Robots in Hospitality and Tourism: A Research Agenda

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Abstract

This conceptual research note revisits, refreshes and reinforces a 1984 study that challenged hospitality educators to include robots in their classes and research. The paper briefly reviews robotics literature, explains three robot categories—industrial, professional service and personal service—emphasises the importance of autonomy and human robot interaction, and provides hospitality and tourism examples. This literature review leads to six areas for teaching and research of robotics in hospitality and tourism. The paper gives academics and practitioners a foundation for envisioning the current and future state of robots in hospitality and tourism.

Keywords: Robots; robotics; human robot interaction; autonomy.

1 Introduction

Why should a science fiction phenomenon, which many believe lies at the margin of today's economy, concern tourism and hospitality academics? The Second Machine Age (Brynjolfsson, McAfee & Cummings, 2014), underscores exponential increases in information technology cost effectiveness. The capabilities of today's robots will double every couple of years, assuming that Moore's Law remains in force. Sensing, actuator and power technology advances should fuel a robotics explosion comparable to what microprocessors did for computing three decades ago (Touretzky, 2010).

A 1984 study (Andrew) challenged hospitality educators to consider technology, particularly robots, in their classes and to research robots' customer acceptance and impacts on the work environment, management training, facility design and bottom line. This manuscript attempts to nudge hospitality and tourism academics, again, to think about robotic applications and subsequent robot delivered service.

2 Literature Review

2.1 The Rise of Robots

Robotic applications abound in manufacturing, the home, medicine, entertainment and various other fields (Thrun, 2004; Vaussard et al., 2014) such as military and law enforcement (Swinson, 1997), and health and aged care (Blackman, 2013; Flandorfer,

2012; Oborn, Barrett, & Darzi, 2011). Surfacing in hospitality and tourism, Japan has a robot hotel (Martin, 2016) and robotic information agents (Pan, Okada, Uchiyama, & Suzuki, 2015). Robotic floor cleaners (Sung, Grinter, Christensen, & Guo, 2008; Touretzky, 2010; Vaussard et al., 2014) and assisted ambient living services—e.g., home-care and smart homes—keep improving (Angulo, Pfeiffer, Tellez, & Alenyà, 2015). Finally, Lego has robot features in many of its products, and robot competitions—e.g., navigating a restaurant or delivering food orders—are emerging (Angulo et al., 2015; Touretzky, 2010).

Pondering his creation, the father of robotics Joseph Engelberger stated, "I can't define a robot, but I know one when I see one (Beer, Fisk, & Rogers, 2012, p. 9)." Robot definitions vary (Beer et al., 2012; Oborn et al., 2011; Thrun, 2004; Vaussard et al., 2014); this paper defines robots as a "relatively autonomous physical device capable of motion and performing a service." Autonomy and human robot interaction (HRI) help clarify the robot concept across three categories—industrial, professional services and personal services (Beer et al., 2012; Thrun, 2004; Vaussard et al., 2014).

2.2 Autonomy and Human Robot Interaction (HRI)

Two key robotic elements are Human Robot Interaction (HRI) and decision-making, a continuum from quasi-autonomous to autonomous (Beer et al., 2012; Belk, 2016; Swinson, 1997; Thrun, 2004). Quasi-autonomous robot decisions usually stem from their programming (i.e., automatic dishwasher) or teleoperation via a remote human operator (i.e., drone controlled with a joy stick). Fully autonomous robots—a goal "since the emergence of the field, both in product development and science fiction" (Beer et al., 2012, p. 7)—exhibit agency, or an ability to accommodate environmental variations without further input (Thrun, 2004).

Autonomy opens the door to human-robot interactions such as awareness, trust and acceptance (Belk, 2016; Beer et al., 2012), a double-edged interaction. Robots in charge could make users feel isolated (Barnett et al., 2014). Human-robot interfaces should follow familiar social rules and conventions, but do we want to interact with robots as "we interact with our next-door neighbour, our colleagues, or with the people who work in our homes (Thrun, 2004, pp. 10-11)?" The ideal robot would be machine-like in speed and precision, adhere to social norms and maintain human attributes such as empathy, while avoiding mood swings, mistakes and biases (Barnett et al., 2014; Thrun, 2004). Paradoxically, humans might be impolite with robots (Barnett et al., 2014).

Service dominant logic, whereby the firm and customer co-create value seems, applicable to HRI (Barnett et al., 2014; Oborn et al., 2011). Drawing on value co-creation helps understand the dynamic HRI social environment. For instance in one study, a robot vacuum cleaner became part of the household social fabric, including non-prescribed cleaning functions such as watching for fun, demonstrating to others, ascribing a personality or gender and dressing the vacuum (Sung et al., 2008).

2.3 Categorising Robots

Robots range in mobility, autonomy and interaction, usually increasing from industrial robots to professional service robots to personal service robots. *Industrial robots* have been in manufacturing—welding, machining, assembly, packaging,

palletising, transportation and material handling—for over half a century (Blackman, 2013; Thrun, 2004). Such robots handle objects from a stationary platform and may exhibit mobility (Thrun, 2004; Oborn 2011). In general, industrial robots are stationary, semi-autonomous thanks to programming and have little social interaction.

