Pearson Boston, MA.

Tam, JL 2004, 'Customer satisfaction, service quality and perceived value: An integrative model', *Journal of Marketing Management*, vol. 20, no. 7-8, pp. 897-917.

Tan, FB & Chou, JPC 2008, 'The relationship between mobile service quality, perceived technology compatibility, and users' perceived playfulness in the context of mobile information and entertainment services', *International Journal of Human–Computer Interaction*, vol. 24, no. 7, pp. 649-671.

Theodosiou, M, Katsikea, E, Samiee, S & Makri, K 2019, 'A comparison of formative versus reflective approaches for the measurement of electronic service quality', *Journal of Interactive Marketing*, vol. 47, pp. 53-67.

Troshani, I, Rao Hill, S, Sherman, C & Arthur, D 2020, 'Do we trust in AI? Role of anthropomorphism and intelligence', *Journal of Computer Information Systems*, pp. 1-11.

Van Der Heijden, H 2004, 'User acceptance of hedonic information systems', *MIS Quarterly*, vol. 28, no. 4, pp. 695-704.

Voorhees, CM, Brady, MK, Calantone, R & Ramirez, E 2016, 'Discriminant validity testing in marketing: An analysis, causes for concern, and proposed remedies', *Journal of the Academy of Marketing Science*, vol. 44, no. 1, pp. 119-134.

Wirtz, J, Patterson, PG, Kunz, WH, Gruber, T, Lu, VN, Paluch, S & Martins, A 2018, 'Brave new world: Service robots in the frontline', *Journal of Service Management*, vol. 29, no. 5, pp. 907-931.

Yang, R 2018, *Artificial intelligence in Singapore: Pervasive, powerful and present*, Singapore Press Holdings, viewed 7 November 2019, <https://www.businesstimes.com.sg/opinion/artificial-intelligence-in-singapore-pervasive-powerful-and-present>.

Yang, Z, Cai, S, Zhou, Z & Zhou, N 2005, 'Development and validation of an instrument to measure user perceived service quality of information presenting web portals', *Information & Management*, vol. 42, no. 4, pp. 575-589.

Yang, Z, Jun, M & Peterson, RT 2004, 'Measuring customer perceived online service quality: Scale development and managerial implications', *International Journal of Operations & Production Management*, vol. 24, no. 11, pp. 1149-1174.

Zarouali, B, Van den Broeck, E, Walrave, M & Poels, K 2018, 'Predicting consumer responses to a chatbot on facebook', *CyberPsychology, Behavior & Social Networking*, vol. 21, no. 8, pp. 491-497.

Zeithaml, VA 1988, 'Consumer perceptions of price, quality, and value: A means-end model and synthesis of evidence', *Journal of Marketing*, pp. 2-22.

Zeithaml, VA, Berry, LL & Parasuraman, A 1996, 'The behavioral consequences of service quality', *Journal of Marketing*, pp. 31-46.

Zheng, X, Men, J, Xiang, L & Yang, F 2020, 'Role of technology attraction and parasocial interaction in social shopping websites', *International Journal of Information Management*, vol. 51, no. 102043, pp. 1-13.

APPENDIX C Measures of constructs

Respondents were asked to rate the following statements using a seven-point Likert scale anchored from 1 = strongly disagree to 7 = strongly agree. Items appeared in random order in the survey.

AISAQUAL

Efficiency
EFF1 The AISA works correctly at first attempt.
EFF2 I can get my task done with the AISA in a short time.
EFF3 The AISA interface design provides information clearly.
EFF4 The AISA adequately meets my requirements.

Security
SEC1 There is no risk of loss associated with disclosing personal information to the AISA.
SEC2 I feel secure in providing sensitive information to the AISA.
SEC3 I believe that information that the AISA has about me is protected.
SEC4 I trust that my personal information with the AISA will not be misused.

Availability
AVA1 The AISA is always available.
AVA2 The AISA is never too busy to respond to my requests.
AVA3 The AISA is always accessible.

Enjoyment
ENJ1 Using the AISA is fun.
ENJ2 Using the AISA is enjoyable.
ENJ3 Using the AISA is interesting.
ENJ4 Using the AISA is entertaining.

Contact
CON1 Human assistants are available to contact via the AISA.
CON2 Follow-up services with human assistants are available to me when necessary.
CON3 I can speak to a human assistant via the AISA.
CON4 Human assistance is easy to access via the AISA.
CON5 The AISA provides detailed contact information when I need human assistance.

Anthropomorphism
ANT1 The AISA has humanlike features.
ANT2 The AISA has personality.
ANT3 The AISA gradually gets to know me.
ANT4 The AISA is able to behave like a human.
ANT5 The AISA responds in ways that are personalised.
ANT6 The AISA is able to communicate like a human.

Satisfaction
SAT1 I am satisfied with my decision to use the AISA.
SAT2 I think that I did the right thing by using the AISA.
SAT3 My choice to use the AISA was a wise one.

Perceived Value
VAL1 Overall, the AISA gives me good value.
VAL2 The time I spent on the AISA was worthwhile.

Loyalty Intentions
LOY1 I will say positive things about the AISA to other people.
LOY2 I will recommend the AISA to someone who seeks my advice.
LOY3 I will encourage friends and others to use the AISA.
LOY4 I will consider the AISA to be my first choice for future tasks.
LOY5 I will use the AISA more in the coming months.

CHAPTER 4. STUDY 3: IN PURSUIT OF HAPPINESS WITH AI: THE ROLE OF SERVICE QUALITY AND PARASOCIAL RELATIONSHIPS

Chapter 4 features the third and final study in this thesis – *In Pursuit of Happiness with AI: The Role of Service Quality and Parasocial Relationships*. Guided by the research agenda in Chapter 2 and equipped with the new AISAQUAL scale developed in Chapter 3, the aim of this study is to investigate the affective outcomes of AISA service quality. Specifically, it examines how consumers' emotional bonds with AISA and their sense of well-being are affected by AISA service quality. The research methodology in this chapter involves the collection and analysis of primary quantitative survey data.

At the time of the submission of this thesis, Study 3 is being prepared for submission to the *Journal of Service Research*. Accordingly, this chapter is presented in a journal article format. The contribution ratio of all authors of this paper is highlighted on the following page, before the abstract of the main paper.

Statement of ownership

Statement of Authorship

Title of Paper	In pursuit of happiness with AI: The role of service quality and parasocial relationships
Publication Status	☐ Published ☐ Accepted for Publication ☐ Submitted for Publication ☑ Unpublished and Unsubmitted w ork w ritten in manuscript style
Publication Details	Currently preparing for journal submission.

Principal Author

Name of Principal Author (Candidate)	Nurhafihz Bin Noor		
Contribution to the Paper	I conceptualized the research paper, designed and conducted experiments for data collection and analysis, interpreted data and wrote manuscript.		
Overall percentage (%)	70%		
Certification:	This paper reports on original research I conducted during the period of my Higher Degree by Research candidature and is not subject to any obligations or contractual agreements with a third party that would constrain its inclusion in this thesis. I am the primary author of this paper.		
Signature		Date	18/1/2021

Co-Author Contributions

By signing the Statement of Authorship, each author certifies that:

i. the candidate's stated contribution to the publication is accurate (as detailed above);

ii. permission is granted for the candidate in include the publication in the thesis; and

iii. the sum of all co-author contributions is equal to 100% less the candidate's stated contribution.

Name of Co-Author	Sally Rao Hill		
Contribution to the Paper	Associate Professor Sally Rao Hill supervised the development of work and assisted in data interpretation, manuscript evaluation and revision. Percentage of contribution: 15%		
Signature		Date	18/1/2021

Name of Co-Author	Indrit Troshani		
Contribution to the Paper	Associate Professor Indrit Troshani supervised the development of work and assisted in data interpretation, manuscript evaluation and revision. Percentage of contribution: 15%		
Signature		Date	18/1/2021

Please cut and paste additional co-author panels here as required.

STUDY 3: IN PURSUIT OF HAPPINESS WITH AI: THE ROLE OF SERVICE QUALITY AND PARASOCIAL RELATIONSHIPS

Abstract

Increased use of artificial intelligence service agents (AISA) has been associated with improvements in AISA service quality. In the process of use, unique forms of attachment often develop between consumers and AISA that manifest as parasocial relationships (PSR). However, the theoretical mechanisms linking AISA service quality to PSR and how they can interact to impact the consumer's subjective well-being remain unclear. Based on data collected from 408 virtual assistant users from the US, this research develops and tests a new theoretical model explaining how AISA service quality influences subjective well-being through the mediating effect of PSR. Findings also indicate significant differences in the PSR effect on subjective well-being between male and female users. Our study advances our understanding of service quality outcomes, establishes a new antecedent to PSR and contributes to a more holistic understanding of how service quality can impact subjective well-being in AI-based service environments. We also provide managerial implications for practitioners incorporating AISA to serve consumers.

Keywords

Service quality; subjective well-being; parasocial relationship; artificial intelligence

4.1 Introduction

As defined in Study 1 and Study 2 of this thesis, artificial intelligence service agents (AISA) are AI-based applications, machines and robots that can learn from experience and improve their service performance. AISA such as virtual assistants (Brill, Munoz & Miller 2019) and physical social robots (Lee, Park & Song 2005) have demonstrated a capability to deeply integrate into service provisioning (De Keyser et al. 2019) and offer high quality service, often with limited observable distinction from human service providers (Huang & Rust 2020a; Wirtz et al. 2018). Consequentially, AISA are broadly seen to have a strong potential to revolutionise the service industry (Davenport et al. 2020; Huang & Rust 2018; Rust 2019), with practitioners deploying AISA to build and manage customer relationships (Huang & Rust 2020b; Shankar 2018). These have contributed to substantial annual growth forecasts of between 14% and 33% for the market value of AISA from 2020 to 2025 (Mordor Intelligence 2020; Androit Market Research 2020).

Increasing consumer interaction with AISA, in combination with rapid advances in AI innovation, are enhancing AISA service quality. Based on the work of Zeithaml (1988), AISA service quality refers to the overall excellence or superiority of AISA's service performance as perceived by consumers. With continued use, consumers can actively contribute to AISA's service performance improvement: as an AISA learns the consumer's past behaviour, it adapts and improves future service performance (e.g. offering more personalised service) (Davenport et al. 2020). In addition, as AI innovation matures, service providers are expected to have greater access to more advanced AI-based systems which they can use to offer more efficient and personalised service solutions to consumers (Pantano & Pizzi 2020). This is expected to enhance AISA's performance capabilities and scope of contribution to AI-enabled services (Meyer, Jonas & Roth 2020).

Notwithstanding the importance of AISA's utilitarian benefits (Meyer-Waarden et al. 2020), advancements in AI are also enabling AISA to provide more hedonic outcomes, such as greater empathy reactions to consumers' emotions (Huang & Rust 2020a). Research has found that such reactions can evoke a sense of attachment to AISA for some consumers (Konok et al. 2018). For instance, some consumers have reported imagining having intimate sexual relationships with their virtual assistants such as Siri, Google Assistant and Alexa, with over a third wishing that their virtual assistants were real people (Pesce 2017). Whilst research into the nature and implications of such emotional relationships with a non-human entity such as AISA have gained attention in recent literature (Peeters & Haselager 2019; Van Doorn et al. 2017), researchers have also called for more empirical studies to better understand the effects of AISA on consumers' well-being (Davenport et al. 2020; Kiron & Unruh 2019; Lu et al. 2020). The need for this research has become even more prominent and urgent given the potential for AISA to provide greater engagement with consumers as a means of tackling social isolation under the imposed lockdown restrictions due to the COVID-19 pandemic in 2020 (Henkel et al. 2020).

