## REFERENCES

- J. L. Jones, N. E. Mack, D. M. Nugent, and P. E. Sandin, "Autonomous floor-cleaning robot," Apr. 18 2017. US Patent 9,622,635.
- [2] L. Pineda, T. Takahashi, H.-T. Jung, S. Zilberstein, and R. Grupen, "Continual planning for search and rescue robots," in *IEEE-RAS 15th International Conference on Humanoid Robots (Humanoids)*, pp. 243–248, IEEE, 2015.
- [3] N. Doering, S. Poeschl, H.-M. Gross, A. Bley, C. Martin, and H.-J. Boehme, "User-centered design and evaluation of a mobile shopping robot," *International Journal of Social Robotics*, vol. 7, no. 2, pp. 203–225, 2015.
- [4] T. Tanioka, K. Osaka, R. Locsin, Y. Yasuhara, and H. Ito, "Recommended design and direction of development for humanoid nursing robots perspective from nursing researchers," *Intelligent Control and Automation*, vol. 8, no. 02, p. 96, 2017.
- [5] J. Albo-Canals, A. B. Martelo, E. Relkin, D. Hannon, M. Heerink, M. Heinemann, K. Leidl, and M. U. Bers, "A pilot study of the kibo robot in children with severe asd," *International Journal of Social Robotics*, vol. 10, no. 3, pp. 371–383, 2018.
- [6] S. Andrist, X. Z. Tan, M. Gleicher, and B. Mutlu, "Conversational gaze aversion for humanlike robots," in *Proceedings of the 2014 ACM/IEEE* international conference on Human-robot interaction, pp. 25–32, ACM, 2014.
- [7] J. Goetz, S. Kiesler, and A. Powers, "Matching robot appearance and behavior to tasks to improve human-robot cooperation," in *Proceedings* of the 12th IEEE international workshop on robot and human interactive communication, pp. 55–60, IEEE Press Piscataway, NJ, 2003.

- [8] I. Leite, C. Martinho, and A. Paiva, "Social robots for long-term interaction: a survey," *International Journal of Social Robotics*, vol. 5, no. 2, pp. 291–308, 2013.
- [9] J. Bongard, "Using robots to investigate the evolution of adaptive behavior," *Current opinion in behavioral sciences*, vol. 6, pp. 168–173, 2015.
- [10] H. A. Karim, A. M. Lokman, and F. Redzuan, "Older adults perspective and emotional respond on robot interaction," in 4th International Conference on User Science and Engineering (i-USEr), pp. 95–99, IEEE, 2016.
- [11] D. Stavrou, D. G. Eliades, C. G. Panayiotou, and M. M. Polycarpou, "Fault detection for service mobile robots using model-based method," *Autonomous Robots*, vol. 40, no. 2, pp. 383–394, 2016.
- [12] P. Liu, D. F. Glas, T. Kanda, H. Ishiguro, and N. Hagita, "A model for generating socially-appropriate deictic behaviors towards people," *International Journal of Social Robotics*, vol. 9, no. 1, pp. 33–49, 2017.
- [13] I. Pedersen, S. Reid, and K. Aspevig, "Developing social robots for aging populations: A literature review of recent academic sources," *Sociology Compass*, vol. 12, no. 6, p. e12585, 2018.
- [14] M. G. Rashed, D. Das, Y. Kobayashi, and Y. Kuno, "A study on proactive methods for initiating interaction with human by social robots," Asian Journal for Convergence in Technology, 2018.
- [15] J. Navarro and M. Karlins, What Every Body Is Saying. William Morrow Paperbacks, 2008.
- [16] C. A. Smarr, T. L. Mitzner, J. M. Beer, A. Prakash, T. L. Chen, C. C. Kemp, and W. A. Rogers, "Domestic robots for older adults: attitudes, preferences, and potential," *International journal of social robotics*, vol. 6, no. 2, pp. 229–247, 2014.
- [17] J. D. Mayer, P. Salovey, and D. R. Caruso, "Target articles:" emotional intelligence: theory, findings, and implications"," *Psychological inquiry*, vol. 15, no. 3, pp. 197–215, 2004.
- [18] B. Scassellati, "Theory of mind for a humanoid robot," Autonomous Robots, vol. 12, no. 1, pp. 13–24.

