



Empirical Research Article

Smart Tourism Design: A Semiotic Affordances Approach

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Abstract

This paper presents a conceptual approach to Smart Tourism Design based on semiotic affordances theory. This conceptual approach repositions smart tourism from a techno-centric perspective that frames a seamless connection between the device and its software, to a more human-centric perspective that favors the user's needs, desires as perceived through the senses. An updated Smart Tourism Design emphasizes the aesthetic dimension of smart tourism that presents the objects of the travel experience as destination specific rather than universal, through representations as digital artifacts. This theory is based on an empirical and objective understanding of representations and how they can be identified as useful in the digital augmentation of travel experiences. Using Peirce's sign systems and Gibson's theory of affordances, smart tourism can transcend a prefabricated device-oriented experience to a closer dynamic and direct interaction between the user and the travel destination. Researchers and developers can use semiotics as a structural approach to recognizing objects as sign-types, and they can use affordances to better identify the immediacy of digital artifacts and purpose-driven by users' spontaneous and immediate motives.

Keywords

Affordances; destination image; destination management; imaging processing; Smart Tourism Design; semiotics

1. Introduction

Smart tourism has provided a wide variety of valuable solutions for visitors to travel destinations, particularly in enabling users to craft their own unique itineraries. They are mostly readymade smart tourism applications developed by service providers in the form of feasible destination solutions that offer information technology and information content to users. These feasible destination solutions reflect how both tourists and service industries have sought to identify or predict problems and solutions using smart tourism applications throughout the journey. This fundamental approach to smart tourism focuses on information processing, or data-driven service itinerary design (Xiang et al., 2021), that has worked to institutionalize the structure of travel and tourist behavior using prefabricated smart tourism applications. From this perspective, applications are made to improve or standardize tourism destination service design by identifying how tourists could adopt them during their travels. In this paper, an emergent paradigm shift toward Smart Tourism Design is described, based on semiotic affordances. From this perspective smart tourism refers to something more complex and foundational than simply the institutional use of travel applications. The user's actual context-specific inquiries regarding the tourism destination and its service providers are based on the objects, or artifacts, perceived or encountered before and during the trip. From this perspective, design meanings in tourism, encompasses industrial and data science matters by incorporating inter-related issues from a design perspective. Although designers have been deeply involved in

creating desirable interaction & interface design artifacts in prior tourism research and practice, surprisingly, most established smart tourism applications have been developed by a developer-centered focus on 'functionality for design' rather than 'design for humanity' (Figure 1).

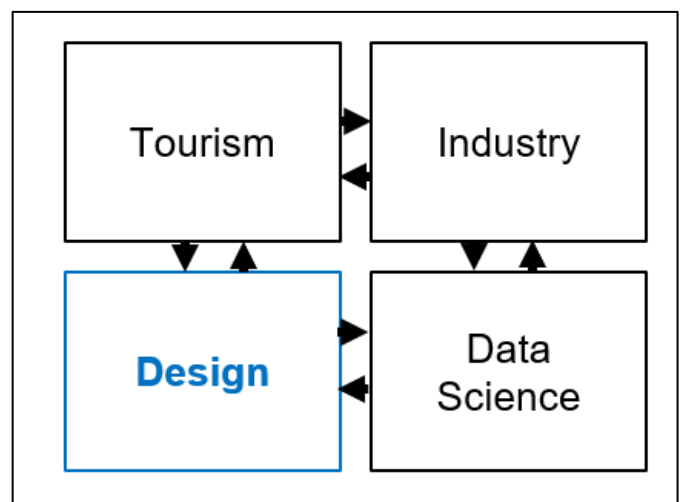


Fig. 1. Historic design perspective Smart Tourism Design (Adapted from Nadin, 1987)

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Smart Tourism Design addresses the aesthetic and functional experiences of the traveler which have both tangible and intangible outcomes. These outcomes can be as smart tourism application solutions and the quality of the emotional dimensions of the travel experience. To make better smart tourism applications, service providers have also configured feasible destination solutions, which deliver relevant information contents for tourists. In this way, travelers and service industries have sought to identify problems and solutions using smart tourism applications throughout the journey. This smart tourism paradigm focused on information processing – what smart tourism could do to institutionalize tourists’ behavior using technology-driven smart tourism applications, and how tourists could adopt them during their travels.

