Technology and Behavioral Design in Tourism

Iis P. Tussyadiah

Abstract As information and communication technologies (ICTs) become an integral part of the tourism environments, tourism technologies are designed to generate impacts on tourists' behavior and transform tourism experiences. Drawing from behaviorism, philosophy of computing, design science and persuasive technology, this chapter provides a theoretical reflection for technology and tourism design by theorizing behavioral design and technological mediation in tourism experiences. It also provides guiding principles to bridge the theories into design practices in for tourism destinations to solve design problems by facilitating behavior change through ICTs. The ultimate goal is for tourism destinations to offer meaningful and memorable tourism experiences for tourists that are advantageous for all stakeholders.

Keywords Information technology • Persuasion • Memorable experience

1 Introduction

In an increasingly competitive travel and tourism industry, destinations around the globe are continuously challenged to develop and manage their offerings in order to deliver quality tourism experiences for their visitors. The approaches and practices of design thinking (Brown 2008, 2009; Dorst 2011; Lockwood 2009; Martin 2009; Rowe 1987) and design doing (Fraser 2006) are considered powerful to achieve and maintain competitive advantages for tourism destinations (Tussyadiah 2014a; Zehrer 2009). Design thinking is conceptualized as "applying a designer's sensibility and methods to problem solving" (Lockwood 2009, p. xi), "a methodology that imbues a full spectrum of innovation activities with a human-centered design ethos" (Brown 2008, p. 1). This entails an integrative, human-centered process that involves empathic research approaches (i.e., a thorough understanding of end users' needs through direct observation and real world experiments), engaging partners in collaboration (i.e., co-design, co-creation), fast learning, and rapid prototyping that

I.P. Tussyadiah (✉)
Washington State University, Vancouver, WA, USA
e-mail: iis.tussyadiah@wsu.edu

D.R. Fesenmaier, Z. Xiang (eds.), *Design Science in Tourism*, Tourism on the Verge, DOI 10.1007/978-3-319-42773-7_12

result in product, service, and/or experience innovation (Brown 2008; Liedtka et al. 2013; Lockwood 2009). Design thinking is considered an exciting new paradigm for problem solving for organizations facing increasingly complex and open-ended challenges, often referred to as wicked problems (e.g., Buchanan 1992; Cross and Roozenburg 1992). Therefore, design thinking helps organizations to be "more innovative, better differentiate their brands, and bring their products and services to market faster" (Brown and Wyatt 2010). Fraser (2006) suggests the importance of turning design thinking into design doing, emphasizing the actions that bridge design approaches with the process of innovation. In tourism management, design thinking (and design doing) is increasingly applied in areas of new product development (i.e., innovation) and management of operations (e.g., service design) (Hjalager 2010; Zehrer 2009). For example, Hallenga-Brink and Brezet (2005) utilize sustainable innovation design diamond, a brainstorming tool to facilitate joint idea generation for product development among small tourism enterprises. Similarly, Stickdorn and Zehrer (2009) illustrate how service design methods can be applied to improve services in tourism destinations.

As a design context, tourism offers distinct characteristics of wicked problems for which design methods could provide effective solutions. First of all, human experiences are at the core of tourism offerings. Since tourism destination is an amalgam of a wide variety of products and services (Cooper 2005), successful tourism innovation and management requires an orchestration of the various elements and coordination of different stakeholders in order to provide seamless experiences for tourists (Ritchie and Crouch 2003; Zach et al. 2008). Furthermore, there is a great extent of subjectivity in tourism experiences, in that they depend on the ways tourists interact with tourism attractions/products/services (i.e., involving sensory, cognition, affect, etc.) and make sense of (derive meanings from) these interactions. Therefore, developing new (or improving existing) tourism products and services necessitates a full consideration of how tourists would experience these products and services in various motivational and situational contexts. To that end, Tussyadiah (2014a) suggests the relevance of experience design approach in tourism and proposes three approaches to tourism experience design: human-centered design (i.e., designing based on an extensive attention to the needs, wants, expectations and limitations of end users), iterative designing process (i.e., designing as a cyclical process that includes several iterations of prototyping, testing, analyzing, and refining the designed systems), and holistic experience concept (i.e., conceptualizing tourism experience as a complex interaction between design attributes and contextual details). Consistent with previous studies on design thinking (e.g., Brown 2008; Liedtka et al. 2013; Lockwood 2009), these approaches imply four fundamentals for tourism experience design: integrative design research, naturalistic inquiry (i.e., real world experiments and observation), participatory design (i.e., engaging all stakeholders), and multidisciplinarity (Tussyadiah 2014a).

In an information age marked with advances in ICTs and the transformation of information-based economy, it is ever more difficult to separate tourism experiences (and, consequently, the designing of tourism experiences) from ICTs. ICTs become an integral part of tourism experiences as tourists use technological devices

as the primary tools to plan their trip, experience tourism destinations, and reflect on their travels (e.g., Tussyadiah and Fesenmaier 2009; Wang et al. 2012, 2014). Similarly, tourism destinations progressively make use of advanced technological systems to provide tourists with necessary services at every stage of tourism experience (i.e., pre-trip, experiential, and post-trip) as well as manage an efficient coordination among various tourism stakeholders. Therefore, it is crucial to integrate ICTs in the application of tourism experience design.

In essence, the roles of ICTs in tourism experience design can be differentiated into: (1) ICTs as tools or methods of designing, (2) ICTs as artifacts or end products of designing, and (3) ICTs as triggers for desired tourist behavior. As design tools, technological systems such as interactive online platforms for participatory activities, templates for storyboarding and blueprinting, devices and software to gather and assess users' experiences, etc., are used to facilitate design research and designing activities. Hotel reservation systems and airport check-in kiosks as well as consumer devices are considered design artifacts—outcomes of designing process. In this case, designing ICTs is about building good, usable systems, devices that work well and people like to use (Wendel 2014). Consequently, it concerns with designing for user experience with (using) technology. Finally, anchored in human-centeredness, technological systems and devices are designed specifically to provide stimuli that prompt desired behavioral outcomes of their users (i.e., behavioral design), beyond user experience. An example is activity-tracking devices designed to promote active, healthy lifestyle. With the transformation of tourist behavior as the ultimate target, designing ICTs for tourism experience is about building systems that are both good and behaviorally effective (Fogg 2009; Wendel 2014).