- [19] S. K. Card, The psychology of human-computer interaction. CRC Press, 2017.
- [20] O. C. Görür, B. S. Rosman, G. Hoffman, and S. Albayrak, "Toward integrating theory of mind into adaptive decision-making of social robots to understand human intention," 2017.
- [21] C. Breazeal, "Social interactions in hri: the robot view," *IEEE Transactions on Systems, Man, and Cybernetics, Part C (Applications and Reviews)*, vol. 34, no. 2, pp. 181–186, 2004.
- [22] S. Strohkorb and B. Scassellati, "Promoting Collaboration with Social Robots," in *The Eleventh ACM/IEEE International Conference on Human Robot Interation*, pp. 639–640, IEEE Press, 2016.
- [23] G. Hoffman and C. Breazeal, "Robotic partners' bodies and minds: An embodied approach to fluid human-robot collaboration," *Cognitive Robotics*, 2006.
- [24] M. N. Nicolescu and M. J. Mataric, "Learning and interacting in human-robot domains," *IEEE Transactions on Systems, man, and Cybernetics-part A: Systems and Humans*, vol. 31, no. 5, pp. 419–430, 2001.
- [25] H. Gunes and M. Piccardi, "Bi-modal emotion recognition from expressive face and body gestures," *Journal of Network and Computer Applications*, vol. 30, pp. 1334–1345, Nov. 2007.
- [26] M. P. Michalowski, S. Sabanovic, and R. Simmons, "A spatial model of engagement for a social robot," in 9th IEEE International Workshop on Advanced Motion Control, 2006., pp. 762–767, IEEE, 2006.
- [27] C. H. Chen and P. S.-P. Wang, eds., Handbook of pattern recognition and computer vision. River Edge, NJ: World Scientific, 3rd ed ed., 2005.
- [28] H. Hüttenrauch, K. S. Eklundh, A. Green, and E. A. Topp, "Investigating spatial relationships in human-robot interaction," in *Intelligent Robots and* Systems, 2006 IEEE/RSJ International Conference on, pp. 5052–5059, IEEE, 2006.
- [29] Göller, Michael and Steinhardt, Florian and Kerscher, Thilo and Zöllner, J Marius and Dillmann, Rüdiger, "Proactive avoidance of moving obstacles

for a service robot utilizing a behavior-based control," in 2010 IEEE/RSJ International Conference on Intelligent Robots and Systems, pp. 5984–5989, IEEE, 2010.

- [30] R. M. Downs and D. Stea, Image and environment: Cognitive mapping and spatial behavior. Transaction Publishers, 1974.
- [31] M. W. and, "Proactive multimodal perception for feature based anchoring of complex objects," in 2007 IEEE International Conference on Robotics and Biomimetics (ROBIO), pp. 1069–1074, Dec 2007.
- [32] A. Sabnis, G. Arunkumar, V. Dwaracherla, and L. Vachhani, "Probabilistic approach for visual homing of a mobile robot in the presence of dynamic obstacles," *IEEE Transactions on Industrial Electronics*, vol. 63, no. 9, pp. 5523–5533, 2016.
- [33] K. Dautenhahn, "Socially intelligent robots: dimensions of human-robot interaction," *Philosophical Transactions of the Royal Society B: Biological Sciences*, vol. 362, no. 1480, pp. 679–704, 2007.
- [34] T. Fong, I. Nourbakhsh, and K. Dautenhahn, "A survey of socially interactive robots," *Robotics and autonomous systems*, vol. 42, no. 3-4, pp. 143–166, 2003.
- [35] A. Bruce, I. Nourbakhsh, and R. Simmons, "The role of expressiveness and attention in human-robot interaction," in *Robotics and Automation*, 2002. Proceedings. ICRA'02. IEEE International Conference on, vol. 4, pp. 4138–4142, IEEE, 2002.
- [36] J. Scholtz, "Theory and evaluation of human robot interactions," in System Sciences, 2003. Proceedings of the 36th Annual Hawaii International Conference on, pp. 10–pp, IEEE, 2003.
- [37] C. Ray, F. Mondada, and R. Siegwart, "What do people expect from robots?," in *Intelligent Robots and Systems*, 2008. IROS 2008. IEEE/RSJ International Conference on, pp. 3816–3821, IEEE, 2008.
- [38] M. Heerink, B. Vanderborght, J. Broekens, and J. Albó-Canals, "New Friends: Social Robots in Therapy and Education," *International Journal* of Social Robotics, vol. 8, pp. 443–444, Aug. 2016.