In this newly emergent paradigm, researchers will be gravitating toward highlighting tourists’ desires, needs, and pain points in creating ‘design meanings’ in smart tourism applications. In this paper, Smart Tourism Design is conceptualized as the core of an interdisciplinary research domain that explores matters dealing with sensing and signaling complex travel phenomena via information searches, decision making, enhanced touristic experiences and the imagined and actual destination image. The authenticity of digital form and function is framed by tourists’

context specific travel inquiries. In this sense, design meanings in tourism, (Nadin, 1987) are interpreted as the art and architectural artifacts’ links between objects in various environments and users’ everyday life (see Figure 2, below). Although designers have been deeply involved in creating desirable interaction & interface design artifacts in smart tourism research and practice, the focus has been on what could be said as developer-centered ‘functionality for design’ rather than ‘design for humanity’ (Hevner et al., 2004). Smart tourism represents breakthrough technologies that have been widely involved in tourism activities and service experiences since the advent of mobile devices over the past decade (Gretzel et al., 2015). It has focused mainly on information processing and institutionalized applications development. However, at this point, a new paradigm is emerging that moves the focus from the application to the artifacts encountered in the traveler’s unique experiences. This Smart Tourism Design paradigm includes matters related to 1) aesthetic and visual images (two-dimensional visual design); 2) ergonomic forms and feasible functions (three-dimensional products & industrial design; 3) interfaces, interactions, and systems (interaction & systems design), and 4) experience and service design (thought & organizational process design).

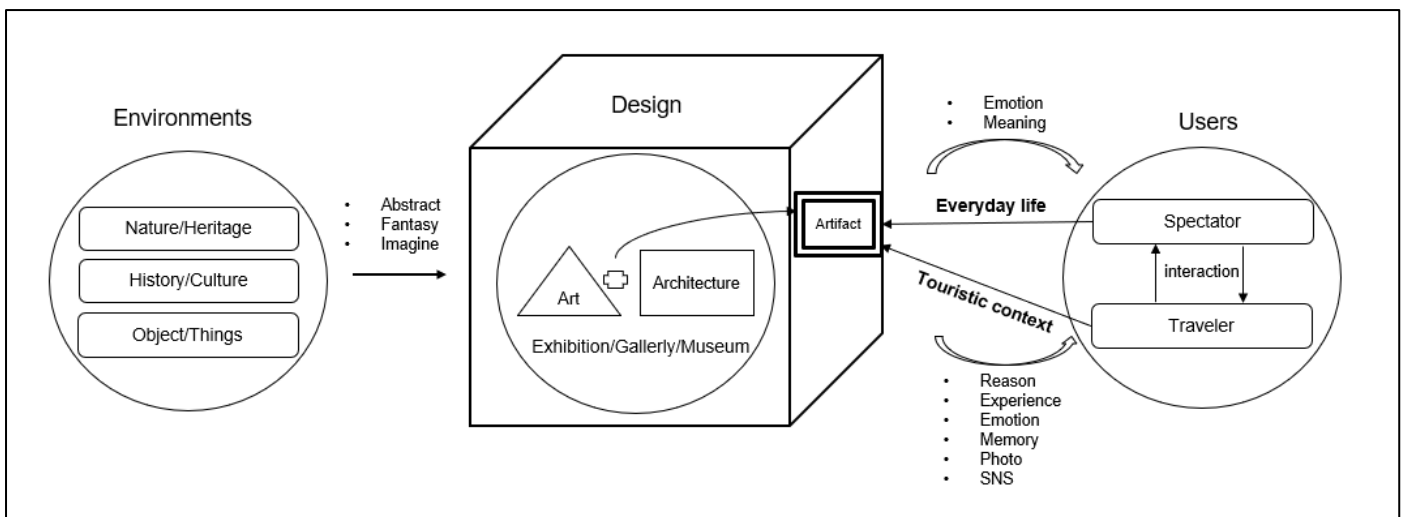


Fig. 2. Design for everyday life and touristic context: The function of the artifact

2. Literature Review

2.1 Theory of Semiotic Affordances for Smart Tourism Design

In the search for associated theories on smart tourism, it is found that “design” can be used to theorize current smart tourism issues and challenges, is especially, related to how technologies could ensemble with the human’s sense and feelings, as depicted here Figure 3.

