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Design Guidance for Location-based Play: a review of research frameworks

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Abstract: How to best make use of design research contributions in a domain to distil the guidance they offer for design students? We outline a typology of design guidance for location-based interactive experiences, compiled from a review of existing design tools, research frameworks, and empirical studies that cited an intention to support the understanding and design of location-based play. Motivated by our reflections on teaching courses that focus on non-traditional, novel interaction methods, we sought to extract value from design tools knowing how useful they can be to students working in unfamiliar genres. Design tools fell across two broad intents: facilitating generation and supporting understanding. Guidance within these is further characterised as establishing benchmarks, generating and developing ideas, alternative considerations, design documentation, structural elements and qualities of experience. Less visible was guidance for the process of design, for translating design into development, and for how designers might respond to the advice.

Keywords: design guidance; location-based; playful interactive experience; design tools

1. Introduction

The last twenty years have seen a surge of research on the design of interactive mobile experiences. The research contributions of this work have taken a range of forms— theoretical or conceptual frameworks, methods, design tools, guidelines. Many (but not all) are based on empirical studies of the deployment and evaluation of systems in laboratories, or in the field. The purpose of our paper is to review a subset of this work with a specific focus on the *design guidance* these research contributions provide to those developing playful interactive experiences. We have several motivations for conducting this review.

In the first place, frameworks are a popular but sometimes nebulous and variegated form of research contribution. The kinds of outcomes that can be labelled “frameworks” can include conceptual distinctions, programmatic agendas, tables, and hierarchical categories. They can also include design tools, flowchart-like maps and general principles. For this

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reason, it can often be difficult to distil from a framework useful information, guidance and/or advice for future design projects. It is also the case, as our review below will evidence, that research contributions (of which frameworks are a popular type) can neglect or obscure practical guidance in favour of other important theoretical, conceptual or methodological reflections, which may appear more likely to have general application beyond the particular cases discussed, and greater academic heft. But more practically, in teaching interaction design, frameworks and tools can be a useful way of condensing a large amount of theory, experience and understanding. As such, a targeted review of these frameworks to organise what guidance they provide design would provide a valuable resource to educators, and would likely be of value to practitioners as well.

In the past twenty years, the landscape of location-based infrastructure and mobile computing has dramatically changed. While initial research in this space was conducted often as university or lab-based “toy” projects, with limited deployments, it is now possible to quickly generate and deploy apps on public release. This changes the nature of the work that frameworks need to do, as they are not just about the conception and deployment of systems, but also must be adaptive to the data and use that widescale deployments can generate in very short periods.

As such, this paper reviews prior work including frameworks, conceptual schema, design tools, etc. that have been proposed for the design of locative, playful interactive experiences. Our review sought to understand the breadth and styles of design support being generated through this research. The papers surveyed below have been selected based on the following criteria: a focus on design rather than only evaluation; a focus on interactive location-based experiences; and a focus on playfulness (or at least open-endedness). With respect to design *guidance*, we have analysed the content of the frameworks found in the literature in so far as they can be turned towards offering practical advice or application to new projects in the domain of location-based play. It is this focus that distinguishes our review. Naturally, this is not the first review of work in this general design space. We are preceded by, for instance, Rashid et al.’s (2006) early review of location-based games, which provides overviews of the architectures, infrastructures and open challenges for the early generations (2000-2005) of mobile locative games, such as *Botfighters* and *Mogi*. A key contribution of their review was to anticipate some of the possibilities for location-based games afforded by then-emerging RFID and Bluetooth technologies. In a different vein, Avouris and Yiannoutsou (2012) provided an educational review of location-based games, focusing on the new opportunities they provided for mobile and context-driven learning. To this end, they make a number of observations regarding how the interplay between physical and virtual spaces, strength of the game narrative, the games’ objectives and durations of play all have important consequences for what players can learn within the environment. These reviews have mapped a number of the essential technical, ludic and educational possibilities of this sub-genre. Our review complements these in two respects. Firstly, its focal aim is distinct, distilling types of design guidance for design students and others who are looking to create novel location-based experiences through the systems they design. The content of our

review differentiates it as well, however. These earlier reviews were constructed based on an analysis of the specifics of the games/systems themselves. Our review, in contrast, has focused on the research contributions advanced in the papers presenting the systems. These contributions include conceptual frameworks, principles, methods, tools etc. that have been proposed through the design and evaluation of location-based games.