We draw on the parasocial relationship (PSR) theory to investigate how AISA service quality affects the consumer's PSR with their AISA and their subjective well-being. First introduced by Horton and Wohl (1956) and Horton and Strauss (1957), PSR is defined as the emotional bond that some people develop with media figures. Based on the extant literature, we demonstrate the applicability of PSR to AISA. We then argue that AISA service quality can enhance the consumer's PSR with their AISA through the six different dimensions of AISA service quality as established in Study 2. This includes the AISA service quality dimension of anthropomorphism which, by itself, is a salient AISA attribute (Troshani et al. 2020). Accordingly, we develop and test a model that explains how AISA service quality can affect

consumers' subjective well-being and the role that PSR plays in this relationship. Subjective well-being is defined as the evaluation that people have of their own lives (Diener 1984).

We make the following two key contributions to the literature. First, our theoretical model features the mediating role of PSR in the AISA service quality context. This advances our understanding of AISA service quality and PSR, as well as the relationship between them. Existing research underscores the increasing significance of AISA (Rust 2019) and PSR in AI-enabled services (Han & Yang 2018), but falls short of explaining the nature of their roles and related implications. In addressing this shortcoming, our study goes beyond traditional outcomes of service quality (e.g. Cronin Jr, Brady & Hult 2000) to explain the specific role that PSR plays and how it is activated by AISA service quality. In addition, our research enhances the PSR theory by establishing AISA service quality as a new antecedent to PSR in the literature (cf. Rubin & McHugh 1987).

Second, our empirical investigation advances the understanding of how consumer well-being can be affected by service quality in the context of AI-enabled services (cf. Henkel et al. 2020). We note that existing research appears to have a dominant focus on the service providers' viewpoint, specifically looking at the importance of achieving service quality outcomes, such as customer satisfaction, perceived value and loyalty (Cronin Jr, Brady & Hult 2000), as a means of advancing their commercial interests (Zeithaml, Berry & Parasuraman 1996). In PSR-related studies, researchers have also shown how an increase in PSR can positively influence the continued use of technology platforms (e.g. Han & Yang 2018; Lim et al. 2020). However, scholars continue to call for more research looking at the role of services in affecting the well-being of consumers (Henkel et al. 2020; Troebs, Wagner & Heidemann 2018). While service quality research in the context of human service agents has made important inroads in this area (e.g. Su, Huang & Chen 2015; Su, Swanson & Chen 2016), our

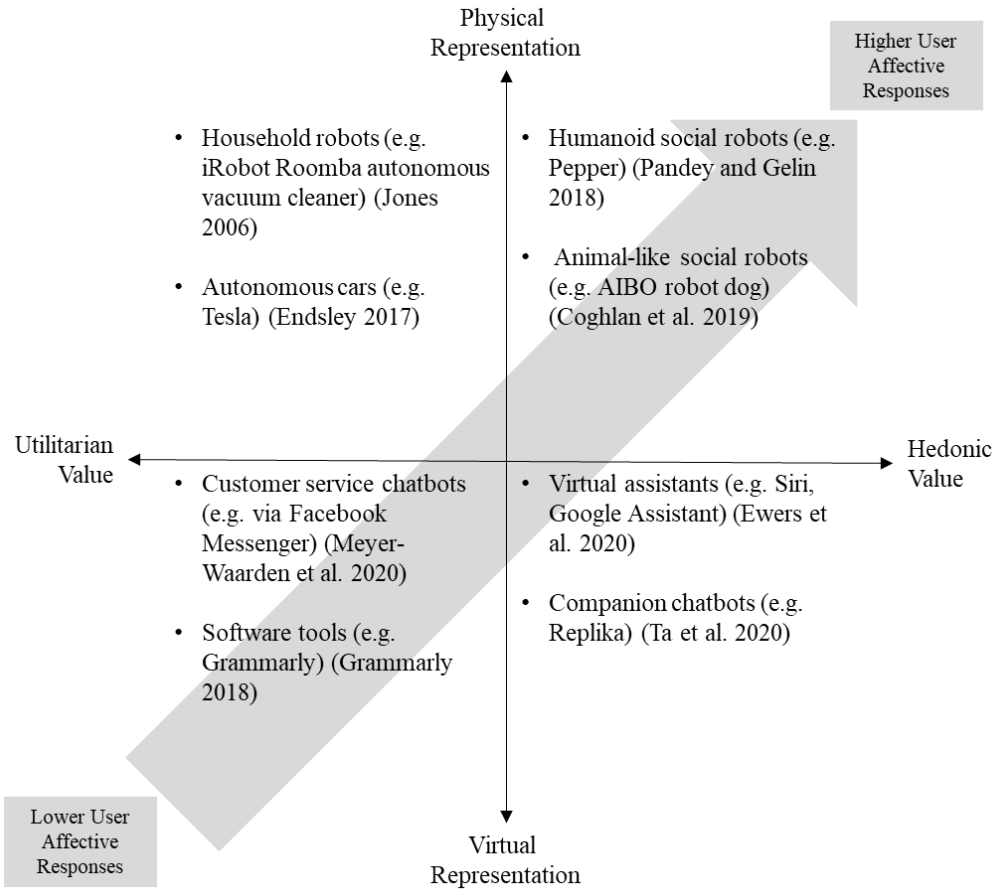
study extends this line of research by investigating service quality in the fast emerging and increasingly relevant AISA service environment (Davenport et al. 2020; Lu et al. 2020).

The remainder of the paper is structured as follows. We begin with an overview of the AISA landscape by introducing a classification mapping various AISA types. We proceed with a review of the existing literature on PSR theory, AISA service quality and subjective well-being which we use as a basis to develop a research model and related hypotheses. We show how the dimensions of AISA service quality can activate PSR. We then discuss the method used to collect data to test our theoretical model and hypotheses using virtual assistants as a specific type of AISA. We conclude the paper with a discussion of findings, and of theoretical and managerial implications.

4.2 An AISA classification

AISA can be categorised based on their perceived primary benefits (i.e. utilitarian vs hedonic) and their form (i.e. virtual vs physical). Consumers' affective responses towards AISA also differ. Thus, we map the AISA landscape based on how consumers generally value an AISA application in the utilitarian-hedonic spectrum (Huang & Rust 2020a) and whether they are dominantly virtual or physical in representation (Davenport et al. 2020; Wirtz et al. 2018) (see Figure 4-1).

Figure 4-1 AISA spectrum by representation, consumer value and affective responses



(Source: developed for this study)

Consumers place primary value on AISA's hedonic factor when the AISA application is primarily designed to provide affective service (Van Der Heijden 2004). For instance, social robots such as Pepper are developed to converse with consumers and keep them company in aged care and schools (Pandey & Gelin 2018). Pepper is also mainly classified as a physical AISA representation despite having virtual text displays which are used to interact with consumers (Pandey & Gelin 2018). Such a physical representation can create relatively higher affective responses from users than virtual AISA (Coghlan et al. 2019). Thus, we expect that AISA which are mainly designed to meet the hedonic needs of consumers and that have a more

physical representation would be likely to evoke high affective responses from consumers, as shown in Figure 4-1.

Nonetheless, many consumers have turned to virtual forms of AISA, such as the companion chatbot Replika (Ta et al. 2020) and virtual assistants including Siri, Alexa and Google Assistant (Ewers, Baier & Höhn 2020), to address their hedonic needs due to their greater availability and convenient accessibility. These AISA are predominantly voice- or text-based and are widely accessible via smartphones (e.g. Siri, Google Assistant, Replika) and internet-connected devices (e.g. Alexa, Google Home Mini) (Hoy 2018). They can offer hedonic benefits to consumers, such as having conversations with consumers and telling jokes (Hoy 2018). Accordingly, virtual assistants have the capacity to offer consumers hedonic functionality. It is therefore possible for consumers to form emotional relationships with their virtual assistants (Pesce 2017). Due to the wide popularity and availability at the time of this study, we selected virtual assistants as a suitable AI application type representing AISA in our research.

4.3 Theoretical background and hypotheses development

4.3.1 Parasocial relationship

The PSR conceptualisation was originally developed to describe the illusionary bond that viewers form with characters played by performers in media such as television and theatre (Horton & Wohl 1956). Despite this quasi-relationship being one-sided and absent of any real reciprocation, spectators can be influenced by the performer through the performer's persona in their role (Horton & Wohl 1956). This enduring relationship can develop over multiple parasocial interactions which are short-term encounters in which the viewer experiences the desire to immediately respond and participate with the performer (Horton & Strauss 1957; Horton & Wohl 1956; Rubin, Perse & Powell 1985). That is, PSR can exist beyond the moment

of interaction (Dibble, Hartmann & Rosaen 2016) and is concerned with the longer term relationships viewers can form with a performer (Rosaen & Dibble 2016). In the AISA use context, an AISA plays the role of the performer.

Beyond celebrities and fictional characters, the concept of PSR has been extended and measured for other types of personas (Horton & Wohl 1956) including racing car drivers (Hartmann, Stuke & Daschmann 2008), social network connections (Tsiotsou 2015) and live-streaming gamers (Lim et al. 2020). Traditional antecedents to PSR include social, task and physical attraction to the persona (Rubin & McHugh 1987) and have been widely adopted in the literature (e.g. Han & Yang 2018; Zheng et al. 2020). Consumers can also develop PSR with inanimate target personas, such as puppets (Horton & Wohl 1956) and AISA such as virtual assistants (Han & Yang 2018) due to their anthropomorphic attributes. Thus, while the AISA service quality dimension of anthropomorphism can be a key trigger to activate PSR, we argue that the multidimensional AISA service quality construct as a whole can have a positive influence on PSR.

4.3.2 AISA service quality

Service quality is an attitude that consumers form based on their overall judgement of the excellence or superiority of the AISA (Zeithaml 1988). This evaluation consists of a composition of perceptual dimensions which are unique to different service environments (Rust & Oliver 1993) and which can be assessed using standardised psychometric scales for each specific type of service agent (Ladhari 2009; Seth, Deshmukh & Vrat 2005). Thus, service quality can be used to assess the overall service performance of AISA.

Specifically, the AISAQUAL scale developed in Study 2 evaluates AISA service quality according to six dimensions – anthropomorphism, efficiency, security, enjoyment, availability and contact with human service agents. In particular, the significance of the

relatively more affective dimensions of AISAQUAL (i.e. anthropomorphism and enjoyment) suggest that in addition to utilitarian benefits, consumers also value the ability of AISA to meet their hedonic needs. In addition, early qualitative evidence from Study 1 suggests that AISA service quality can lead to various affective outcomes such as satisfaction and subjective well-being. We posit that AISA service quality can also be an antecedent to PSR. We explain this position in the following subsections which culminates with the argument that the AISA service quality link with PSR is activated by the cumulative effect that results from individual relationships between AISA service quality dimensions and PSR.

Anthropomorphism is a salient attribute of AISA (Wirtz et al. 2018) and can facilitate PSR between a consumer and AISA. Anthropomorphism refers to the attachment of human-like characteristics to AISA (Study 2). Indeed, like television characters who create the illusion of intimacy through gestures and other communication cues (Horton & Wohl 1956), AISA have a wide range of interface designs that can mimic human traits, such as voice (Kepuska & Bohouta 2018). In the extant literature, judgements on AISA's social attraction, which include the humanness of the interaction experience, have been shown to positively affect PSR with AISA (Han & Yang 2018). The quality of AISA's humanness attribute is similar to the AISA service quality dimension of anthropomorphism (Study 2). Separately, in the brand literature, Fetscherin (2014) found that PSR theory was better in explaining the relationship consumers form with brands they love than was interpersonal relationship theory. Conceptually, PSR adequately captured the nature of this affective attachment which is one-sided towards an object (i.e. brand) that is inanimate and anthropomorphic. Thus, consumers may also 'love' AISA – an object that, like brands, is inanimate and anthropomorphic – and AISA service quality – where anthropomorphism is a dimension in its measurement – through PSR.

Efficiency refers to the ease and speed of using AISA (Study 2). The ability of AISA to adapt to the consumer's idiosyncrasies and guide them towards an ideal solution is valued

by consumers (Fernandes & Oliveira 2021; Wirtz et al. 2018). In their seminal study, Han and Yang (2018) found that task attraction with AISA influences PSR with AISA. Task attraction represents the positive judgements about the service application's task completion ability, which leads to the formation of unique and positive emotional connections with the service agent (Zheng et al. 2020). These positive views, based on the ease of performing service tasks, are conceptually captured by the efficiency dimension in AISA service quality established in Study 2.

