Children and social robots

Towards a better understanding of their acceptance of a new technology

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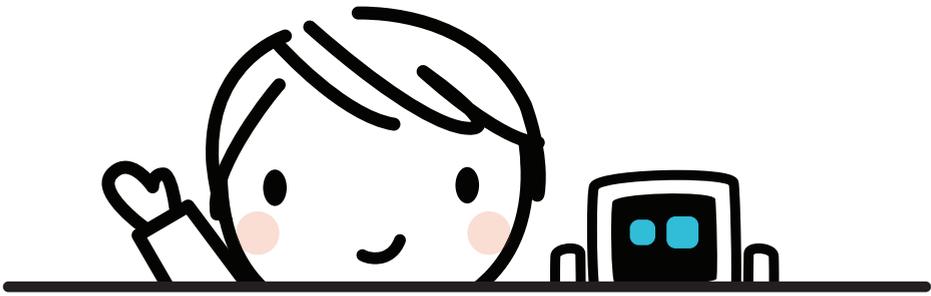**Publication date**
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General Introduction

Due to the rapid technological developments of the past decades, social robots have increasingly moved out of the lab into more naturalistic environments, such as schools and homes, and are progressively used in areas as diverse as service and entertainment (for an overview, see Bartneck et al., 2020). According to the International Federation of Robotics, the turnover of consumer service robots (also including non-social robots) grew by 16% in 2020. Robots for domestic use are the largest group of service robots with almost 18.5 million units sold in 2020 (International Federation of Robotics, 2021). In 2019, the total number of robots for entertainment already grew by 13% to 4.6 million units and is expected to grow to 6.7 million units in 2023 (International Federation of Robotics, 2020).

Social robots can be defined as robots capable of approaching human-human interaction (Broadbent, 2017). With the entry of social robots to the consumer market, and the rise of robotic toys (see also Peter et al., 2019), children have become the primary target group of social robots (Sheridan, 2020). Against this background, several researchers have predicted that social robots will play a prominent role in children's future everyday lives (e.g., Beer et al., 2011; Kahn et al., 2013; Kanda et al., 2004). In fact, social robots have initially been employed in education (for a review, see Belpaeme et al., 2018), physical therapy (for a review, see Malik et al., 2016), and autism therapy (Vanderborght et al., 2012), but also 'simply' for children's entertainment (Aaltonen et al., 2017; Neerincx et al., 2021).

However, although social robots are increasingly targeted at children, crucial questions have rarely been asked: To what extent do children accept social robots in the first place? And relatedly: Why would children accept – or reject – these social robots? And how does children's acceptance of robots evolve over time? Although straightforward, these questions are important: Without children's basic acceptance of the social robot, subsequent processes and intended effects of child-robot interaction (CRI), such as the formation of fulfilling social relationships (Kanda et al., 2007), pleasurable engagement with the robot (Belpaeme et al., 2012), or learning from a robot (Ahmad et al., 2019; Baxter et al., 2017), may not emerge. Moreover, high hopes about social robots being alternatives to humans in therapy may not materialize because, over time, children may lose interest in the robots. And plans of social robots assisting teachers in schools may not work because children reject robots (see also Kory-Westlund & Breazeal, 2019).

Although the degree of children's acceptance of robots may thus have important consequences, CRI researchers have not paid much attention to it. By and large, there seems to be a tendency in the field of CRI to uncritically assume that robots are almost universally accepted by children (see e.g., Kahn et al., 2013). Not only is there some tentative evidence that this assumption may be problematic (e.g., Kanda et al., 2004, 2007; Komatsubara et al., 2014), but it may also distort our view on what to study in CRI. Assuming that nearly all children like and accept social robots may lead to a focus on the positive aspects of CRI, such as pleasure and engagement with the robot, whereas negative aspects of CRI, such as reasons for rejecting or disliking a social robot, are neglected. Dealing with children's acceptance of social robots thus not only sheds light on a pivotal first step of children's interaction with social robots, but also broadens our understanding of CRI more generally.

Against this background, the main goal of this dissertation is to gain more knowledge on whether and why children accept a social robot and how acceptance evolves over time. In line with the literature on technology acceptance, acceptance of social robots in this dissertation is defined as the longitudinal use of the technology (i.e., behavioral acceptance) as well as the intention to use the technology longitudinally (i.e., intentional acceptance) (e.g., Davis, 1989; Heerink et al., 2010; Venkatesh et al., 2003). It is a process with different phases (see below) in which a technology may eventually be integrated in a user's (daily) life (De Graaf et al., 2018).