1.1 Challenges

We encountered several practical challenges in conducting the review that are particularly instructive of several aspects of research in the design of interactive systems. Much of this relates to the fluidity with which certain terms can be (and are) used. This is not limited to search terms that define the domain (e.g. playful experiences, mobile games etc.), but also to the terminology used to define the outcomes of research (e.g. tools, methods, frameworks, approaches etc.). This breadth in foci and outcome is exacerbated by the variety of meanings that are often attached to “design” which can refer to form, system, function, configuration, process, method or approach (see, for example, Pobiner & Mathew, 2007) with different connotations and emphases among those, particularly concerning the kind of design guidance that these contributions offer. We mention this not to belabour the difficulty of the task, but to begin on a note of humility—we have certainly missed incorporating some highly relevant work from this review owing to mismatches in the terms we were using to search. While tasks such as this would certainly be made much easier through attempts to standardise terminology, we fear that likely would hamper as many research trajectories as those it would make easier¹.

The impetus for the review came through reflecting on our collective experiences teaching courses that focus on novel interactions with technology, where students are tasked with expanding their understanding of what interaction entails and how we can engage with technology beyond traditional paradigms. Supporting their design activities through these courses inevitably involves discussion and consternation about firstly defining, and then designing, non-traditional types of interactive experiences. With the widespread uptake of mobile location-based games such as Pokémon GO and Ingress, an increased interest in creating these styles of experiences has arisen.

In light of the challenges faced in the domain terminology, the interactive experiences we surveyed generally shared the following characteristics, regardless of the term used to define them:

- The significance of physical space: movement of participants through space, consideration for the characteristics of space, interactions contextualised to space, augmentation of physical space and embedding of characteristics of space into the

1 Because of the fluidity of the terms in this space, much of what is gained by using one term rather than another is not in what it uniquely denotes, but in the connotations of the language used. This is particularly valuable in design when it is often more important to open up possibility spaces than to nail down concrete distinctions

play narrative.

- An essential interactivity: between participants, across physical and digital worlds, with and within the location.
- A playful quality: experiences (including games) designed for play and entertainment.

These experiences are interchangeably and with subtle differentiations described using the higher-level terms *playful*, *experience* and *game*; with further qualification as:

- Interactive experiences (Benford & Giannachi, 2008; Mitchell & Olsson, 2018; Wouters et al., 2016)
- Playful experiences (Arrasvuori et al., 2011; Lucero & Arrasvuori, 2013, 2010)
- Mixed reality experiences and games (Hinske et al., 2007; Wetzel et al., 2017)
- Pervasive games and experiences (Arango-López et al., 2019, 2017; Benford et al., 2005; Guo et al., 2010; Hinske et al., 2007; Jegers, 2007, 2009; Magerkurth et al., 2005; Montola, 2005; Nieuwdorp, 2007; Walther, 2005, 2011; Walz & Ballagas, 2007)
- Urban games and experiences (Mitchell & Olsson, 2018; Wouters et al., 2016)
- Location-based/location-aware games and experiences (Broll & Benford, 2005; Maia et al., 2017; Neustaedter et al., 2013; Walz & Ballagas, 2007)
- Ubiquitous games (Chalmers et al., 2005; McGonigal, 2006)
- Alternate Reality Experiences (Gutierrez et al., 2011; Hansen et al., 2013; Kourouthanassis et al., 2015)
- Shared interactive narratives (Benford & Giannachi, 2008)
- Augmented reality experiences (Gutierrez et al., 2011; Kourouthanassis et al., 2015)

Walther collects a number of these under the broader genre of pervasive games: incorporating mobile games, location-based games, ubiquitous games, virtual reality games & augmented reality games where each shares the key characteristics of “(1) the explicitness of computational tasks; and (2) the overall importance of physical space” (2005, p. 4). On the other hand, others bring pervasive games and experiences under the umbrella of mixed reality experiences (Hinske et al., 2007; Wetzel et al., 2017). Various attempts to examine and align the discourse around pervasive games (Arango-López et al., 2017; Hinske et al., 2007; Nieuwdorp, 2007) bring some clarity to what it means for a game to be pervasive. However, these discussions have been focused on the realm of pervasive games & pervasive computing, excluding other defining terms considered in our review. Location-based and location-aware games and experiences can be found as a subset of pervasive games but also as a genre in their own right.

