D4.1 State of the art overview of existing ways of involving a variety of stakeholders in the creation of and reflection on content creation within an urban context (Chapter II)

Prepared by Paul Biedermann and Andrew Vande Moere

Research[x]Design - KU Leuven

Partners: KU Leuven, StudioDott, Bits of Love, NXP, VRT and BUUR

Date: 31/05/2019

General Introduction and Content Overview

The current report represents **chapter II** of a multi-chapter document, which is continuously updated with the latest findings of task (T) 4.1: Knowledge Synthesis of work package (WP) 4: Interaction Design of the CityStory project. The central challenge of this WP is to understand how physical interaction components (e.g. installations in the city, mobile units) can be intertwined with digital interfaces (e.g. smartphones, public displays). The results documented in this report will further serve as input to inform the ongoing research activities of WP2 and WP3 and will be evaluated within WP5.

This particular chapter contains the findings of all research activities, carried out in between January 2020 (M05) and May 2020 (M09). It builds on the data set of chapter I and presents an updated version of the previously acquired public engagement framework. Furthermore, it proposes an encompassing placemaking interface stakeholder relationship model, that describes how the investigated interfaces encouraged or resisted true bidirectional dialogues amongst all involved stakeholders. Finally, it discusses their power relationships and provides a list of critical considerations of how to design more democratic interfaces, that facilitate placemaking in transparent and accountable ways between all the stakeholders.

Contents

ABSTRACT

Public interfaces are proposed to facilitate placemaking by stimulating opportunistic interactions between different stakeholders. Although these interfaces promote a participatory ideology, not all involved stakeholders are actively engaged, nor made aware of the powers and biases that they introduce in the participation process. By carefully deconstructing the interaction modalities, media typologies and stakeholder relationships of about 32 distinct public interface projects, this narrative review describes how they encouraged true bidirectional dialogues to take place between all involved stakeholders. We thus propose an encompassing placemaking interface stakeholder relationship model, through which we distinguish three types of public engagement that differ by how they empowered participants to shape the debate. Finally, we discuss how placemaking interfaces are often fully controlled by rather covert gatekeepers with technological motivations, how their content medium typologies resist more qualitative participant feedback, and how future advancements can more directly integrate the democratic goals of placemaking.

1 Introduction

Placemaking initiatives often make use of public engagement methods to bring people together around shared activities in order to recognize local opportunities and critically reflect on community challenges. More traditional approaches consider placemaking to be part of a rather administrative strategy, in which decision makers initiate public meetings to gain insights of views, opinions and ideas from local communities [17]. Public interfaces have become ubiquitous in our modern city landscape. Next to displaying advertising [23]
or mundane types of information like time schedules [35], they are now being experimented with to help solving various civic concerns [11], ranging from responsible energy consumption [39], over social cohesion [22] to participation in urban planning [3]. Instead of passively providing citizens access to information, new types of public interfaces, that are also often described as pop-up urbanism, tactical urbanism, DIY urbanism, guerrilla urbanism, temporary urbanism, or insurgent urbanism are promised to support the facilitation of placemaking [13], i.e. the activities that transform community narratives to build more inclusive, participatory, and democratic communities [36]. In this study, we thus coin the term 'placemaking interface' to denote and classify public interfaces that intends to empower different stakeholders to publicly communicate their needs and desires [19, 23, 32, 33, 41], or to enable self-organization towards positive social change [17, 24]. This is often achieved by situating interactive communication interfaces at times and places where it is immediately relevant [3], rendering conventional and often time consuming procedures in simpler and more accessible ways [33] or utilising the perceived hedonics of an interface or interaction modality to spark the curiosity of passers-by [12, 32, 38]. As a result, placemaking interfaces aim to provide participants with different levels of agency. A polling interface that allows passers-by to push a button as a response to a multiple-choice question for instance, affords many simple and immediate participations, yet limits the complexity of how opinions or needs can be expressed. A text- or video-based system in contrast, might require more time and effort to engage with, but also provides more expressive freedom to potentially help shape a public debate.

Past public interface research has initially started from solving fundamental usability issues, such as by describing the honeypot effect [43] or display blindness [26], and has moved on towards more sophisticated and multifaceted design considerations that target more physical and social implications for public interaction [34], external factors that impact engagement [25] and improved interaction modalities [16]. As most researchers focus on capturing the impact aspect are external of the interface, and despite the intention to support collaborative placemaking, we believe that the design, maintenance, and supervision of most placemaking interfaces, still resides with a central, and therefore authoritative entity [44]. This demonstrates the gap between the ownership of achievement and the ownership of technology [24]: while citizens are technically able to respond to predefined content, they do not necessarily have control over how their contributions are used. This inequality potentially causes participants to doubt the ability of an interface to

have an impact on the community [33]. Motivated to push forward more inclusive citizen participation processes, different frameworks and taxonomies [13, 24] have been proposed to advocate a "middle out" approach that ultimately aims to integrate objectives from top-down decision makers, such as administrative officials, with the bottom-up initiatives of everyday citizens. While these frameworks are certainly relevant to clarify the importance of such collaborations, they do not yet capture the complex interplays of decision making that underlie most placemaking interfaces, such as how citizens are called to action, which of their reactions are selected, curated, redistributed to inform them, and ultimately, how these reactions are used to influence decisions.

With this study, we aim to better understand how these different stakeholders engage with each other to initiate, sustain and reflect upon the public debates via the use of placemaking interfaces. To unveil these relationships, we conducted a narrative literature review of academic publications that described the actual deployment of one or more placemaking interfaces. We coded their descriptions to identify the exact infrastructural concepts, methods and tools that were intended to facilitate placemaking, as well as all the stakeholders that were involved and their roles. By aggregating and grouping these aspects, we are able to synthesize a comprehensive relational model of how these infrastructural means are meant to encourage or resist interactions between all stakeholders. By then applying this model to current practices, we identified three distinct placemaking interface typesthat differ by how they empowered participants to shape the debate: Reflection interfaces intend to prompt citizens to reflect on a specific topic and steer public debate; Communication interfaces intend to provide a platform for citizens to connect and exchange ideas or discuss topics of interest; while inquiry interfaces specifically aim to consult the public. Finally, we discuss a set of critical considerations in which we propose how the often covert gatekeeping powers should become more distributed in transparent and accountable ways between all the stakeholders; how placemaking interfaces should target more challenging participation contexts rather than technological motives; how their media typologies resist more qualitative types of feedback; and how future advancements could make placemaking interfaces more truly democratic.