- [39] B. Robins, K. Dautenhahn, R. T. Boekhorst, and A. Billard, "Robotic assistants in therapy and education of children with autism: can a small humanoid robot help encourage social interaction skills?," Universal Access in the Information Society, vol. 4, pp. 105–120, Dec. 2005.
- [40] C. L. Sidner, C. Lee, L.-P. Morency, and C. Forlines, "The effect of head-nod recognition in human-robot conversation," in *Proceedings of the 1st ACM SIGCHI/SIGART conference on Human-robot interaction*, pp. 290–296, ACM, 2006.
- [41] C. D. Kidd and C. Breazeal, "Robots at home: Understanding long-term human-robot interaction," in *Intelligent Robots and Systems*, 2008. IROS 2008. IEEE/RSJ International Conference on, pp. 3230–3235, IEEE, 2008.
- [42] R. C. Arkin, M. Fujita, T. Takagi, and R. Hasegawa, "An ethological and emotional basis for human-robot interaction," *Robotics and Autonomous Systems*, vol. 42, no. 3-4, pp. 191–201, 2003.
- [43] B. Mutlu, T. Shiwa, T. Kanda, H. Ishiguro, and N. Hagita, "Footing in human-robot conversations: how robots might shape participant roles using gaze cues," in *Proceedings of the 4th ACM/IEEE international conference* on Human robot interaction, pp. 61–68, ACM, 2009.
- [44] C. L. Sidner, C. D. Kidd, C. Lee, and N. Lesh, "Where to look: a study of human-robot engagement," in *Proceedings of the 9th international conference* on *Intelligent user interfaces*, pp. 78–84, ACM, 2004.
- [45] S. Satake, T. Kanda, D. F. Glas, M. Imai, H. Ishiguro, and N. Hagita, "How to approach humans?: strategies for social robots to initiate interaction," in *Proceedings of the 4th ACM/IEEE international conference on Human robot interaction*, pp. 109–116, ACM, 2009.
- [46] E. Aguirre, M. Garcia-Silvente, A. González, R. Paúl, and R. Munyoz, "A Fuzzy System for Detection of Interaction Demanding and Nodding Assent Based on Stereo Vision," *Journal of Physical Agents*, vol. 1, no. 1, pp. 15–26, 2007.
- [47] A. Fern'ndez-Baena, A. Susin, and X. Lligadas, "Biomechanical Validation of Upper-Body and Lower-Body Joint Movements of Kinect Motion Capture Data for Rehabilitation Treatments," pp. 656–661, IEEE, Sept. 2012.

- [48] M. L. Walters, D. S. Syrdal, K. L. Koay, K. Dautenhahn, and R. Te Boekhorst, "Human approach distances to a mechanical-looking robot with different robot voice styles," in *RO-MAN 2008-The 17th IEEE International Symposium on Robot and Human Interactive Communication*, pp. 707–712, IEEE, 2008.
- [49] P. A. Hancock, D. R. Billings, K. E. Schaefer, J. Y. Chen, E. J. De Visser, and R. Parasuraman, "A meta-analysis of factors affecting trust in human-robot interaction," *Human Factors*, vol. 53, no. 5, pp. 517–527, 2011.
- [50] K. Pitsch, H. Kuzuoka, Y. Suzuki, L. Sussenbach, P. Luff, and C. Heath, ""the first five seconds": Contingent stepwise entry into an interaction as a means to secure sustained engagement in hri," in *Robot and Human Interactive Communication, 2009. RO-MAN 2009. The 18th IEEE International Symposium on*, pp. 985–991, IEEE, 2009.
- [51] Z. Zhang, "Microsoft kinect sensor and its effect," *IEEE multimedia*, vol. 19, no. 2, pp. 4–10, 2012.
- [52] E. Grigore, A. Roncone, O. Mangin, and B. Scassellati, "Preference-based assistance prediction for human-robot collaboration tasks," in *Intelligent Robots and Systems (IROS)*, 2018.
- [53] E. C. Grigore, O. Mangin, A. Roncone, and B. Scassellati, "Predicting supportive behaviors for human-robot collaboration," in *Proceedings of* the 17th International Conference on Autonomous Agents and MultiAgent Systems, pp. 2186–2188, International Foundation for Autonomous Agents and Multiagent Systems, 2018.
- [54] T. Stipancic, B. Jerbic, and P. Curkovic, "A context-aware approach in realization of socially intelligent industrial robots," *Robotics and computer-integrated manufacturing*, vol. 37, pp. 79–89, 2016.
- [55] A. M. von der Pütten, N. C. Krämer, C. Becker-Asano, K. Ogawa, S. Nishio, and H. Ishiguro, "At the cafe—exploration and analysis of people's nonverbal behavior toward an android," *Geminoid Studies: Science and Technologies* for Humanlike Teleoperated Androids, pp. 375–397, 2018.
- [56] S. Andrist, B. Mutlu, and A. Tapus, "Look like me: matching robot personality via gaze to increase motivation," in 33rd annual ACM conference on human factors in computing systems, pp. 3603–3612, ACM, 2015.