This chapter focuses on the third role of ICTs in tourism experience design by emphasizing the foundation and approaches to designing technological systems with a consideration of transforming tourist behavior, including design intervention practices (e.g., Tromp et al. 2011). As the core area of human-computer interaction (HCI), Verbeek (2015) argues that because technology-in-use helps shape the interactions between humans and their environment, designing interactions is about designing relations between humans and the world (Verbeek 2015). This signifies the phenomenological concept of technological mediation in human experiences (Ihde 1990; Verbeek 2007, 2008, 2015) and its application in tourism context (Tussyadiah and Fesenmaier 2009; Wang et al. 2012). Additionally, behavioral design is often associated with providing technological solutions to persistent behavioral problems (Datta and Mullainathan 2012; Wendel 2014), such as lack of self-control, lack of attention (e.g., mindlessness), and/or lack of cognitive ability. In these cases, a better understanding on why people behave in a certain way or make certain decisions (i.e., theories in behaviorism) helps guide behavioral manipulation process from defining and diagnosing the behavioral problems to designing, testing, and refining solutions for these problems. Purposively, this chapter provides approaches to behavioral design facilitated by ICTs based on Tussyadiah's (2014a) fundamentals to tourism experience design (i.e., design doing) with key insights from HCI, philosophy of computing, and psychology.

2 Theorizing Behavioral Design in Tourism

Behavioral design is an active attempt to deliberately and effectively affect human behavior. Research in psychology, behavioral economics, and persuasive technology provides an explanation on how the environment plays a role in influencing a wide range of human behaviors and provides contexts in which these behaviors occur (e.g., Maslow and Mintz 1956). Beckman and Barry (2007) suggest that contexts (including immediate physical and situational surroundings, culture, history, etc.) provide a basis for the meaning and significance attached to roles and behavior. In essence, Thompson (1986) argues that natural behavioral design is associated with two arrays and a correlation: an array of behaviors, an array of circumstances, and a correlation between the two arrays such that a certain behavior is deployed in a particular circumstance. Design is, thus, about matching a form of behavior to the circumstance in which the target behavior is typically employed.

Indeed, design science applies principles of behaviorism that attach human behavior with the environment, such as operant conditioning (Skinner 1938, 1953) and social learning theory (Bandura 1977). The basic tenet of operant conditioning states that behavior that is reinforced (rewarded) tends to be strengthened or repeated, while behavior that is not reinforced (ignored or punished) tends to be weakened or extinguished. It contributes to behavior shaping and modification by providing the guiding principles to design the conditions for behavior reinforcement. For example, in order to shape extremely complex behavior, Skinner (1953) suggests moving the conditions required to receive rewards a step closer to the target behavior (i.e., successive approximation). Social learning theory (Bandura 1977), on the other hand, states that behavior is learned from the environment through observation of the behavior of others (i.e., models). Human beings are considered active information processors who think about the relationship between their behavior and its consequences. Designing with behaviorism in mind, it is suggested that treatments (i.e., rewards or punishments) delivered based on actual performance are proving most powerful in producing behavioral change (Bandura 1977; Bandura et al. 1977).

In the early practices of tourism design (i.e., originated from the field of regional planning, urban design, and architecture), designing for tourism experiences involves altering the physical environment (e.g., tourist sites, built environments), manipulating the design elements (i.e., forms, layouts) in ways that condition tourists to deploy or restraint from deploying certain behaviors. For example, Gunn (1988) provides guidelines and principles to design the vacationscape, various tourism attractions, both natural and commercial, that enhance visitor experience and maintain the natural integrity of the environment. The guidelines suggest different building layouts and configurations of tourism resort sites that result in different behavioral outcomes among visitors (e.g., Gunn 1988, 2002; Mills 1983). Grouping buildings together around a communal space will encourage visitors to engage in social activities, while placing them apart from each other will curb social activities and help accentuate the feelings of seclusion and exclusivity.

Additionally, the marking of hiking trails (e.g., with signage, fences, railings) is a design manifestation to regulate the flow of tourist movements and restrict trampling of protected areas. Similarly, the terms servicescape (Bitner 1992) and atmospherics (e.g., Hoffman and Turley 2002) are suggested to denote the (often consciously designed) settings in which certain consumption behavior takes place. Bitner (1992) proposes three dimensions of servicescape: (1) ambient conditions, (2) spatial layout and functionality, and (3) signs, symbols, and artifacts. Rosenbaum and Massiah (2011) extend these environmental dimensions to include physical, social, socially symbolic, and natural dimensions. Designing for desired consumption behavior (e.g., buy more, stay longer), thus, involves tinkering with these servicescape dimensions, creating the circumstance, the context, to which consumers respond with an action (Wakefield and Blodgett 1996).

Based on these practices, behavioral design in tourism is about priming tourists to perform target behavior through environmental cues and reinforcement. However, other factors such as motivation and personal characteristics influence how tourists respond to various environmental stimuli. To that end, Fogg (2009) proposes a behavioral model, called Fogg Behavioral Model (FBM), which consists of three factors: motivation, ability (i.e., simplicity), and triggers (i.e., a cue to act now). All of these factors must be present at the same moment for an intentional action (behavior) to occur (i.e., [B = MAT]). He further suggests the diminishing marginal returns that happen with increasing motivation and ability, suggesting that motivation and ability are trade-offs of some sorts. That is, increasing motivation (e.g., by providing rewards) is not always the solution to increase behavior performance, increasing ability (e.g., by simplifying tasks) often is. Finally, when the combination of motivation and ability positions a person above the behavior activation threshold, a trigger (e.g., a sounding alarm, a growling stomach, a text message) will cause her to perform the target behavior. Building upon FBM, Wendel (2014) proposes a model called Create Action Funnel, which includes five stages (i.e., mental events) through which a potential action needs to pass in order for it to be performed/undertaken: cue (i.e., external and internal triggers that make a person thinks about an action), reaction (i.e., intuitive processing, automated response to the idea), evaluation (i.e., the action rises to conscious awareness with a considerations of its costs and benefits), ability (i.e., feasibility of taking action) and timing (i.e., when to take action). It is suggested that the target behavior can fall out of the funnel at any stage (Wendel 2014) as people fail to recognize cues, inhibit negative response, fail to recognize value, unable to act, or perceive no sense of urgency (i.e., procrastination).