Security and the perceived safety of using AISA has also been shown to influence PSR (Han & Yang 2018). In service interactions, including those with AISA, trust is of great importance to consumers in order for them to be willing to accept and engage AISA (Fernandes & Oliveira 2021). Indeed, as more consumer data is collected by AISA, the issue of data protection continues to become critical for both consumers and companies (Huang & Rust 2020b). In reducing consumers' privacy concerns by increasing the perceived security of the AISA, companies can facilitate interactions between consumers and AISA, thereby building trust which forms a foundation for relationship-building with the AISA (Troshani et al. 2020).

Enjoyment in using the AISA can be categorised as both a dimension of AISA service quality (Study 2) and an outcome of parasocial interaction encounters with the AISA (Hartmann & Goldhoorn 2011; Horton & Strauss 1957). Consumers who feel that they are being addressed directly by the performer may find the experience more enjoyable (Hartmann & Goldhoorn 2011). Indeed, AISA can offer more meaningful attention by deeply personalising the service experience based on the unique needs of the individual consumer (Huang & Rust 2018). The accumulation of such frequent parasocial interactions, which are anchored by degrees of enjoyable moments, can lead to PSR (Rubin, Perse & Powell 1985).

Availability of AISA anytime, anywhere will become more pronounced as AI technology continues to become infused into service environments (Van Doorn et al. 2017). A

significant development supporting this area is the Internet of Things, which will enable various AISA to connect with one another and with consumers (Huang & Rust 2020a). As a result, consumers may find themselves becoming increasingly aware of the social presence of AISA, which can foster parasocial experiences with their AISA (Kim & Song 2016).

Contact refers to the AISA user's ability to access human assistance (Study 2). Research suggests that the mere noticeable presence of optional human support to augment AISA, without consumers actually accessing such a support service in some instances, can increase consumers' confidence and trust in the service provider (Shell & Buell 2019). When contact is initiated with the human assistant as part of service recovery (cf. Parasuraman, Zeithaml & Malhotra 2005), a successful service resolution can also increase the service provider's trustworthiness in the consumer's eyes (Gustafsson 2009). Such overall trust in the AISA service provider can translate to greater assurance in using the AISA application itself (Bélanger & Carter 2008), thereby strengthening the relationship between consumers and AISA (Tukachinsky 2010).

PSR resulting from interaction with AISA is unique in its resemblance to a real social relationship and can involve a deeper emotional connection with consumers (Pantano & Pizzi 2020; Van Doorn et al. 2017). The AISA is not merely acting as an intermediary to facilitate a relationship between the consumer and other humans, but is rather the target of the relationship formation itself (cf. Giles 2002). Accordingly, we have argued that the consumers' overall judgement of AISA service quality based on its dimensions can result in an increased emotional bond with their AISA. As service quality judgements can be formed after a period of AISA use, we would also expect the development of PSR to be reinforced due to multiple interactions with AISA and evaluations of its perceived service quality. Thus, we hypothesise that:

H1. AISA service quality positively influences the consumer's parasocial relationship with AISA.

4.3.3 Subjective well-being

Subjective well-being refers to the evaluation that people give to their own lives. This self-assessment can be cognitive (e.g. life satisfaction) or affective (e.g. moods and emotions) (Anderson et al. 2013; Diener et al. 1985; Diener et al. 1999). Various scales have been developed in the literature to measure these cognitive or affective components (Larsen, Diener & Emmons 1985; Pavot & Diener 1993), including the Satisfaction With Life Scale (Diener et al. 1985) and Subjective Happiness Scale (Lyubomirsky & Lepper 1999). In the context of service quality, the hedonic tradition of measuring subjective well-being fits within our study context of affective outcomes arising from consumer interactions with the service environment (Anderson et al. 2013), and has been applied in past service quality studies (e.g. Su, Swanson & Chen 2016).

Traditionally, service quality outcomes, such as satisfaction, perceived value and loyalty have received greater attention in the service literature (Anderson & Ostrom 2015; Cronin Jr, Brady & Hult 2000). However, service interactions between consumers and their service agents can influence their overall affective states (Anderson et al. 2013), with higher quality services contributing to improved well-being (Sirgy, Lee & Rahtz 2007). Subjective well-being has also been put forth as an important research area due to the increasing permeability and impact of service systems in the consumers' lives (Anderson & Ostrom 2015; Ostrom et al. 2015; Rafaeli et al. 2017; Rosenbaum 2015).

A limited number of studies have investigated how service quality affects subjective well-being for human service environments (Su, Huang & Chen 2015; Su, Swanson & Chen 2016). In the tourism context, both Su, Huang and Chen (2015) and Su, Swanson and Chen (2016) found that service quality affected subjective well-being indirectly with no significant direct relationship between them (Su, Huang & Chen 2015). As technology becomes more integrated into service (Parasuraman 2000) and an array of technologies including AISA are

introduced into the service industry (Rust 2019), it is also critical to assess how well-being can be affected by the use of these applications in service. The association between technology and well-being may be negative if the user is unsure of how to use a complex system (Venkatesh & Bala 2008), or positive if the technology facilitates continued interactions (Chiu et al. 2013).

Beyond professional social support services, general supportive interactions with others can improve a person's subjective well-being (Cohen 2004). PSR attachments are a means to experience such social relationships (Horton & Wohl 1956), and can also impact the person's overall affective state (Dibble, Hartmann & Rosaen 2016). Hence, this study hypothesises:

H2. Parasocial relationship with AISA positively influences a consumer's subjective well-being.

4.3.4 Loneliness

AISA such as social robots have been used in service environments including aged care to address loneliness (Chen et al. 2020). Loneliness refers to the unpleasantness that a person can experience from the lack of quantity or quality in their social relationships (Perlman & Peplau 1981). This internal psychological state occurs when a person perceives that their social relationships fall short of what they desire (Rubin, Perse & Powell 1985). Thus, inherent to loneliness is also a social aspect and the absence of adequate emotional attachment to others (Ben-Zur 2012). There is also empirical evidence that loneliness can have a direct impact on the person's subjective well-being (Ben-Zur 2012; Diener 1984). Thus, we hypothesise:

H3. Loneliness negatively influences a consumer's subjective well-being.

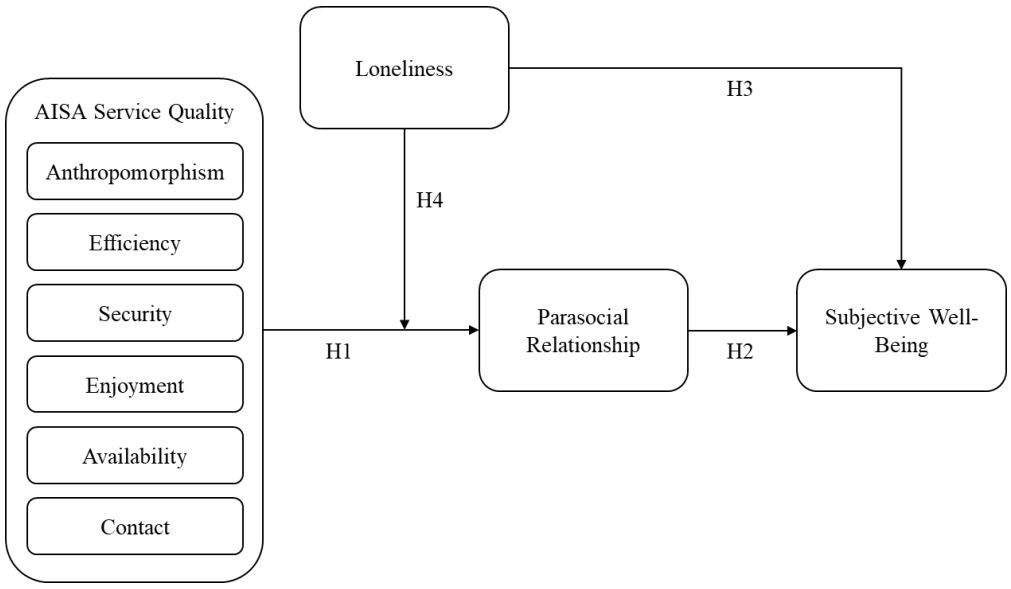
Emerging research has suggested that AISA can offer hedonic support to consumers who are isolated and lack social relationships (Kiron & Unruh 2019; Odekerken-Schröder et al. 2020). For instance, beyond performing utilitarian tasks such as sending text messages for consumers, virtual assistants can keep consumers company by telling them stories (Hoy 2018). Although

the empirical evidence for the effect of a direct intervention by AISA on loneliness remains debatable (Konok et al. 2018), a lonely person can yearn for a deeper PSR with AISA to help keep them company (Horton & Wohl 1956). We therefore propose the following hypothesis:

H4. The positive relationship between AISA service quality and parasocial relationship is strengthened for consumers with higher levels of loneliness.

The theoretical framework integrating our proposed interrelationships between the variables discussed in this section is shown in Figure 4-2.

Figure 4-2 Research model



4.4 Methodology

4.4.1 Construct measurement

The measure items used in this study were adapted from previous constructs developed in the literature. For AISA service quality, the 26-item multidimensional AISAQUAL scale from Study 2 of this thesis was used. To measure PSR, we adapted five of the six items from the positive PSR sentiments about virtual friendship by Hartmann, Stuke and Daschmann (2008) that were appropriate to the AISA context. Subjective well-being was measured using three

items from Su, Swanson and Chen (2016). We also adapted three items from the loneliness scale by Hughes et al. (2004). Finally, it is conceivable that the consumer interacting with AISA may develop a sense of relationship with the brand of the AISA (e.g. Wu et al., 2017). Accordingly, we controlled for brand attachment to help isolate relationship effects that the consumer experiences with AISA to PSR by adopting three items from Ilicic and Webster (2014). Table 4-1 details all the item measures used in our study.

Table 4-1 Survey items used in study

Construct	Item		Source
AISA Service Quality	*Efficiency*		Study 2 of thesis
	EFF1	The AISA works correctly at first attempt.	
	EFF2	I can get my task done with the AISA in a short time.	
	EFF3	The AISA interface design provides information clearly.	
	EFF4	The AISA adequately meets my requirements.	
	Security		
	SEC1	There is no risk of loss associated with disclosing personal information to the AISA.	
	SEC2	I feel secure in providing sensitive information to the AISA.	
	SEC3	I believe that information that the AISA has about me is protected.	
	SEC4	I trust that my personal information with the AISA will not be misused.	
	Availability		
	AVA1	The AISA is always available.	
	AVA2	The AISA is never too busy to respond to my requests.	
	AVA3	The AISA is always accessible.	
	Enjoyment		
	ENJ1	Using the AISA is fun.	
	ENJ2	Using the AISA is enjoyable.	
	ENJ3	Using the AISA is interesting.	
	ENJ4	Using the AISA is entertaining.	
	Contact		
	CON1	Human assistants are available to contact via the AISA.	
	CON2	Follow-up services with human assistants are available to me when necessary.	
	CON3	I can speak to a human assistant via the AISA.	
	CON4	Human assistance is easy to access via the AISA.	
	CON5	The AISA provides detailed contact information when I need human assistance.	
	Anthropomorphism		
	ANT1	The AISA has humanlike features.	
	ANT2	The AISA has personality.	
	ANT3	The AISA gradually gets to know me.	
	ANT4	The AISA is able to behave like a human.	
	ANT5	The AISA responds in ways that are personalised.	
	ANT6	The AISA is able to communicate like a human.	
Parasocial Relationship	PSR1	I think the AISA is like an old friend.	Hartmann, Stuke and Daschmann (2008)
	PSR2	The AISA makes me feel as comfortable as when I am with friends.	
	PSR3	I think about the AISA even when I am not interacting with it.	
	PSR4	I miss the AISA if I do not use it for a long time.	
	PSR5	I feel that I know the AISA very well.	
Subjective Well-Being	SWB1	In general, I consider myself a very happy person.	Su, Swanson and Chen (2016)
	SWB2	Compared to most of my peers, I consider myself happier.	
	SWB3	I am generally very happy and enjoy life.	