- [57] J. S. Hu, J. J. Wang, and D. M. Ho, "Design of sensing system and anticipative behavior for human following of mobile robots," *IEEE Transactions on Industrial Electronics*, vol. 61, no. 4, pp. 1916–1927, 2014.
- [58] C. Liang, L. Qi, and L. Guan, "Motion energy guided multi-scale heterogeneous features for 3d action recognition," in *Visual Communications* and Image Processing (VCIP), 2017 IEEE, pp. 1–4, IEEE, 2017.
- [59] M. Moradi, M. Moradi, and F. Bayat, "On robot acceptance and adoption a case study," in 2018 8th Conference of AI & Robotics and 10th RoboCup Iranopen International Symposium (IRANOPEN), IEEE, 2018.
- [60] N. Mavridis, "A review of verbal and non-verbal human-robot interactive communication," *Robotics and Autonomous Systems*, vol. 63, pp. 22–35, 2015.
- [61] B. van den Brink, Z. Yumak, et al., "Social gaze model for an interactive virtual character," in *International Conference on Intelligent Virtual Agents*, pp. 451–454, Springer, 2017.
- [62] M. Bennewitz, F. Faber, D. Joho, M. Schreiber, and S. Behnke, "Towards a humanoid museum guide robot that interacts with multiple persons," in *Humanoid Robots*, 2005 5th IEEE-RAS International Conference on, pp. 418–423, IEEE, 2005.
- [63] R. Mead and M. J. Matarić, "Proxemics and performance: Subjective human evaluations of autonomous sociable robot distance and social signal understanding," in *Intelligent Robots and Systems (IROS)*, 2015 IEEE/RSJ International Conference on, pp. 5984–5991, IEEE, 2015.
- [64] R. Mead and M. J. Matari, "Autonomous human-robot proxemics: socially aware navigation based on interaction potential," *Autonomous Robots*, vol. 41, no. 5, pp. 1189–1201, 2017.
- [65] M. Strait, C. Canning, and M. Scheutz, "Let me tell you! investigating the effects of robot communication strategies in advice-giving situations based on robot appearance, interaction modality and distance," in *Proceedings of the 2014 ACM/IEEE international conference on Human-robot interaction*, pp. 479–486, ACM, 2014.

- [66] T. Kanda, M. Shiomi, Z. Miyashita, H. Ishiguro, and N. Hagita, "An affective guide robot in a shopping mall," in *Human-Robot Interaction (HRI)*, 2009 4th ACM/IEEE International Conference on, pp. 173–180, IEEE, 2009.
- [67] A. Birk, "Robot learning and self-sufficiency: What the energy-level can tell us about a robot's performance," in *European Workshop on Learning Robots*, pp. 109–125, Springer, 1997.
- [68] J. Peltason and B. Wrede, "Pamini: A framework for assembling mixed-initiative human-robot interaction from generic interaction patterns," in *Proceedings of the 11th annual meeting of the special interest group* on discourse and dialogue, pp. 229–232, Association for Computational Linguistics, 2010.
- [69] A. Bauer, K. Klasing, G. Lidoris, Q. Mühlbauer, F. Rohrmüller, S. Sosnowski, T. Xu, K. Kühnlenz, D. Wollherr, and M. Buss, "The autonomous city explorer: Towards natural human-robot interaction in urban environments," *International Journal of Social Robotics*, vol. 1, no. 2, pp. 127–140, 2009.
- [70] M. L. Spekman, E. A. Konijn, and J. F. Hoorn, "Perceptions of healthcare robots as a function of emotion-based coping: The importance of coping appraisals and coping strategies," *Computers in Human Behavior*, vol. 85, pp. 308–318, 2018.
- [71] P. H. Kahn, H. Ishiguro, B. Friedman, and T. Kanda, "What is a human?-toward psychological benchmarks in the field of human-robot interaction," in *Robot and Human Interactive Communication*, 2006. *ROMAN 2006. The 15th IEEE International Symposium on*, pp. 364–371, IEEE, 2006.
- [72] M. L. Walters, D. S. Syrdal, K. Dautenhahn, R. Te Boekhorst, and K. L. Koay, "Avoiding the uncanny valley: robot appearance, personality and consistency of behavior in an attention-seeking home scenario for a robot companion," *Autonomous Robots*, vol. 24, no. 2, pp. 159–178, 2008.
- [73] C. Rich, B. Ponsler, A. Holroyd, and C. L. Sidner, "Recognizing engagement in human-robot interaction," in *Human-Robot Interaction (HRI)*, 2010 5th ACM/IEEE International Conference on, pp. 375–382, IEEE, 2010.

