

# 1 **Calm ICT design in hotels: A critical review of applications and** 2 **implications**

3

## 4 **Abstract**

5 There has recently been a call for revisiting the effect of ICT on guest experience in hotels. This  
6 is because ICT solutions can act not only as enhancers of hotel guest experience, but also as its  
7 inhibitors. In response to this call, the notion of calm ICT design has recently been introduced.  
8 Calm ICT design describes the ICT solutions that are used only when and if required, thus not  
9 calling user's attention at all times. Although this concept is highly relevant to the hospitality  
10 industry, it has never been systematically considered within. This paper conceptualizes calm  
11 ICT design for application in the hospitality context. To this end, it analyzes the ICT solutions  
12 that are currently employed by hospitality businesses from the calm ICT design perspective;  
13 discusses how the opportunities offered by calm ICT design can be better capitalized upon by  
14 hospitality managers; and outlines directions for future research.

15 **Key words:** technology, hotel, guest experience, calm ICT design

16

## 17 **Introduction**

18

19 The use of ICT adds a new dimension to the complete modern hotel experience  
20 (Buhalis & Leung, 2018; Sarmah, Kamboj, & Rahman, 2017; Sigala, 2018). In the context of  
21 co-creation of experiences, ICT is more than just an ordinary tool (Neuhofer, Buhalis, &  
22 Ladkin, 2012) offering various possibilities for experience enhancing. As a result, the positive  
23 role of ICT has been widely recognized in the hospitality literature (Law, Buhalis, &  
24 Cobanoglu, 2014). However, ICT can also diminish or even destroy the hotel guest  
25 experience through, for example, technological failures and visual or noise pollution  
26 (Benckendorff, Sheldon, & Fesenmaier, 2014), information overload (Friás *et al.*, 2008),  
27 technostress (Lee *et al.*, 2014), poor design (Benckendorff *et al.*, 2014) and depersonalized  
28 hotel experience (Tarlow, 2011). Hence, the "by default" integration of ICT solutions into  
29 hotel experience with an intention of value creation and enhancement may not always work  
30 as intended (Neuhofer, 2016) and can even lead to „value co-destruction“ instead (Plé &  
31 Chumpitaz Cáceres, 2010). Value co-destruction happens when ICT does not deliver its  
32 ultimate purpose to consumers due to hotel guest disengagement with technology or due to  
33 inadequate technology design and implementation. An example of this would be a situation  
34 when hotel guests have limited knowledge of a new ICT solution and are therefore unable to  
35 use it as expected by a technology provider (hotel) (Plé & Chumpitaz Cáceres, 2010).  
36 Alarmingly, although the issue of technological overload has potential to inhibit hotel guest

37 experience, it has largely been overlooked by the industry practitioners to date (Cobanoglu *et*  
38 *al.*, 2011).

39 The detrimental effect of prospective technological overload on consumer experience  
40 has been envisioned back in the early 1990s, i.e. long before the era of omnipresent  
41 computing. Weiser and Brown (1995) raised first concerns about potential, computer-  
42 imposed, information overload and the subsequent stress this overload creates for technology  
43 users (Byrne *et al.*, 2009; Greenfield, 2006). As a partial solution, Weiser and Brown (1995)  
44 introduced the concept of ‘calm technology’ which advocates the design of technology from  
45 the perspective of its users, rather than providers. ‘Calm technology’ is the context in which  
46 technology recedes into the background of people’s lives (Mark Weiser & Brown, 1995),  
47 drawing the end user’s attention only if and when necessary. Case (2015) has further  
48 suggested that the term ‘calm interaction’ or simply ‘calm design’ may be more accurate than  
49 ‘calm technology’ as it implies that technology is used for a smooth capture of the end user’s  
50 attention only when required, while calmly remaining in the background at most times. The  
51 ultimate purpose of calm design is not to calm people physiologically, emotionally or  
52 cognitively, but to design ICT solutions that can be more easily used in a calm manner  
53 (Moraveji *et al.*, 2011; Stanford University’s Calming Technology Lab, 2011). With the rapid  
54 development of the Internet and with smart technologies getting better embedded and more  
55 seamlessly integrated into everyday objects, the concept of calm ICT design is gaining  
56 popularity in ubiquitous computing and ambient intelligence as well as in product design  
57 (Case, 2015a; Elwood, 2010; Hohl, 2009; Rogers, 2006; Weiser & Brown, 1995).

58 The concept of calm ICT design is underpinned by the idea that technology has no  
59 purpose by itself, but it should serve in delivering a desired experience (Case, 2015). For  
60 example, when applied in the hospitality context, calm ICT design should facilitate delivery  
61 of a pleasant and stress-free hotel experience. Calm ICT design can be integrated into the  
62 items used by the hotel guests the most, such as smartphones and wearables, as well as into  
63 more sophisticated and yet less frequently employed technological solutions in hospitality  
64 management, such as the video display units and the biometric technologies. Although calm  
65 ICT design has become a significant factor for everyday product development (Case, 2015a),  
66 its implications for hotel management remain poorly understood.

67 In order to understand the implications of calm ICT design for hotel guest experience, a  
68 narrative review of the key existing and forthcoming support technology infrastructure should  
69 be undertaken. To this end, this paper conducts a critical analysis of the literature on  
70 contemporary ICT solutions in hospitality to better understand the potential for application of  
71 calm ICT design in hotels. Thus, this review paper fills the gap in the literature on the  
72 employment of calm ICT design in hotels. By outlining directions for future research, the  
73 paper further contributes to the ongoing academic discourse on the use of smart technologies  
74 and disruptive ICT solutions within hotels.

75

76 **The notion of calm (ICT) design**

77

78 In their seminal work, Weiser and Brown (1995) divided technologies into calm and  
79 disturbing. The differentiation was made on the grounds of how technologies engage with the  
80 user's central and peripheral attention. Calm technology should engage with both and, while  
81 it focuses on central attention, peripheral attention is naturally attuned. In terms of audio-  
82 enabled kitchen appliances, for example, the user's central attention is on the meal  
83 preparation while peripheral attention is attuned with subtitle audio notifications when setting  
84 up devices. The peripheral attention can suddenly become central and demand action. In the  
85 audio-enabled kitchen appliances example, a sudden change in the notification sound level  
86 draws users' attention and prompts them to check the water level in the steam cooker, for  
87 example. What is fundamentally 'encalming' in this example is a smooth transition from  
88 peripheral to central attention and backwards only when needed, while the device is trusted  
89 by its user to perform its original task at all other times (Case, 2015).