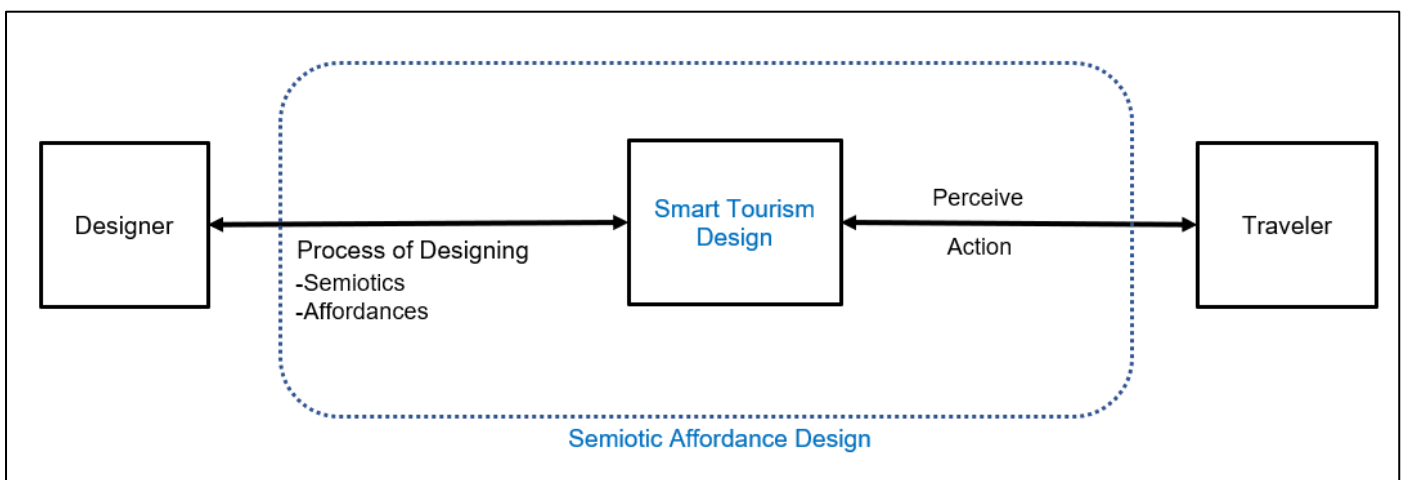


Fig. 3. Smart Tourism Design by semiotic affordance design

Almost all previous studies have considered how IT arSmart Tourism Design emphasizes the connection between information technologies and human senses, desires, and emotions. People’s actual inquiries are contextual and highly changeable. Information processing as an institutional perspective has been favored in smart tourism research to date because it presents a standardized and predictable approach to the development and use of applications that are deterministic in shaping decision making, behavior, or data service use (Hevner et al., 2004). This approach is based on finding pattern recognition in adoption and usage rather than the context specific needs and desires of the individual user.

Smart Tourism Design is concerned with demonstrating how unique tourism objects can be represented aesthetically and functionally as artifacts through information processing technologies. In this sense, the physical realities of tourism objects are transformed into semiotic affordances or functional signs tacitly recognized by users as being useful in helping to fulfil their real or perceived travel needs and desires (Gibson, 1979). Two basic research questions can be proposed to address the catalysts for this emergent paradigm and its potential impact on smart tourism research:

- How can a design perspective identify desirable smart tourism in an increasingly complex tourism industry with its growing mass of travel data?
- What aspects of smart tourism applications will be configured, based on design issues, to create more desirable design artifacts and actions based on semiotic affordances?

The four major features of a Smart Tourism Design paradigm previously discussed and illustrated in Figure 1 have operational impacts on: 1) tourism artifacts and design environment, 2) communication as a form of social interaction between object, artifact, and technology, 3) business and services, and 4) data science and smart tourism analytics. Design activities in smart tourism can optimize the means of communication related not only to words, but also through or representations of what tourism objects are or appear to be, through the lens of information technologies and data generation. Individuals can perceive destination spaces in an environment as being constructed with objects that are represented as signs that convey useful meanings as affordances (Gibson, 1977), particularly in the tourism service sector (Norman, 2013). In addition, semiotic affordances in tourism, include those objects found in attractions and sites, transportation mobilities, restaurant dining experiences, ancillary and amenities services, and even further, in recent COVID-19 situations at the destination (Hunter, 2022). They exist as visual or tactile cues on how to act or act in an immediate and unique travel situation. Smart design provides a mimetic digital artifact that reflects real objects in terms of their practical use value. Actions taken by users will contribute to new insight into travel behavior and decision making in smart tourism research. In Figure 4, the link between semiotic affordances in design and artifacts in the wider context of applications (as a user experience) is illustrated.