These behavioral models provide design consequences for tourism experience design in order to discourage undesired behavior and encourage desired behavior (Fogg 2009; Tromp et al. 2011). Indeed, the three factors in FBM are the focal area for designing persuasive technology (Fogg 2009; Fogg and Hreha 2010). That is, aiming at behavioral outcomes entails designing for motivation, designing for ability, and designing for triggers/cues. To increase motivation, Fogg (2009) suggests applying three elements: pleasure/pain, hope/fear, and social acceptance/rejection, consistent with reinforcements and punishments in operant conditioning

(Skinner 1953). In terms of designing for ability (i.e., simplicity), consistent with negative reinforcements in operant conditioning (Skinner 1953), Fogg (2009) suggests that ICTs should reduce or eliminate these six elements associated with performing target actions: time, money, physical effort, brain cycles (i.e., deep thinking), social deviance, and non-routine. Indeed, performing a routine requires intuitive response with less cognitive effort to almost no thinking (i.e., as in fast thinking Kahneman 2013 and the habit loop Duhigg 2012), while unfamiliar behavior typically involves intensive thinking with conscious cost-benefit calculations (Wendel 2014). Lastly, in terms of providing cues (triggers), technological systems can be designed as sparks (targeting low motivation), facilitators (targeting low ability), and signals (targeting high motivation and high ability). In tourism context, various context-aware smartphone apps can be considered triggers as they alert travelers to head to the airport in anticipation of their flight (a signal), remind them to finish a hike or a tour (a spark), and make it easier to share travel pictures with friends (a facilitator).

Siegel and Beck (2014) bring to attention the temporality aspect of behavioral design, arguing for technological systems that are designed to facilitate attitudinal and behavioral transformation over time (i.e., slow change) as opposed to immediate or quick change. Slow change behavioral design is typically associated with behavior that is difficult to initiate and requires sustained user engagement over time (Karapanos 2015), such as recovering from addiction or bad habits, increasing environmental responsibility, and general self-improvements. In tourism, shaping socially responsible behaviors (e.g., appreciation of cultural heritage and conservation ethics) can be considered slow change, while targeting on-site actions through influencing tourists in decision making processes is fast change behavioral design. An example to designing for immediate experience is the use of context-aware systems combined with gameplay and social networks (e.g., Tussyadiah 2012; Bulencea and Egger 2015) to persuade tourists to visit particular tourism attractions and establishments by instantly rewarding their performance (e.g., with points, badges, positions in leaderboards, coupons, etc.).

Finally, Tromp et al. (2011) consider a wider implication of behavioral design involving technology, in that target behavior should realize desired social implications. They propose a framework positioning behavior in between human-technology interactions at a lower level (representing ways of influencing) and social implications at a higher level (representing reasons for influencing). While human-technology interactions address individual concerns, social implications denote collective concerns (i.e., concerns people have as a family, an organization, a society). In that, the target behavior should be perceived as a means to achieve individual goals as well as desired social implications. In many cases, individual and collective concerns do not coincide. For example, there are often conflicts between own comfort (individual concern) and the importance of preserving the environment for future generations (collective concern) corresponding to sustainable tourism behavior. Hence, they argue that the power of design lies in bridging between these concerns.

3 Theorizing Technological Mediation in Tourism

In order to design technological systems that transform tourist behavior, it is important to situate the roles technology plays in tourism experiences, specifically in terms of mediation. The modernist approach to technological mediation assumes that technology is neutral; technological products (i.e., machines) function as tools people use to interact with the world (Verbeek 2005). However, recent literature in philosophy of computing suggests non-neutrality of technology in mediated experiences (e.g., Ihde 1990; Verbeek 2005, 2007, 2008, 2015). Rather than thinking of technology as functional, post-modernist and post-humanist perspectives recognize the mediating role of technology as transforming human experiences (Verbeek 2005, 2015). These perspectives signify the crucial role of ICTs in behavioral design. In its simplest form, the creation of mechanical clocks makes temporal coordination and comparison possible and, consequently, directs people to orchestrate practices and processes more efficiently (Simpson 1995). In this case, technological systems change human behavior across space and time and transform social life (Wise 1997). Comparably, it can be observed in the designing of schedules, itineraries, and opening hours of tourism attractions to shape tourist behavior and experience, influencing duration, pace, and intensity of interactions during a visitation. More recently, the advancement in artificial intelligence enables technology to track (and model) tourist behavior, use it to predict future states, and proactively recommend actions to tourists (see Tussyadiah and Wang 2014). For these experiences, what is being designed is not the thing (technological artifacts), but the human–world relation in which experiences take shape (Verbeek 2015). Therefore, Verbeek (2015) asserts that designing technology is, essentially, designing human beings.

The theory of mediation suggested by Ihde (1990) is useful to elucidate the roles of ICTs in tourism experience. Using a post-phenomenological approach, he analyzes and proposes four types of relations between human being, technology, and the world (i.e., schematically: [Human—Technology—World]) in mediated experiences: embodiment, hermeneutic, alterity, and background relations (see Table 1 for schematic representations of these relations). Embodiment relation denotes a symbiosis between humans and technology, a unity that is directed at the world (i.e., schematically:). An example of this mediation is the experience of seeing through Google Glass (Tussyadiah 2014b), where wearable technology becomes an extension of human bodies, allowing for visual perception to take place. Hermeneutic relation explains the roles of technology to represent the world through symbols/values that need to be read/interpreted in order to understand the world. An example is tourists using a weather app on a smartphone; while the device does not provide direct experiences of rain or sun (cold or hot), tourists read the symbols (or numbers) to interpret the condition of a tourism destination. Alterity relation illustrates how humans interact with technology as an agent, with the world at the background of this interaction. In this relation, technology is considered an agent, a social actor (Tussyadiah 2014c), thus, the terminus of experience. An example is

Table 1 Schematic representation of technological mediation

Initial mediation relations	Extended mediation relations
Embodiment relation: [(Human—Technology) → World]	Cyborg relation: [Human/Technology → World)]
Hermeneutic relation: [Human → (Technology—World)]	Immersion relation: [Human ↔ Technology/World)]
Alterity relation: [Human → Technology (World)]	Augmentation relation: [(Human—Technology) → World + Human → (Technology—World)]
Background relation: [Human (Technology/World)]	
Source: Ihde (1990)	*Source*: Verbeek (2015)

tourists making use of check-in kiosks at an airport or ticket machines at a train station. Finally, background relation indicates that technology serves as the context (at the background) of human actions, such as the warmth from a heating installation.