Construct	Item		Source
Loneliness	LON1	In general, I feel like I lack companionship.	Hughes et al. (2004)
	LON2	In general, I feel like I am often left out.	
	LON3	In general, I feel isolated from others.	
Brand Attachment	BRAT1	I miss the services of [AISA brand name] when they are not available.	Ilicic and Webster (2014)
	BRAT2	If [AISA brand name] was permanently gone I would be upset.	
	BRAT3	Losing [AISA brand name] forever would be distressing to me.	

4.4.2 Data collection

A self-administered survey was distributed using the online panel company Qualtrics to virtual assistant users from the USA. Purposive sampling was used with the survey participation dependent on the respondents having prior experience interacting with virtual assistants in the previous three months. The sample was sourced from the US since it represents one of the top 10 countries with a significant number of AISA users (PwC 2018) and is expected to continue to lead the global market share for virtual assistants (Androit Market Research 2020).

The questionnaire consisted of two sections. The first section contained demographic and AISA usage questions including screening questions on their AISA usage to ensure that respondents met the participation criteria[8]. In the second section, respondents were asked to rate the construct item statements in Table 4-1 using a seven-point Likert scale anchored from 1 = strongly disagree to 7 = strongly agree. Construct items were shown to the respondents in random order.

Several measures were taken to improve overall response quality. First, we included one instructional manipulation check (IMC) (Oppenheimer, Meyvis & Davidenko 2009) at the beginning of the survey which instructed participants to select "Others" to a question "Any other comments before we proceed with the survey". To reduce common method bias, several procedural remedies as recommended by MacKenzie and Podsakoff (2012) were factored into our survey, including enhancing cognitive effort by explaining to respondents how their

[8] Survey participation criteria: i) Individuals 18 years and above, ii) US residents and iii) used virtual assistants in the previous three months.

responses will benefit the study, and encouraging true responses by describing procedures to ensure anonymity. At the beginning of the survey, respondents were also informed of a formal ethics approval obtained for the study from the authors' affiliated university. In addition, straight-lining problems with participant responses were also addressed. Specifically, we removed responses containing identical or nearly identical response categories to the questionnaire items (Herzog & Bachman 1981).

The final sample consisted of 408 responses with an almost even gender split (male=49.8%, female=50.2%). Half the respondents used their AISA on a daily basis (50.0%) while about one-third did so weekly (32.4%). The majority of respondents (52.2%) had also used their AISA for two to three years. Alexa, Google Assistant and Siri were the three most popular types of virtual assistants used which mirrors the virtual assistant usage trend amongst the US population (Olson & Kemery 2019). Table 4-2 summarises the profiles of respondents for the survey.

Table 4-2 Profile of survey respondents

Category	Frequency	Percentage	Category	Frequency	Percentage
			Work industry		
Gender			Accommodation and food services	18	4.4
Male	203	49.8	Administrative and support services	16	3.9
Female	205	50.2	Arts and recreation services	10	2.5
Total	408	100.0	Construction	8	2.0
			Education and training	31	7.6
Age			Electricity, gas, water and waste services	9	2.2
18-24	67	16.4	Financial and insurance services	36	8.8
25-34	125	30.6	Health care and social assistance	36	8.8
35-44	114	27.9	Information media and telecommunications	24	5.9
45-54	46	11.3	Manufacturing	6	1.5
55-64	30	7.4	Mining	3	.7
65 and above	26	6.4	Professional, scientific and technical services	44	10.8
Total	408	100.0	Public administration and safety	12	2.9
				7	1.7
Highest education					
Less than high school	7	1.7			
High school	76	18.6			
Vocational training	15	3.7			
Some college	111	27.2			
Bachelor's degree	120	29.4			
Postgraduate degree	79	19.4			
Total	408	100.0			

Category	Frequency	Percentage	Category	Frequency	Percentage
Personal annual income (USD)			Rental, hiring and real estate services	39	9.6
Less than $25,000	100	24.5	Retail trade	14	3.4
$25,000 to $49,999	96	23.5	Transport, postal and warehousing	1	.2
$50,000 to $74,999	82	20.1	Wholesale Trade	19	4.7
$75,000 to $99,999	53	13.0	Other Industries	22	5.4
$100,000 and more	77	18.9	Retired	53	13.0
Total	408	100.0	Unemployed	408	100.0
			Total		
AISA usage frequency			*Virtual assistant context*		
Daily	204	50.0	Alexa	131	32.1
Weekly	132	32.4	Bixby	17	4.2
Every 2-3 weeks	31	7.6	Cortana	1	.2
Monthly	21	5.1	Google Assistant	118	28.9
Every 2-3 months	12	2.9	Google Home Mini	30	7.4
Every 4-6 months	2	.5	Google Nest Mini	1	.2
Once a year	6	1.5	Siri	110	27.0
Total	408	100.0	Total	408	100.0
AISA usage experience			*Virtual assistant brand*		
Less than 1 year	92	22.5	Amazon	131	32.1
2-3 years	213	52.2	Apple	110	27.0
4-5 years	75	18.4	Google	149	36.5
6-7 years	22	5.4	Microsoft	1	.2
8 years and above	6	1.5	Samsung	17	4.2
Total	408	100.0	Total	408	100.0

4.5 Analysis and results

4.5.1 Model evaluation

The psychometric properties of our study model were assessed using the Partial Least Squares Structural Equation Modelling (PLS-SEM). The PLS-SEM method has been used in marketing and IS research, and is well-suited to exploring and predicting new theoretical relationships between variables (Hair, Risher, et al. 2019). In addition, as the mediating role of PSR is of significance to our study, the PLS-SEM method offers the advantage of establishing mediation effects without the need for a separate mediation analysis using the PROCESS macro in SPSS (Sarstedt et al. 2020). Accordingly, the software package SmartPLS 3 was used to execute PLS-SEM rather than SPSS AMOS which is also more appropriate for Covariance-Based Structural Equation Modelling (Hair, Risher, et al. 2019).

The advocated two-step model assessment procedure consisting of evaluating the outer measurement model before testing the inner structural model was used for our study (Hair, Black, et al. 2019). To prepare for analysis, each dimension of AISA service quality was aggregated into indicators using the average score of items per dimension (Ding, Hu & Sheng 2011; Lin & Hsieh 2011). In terms of model fit, the applicability and reliability of different goodness-of fit measures for PLS-SEM remain debated and cautiously advocated in the literature (Benitez et al. 2020; Hair, Sarstedt & Ringle 2019). Accordingly, the frequently used Standardised Root Mean Square Residual (SRMR) heuristic for PLS-SEM (Fernandes & Oliveira 2021) was employed for our model. Confirmatory factor analysis resulted in an SRMR value of .07 which met the suggested threshold of .08 (Henseler, Hubona & Ray 2016).

Next, we evaluated the PLS-SEM measurement model for reliability and validity (Hair, Risher, et al. 2019). For internal consistency reliability, all Cronbach's alpha and composite reliability values satisfied the recommended threshold of .70 (Bagozzi & Yi 2012). As for convergent validity, all average variance extracted (AVE) values exceeded the minimum cut-off of .50 (Bagozzi & Yi 1988). In terms of indicator reliability, the majority of factor loadings satisfied the ideal criteria of .70 (Bagozzi & Yi 2012). Anthropomorphism, a key AISA service quality attribute identified in our study to affect PSR, loaded the strongest for AISA service quality (β=.81, $p < .001$). Availability (.53) fell within the acceptable range of .50 to .95 (Bagozzi & Yi 1988), and was retained as the overall measurement model reliability and validity criteria were met (Benitez et al. 2020). Table 4-3 summarises the reliability and convergent validity results of the measurement model.

Table 4-3 Reliability and convergent validity results of the measurement model

Construct	Item		Mean	Standard Deviation	Loading	Cronbach's Alpha	Composite Reliability	AVE
AISA Service Quality	EFF	Efficiency	5.32	1.06	.76	.82	.87	.53
	SEC	Security	4.46	1.41	.73			
	AVA	Availability	5.91	0.90	.53			
	ENJ	Enjoyment	5.69	1.03	.76			
	CON	Contact	4.55	1.20	.73			
	ANT	Anthropomorphism	4.76	1.12	.81			
Parasocial Relationship	PSR1	I think the AISA is like an old friend.	3.88	1.80	.86	.89	.92	.70
	PSR2	The AISA makes me feel as comfortable as when I am with friends.	4.23	1.73	.81			
	PSR3	I think about the AISA even when I am not interacting with it.	3.34	1.93	.84			
	PSR4	I miss the AISA if I do not use it for a long time.	3.57	1.92	.86			
	PSR5	I feel that I know the AISA very well.	4.52	1.62	.81			
Subjective Well-Being	SWB1	In general, I consider myself a very happy person.	5.01	1.51	.92	.89	.93	.81
	SWB2	Compared to most of my peers, I consider myself happier.	4.57	1.56	.88			
	SWB3	I am generally very happy and enjoy life.	5.03	1.51	.90			
Loneliness	LON1	In general, I feel like I lack companionship.	3.76	1.87	.84	.86	.92	.78
	LON2	In general, I feel like I am often left out.	3.96	1.86	.90			
	LON3	In general, I feel isolated from others.	3.91	1.88	.92			

For discriminant validity, all values of the Hetero-Trait Mono-Trait (HTMT) ratio of the correlations were found to meet the conservative cut-off of .85, indicating discriminant validity (Henseler, Ringle & Sarstedt 2015) (see Table 4-4).

Table 4-4 Discriminant validity results using HTMT analysis

Construct	AISA Service Quality	Loneliness	Parasocial Relationship	Subjective Well-Being
AISA Service Quality				
Loneliness	.12			
Parasocial Relationship	.76	.22		
Subjective Well-Being	.35	.34	.35	

4.5.2 Common method bias testing

In addition to procedural remedies, statistical remedies were employed in our study to further mitigate common method bias. First, using Harman's single-factor test, none of our model factors accounted for more than 50% of the covariance among items (Fuller et al. 2016). In addition, using the guidelines by Kock (2015), the variance inflation factor (VIF) values from

a full collinearity test were lower than the threshold of 3.3. Both tests suggested that common method bias remained undetected in our study.

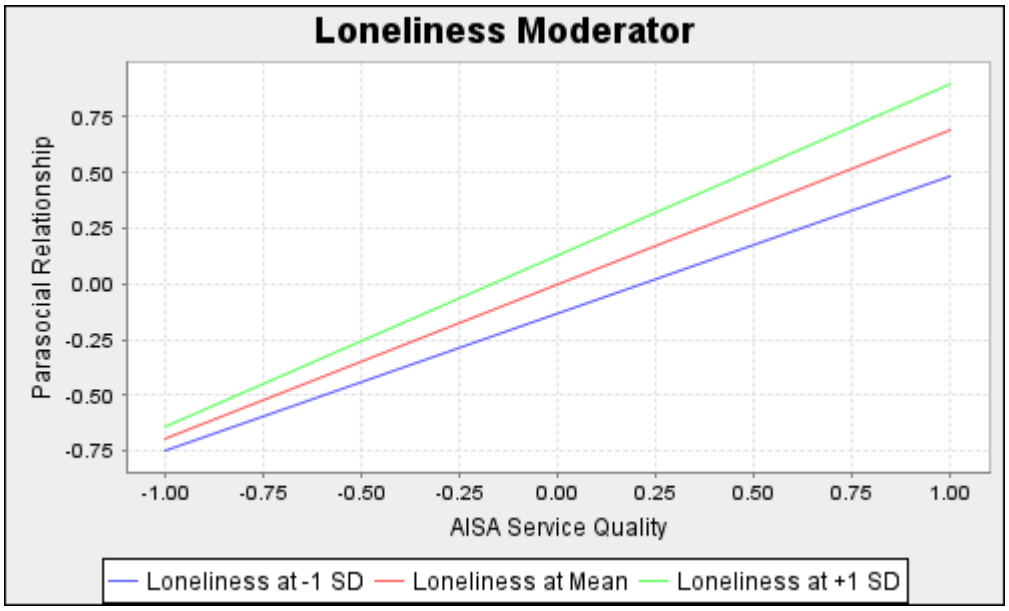
4.5.3 Hypotheses testing

Having assessed our measurement model to be satisfactory, we proceeded to assess the structural model and conducted path analysis. The statistical significance of the weights in the analysis was achieved through a bootstrapping procedure with 5000 samples using a two-tail test at 95% significance level (Hair, Risher, et al. 2019). As seen in Table 4-5, there was a significant and positive relationship between AISA service quality and PSR (β=.69, $p < .001$), thus supporting H1. There was also a significant and positive relationship between PSR and subjective well-being (β=.37, $p < .001$), thus supporting H2. The mean indirect effect of the PSR mediation between AISA service quality and subjective well-being was also positive and significant (β=.25, $p < .001$) (Zhao, Lynch Jr & Chen 2010). As for loneliness, there was a significant and negative relationship between loneliness and subjective well-being (β=-.38, $p < .001$), thus supporting H3. For the moderation effect of loneliness, using a two-stage approach (Henseler & Chin 2010), loneliness was found to positively moderate the relationship between AISA service quality and PSR (β=.08, $p < .05$), thus supporting H4. This moderating effect is also visualised in Figure 4-3, where a higher level of loneliness (+1 SD) translates to a stronger (steeper) relationship between AISA service quality and parasocial relationship. The control variable of brand attachment was not significant in our model.