The Foundations of Children's Social Robot Acceptance: Advancing Theory and Measurement

To date, we lack systematic knowledge about the extent to which children accept social robots and about the antecedents of children's robot acceptance. On the one hand, this lack of systematic knowledge may be the result of the novelty of social robots. On the other hand, it may be the result of an interdisciplinary – and thus inevitably scattered – research field (for a similar observation concerning HRI more generally, see Baxter et al., 2016; Eyssel, 2017). Without such knowledge, however, we miss a sound theoretical basis upon which we can assess the state of the art of research on children's acceptance of social robots and its antecedents. Specifically, we are ill-equipped to evaluate where studies and their results converge, where they diverge, and most important, where the field has shortcomings that need to be addressed by future research. Therefore, the first objective of this dissertation is to provide a theoretical overview of children's social robot acceptance by reviewing the literature on

children's acceptance of social robots and exploring potential antecedents of acceptance.

Similar to research on other concepts in CRI (e.g., Van Straten, Kühne et al., 2020), there seems to also be little consensus on the methodological approach to social robot acceptance. Although the use of different, often incommensurable measures also applies to the broader field of HRI (e.g., Baxter et al., 2016; Eyssel, 2017), this practice makes it difficult to compare the results of studies and to draw consistent conclusions on children's acceptance of social robots. The variety of measures currently used in CRI is especially problematic for children's intentional acceptance of social robots because it constitutes – in contrast to behavioral acceptance – a latent concept which can only be measured indirectly (i.e., through indicators) and through self-report. Therefore, the second objective of this dissertation is to develop and validate a self-report measure of intentional acceptance and, thereby, contribute to a more consistent study of children's acceptance of social robots.

Broadening the View: Pre-Adoption and Acceptance Over Time

Based on the literature on adults' acceptance of social robots, and in line with the definition above, this dissertation conceptualizes acceptance as a process consisting of different phases (e.g., De Graaf et al., 2016, 2018; Rogers, 1983; Sung et al., 2010): (1) the *pre-adoption* phase during which the user, prior to actual interaction with a technology, gains knowledge on it and develops an intention to adopt it; (2) the *adoption* phase during which the user interacts with (i.e., encounters) the technology for the first time in real-life and decides whether to adopt it; (3) the *adaptation* phase during which the user continues to experience and adjust the technology to their needs to either reaffirm their adoption decision or to discontinue use of the technology; and (4) the *use/retention* phase during which the user becomes functionally dependent (i.e., *integration*) as well as emotionally attached (i.e., *identification*) to the technology. Acceptance as a process implies that, in these various stages, acceptance can manifest itself through use intention (i.e., intentional acceptance) as well as use behavior (i.e., behavioral acceptance). This process character of acceptance is also implied when we more generally speak of 'acceptance' or 'to accept' in this dissertation.

As the first step in getting in touch with a technology, the pre-adoption phase is crucial in the acceptance process. At pre-adoption (i.e., prior to adoption), the intention to start using and trying out the robot (i.e., the adoption intention)

is mainly based upon expectations and indirect experiences, such as media representations or others' descriptions of their experiences with robots. After adoption, in contrast, the decision to continue using the robot is based (mainly) upon own experiences with the robot (De Graaf et al., 2016, 2018, 2019; Ruijten & Cuijpers, 2017; Sung et al., 2010). When the conception of the robot generated in the pre-adoption phase does not match a child's experiences with it after adoption, the robot may be rejected (Fernaeus et al., 2010; Lohse, 2011; Sung et al., 2010). As an initial step in understanding children's acceptance of social robots, it is therefore essential to gain more insight into their intention to adopt the robot at pre-adoption (De Graaf et al., 2016; Ghazali et al., 2020; Rogers, 1983).

The few existing studies that center on children's intention to engage with a social robot have found that children had a strong intention to *interact* with the robot (e.g., Ferraz et al., 2016; Robert & Van Den Bergh, 2014). Except for these related studies, however, we still know very little about children's intention to *adopt* social robots. Specifically, we lack knowledge on what drives children's adoption intention and whether existing models that predict behavioral intentions more broadly are applicable to children's adoption of social robots. This is problematic because without an initial intention to adopt the robot, children are unlikely to accept a robot in the long run. Therefore, the third objective of this dissertation is to study children's intention to adopt a social robot and, more specifically, which factors contribute to this initial adoption decision.