In light of recent technological advancement, Verbeek (2008, 2015) suggests additional relations that are not captured in Ihde's four categories: cyborg, immersion, and augmentation. The term cyborg relation is used to explain the hybridity between humans and technology, where devices are not worn on (external to), but integrated (implanted) into human bodies. Therefore, this relation is more intimate than embodiment as humans and technology become a hybrid being. Immersion relation describes human interactions with smart environments, ambient intelligence (i.e., technology merges with the world), or persuasive technology (Fogg 2003), where technology serves as the interactive context (not just a background) for human actions (Verbeek 2008). In tourism, interactive exhibits in museums (e.g., Warpas 2014) and the development of smart destination supported by the internet-of-things demonstrate this relation. Lastly, Verbeek (2015) added augmentation relation to explain the use of face-mounted wearable technology that is equipped with information overlay. In essence, this is a combination of embodiment and hermeneutic relations, whereby technology is embodied (as in seeing through Google Glass) and, in return, it provides a representation of the world that needs to be read. The use of wearable augmented reality in tourism attractions (e.g., Leue et al. 2015; tom Dieck and Jung 2015) is an example of augmentation relation. Importantly, these relations demonstrate that technology helps shape human experiences, assisting human beings in gaining knowledge about the world and making important (in some cases, moral and ethical) choices. To this end, Verbeek (2015) argues that technological mediation is part of the human condition and, therefore, should take "a central place in the conceptual framework that implicitly and explicitly guides design activities" (p. 31).

In addition to the aforementioned types of mediation relations, how technology influences humans in mediated experiences is an important design consideration for

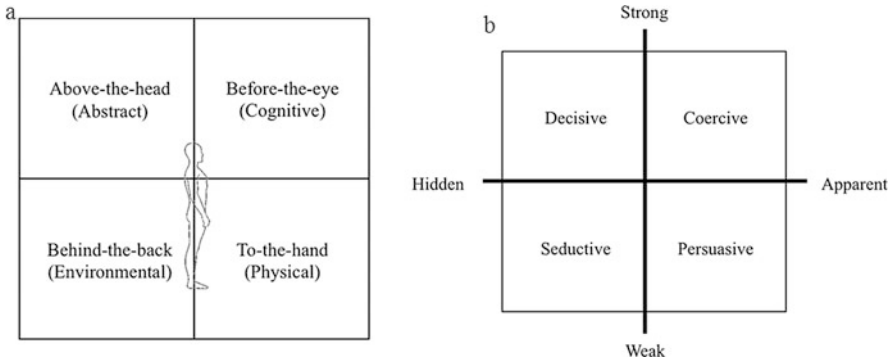

Fig. 1 Influences of technology on human experiences. (**a**) Points of contact *Source*: Dorrestijn et al. (2014) (**b**) Types of influence *Source*: Tromp et al. (2011)

tourism. Using the human body as a reference, Dorrestijn et al. (2014) explain four dimensions of human–technology arrangements or points of contact through which technology influences human experiences (see Fig. 1a): (1) before-the-eye/cognitive (i.e., technology aids in decision-making processes through guidance and persuasion), (2) to-the-hand/physical (i.e., technology influences bodily actions, such as through coercion and mediated gestures), (3) behind-the-back/environmental (i.e., technology indirectly influences behavior through technical determinism and environmental conditioning), and (4) above-the-head/abstract (i.e., the role technology plays in our thinking, such as having utopian or dystopian views of the impacts of technology in society at a general level). The first two points of contact represent direct influences, while the rest indirect, with technology serving as contexts of experiences. In the designing processes, these points of contact guide the assessment of how technology should impacts user behavior (e.g., coercion, guidance, persuasion) and how these may provoke reactions from different users (Dorrestijn et al. 2014; Verbeek 2015). From a slightly different angle, using the dimensions of salience/visibility (i.e., apparent versus hidden) and force (i.e., weak versus strong), Tromp et al. (2011) classify technology influence on human experiences into four types: coercive (apparent, strong), persuasive (apparent, weak), seductive (hidden, weak), and decisive (hidden, strong) influence (see Fig. 1b). Examples of the four influence types in tourism design are the "no entry beyond this point" signs in an attraction, similar to a pop-up warning on a website (coercive, discouraging access), recommendations to visit nearby points of interests on smartphones (persuasive, encouraging visitation), the impacts of using first-person view cameras on the types of activities participated in the destinations (seductive, encouraging actions/performance), and online travel community providing password-protected resources for members only (decisive, encouraging subscription). Tromp et al. (2011) suggest that design strategies corresponding to different influence types should be applied accordingly to generate meaningful experiences.

4 Guiding Principles for Technology and Behavioral Design in Tourism

Based on the aforementioned theories and conceptual models, a set of guiding principles for tourism experience design involving ICTs is proposed in the following section. First and foremost, it is imperative for tourism destinations to identify design problems, the target behavior that will be effective as a means to achieve the overall goal of creating meaningful tourism experiences for tourists. In order to do this, designing starts with selecting the right target outcomes from both sides: the tourists (at the individual and social levels) and the destination. Target behavior should then be identified from a range of possible actions that tourists could undertake in order to arrive at these outcomes in the most efficient way. A deep understanding of the tourists and their behavior will guide the conceptual design, whether designing should aim at a behavioral reinforcement (i.e., facilitation) or behavioral intervention (i.e., changing patterns of actions), whether the target behavior would require slow change (e.g., long-term travel planning behavior) or immediate actions (e.g., on-site decisions), etc. Gauging tourist motivation and ability as well as reactions to various stimuli in relation to target behavior will also provide insights on the structure of detailed actions and how to prepare the environments (i.e., contexts) to condition for these actions. Considerations of the roles of ICTs, whether to serve as the context of experience or to sense the right environment in order to provide triggers, and the types of influence they infer on the tourists, are integral in the conceptual design.