2 Methodology

This narrative review is based on a convenience sample of exemplary academic publications by querying relevant online databases. In our search, we focused particularly on publications which: 1) transparently reported on the design and/or deployment of at least one digital or tangible interface, situated in urban space; which 2) allowed different stakeholders to create and share information with one another; with 3) the intention to initiate some kind of placemaking activity. Based on these goals, our queries were defined by combinations of terms like *"urban participation", "citizen participation", "placemaking", "public interfaces"* and *"public displays*". Naturally, we analysed the reference lists of already selected papers to source additional works that matched our selection criteria. As some publications report on multiple types of placemaking devices, our sample consists of 26 academic publications that describe a total of 32 different public interfaces. Most publications originate from conferences related to human-computer interaction (i.e. CHI and DIS), although some were published at journals from other disciplines, such as the Journal of the Mobile Digital Commons Network and Urban Forestry & Urban Greening. As we do not position this study as a systematic review, our conclusions should not be generalized outside of the current research tendencies in the field of human-computer interaction in general, and public display research in particular. Despite their probable disinterest in innovating technological interfaces, other relevant movements might exist in both practice as academic research, particularly when we would take into account the increasing interest in facilitating placemaking from academic disciplines such as social and urban studies, social geography, arts or design-based studies, as well as community-based, place-based and participatory (design) research, and many others.

In the next step, we analysed each paper's textual and visual descriptions to dismantle its mentioned placemaking interfaces into their discernible technical elements (e.g. input and feedback devices, databases), the functionalities they afforded (e.g. contributing or responding to content by casting a vote, creating text or recording audio-visual material), and estimated all the informational flows between the stakeholders (e.g.

negotiating, inquiring or moderating content). We then mapped these relationships in a schematic diagram, noting how each functionality generated, stored, filtered or displayed information, and how each stakeholder has a certain level of control over it. By consistently abstracting the power relationships of each interface, we were able to benchmark, overlap, and group them in terms of three distinct typologies of placemaking interfaces. All projects within each interface type where then internally compared in order to map out their core characterising aspects. Finally, we synthesised our reflections and understandings that arose during this iterative process into a set of critical considerations.

3 Placemaking Interface Stakeholder Relationship Model

3.1 Analysis

Table 1 overviews the 26 reviewed publications and their respective 32 placemaking interfaces, which we divided into two distinct approaches: **Data-based placemaking interfaces** are designed to generate and/or visualize quantitative data, such as automated sensor readings [12, 39] or multiple choice polling results collected through touch displays [17], tangible interfaces [7, 8, 22, 33, 41] and motion capturing [38]. **Narrative-based placemaking interfaces** enable the direct authoring of a narrative, which typically is a more orchestrated plot of distinct pieces of data, often in the form of text submission through personal computing devices [14, 23, 32], tangible interfaces [10, 19, 21, 40] or the creation of video [15] and photo [27] content through place-based recording devices. Notably, these two categories are not necessarily mutually exclusive, as a narrative can also emerge when stakeholders come together to debate over (displayed) data. This might happen for instance on-site, when people collaboratively engage with an intervention [5, 22] or during public meetings where gathered data is discussed [41].

3.2 The Model

Figure 1 illustrates all the stakeholders and infrastructural means that were identified. The model demonstrates how each power relationship originates from the (diagonally aligned) decision maker or a participant. Often covertly present, however, sits the Gatekeeper: the party that mediates between both aforementioned parties, often because they are insufficiently technologically skilled to actually operate or maintain a placemaking interface. The encompassing model expresses our assumption that each stakeholder should have the inherent right and ability to directly create or convey content, which in turn might be used as a call-to-action to encourage others to contribute their own content, i.e. a response to a call-to-action. To enable this type of participative feedback loop, all content must be first generated on what is called a “creation interface”, before it can be conveyed to others as a call-to-action (e.g. an invite to contribute content) or a response (e.g. a data visualisation or narrative) on what is called a “feedback interface”. While the creation and feedback interface often co-exist in the same interface, they are drawn separately in the model to better reflect their conceptual distance as well as the practices that deliberately separated them.

Table 1: Overview of reviewed works, input/output mediums and interface types

				Reflection Interfaces	Communication Interfaces		Inquiry Interfaces		
	Name	Input medium	Output medium						
	Animato [40]	notice board	notice board			X	X		
	Byhøst [29]	app	app			X	X		
	Moment Machine [27]	camera	digital display		X				
	CitySpeak [23]	app	digital display			X			
	CITYtalking [20]	intercom	digital display		X				
	Climate on the Wall [15]	Interactive projection	Interactive projection			X	X		
	CO2nfessions [15]	camera, microphone	digital display, speakers		X		X		
	Discussions in Space [32]	app	digital display, Twitter				X		
	DIY-Shrine [20]	camera, microphone	digital display, speakers				X		
	IOT Ideation Cards [2]	deck of cards	deck of cards						X
	IOT Un-kit Experience [2]	prototyping toolkit	prototype						X
	Kerro Kartalla [29]	app	app				X		
	Loaded Dice [2]	prototyping toolkit	prototype						X
	Maptionaire [29]	app	app					X	
	Madeira Story Generator [21]	keyboard, Twitter	airport split flap display, Twitter		X				
	MR-Tent [42]	interactive table	projection, speakers, prototype						X
	OpenWindow [44]	attached keyboard, webform	digital display		X				
	Stalltalk [14]	app	app			X			

	The InstaBooth [3]	prototyping booth	projection, prototype						X
	The Storytelling Machine [31]	pen, paper	projection		X				
	Travelling Suitcases [10]	microphone, pen, paper, photos	notes, photos, speakers, website		X				X
	Ubinion [19]	Camera, touch interface	digital display, Facebook, Twitter				X		
	Zwerm [9]	tangible interface	tangible interface, website			X		X	
	Citizen Dialog Kit [7]	tangible interface	digital display					X	
	Fair Numbers [22]	app	tape visualisation	X			X		
	Flora Luma [12]	touch sensor	LED installation	X					
	MyPosition [38]	motion tracker	digital display				X		
	Poster Vote [41]	tangible interface	event					X	
	Street Infographics [5]	-	Physical display	X					
	Traject Yourself [8]	tangible interface	digital display				X		
	Viewpoint [33]	tangible interface	digital display				X		
	Visualizing Mill Road [22]	tangible interface	chalk graffiti	X			X		