90 It is important to recognize that the notion of calm design is not novel. Essentially, it  
91 represents a revised approach in technology design which puts end-users in the focus. The  
92 intention is to reduce the mental costs for consumers of technology, i.e. technology facilitates  
93 end-users to reach a desired goal via the fewest possible number of steps (Case, 2015). Riecki  
94 *et al.* (2004) view this type of "calmness" as a user-centric measure, which describes how a  
95 system appears to the user when technology is utilized in a specific context. Therefore, the  
96 important aspects of calm technology are: timing (an application interacts with a user in the  
97 right situation and at the right time) and the relevance of interaction (interaction fits into a  
98 specific situation). In the ambient intelligence context, calm design begins when computer  
99 technology vanishes in the background (Bibri, 2015). From one point of a view, the computer  
100 disappearance can be seen as physical disappearance, i.e. when computers become small  
101 enough to be invisibly embedded into objects or people (for example, smart wearables), or  
102 mental disappearance, i.e. when people no longer perceive devices as computers but as  
103 integral elements of augmented artifacts in the environment (for instance, interactive screens,  
104 holograms, or realistic, augmented reality-based, video games) (Streitz, 2001; Tugui &  
105 Genete, 2009). Moreover, the "invisibility" of technology is achieved when the users' focus is  
106 on the task, not on the tool they use (Weiser, 1993). For example, *Google Search* would  
107 qualify as invisible as its robust search engine is hidden behind the minimalistic omni-channel  
108 digital experience that works well enough, so the users tend to forget it even exists  
109 (Ocallaghan, 2014; Sension, 2018).

110 Tugui and Genete (2009) pinpoint the minimum conditions for ICT solutions to become  
111 calm, i.e. their adaptability to end-user behavior as enabled by flexible communication;  
112 information security and confidentiality of the end-user's private data; universal user interface

113 which remains unconditioned and permanent in various environments; invisibility of the  
114 material system which functions without excessive user interventions; integration of all of the  
115 equipment and applications into a single platform; and constant availability as a result of  
116 growing reliance of industry practitioners and consumers upon technology. Case (2015)  
117 outlines examples of the practical application of calm design and defines the basic principles  
118 and patterns for non-intrusive technology design to ensure it becomes an integral part of an  
119 end-user's life, and not a distraction from it. In order for technology to be calm, Case (2015)  
120 insists that it should require the smallest possible amount of attention from end-users and, for  
121 delivering or extending communication, it should use end-users' peripheral attention.  
122 Furthermore, Case (2015) advocates that calm design should encompass the best of  
123 technology (for example, its ability to perform complex algorithms) and the best of humanity  
124 (for instance, it should contain features enabling end-users to do what they know best, such as  
125 recognizing specific contexts and communicating seamlessly with other users). This is based  
126 on the principles of affective computing that relate to systems and devices that are able to  
127 work with and simulate human emotions (Picard, 1995), such as a robotic companion for the  
128 elderly (Sharkey & Sharkey, 2012) or the educational robots for children with autism (Robins  
129 & Dautenhahn, 2014). Furthermore, Case (2015) points that technology should not  
130 necessarily communicate with end-users verbally as interacting via simple audio-visual  
131 notifications is often enough. In order to offer a friction free end-user experience, all possible  
132 technology failures have to be carefully addressed to enable even least experienced users to  
133 deal with technology seamlessly. Ideally, the right amount of technology is the minimum  
134 needed to solve the problem. Finally, in order to avoid any tension, calm technology should  
135 respect the social norms, as people may need time to get accustomed to certain technological  
136 solutions (Case, 2015). Indeed, consumer distrust in a new technology may affect the success  
137 of its market penetration and it is thus critical to understand public attitudes to various ICT  
138 solutions, especially the novel ones.

139 Some of the most notable examples of calm ICT design are related to calm  
140 communication, such as the different sounds of the status tones, relevant pop-ups or haptic  
141 alerts used in wearables. An example is the Dark Sky weather application for hiking that  
142 employs user's location, criteria entry and upcoming weather patterns to notify the user when  
143 needed but otherwise running calmly in the background (Grossman, 2015). By exploring the  
144 possibilities of applying the principles of calm technology in marketing in the era of the  
145 Internet of Things (IoT), Sweterlitsch (2016) even coins the term "atmospheric approach"  
146 (marketing is invisible, yet it is everywhere), referring to the marketing paradigm that delivers  
147 a message quietly and without interruption using peripheral awareness so that customers can  
148 choose to attend the message or take action with the least amount of mental cost. In the  
149 hospitality context, a good example of calm ICT design is Gustaffo, a digital concierge  
150 service for hotels that integrates into existing hotel's ICT solutions, constantly working

151 behind the scene to address the needs of hotel guests. With this service there is no need for  
152 the guests to install a hotel smartphone application, as they can be automatically redirected to  
153 the digital concierge which becomes active immediately after the guests have logged into the  
154 hotel's WiFi. It can independently read and interpret written or spoken language and give an  
155 appropriate answer (i.e. provide a service) by using the way of communication that the guests  
156 choose (for example, Amazon's Alexa, Facebook messenger, Twitter, WeChat, Whatsapp or  
157 chat widgets from the hotel homepage) (Gustaffo, 2018). For the guests, this calm ICT design  
158 solution reduces the barrier of technology use and, for the hotels, it offers better opportunities  
159 to promote its services.

160

### 161 **Current hotel ICT solutions and calm ICT design**

162

163 To analyze current hotel ICT solutions from the viewpoint of their suitability for calm  
164 ICT design, a smart technology paradigm has been utilized. The categorization of current ICT  
165 solutions as applied in hotels is based on the key smart technologies (Stankov, Pavluković,  
166 Alcántara-Pilar, Cimbalević, & Armenski, 2018) and will encompass: smartphones,  
167 wearables, biometric and audio-visual technology, as well as the supporting components,  
168 including intelligent software agents and geolocation systems.