In their infancy, service robots are growing at a much faster pace than industrial robots (Thrun, 2004). *Professional service robots* operate in inaccessible areas such as underwater, nuclear waste sites and the battlefield (Swinson, 1997; Thrun, 2004). Accessible areas, such as health care (Oborn et al., 2011) and aged care (Beer et al., 2012; Blackman, 2013; Flandorfer, 2012), are ripe for professional service robot intrusion. These robots usually are mobile rather than stationary, may have social interaction and are somewhat autonomous thanks to teleoperation and programming.

Personal service robots assist and entertain people. Home and yard robots, such as floor cleaners and lawn mowers, are established market categories (Blackman, 2013; Sung et al., 2008; Vaussard et al., 2014). A recent experimental study in Japan demonstrated hotel lobby robots as an alternative to information via digital signs (Pan et al., 2015). Of the three robot categories, personal service robots tend to have the most mobility, autonomy and HRI.

3 Hospitality and Tourism Challenges

Over three decades ago, Andrew (1984) challenged hospitality academics to discuss robots in their classes and to research five robotic areas: customer acceptance in foodservice and robots' impacts on the work environment, training, facility design and bottom line. This conceptual paper extends his challenge to include tourism academics and a sixth area, robotic design.

Educators could encourage students to follow and participate in robot competitions (Touretzky, 2010). RoboCup@Home and RoCKIn@Home, for example, focus on personal service robots for domestic applications such as serving at a cocktail party or navigating a restaurant (Angulo et al., 2015). Competitions could also provide opportunities for hospitality and tourism students to collaborate across disciplines such as computer science, engineering, psychology and anthropology.

Pedagogically, lectures should incorporate examples of robots—industrial, professional services and personal services—in assignments, readings and class discussions. For example, what have students read about robots in hospitality and tourism? What type of robots will customers accept, and why? How will robots affect hospitality and tourism investments, revenue, expenses and profitability? These proposed classroom questions complement six proposed research agenda questions.

3.1 Customer acceptance of robots in tourism and hospitality operations

Personal service robots, and somewhat professional service robots, should be the predominant robot categories related to customer acceptance. Accordingly, the co-creation of value (Barnett et al., 2014; Oborn et al., 2011) and related HRI (Beer et

al., 2012; Belk, 2016; Sung et al., 2008; Thrun, 2004; Wu et al., 2014) should influence customer acceptance of robots, and service failure reactions.

3.2 The impact of robotics on tourism and hospitality financial operations

Industrial robots in the back of the house and service robots in the front of the house have financial effects. Research questions include robotic return on investment (ROI), capital investments, expenses, revenues, leasing versus buying and robot maintenance and depreciation. HRI should also play an important role in the financial aspects of robots, particularly personal service robots (Beer et al., 2012; Belk, 2016; Thrun, 2004). That is, what HRI aspects will increase robotic ROI?

3.3 The effect of robotics on the tourism and hospitality workplace

Similar to financial impacts, industrial robots in the back of the house and service robots in the front of the house should have workplace effects. For example, will robots eliminate some jobs and create other jobs? HRI will be important with personal service robots (Barnett et al., 2014; Belk, 2016; Thrun, 2004; Wu et al., 2014). And inevitably, employees will find ways to 'play' with the robots (Sung et al., 2008).

3.4 Robotic impacts on successful tourism and hospitality education

Complementary robotic areas such as information and digital technologies seem a good start for examining what leads to successful tourism and hospitality robotic skills. Given the nascent robot field, and the applied aspects, research into training would help grow this area. For example, how do Kirkpatrick's (1967) four training levels—reactions, learning, behaviour and results—align with robotic training?

3.5 Robotic impacts on tourism and hospitality design and facilities layout

Industrial robots could have major implications on designing robot-friendly kitchens. Similarly, service robots could necessitate re-designing hotels and restaurants for efficient cleaning and customer service (Vaussard et al., 2014).

3.6 Robotic designs in hospitality and tourism

Robot design seems particularly important for personal service robots. Design challenges include dynamic navigation, simple set-up, object/human recognition and manipulation, HRI, cognition and ambient intelligence (Angulo et al., 2015). HRI, a common theme in these six research questions, includes communication—e.g., voice, haptic, visual and programming—and anthropomorphic outcomes (Belk, 2016).

4 Conclusions and Future Research

This conceptual paper scratches the surface of robots in tourism and hospitality. A major limitation is that robots are evolving quickly. Now is the time to consider robots in classrooms, businesses and research. Hospitality and tourism academics have the opportunity to position students, industry and themselves at the forefront of the robotic era. The revolutionary aspects of robotics will challenge managers to integrate robots into an already complex service system of employees, customers, suppliers, food processing and information technology. As academic theory tends to inform about human actors, theory and research should encompass non-human agents.

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