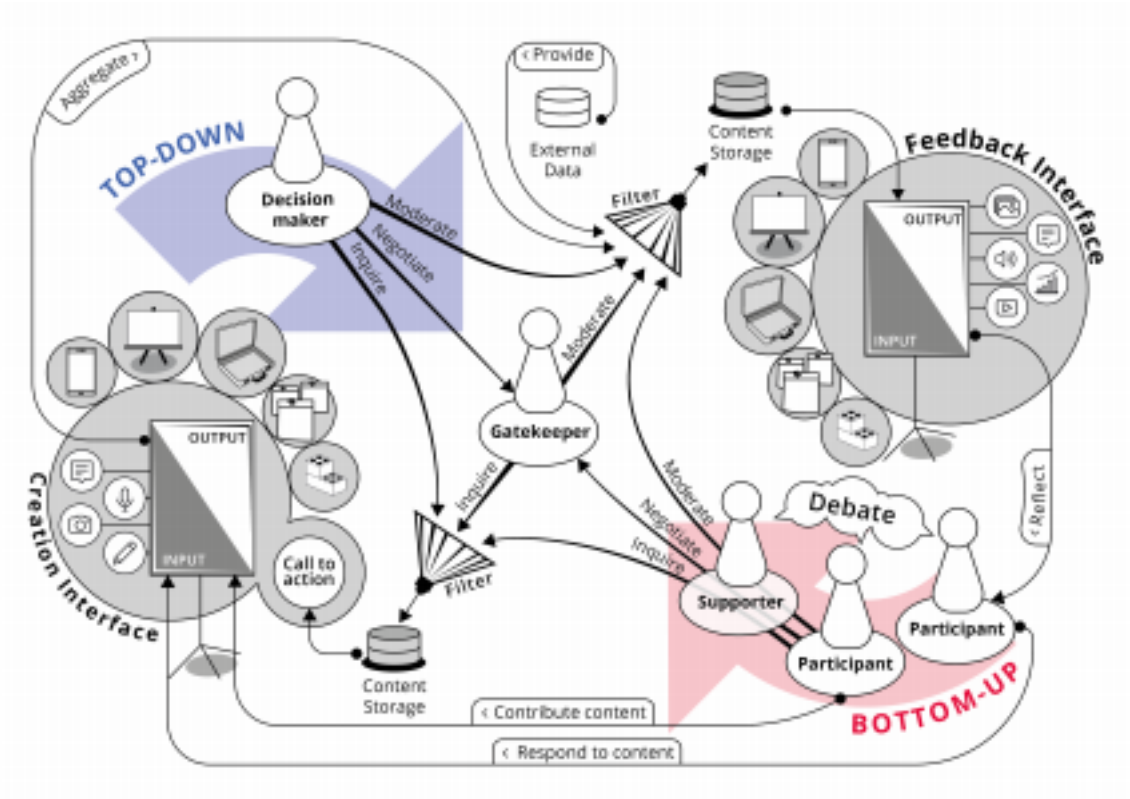

Figure 1: The Placemaking Interface Stakeholder Relationship model. Note: creation and feedback interfaces are visually separated, depending on the system, they might as well be included in one single interface.

3.3 Stakeholders

Decision Makers are comprised of authorities in certain positions of power, usually represented by governmental agencies or private companies who engage with placemaking in a top-down manner. These parties often set the context or fund a placemaking interface, yet they do not necessarily take part in its active deployment. The reviewed publications reported on a total of 17 interfaces that directly involved decision makers during the design process, mainly by describing their motivations to partake: city councils deployed placemaking interfaces as attractions during major participation events [15, 40]; urban planning departments used situated interfaces to gather place-specific feedback from citizens [32, 42]; local elected officials used polling devices to involve citizens in democratic decision making [33]; a design studio provided an interactive interface to engage participants in collaborative storytelling during a series of events [31] and estate owners passed along a portable interface to involve residents in building more cohesive communities [10]. **Participants** refer to the citizens or citizen organizations that engage with placemaking in a bottom-up manner. These include people who actively engage with an interface by e.g. contributing content in form of a narrative or data; as well as those who just 'lurk', by consuming its content without actually actively contributing [1]. As a special subcategory of participants, **Supporters** assist during the deployment of a placemaking interface, without yet having any control over it. For instance, neighbourhood champions were meant to boost participation within their community [9], hired performers demonstrated functionality to trigger passers-by [43], artists rendered content more accessible to the public [22], store owners hosted technology and served as contact for the public [33] and moderators provided additional meaning by facilitating discussions and engagement [12, 40].

While the active involvement of supporters was only mentioned in 7 of all reviewed interface designs, this does not necessarily mean that they were not more prevalent but might have been considered to be obvious or irrelevant to report about. The term **Gatekeeper** is borrowed from the Social Sciences, where it is used to

describe an individual or collective actor who is in a position to control access to resources and rewards that are relevant in a particular social system [18]. A Gatekeeper is thus the entity that is responsible for actually deploying, managing and maintaining a placemaking interface. This responsibility typically includes the facilitation of the call to action [7, 22], and moderating [2, 19] or filtering [32] the contributed content of the participants, for which the gatekeeper often has to collaborate with the decision makers [15, 32, 33] or the participants themselves [9, 41, 44] to fully understand their intentions and needs to implement them. While
we assume that gatekeepers are to different extends involved in each placemaking interface, we could only identify them only in 18 out of the 32 cases that explicitly reported on their tasks within the participation process other than only practically setting up the technology. Commonly gatekeeping is taken up by academic researchers or designers, who are intrinsically motivated to deploy the placemaking interface from a more technological curiosity [27, 38], also because they are the only readily available stakeholders possessing the necessary skills to access and facilitate the interface [32].

3.4 Interface Components

We propose that a placemaking interface typically consist of four distinct parts: two interactive, front-end 'display' elements, i.e. the creation and feedback interface; and two back-end storages that keep all the user generated content, i.e. the call to action and its responses, so that the content can be queried, filtered and moderated. Although the creation and feedback interfaces are often integrated within one physical interface, some interfaces deliberately spatially separated them so that participants could observe content undisturbed, while others simultaneously create it. For example, whereas a polling interface allowed participants to cast a vote and view results on the same device [7]; a video recording booth collected contributions, while the results were shown on a detached display [15].

As shown in Figure 2, a **creation interface** typically consists of two parts: the call-to-action forms the formal invite for participation, such as a question that is sufficiently relevant or provocative to draw the attention of potential participants and/or instructions of how to engage; whereas the interface itself enables them to actually contribute content. The latter can be physical in form of tangible interaction elements such as buttons [7, 33], keyboards [19, 21], cameras [27] or microphones [15] or digital as apps or online forms that outsource authoring to personal computing devices [23, 32]. In some cases creation interfaces are additionally supported by tangible props, particularly because they are believed to be more inspirational and trigger for more complex contributions [15].

Figure 2: Creation interfaces: A) CitySpeak's [23] exploit participants phones to create text and displays it on a separate screen B) PosterVote [41] hosts integrated buttons to collect participants votes, while the results are presented verbally during community events C) Ubinion [19] uses the same interface to create a photo, annotate text and view previous contributions D) Visualizing Mill Road [22] uses a tangible interface, to collect votes, that are separately visualized as chalk graffities.

Figure 3 details how **feedback interfaces** allow participants to consume and reflect on content, such as datasets, textual or audio-visual contributions created by other stakeholders. They are often manifested to participants in the public realm through digital means, e.g. in the form of custom-made websites or apps [14, 29], represented on popular social media platforms [19, 21, 32], as well as in the physical realm, in form of digital displays [15, 19, 32], written notes [10], chalk graffities [22], physical signage [5, 40] or as events, where contributions are verbally presented by a facilitator [41]. A well-designed feedback interface also

serves as a call-to-action, particularly because the act of physically engaging with an interface has been shown to evoke interests of others (i.e. the honeypot effect [43]), which transforms someone's contribution into a call to action for others, potentially persuading them to interact as well [32].

Figure 3: Feedback interfaces: A) Street Infographics [5] augments previously collected demographic data on street signs, B) Discussions In Space [32] displays real-time contributions, submitted by participants via SMS, C) Climate On The Wall [15] uses the same "display" for participants to contribute and reflect on content, D) Visualizing Mill Road [22] displays previously collected polling data on streets.