Table 4-5 Hypotheses testing results for research model

Hypothesis	β Values	*p* Values	Result
H1: AISA Service Quality → Parasocial Relationship	.69	.001	Supported
H2: Parasocial Relationship → Subjective Well-Being	.37	.001	Supported
H3: Loneliness → Subjective Well-Being	-.38	.001	Supported
H4: Moderating Effect of Loneliness on AISA Service Quality → Parasocial Relationship	.08	.010	Supported

Figure 4-3 Slope plot for moderating effect



Finally, we conducted a multi-group analysis to assess if the path coefficients vary according to the demographic variables of age and gender. These variables were chosen because the literature suggests that younger consumers may experience stronger PSR effects (Labrecque 2014) and place different emphasis on hedonic benefits associated with technology (Venkatesh, Thong & Xu 2012) including AISA (Ewers, Baier & Höhn 2020). Similarly, females may experience stronger effects associated with PSR (Hu 2016) and subjective well-being (Diener et al. 1999).

Using a median split to separate the age groups (Iacobucci et al. 2015), results indicated that our empirical model persisted across age with no significant differences between younger (aged 18-34) and older (aged 35 and above) groups. Path relationships were also generally invariant across gender except for H2 (PSR → subjective well-being), where we observed that the effect was significantly higher for males than females (β difference=.37, *p* difference < .001). These results will be further discussed in the next section.

4.6 Conclusion

4.6.1 Theoretical implications

Consumers are using AISA for a variety of reasons including as a means to help fulfil their emotional needs. We develop and test a theoretical model integrating PSR construct into the service quality literature for the AISA context. Our results show that an inanimate entity such as AISA can induce PSR for consumers through service quality, which in turn can positively affect subjective well-being. This is in contrast to past studies which have linked service quality to subjective well-being through the customer satisfaction construct (Su, Huang & Chen 2015; Su, Swanson & Chen 2016). This deepens our understanding of how AISA service quality can contribute beyond traditional behavioural loyalty outcomes by including the affective outcome of PSR. In addition, this enhances PSR theory by establishing AISA service quality as a new antecedent to PSR in the literature (cf. Rubin & McHugh 1987).

Our study is a direct response to the call for further research into how AI-enabled services impact consumers (Davenport et al. 2020; Lu et al. 2020). To the best of our knowledge, this is the first study to empirically examine how AISA service quality affects subjective well-being. These findings contribute to both the service quality literature in the area of service and well-being (Anderson & Ostrom 2015), and the IS literature in the context of investigating new consumer outcomes (Venkatesh, Thong & Xu 2016).

Another interesting finding of our study was the greater influence of PSR on subjective well-being for male consumers. This result is in contrast to extant technology-usage studies in which males were found to be less emotionally oriented than females (e.g. Shi, Chen & Chow 2016; Venkatesh, Thong & Xu 2012). Instead, our findings are in line with studies which suggest that males may hold more positive views towards AISA than females (Konok et al. 2018). A key difference between AISA (i.e. AI-based technology) and non-AI-based technologies is the technological novelty associated with AISA. Indeed, there is evidence to

suggest that females may experience greater inhibitions in using new technology due to a perceived lack of control and uncertainty over the technology (Rojas-Méndez, Parasuraman & Papadopoulos 2017). These negative dispositions may reduce their overall affective state from engaging with AISA. A more direct explanation could be the user interface of AISA primarily designed for hedonic tasks, which tend to lean towards being more female-like (Fung 2019), thus amplifying the effects of the emotional bonds male users can form with their AISA in satisfying their hedonic needs (Pesce 2017).

Overall, the theoretical results of our study contribute to the areas of emotion research and consumer well-being in service environments provisioned by AISA.

4.6.2 Managerial implications

With the knowledge that AISA service quality can increase levels of PSR which in turn can increase subjective well-being, consumers can take several measures. First, in assessing AISA purchase and future use, consumers can use the six dimensions of AISA service quality (i.e. efficiency, security, availability, enjoyment, contact and anthropomorphism) to assist in their decision making. Accordingly, companies can also use these six dimensions as effective benchmarks in the development of AISA and implementation within the market. As our research has highlighted the key role of anthropomorphism as a strong PSR trigger, consumers can now actively seek AISA with more anthropomorphic attributes (e.g. interfaces associated with voice and gestures) which can better cater to a consumer's specific service situation and thereby foster more affective interactions.

Second, on the established positive link between PSR and subjective well-being, consumers can now rest assured that they have the viable option of interacting with AISA as a means of meeting their hedonic needs. As such, the fostering of a greater awareness by consumers of how the use of AISA can affect their subjective well-being is key. Companies

can be more forthcoming on the positive benefits that AISA can bring to consumers' well-being, in particular, for individuals experiencing a greater sense of loneliness, by promoting these as part of the core service benefits in their promotion campaigns.

Finally, consumers of different age groups can look forward to benefiting from AISA to improve their well-being. They can express to companies their interest in being able to personalise their AISA based on specific gender cues such as the AISA name, appearance and tone of voice. Companies with expertise to understand different gender preferences associated with AISA can develop a more effective AISA range to serve a broader and more inclusive market (Fung 2019).

4.6.3 Limitations and future research

There are several limitations in our study which represent opportunities for future research. First, our sample was based on US consumers. As such, their perceptions may not be representative of other populations from regions where attitudes and experiences with AI may differ (MacDorman, Vasudevan & Ho 2009). Thus, future research can investigate the effects that culture can have on our model by comparing results based on samples from different regions.

Second, the assessment of our model revealed variances across gender. Future research can extend this investigation to better understand the role of gender as well as other possible moderators (e.g. design interface) which may affect the intensity of the relationship between AISA service quality, PSR and subjective well-being across different consumer segments.

Third, while loneliness was chosen as a moderator for our study, the relationship between AISA service quality and PSR may also be strengthened from repeated service interactions with the AISA. This can be evaluated in future studies examining the moderating role of usage frequency with the AISA.

Finally, we encourage researchers to examine how various types of AISA with different representation-value contexts as identified in our classification, such as social robots with high physical representation and hedonic value, can affect the relationships between AISA service quality, PSR and subjective well-being. The answer to these questions will become increasingly important as AISA become more sophisticated and permeate more aspects of society.

References

Anderson, L & Ostrom, AL 2015, 'Transformative service research: Advancing our knowledge about service and well-being', *Journal of Service Research*, vol. 18, no. 3, pp. 243-249.

Anderson, L, Ostrom, AL, Corus, C, Fisk, RP, Gallan, AS, Giraldo, M, Mende, M, Mulder, M, Rayburn, SW & Rosenbaum, MS 2013, 'Transformative service research: An agenda for the future', *Journal of Business Research*, vol. 66, no. 8, pp. 1203-1210.

Androit Market Research 2020, *Intelligent virtual assistant (iva) market to grow at 33% cagr during forecast period (2020-2025) - insights on growth drivers, size and share analysis, key trends, leading players, and business opportunities: Adroit market research*, GlobeNewswire, viewed 26 February 2020, <https://www.globenewswire.com/news-release/2020/02/24/1988963/0/en/Intelligent-Virtual-Assistant-IVA-Market-to-grow-at-33-CAGR-during-forecast-period-2020-2025-Insights-on-Growth-Drivers-Size-and-Share-Analysis-Key-Trends-Leading-Players-and-Busin.html>.

Bagozzi, RP & Yi, Y 1988, 'On the evaluation of structural equation models', *Journal of the Academy of Marketing Science*, vol. 16, no. 1, pp. 74-94.

Bagozzi, RP & Yi, Y 2012, 'Specification, evaluation, and interpretation of structural equation models', *Journal of the Academy of Marketing Science*, vol. 40, no. 1, pp. 8-34.

Bélanger, F & Carter, L 2008, 'Trust and risk in e-government adoption', *The Journal of Strategic Information Systems*, vol. 17, no. 2, pp. 165-176.

Ben-Zur, H 2012, 'Loneliness, optimism, and well-being among married, divorced, and widowed individuals', *The Journal of Psychology*, vol. 146, no. 1-2, pp. 23-36.

Benitez, J, Henseler, J, Castillo, A & Schuberth, F 2020, 'How to perform and report an impactful analysis using partial least squares: Guidelines for confirmatory and explanatory is research', *Information & Management*, vol. 57, no. 2, p. 103168.

Brill, TM, Munoz, L & Miller, RJ 2019, 'Siri, alexa, and other digital assistants: A study of customer satisfaction with artificial intelligence applications', *Journal of Marketing Management*, vol. 35, no. 15-16, pp. 1401-1436.

Chen, S-C, Moyle, W, Jones, C & Petsky, H 2020, 'A social robot intervention on depression, loneliness, and quality of life for Taiwanese older adults in long-term care', *International Psychogeriatrics*, vol. 32, no. 8, pp. 981-991.

Chiu, C-M, Cheng, H-L, Huang, H-Y & Chen, C-F 2013, 'Exploring individuals' subjective well-being and loyalty towards social network sites from the perspective of network externalities: The facebook case', *International Journal of Information Management*, vol. 33, no. 3, pp. 539-552.

Coghlan, S, Vetere, F, Waycott, J & Neves, BB 2019, 'Could social robots make us kinder or crueller to humans and animals?', *International Journal of Social Robotics*, pp. 1-11.

Cohen, S 2004, 'Social relationships and health', *American psychologist*, vol. 59, no. 8, p. 676.

Cronin Jr, JJ, Brady, MK & Hult, GTM 2000, 'Assessing the effects of quality, value, and customer satisfaction on consumer behavioral intentions in service environments', *Journal of Retailing*, vol. 76, no. 2, pp. 193-218.

Davenport, T, Guha, A, Grewal, D & Bressgott, T 2020, 'How artificial intelligence will change the future of marketing', *Journal of the Academy of Marketing Science*, vol. 48, no. 1, pp. 24-42.

De Keyser, A, Köcher, S, Alkire, L, Verbeeck, C & Kandampully, J 2019, 'Frontline service technology infusion: Conceptual archetypes and future research directions', *Journal of Service Management*, vol. 30, no. 1, pp. 156-183.

Dibble, JL, Hartmann, T & Rosaen, SF 2016, 'Parasocial interaction and parasocial relationship: Conceptual clarification and a critical assessment of measures', *Human Communication Research*, vol. 42, no. 1, pp. 21-44.

Diener, E 1984, 'Subjective well-being', *Psychological Bulletin*, vol. 95, no. 3, pp. 542-575.

Diener, E, Emmons, RA, Larsen, RJ & Griffin, S 1985, 'The satisfaction with life scale', *Journal of personality assessment*, vol. 49, no. 1, pp. 71-75.