Children's Longitudinal Social Robot Acceptance

Several scholars have observed that the fields of CRI and HRI are currently dominated by cross-sectional studies (see e.g., Bartneck et al., 2020; Baxter et al., 2016; Eyssel, 2017; Van Straten, Peter et al., 2020). It can be informative to study children's acceptance of social robots cross-sectionally, for example at its first stage, by focusing on pre-adoption or adoption. The investigation of acceptance, however, ideally relies on a longitudinal perspective to capture children's repeated and longitudinal use behavior. Moreover, there is some tentative evidence from studies on robots in educational and domestic settings that children's initial enthusiasm for social robots decreases after some time (Fernaeus et al., 2010; Kanda et al., 2004, 2007; Komatsubara et al., 2014; Salter et al., 2004). Focusing solely on single, initial interactions between children and robots may thus result in the aforementioned idea that (nearly) all children accept social robots, which may not hold true when investigated longitudinally.

Studying children's acceptance of social robots longitudinally may also extend the focus of research on children's robot acceptance to the *non*-acceptance of social robots. Understanding why children do not accept robots may ultimately be as important as understanding why they accept them: Only with such a broader view of children's acceptance of robots will we get a more encompassing impression of what social robots mean to children. Therefore, the fourth objective of this dissertation is to study children's acceptance over time and additionally investigate whether and why children may *not* accept a social robot.

Dissertation Outline

This dissertation contains four chapters with original research that iteratively build up on one another. Chapter 2 is a narrative review of the literature on children's acceptance, thus providing the theoretical basis of the dissertation. Addressing shortcomings identified in Chapter 2, Chapter 3 focuses on the development and validation of a self-report measure of intentional acceptance, thus providing a methodological foundation for the empirical investigation of children's acceptance of social robot. The study presented in Chapter 4 centers on the first stage in children's robot acceptance, that is, pre-adoption, relying on the measure from Chapter 3 adjusted to the purposes of the study. Based on insights gained in Chapter 4, Chapter 5 deals with children's social robot acceptance over time. The dissertation concludes with a general discussion of the findings and their implications.

Chapter 2: What Do We Know About Children's Acceptance of Social Robots?

As mentioned before, there is little systematic knowledge about children's acceptance of social robots in general and its antecedents in particular. To fill this research gap, the first chapter of this dissertation provides a narrative review of the literature on children's acceptance of social robots published between 2000 and 2017. The review focuses on the extent to which children accept social robots and systematizes the literature in terms of potential antecedents of children's intentional and behavioral social robot acceptance. Specifically, the review centers on four groups of antecedents: robot, user, interaction, and methodological characteristics. Finally, the review also evaluates theoretical and methodological shortcomings in extant research. The results of this review, and notably the shortcomings identified, provide the rationale for the remaining chapters of this dissertation.

Chapter 3: A Self-Report Measure for Children's Intentional Acceptance

Similar to research in CRI (e.g., Kory-Westlund & Breazeal, 2019; Van Straten, Peter et al., 2020) and HRI more generally (e.g., Baxter et al., 2016; Eyssel, 2017), the conceptual and methodological approaches to the study of children's intentional acceptance of social robots are not only diverse but also often incomparable and inconsistent. Against this background and based on insights gained in Chapter 2, Chapter 3 develops and validates a 4-item self-report measure for children's intentional acceptance of social robots. The goal of establishing this reliable and valid measure is to facilitate a more consistent approach in studying children's acceptance of social robots. The measure provides the basis for the self-report measure of adoption intention in Chapter 4.

Chapter 4: A Model of Children's Intention to Adopt Social Robots

Previous research suggests that children seem to be enthusiastic to interact with social robots, especially in initial interactions (e.g., Breazeal, Dautenhahn, et al., 2016; Park et al., 2017; Kory-Westlund et al., 2016). However, due to several methodological and theoretical shortcomings in the field, we know little about what predicts the first phase in the acceptance process, that is pre-adoption. Building on the Theory of Planned Behavior (Ajzen, 1991), the fourth chapter aims at developing and testing a model of children's intention to adopt a social robot at home, using data from a representative survey among 570 children aged 8 to 9. Specifically, Chapter 4 focuses on two groups of distal predictors: personal and contextual factors. It investigates, by means of structural equation modelling, whether the association of these distal predictors with children's intention to adopt the social robot is mediated by three proximal antecedents: attitudes, social norms, and self-efficacy. Several insights generated in Chapter 4, such as the importance of studying acceptance longitudinally and focusing on behavioral acceptance, serve as a basis for Chapter 5.