In defining the boundaries of this review, oft-cited domain and design related works were examined and although relevant to understanding the broader discipline, were ultimately excluded. For example, Benford et al (2005) provide an account of their experiences in bridging the digital and physical worlds through pervasive game-play and while identifying

the challenges faced they stop short of formulating guidance for design. Kourouthanassis and colleagues (2015) offer a set of interaction design principles for mobile augmented reality applications, however, the focus is on interactions with the mobile application rather than the nature of the experience being designed. While relevant to later stages of the development process, the principles do not offer guidance for the design of the experience or considerations to be made. Technical frameworks, for example, CREANDO (Arango-López et al., 2019), LAGARTO (Maia et al., 2017), fAR-PLAY (Gutierrez et al., 2011) and others, offer software platforms for the implementation of interactions in an experience and are often created to realise particular styles of experience. The platform fAR-PLAY (Gutierrez et al., 2011) for example, supports the implementation of augmented reality experiences designed according to a treasure-hunt metaphor.

More broadly, the space and place work of Harrison and Dourish (Dourish, 2006; Harrison & Dourish, 1996) and Messeter's definition of *place-specific computing* (2009) offer conceptual framing and provide relevant distinctions for understanding the role of and implications for location in interactive experiences. McGonigal (2006), Hinske et al (2007) and Magerkurth et al (2005) each offer discussions and classifications for the various experiences feature the characteristics focused on in this review. While providing depth and distinctions regarding the particularities of genre, play and game, their intent is directed more to academic discourse than design activity.

2. The Review

This review was particularly concerned with:

- Understanding the scope of design guidance available
- How design tools are presented to the broader community
- Where possible how it was developed
- Finally, how these tools and frameworks can be translated into design guidance

Here we will describe each of the design tools reviewed including its stated intent and its form of delivery. Except for the PLEX and MRE cards (Lucero & Arrasvuori, 2010; Wetzel et al., 2017) both available online with supporting websites, the design guidance reviewed was only available through research-focused publications.

Walther (2005) provides a **conceptual framework** for the analysis of pervasive games. The stated intent is to assist in the design and understanding of pervasive games, however the focus of the paper is clearly on defining the ontology of pervasive games as a distinct (media) domain. It does this by introducing fine distinctions regarding the temporal and spatial dimensions of pervasive games, and by mapping out a conceptual space of possibilities through a review of existing games. The framework consists of four axes: distribution (of computational services), mobility, persistence (always available) & transmediality (games transcend a single medium and cast players as creators not just consumers of the game scape). Though described as mutually orthogonal dimensions, Walter represents these

four axes in a two-dimensional Cartesian plane. Within this possibility space, games operationalise three core units, building on Juul's (2003) work to add pervasive-specific concerns: game rules, game entities and game mechanics. The four axes act as dimensions for the conceptual breadth of pervasive games, while the core units provide mechanisms to describe a pervasive game instance.

In a later work, Walther (2011) expands upon the implications of game-play and game-spaces in pervasive games. Providing a discussion of the distinction between game-mode and play-mode, Walther aims for a definition of pervasive ludology that expands on traditional ludological understandings of game worlds and the interplay between "gaming (to progress) and playing (to be present)" (Walther, 2011, p. 141). Pervasive game spaces are explored further in regard to perception, layering and access under three distinct and interrelated definitions. *Tangibility space* dealing with the material interactions in the game-world, *distributed information space* the virtual realm of the game-world as mapped to the material and *accessibility space* the way in which players move between the tangible and virtual realms. To support designers and researchers negotiating the realm of pervasive games and its particular style of gameplay, four **design heuristics** are proposed. *Exploration* proposes spaces that allow for open exploration while supporting structured player progression through the game. The *mapping* of the multiple game spaces from the varying perspectives of game-play, game-rules, game-world. *Persistence* asks designers to consider providing players with physical and narrative escape from the "always 'on'" (Walther, 2011, p. 145) nature of the game-world. *Ludic and semantic structures* ask that narrative be designed not only in terms of game mission but also as a changeable construct that responds to and reflects how the game is played. These heuristics offer support for the varying and variable spaces a pervasive game constructs and the player inhabits over time.