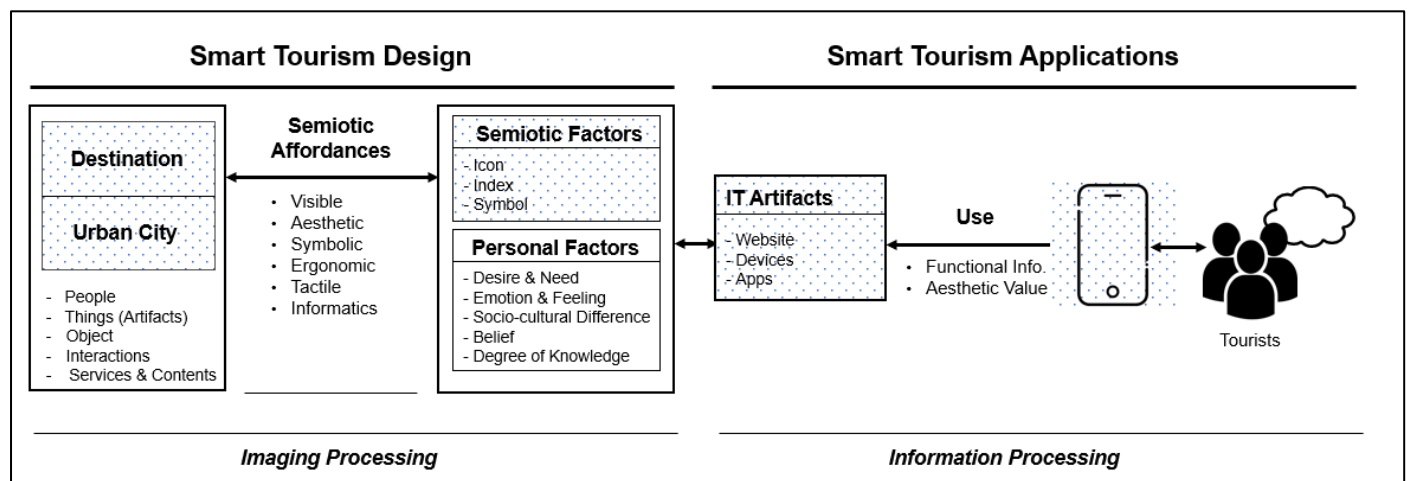


Fig. 4. How Smart Tourism Design links semiotic affordances to IT artifacts

3. Conceptual Research Model

3.1 Semiotics and Affordances

The science of the sign includes a wide range of theoretical views and methodological designs. It is generally understood as the science of the sign. Semiotics was originally conceptualized as a way to identify and interpret reality as linguistic, or the representation of reality within the human mind (Saussure, 1959) versus a system of objects that exist outside the mind (Peirce, 1955). These two different ways of thinking about signs and their representations originated in the late nineteenth century and have been developed by many others for interpretive research in various disciplines and fields of study (Barthes, 1972; Nadin, 1987). In every case, interpretation takes place in a discreet, closed logical or empirical system. In other words, any semiotic analysis is context specific. In Smart Tourism Design, Peirce’s semiotics is paired with affordances theory to examine how a

system of objects can be transformed into digital artifacts to facilitate the achievement of users’ needs and desires during the travel experience. The concept of affordance refers to ‘information pickup’ using any sensory apparatus, including sight, sound, smell, touch, balance, kinesthetic, acceleration, or physical body position. Affordance, in design, is a “relationship between a physical object and a person” (Norman, 2013, p. 11) and how the object is directly perceived and reacted to, immediately, instinctively, and unconsciously (Gibson, 1977). Semiotic affordances in practice, should work to identify these reactions between the individual and the imagery in the surrounding real or virtual destination landscape (Hunter, 2016). Even machines or forms of artificial intelligence can apprehend such signs and apply various interpretations based on their seen use, or exchange values (Nadin, 1987). In addition, signs representing aesthetic pleasure beyond functional value – like fashion and style – are affordances of experience design. In smart tourism, new developments such as the metaverse construct offer actual designs, crafts, logos, and

trademarks in the virtual world. They strengthen users' desires and motivations. These digital artifacts reflect, like mirror images, what is going on in the realities of destinations and places (Koo et al., 2022).