Chapter 5: Children's (Non-)Acceptance of Social Robots Over Time

As mentioned above, the majority of previous studies in CRI is cross-sectional with the result of potentially flawed assumptions about children's acceptance of social robots (for a similar claim in HRI, see Bartneck et al., 2020). Against this background, Chapter 5 describes the follow-up study to Chapter 4 in which children received the social robot Cozmo to play with it at home over the course of eight weeks. Based on four waves from a six-wave panel study among 321 children aged 8 to 9, the fifth chapter aims to gain more insight into

children's longitudinal acceptance of domestic social robots, different types of (non-)users; and reasons why children may not accept a social robot. Moreover, Chapter 5 explores a potential discrepancy between a self-report measure, which is usually easier to implement but at the same time may suffer from several shortcomings (e.g., social desirability bias; Fisher, 1993; Tourangeau et al., 2000), and an observational measure of children's behavioral acceptance of social robots (see e.g., Eyssel, 2017). Overall, Chapter 5 thus presents a longitudinal look at children's acceptance of social robots that generates important insights for our theoretical, but also practical understanding of it.

References

Aaltonen, I., Arvola, A., Heikkilä, P., & Lammi, H. (2017). Hello Pepper, may I tickle you? *Proceedings of the Companion of the 2017 ACM/IEEE International Conference on Human-Robot Interaction '17*, 53–54. https://doi.org/10.1145/3029798.3038362

Ahmad, M. I., Mubin, O., Shahid, S., & Orlando, J. (2019). Robot's adaptive emotional feedback sustains children's social engagement and promotes their vocabulary learning: A long-term child–robot interaction study. *Adaptive Behavior*, *27*(4), 243–266. https://doi.org/10.1177/1059712319844182

Ajzen, I. (1991). The theory of planned behavior. *Orgnizational Behavior and Human Decision Processes*, *50*, 179–211. https://doi.org/10.1016/0749-5978(91)90020-T

Bartneck, C., Belpaeme, T., Eyssel, F., Kanda, T., Keijsers, M., & Šabanović, S. (2020). Applications. In *Human-Robot Interaction - An Introduction* (pp. 161–184). Cambridge University Press. https://doi.org/10.1017/9781108676649

Baxter, P., Ashurst, E., Read, R., Kennedy, J., & Belpaeme, T. (2017). Robot education peers in a situated primary school study: Personalisation promotes child learning. *PLoS ONE*, *12*(5), 1–23. https://doi.org/10.1371/journal.pone.0178126

Baxter, P., Kennedy, J., Senft, E., Lemaignan, S., & Belpaeme, T. (2016). From characterising three years of HRI to methodology and reporting recommendations. *Proceedings of the 11th International Conference on Human-Robot Interaction*, 391–398. https://doi.org/10.1109/HRI.2016.7451777

Beer, J. M., Prakash, A., Mitzner, T. L., & Rogers, W. A. (2011). *Understanding robot acceptance* (Report No. HFA-TR-1103). Georgia Institute of Technology. https://smartech.gatech.edu/bitstream/handle/1853/39672/HFA-TR-1103-RobotAcceptance.pdf

Belpaeme, T., Baxter, P. E., Read, R., Wood, R., Cuayáhuitl, H., Kiefer, B., Racioppa, S., Kruijff-Korbayová, I., Athanasopoulos, G., Enescu, V., Looije, R., Neerincx, M., Demiris, Y., Ros-Espinoza, R., Beck, A., Cañamero, L., Hiolle, A., Lewis, M., Baroni, I., … Humbert, R. (2012). Multimodal child-robot interaction: Building social bonds. *Journal of Human-Robot Interaction*, *1*(2), 33–53. https://doi.org/10.5898/jhri.1.2.belpaeme

Belpaeme, T., Kennedy, J., Ramachandran, A., Scassellati, B., & Tanaka, F. (2018). Social robots for education: A review. *Science Robotics*, *3*(21), 1–10. https://doi.org/10.1126/scirobotics.aat5954

Breazeal, C., Dautenhahn, K., & Kanda, T. (2016). Social Robotics. In B. Siciliano & O. Khatib (Eds.), *Springer Handbook of Robotics* (pp. 1935–1972). Springer. https://doi.org/10.1007/978-3-319-32552-1