Montola offers three key "**expansions on the magic circle**" (2005) as a frame for understanding how games might be pervasive. Traditional games, digital and non-digital, are played with negotiated understandings of who is playing, the time and location at which the game is played; demarcations of what counts as an action "inside the game" versus what is not. This social contract ("the magic circle") is established for the duration of the game. Montola's analysis shows how pervasive games expand, violate or renegotiate these boundaries: spatially, temporally and socially. The location of the game may shift during the game; the temporal bounds of the game become less clear as it interleaves with everyday life or as start and endpoints become less defined; who counts as a "player" can become blurred as bystanders become participants and strangers form alliances. This conceptual framework provides criteria by which to understand and envisage pervasive games, and how the concept of "game" is evolving to encompass the novel opportunities and experiences enabled by pervasive gaming.

More pragmatically, the **PLEX suite** (Arrasvuori et al., 2011; Lucero & Arrasvuori, 2013) comprises a framework of 22 ludic categories (e.g. thrill, discovery, fantasy, humour) and a card deck with corresponding activities. The explicit intention of the suite is to support ideation and inspiration for the design of playful experiences. The PLEX card deck offers

a design tool derived from the framework to assist in the idea generation process. Each framework category is represented on a single card, with the name of the category, a representative image and a short explanatory phrase, e.g. “CAPTIVATION: forgetting one’s surroundings”. The authors provide two game-like structured activities for employing the cards, one for the rapid generation of new ideas and the other for developing richer ideas through scenarios. Both approaches situate usage of the cards in the ideation phase of the design process. In evaluation, the PLEX deck plus activities received mixed reviews, with some designers finding the structure and stimulus generated quick and concrete ideas, while others found it overly constraining, inhibiting their creativity. With respect to this review, the PLEX suite is oriented entirely towards playfulness; it does not explicitly address location-based content.

In a similar vein but with location featuring more explicitly, the **Mixed Reality Experience (MRE) cards** (Wetzel et al., 2017) focus on generating and developing ideas for mixed reality experiences. There are three types of cards: opportunities, challenges and questions; each of which offer prompts related to specific mixed reality considerations, e.g. physical, location, gameplay, players, time, management, technology, audio and sensors. Two techniques are provided for using the cards to generate ideas, *limited choice* and *random choice* where designers combine *opportunity* cards from the MRE set with *theme* cards to create unique combinations for game ideas. Not included in the card set are the *theme* cards required for these techniques; the design team is tasked to source for an additional inspiration with the recommendation to select cards with visuals that allowed for creative interpretation. To further develop an idea, *opportunity* cards are used to expand the idea, then *question* cards to solidify the idea and finally *challenge* cards to test for flaws in the idea. At the end of this process, the idea is documented, along with the cards used, to capture the outcome of the idea development.

The **PLEX** (Lucero & Arrasvuori, 2010) and **MRE cards** (Wetzel et al., 2017) are both design tools that are the result of an iterative design process, with content and representation refined through evaluation sessions with designers of varying experiences and backgrounds. The cards and techniques for use are presented as a progressively refined outcome of a series of deployments.

Benford & Giannachi (2008) introduce “**temporal trajectories**” as a mechanism for understanding and managing individual and shared story-lines in long-running, multi-player narrative-based interactive experiences. Temporal trajectories offer considerations for how to commence, resume and end individual stories as participants enter and leave the narrative play; and how to interweave and reconcile individual actions in the broader shared narrative. This concept is further elaborated through a conceptual framework (Benford et al., 2009) sensitising designers to the hybrid nature of space, time, individual roles and interfaces in these experiences and the ways in which users traverse and transition across the seams in these aspects.

The concept of “**seamful design**” (Broll & Benford, 2005; Chalmers et al., 2005) offers

considerations for how the technological limitations affecting an experience might be exploited and designed *for* rather than mitigated against. The approach is described through case studies of location-based mobile games designed to allow players to exploit and appropriate limitations such as poor network connectivity as gameplay strategies. This work provides an alternative approach to infrastructure and environmental constraints that exploits the “glitches” to enhance the participant experience rather than disguising them.