169

#### 170 *Smartphones*

171 Smartphones have changed the communication landscape in the hospitality sector as  
172 they have become ubiquitous, providing a key medium for information delivery and exchange  
173 (Kim and Law, 2015). The growing number of consumers nowadays own multiple devices  
174 and use them consecutively when searching travel information and booking, however,  
175 comparing to other devices smartphones are the most portable, versatile and accessible  
176 virtually anywhere (Murphy, Chen, & Cossutta, 2016) including almost all possible scenarios  
177 hotel experience. Hoteliers have begun responding to this trend by developing corporate  
178 mobile phone use strategies and accompanying applications (Chen, Murphy, & Knecht,  
179 2016). For example, Radisson RED (Brussels, Belgium) uses all-in-one hotel application to  
180 deliver services through the hotel guests' smartphones. Room reservation and seamless  
181 control over hotel stay with keyless technologies are enabled by a dedicated app. Everything a  
182 guest might need before, during and after their stay is centralized on a single, easy-to-use  
183 platform (Assa Abloy, 2016).

184 The main strengths of smartphones for calm ICT design are related to the fact that  
185 mobile applications have shifted from being a novelty to becoming an essential part of  
186 consumer experience, with the capabilities of offering personalized information for guests,  
187 two-way sharing, context awareness based on smartphone sensors, or communication with

188 other machines (Dickinson et al., 2014). Smartphones are therefore able to offer better  
189 convenience, flexibility, efficiency and fun for users (Kim and Law, 2015). On the other side,  
190 when mobile applications are incorporated into the hotel guest experience, they can distract  
191 consumers and reduce calmness. This can be a result of, for instance, poor connectivity, high  
192 consumption of battery power, charging issues, limited device processing capabilities or  
193 excessive roaming charges. Furthermore, emerging sophisticated hotel services, followed by  
194 virtual and augmented reality features, will require additional resources and will impose  
195 further pressure on average smartphone processing capabilities (Chiu & Leung, 2005).  
196 Finally, the current mobile app market is saturated (Lunny, 2016) which can increase  
197 consumers' unwillingness to install another app just for the purpose of hotel stay.

198

### 199 *Wearables*

200 Wearables encompass various technological solutions that stand for the different forms  
201 of body mounted technology (Atembe, 2015). They represent an emerging ICT trend which  
202 finds purpose during travel and hotel stay by facilitating communication, navigation,  
203 information search or health monitoring (Atembe, 2015; Ortiz Rincon, Tommasini, Rainoldi,  
204 & Egger, 2017; Tussyadiah, 2013). For example, Palladium Hotel Group (Ibiza, Spain)  
205 introduced the VIB (Very Important Bracelet). With its smart bracelets, the hotel guests can  
206 access rooms and other hotel facilities, pay for products and take advantage of exclusive  
207 discounts. The bracelets are programmed to ensure that guests' information is safely protected  
208 (Palladium Hotel Group, 2014). Drawing on this example, wearables will become an  
209 important ICT solution to be used in the context of all-inclusive holidays where they would  
210 replace traditional paper bracelets by offering not only a fashionable hi-tech device, but also a  
211 device with integrated functionality.

212 Some existing wearable technologies represent, in their essence, examples of calm ICT  
213 design as they are almost invisible; small-sized and discrete; unobtrusive; easy to set up and  
214 use; highly personalized to end-user requirements; with automated action based on sensors  
215 and with enabled connectivity with servers. Wearables extend the concept of embedding  
216 ubiquitous computing beyond hand-held devices (Elwood, 2010). As such, wearables reveal  
217 opportunities to create tailored hotel guest experiences based on consumer location,  
218 previously recorded preferences, or even current moods (Choe & Fesenmaier, 2017; Dibble,  
219 2015). The real value of wearables is in their capability to provide access to vital body  
220 parameters (Chan, Estève, Fourniols, Escriba, & Campo, 2012) and possibly determine user's  
221 emotional status; this can be used to deliver more relevant, emotion-based content services in  
222 hotels (Lee and Kwon, 2010).

223 Despite numerous advantages of the use of wearables for calm ICT design, there are  
224 some notable weaknesses. Hotels must carefully consider the key drivers of the wearables'  
225 adoption in the first place as to figure out how they can be best used in the guest

226 accommodation context. Some wearables are not yet widely accepted by the public because  
227 of their design and size/bulkiness. Some custom made wearables (bracelets and smart  
228 watches) can be too expensive to embrace for small hotels (Little Hotelier, 2015). Lastly,  
229 wearables are less versatile compared to the capabilities of hand-held devices and traditional  
230 desktop computers (Glaros and Fotiadis, 2005).

231

### 232 *Biometric technology*

233 Biometric technology encompasses various forms - fingerprint and iris scanning, facial,  
234 voice, hand geometry or signature recognition - and offer multiple opportunities for hotels  
235 (Mills *et al.*, 2010). Biometrics have long been around and the hospitality industry has  
236 recently started embracing them to enhance its management and improve quality service  
237 delivery, such as providing seamless access for hotel guests to control and payment, time and  
238 attendance systems (Kang *et al.*, 2007). Therefore biometrics are gradually becoming a  
239 common in-room technological solution for hotels. For example, Waldorf Towers Hotel (New  
240 York, USA) uses the *Elsafe* biometric safe with fingerprint recognition which enables the  
241 hotel guests to securely store their personal belongings by applying little effort (Assa Abloy,  
242 2003).

243 There are several important characteristics of biometric technology that contribute to its  
244 calm ICT design, such as the relative easiness of use, speed and reliability, longevity,  
245 suitability for many environments (Meyers & Mills, 2005). Most importantly, biometrics do  
246 not necessitate use of extra devices. The biometric access control systems are often seen as a  
247 means to make hotel premises safer for guests and to prevent its misuse by criminal elements  
248 (Thakkar, 2016).

249 Despite their multiple advantages, currently, neither guests nor hoteliers are yet fully  
250 ready for biometrics (Bilgihan, Karadag, Cobanoglu, & Okumus, 2013), thus preventing it  
251 from being considered as an example of calm ICT design. Biometric identification has to  
252 overcome such challenges as under-developed national legislation, user privacy and personal  
253 concerns, misunderstanding of the system functioning and high costs of deployment, among  
254 others (Kang *et al.*, 2007; Kim, Farrish, & Schrier, 2013; Neo, Rasiah, Tong, & Teo, 2014).