In this paper, the interpretation of signs moves from mimetic perception to the practical matter of interaction (Heft, 1989). A theory of semiotic affordances refers to the ways in which an individual recognizes the modality or reality value of the sign (Hunter, 2022). It closes the gap between the mind and the social self. Through affordances, travelers understand what actions to take or how the communication between traveler and machine (where they touch, click, and press), takes place. Functions that are actually and smoothly possible, become intuitive. Therefore, travelers can take the sign or sign systems and construct the meanings of them in conjunction with the senses as well as through the lens of digital artifacts on mobile smart devices. Through semiotic affordances, the practical matter of interaction between sign and visitor is accomplished by context specific inquiries that work to conjure up a series of tourism-related images that connect mind to the senses through information processing via unique applications. The actions of the tourist as consumers of the sign and its artifact, mirrored through information processing technology highlight "the symbolic nature of the tourism destination experience" (Echtner, 1999, p. 54). In the following paragraph, the essentials of Peircean semiotics as they apply to affordances in Smart Tourism Design, are outlined.

3.2 Triadic Concepts of Peircean Semiotics

Sign theory was devised as a system of logic or a medium for inquiry to explain all scientific disciplines and the process of scientific inquiry (Atkin, 2022). The sign, in this system of logic refers to the signifying element of something rather than the thing as a whole. In other words, the affordances, or relevant use value of the sign is that which represents something to the senses. The color, material, occupants, or other properties of a sign might take precedent as its representative quality or characteristic depending upon the needs or desires of the observer. In this sense, the sign is pragmatic and contextual, depending upon the logical closed system in which it appears. Understanding Peircean semiotics (Noth, 1990) requires the brief definition of three sets of triadic concepts:

- Philosophical categories: firstness, secondness, and thirdness.
- Sign categories: representamen, object, and interpretant.
- Sign types: icon, index, and symbol.

These three related triadic concepts (Hunter, 2022) can be briefly explained as follows, and as illustrated in Figure 3, below:

- Philosophical categories frame the hierarchy of the sign. Firstness refers to a pure and latent quality of a sign as an emotional experience (the quality of happiness or satisfaction). Secondness refers to the mode of being or practical experience (the cause and effect of service quality as a determinant of

satisfaction). Thirdness refers to rules and prediction, or cause and effect (company policies on service quality and their implementation in the hospitality industry) and is therefore an intellectual process of representation.

- Sign categories include a thing that represents some object (first order representamen) before any interpretation takes place – happiness before any recognition of its cause, say, by service quality. A sign, for example, of service quality, is an object representing the practical experience (second order object) that causes the firstness of happiness or satisfaction. In this sense, one learns to recognize certain discreet things, gestures, or acts and representations of the abstract notion of service quality. Force of habit, rules, or a general consensus on reality (third order interpretant) freezes the representation of service quality as a contingent sign of happiness or satisfaction in the context of the hospitality industry.
- Sign types explain how representations of firstness might appear to the individual (interpretant) and how they might be recognized. Iconic signs bear universal verisimilitude to the firstness of their representative context (restroom and exit signs, a wine glass, or a portrait of a famous person). Indexical signs convey information regarding experience in context (a clock indicating time, a sign indicating business hours, a compass indicating north, or a smile indicating hospitality). Symbolic signs are the product of thirdness, or a learned intellectual experience (a wine glass as a vessel for drinking wine, a front desk as the place to check in to the hotel, a uniform as a sign of employment and employment position or status). Iconic, indexical, and symbolic sign types – or categories – are not mutually exclusive. A sign might include characteristics of any or all sign types.

The triadic structure of Peirce's philosophy of semiotics – where concepts are grouped into sets of three – is commonly presented in the form of triangles. To the casual reader, this can be highly misleading if the operational relationship between the three points and lines of the triangle(s) are not specifically articulated. This is especially important given the sometimes-hierarchical relationship between some concepts (philosophical categories of firstness, secondness, and thirdness) and otherwise weedy or fuzzy boundaries (Meyer, 2006) between other concepts (sign types as icon, index, and symbol). Sign categories (representamen, object, and interpretant) on the other hand, are all contained within the consciousness of the interpretant (the individual) as representative or mimetic perceptions of real objects (Lau, 2014) (See Figure 5, below). Nevertheless, when properly applied, Peirce's triadic sign theories can be applied to the custom interpretation of many situations in Smart Tourism Design. These can include tourism related assets (destinations, landmarks, amusement parks, events, and tangible or intangible cultural heritage properties), service-related assets (amenities and services, accommodation, and gastronomy), social infrastructure (transportation services), or leisure activities (hiking, swimming, riding, walking and running, sunbathing, and wellness).