Mitchell & Olsson (2018) offer three “**inspiration patterns**” for encouraging social play between strangers in the design of urban location-based games and experiences. Further patterns are in production for connecting people in urban interactive spaces that consider different challenges. Many playful interactive experiences involve collaborative or collective interactions between multiple participants who may or may not be known to one another. To overcome the awkwardness of engaging with strangers, these patterns offer stimuli for exploring potential interactions. This particular set of patterns explore rhythm as a central theme, *sharing vibrations* encourages designers to consider how the actions of one might be experienced by another; *actions that need another* promotes interactions that require collective or coordinated effort; *crosswire outputs* suggest switching connections between participant inputs and outputs. Each of these patterns promotes an awareness of the actions of others, to create connections through shared, playful experiences.

A player-centric process is advocated by Walz & Ballagas (2007) to influence player behaviour in a pervasive game. Presented through the lens of the REXplorer game, this article proposes a set of “**pervasive persuasive tactics (PPT)**” as useful for design. The player-centric process is not described here, however, the importance of understanding the player is emphasised prior to introducing the design tactics. *Formal tactics* highlight the spatial and locational qualities of the game board, traversal and navigation of the game board, interaction styles and devices, reward structures and replayability. *Dramaturgical tactics* consider the game narrative and experience in regard to character design, interaction forms, emotive and spatial connection to narrative. Walz & Ballagas illustrate each tactic with examples from REXplorer providing insight into use more generally in the design of pervasive games. Focused on developing the game experience concept, the tactics ground the design work in the creation of meaningful connections between narrative, location and player.

Interactive experiences that are embedded into the urban environment will often involve situated interactions as part of the play. Usually of a public nature, these situated interactions can suffer from a lack of participant engagement by failing to capture the interest of passers-by sufficiently. Wouters et al (2016) offer a model for understanding how to leverage and maximise participant interaction with public interactive systems through the **honeypot effect**. The model presents the various roles of participation from non-engaged passers-by, to interested audience members, to committed actor participants. It also maps potential trajectories through the model, along with the flow of interaction and influence as people transition between the user roles.

Building on Sweetser & Wyeth’s GameFlow model (2005) for evaluating player experience in

computer games, the **Pervasive GameFlow (PGF) Model** proposed by Jegers (2007) is both a set of heuristic design guidelines and a player experience evaluation tool. The model consists of 8 elements that contribute to player enjoyment, each with an associated set of criteria against which it can be measured. For example, the criterion “Pervasive games should enable the player to shift focus between the virtual and physical parts of the game world without losing too much of the feeling of immersion.” can be used to design and measure player “immersion” in a game (Jegers, 2009, p. 12). While the model provides criteria to orient to in design, it does not offer guidance on how these might be achieved and is presented through evaluative rather than generative case studies.

For understanding what is and isn’t a pervasive game, Guo et al (2010) offer **TeMPS**, a conceptual framework based on a review of existing pervasive, social games. They distinguish pervasive games from other forms of computer games through 4 key perspectives *Temporality, Mobility, Perceptibility* and *Sociality*. In their review, games are scored against each of the perspectives. Temporality is judged by whether game time is open-ended, allowing players to enter and exit the game at will without being bound by fixed time limits or timed rounds. For mobility, a game is considered pervasive if it allows play anywhere in any location, or with physical movement within a fixed location. Perceptibility judges a game on the ways in which the player interacts during play and how the reality of the game is presented back to the player. Finally, sociability considers whether the game supports players interacting with each other as collaborators and as competitors. It also considers whether the game has additional value, such as educational or health outcomes, beyond its base entertainment value (Guo et al., 2010). When reviewing the game score, insights into the pervasive and social nature of the game are revealed. Looking forward to design, the breakdown of each of the perspectives offers insights into the factors that contribute to the “pervasiveness” of an experience.