A **Storage** accumulates either data or user-generated content automatically [12, 39] or opportunistically over the course of a deployment. A placemaking interface storage facility typically consist of a traditional database that is stored on a local or wirelessly networked machine. Yet notably, contributions can be represented physically, such as through public notice boards [40], photos and notes [10] or tangible prototypes created in co-design sessions [2, 3]. As hand-crafted artefacts "store" the meaning of a contribution, the storage becomes somewhat synonymous with the feedback interface, as the content is physically embodied through the medium itself. A **Filter** denotes the process or mechanism of revising content, i.e. by excluding unwanted contributions from being shown publicly as well as moderation tasks, such as sorting content by relevance.

Filters are usually—yet not necessarily—deployed before the content is presented to other participants, as to prevent offensive or off-topic messages from the participants. Filtering has been typically carried out manually by gatekeepers [32] or decision makers [19], yet can also be automated in form of filtering algorithms [23], or outsourced to popular social media platforms like Twitter [21], as these provide powerful, already built-in censuring functionalities.

4 Interface Types

We identified three distinct placemaking interface typologies by distinguishing the differing levels of agency participants have to influence the initiated citizen participation. A detailed overview of the criteria that determine each of these typologies and the reviewed interfaces is shown in Table 1.

4.1 Reflection Interfaces

As shown in Figure 4A, reflection interfaces attempt a 'top-down' approach to placemaking, in which decision makers present information to participants to trigger reflection and steer public debate (Figure 4B). Both decision makers and gatekeepers have full control over the process, as they choose what is displayed, which is often a stream of external data, such as sensor readings from smart metering systems [39], open data from local councils [5] or data that has been previously collected by polling citizens [22]. Its most important distinguishing factor is the absence of a feedback loop, as participants can only consume, and not react to the content that is shown. Consequently, participants can only debate the implications of the content face to face, during collective encounters with other participants [22], when sharing their memory with friends or family after their observation [5] or during conversations [12] or follow up interviews [5, 22] with decision makers or gatekeepers.

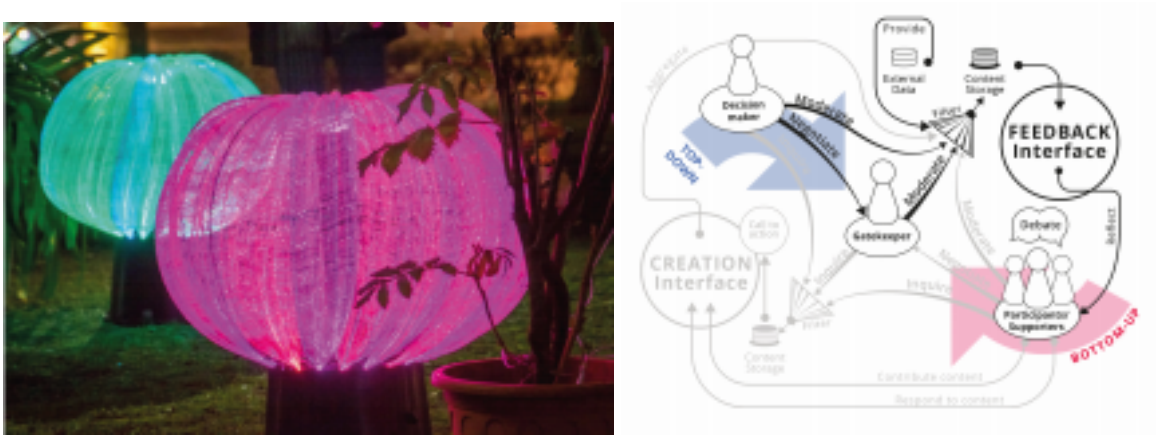

Figure 4: A) Reflection Interfaces enable top down stakeholders to present content to trigger reflection. Participants observe content but cannot share reflections through the interface. B) Flora Luma [12] senses electrical activities of plants, translating it to colourful lights to foster respectful multispecies coexistence.

4.2 Communication Interfaces

Communication interfaces aim to facilitate public debate by empowering participants to exchange ideas and concerns with one another. In other words, they allow participants to contribute and disseminate their 'own' content. These interfaces accomplish communication either in a **one-directional** way (Figure 5 A), allowing participants to contribute content by themselves(Figure 6A); or in a **bi-directional way** (Figure 5 B), offering participants to react to this previously generated content (Figure 6B).

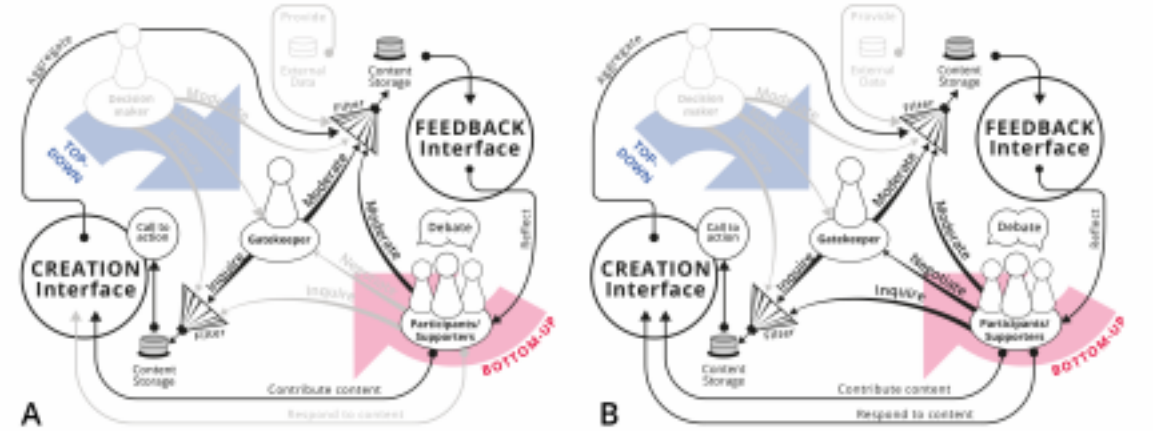

Figure 5: subcategories of Communication Interfaces: A) one-directional allows participants to contribute and show content, while B) bi-directional allows participants to respond to previously contributed content.

Interfaces of this type are found to be exclusively initiated by gatekeepers, such as researchers or social entrepreneurs, often sharing the goal to support citizens in reclaiming public space [23]. Therefore, they usually utilize technological infrastructures that are either already available, such as permanently installed public displays [23, 32]; or are cheaply created, such as by using location-based QR codes linking users to microblogs [14] or public noticeboards from lightweight materials [40]. While the interfaces form the technological means with which content is created, the actual topics of the content either remain free to choose, or are predefined within broader societal themes such as sustainability [15] or urban foraging [29]. While the content is sometimes filtered by a gatekeeper [23], in most cases participants are able to determine

what content is shown [10, 27, 44] by directly publishing their contributions to a feedback interface without the need of external filtering.

Figure 6: A) Open Window [44] allows participants to create and display personalized messages to passers-by in their neighbourhood. B) City Speaks [23] offers bi-directional engagement by allowing participants to create messages and respond to previously created messages on public screens.