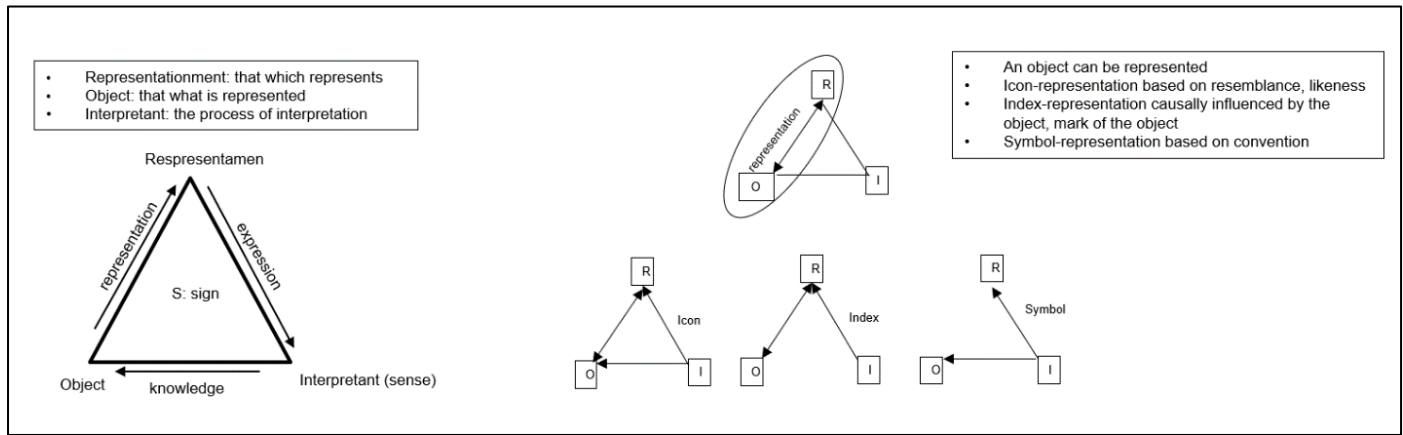


Fig. 5. Conceptualizing triadic concepts in Peircean Semiotics (Adapted from Nadin, 1987)

4. Methodological Deployment for Smart Tourism Design

Peircean semiotics is logical in the sense that it can only be used to interpret a cohesive closed system of signs. In smart tourism, this system of signs would refer to a destination's imagery and 'image processing' (Hunter, 2016), and its galaxy of representations – as found, and as duplicated in smart tourism applications and websites, the virtual reality of devices, digital/metaverse platforms, and other digital artifacts. These signs are empirical and are evidence of the affordances sought by visitors to the destination (pre-visit, visit, and post-visit). These signs represent individuals' immediate mimetic perceptions as well as their anticipated or experienced places and events (Hunter, 2021). Peircean semiotics fits with the notion of affordances in the sense that signs act as representations of things that play out in real time and in real situations with the visitor's experiences. These sign-affordances are not hypothetical, they are real and immediate events that are accessed in real time both physically and by way of smart tourism devices and applications (Chung et al., 2015). Smart Tourism Design – in semiotic affordances theory – is normative and functional, emotional, and aesthetic, and user-driven rather than device-driven. However, due to the complexity of semiotics and affordance theories, and the chaotic nature of tourism destinations and destination management (Olmedo & Mateos, 2015; Pappas, 2018) there are many ways to deploy a research methodology for Smart Tourism Design. However, there are some essential guiding principles for semiotic affordances theory (Hunter, 2022):

- Semiotic signs must be representations of visible, tangible objects, individuals, landscapes, or built spaces that can be experienced in reality.
- Semiotic signs must be part of a logical and cohesive set (sample) that collectively represent a social context, such as a tourism destination or an element of that destination such as a hotel, an attraction, or a shopping venue.
- Semiotic signs must be tangible in the sense that they have a point of origin, they are collectible and transferrable, and can be objectively recognizable as empirical objects (the most common form would be the photograph).
- Semiotic signs must be accessible to interpretation in terms of firstness, secondness and thirdness (Peirce, 1955).
- Semiotic signs must include both denotative (essential descriptive characteristics) and secondary connotative (potential affordances) attributes that tie them to the research context and bear interpretable implications for Smart Tourism Design research (Barthes, 1972).

In addition to these five guiding principles for a semiotic affordance methodology, there are also some essential components for data gathering and analysis (van Leeuwen, 2005).