5 Design Approaches

Tussyadiah (2014a) lays a theoretical foundation for tourism experience design with the considerations for human-centeredness, iterative process, and holistic experience concept. The key to behavioral design through ICTs is placing the humanness of tourists at the center of designing process. The theories of mediation inform that tourism experience design involving ICTs is about designing technological systems that are both effortless (simple) and enjoyable (motivating) for tourists and effective in instilling target behavior. In interaction systems design, human-centeredness is codified in the ISO standard of human-centered design for interaction systems (ISO 9241–210 2010), which includes six basic principles: (1) the design is based upon an explicit understanding of users, tasks, and environments, (2) users are involved throughout the design and development, (3) the design is driven and refined by user-centered evaluation, (4) the process is iterative, (5) the design addresses the whole user experience, and (6) the design team includes multidisciplinary skills and perspectives. At the lowest level, designing process should include tourists in usability testing of technological systems (e.g., focus

groups to gain tourist feedback on design prototypes). However, in order to generate relevant and effective systems, it is important that the entire designing process is informed by a thorough understanding of what influence certain tourist experience. In line with Sleeswijk et al. (2005), tourists are experts of their experience. Therefore, they need to be integrated early in the process and participate in all designing activities. As argued by Sanders and Stappers (2014), design practices move from designing for people, to designing with people (i.e., co-design) and by people.

Design methods are characterized with experimentation aimed at iterating toward a "better" answer (Liedtka and Ogilvie 2011). The design cycle is typically consisting of the following components: analysis, design, prototype, and test (Ladner 2015) or understand, discover, design, and refine (Wendel 2014), indicating activities of problem finding, problem selection, solution finding, and solution selection (Beckman and Barry 2007). The key is that design cycle is never a clean and linear pass-through process (Fraser 2006), it requires repeating the design cycle again and again until satisfactory design is obtained. Design practices are characterized with fast learning (through human-centered discovery) and rapid prototyping, suggesting the unique role of research in designing. Sanders and Stappers (2014) illustrate the many relationships between design and research: (1) overlapping collaboration between design and research, (2) research as important ingredients in design, (3) design as part of research, and (4) design and research as separate practices. In light of these different relations, Tussyadiah (2014a) suggests that in tourism experience design, design research is distinct from but integral to designing, which is Sanders and Stappers's second relation. Drawing from Evenson and Dubberly (2010), integrative design research approaches consisting of explorative, generative, and evaluative research, each corresponding to different activities in the design cycle, are suggested as parts of the iteration.

Lastly, behavioral design should be targeted toward achieving the goals that are inclusive of all aspects of an experience. Even though behavioral interventions tend to be incremental (e.g., tiny habit-forming activities), it is based on a consideration that these activities are supportive of a holistic experience. Therefore, designing behavioral intervention for on-site activities cannot be done in isolation from pre-trip and post-trip experience. It is an integral part of what tourists will enjoy, reflect, and derive meaning from. Also, changing one behavior (or conditioning any one aspect of an experience) most likely casts an influence on subsequent actions and, eventually, transforms the overall experience. Further, it is also important to position tourism experience in its role within the life of a tourist, in that tourism and everyday experiences are intertwined and shape one another.

6 Design Tools

As an experience, tourism is temporary in nature (i.e., confined within the duration of a trip). As a result, many design issues in practice concern with on-site behavioral design problems that require immediate actions (as opposed to slow change). However, extending the temporal dimension of tourism experience to include pre-trip and post-trip experiences and integrating technology use behavior into the equation, slow change behavioral design can be relevant to tourism. In the interest of bridging the theories into practice, relevant on-site behavioral intervention scenarios are illustrated in the following. Tourism destinations may face the problems of extreme overcrowding in some areas and underutilization in others (i.e., activity dispersion problems), resulting in economic, social, and environmental challenges for the region and concerns over low tourist satisfaction. Diverging tourist movement, which requires intervening tourists to avoid certain attractions during a period of time, can achieve the goal of dispersing tourism activities in a destination. Additionally, tourism attractions may identify problems of low visitor engagement, which limits the cognitive and affective experiences, thus the potential to develop a deeper emotional attachment. Enhancing artifacts through digital means may spark imagination and interest among visitors, leading to a higher level of engagement (e.g., Leue et al. 2015; tom Dieck and Jung 2015; Warpas 2014).

The prevalent use of smartphones for everyday experiences indicate that people are familiar with technological applications that explicitly or implicitly suggest actions, proactively or on demand: a navigation app telling them to turn right, a photography app reminding them to take a selfie, a digital assistant app suggesting a popular place for lunch nearby, a weather alert, etc. A navigation app (such as Google Map) can go further to alert users of traffic congestions (e.g., marking the routes in red) or notify users that the destination will be closed by the time they reach it. Falling under the category of persuasive technology (Fogg 2003), these systems are designed to deliver tiny behavioral interventions, sending apparent influences (e.g., through rewards and punishments) to shape user behavior on behalf of marketers, managers, teachers, doctors, etc. Furthermore, intelligent personal devices (e.g., smartphones, smart watches, etc.) are able to track and "model" the behavior of (and give feedback to) their users, the capacity that will improve as uses intensify. From tourism design point of view, tapping into tourists' personal technology for behavioral intervention (i.e., leading tourists to undertake certain actions in order to solve design problems) is a worthwhile technological solution. Using personal devices also allows behavioral design approaches to address experiences with a high level of granularity, making it possible for tourism destinations to target behavior deeper into the micro-moments in situated tourism experiences.