Content creation and management for large-scale location-based interactive experiences can be an onerous task when one considers the potential for participation to happen anywhere, at any time, with anyone. Inspired by the long-term, global success of the location-based game Geocaching², Neustaedter et al (2013) offer lessons for designing **scalable location-based games** based on a study of player participation in Geocaching. The Geocaching game is unique in that it is primarily player-driven, where players create, place and promote geocaches; and players seek out, engage with and post about geocaches. The game is facilitated online by Groundspeak Inc. with content creation and maintenance carried out by the players. Neustaedter and colleagues derive a series of lessons for designers to consider for creating experiences that can scale in audience and location size: keeping content creation lightweight for both players and game-designers; for games that support player-based content creation allowing for the creation of elaborate content; support development and evolution of customs over time in the game as separate to game rules; allow lightweight monitoring and reporting of game elements, other players and non-players by players; and the ability to maintain the content generated by other players. These lessons are each

2 Geocaching website: <https://www.geocaching.com/play>

presented with supporting examples from Geocaching and connected with supporting and cautionary examples from alternative location-based experiences.

In a similar vein, Hansen et al. (2013) define a set of design objectives and associated strategies for creating **reusable alternate reality games (ARG)**. The objectives to promote reusability are that an ARG is *replayable*, *adaptable* and *extensible*. Replayability allows for players to experience the game multiple times, the depth may vary from a retracing of a path to the generation of an entirely new experience. Adaptability speaks to the ability for the game to be translated to new contexts. If a game can be added to with minimal effort, for example through expanding the narrative into new areas, it is considered extensible. These objectives are interrelated and a game that is considered reusable may achieve these at varying depths. Multiple design patterns with examples are provided to support each objective, for example, “Multiple seasons or episodes: a game is organized so that new episodes or seasons build off of prior ones” (Hansen et al., 2013, p. 6) is given as a pattern to support extensibility. In presenting the objectives and associated design patterns, Hansen and colleagues are also careful to describe the barriers to reusability.

3. Summary

From the review above, it becomes clear that even in a narrowly defined domain such as location-based playful interactive system design, there is a very broad range of design-relevant concerns that emerge. Some frameworks establish a conceptual landscape and are concerned with defining (or redefining) phenomena such as play, space, or time. Others have been much more detailed, focused on design components of play or the mechanics of games. For this reason, we have organised our discussion to introduce a rough typology of the kinds of design guidance that can be found within these studies.

The order of the typology below generally aligns the guidance with approximately where in the design process, for the creation of playful location-dependent interactive experiences, it is likely to be most applicable. Such a process is likely to involve early attempts to understand the *thing* they are trying to design, revealing the rules or criteria that define the bounds of that location-based, interactive space, and becoming aware of a range of additional considerations that could impact the design and design process. From this “pre-design” stage, one would anticipate the process to then generate ideas that ‘fit’ within the space, refine those ideas and consider how these might translate into a valuable experience for players.

The *design guidance* (Table 1) identified in these studies offers divergent and convergent resources for the generation, development and exploration of ideas.

Table 1 A typology of design guidance for location-based systems

	Description	Guidance	Examples	Papers
Benchmarks	Benchmarks define the genre of interactive location-based experiences, and criteria by which systems might be compared and evaluated.	Provide design students with goals and boundaries for systems, as well as genre-specific dimensions to consider.	Temporality, mobility, persistence, playability, spatiality	Walther (2005, 2011); Montola (2005); Benford et al. (2009); Guo et al. (2010)
Idea generation & development	Methods that support the generation and development of design ideas, mechanics and experiences for location-based systems.	These tools provide a structure for novice designers to guide them through generative activities in the process.	PLEX framework, MRE ideation cards	Lucero & Arrasvuori (2010); Wetzel et al. (2017)
Alternative considerations	Alternative considerations are suggestive of different perspectives to understand the domain, aspects that deserve greater attention.	These contributions are conceptual reorientations that may offer novel design possibilities .	Seamful interactions, reusable assets, scalable audiences	Chalmers (2005); Hansen et al. (2013); Neustaedter et al. (2013)
Design documentation	Some tools are also valuable as a means of documenting design processes, avenues explored, and decisions made.	These tools offer pragmatic benefit to design, helping teams keep track of rationale , the conceptual ground covered, and design alternatives considered.	MRE ideation cards (and variations)	Wetzel et al. (2017)
Structural elements	Some frameworks break down the individual components of interactive location-based systems and how they interact with each other.	These contributions are useful for explaining how the design and implementation of systems work, and how certain elements can (or need to) work together to generate particular experiences, which can work as rudimentary design patterns .	Game mechanics, rules, entities, transitions, patterns	Walther (2005, 2011)