4.3 Inquiry Interfaces

The overall aim of inquiry interfaces is to make civic consultation processes more accessible by shifting the approach from closed meetings to public events, with a strong emphasis on engaging those who normally do not, or cannot, take part in public debate, such as the youth, time-poor or impassive individuals [32], or marginalized groups [19, 32, 33]. As such, they are primarily designed to "poll" the public. As shown in Figure 7, the content is always contributed in response to a certain call to action, such as a specific question, which stakeholders can create through a dedicated creation interface [32] or in consultation with a gatekeeper, who then publishes the inquiry [33].

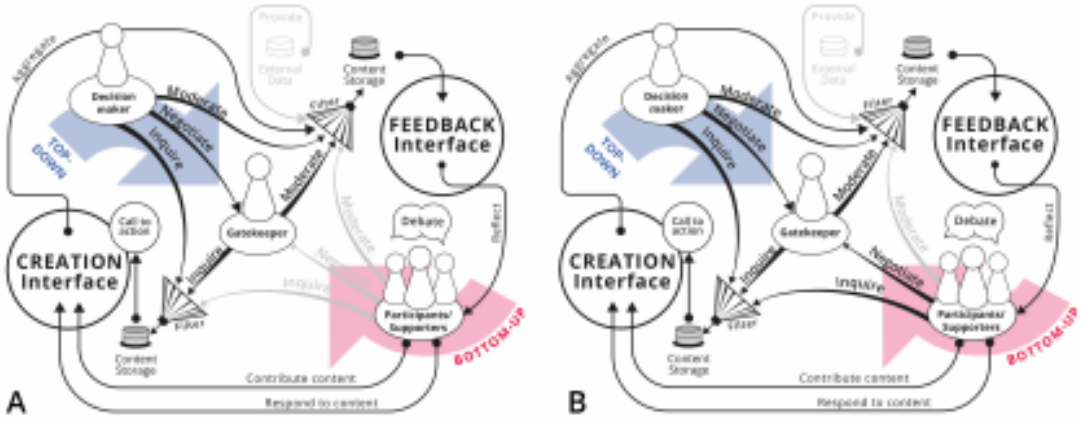

Figure 7: subcategories of Inquiry Interfaces: A) official inquiries are administered by decision makers and gatekeepers only, while B) open inquiries allow all stakeholder groups to poll the public.

A 'closed' feedback loop is created when the reactions from the participants are then becoming publicly displayed on a feedback interface. This type affords **official inquiries** (Figure 7A)**,** where only selected individuals, such as decision makers or gatekeepers, have the authority to define the calls to action (Figure 8A); in contrast to **open inquiries** (Figure 7B), where everyone is empowered to initiate a call to action (Figure 8B). **Tangible inquiries** form an exception in which the content is expressed through physical artefacts and prototypes (Figure 8C), that describe future visions [20, 42] or personal insights [2, 10] of a

specific place. Here, the unique imaginative and entertaining qualities of making are exploited to align various collocated stakeholders to collaboratively design and discuss solutions in response to a given task.

Figure 8: A) Viewpoint [33] allows local elected officials to poll the public. B) Citizen Dialog Kit [7] is an open source toolkit, that enables participants to create personalized interfaces to poll the public. C) Travelling suitcases [10] offer participants means to physicalize personal stories into a collective narrative by combining audio recording with annotated photos and written notes, for the creation of a community based walking trail.

4.4 Differences in Participant Agency

Although placemaking is ultimately meant to create a complete, iterative feedback loop between all stakeholders, most placemaking interfaces are focused on encouraging discussions between participants foremost. While top-down stakeholders have immediate access to all the content, they seem not to take part in the debate themselves. Instead, they seem only able to raise their 'voice' implicitly, such as via their filtering and moderation actions. As such, placemaking interfaces bring forward a new boundary that should be crossed, namely between those who 'contribute' content, and those 'own' and 'control' it. Within this context, we recognize that the presented interface types afford at least three different types of agency for the participants to steer public debate:

Reflection interfaces do not provide any feedback mechanism. Instead, they allow information to flow from top-down to bottom-up stakeholders in one direction. Much like how public advertising functions, the indirect impact of these interfaces, such as the actual reflections or behavioural changes of the participants it nudges, can only be indirectly captured. Instead, the real power of reflection interfaces sits in informing participants in truly opportunistic and easily accepted ways, because they do not explicitly expect any significant effort to use them. Despite their rather passive nature, reflection interfaces still have the ability to acknowledge the existence of latent communities, much like how community displays, or electronic bicycle counters promote particular behaviours by capturing and then publicly announcing them.

Communication interfaces afford participants with more agency, as their technological infrastructure allows them to contribute content by themselves. As such, we identified six interfaces that allowed participants to communicate with each other within a closed feedback loop. Although bi-directional in nature, the usage of feedback loops within communication interfaces is often limited by the inherent motivation and ability of participants to physically return to its location to sustain the debate. The 7 remaining communication interfaces allowed only one-directional contributions, that similar to reflection interfaces limited the debate to one individual's opinion, yet left the power of contributing content with the bottom-up stakeholders. Notably, only two interfaces also allowed gatekeepers to partake in the debate for themselves, other than face to face conversations or follow-up interviews.

Inquiry interfaces offer bi-directional information flows between participants and decision makers, even when the role of participants keeps resolving around 'responding' to predefined calls-to-action. In 19 projects of this engagement type, the inquiry was exclusively determined by decision makers or gatekeepers, while 4 also enabled participants to be part of this process. There were only 4 interfaces, that enabled those making an inquiry to also react to the participant's responses. This shows that, while the actual participation dialog seems bi-directional, the call to action and feedback respectively works mostly one-directional.

5 Discussion

5.1 How Placemaking Interfaces are Controlled by Gatekeepers

Transparency. Providing participants with truly anonymous access to a public interface is argued to empower a more inclusive audience and deliver more diverse and rich contributions [14]. Yet allowing participants to contribute content anonymously requires some process of moderation or filtering to avoid malicious or inappropriate content to become publicly broadcasted [28] and as such, promote a safe space for participation [23]. Ranging from selecting a range of numerical sensor measurements that represent local air pollution levels [4], to editing an audio-visualstory created by local community members [15], moderating publicly relevant content in a representative way is not trivial and open for certain bias. Such bias might even present itself unintentionally, such as when a gatekeeper only selects the gravest pollution levels that have been measured to make a more persuasive case or cuts out scenes that seem boring yet might carry particular local relevance. While such moderations might be arguable, there are currently no mechanisms for sceptical participants to at least look up or argue about the existence of a filtering bias, such by having direct and open access to the source data in the content storages.

Responsibility. The gatekeeper's main placemaking role is to filter and "middle out" the content between the intentions from the decision makers and the aspirations from the participants, so that it conveys a truthful and representative picture of the participation process. While one can easily accept that a gatekeeper who is affiliated with the decision-makers or participants cannot necessarily be truly objective to the filtering process, the motives of external parties who take over the gatekeeping role like researchers might be less obvious to estimate and interpret.

Accountability. Our model demonstrates that a placemaking interface requires gatekeepers to maintain, update and 'filter' user-generated content. Yet we reveal that this task is often accomplished by one or more people that are not necessarily explicitly identified nor acknowledged to all other stakeholders. While it is known that passers-by estimate the ownership of a public intervention primarily through its location and materiality [6], their perception of who determines the content is thus not always necessarily accurate.