Presented in Table 2 is an array of design tools corresponding to four stages/activities in the design cycle provided for tourism destinations engaging in behavioral design with ICTs. In the aforementioned design problems, the first step to

Table 2 Tool kit for technology and behavioral design in tourism

Activities	Approaches	Tools	Use scenarios
Observe—Understand	*Explorative design research*. Human-centered discovery of subjective experiences. *Naturalistic inquiries*. Gathering information and user behavior in natural experience settings and real use situations.	*Participant observation* (e.g., User Shadowing). Observers participate in on-going activities (tourism) and record observation (e.g., notes, pictures, videos, etc.).	Shadowing tourists to observe their actual behavior in the natural (unaltered) environment; decision-making strategies, triggers of behavior, attitudes, habits, states of mindfulness/mindlessness, etc.
		Autoethnography (e.g., mobile ethnography, user diaries, user stories). Ask tourists to develop self-reflective narrative of subjective (tourism) experiences (e.g., in forms of writings, video diaries, etc.).	Tourists are asked to record and report their experiences in different media. This can also be achieved by exploring first-person narratives from secondary sources, such as travel blogs (i.e., through netnography).
		In-depth interview (alt. focus group discussion). Direct questioning to gauge tourist opinions, attitudes, etc.	Tourists (as individuals or groups) are formally or informally asked to articulate their opinions, attitudes, and feelings regarding their behavior and experiences.
Analyze—Reflect	*Generative design research—projective approach*. Focusing on expressive exercises to facilitate users in articulating their thoughts, feelings, and desires that are usually hard to communicate verbally. *Holistic experience concept*. Inclusive of all elements that make up the structure of tourism experience.	*Projective interview*. Using objects and/or metaphors to gauge reflections on experience or phenomena.	Personifying objects onto which tourists can project their attitudes and feelings more easily. This is particularly useful in gauging tourist attitude toward technological systems (i.e., machines) in a mediating role that cast an influence on human behavior.
		Experience mapping (alt. consumer journey mapping). Developing a visual representation of user engagement with the system throughout the entire journey. *Storyboarding*. Creating visual sequence of events to capture interactions with the system.	A tourism experience map is a holistic visual representation of tourist journey from pre-trip to post-trip stages, which details the different activities undertaken and touch points where tourists interact with different stakeholders. Included are tourist emotional states as they

(continued)

Table 2 (continued)

Activities	Approaches	Tools	Use scenarios
			go through the different stages and touch points, magic moments (positive experiences) and pain points (negative experiences) along the experience. Identify opportune moments (e.g., critical events in the journey) where an intervention will be most effective. Similarly, a storyboard will capture sequential activities, which can accommodate scenarios of likely events in addition to actual experiences.
Make—Design	*Generative design research—constructive approach*. Focusing on creating and testing experience concepts, which involve some concrete parameters *Participatory designing—co-creation*. Active engagement of users at every stage of the designing process. *Holistic experience concept*. Inclusive of all elements that make up the structure of tourism experience.	*Brainstorming* (alt. brainwriting, bodystorming). Generating ideas/solutions from participants.	Involving relevant stakeholders (e.g., through open discussions or in writing) to generate an array of ideas (all possible solutions) to solve design problems, including sets of behavior to target (types, structure, granularity, etc.), sets of strategies to influence the behavior, configuration of ICT infrastructure, etc.
		Flexible modeling. Allowing participants to configure a system from a set of predetermined elements.	Creating the necessary parts (elements) of an intelligent system and then asking tourists and other stakeholders to configure a system (e.g., using clay, collages, cards). Different stakeholders might have different considerations in mind when developing the model.
		Paper Prototyping (co-creative sketching, public prototyping). Creating rough drawings or	Relevant stakeholders working together to sketch conceptual design (e.g., hand-written on

(continued)

Table 2 (continued)

Activities	Approaches	Tools	Use scenarios
		mockups of the system and using them to gather feedback.	paper) or build mockups (e.g., using cardboard boxes), or enact design scenarios in order to facilitate an early evaluation on its usability and experience, as well as gather initial feedback.
Test—Refine	*Evaluative design research*. Iterative testing and feedback on experience concepts; monitoring the quality of the designed socio-technical systems and the holistic experiences they allow for. *Naturalistic (contextual) inquiries*. Gathering information and user behavior in natural experience settings and real use situations.	*Heuristic evaluation* (usability testing). Evaluating the system; documenting flaws and areas of improvement.	Introducing the system to tourists (e.g., describing how it works, showing the interface, etc.) and asking them to evaluate and report any flaws in the system for further refinement.
		Field experiment (A/B testing). Experimentally examine an intervention in the real world settings.	Implementing the system in real tourism settings (with real tourists as participants) and assess the effectiveness of the system in producing desired tourist behavior. Design experiments with varying: – Types of influence (e.g., coercive, persuasive, seductive, decisive) – Types of motivation (e.g., external or internal rewards, punishments) – Timing for rewards to be given – Conflicts of interests, etc.

addressing tourist dispersion and engagement issues is to take a closer look at the physical, cognitive, emotional, and social aspects of tourist behavior relevant to the design problems; how tourists make decisions on-site (i.e., in cases of planned vs. spontaneous activities), how they deal with disruptions to planned behavior (e.g., changes in the environment/condition, limited ability), what sparks their motivation (i.e., both externally and internally), how they compromise individual and collective concerns, etc. Importantly, these patterns should also be observed as emerging from (in the context of) personal technology use to elucidate the perceived roles and influences of technology on tourist behavior and the ways these influences are perceived and responded. For example, explorative and generative

research could be targeted to understand how tourists react to notifications, recommendations (persuasion), or warning (coercion) from a technology (i.e., for consideration of types of influence, mediation relations), if different ways of facilitating perception (i.e., tourists ← world), such as augmentation and mediated gestures, result in desired actions (i.e., tourists → world), fear and angst toward the role of technology in the society at a general level, etc.

