Transformational and Transactional Robot Leader Behavior

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Digitalization is creating new challenges and opportunities for organizations (Schwarzmüller, Brosi, Duman, & Welpe, 2018). Human-robot interaction research has started to investigate how humans react and relate to robots in various work contexts. Humans have been shown to categorize social robots based on social group associations as they would human peers (Westlund, Martinez, Archie, Das, & Breazeal, 2016) and when perceived as autonomous, humans ascribe credit or blame to robots (Kim & Hinds, 2006). These findings indicate that humans consider robots as accountable as their human peers. Our work raises the question whether robots can not only be viewed as coworkers, but also as leaders, and influence human work.

Initial research on robots displaying leadership behaviors indicates promising potential. Robots and algorithms have been suggested to be capable of leadership tasks such as identifying the most motivated employees (Canós-Darós, 2013). When working with a robot, human participants report to like being led by the robot, if robot leadership increases efficiency (Gombolay, Gutierrez, Clarke, Sturla, & Shah, 2015). In social settings, humans trust robots as they trust humans (Mota et al., 2016). Building on the assumption that humans can trust robots and might accept guidance from robots, we investigate the potential of implementing leadership behaviors in social robots.

Leadership research identified specific leadership styles – including transformational and transactional leadership – as effective in a variety of contexts (Braun, Peus, Weisweiler, & Frey, 2013). Transformational leadership is the most extensively studied leadership style and has been linked to a multitude of positive outcomes, e.g. creativity, engagement, and trust (Avolio, Zhu, Koh, & Bhatia, 200; Braun et al., 2013). Transformational leadership is characterized by idealized influence, inspirational motivation, intellectual stimulation, and individual consideration (Bass, 1999). Transactional leadership, conversely, is represented by management-by-exception (active, passive) and contingent reward (Bass, 1999), and – in contrast to transformational leadership – is suggested to be particularly efficient under time pressure and for tasks that do not require creativity. We investigate, whether these differential effects can be replicated when those leadership styles are displayed by a robot.

In an experimental study, we implemented three different leadership styles (i.e., transformational, transactional, and – as control condition – minimal leadership) in social robots. We expected a transformational – compared to a transactional or neutral – robot to impact human followers more positively, because transformational behaviors increase perceptions of competence and trust (Arnold, Barling, & Kevin Kelloway, 2001). We, thus, expected human followers to especially trust a transformational – as compared to a transactional – robot leader resulting in higher task engagement, organizational commitment, and ultimately task performance. Crucially, social robots show additional promise for leadership applications by representing embodied agents, which have been linked to increased trust between humans and agents (Glikson & Woolley, 2020).

In our between-subjects experimental study participants (so far 67 Executive Master of Business Administration students, aiming for N=150) were asked to listen to a 3-minute presentation by a social robot (i.e., Pepper by SoftBank Robotics) representing the marketing department of a botanical company. The company was said to create a product helping customers grow plants. After having

introduced the product, the robot gave participants a task in which they were asked to develop a marketing strategy for that product, guided by questions stated by the robot. Robots differed according to three conditions: the robot displayed either transformational, transactional, or "minimal" leadership behavior. Leadership styles were differentiated based on the text spoken by the robot and its movements.

In the transformational condition, the speech included the robot's vision for the product, motivation for its employees, offer of support, and was accompanied by large projecting movements like throwing its hands in the air, while talking about the organization's future. In the transactional condition, the spoken text included clear directives and promising rewards based on performance; movements were generally smaller than in the transformational condition, and additionally included directive movements such as the robot pointing with its finger at the participants or shaking its head. Finally, the "minimal" behavior condition, which represented our control condition, consisted of the robot talking about the company in a practical way and only referring to facts when describing the organization and product, while showing very small movements close to its body.

Preliminary results of analyses of variance show that participants perceived the robot to be significantly more competent ($F(2,64) = 3.19$, $p < 0.05$) when they engaged with the transformational robot ($M = 4.07$, $SD = .96$) compared to the transactionally ($M = 3.38$, $SD = .78$) and the minimally ($M = 3.52$, $SD = 1.15$) leading robot. Moreover, the robot was rated as significantly more trustworthy ($F(2,64) = 3.97$, $p < 0.05$) when it displayed transformational ($M = 4.15$, $SD = 1.04$) compared to transactional ($M = 3.16$, $SD = 1.18$) and minimal ($M = 3.49$, $SD = 1.43$) leadership behaviors.

Our results indicate that perceptions of human and robot leadership are similar: Human transformational – as compared to transactional – leaders are perceived as most competent and trustworthy (Arnold et al., 2001), and so are transformational robot leaders. Participants' perceptions of robot leaders mirror how they would perceive a human leader displaying the respective behavior. Upon completing data collection, we will additionally investigate how different leadership styles influence followers' task engagement and performance.

Our study is a first step in establishing whether findings about effects of specific leadership behaviors in humans can be transferred to robot leaders. Our research provides insight into reactions to and perceptions of robot leadership behaviors and illuminates the potential for robot leadership. We expect our findings to open up new vistas on how robots can be utilized as leaders in established organizations and structures.

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