Democratization. We argue that engaging participants in the filtering and moderation tasks could additionally contribute to a general sense of ownership. Supporters, being trusted and easily reachable persons who have some representative power of a community [37] seem to be the most obvious stakeholders to fulfil gatekeeping tasks. Because of their close connections within their neighbourhood, they can facilitate the creation of content in ways that keep up the interest and motivation of a community [9]. Yet the choice of supporters must often be motivated by their willingness or ability to learn new technical skills, rather than their natural ability to represent certain communities and their concerns.

Considerations. The fact that time-consuming and financial development efforts were expended in order to permit, plan, deploy and maintain a placemaking interface in the first place, should sufficiently demonstrate that there is a certain underlying 'agenda' that is driven by certain stakeholders. In practice, this agenda is mediated by the gatekeeper, perhaps the most powerful, but also the least visible, stakeholder behind any placemaking interface. As the practice of public interfaces is maturing and becoming applied into more real world situations, the mediating role, bias and influence of gatekeeping should be carefully considered. As the apparent lack of transparency decreases the efficacy of public interactive systems [33], we propose that the gatekeeper's role should be better articulated and communicated towards and the public as well as in future study descriptions, so that it could potentially be taken into account and benchmarked in literature reviews.

Potentially achievable efforts in this direction could be comprised of: 1) clearly announcing the identity, affiliation, contact details and responsibilities of the gatekeepers, enabling all stakeholders to estimate their bias; 2) explicitly acknowledging the process of moderation, such as by clearly conveying how the shown content only forms a sample of all the feedback that was submitted (in [23] for instance, inappropriate comments were displayed as an encrypted order of letters); and 3) providing direct and open access to *all* the user-generated content – even those that seems erroneous or of malicious intent, hereby enabling all stakeholders to critically compare the content that is publicly shown with what was actually submitted. The

creation of content is often suggested to be crucial for the acceptance of a placemaking interface within a

community [24, 30]. We thus propose that this activity should also include content moderation and filtering, by: 4) developing accessible tools that allow lay people to filter content for themselves, hereby either distributing publishing rights directly to other stakeholders, or layering the moderation process with a stage that allows stakeholders, i.e. both decision makers as participants, to "propose" what content should ideally be published. More technologically-driven efforts could: 5) integrate semi-automated, yet transparent and adaptable ways of gatekeeping that take into account the depolarisation of textual and visual discourses; or 6) consider 'mass-distributed' ways of gatekeeping, such as by integrating proven content mass-moderation mechanisms from contemporary social media applications like Twitter or Instagram.

5.2 How Placemaking Interfaces are Technologically Motivated

Motivation. Despite that placemaking interfaces inherently intend to empower citizen participation, they are often initiated and maintained in a top-down manner, i.e. by decision makers [32, 33] or gatekeeper [5, 22]. A decision-maker is obviously motivated to help make a placemaking activity succeed, and as such might be interested in exploiting the unique opportunistic qualities of a public interface. However, gatekeepers that are external to the inherent goals of the participation process, such as those with affiliation to a research institution, might be driven by more utilitarian motives, such as to successfully test a conceptual or technological innovation in an ecological valid setting. As such, many cases focused on how participants engaged with a proposed technological probe, rather than considering why a specific polling question had to be asked, how the local participation issue was important to that specific community or how the feedback was going to be used to address that issue.

Technical Ability. Possessing the authoritative and administrative rights to filter all storages, gatekeepers are the only stakeholders with unrestrictive influence on the content moderation process. While moderation rights could potentially be delegated downwards, filtering digital content often requires various technical skills, particularly when the moderation interface is custom-made, and its functionalities do not rise above a high-fidelity prototyping level. In addition, filtering contributions are time consuming and distracting when accomplished manually [32].

Artificial Contexts. Our convenience sample suggests that few placemaking interfaces were deployed in challenging locations, insofar that some were deployed within rather artificial contexts within or close by universities (e.g. [32, 38]). This limitation might be best explained by the rather fragile character of an experimental interface, as well as its practical requirement to be situated in a physical environment that allows direct access to technical (e.g. power, networking) features, set within a socially predictable environment (e.g. dominant language, digital media literacy skills, risk of vandalism).

Considerations. Grounding our convenience sample within the field of HCI, most interfaces inherently tackled a technological rather than placemaking focus. In the future, however, we propose that placemaking interfaces should be: 1) solely managed by stakeholders outside of the participation process itself, i.e. forcing the researcher "out" of the stakeholder model; which also means that 2) all gatekeeping tasks should become easily accessible by custom interfaces that are intuitively usable to non-expert users. Next to these necessary software advancements; 3) the hardware of placemaking interfaces should become sufficiently robust to be deployed in more challenging environments.

5.3 How Placemaking Interfaces Express Participant Feedback Data.

Table 1 shows that reflection interfaces exclusively display textual or visual representations of data, such as numerical statistics or infographics of demographic data to convey their purpose of triggering reflections. Therefore, a reflection interface is ideal to convey a holistic overview of local sentiments, as its visualizations are able to objectively summarize all submitted opinions without the need for deliberate moderation. Yet at the same time, data always forms a limited picture of reality, as it tends to capture environmental phenomena as discrete measurements that might be experienced differently by participants. Similarly, feedback in the form of data often limits the potential needs, sentiments and opinions of

participants into simplistic multiple-choice options that not even necessarily accurately correspond to how people feel.

Narrative. Communication and inquiry interfaces provide, capture or convey narratives via different forms of audio-visual media, including audio, video, photo and text. Here, participant feedback can consist of more open-ended and qualitative contributions, which contextualize local opinions in more subjective terms. The opportunities and challenges of this qualitative characteristic is perhaps most exemplified in the case of tangible inquiry interfaces, where feedback is translated into meaning which however can only be fully comprehended by those who were physically present during its actual construction.

Moderating call to actions. The value of feedback to engage and sustain participation has been acknowledged in multiple experiments [19, 22, 32]. Conversely, feedback can serve to raise a systems credibility by confirming participants contribution [33], insofar that its lack [41] caused mistrust with participants whether or not their vote has been cast. Publicly displaying previous contributions can further serve as a trigger to engage observers in creating own input [32]. However, in several cases where the provided data or narrative feedback was used as calls-to-action, the feedback was moderated by other stakeholders and thus potentially biased.

Considerations. To enable truly 'democratic' renditions of placemaking interfaces, we propose to 1) progress towards more hybrid approaches that exploit the communicative advantages of both data and narrative. For instance, participants could be educated with calls-to-action that are grounded in local opinions or trustworthy data measurements of relevant phenomena, to which they can relate their reflections as more open-ended qualitative contributions. Truly 'bottom-up' placemaking interfaces should then take also into account that 2) the calls-to-action should be treated similarly to the actual reactions that they generate, as participants should be empowered to choose and moderate them for themselves in accessible and transparent ways.