- A sample set of representations based on a population of semiotic signs contained in any closed logical system (a particular tourism destination, or related smart tourism platform).
- A content analysis must be performed to identify denotative signs (Barthes, 1972).
- A semiotic analysis of some kind (Hunter, 2016) to identify connotative sign types based on Peirce's triadic concepts, such as icon, index, and symbol.
- Implications for tourism destination image management (Mackay & Fesenmaier, 2000), chaotic tourism management (Pappas, 2018), or smart tourism applications (Chung et al., 2015) that can be linked to findings derived from the semiotic analysis.

4.1 Implications for Smart Tourism Design and Semiotic Affordances in Destination Management

The driving goal for proposing a theory of semiotic affordances for Smart Tourism Design, is to find a deeper and more sustainable explanatory and predictive device for a smart tourism oriented toward a human – rather than an institutional or technological – perspective. Semiotics provides a ready-made theoretical and methodological approach to identifying and categorizing the signs and representations found at a tourism destination. Each version of a semiotic affordance is fully bespoke and specifically constructed for any application and its corresponding network of real-world objects at the tourism destination. Semiotic sign-types (icon, index, and symbol) used in smart tourism artifacts will usually only make sense in a specific tourism context and are determined by the specific needs and desires of certain users – although in certain cases they may be transferrable. Sign-types are the items that in smart tourism, become data and code for various travel applications and virtual or augmented reality applications, and digital/metaverse platforms. However, in current smart tourism research and technology development, the emphasis is on the structural design and convergence of digital platforms or applications and devices. The gap between what is 'real' and what is 'ersatz' in tourism experience cannot be bridged with this approach because the intuitive and experiential desires and needs of the user (the tourist or traveler) are subsumed under the smart technology. In proposing a new theoretical view, the affordance value (Gibson, 1979) of the sign becomes the primary determinant driving design and development in smart tourism technology. In firstness, smart tourism digital/metaverse platforms provide icons with direct resemblance to the experiences or things they represent. In secondness, they provide the interface or purpose-driven

technology to provide access to the sign indexicality or reality of experience represented by the device and its applications. In thirdness, smart tourism platforms seamlessly optimize the symbolic human experience of the tourism destination and related travel needs and desires.

Affordance theory simplifies semiotics by making basic claims regarding the nature of human perception as a product of evolution that has linked various things in a specific environment with what they provide or furnish in terms of inherent potential for benefit or harm (Araújo & Davids, 2009). The existential experience of the tourist before, during, and after the visit consists of a never-ending flow of immediate needs and desires, shaped by their perceptions. However, the goal of smart tourism technology development is to develop algorithms or methods to identify patterns in how smart platforms are used by the tourism market in general. The theoretical proposition made in this paper is that the location of affordance should be moved closer to the immediate perceptions of the individual tourist rather than being based on the determination of the human or virtual intermediary. Instead of the tour guide or the augmented reality of smart maps or signs directing the tourist where to go (Jung et al., 2015), the immediate needs or desires of the tourist drive the direction in which they might navigate the destination. Or, where desired products and services are concerned, the fit between task and technology in their attainment is optimized (Lin & Huang, 2008).

Researchers are interested in exploring how Smart Tourism Design aspects act as functional semiotic signs in the sense that they are tacitly recognized by users, and as solutions in the form of immediate affordances in attraction sites, transportation mobility, restaurant dining, or ancillary and amenities services. Affordance theory can help researchers and practitioners to maximize the experience potential of a tourism destination based on an ecological approach, rather than on any predetermined user or customer format provided by intermediaries (Ackerman, 2019). A semiotic affordance theory can enable tourists to recognize the signs that will fulfill their needs and desires and access them more immediately without having to necessarily navigate the complexity of downloading cumbersome applications. Smart tourism applications can be designed with the user in mind rather than in information platform development (Cheng et al., 2019). Affordances, as opportunities for action, can be made more accessible by closing the distance between the individual as tourist and the technology produced and disseminated through smart tourism (Cabiddu et al., 2014). In this paper, semiotics and affordance theory are described as a synergistic approach to humanizing smart tourism, based on the immediate perception of the tourism destination environment as a site for realizing desires and experiences.