Guided by these insights, involving tourists and all stakeholders in a series of constructive research and participatory design techniques will shape the conceptual design and prototype of the technological systems. From the technology development perspective, it is also about configuring the infrastructure to enable real-time machine-to-machine interactions (e.g., sensors, cloud, network). Therefore, generative research activities should produce action (behavior) scenario, ICT system scenario, and interaction scenario. The next step is to involve tourists in testing the prototypes, which could by setting up a field experiment with different intervention strategies (e.g., types of influence, types of interaction) and varying environmental conditions (e.g., timing, reward systems). Iterations of these activities will lead to the system design (e.g., interface, infrastructure) that is ready for implementation.

7 Concluding Remarks

ICTs have tremendous potentials to shape and transform tourist behavior. Specifically, the advancement in intelligent personal technologies (i.e., small, easy to carry technological devices designed for personal use) allows for digital devices to track and model user behavior and to provide feedback on user performances, making it possible to influence user experience by suggesting relevant decisions and actions in opportune moments. Therefore, it is imperative for tourism destinations to take advantage of ICTs to design tourism experiences. In order to influence tourist behavior through design, tourism destinations can make use of behavioral design principles derived from theories in psychology, especially behaviorism, in order to better understand human behavior in given contexts, philosophy of computing (and persuasive technology) to follow the different roles of technology in human experiences, and design science to master the guiding principles and approaches to designing process. Designing technology for behavior modification, whether it requires slow change of immediate actions, is about developing technological systems that are effective in producing desired user actions. Therefore, it requires a deeper understanding of tourist behavior as a basis of designing. Because tourists are experts of their own subjective experiences, they should be integrated in the entire activities within the design cycles, emphasizing the shift from design for tourists to design with tourists (and by tourists).

References

Bandura, A. (1977). *Social learning theory*. Englewood Cliffs, NJ: Prentice Hall.

Bandura, A., Adams, N. E., & Beyer, J. (1977). Cognitive processes mediating behavioral change. *Journal of Personality and Social Psychology, 35*, 125–139.

Beckman, S. L., & Barry, M. (2007). Innovation as a learning process: Embedding design thinking. *California Management Review, 50*(1), 25–56.

Bitner, M. (1992). Servicescapes: The impact of physical surroundings on customers and employees. *Journal of Marketing, 56*, 57–71.

Brown, T. (2008, June). Design thinking. *Harvard Business Review*, 1–10.

Brown, T. (2009). *Change by design: How design thinking transforms organizations and inspires innovation*. New York: Harper Collins.

Brown, T., & Wyatt, J. (2010). Design thinking for social innovation. Stanford Social Innovation Review, Winter 2010. Retrieved from http://ssir.org/articles/entry/design_thinking_for_social_innovation

Buchanan, R. (1992). Wicked problems in design thinking. *Design Issues, 8*(2), 5–21.

Bulencea, P., & Egger, R. (2015). *Gamification in tourism: Designing memorable experiences*. Book on Demand.

Cooper, C. (2005). *Tourism: Principles and practice*. Upper Saddle River, NJ: Prentice Hall.

Cross, N., & Roozenburg, N. (1992). Modelling the design process in engineering and in architecture. *Journal of Engineering Design, 4*, 325–337.

Datta, S., & Mullainathan, S. (2012). *Behavioral design: A new approach to development policy*. CGD Policy Paper 016. Washington, DC: Center for Global Development. http://www.cgdev.org/content/publications/detail/1426679

Dorrestijn, S., van der Voort, M., & Verbeek, P.-P. (2014). Future user-product arrangements: Combining product impact and scenarios in design for multi age success. *Technological Forecasting and Social Change, 89*, 284–292.

Dorst, K. (2011). The core of 'design thinking' and its application. *Design Studies, 32*(6), 521–532.

Duhigg, C. (2012). *The power of habit*. New York, NY: Random House.

Evenson, S., & Dubberly, H. (2010). Designing for service: Creating an experience advantage. In G. Salvendy & W. Karkowski (Eds.), *Introduction to service engineering* (pp. 403–413). Chichester: Wiley.

Fogg, B. J. (2003). *Persuasive technology: Using computers to change what we think and do*. Amsterdam: Morgan Kauffmann.

Fogg, B. J. (2009). *A behavior model for persuasive design. Proceedings of the 4th International Conference on Persuasive Technology*. New York: ACM.

Fogg, B. J., & Hreha, J. (2010). Behavior wizard: A method for matching target behaviors with solutions. *Lecture Notes in Computer Science, 6137*, 117–131.

Fraser, H. (2006). *Turning design thinking into design doing*. Rotman Magazine, Spring/Summer 2006, 24–28.

Gunn, C. A. (1988). *Vacationscape: Designing tourist regions*. Boston: CABI Publishing.

Gunn, C. A. (2002). *Tourism planning: Basics, concepts, cases*. London: Routledge.

Hallenga-Brink, S. C., & Brezet, J. C. (2005). The sustainable innovation design diamond for micro-sized enterprises in tourism. *Journal of Cleaner Production, 13*(2), 141–149.

Hjalager, A.-M. (2010). A review of innovation research in tourism. *Tourism Management, 31*(1), 1–12.

Hoffman, K. D., & Turley, L. W. (2002). Atmospherics, service encounters and consumer decision making: An integrative perspective. *Journal of Marketing Theory and Practice, 10*(3), 33–47.

Ihde, D. (1990). *Technology and the lifeworld: From garden to Earth*. Bloomington, IN: Indiana University Press.

International Organization for Standardization. (2010). *Ergonomics of human-system interaction—Part 210: Human-centred design for interactive systems* (ISO 9241–210:2010). Geneva: ISO.