5.4 How Placemaking Interfaces can Matter

Placemaking Needs. The deployment of a placemaking interface always requires a negotiation between the organizing stakeholders and the interface developers (often acting as gatekeepers), at least to determine its actual suitability to the chosen participation context, and to organize its practical deployment. Vice versa, as the technology matures specific stakeholders will actively consider deploying a public interface to help solve particularly challenging participation concerns. Both processes are not well documented, causing us to doubt that current public interface research might not align well with the real needs of the placemaking practice.

Challenge. The inquiry interfaces that specifically aim to solve civic purposes, often limit the consultation to rather shallow participation themes. In effect, we found a tendency towards more open-ended inquiries (e.g. "What is the dirtiest spot in your neighborhood?" [9], or "How busy is this place at the moment?" [8]), that aim to sustain interest in collecting data, rather than trying to solve a specific local challenge.

Trust. Multiple publications (e.g. [33, 41]) reported on a certain mistrust from participants against authoritarian consultation. Participants claimed to feel not well represented by local decision makers and where therefore hesitant to engage, which potentially leads them not to partake in the participation process. As placemaking interfaces proclaim to empower citizens, they should provide sufficient agency to participants to codetermine the topics posed for debate.

Empowerment. In fact, only 10 of the reviewed placemaking interfaces were initiated with support of participants. Of those, most deployments only used participants in rather incidental roles, such as to host the technology or assess particular study designs [33]. The lack of participant-initiated interface deployments suggests that they are either not allowed, not aware or not yet fully empowered to deploy interfaces for themselves.

Representativeness. The notion of feedback requires participants to perceive the input of others. Yet when participants are exposed to previous results before interacting, they might be persuaded to align with the majority, or gain the impression that their participation is futile, particularly when their choice is amongst the minority [33, 38]. As placemaking interfaces mature to become deployed from explorative to more decisive

contexts, a concern will arise that they might be potentially hacked, further decreasing the trust of participants.

Agency. Few of the publications reported on how the results from the placemaking interfaces were actually used in the decision making that followed. Offering feedback mechanisms to participants without acknowledging how and to what extent their contribution is used can potentially lead to a sense of consultation fatigue [33].

Takeaway. For placemaking interfaces to become a participative method that is equally reliable and representative as commonly used workshops and online consultations, we believe that: 1) the field should articulate the qualities of each interface method in relation to actual participation needs; and vice versa 2) empower participation stakeholders to influence the research agenda of future research towards more challenging topics. This should allow us to: 3) tackle more challenging participation questions, preferably by 4) empowering citizens to codetermine the themes that must be tackled; or 5) allowing them to deploy them by themselves, such as via open source and DIY toolkit approaches. Yet future studies should establish to what extent the collected contributions, i.e. narratives and data, is 6) truly representative and trustworthy to base decisions on; insofar that 7) the generated insights and the decisions that followed from these insights must be provided back to the participants in order to achieve trust that their input was actually taken into consideration. Being gathered by a public interface, it seems obvious that the same technological means could be used to disseminate this feedback to the participants.

6 Limitations

A more thorough systematic literature review methodology might have provided more trust in our main findings, in particular to matters that regard the frequency of some observed phenomena, which could also be balanced against the estimated quality of each study. Nonetheless, we believe that the narrative review methodology, supported with all the evidence synthesized in Table 1, provided us with sufficient and transparent proof to draw valuable conclusions that are relevant for placemaking interfaces in particular, and perhaps public interface research in general. Due to the inconsistencies in how the publications reported the actual processes that drove their deployments, we might have misinterpreted some interfaces to fall within the wrong categories. We note however that our model and its classifications is not exhaustive nor deterministic but meant as a critical synthesis of the most prevalent stakeholders, their roles and their influences in contemporary placemaking interface development.

7 Conclusion

In this paper we presented a narrative review of placemaking interfaces, which enabled us to map out the most essential information flows between various stakeholders and interface components. Our main factual findings are summarized and illustrated in a public interface stakeholder relationship model, which could be used by future researchers and practitioners to identify, analyse and potentially evaluate the more critical aspects that underlie a placemaking interface. By applying this model to current practices, we identified three distinctive interface types: reflection, communication and inquiry, by their level of agency they provide to participants to impact a debate. Through an extensive discussion of the implications of the model, we revealed various current shortcomings and future challenges in the current practice of placemaking interfaces. Finally, we proposed a list of considerations for future research trajectories for the design and deployment of novel systems, in order to democratize the power structures between the involved stakeholders and open new ways for true bottom up and self-regulatory placemaking initiatives by way of new types of interfaces.

ACKNOWLEDGMENTS

Removed for blind review.

REFERENCES

[1] Yair Amichai-Hamburger, Tali Gazit, Judit Bar-Ilan, Oren Perez, Noa Aharony, Jenny Bronstein and Talia Sarah Dyne. 2016. Psychological factors behind the lack of participation in online discussions.

Computers in Human Behavior, 55 (February 2016), 268-277, https://doi.org/10.1016/j.chb.2015.09.009

[2] Arne Berger, Aloha Hufana Ambe, Alessandro Soro, Dries De Roeck and Margot Brereton. 2019. The Stories People Tell About The Home Through IoT Toolkits. In *Proceedings of the Designing Interactive Systems Conference - DIS '19,* June 23 - 28, 2019, San Diego, California, USA. https://doi.org/10.1145/3322276.3322308

[3] Glenda Amayo Caldwell, Mirko Guaralda, Jared Donovan and Markus Rittenbruch. 2016. The InstaBooth: Making Common Ground for Media Architectural Design. In *Proceedings of the 3rd. Conference on Media Architecture Biennale - MAB,* June 1 - 4, 2016, Sydney, Australia. https://doi.org/10.1145/2946803.2946806

[4] Sandy Claes, Jorgos Coenen and Andrew Vande Moere. 2018. Conveying a civic issue through data via spatially distributed public visualization and polling displays. In *Proceedings of the 10th Nordic Conference on Human-Computer Interaction - NordiCHI '18,* October 1 - 3, 2018, Oslo, Norway. 10.1145/3240167.3240206

[5] Sandy Claes and Andrew Vande Moere. 2013. Street Infographics: Raising Awareness of Local Issues through a Situated Urban Visualization. In *Proceedings of the 2nd. ACM International Symposium on Pervasive Displays,* June 4 -5, 2013, Mountain View, California, USA. https://doi.org/10.1145/2491568.2491597

[6] Sandy Claes and Andrew Vande Moere. 2017. Replicating an In-The-Wild Study One Year Later. In *Proceedings of the Conference on Designing Interactive Systems: DIS '17,* June 10 - 14, 2017, Edinburgh, United Kingdom. 10.1145/3064663.3064725

[7] Jorgos Coenen, Maarten Houben and Andrew Vande Moere. 2019. Citizen Dialogue Kit: Public Polling and Data Visualization Displays for Bottom-Up Citizen Participation. In *Proceedings of the Designing Interactive Systems Conference 2019 Companion - DIS '19 Companion,* June 23 - 28, 2019, San Diego, California, USA. https://doi.org/10.1145/3301019.3325160

[8] Jorgos Coenen, Eslam Nofal and Andrew Vande Moere. 2019. How the Arrangement of Content and Location Impact the Use of Multiple Distributed Public Displays. In *Proceedings of the Designing Interactive Systems Conference - DIS '19,* June 23 - 28, 2019, San Diego, California, USA. https://doi.org/10.1145/3322276.3322294

[9] Tanguy Coenen, Peter Mechant, Thomas Laureyssens, Laurence Claeys and Johan Criel. 2013. ZWERM: stimulating urban neighborhood self-organization through gamification. In *Proceedings of the International conference Using ICT, Social Media and Mobile Technologies to Foster Self-Organisation in Urban and Neighbourhood Governance,* May 16 -17, 2013, Delft, Netherlands.