For the traveler, semiotic affordances in the emergent Smart Tourism Design paradigm emphasize usefulness in functional image processing as well as aesthetic value in hedonic processing for specific users. It frames tourist attractions and sites, and tourist objects/things and their corresponding digital artifacts as a seamless continuity of function and aesthetic design. Digital devices will grow closer to being real extensions of the human senses, blending image and information within specific spatial or virtual contexts with their own unique tourism activities, and meaningful experiences and outcomes. For the destination, semiotic affordances will inform the development or calibration of existing smart tourism applications for more essential human interactions with the objects and experiences that punctuate destination spaces. Image perception and information processing are closely joined together in Smart Tourism Design, to provide meaningful access that reflect the destination's real characteristics rather than simply those that are projected by marketing interests (Hunter, 2016). Better design in smart tourism will motivate travelers' visit intentions and influence behavior that brings out the best qualities of the destination travel experience. Smart tourism researchers will also benefit from better information technology design, providing more insight into

user-driven actions and the effects of digital artifacts on the consequent digital transformation of the destination context.

5. Conclusions

A semiotic affordances approach for Smart Tourism Design marks a paradigm shift in smart tourism from data driven information processing based on users' actual context-specific inquiries before and during the travel experience. It requires a more seamless connection between objects with sign-value in the destination environment and data-driven applications (Xiang et al., 2021). It provides a better representation of motivations to travel, service experiences, and the sharing of those experiences on social media. It conceptualizes digital artifacts as flexible and evolving with real social events and technological developments that transform travelers' experiences at the destinations they visit. The main purpose of proposing a conceptual view on semiotic affordances in Smart Tourism Design is to highlight design image that reflects aesthetic travel experience. This is a largely emotional aspect of desire in travel that has been overlooked in smart tourism research to date. This perspective does not seek to replace but rather to augment fundamental development issues in smart tourism and related tourism fields that remains concerned with itinerary process design, and the configuration of tourism products and services. Better design will work to apprehend and improve the delivery of unique meanings associated with the objects of the tourism and travel experience and memories of the destination.

Semiotic affordances in Smart Tourism Design provides a structured approach to understanding the aesthetic value of travel and destination information. It adds depth and dimension to travel and research on travel experience that is largely utilitarian. It also adds value, as the fundamental practicalities of smart tourism have already mostly been addressed by applications development. A deeper quality of experience is needed as digital tourism design has matured with increasingly complex platforms and user needs (Koo et al., 2022). Readers of Current Issues in Tourism will recognize that new issues in smart tourism will be increasingly object oriented, context specific and non-transferrable, driven by spontaneous user needs and desires, and defined by information processing of their artifacts rather than externalized as applications. In an increasingly complex smart tourism field, researchers, and practitioners, as well as destination marketers will require the theoretical power and range that can be unlocked by semiotic affordances theory.


Declaration of competing interests


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Author Biographies

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Jaehyun Park, Jaehyun Park is an Associate Professor in the School of Design at the Hong Kong Polytechnic University. He was an Associate Professor in the Design and Architecture Department at Kyoto Institute of Technology and a Specially Assigned Associate Professor in the School of Engineering at the Tokyo Institute of Technology. His academic disciplines have transformed three inter-related studies among Arts & Design, Management, and Technology. He received two Bachelor Degrees (Painting and Visual Communication Design) from Seoul National University in Seoul, South Korea. He studied User-Centered Design and Planning during his master at the Institute of Design of Illinois Institute of Technology in Chicago, the United States. He obtained his PhD in Information Systems (IS) from the Weatherhead School of Management at Case Western Reserve University in Cleveland, the United States. As a socio-technical researcher by a view of social construction, Dr Park's research interest and contributions are condensed into three genres as interdisciplinary studies: (1) UX & Service Design, Entrepreneurship, and Design Thinking; (2) Smart Tourism, Smart Cities, and Smart Work; and (3) Digital Innovation. In particular, his research highlights exploring new interpretations of products, systems, and services, especially as they relate to the issue of human enterprise in design, innovation, and technology research. For successful business-design solutions, he believes that the most critical issue is to identify emerging relationships among business, design, and technology, and the human-centered approach is the core of identifying relationships for the successful design and innovations over time. Dr Park's works have been published in the premier international design, technology, innovation, and management Journals (e.g., Information & Management, IT & People, Service Industries Journal, Journal of Knowledge Management, Creativity and Innovation Management, and so on) and international conferences in Information Systems (IS), innovation, and design conferences (e.g., ICIS, AMCIS, PACIS, Desrist, ICEE, and DRS). In addition, several research outcomes are now under reviews by multiple journals (e.g., JBE, IT&P, R&D management, and SIJ). Moreover, he has proposed diverse Journal special issues as a guest editor (e.g., I&M, Internet Research) and conference tracks as a chair (e.g., PACIS 2018~2020) to enhance how the design research can make impact within the disciplined research domains.

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