Qualities of experience	Experiential qualities dimensionalise the experience outcomes of systems for players, and considerations to take into account in the generation of those experiences.	The guidance offered ranges between experience design goals , design patterns , tactics , models and conceptual distinctions , useful as general orientations for design, or as instructions to follow.	Pervasive persuasive tactics, temporal trajectories, pervasive gameflow model, design patterns	Mitchell & Olsson (2018); Wouters et al. (2016); Walz & Ballagas (2007); Benford & Giannachi (2008); Jegers (2009)
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However, there is not a neat one-to-one fit from the type or content of a framework and the kind of guidance it may offer design. For this reason, some of the tools we review appear in more than one category above. Across the various contributions, the following intents can be used to categorise the design tools:

Establishing benchmarks for the experience being developed to understand the characteristics and bounds of the genre and how it differs from other styles of interactive experiences. Understanding the ways in which the experience stretches the bounds of traditional games through expansions on the ‘magic circle’ (Montola, 2005); mapping the space of pervasive games through the 4 axes of Pervasive Gaming (Walther, 2005); and defining the particular characteristics using the TeMPS Framework (Guo et al., 2010).

Card-based games have gained popularity as a design tool (Roy & Warren, 2019) for **generating new ideas**. The creators of the PLEX framework (Lucero & Arrasvuori, 2010) and Mixed Reality Experience (MRE) Ideation Cards (Wetzel et al., 2017) provide card-based design games that engage designers with stimuli and context-specific considerations in structured activities. Each of these provides a set of playing cards and instructions for how to use the cards.

The MRE card deck (Wetzel et al., 2017) extends ideation into refinement by providing alternative rules for **developing existing ideas**. The card deck itself remains constant, what varies in the applications for design are the type and number of cards used and the ‘rules’ for how the cards are used to achieve different intents.

Alternative considerations offer different perspectives for the design and development of experiences. Designing experiences that allow for reuse of assets & interactions and promote extended lifetimes for experiences (Hansen et al., 2013); highlighting & incorporating the ‘seams’ inherent in interactive, technology-mediated experiences (Broll & Benford, 2005; Chalmers et al., 2005); designing experiences able to scale in regards to location and audience (Neustaedter et al., 2013).

Documenting process and design activities to facilitate further development is proposed in the MRE card deck by the arrangement and annotation of cards and ideas generated during design sessions (Wetzel et al., 2017).

Mapping the structural elements of designs in this space provides another form of guidance. Some contributions are concerned with the elements that comprise the interactive experience, such as specific game mechanics. The pervasive game units offered by Walther - *rules* that govern play, digital, physical and human *entities* that facilitate play and the *mechanics* for interacting with and within the game-world (Walther, 2005); and further the design heuristics that consider how the game world supports play, how the spaces are mapped, how players move in and out of game-mode and finally how the narrative responds to gameplay over time (Walther, 2011). A variety of technological frameworks and platforms would provide this type of design guidance, however, each requires a more detailed system design to be in place before an appropriate selection can be made.

Unpacking qualities of the experience specifically considers the internal qualities of an experience regarding its interaction with audience and location, and how these can be generated in interaction. For instance, Mitchell & Olsson (2018) offer design patterns to facilitate and encourage play between strangers in public places. Others consider how to leverage the transition of players between bystander, participant actor roles (Wouters et al., 2016); Walz & Ballagas (2007) provide a series of “pervasive persuasive tactics (PPT)”; understanding how participants can traverse narrative as they enter and leave the experience over time with Temporal Trajectories (Benford & Giannachi, 2008); designing to enhance player engagement and enjoyment using the Pervasive GameFlow model (Jegers, 2009). These focus on generating various qualities of the experiential outcomes of location-based systems.

4. Discussion

It is notable how much of the design guidance that is on offer from this body of work is closely tied to (a) understanding the conceptual design space of possibilities and/or (b) providing tools to aid in the generation, refinement and evaluation of design ideas. This leads us to some observations on areas that appear to be absent from this work.