Diener, E, Suh, EM, Lucas, RE & Smith, HL 1999, 'Subjective well-being: Three decades of progress', *Psychological Bulletin*, vol. 125, no. 2, pp. 276-302.

Ding, DX, Hu, PJ-H & Sheng, ORL 2011, 'E-selfqual: A scale for measuring online self-service quality', *Journal of Business Research*, vol. 64, no. 5, pp. 508-515.

Endsley, MR 2017, 'Autonomous driving systems: A preliminary naturalistic study of the Tesla Model S', Journal of Cognitive Engineering and Decision Making, vol. 11, no. 3, pp. 225-238.

Ewers, K, Baier, D & Höhn, N 2020, 'Siri, do I like you? Digital voice assistants and their acceptance by consumers', *SMR - Journal of Service Management Research*, vol. 4, no. 1, pp. 52-70.

Fernandes, T & Oliveira, E 2021, 'Understanding consumers' acceptance of automated technologies in service encounters: Drivers of digital voice assistants adoption', *Journal of Business Research*, vol. 122, pp. 180-191.

Fetscherin, M 2014, 'What type of relationship do we have with loved brands?', *Journal of Consumer Marketing*.

Fuller, CM, Simmering, MJ, Atinc, G, Atinc, Y & Babin, BJ 2016, 'Common methods variance detection in business research', *Journal of Business Research*, vol. 69, no. 8, pp. 3192-3198.

Fung, P 2019, *This is why AI has a gender problem*, World Economic Forum, viewed 27 October 2020, <https://www.weforum.org/agenda/2019/06/this-is-why-ai-has-a-gender-problem>.

Giles, DC 2002, 'Parasocial interaction: A review of the literature and a model for future research', *Media Psychology*, vol. 4, no. 3, pp. 279-305.

Grammarly 2018, How we use AI to enhance your writing, Grammarly, viewed 16 May 2020, <https://www.grammarly.com/blog/how-grammarly-uses-ai>.

Gustafsson, A 2009, 'Customer satisfaction with service recovery', *Journal of Business Research*, vol. 62, no. 11, pp. 1220-1222.

Hair, JF, Black, WC, Babin, BJ & Anderson, RE 2019, *Multivariate data analysis*, Eighth edn, Cengage Learning EMEA, United Kingdom.

Hair, JF, Risher, JJ, Sarstedt, M & Ringle, CM 2019, 'When to use and how to report the results of PLS-SEM', *European Business Review*.

Hair, JF, Sarstedt, M & Ringle, CM 2019, 'Rethinking some of the rethinking of partial least squares', *European Journal of Marketing*.

Han, S & Yang, H 2018, 'Understanding adoption of intelligent personal assistants: A parasocial relationship perspective', *Industrial Management & Data Systems*, vol. 118, no. 3, pp. 618-636.

Hartmann, T & Goldhoorn, C 2011, 'Horton and Wohl revisited: Exploring viewers' experience of parasocial interaction', *Journal of Communication*, vol. 61, no. 6, pp. 1104-1121.

Hartmann, T, Stuke, D & Daschmann, G 2008, 'Positive parasocial relationships with drivers affect suspense in racing sport spectators', *Journal of Media Psychology: Theories, Methods, and Applications*, vol. 20, no. 1, pp. 24-34.

Henkel, AP, Čaić, M, Blaurock, M & Okan, M 2020, 'Robotic transformative service research: Deploying social robots for consumer well-being during covid-19 and beyond', *Journal of Service Management*.

Henseler, J & Chin, WW 2010, 'A comparison of approaches for the analysis of interaction effects between latent variables using partial least squares path modeling', *Structural Equation Modeling*, vol. 17, no. 1, pp. 82-109.

Henseler, J, Hubona, G & Ray, PA 2016, 'Using PLS path modeling in new technology research: Updated guidelines', *Industrial Management & Data Systems*.

Henseler, J, Ringle, CM & Sarstedt, M 2015, 'A new criterion for assessing discriminant validity in variance-based structural equation modeling', *Journal of the Academy of Marketing Science*, vol. 43, no. 1, pp. 115-135.

Herzog, AR & Bachman, JG 1981, 'Effects of questionnaire length on response quality', *Public opinion quarterly*, vol. 45, no. 4, pp. 549-559.

Horton, D & Strauss, A 1957, 'Interaction in audience-participation shows', *American Journal of Sociology*, vol. 62, no. 6, pp. 579-587.

Horton, D & Wohl, RR 1956, 'Mass communication and para-social interaction: Observations on intimacy at a distance', *Psychiatry*, vol. 19, no. 3, pp. 215-229.

Hoy, MB 2018, 'Alexa, siri, cortana, and more: An introduction to voice assistants', *Medical Reference Services Quarterly*, vol. 37, no. 1, pp. 81-88.

Hu, M 2016, 'The influence of a scandal on parasocial relationship, parasocial interaction, and parasocial breakup', *Psychology of Popular Media Culture*, vol. 5, no. 3, p. 217.

Huang, M-H & Rust, RT 2018, 'Artificial intelligence in service', *Journal of Service Research*, vol. 21, no. 2, pp. 155-172.

Huang, M-H & Rust, RT 2020a, 'Engaged to a robot? The role of AI in service', *Journal of Service Research*, p. 1094670520902266.

Huang, M-H & Rust, RT 2020b, 'A strategic framework for artificial intelligence in marketing', *Journal of the Academy of Marketing Science*, pp. 1-21.

Hughes, ME, Waite, LJ, Hawkley, LC & Cacioppo, JT 2004, 'A short scale for measuring loneliness in large surveys: Results from two population-based studies', *Research on aging*, vol. 26, no. 6, pp. 655-672.

Iacobucci, D, Posavac, SS, Kardes, FR, Schneider, MJ & Popovich, DL 2015, 'The median split: Robust, refined, and revived', *Journal of Consumer Psychology*, vol. 25, no. 4, pp. 690-704.

Ilicic, J & Webster, CM 2014, 'Investigating consumer–brand relational authenticity', *Journal of Brand Management*, vol. 21, no. 4, pp. 342-363.

Jones, JL 2006, 'Robots at the tipping point', IEEE Robotics and Automation Magazine, vol. 13, no. 1, p. 76.

Kepuska, V & Bohouta, G 2018, 'Next-generation of virtual personal assistants (microsoft cortana, apple siri, amazon alexa and google home)', in *2018 IEEE 8th Annual Computing and Communication Workshop and Conference (CCWC)*, IEEE, pp. 99-103.

Kim, J & Song, H 2016, 'Celebrity's self-disclosure on twitter and parasocial relationships: A mediating role of social presence', *Computers in Human Behavior*, vol. 62, pp. 570-577.

Kiron, D & Unruh, G 2019, 'Even if AI can cure loneliness - should it?', *MIT Sloan Management Review*, vol. 60, no. 2, pp. 1-4.

Kock, N 2015, 'Common method bias in PLS-SEM: A full collinearity assessment approach', *International Journal of e-Collaboration (IJEC)*, vol. 11, no. 4, pp. 1-10.

Konok, V, Korcsok, B, Miklósi, Á & Gácsi, M 2018, 'Should we love robots?–the most liked qualities of companion dogs and how they can be implemented in social robots', *Computers in Human Behavior*, vol. 80, pp. 132-142.

Labrecque, LI 2014, 'Fostering consumer-brand relationships in social media environments: The role of parasocial interaction', *Journal of Interactive Marketing*, vol. 28, no. 2, pp. 134-148.

Ladhari, R 2009, 'A review of twenty years of servqual research', *International Journal of Quality and Service Sciences*, vol. 1, no. 2, pp. 172-198.

Larsen, RJ, Diener, E & Emmons, RA 1985, 'An evaluation of subjective well-being measures', *Social indicators research*, vol. 17, no. 1, pp. 1-17.

Lee, KM, Park, N & Song, H 2005, 'Can a robot be perceived as a developing creature? Effects of a robot's long-term cognitive developments on its social presence and people's social responses toward it', *Human Communication Research*, vol. 31, no. 4, pp. 538-563.

Lim, JS, Choe, M-j, Zhang, J & Noh, G-Y 2020, 'The role of wishful identification, emotional engagement, and parasocial relationships in repeated viewing of live-streaming games: A social cognitive theory perspective', *Computers in Human Behavior*, vol. 108, no. 106327, pp. 1-10.

Lin, J-SC & Hsieh, P-L 2011, 'Assessing the self-service technology encounters: Development and validation of SSTQUAL scale', *Journal of Retailing*, vol. 87, no. 2, pp. 194-206.

Lu, V, Wirtz, J, Kunz, W, Paluch, S, Gruber, T, Martins, A & Patterson, P 2020, 'Service robots, customers, and service employees: What can we learn from the academic literature and where are the gaps?', *Journal of Service Theory and Practice*, vol. 30, no. 3, pp. 361-391.

Lyubomirsky, S & Lepper, HS 1999, 'A measure of subjective happiness: Preliminary reliability and construct validation', *Social indicators research*, vol. 46, no. 2, pp. 137-155.

MacKenzie, SB & Podsakoff, PM 2012, 'Common method bias in marketing: Causes, mechanisms, and procedural remedies', *Journal of Retailing*, vol. 88, no. 4, pp. 542-555.

MacDorman, KF, Vasudevan, SK & Ho, C-C 2009, 'Does japan really have robot mania? Comparing attitudes by implicit and explicit measures', *AI & society*, vol. 23, no. 4, pp. 485-510.

Meyer-Waarden, L, Pavone, G, Poocharoentou, T, Prayatsup, P, Ratinaud, M, Tison, A & Torné, S 2020, 'How service quality influences customer acceptance and usage of chatbots?', *SMR - Journal of Service Management Research*, vol. 4, no. 1, pp. 35-51.

Meyer, P, Jonas, JM & Roth, A 2020, 'Frontline employees' acceptance of and resistance to service robots in stationary retail - an exploratory interview study', *SMR - Journal of Service Management Research*, vol. 4, no. 1, pp. 21-34.

Mordor Intelligence 2020, *Social robot market - growth, trends and forecasts (2020-2025)*, Mordor Intelligence, viewed 22 October 2020, <https://www.mordorintelligence.com/industry-reports/social-robots-market>.

Odekerken-Schröder, G, Mele, C, Russo-Spena, T, Mahr, D & Ruggiero, A 2020, 'Mitigating loneliness with companion robots in the covid-19 pandemic and beyond: An integrative framework and research agenda', *Journal of Service Management*.

Olson, C & Kemery, K 2019, *Voice report*, Microsoft.

Oppenheimer, DM, Meyvis, T & Davidenko, N 2009, 'Instructional manipulation checks: Detecting satisficing to increase statistical power', *Journal of Experimental Social Psychology*, vol. 45, no. 4, pp. 867-872.

Ostrom, AL, Parasuraman, A, Bowen, DE, Patricio, L & Voss, CA 2015, 'Service research priorities in a rapidly changing context', *Journal of Service Research*, vol. 18, no. 2, pp. 127-159.

Pandey, AK & Gelin, R 2018, 'A mass-produced sociable humanoid robot: Pepper: The first machine of its kind', *IEEE Robotics & Automation Magazine*, vol. 25, no. 3, pp. 40-48.

Pantano, E & Pizzi, G 2020, 'Forecasting artificial intelligence on online customer assistance: Evidence from chatbot patents analysis', *Journal of Retailing and Consumer Services*, vol. 55, p. 102096.

Parasuraman, A 2000, 'Technology readiness index (tri) a multiple-item scale to measure readiness to embrace new technologies', *Journal of Service Research*, vol. 2, no. 4, pp. 307-320.

Parasuraman, A, Zeithaml, VA & Malhotra, A 2005, 'E-s-qual: A multiple-item scale for assessing electronic service quality', *Journal of Service Research*, vol. 7, no. 3, pp. 213-233.

Pavot, W & Diener, E 1993, 'The affective and cognitive context of self-reported measures of subjective well-being', *Social indicators research*, vol. 28, no. 1, pp. 1-20.