255

### 256 *Audio-visual technology*

257 Audio-visual technology is a traditional hotel ICT category that encompasses various  
258 video display systems, self service automated machines or innovative voice-controlled  
259 systems. For example, Wynn (Las Vegas, USA) was among the first hotels in the world to  
260 commercially introduce the *Amazon Echo* smart speakers as room equipment. Guests can  
261 verbally control many aspects of lighting, temperature and the audio-visual components of a  
262 hotel room using commands via the voice-activated assistant *Alexa* service (Raz, 2016).

263           Importantly, infrastructure that enables calm ICT design is largely dependent on audio-  
264 visual technology. Clarity and consistency are the vital aspects of smart technology use in this  
265 context (Tarlow, 2011). Through video displays, important information can be provided to  
266 hotel guests in their native language while the consistency of end-user interface (UI) in  
267 different locations could be reinforced by adopting popular mobile operating system  
268 interfaces. Calm ICT design can utilize advanced combinations of tone, lights or sensory  
269 stimulation to suit everyone’s taste and mood (Case, 2015). Although human-to-machine  
270 communication is still a major problem to overcome (Case, 2015), in the realm of applying  
271 calm ICT design in hotels many improvements can be made. Most commonly, if UI calls for  
272 all of the user’s visual or auditory focus, the envisioned interaction can actually be distracting  
273 (Case, 2015).

274

#### 275           *Intelligent software agents and geolocation systems*

276           Many ICT solutions presented above are usually underpinned by robust intelligent  
277 software agents. Intelligent software agents are an important asset for calm ICT design as  
278 they can bridge the gap between computers and specific applications (Hermans, 1998). Most  
279 examples of current use of artificial intelligence (AI) in the hospitality sector are related to the  
280 back office operations, such as revenue management, marketing or advertising, while there  
281 are many other possible applications in daily operation activities that directly affect guests,  
282 such as housekeeping, check-in or check-out procedures, predicting of room maintenance  
283 work, and food procurement, to mention a few (Alsetoohy & Ayoun, 2018; Reeves, 2018).

284           Similarly, geolocation systems are an underlying technology which enables recognition  
285 of location that is critical for understanding the spatial context for human-computer  
286 interaction in delivering desirable experiences. As such, it is often an indispensable  
287 component of all above-mentioned technologies. For example, Hyatt Regency (Santa Clara,  
288 USA) uses *Cisco* high-speed Wi-Fi, as a geolocation system. With the Wi-Fi coverage being  
289 seamlessly provided throughout the property, the hotel uses data about guest location and  
290 behavior to improve the effectiveness of on-site promotions (one-to-one advertising,  
291 delivering notifications) and to increase revenues from its catering and leisure facilities  
292 (Cisco, 2015).

293           Contextual information and communication are one of the most important  
294 characteristics of calm ICT design that should be provided by intelligent software agents as  
295 they intend to recommend personalized content based on the users’ dynamical behavior and  
296 the content they create and consume (Wang, Zhu, Cui, Sun, & Yang, 2013). In that sense,  
297 geolocation systems offer opportunities for the development of proximity and location  
298 services (Yamamoto, 2009) and enhancing guest experience (Chung, Tyan, & Han, 2017).  
299 For example, proximity marketing and location-based marketing have potential to be “calm”  
300 as they represent wireless distribution of the advertising content to the equipped users which



301 is localized to a particular place and bordered by invisible geo-fences or edges of transmitters'  
302 signal range (Yovcheva *et al.*, 2012). In general, from the end-user viewpoint, geolocation  
303 systems represent an easy-to-deploy and enjoyable way of identifying locations (Chung &  
304 Lee, 2016) while complex ICT support services are completely submerged in the background  
305 and require no interaction.

306 In practice, while there are growing examples of contextual notifications in action that  
307 come from weather, location, time, metabolic and emotional states or proximity, this area is  
308 yet to be developed (Case, 2015). Besides the necessity to have constant access to the mobile  
309 equipment in order to participate in proximity marketing supported by geolocation systems,  
310 hotel guests must further satisfy a number of preconditions that can be discomfoting (for  
311 example, Wi-Fi or Bluetooth enabled on smartphones and required application opt-in). In that  
312 context, pushed-based personalized messages represent a key obstacle for the application of  
313 calm ICT design in services based on geolocation systems as marketers might often try to  
314 overwhelm consumers with offers and messages (Balasubramanian, 2009). Finally, there are  
315 emerging ethical concerns regarding the potential violation of hotel guests' privacy when  
316 using these systems (Hardy *et al.*, 2017) and it is another problem to be solved in terms of  
317 calm ICT design as applied in hotels.

318

### 319 **Functionality of calm ICT design for hotels**

320

321 According to Pizam (2010), the creation of memorable hotel guest experience is a  
322 cornerstone of the hospitality industry. This is a challenging task to fulfill given the  
323 multidimensional structure of consumer experience which consists of personal characteristics,  
324 trip-related determinants, physical environments and human (social) interactions (Cetin &  
325 Walls, 2016; Walls, Okumus, Wang, & Kwun, 2011). It has been well recognized that ICT  
326 solutions can aid hoteliers in the creation of memorable hotel guest experience (Whitelaw,  
327 2008). However, there have also been reports indicating that the incorrect or improper use of  
328 ICT in hotels can dissatisfy guests, thus diminishing their experience (Cobanoglu *et al.*, 2011;  
329 Kronsberg, 2016). This is because there are novel ICT solutions designed for hospitality  
330 management that hotel guests do not always embrace and these are seen as disruptive  
331 (Cobanoglu *et al.*, 2011). For example, the ICT solutions for augmenting or replacing  
332 interactions between hotel guests and front-line employees can impede development of  
333 employee-guest rapport and lead to lower service evaluations (Giebelhausen, 2014).

334 The advantage of calm ICT design in hotels lies in the fact that it is an attention and  
335 focus-based approach that is predominately related to the 'calm' state of a guest that should  
336 not shift to the "disturbed" state when consuming hotel services delivered by ICT.  
337 Essentially, calm ICT design should help the guest to deal with shortcomings of the ICT  
338 uptake in hotels. Consequently, by removing the ICT-induced friction in guest experience, no

339 additional mental cost is required which could then increase guest satisfaction. Below we  
340 propose the functional strategies that stress the advantages of calm ICT design for hotels.