We note that there is an absence of guidance that considers how designers can move from ideation to deployment—the focus is squarely on framing the domain and ideation. So design guidance is readily available for those querying the domain in attempting to understand what distinguishes a playful, interactive, location-dependent experience from other works. And guidance also tends to provide conceptual rather than pragmatic support for the design of experiences. Considering the complexities of space (Walther, 2011) and the variety of considerations with regards to scalability (Neustaedter et al., 2013), reusability (Hansen et al., 2013), there would be significant effort involved in developing the ideas generated into a deployable experience, and none of the works reviewed considered deployment as a problem.

It was also surprising to us that there were no frameworks explicitly oriented to guide the process of designing location-specific interactive experiences or involving other stakeholders in design. Although some methods could be simply adapted to participatory activities

(such as the PLEX card suite), there was little guidance on the participation or involvement of players or other domain experts in design. Walz & Ballagas (2007) clearly express the imperative to understand potential players, but they do not expand on their approaches at the point of presenting their design tactics. Their player-centric approach is described through a case study (Ballagas & Walz, 2007), although this is presented as an account rather than as a guide for design. Jegers (2009) work centres around player enjoyment of pervasive games where the focus is on the ways designers can maximise the flow experience through design approaches in the game itself. The consideration of players as a central component to the experience appears to be missing from the majority of the guidance reviewed here. Where players are described explicitly as contributing to the experience, it is done through the lens of the gameplay and game elements. The consideration of motivation, access, resources, interests was not found in the reviewed works.

We were surprised to find little discussion of the nature of the physical locations beyond their physical characteristics. Where discussed, the impact of the physical context on the success and style of the experience appears to be considered more in terms of safety, navigability and access rather than from a socio-cultural perspective. With physicality and physical location a central characteristic of the design-object for the guidance reviewed, this seems to be a key omission. Especially given the potential for controversy as created, for example, by Niantic's³ generation of Pokémon at places of significant tragedy and trauma such as the Berlin Holocaust Museum⁴, New York's Ground Zero⁴ and the Hiroshima Memorial⁵ in Japan. While guilt should be shared by those who chose to actively capture Pokémon at these locations, embedding the possibility of gameplay with no consideration for the socio-cultural context falls squarely in the hands of the designers.

We can only speculate on these omissions—potentially this is due to a focus on what are considered the “trickier” aspects of the design process (generation) rather than the practicalities of moving from an idea to an implemented system. Or perhaps it is because researchers do not feel (or have not found) that location-based experiences necessitate a process at much variance with a generic user-centred design process. Whatever the case, it remains that there is ample support for idea generation and alternative considerations, and understanding the nature and components of playful experiences, but little guidance on some other aspects of design.

3 Niantic are the creators of the popular Pokemon GO augmented reality game. Website at <https://nianticlabs.com/support/pokemongo/>

4 Framke, Caroline. (2016) Pokémon Go in the Holocaust Museum or Ground Zero: Nintendo has no fix yet. Vox Media. <https://www.vox.com/2016/7/13/12161974/pokemon-go-holocaust-museum-remove-pokestop>

5 Mulkerin, Tim. (2016) You officially can't play Pokémon Go at the Hiroshima Memorial or the Holocaust Museum. Business Insider. <https://tinyurl.com/rp3bngd>

5. Conclusion

In this paper, we have presented a typology of design guidance proposed for the creation of playful, location-dependent, interactive experiences. These design-objects are variously described as location-based games, urban interactive experiences, pervasive games, alternate reality experiences, augmented reality games by the literature reviewed. In conducting the review, we aimed to understand the scope of design tools available, how they are developed and distributed, and what design guidance is provided. With the exception of the card-based tools (Lucero & Arrasvuori, 2010; Wetzel et al., 2017), the design tools reviewed are provided as descriptions, graphs and tables within journal and conference articles. As mentioned, we encountered challenges in the review related to the varied terms used to describe not only the style of work to be designed but the design tools we sought to review. There are, no doubt, relevant design tools that have been omitted through this process. The typology produced defines guidance that provides criteria for establishing benchmarks to define and describe the design space; provides guidance and stimulus for generating, developing and documenting ideas; offers alternative considerations for the broader experience; ways to map the various structural elements of an experience; and approaches to unpack the qualities of the experience itself.

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