Peeters, A & Haselager, P 2019, 'Designing virtuous sex robots', *International Journal of Social Robotics*, pp. 1-12.

Perlman, D & Peplau, LA 1981, 'Toward a social psychology of loneliness', *Personal relationships*, vol. 3, pp. 31-56.

Pesce, NL 2017, *A quarter of us want to have sex with alexa*, MarketWatch, viewed 28 June 2020, <https://www.marketwatch.com/story/a-quarter-of-us-want-to-have-sex-with-alexa-2017-04-06-148821>.

PwC 2018, *Artificial intelligence: Touchpoints with consumers*, Global Consumer Insights Survey.

Rafaeli, A, Altman, D, Gremler, DD, Huang, M-H, Grewal, D, Iyer, B, Parasuraman, A & de Ruyter, K 2017, 'The future of frontline research: Invited commentaries', *Journal of Service Research*, vol. 20, no. 1, pp. 91-99.

Rojas-Méndez, JI, Parasuraman, A & Papadopoulos, N 2017, 'Demographics, attitudes, and technology readiness: A cross-cultural analysis and model validation', *Marketing Intelligence & Planning*, vol. 35, no. 1, pp. 18-39.

Rosaen, SF & Dibble, JL 2016, 'Clarifying the role of attachment and social compensation on parasocial relationships with television characters', *Communication Studies*, vol. 67, no. 2, pp. 147-162.

Rosenbaum, MS 2015, 'Transformative service research: Focus on well-being', Taylor & Francis.

Rubin, AM, Perse, EM & Powell, RA 1985, 'Loneliness, parasocial interaction, and local television news viewing', *Human Communication Research*, vol. 12, no. 2, pp. 155-180.

Rubin, RB & McHugh, MP 1987, 'Development of parasocial interaction relationships', *Journal of Broadcasting and Electronic Media*, vol. 31, no. 3, pp. 279-292.

Rust, RT 2019, 'The future of marketing', *International Journal of Research in Marketing*.

Rust, RT & Oliver, RL 1993, *Service quality: New directions in theory and practice*, Sage Publications.

Sarstedt, M, Hair Jr, JF, Nitzl, C, Ringle, CM & Howard, MC 2020, 'Beyond a tandem analysis of sem and process: Use of PLS-SEM for mediation analyses!', *International Journal of Market Research*, vol. 62, no. 3, pp. 288-299.

Seth, N, Deshmukh, SG & Vrat, P 2005, 'Service quality models: A review', *International Journal of Quality & Reliability Management*, vol. 22, no. 9, pp. 913-949.

Shankar, V 2018, 'How artificial intelligence (AI) is reshaping retailing', *Journal of Retailing*, vol. 94, no. 4, pp. vi-xi.

Shell, MA & Buell, RW 2019, 'How necessary is the human touch?', *Harvard Business Review*, vol. 97, no. 4, pp. 28-28.

Shi, S, Chen, Y & Chow, WS 2016, 'Key values driving continued interaction on brand pages in social media: An examination across genders', *Computers in Human Behavior*, vol. 62, pp. 578-589.

Sirgy, MJ, Lee, D-J & Rahtz, D 2007, 'Research on consumer well-being (CWB): Overview of the field and introduction to the special issue', *Journal of Macromarketing*, vol. 27, no. 4, pp. 341-349.

Su, L, Huang, S & Chen, X 2015, 'Effects of service fairness and service quality on tourists' behavioral intentions and subjective well-being', *Journal of Travel & Tourism Marketing*, vol. 32, no. 3, pp. 290-307.

Su, L, Swanson, SR & Chen, X 2016, 'The effects of perceived service quality on repurchase intentions and subjective well-being of Chinese tourists: The mediating role of relationship quality', *Tourism Management*, vol. 52, pp. 82-95.

Ta, V, Griffith, C, Boatfield, C, Wang, X, Civitello, M, Bader, H, DeCero, E & Loggarakis, A 2020, 'User experiences of social support from companion chatbots in everyday contexts: Thematic analysis', *Journal of medical Internet research*, vol. 22, no. 3, p. e16235.

Troebs, C-C, Wagner, T & Heidemann, F 2018, 'Transformative retail services: Elevating loyalty through customer well-being', *Journal of Retailing and Consumer Services*, vol. 45, pp. 198-206.

Troshani, I, Rao Hill, S, Sherman, C & Arthur, D 2020, 'Do we trust in AI? Role of anthropomorphism and intelligence', *Journal of Computer Information Systems*, pp. 1-11.

Tsiotsou, RH 2015, 'The role of social and parasocial relationships on social networking sites loyalty', *Computers in Human Behavior*, vol. 48, pp. 401-414.

Tukachinsky, R 2010, 'Para-romantic love and para-friendships: Development and assessment of a multiple-parasocial relationships scale', *American Journal of Media Psychology*, vol. 3, no. 1/2, pp. 73-94.

Van Der Heijden, H 2004, 'User acceptance of hedonic information systems', *MIS Quarterly*, vol. 28, no. 4, pp. 695-704.

Van Doorn, J, Mende, M, Noble, SM, Hulland, J, Ostrom, AL, Grewal, D & Petersen, JA 2017, 'Domo arigato Mr. Roboto: Emergence of automated social presence in organizational frontlines and customers' service experiences', *Journal of Service Research*, vol. 20, no. 1, pp. 43-58.

Venkatesh, V & Bala, H 2008, 'Technology acceptance model 3 and a research agenda on interventions', *Decision sciences*, vol. 39, no. 2, pp. 273-315.

Venkatesh, V, Thong, JYL & Xu, X 2012, 'Consumer acceptance and use of information technology: Extending the unified theory of acceptance and use of technology', *MIS Quarterly*, vol. 36, no. 1, pp. 157-178.

Venkatesh, V, Thong, JYL & Xu, X 2016, 'Unified theory of acceptance and use of technology: A synthesis and the road ahead', *Journal of the Association for Information Systems*, vol. 17, no. 5, pp. 328-376.

Wirtz, J, Patterson, PG, Kunz, WH, Gruber, T, Lu, VN, Paluch, S & Martins, A 2018, 'Brave new world: Service robots in the frontline', *Journal of Service Management*, vol. 29, no. 5, pp. 907-931.

Wu, J, Chen, J & Dou, W 2017, 'The internet of things and interaction style: The effect of smart interaction on brand attachment', *Journal of Marketing Management*, vol. 33, no. 1-2, pp. 61-75.

Zeithaml, VA 1988, 'Consumer perceptions of price, quality, and value: A means-end model and synthesis of evidence', *Journal of Marketing*, pp. 2-22.

Zeithaml, VA, Berry, LL & Parasuraman, A 1996, 'The behavioral consequences of service quality', *Journal of Marketing*, pp. 31-46.

Zheng, X, Men, J, Xiang, L & Yang, F 2020, 'Role of technology attraction and parasocial interaction in social shopping websites', *International Journal of Information Management*, vol. 51, no. 102043, pp. 1-13.

Zhao, X, Lynch Jr, JG & Chen, Q 2010, 'Reconsidering Baron and Kenny: Myths and truths about mediation analysis', *Journal of Consumer Research*, vol. 37, no. 2, pp. 197-206.

CHAPTER 5. THESIS CONCLUSION

5.1 Introduction

The objective of this thesis was to investigate AISA service quality and its outcomes from the perspective of consumers. Accordingly, the scope of this thesis is centered on consumer service environments. Recent studies have stressed the need to better understand AISA service quality (Bock, Wolter & Ferrell 2020; Lu et al. 2020) and address the deficiencies associated with existing service scales in evaluating AISA service quality (Meyer-Waarden et al. 2020; Morita et al. 2019). In response to this call, a significant contribution of this thesis is the development of AISAQUAL: a reliable service quality scale designed for the AISA context that is useful for researchers and practitioners. In addition, consumers too stand to benefit from the findings of this thesis. The remaining sections of this chapter will summarise these main research findings and their key implications. A discussion of the limitations of this research and future research opportunities concludes the chapter.

5.2 Summary of research findings

The three main studies of this thesis reveal and confirm the profound impact that AI has on service quality (Bock, Wolter & Ferrell 2020). Study 1 laid the groundwork with its rich qualitative insights that pointed to the potential uniqueness of AISA service quality and its combination of dimensions. This first snapshot of a distinct measurement of AISA service quality is supported by the literature that has long established the disruptive impact of the service environment on service quality perceptions (Ladhari 2009, 2010; Rust & Oliver 1993). Study 2 empirically validated this insight in the context of AISA. The establishment of anthropomorphism as a new service quality dimension lends credence to the importance of anthropomorphism in services (e.g. Benlian, Klumpe & Hinz 2019; Sheehan, Jin & Gottlieb 2020; Troshani et al. 2020; Wirtz et al. 2018). Finally, findings from Study 3 that point to the

overall benefit to consumers resulting from the interrelationships between AISA service quality, PSR, subjective well-being and loneliness support the use of AISA to manage consumer emotions and their overall affective states (Henkel et al. 2020; Odekerken-Schröder et al. 2020).

5.3 Research implications

5.3.1 Theoretical contributions

Despite a rich tradition of assessing service quality in various service environments, current service quality literature has yet to investigate the fast-emerging AISA service environment that consumers are experiencing, and the implications for AISA service quality. This thesis goes beyond conceptualising AI-based services which has been the subject of emerging research in the use of AI in service (Bock, Wolter & Ferrell 2020; Huang & Rust 2020; Wirtz et al. 2018). In the following discussion, I emphasise the main findings from each of the three studies conducted in this thesis.

Study 1 investigated the current state of consumer experiences with AISA to advance our understanding of the applicability of the service quality model in the AISA context. Through an interdisciplinary review of the services marketing and IS literatures and in-depth interviews with AISA users and experts, the framework presented in Study 1 provides a nuanced understanding of the key antecedents, dimensions, outcomes and moderators of AISA service quality as perceived by consumers. The 12 conceptual dimensions of AISA service quality as identified in Study 1 contribute to the foundation for the development of an empirical AISA service quality scale.

The growing research interest in services enabled by AISA and the continued use of AISA in service sectors makes urgent the development of a suitable AISA service quality scale (Bock, Wolter & Ferrell 2020; Lu et al. 2020). Thus, Study 2 directly responds to this call: to

the best of my knowledge, it is the first to develop an empirical service quality scale for AISA. AISAQUAL is found to consist of six dimensions and 26 item measures. AISAQUAL fills a void and extends current understanding of consumer service quality evaluations for different service environments using validated and generalisable scale instruments which can accordingly be used for further theory development (Ranjan & Read 2016). Study 2 identifies anthropomorphism as a new and significant service quality dimension in the literature. This contributes to the rich and growing literature investigating the importance of anthropomorphism in AISA services (e.g. Benlian, Klumpe & Hinz 2019; Sheehan, Jin & Gottlieb 2020; Troshani et al. 2020) including exploring the role of AISA service quality in models which anthropomorphism is present (e.g. sRAM by Wirtz et al. 2018). In addition, Study 2 confirms the theoretical relationships between service quality and customer satisfaction, perceived value and loyalty intentions in the AISA context.

One area for theory development concerns a better understanding of how AISA can help consumers to fulfil their emotional needs and sense of well-being. Based on the research agenda in Study 1, Study 3 develops and tests a theoretical model integrating PSR and subjective well-being constructs into the service quality literature for the AISA context. In investigating these affective outcomes, the results show that PSR can be activated by AISA service quality and in turn positively affect subjective well-being. This extends our understanding of how service quality affects subjective well-being (Su, Huang & Chen 2015; Su, Swanson & Chen 2016) and provides insight into how AISA service quality can contribute to affective outcomes such as PSR. Study 3 also contributes to the PSR theory by establishing AISA service quality as a new antecedent to PSR (cf. Rubin & McHugh 1987). In addition, Study 3 is a first empirical response to the call for further research into how AI-enabled services can impact consumers' well-being (Davenport et al. 2020; Lu et al. 2020) using AISA service quality. As the findings from Study 3 suggest, further research is required to better understand

how gender impacts AISA service quality and its affective outcomes of PSR and subjective well-being.