Kahneman, D. (2013). *Thinking fast and slow*. New York, NY: Farrar, Straus and Giroux.
Karapanos, E. (2015). Sustaining user engagement with behavior-change tools. *Interactions, 22* (4), 48–52.
Ladner, R. E. (2015). Design for user empowerment. *Interactions, 22*(2), 24–29.
Leue, M. C., Jung, T., & tom Dieck, D. (2015). Google glass augmented reality: Generic learning outcomes for art galleries. In I. Tussyadiah & A. Inversini (Eds.), *Information and communication technologies in tourism 2015* (pp. 463–476). Switzerland: Springer International Publishing.
Liedtka, J., King, A., & Bennett, K. (2013). *Solving problems with design thinking: Ten stories of what works*. New York, NY: Columbia Business School Publishing.
Liedtka, J., & Ogilvie, T. (2011). *Designing for growth: A design thinking tool kit for managers*. New York, NY: Columbia Business School Publishing.
Lockwood, T. (2009). Foreword: The importance of integrated thinking. In T. Lockwood (Ed.), *Design thinking: Integrating innovation, customer experience, and brand value* (pp. vii–xvii). New York, NY: Allworth Press.
Martin, R. A. (2009). *The design of business: Why design thinking is the next competitive advantage*. Boston, MA: Harvard Business Press.
Maslow, A. H., & Mintz, N. (1956). Effects of esthetic surroundings: I. Initial effects of three esthetic conditions upon perceiving "energy" and "well-being" in faces. *Journal of Psychology, 41*, 247–254.
Mills, E. D. (1983). *Design for holidays and tourism*. Oxford: Butterworth-Heinemann.
Ritchie, J. R. B., & Crouch, G. I. (2003). *The competitive destination: A sustainable tourism perspective*. Wallingford: CABI.
Rosenbaum, M. S., & Massiah, C. (2011). An expanded servicescape perspective. *Journal of Service Management, 22*(4), 471–490.
Rowe, P. G. (1987). *Design thinking*. Boston, MA: MIT Press.
Sanders, L., & Stappers, P. J. (2014). From designing to co-designing to collective dreaming: Three slices in time. *Interactions, 21*(6), 24–33.
Siegel, M., & Beck, J. (2014). Slow change interaction design. *Interactions, 21*(1), 28–35.
Simpson, L. (1995). *Technology, time, and the conversations of modernity*. New York, NY: Routledge.
Skinner, B. F. (1938). *The behavior of organisms: An experimental analysis*. New York, NY: Appleton-Century.
Skinner, B. F. (1953). *Science and human behavior*. Toronto: Macmillan Co.
Sleeswijk Visser, F., Stappers, P. J., Van der Lugt, R., & Sanders, E. B.-N. (2005). Contextmapping: Experiences from practice. *CoDesign, 1*(2), 119–149.
Stickdorn, M., & Zehrer, A. (2009). Service design in tourism: Customer experience driven destination management. In S. Clatworthy (Ed.), *Proceedings of the 1st Nordic service design conference*. Norway: Oslo.
Thompson, N. S. (1986). Deception and the concept of behavioral design. In R. W. Mitchell & N. S. Thompsson (Eds.), *Deception: Perspectives on human and nonhuman deceit* (pp. 53–66). Albany, NY: State University of New York Press.
tom Dieck, M. C., & Jung, T. (2015). A theoretical model of augmented reality acceptance in urban heritage tourism. *Current Issues in Tourism*, OnlineFirst Doi: 10.1080/13683500.2015.1070801
Tromp, N., Hekkert, P., & Verbeek, P.-P. (2011). Design for socially responsible behavior: A classification of influence based on intended user experience. *Design Issues, 27*(3), 3–19.
Tussyadiah, I. P. (2012). A concept of location-based social network marketing. *Journal of Travel & Tourism Marketing, 29*(3), 205–220.
Tussyadiah, I. P. (2014a). Toward a theoretical foundation for experience design in tourism. *Journal of Travel Research, 53*(5), 543–564.

Tussyadiah, I. (2014b). Expectation of travel experiences with wearable computing devices. In Z. Xiang & I. Tussyadiah (Eds.), *Information and communication technologies in tourism 2014* (pp. 539–552). Switzerland: Springer International Publishing.

Tussyadiah, I. P. (2014c). Social actor attribution to mobile phones: The case of tourists. *Information Technology and Tourism, 14*, 21–47.

Tussyadiah, I. P., & Fesenmaier, D. R. (2009). Mediating tourist experiences: Access to places via shared videos. *Annals of Tourism Research, 36*(1), 24–40.

Tussyadiah, I. P., & Wang, D. (2014). Tourists' attitudes toward proactive smartphone systems. *Journal of Travel Research*, OnlineFirst Doi: 10.1177/004728751456316.

Verbeek, P. -P. (2005). *What things do: Philosophical reflections on technology, agency, and design* (R. P. Crease, Trans.). University Park, PA: The Pennsylvania State University Press.

Verbeek, P.-P. (2007). Beyond the human eye: Technological mediation and posthuman visions. In P. Kockelkoren (Ed.), *Mediated vision*. Rotterdam: Veenman Publishers and ArtEZ Press.

Verbeek, P.-P. (2008). Cyborg intentionality: Rethinking the phenomenology of human-technology relations. *Phenomenology and the Cognitive Sciences, 7*(3), 387–395.

Verbeek, P.-P. (2015). Beyond interaction: A short introduction to mediation theory. *Interactions, 12*(3), 26–31.

Wakefield, K. L., & Blodgett, J. G. (1996). The effects of the servicescape on customers' behavioral intentions in leisure service settings. *Journal of Services Marketing, 10*(6), 45–61.

Wang, D., Park, S., & Fesenmaier, D. R. (2012). The role of smartphones in mediating the touristic experience. *Journal of Travel Research, 51*(4), 371–387.

Wang, D., Xiang, Z., & Fesenmaier, D. R. (2014). Adapting to the mobile world: A model of smartphone use. *Annals of Tourism Research, 48*, 11–26.

Warpas, K. (2014). Designing for dream spaces. *Interactions, 21*(3), 66–69.

Wendel, S. (2014). *Designing for behavioral change: Applying psychology and behavioral economics*. Sebastopol, CA: O'Reilly.

Wise, J. M. (1997). *Exploring technology and social space*. Thousand Oaks, NJ: Sage.

Zach, F., Gretzel, U., & Fesenmaier, D. R. (2008). Tourist activated networks: Implications for dynamic packaging systems in tourism. In P. O'Connor, W. Höpken, & U. Gretzel (Eds.), *Information and communication technologies in tourism 2008* (pp. 198–208). Vienna: Springer.

Zehrer, A. (2009). Service experience and service design: Concepts and application in tourism SMEs. *Managing Service Quality, 19*(3), 332–349.