341

#### 342 *ICT supported hotel communication*

343 ICT supported communication is an integral element of hotel experience (Benckendorff  
344 et al., 2014; Chen et al., 2016; Ting, 2017). From the calm ICT design perspective it can  
345 encompass various contexts of the use of ICT solutions to interact with hotel guests,  
346 including: hotel apps working in the background and notifying the end-users only when  
347 needed; pull notifications (for examples, from smart posters) (Pesonen & Horster, 2012), opt-  
348 in push notifications (*iBeacon*) (Babu, 2015), unified user experiences for e-info points (for  
349 example, use of *Google Material design* for hotel applications) (Cousins, 2015), employment  
350 of enhanced visual communication with the use of virtual reality functions on hotel websites  
351 (Lee and Oh, 2007) or the use of standard emojis in delivering information (Clark, 2014). The  
352 potential ‘calmness’ of these ICT solutions has been enabled by the advancements in audio-  
353 visual technologies and smartphone development alongside their omnipresence. One of the  
354 key principles of calm ICT design, which utilizes periphery attention of end-users to  
355 communicate additional messages, would require extension of ICT solutions to the physical  
356 sphere in order to provide more human-like communication by, for example, using audio-  
357 visual or tactile communicators. In that sense, some hotels have adopted tablets to control  
358 room appliances and house-keeping services while some hotels employ remote energy control  
359 devices with “on/off buttons”, voice and light notifications (Wasan, 2014). For example,  
360 *Marriot* actively investigates this system to enable consumers to completely bypass the touch  
361 screens or physical button commands (Eye for Travel, 2016).

362

#### 363 *Guest-host transactions*

364 The main advantage of calm ICT transactions for guests is the convenience of use  
365 which leaves enough space to enjoy the basic hotel experience, as no additional mental cost is  
366 needed to conduct practical operations. Guest-host transactions based on calm ICT design  
367 encompass examples of paperless transactions (Neo et al., 2014; The Japan News, 2016),  
368 contactless identification and payment (Bilolo, Boeck, Durif, Levesque, & Levesque, 2015),  
369 proximity transaction services (Pesonen & Horster, 2012), self-directed experiences (for  
370 example, *Starwood’s* keyless mobile entry) (Ting, 2016; Lim et al., 2018.) or indoor/outdoor  
371 visitors tracking without their active participation (Williams, 2015). Most of these  
372 transactions are provided with the use of biometric identification technology or, more  
373 commonly, with the help of smartphones and wearables. The solutions that are able to  
374 provide totally calm ICT transactions include the assets required for information aggregation,  
375 ubiquitous mobile connectedness and real time synchronization of information (Neuhofer et

376 *al.*, 2015). Given the present context, calm ICT design provides hotels with the new  
377 opportunities to deliver exceptional guest experiences that benefit from simpler and user  
378 friendlier processes (Amadeus, 2007).

379

### 380 *Branded calm ICT hotel services*

381 Calm ICT design can aid in the development of new business models; it can further  
382 make some traditional hotel services to disappear while some new services to emerge (Tugui  
383 & Genete, 2009). For example, so-called ‘digital detox’ facilities and silent retreats (Lippe-  
384 McGraw, 2017) or other ‘niche’ types of the hotel industry’s offers, such as spa & wellness,  
385 rural hotels or ‘slow’ hotels that are underpinned by the idea of technological disconnection,  
386 and where the over-use of ICT can detrimentally affect the core hotel experience, can benefit  
387 from adopting calm ICT design. Similarly, the old-fashioned in-room control devices can be  
388 replaced with smart, hyper-personalized hotel experiences controlled with consumer  
389 smartphones (Ting, 2017). Yet, the services co-created by hotel management, guests and calm  
390 ICT design are rare in existing hotel industry practices (Neuhofer, Buhalis, & Ladkin, 2014).  
391 Branding calm hotel services would imply intentional efforts of hotels to create more  
392 complex services based on calm ICT design. Furthermore, calm service cannot solely rely on  
393 the digital sphere of hotel products. In order to use calm ICT design, integration of the digital  
394 and physical artifacts (e.g. installing mobile applications onto smartphones with subsequent  
395 interaction with other devices) is often needed. Evolving from the initial ideas and conceptual  
396 modeling of hotel products towards the development of a tangible, real-life product for  
397 guests, the future of calm ICT design would anticipate shifts from the digital to the non-  
398 digital, more physical solutions (Hohl, 2009). Hence, calm ICT design holds opportunities for  
399 new (re-) branding approaches for hotels that go in line with novel technological trends. The  
400 proposition of new and uniquely branded calm ICT design based hotel services supports this  
401 idea.

402

403

### 404 **Management issues of calm ICT design for hotels**

405

#### 406 *The challenges of introducing a new ICT design concept in hospitality*

407 One of the main goals of calm technology is in enabling people to handle vast amounts  
408 of information without becoming either overwhelmed with stress or to not become unaware  
409 of the world around them (Brown, Fercher, & Leitner, 2017). In the case of hotel experiences,  
410 effective employment of calm ICT design would require understanding of the manifold  
411 variables (Gretzel, 2011) which includes, but is not limited to (1) different types of hotel

412 experiences and (2) hospitality business models in general, as well as, (3) varied guest  
413 preferences towards ICT in hotels.

414 Hotel experiences are ranging from intimate guesthouse experiences, depersonalized  
415 self-service experiences of short stays at transit points, high class business experiences to  
416 luxury resort experiences with different cognitive, affective, and sensory attributes (Kim &  
417 Perdue, 2013; Ren, Qiu, Wang, & Lin, 2016) which all require different levels of ICT  
418 employment. The development of ICT itself allow some issues of ICT to diminish or  
419 disappear, for example context-aware technologies and personalization, coupled with  
420 improved the system's quality, new ways of interacting with the system, technical reliability,  
421 all help in achieving more calm use of ICT. Novel examples of technology enhanced  
422 experiences, simplification and automation of hotel daily operations activities within the  
423 context of smart hotel experiences also contribute to this trend (Buhalis & Leung, 2018). Still,  
424 within plethora of existing approaches, the hotel industry-specific implications of generic ICT  
425 design for dealing with the overall problems of ICT proliferation still remain poorly  
426 understood. Therefore, the introduction of calm ICT design contributes to the agenda of  
427 creating non-intrusive technology design so that it becomes an integral part of a guest's  
428 experience.