5.3.2 Managerial relevance

Findings from Study 1, 2 and 3 in this thesis provide several important considerations for both service providers and consumers. These key implications are elaborated in the discussion below.

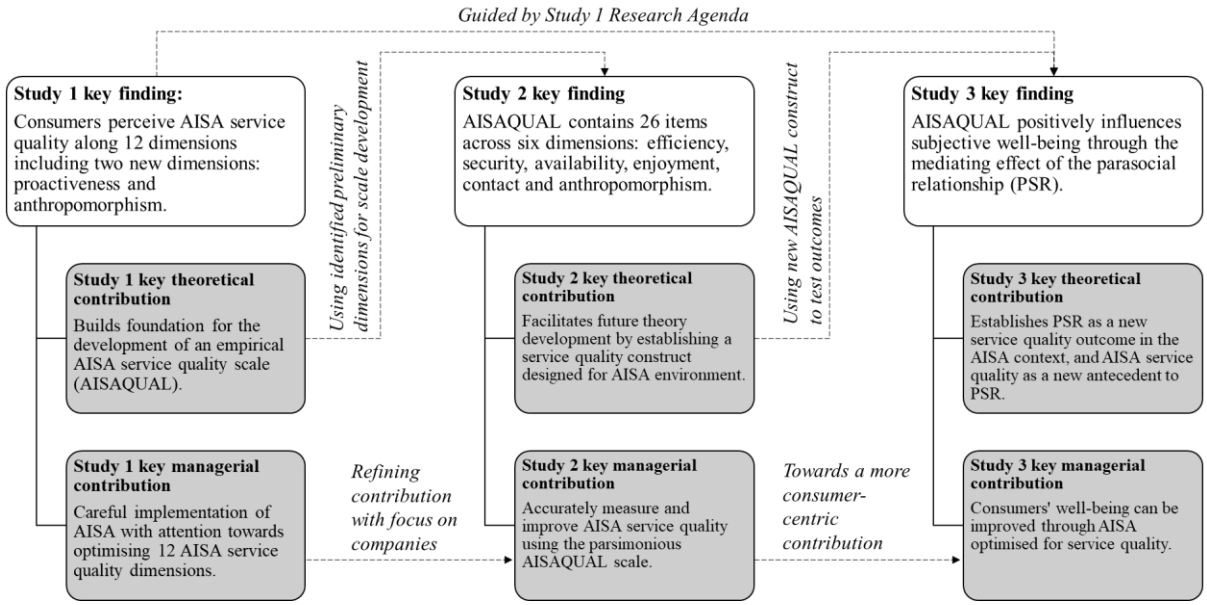
First, the initial insights on the potential dimensions of AISA service quality from Study 1 and the refinement of this measurement to produce the AISAQUAL scale in Study 2 represent continuous efforts to enable companies to use a reliable and accurate diagnostic tool to improve AISA service quality based on consumer perspectives. As the final AISAQUAL scale is parsimonious, this helps service managers to administer it to better understand customer perceptions and address service quality concerns in a systematic way. Moreover, AISAQUAL can guide the development of better AISA which specifically cater to the service expectations of consumers served by AISA.

While the proper measurement of AISA service quality using AISAQUAL can lead to commercial benefits such as satisfaction and loyalty, consumers too can have a more direct benefit from AISA service quality. As AISA service quality can increase levels of PSR which in turn can increase subjective well-being, consumers can use the six dimensions of AISA service quality to assist in their purchasing decision. In addition, consumers of different age and gender profiles can rest assured that they can use AISA to meet their hedonic needs.

Overall, insights from the studies in this thesis emphasise that the development of AISA require a focus on both the utilitarian and hedonic benefits to consumers. To cope with this emerging AISA environment, early consumer involvement and feedback are key to a better understanding of the design and system considerations that can optimise AISA service quality.

The findings also support the careful implementation of AISA together with human service agents (Paluch & Wirtz 2020), as well as the importance of building emotional bonds and trust with consumers. Figure 5-1 summarises the key findings and implications of all three studies.

Figure 5-1 Key research findings and contributions from thesis



5.4 Research limitations and future research directions

This thesis contributes to the rich service quality literature by investigating AISA service quality, developing a robust service quality scale with good psychometric properties to accommodate the new AISA service environment, as well as further investigating the affective outcomes of AISA service quality, specifically PSR and subjective well-being. Despite these insights, several overarching research limitations should be reiterated which also represents opportunities for further studies.

First, the samples used for Studies 1, 2 and 3 were based on Australia, Singapore and US consumers. As such, their perceptions may not be representative of other populations from regions where attitudes and experiences with AI may differ (Funk et al. 2020; MacDorman,

Vasudevan & Ho 2009). Thus, future research can investigate the effects that culture and national settings can have on the findings of this thesis by comparing results based on samples from different regions. As Study 3 suggests, other user characteristics including gender can also be further investigated.

Second, the effects of AISAQUAL on the outcome variables used in Studies 2 and 3 were based on a cross-sectional view. As AISA are expected to serve consumers in the long run, understanding possible shifts in attitudes over time (Hussain et al. 2019) and whether these may lead to more positive or negative outcomes is worth further investigation. Hence, this thesis recommends future longitudinal studies assess how the prolonged service performance of AISA can change consumer outcomes. In line with the literature, these longitudinal studies would employ self-reported surveys to measure consumer responses related to service quality (Hussain et al. 2019).

Third, at the time of this thesis, the AISA types most widely used by consumers are chatbots and virtual assistants. Hence, these software applications were used as suitable representative technology types for Studies 1, 2 and 3. An inspection of the measure items of the six dimensions of AISAQUAL in Study 2 suggests that the item measures might also be applicable to other AISA types including machines and robots. This thesis encourages researchers to examine how various types of AISA with different representation-value contexts as identified in the classification in Study 3, such as social robots with high physical representation and hedonic value, can affect the conclusions in this thesis. Future research can also investigate the replicability of this thesis' findings in the different service contexts in which these AISA operate. These will become increasingly important as AISA become more sophisticated and permeate more aspects of service and society.

Finally, while Study 3 answers the call of several research agenda items proposed in Study 1, many research agenda questions remain. Using the AISAQUAL scale developed in

Study 2, this thesis encourages further research to explore these many other important questions to advance our understanding of AISA service quality.

References

Benlian, A, Klumpe, J & Hinz, O 2019, 'Mitigating the intrusive effects of smart home assistants by using anthropomorphic design features: A multimethod investigation', *Information Systems Journal*, pp. 1-33.

Bock, DE, Wolter, JS & Ferrell, O 2020, 'Artificial intelligence: Disrupting what we know about services', *Journal of Services Marketing*.

Collier, JE & Bienstock, CC 2009, 'Model misspecification: Contrasting formative and reflective indicators for a model of e-service quality', *Journal of Marketing Theory and Practice*, vol. 17, no. 3, pp. 283-293.

Davenport, T, Guha, A, Grewal, D & Bressgott, T 2020, 'How artificial intelligence will change the future of marketing', *Journal of the Academy of Marketing Science*, vol. 48, no. 1, pp. 24-42.

Funk, C, Tyson, A, Kennedy, B & Johnson, C 2020, *4. Publics express a mix of views on AI, childhood vaccines, food and space issues*, Pew Research Center, viewed 13 January 2021, <https://www.pewresearch.org/science/2020/09/29/publics-express-a-mix-of-views-on-ai-childhood-vaccines-food-and-space-issues/>.

Henkel, AP, Čaić, M, Blaurock, M & Okan, M 2020, 'Robotic transformative service research: Deploying social robots for consumer well-being during covid-19 and beyond', *Journal of Service Management*.

Huang, M-H & Rust, RT 2020, 'Engaged to a robot? The role of AI in service', *Journal of Service Research*, p. 1094670520902266.

Hussain, K, Jing, F, Junaid, M, Bukhari, FAS & Shi, H 2019, 'The dynamic outcomes of service quality: A longitudinal investigation', *Journal of Service Theory and Practice*, vol. 29, no. 4, pp. 513-536.

Jarvis, CB, MacKenzie, SB & Podsakoff, PM 2003, 'A critical review of construct indicators and measurement model misspecification in marketing and consumer research', *Journal of Consumer Research*, vol. 30, no. 2, pp. 199-218.

Ladhari, R 2009, 'A review of twenty years of servqual research', *International Journal of Quality and Service Sciences*, vol. 1, no. 2, pp. 172-198.

Ladhari, R 2010, 'Developing e-service quality scales: A literature review', *Journal of Retailing and Consumer Services*, vol. 17, no. 6, pp. 464-477.

Lu, V, Wirtz, J, Kunz, W, Paluch, S, Gruber, T, Martins, A & Patterson, P 2020, 'Service robots, customers, and service employees: What can we learn from the academic literature and where are the gaps?', *Journal of Service Theory and Practice*, vol. 30, no. 3, pp. 361-391.

MacDorman, KF, Vasudevan, SK & Ho, C-C 2009, 'Does japan really have robot mania? Comparing attitudes by implicit and explicit measures', *AI & society*, vol. 23, no. 4, pp. 485-510.

MacKenzie, SB, Podsakoff, PM & Podsakoff, NP 2011, 'Construct measurement and validation procedures in mis and behavioral research: Integrating new and existing techniques', *MIS Quarterly*, vol. 35, no. 2, pp. 293-334.

Meyer-Waarden, L, Pavone, G, Poocharoentou, T, Prayatsup, P, Ratinaud, M, Tison, A & Torné, S 2020, 'How service quality influences customer acceptance and usage of chatbots?', *SMR - Journal of Service Management Research*, vol. 4, no. 1, pp. 35-51.

Morita, T, Kashiwagi, N, Yorozu, A, Suzuki, H & Yamaguchi, T 2019, 'Evaluation of a multi-robot cafe based on service quality dimensions', *The Review of Socionetwork Strategies*, pp. 1-22.

Odekerken-Schröder, G, Mele, C, Russo-Spena, T, Mahr, D & Ruggiero, A 2020, 'Mitigating loneliness with companion robots in the covid-19 pandemic and beyond: An integrative framework and research agenda', *Journal of Service Management*.

Paluch, S & Wirtz, J 2020, 'Artificial intelligence and robots in the service encounter', *SMR - Journal of Service Management Research*, vol. 4, no. 1, pp. 3-8.

Ranjan, KR & Read, S 2016, 'Value co-creation: Concept and measurement', *Journal of the Academy of Marketing Science*, vol. 44, no. 3, pp. 290-315.

Rubin, RB & McHugh, MP 1987, 'Development of parasocial interaction relationships', *Journal of Broadcasting and Electronic Media*, vol. 31, no. 3, pp. 279-292.

Rust, RT & Oliver, RL 1993, *Service quality: New directions in theory and practice*, Sage Publications.

Sheehan, B, Jin, HS & Gottlieb, U 2020, 'Customer service chatbots: Anthropomorphism and adoption', *Journal of Business Research*, vol. 115, pp. 14-24.

Su, L, Huang, S & Chen, X 2015, 'Effects of service fairness and service quality on tourists' behavioral intentions and subjective well-being', *Journal of Travel & Tourism Marketing*, vol. 32, no. 3, pp. 290-307.

Su, L, Swanson, SR & Chen, X 2016, 'The effects of perceived service quality on repurchase intentions and subjective well-being of Chinese tourists: The mediating role of relationship quality', *Tourism Management*, vol. 52, pp. 82-95.

Theodosiou, M, Katsikea, E, Samiee, S & Makri, K 2019, 'A comparison of formative versus reflective approaches for the measurement of electronic service quality', *Journal of Interactive Marketing*, vol. 47, pp. 53-67.

Troshani, I, Rao Hill, S, Sherman, C & Arthur, D 2020, 'Do we trust in AI? Role of anthropomorphism and intelligence', *Journal of Computer Information Systems*, pp. 1-11.

Wirtz, J, Patterson, PG, Kunz, WH, Gruber, T, Lu, VN, Paluch, S & Martins, A 2018, 'Brave new world: Service robots in the frontline', *Journal of Service Management*, vol. 29, no. 5, pp. 907-931.