Broadbent, E. (2017). Interactions with robots: The truths we reveal about ourselves. *Annual Review of Psychology*, *68*, 627–652. https://doi.org/10.1146/annurev-psych-010416-043958

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of social robots. *MIS Quarterly*, *13*(3), 319–340. https://doi.org/10.2307/249008

De Graaf, M. M. A., Ben Allouch, S., & Van Dijk, J. A. G. M. (2016). Long-term evaluation of a social robot in real homes. *Interaction Studies*, *17*(3), 461–491. https://doi.org/10.1075/is.17.3.08deg

De Graaf, M. M. A., Ben Allouch, S., & Van Dijk, J. A. G. M. (2018). A phased framework for long-term user acceptance of interactive technology in domestic environments. *New Media & Society*, *20*(7), 2582–2603. https://doi.org/10.1177/1461444817727264

De Graaf, M. M. A., Ben Allouch, S., & Van Dijk, J. A. G. M. (2019). Why would I use this in my home? A model of domestic social robot acceptance. *Human-Computer Interaction*, *34*(2), 115–173. https://doi.org/10.1080/07370024.2017.1312406

Eyssel, F. (2017). An experimental psychological perspective on social robotics. *Robotics and Autonomous Systems*, *87*, 363–371. https://doi.org/10.1016/j.robot.2016.08.029

Fernaeus, Y., Håkansson, M., Jacobsson, M., & Ljungblad, S. (2010). How do you play with a robot toy animal? *Proceedings of the 9th International Conference on Interaction Design and Children*, 39–48. https://doi.org/10.1145/1810543.1810549

Ferraz, M., Câmara, A., & O'Neill, A. (2016). Increasing children's physical activity levels through biosymtic robotic devices. *Proceedings of the 13th International Conference on Advances in Computer Entertainment Technology*, Article 2. https://doi.org/10.1145/3001773.3001781

Fisher, R. J. (1993). Social desirability bias and the validity of indirect questioning. *Journal of Consumer Research*, *20*(2), 303–315. https://doi.org/10.1086/209351

Ghazali, A. S., Ham, J., Barakova, E., & Markopoulos, P. (2020). Persuasive Robots Acceptance Model (PRAM): Roles of social responses within the acceptance model of persuasive robots. *International Journal of Social Robotics*, *12*(5), 1075–1092. https://doi.org/10.1007/s12369-019-00611-1

Heerink, M., Kröse, B. J. A., Evers, V., & Wielinga, B. J. (2010). Assessing acceptance of assistive social agent technology by older adults: The Almere model. *International Journal of Social Robotics*, 2(4), 361–375. https://doi.org/10.1007/s12369-010-0068-5

International Federation of Robotics. (2020). *Executive Summary WR Service Robots*. https://ifr.org/img/worldrobotics/Executive_Summary_WR_2020_Service_Robots.pdf

International Federation of Robotics. (2021, Nov 04). *"Service Robots" Hit Double Digit Growth Worldwide* [Press release]. https://ifr.org/ifr-press-releases/news/service-robots-hit-double-digit-growth-worldwide

Kahn, P. H., Gary, H. E., & Shen, S. (2013). Children's social relationships with current and near-future robots. *Child Development Perspectives*, *7*(1), 32–37. https://doi.org/10.1111/cdep.12011

Kanda, T., Hirano, T., Eaton, D., & Ishiguro, H. (2004). Interactive robots as social partners and peer tutors for children: A field trial. *Human-Computer Interaction*, *19*(1), 61–84. https://doi.org/10.1207/s15327051hci1901&2_4

Kanda, T., Sato, R., Saiwaki, N., & Ishiguro, H. (2007). A two-month field trial in an elementary school for long-term human-robot interaction. *IEEE Transactions on Robotics*, *23*(5), 962–971. https://doi.org/10.1109/TRO.2007.904904

Komatsubara, T., Shiomi, M., Kanda, T., Ishiguro, H., & Hagita, N. (2014). Can a social robot help children's understanding of science in classrooms? *Proceedings of the 2nd International Conference on Human-Agent Interaction*, 83–90. https://doi.org/10.1145/2658861.2658881

Kory-Westlund, J. M., & Breazeal, C. (2019). Assessing children's perceptions and acceptance of a social robot. *Proceedings of the 18th ACM International Conference on Interaction Design and Children*, 38–50. https://doi.org/10.1145/3311927.3323143