429 Apart from the level of designing different guest experiences the introduction of calm  
430 ICT is facing with infrastructural problems. The procurement of ICT solutions for hotels  
431 generally follows the pattern of technology usage among the different hotel groups and their  
432 technology knowledge and specialization (Namasivayam, Enz, & Siguaw, 2000). However,  
433 managers should be aware of the specificity of calm ICT design when it is considered an  
434 innovation for a hotel. Usually, when adopting calm ICT design, the focus is on the relative  
435 advantages that this design can bring over existing ICT solutions (e.g. economic benefits,  
436 social prestige, legitimacy or guest convenience) and on the compatibility with existing  
437 technological systems and strategies (Namasivayam et al., 2000). Evidently, in the context of  
438 calm ICT design, the perceived complexity of innovation technology and its ability to be  
439 tested in different contexts should dominate in its evaluation. Unlike the common desire of  
440 hotel managers to showcase their investment in innovative technologies, the visibility of calm  
441 ICT design is often reduced.

442 Finally, while information search, paying for services, interacting with in-room  
443 appliances and other simple transaction can benefit the most from calm ICT design, direct  
444 human contact is still a cornerstone of many aspects of hotel experiences (for example,  
445 communicating with front-office or restaurant staff) (Rafat & Clampet, 2017). In that sense,  
446 depending on innovative business strategies of hotels calm ICT design can be seen as a short-  
447 term investment in the new more calm ICT or redesign of existing ones; or as a long-term  
448 strategy to prove calm ICT experiences that will help guests in achieving more pleasurable  
449 experiences on hotel premises.

450 The perspectives of consumer's characteristics that are related to calm ICT usage are  
451 discussed in next paragraph.

452

453 *Varied guest preferences towards calm ICT design in hotels*

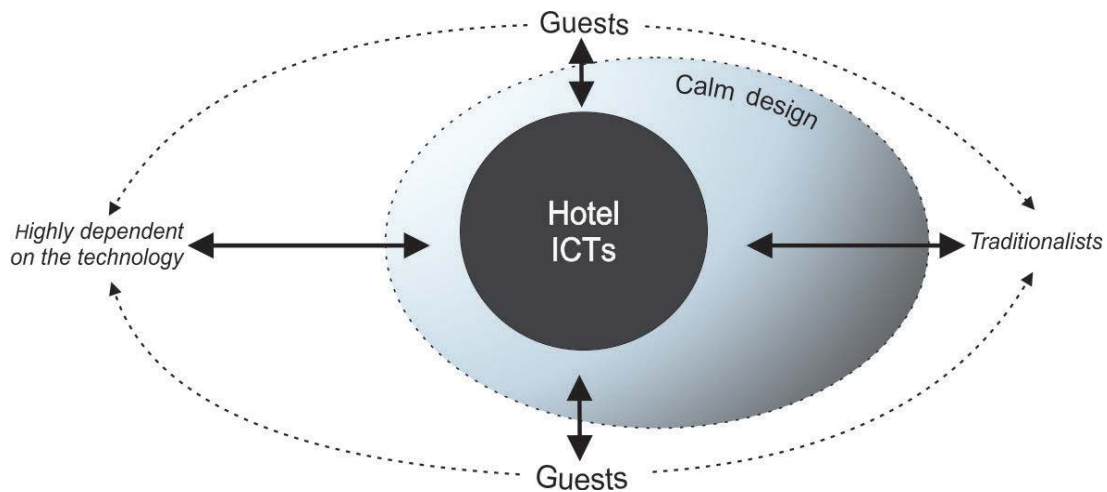
454 There are substantial differences in the extent to which hotel guests are prepared to  
455 embrace ICT solutions during their stay. Innovation theory suggests that innovators and early  
456 adopters among consumers are more interested in the use of novel technologies (Kah *et al.*,  
457 2008). Amadeus (2015) categorizes hotel guests based on consumer preference for certain  
458 types of user experiences (UE) and certain types of desired experiences as facilitated by  
459 technology. The categorization spectrum disclosed by Amadeus (2015) stretches from pre-  
460 digital nostalgia consumer groups that will openly deny ICT solution, but still use its benefits  
461 for personal gains, to the opposite side of technology addict consumer groups. Furthermore,  
462 depending on the context, consumers assign different values to ICT use (Akaka *et al.*, 2012).  
463 Some consumers see ICT solutions beneficial while some consider them restrictive (Akaka &  
464 Vargo, 2014). As discussed earlier, the dimension of consumer preferences towards ICT  
465 solutions in conjunction with certain contexts of ICT use in hotels can thus lead to  
466 dissatisfying guest experiences.

467 The future development of calm ICT design for hotels will depend on its capacity to be  
468 accepted by the end-users (guests) and to be aligned with the producers' interest in the field  
469 (Tugui & Genete, 2009). Formalization of a calm ICT hotel experience as a theoretical  
470 framework could lead to the practical development of the new services that will respect the  
471 different consumer needs by concurrently avoiding the problem of technology overload. That  
472 would imply inclusion of 'calmness' as a standard variable of consumer perceptions towards  
473 ICT when evaluating hotel guest experiences and procuring ICT solutions by hotels.

474 If offered to the traditionalists, a form of 'calm ICT design barrier' is needed to serve as  
475 a buffer zone between ICT intensive hotel guest experience and desired calm experience of  
476 the traditionalists. Figure 1 graphically present the amount of hotel interventions in calm ICT  
477 design that is needed in response to different guest preferences towards ICT design in hotels .  
478 In the case of hotel guests who are highly dependent on technology, this barrier (the level of  
479 hotel interventions) can be loosened. Again, in the case of the traditionalists, 'calmness'  
480 largely relies upon traditional, one-directed creation of experience which is from a provider to  
481 a consumer (Neuhofer *et al.*, 2012). In this case, a hotelier uses technology to aid in the  
482 delivery of technology-enhanced staged experiences (Neuhofer *et al.*, 2014). As suggested by  
483 Riecki *et al.* (2004), calm ICT design should bring the systems that do not interfere with end-  
484 users unnecessarily, but instead that quietly support end-users by providing the required  
485 service, when and if required and without distraction. In this sense, the design of calm ICT  
486 services can be driven by hotel guest needs, such as, for instance, the needs of the elderly or

487 disabled people as a means to enhance existing hotel experiences. Hotel services designed  
488 with this idea in mind could also encompass traditional hotel experiences that are  
489 characterized by the limited embracement of technology and restricted business-to-guest and  
490 guest-to-guest co-creation. For example, there are some propositions for small hotels to offer  
491 silent un-alarm clocks or sleep sensors in the form of bracelets to provide calm ICT  
492 experience in its purest form (Little Hotelier, 2015).