- [74] E. Martinson and D. Brock, "Improving human-robot interaction through adaptation to the auditory scene," in *Human-Robot Interaction (HRI)*, 2007 2nd ACM/IEEE International Conference on, pp. 113–120, IEEE, 2007.
- [75] O. A. I. Ramírez, H. Khambhaita, R. Chatila, M. Chetouani, and R. Alami, "Robots learning how and where to approach people," in *Robot and Human Interactive Communication (RO-MAN)*, 2016 25th IEEE International Symposium on, pp. 347–353, IEEE, 2016.
- [76] K. Fischer, L. C. Jensen, S.-D. Suvei, and L. Bodenhagen, "Between legibility and contact: The role of gaze in robot approach," in *Robot and Human Interactive Communication (RO-MAN), 2016 25th IEEE International Symposium on*, pp. 646–651, IEEE, 2016.
- [77] M. A. Yousuf, Y. Kobayashi, Y. Kuno, A. Yamazaki, and K. Yamazaki, "How to move towards visitors: A model for museum guide robots to initiate conversation," in *RO-MAN*, 2013 IEEE, pp. 587–592, IEEE, 2013.
- [78] S. Oishi, Y. Kohari, and J. Miura, "Toward a robotic attendant adaptively behaving according to human state," in *Robot and Human Interactive Communication (RO-MAN), 2016 25th IEEE International Symposium on*, pp. 1038–1043, IEEE, 2016.
- [79] Y. Gao, S. Wallkötter, M. Obaid, and G. Castellano, "Investigating deep learning approaches for human-robot proxemics," in 2018 27th IEEE International Symposium on Robot and Human Interactive Communication (RO-MAN), pp. 1093–1098, IEEE, 2018.
- [80] A. Cruz-Maya and A. Tapus, "Adapting robot behavior using regulatory focus theory, user physiological state and task-performance information," in 2018 27th IEEE International Symposium on Robot and Human Interactive Communication (RO-MAN), pp. 644–651, IEEE, 2018.
- [81] J. James, C. I. Watson, and B. MacDonald, "Artificial empathy in social robots: An analysis of emotions in speech," in 2018 27th IEEE International Symposium on Robot and Human Interactive Communication (RO-MAN), pp. 632–637, IEEE, 2018.
- [82] E. T. Hall, R. L. Birdwhistell, B. Bock, P. Bohannan, A. R. Diebold Jr, M. Durbin, M. S. Edmonson, J. Fischer, D. Hymes, S. T. Kimball, et al.,

"Proxemics [and comments and replies]," *Current anthropology*, vol. 9, no. 2/3, pp. 83–108, 1968.

- [83] A. Kendon, Conducting interaction: Patterns of behavior in focused encounters, vol. 7. CUP Archive, 1990.
- [84] C. Shi, S. Satake, T. Kanda, and H. Ishiguro, "A robot that distributes flyers to pedestrians in a shopping mall," *International Journal of Social Robotics*, vol. 10, no. 4, pp. 421–437, 2018.
- [85] S. Petisca, J. Dias, P. Alves-Oliveira, and A. Paiva, "Emotional sharing behavior for a social robot in a competitive setting," in *Robot and Human Interactive Communication (RO-MAN), 2016 25th IEEE International Symposium on*, pp. 730–735, IEEE, 2016.
- [86] T. J. Madden, P. S. Ellen, and I. Ajzen, "A comparison of the theory of planned behavior and the theory of reasoned action," *Personality and social psychology Bulletin*, vol. 18, no. 1, pp. 3–9, 1992.
- [87] W. Schneider, S. T. Dumais, and R. M. Shiffrin, "Automatic/control processing and attention.," tech. rep., Illinois Univ Champaign Human Attention Research Lab, 1982.
- [88] A. J. Gruber and R. J. McDonald, "Context, emotion, and the strategic pursuit of goals: interactions among multiple brain systems controlling motivated behavior," *Frontiers in behavioral neuroscience*, vol. 6, p. 50, 2012.
- [89] T. Fu and A. Macleod, "Intellichair: An approach for activity detection and prediction via posture analysis," in *Intelligent Environments (IE)*, 2014 *International Conference on*, pp. 211–213, IEEE, 2014.