Kory-Westlund, J. M., Martinez, M., Archie, M., Das, M., & Breazeal, C. (2016). Effects of framing a robot as a social agent or as a machine on children's social behavior. *Proceedings of the 25th International Symposium on Robot and Human Interactive Communication*, 688–693. https://doi.org/10.1109/ROMAN.2016.7745193

Lohse, M. (2011). Bridging the gap between users' expectations and system evaluations. *Proceedings of the IEEE International Workshop on Robot and Human Interactive Communication*, 485–490. https://doi.org/10.1109/ROMAN.2011.6005252

Malik, N. A., Hanapiah, F. A., Rahman, R. A. A., & Yussof, H. (2016). Emergence of socially assistive robotics in rehabilitation for children with Cerebral Palsy: A review. *International Journal of Advanced Robotic Systems*, *13*(3), 1–7. https://doi.org/10.5772/64163

Neerincx, A., Hiwat, T., & De Graaf, M. (2021). Social robot for health check and entertainment in waiting room: Child's engagement and parent's involvement. *Adjunct Proceedings of the 29th ACM Conference on User Modeling, Adaptation and Personalization*, 120–125. https://doi.org/10.1145/3450614.3463413

Park, H. W., Gelsomini, M., Lee, J. J., & Breazeal, C. (2017). Telling stories to robots: The effect of backchanneling on a child's storytelling. *Proceedings of the 12th ACM/IEEE International Conference on Human-Robot Interaction*, 100–108. https://doi.org/10.1145/2909824.3020245

Peter, J., Kühne, R., Barco, A., De Jong, C., & Van Straten, C. L. (2019). Asking today the crucial questions of tomorrow: Social robots and the Internet of Toys. In G. Mascheroni & D. Holloway (Eds.), *The Internet of Toys. Practices, Affordances and the Political Economy of Children's Smart Play* (pp. 25–46). Palgrave MacMillan. https://doi.org/10.1007/978-3-030-10898-4

Robert, D., & Van Den Bergh, V. (2014). Children's openness to interacting with a robot scale (COIRS). *Proceedings of the 23rd IEEE International Symposium on Robot and Human Interactive Communication*, 930–935. https://doi.org/10.1109/ROMAN.2014.6926372

Rogers, E. M. (1983). *Diffusion of innovations* (3rd ed.). The Free Press, New York.

Ruijten, P., & Cuijpers, R. (2017). Dynamic perceptions of human-likeness while interacting with a social robot. *Proceedings of the Companion of the 2017 ACM/IEEE International Conference on Human-Robot Interaction*, 273–274. https://doi.org/10.1145/3029798.3038361

Salter, T., Dautenhahn, K., & Boekhorst, R. Te. (2004). Robots moving out of the laboratory - Detecting interaction levels and human contact in noisy school environments. *Proceedings of the 13th IEEE International Workshop on Robot and Human Interactive Communication*, 563–568. https://doi.org/10.1109/roman.2004.1374822

Sheridan, T. B. (2020). A review of recent research in social robotics. *Current Opinion in Psychology*, *36*, 7–12. https://doi.org/10.1016/j.copsyc.2020.01.003

Sung, J. Y., Grinter, R. E., & Christensen, H. I. (2010). Domestic robot ecology: An initial framework to unpack long-term acceptance of robots at home. *International Journal of Social Robotics*, *2*(4), 417–429. https://doi.org/10.1007/s12369-010-0065-8

Tourangeau, R., Rips, L. J., & Rasinski, K. (2000). *The psychology of survey response*. Cambridge University Press. https://doi.org/10.1017/CBO9780511819322

Van Straten, C. L., Kühne, R., Peter, J., De Jong, C., & Barco, A. (2020). Closeness, trust, and perceived social support in child-robot relationship formation: Development and validation of three self-report scales. *Interaction Studies*, *21*(1), 57-84. https://doi.org/10.1075/is.18052.str

Van Straten, C. L., Peter, J., & Kühne, R. (2020). Child–robot relationship formation: A narrative review of empirical research. *International Journal of Social Robotics*, *12*(2), 325–344. https://doi.org/10.1007/s12369-019-00569-0

Vanderborght, B., Simut, R., Saldien, J., A. Pop, C., Rusu, A. S., Pintea, S., Lefeber, D., & David, D. O. (2012). Using the social robot probo as a social story telling agent for children with ASD. *Interaction Studies*, *13*(3), 348–372. https://doi.org/10.1075/is.13.3.02van

Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. *MIS Quarterly*, *27*(3), 425–478. https://doi.org/10.2307/30036540