493



494

495 Figure 1. The relations between calm ICT design and varied guest preferences towards  
496 ICT

497 On the other side, hotel services can be created with the more active use of ICT  
498 solutions if the guests are familiar with a particular type of technology (Pang, 2011) and its  
499 employment will not impose more stress. With the proliferation of ICT there were reports on  
500 digitally adept travelers actually expecting and welcoming the high level of ICT-based  
501 experiences (Ali, Clampet, Schaal, & Shankman, 2014). In this case, calm ICT design can  
502 enhance consumer experience and engage the hotel guests in experience co-creation. This  
503 kind of calmness can be achieved with most of existing technologies as they can be re-  
504 designed to provide more engaging environments, similar to those used in everyday life. This  
505 can add value by actively embracing the intelligently designed ICT solutions and making  
506 them more engaging, thus enabling co-creation in physical and virtual settings and enhancing  
507 the hotel guest experience.

508

509 **Limitations of calm ICT design for hotels**

510

511 *General constraints and current state of ICT development*

512 There are general constraints experienced by service providers in their endeavor to  
513 adopt new ICT solutions. Wasan (2014) categorizes these constrains as internal barriers (i.e.  
514 personal barriers to the ICT adoption, operational barriers, financial barriers, human resources  
515 barriers) and external barriers (i.e. market forces, legislation, policies and regulatory  
516 standards, customer attitudes, rapidly changing technology, construction challenges). The key  
517 challenge for achieving calm ICT design in hotels rests in the scope of currently existing  
518 technological limitations. Considerable efforts have gone into realizing the Weiser and  
519 Brown's vision in terms of developing frameworks, technologies and infrastructures,  
520 including proactive computing, ambient awareness, placing sensors, but, as interesting as  
521 these endeavors have been, they still do not match up to the envisioned calm computing  
522 (Rogers, 2006). Available technologies are not capable of matching all principles of calm ICT  
523 design as the gap between human analogues and computer digital nature remains wide  
524 (Greenfield, 2006). When applied to hotels, a prerequisite for the successful calm ICT design  
525 implementation can be trivial for certain hotels (i.e. luxury hotels or large hotel chains), but  
526 can be crucial for some others. For example, the cost-effective access to Wi-Fi is still a major  
527 challenge for smaller, independent hotels and cruises. Furthermore, given its novelty, calm  
528 ICT design may require expensive infrastructure which can intensify financial pressures  
529 imposed on hotels. This is of special importance for small and medium hotels that make the  
530 largest share of the sector.

531

532 *Vagueness of the concept of calm ICT design for hoteliers and consumers*

533 At the current state of research, for the majority of hotel guests it would be difficult to  
534 identify a desired level of calmness when interacting with ICT solutions. As discussed earlier,  
535 calmness is a user's centric measure in a specific usage situation. In this sense, labeling some  
536 hotel services based on the level of 'calmness' offered may be appropriate in some cases. For  
537 example, a 'tech free' hotel experience can sit on the one side of the spectrum while a  
538 'virtually augmented' hotel experience can represent the other side; these can be branded and  
539 offered to the niche tourist segments. Looking from a general perspective, guests from  
540 specific geographies, socio-demographic groups, cultural backgrounds or psychographic  
541 profiles can be well accustomed to a certain technology while the same technology can be  
542 new or confusing for the others (Lo *et al.*, 2002; Benckendorff *et al.*, 2014). For example,  
543 social media can deliver desirable and less intrusive messages and hotel alerts to the  
544 youngsters which can be seen by this category of consumers as a calm practice; this is  
545 because these user groups have by now become 'immune' to the distraction effect of social  
546 media (Pang, 2013; Stankov *et al.*, 2014). Concurrently, the older generations could repel

547 social media as a communication channel. Furthermore, consumers may expect the different  
548 sorts of interaction with technology in various hotel experience's phases as the guests exhibit  
549 different user profiles depending on specific situations (Manes, 2001). Technology does not a  
550 priori create a value for all kinds of hotel stays, situations and experiences (Neuhofer, 2016).  
551 All these aspects need to be recognized and accurately assessed by hoteliers when  
552 conceptualizing calm ICT design.

553

#### 554 *Privacy concerns*

555 Calm ICT design raises privacy concerns as security of storage of personal information  
556 by service providers and the use of different sensors creates a challenge for technology  
557 designers and emphasizes the need to develop relevant solutions (Alizadeh *et al.*, 2012).  
558 Generally, privacy concerns represent one of the major obstacles in the ICT adoption by hotel  
559 guests (Wozniak, Liebrich, Senn, & Zemp, 2016). The growth of such services as *SnapChat*  
560 and *Whispr*, or the search engine *DuckDuckGo*, that do not collect or store personal  
561 information, indicate consumer interest in the use of anonymized platforms (Johnston, 2015).  
562 Privacy concerns determine why some potentially promising calm technologies have not been  
563 empirically realized. Yet, the *Google Glass* can be used by receptionists in order to identify  
564 hotel guests with the help of the facial recognition technology (Udell, 2014). Kim *et al.*  
565 (2013) identified the need for more IT security among hoteliers highlighting a gap between  
566 understanding the ICT budget adequacy and the adequacy of installed ICT security systems.

567

568

#### 569 **Conclusion and future research needs**

570

571 This paper has introduced calm ICT design and explored its applicability to hotels,  
572 highlighting the opportunities for its more careful investigation as a means to refine theory  
573 and practice of hospitality service provision. The paper has extended the on-going discussion  
574 on the role of ubiquitous computing and ambience awareness towards the hotel sector where  
575 these topics have not been systematically examined to date. From a practical perspective, a  
576 number of implications emerge from this study for the creation of new and for the  
577 enhancement of existing hotel guest experience. For hoteliers, this knowledge can advance  
578 their understanding of the shortcomings of unselective ICT use for the purpose of creating  
579 guest experiences. The previous sections of the paper have elaborated upon calm ICT design  
580 in hotels and discussed the key issues that may emerge from its use. In the following, based  
581 on earlier analysis, the future research directions are outlined.

582



583 *The attention management and calm ICT design in hotel experiences*

584 Consumers have been empowered with various ICT solutions, most of which calling for  
585 their attention. Instead of being carefully directed towards a certain experience, in this case  
586 hotel experience, consumers' attention is now being constantly distracted through the addition  
587 of a larger number of ICT solutions. As a process by which people filter internal and external  
588 information into their awareness, human attention is, in many aspects, a limited resource and,  
589 from the personal and business perspective, it needs to be allocated strategically (Campos,  
590 Mendes, do Valle, & Scott, 2016; Livingstone & Isaacowitz, 2017; Webster, 2014),  
591 especially when it comes to hotel experiences that are, in most cases, limited to a short period  
592 of time (Ooi, 2005). Magnini and Dallinger (2018) even indicate that due to modern  
593 information overload, the hotel guests are typically not paying full attention as they move  
594 through the hotel environments except when something positive or negative happens that they  
595 did not expect. Still, the hospitality-specific implications of this limited attention span and its  
596 role in ICT design remain poorly understood which opens a broad field for investigation.  
597 Research can start by looking at a broad set of methods of human-computer interactions and  
598 interaction design (Goodwin, 2009; Nielsen, 2013), especially to identify the key  
599 characteristics and generalize the goals of potential consumers, particularly for different hotel  
600 types within the process of co-creation experiences (Campos, Mendes, Valle, & Scott, 2018)  
601 (Campos, Mendes, do Valle, Scott, 2018).

602

603 *Calm ICT design and co-creating digital well-being*

604 The relevance of calm ICT design is now reconfirmed by the recent market calls and  
605 industry responses to information overload and addictive technologies in digitally-led life  
606 (Alter, 2018). For example, the new Android operative system is equipped with capabilities to  
607 help people achieve the balance with technology usage and this business move is based on the  
608 consumers' requests (Samat, 2018). The new concept of the Google's operating system favors  
609 so called concept of digital well-being of consumers. The term digital wellbeing describes the  
610 framework that "looks after personal health, safety, relationships and work-life balance in  
611 digital settings; enables acting safely and responsibly in digital environments; manage digital  
612 stress, workload and distraction; uses digital media to participate in political and community  
613 actions; uses personal digital data for wellbeing benefits; acts with concern for the human and  
614 natural environment when using digital tools; balances digital with real-world interactions  
615 appropriately in relationships; etc." (Beetham, 2016). Digital wellbeing cannot be created  
616 solely relying on individual capabilities and therefore is not exclusively individual  
617 responsibility (Beetham, 2016; Nansen, Chakraborty, Gibbs, MacDougall, & Vetere, 2012).  
618 Similarly, Gui, Fasoli and Carradore (2017) state that digital wellbeing is a state obtainable  
619 not only by the individual personal skills, but also is a societal characteristic that determines

620 what is the norm in digital media usage. In case of hotel experiences, the responsibilities are  
621 both on the guests as well as hotels that should help in co-creating pleasurable experiences  
622 (Harkison, 2018) and limiting all ICT frictions accordingly. Thus, calm ICT design that is  
623 provided by hotels but evaluated with the scope of guests' attention can be seen as a hotel-  
624 industry response to the growing demand in the global goal of achieving digital wellbeing.

625

### 626 *Measuring 'calmness' of hotel guest experience*

627 Calm ICT design started as a research philosophy, as it was envisioned before the  
628 practical realization of the omnipresent Internet, mobile phones and smart devices. Straight  
629 from the beginning, there have been attempts to measure 'calmness' of ICT solutions, but  
630 these have mostly been unnoticed by industry practitioners and academics. For example,  
631 Riekkilä *et al.* (2004) presented a framework for evaluating the degree of 'calmness' for  
632 ubiquitous applications in the real usage context. The study identified the main characteristics  
633 of 'calmness' from the end-user perspective and then utilized these characteristics to define  
634 the dimensions for the evaluation. The framework was subjective and 'calmness' was not  
635 presented numerically, but shown graphically. Later, Brown *et al.* (2014) proposed a  
636 prototype of quantitative metrics for the evaluation of ICT's calmness based on the Weiser's  
637 vision of calm technology and on the principles of anthropology-based computing and  
638 peripheral interaction. In its essence, calm ICT design should enable consumers 'to deal with  
639 large amounts of information without becoming either overwhelmed by stress or to the world  
640 around them' (Brown, 2016). Therefore, quantifying the core dimensions of calm ICT design  
641 for enhancing hotel experience is paramount for the evaluation of technological 'calmness' in  
642 the hotel context, better understanding of consumer segmentation based on their preferences  
643 towards technological 'calmness' and subsequent ICT redesign and new product development  
644 for hotels.

645

### 646 *Collecting empirical evidence of calm ICT design in hotels*

647 This paper has showed that calm ICT design in hotels can top the key existing and  
648 forthcoming technology support infrastructure. The effectiveness of calm technologies may  
649 often be misunderstood or it can be viewed as a question of the common sense. In particular,  
650 the principles of calm ICT design can be seen as subjective due to the post-disciplinary nature  
651 and the complexity of the approach, ranging from human-centered design, social design, and  
652 anthropology (Case, 2015). For example, looking from the calm ICT design perspective, hotel  
653 key-cards are small-sized, do not require a charger, user interface or operating system, and  
654 they provide convenience for users. However, when applied to hotels, there is at least one  
655 new dimension that comes into play – the preferable hotel experience that can be affected by  
656 the 'good' or 'bad' ICT design depending on the different contexts of the use and varied guest

657 preferences towards technology use. In that sense, consumers who are accustomed to the use  
658 of smartphones for paperless transactions or identification in everyday life can find it agitated  
659 if they have to pay attention to keeping the key-card during hotel stay. Therefore, in order to  
660 avoid the danger of becoming another fuzzy approach, further empirical examination of the  
661 feasibility of adopting calm ICT design in hotel experience is needed. More specifically, more  
662 research encompassing the examples of existing calm ICT design applications in hotels is  
663 required, indicating how the different hotel types can benefit from the broader adoption of  
664 this approach. Despite all the challenges, there are good prospects for calm ICT design in  
665 hotels given the rapidly changing nature of consumer preferences and the expectations of  
666 technology transfers undertaken by hoteliers to manage consumer expectations.

667

668

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