[10] Clara Crivellaro, Alex Taylor, Vasillis Vlachokyriakos, Rob Comber, Bettina Nissen and Peter Wright. 2016. Re-Making Places: HCI, 'Community Building' and Change. In *Proceedings of the CHI Conference on Human Factors in Computing Systems - CHI '16,* May 7 - 12, 2016, San Jose, California, USA. https://doi.org/10.1145/2858036.2858332

[11] Patrick Tobias Fischer and Eva Hornecker. 2012. Urban HCI: spatial aspects in the design of shared encounters for media facades. In *Proceedings of the ACM Annual Conference on Human Factors in Computing Systems,* May 5 -10, 2012, Austin, Texas, USA. https://doi.org/10.1145/2207676.2207719

[12] Raune Frankjaer. 2017. Fostering Care and Peaceful Multispecies Coexistence with Agential Provotypes. In *Proceedings of the 23rd. International Symposium on Electronic Arts,* June 11 - 18, 2017, Manizales, Colombia.

[13] Joel Fredericks. 2019. From Smart City to Smart Engagement: Exploring Digital and Physical Interactions for Playful City-Making. In Making Smart Cities More Playable Exploring Playable Cities. Springer, 107-137. https://doi.org/10.1007/978-981-13-9765-3_6

[14] Jonathan Friedmann and Michael Horn. 2013. StallTalk: Graffiti, Toilets, and Anonymous Location Based Micro Blogging. In *Proceedings of the CHI '13 Extended Abstracts on Human Factors in Computing Systems* April 27 - May 2, 2013, Paris, France. https://doi.org/10.1145/2468356.2468738

[15] Jonas Fritsch and Martin Brynskov. 2009. Between engagement and information: Experimental urban media in the climate change debate. In *Proceedings of the 4th. conference of Communities and Technologies,* June 25 - 27, 2009, University Park, Pennsylvania, USA.

[16] Luke Hespanhol and Martin Tomitsch. 2015. Strategies for Intuitive Interaction in Public Urban Spaces. *Interacting with Computers*, 27, 3 (January 2015), 311-326, https://doi.org/10.1112/iwcomp/iwu051

[17] Luke Hespanhol and Martin Tomitsch. 2018. Power to the People: Hacking the City with Plug-In Interfaces for Community Engagement. In The Hackable City Digital Media and Collaborative City Making in the Network Society. Springer, 25-50. https://doi.org/10.1007/978-981-13-2694-3_2

[18] Barbara Hoenig. 2015. Gatekeepers in Social Science. In The International Encyclopedia of the Social & Behavioral Sciences. 2nd edition. Elsevier, 618-622. https://doi.org/10.1016/b978-0-08-097086- 8.03011-7

[19] Simo Hosio, Vassilis Kostakos and Hannu Kukka. 2012. From School Food to Skate Parks in a few Clicks: Using Public Displays to Bootstrap Civic Engagement of the Young. In *Proceedings of the 10th. International Conference, Pervasive 2012,* June 18 - 22, 2012, Newcastle, UK. https://doi.org/10.1007/978-3-642-31205-2_26

[20] Sarah Johnstone, Glenda Amayo Caldwell and Markus Rittenbruch. 2015. Defining the InstaBooth : Facilitating debate and content creation from situated users. In *Proceedings of the MEDIACITY 5 International Conference,* May 1 - 3, 2015, Plymouth, UK.

[21] Clinton Jorge, Valentina Nisi, Nuno Nunes, Giovanni Innella, Miguel Caldeira and Duarte Sousa. 2013. Ambiguity in Design: An Airport Split-Flap Display Storytelling Installation. In *Proceedings of the CHI '13 Extended Abstracts on Human Factors in Computing Systems,* April 27 - May 2, 2013, Paris, France. https://doi.org/10.1145/2468356.2468452

[22] Lisa Koeman, Vaiva Kalnikaitė, Yvonne Rogers and Jon Bird. 2014. What Chalk and Tape Can Tell Us: Lessons Learnt for Next Generation Urban Displays. In *Proceedings of the 3rd. International Symposium on Pervasive Displays - PerDis '14,* June 3 - 4, 2014, Copenhagen, Denmark. https://doi.org/10.1145/2611009.2611018

[23] Maroussia Lévesque, Lucie Bélanger and Jason Lewis. 2006. Cityspeak's Reconfiguration of Public Media Space. *Journal of the Mobile Digital Commons Network*, 1, 1 (January 2006), [24] Can Liu, Mara Balestrini and Giovanna Nunes Vilaza. 2019. From Social to Civic: Public Engagement with IoT in Places and Communities. In Social Internet of Things. Springer, 185-210. https://doi.org/10.1007/978-3-319-94659-7_10

[25] Ville Mäkelä, Sumita Sharma, Jaakko Hakulinen, Tomi Heimonen and Markku Turunen. 2017. Challenges in Public Display Deployments. In *Proceedings of the CHI Conference on Human Factors in Computing Systems - CHI '17,* May 6 - 11, 2017, Denver, Colorado, USA. https://doi.org/10.1145/3025453.3025798

[26] Nemanja Memarovic, Sarah Clinch and Florian Alt. 2015. Understanding Display Blindness in Future Display Deployments. In *Proceedings of the 4th. International Symposium on Pervasive Displays - PerDis '15,* June 10 - 12, 2015, Saarbrücken, Germany. https://doi.org/10.1145/2757710.2757719

[27] Nemanja Memarovic, Ava Fatah gen Schieck, Holger M. Schnädelbach, Efstathia Kostopoulou, Steve North and Lei Ye. 2015. Capture the Moment: "In the Wild" Longitudinal Case Study of Situated Snapshots Captured Through an Urban Screen in a Community Setting. In *Proceedings of the 18th. ACM Conference on Computer Supported Cooperative Work & Social Computing - CSCW '15,* March 14 -

18, 2015, Vancouver, BC, Canada. https://doi.org/10.1145/2675133.2675165 [28] Dieter Michielsen, Tonia Dalle, Mara Usai, Rosaura Romero and Burak Pak. 2017. Learning Participatory Urban Research Towards a Network of Collective Ingenuity (OURB). In *Proceedings of the 35th. International Conference on Education and Research in Computer Aided Architectural Design in Europe,* September 20 - 22, 2017, Rome, Italy.

[29] Maja Steen Møller, Anton Stahl Olafsson, Kati Vierikko, Karina Sehested, Birgit Elands, Arjen Buijs and Cecil Konijnendijk van den Bosch. 2018. Participation through place-based e-tools: A valuable resource for urban green infrastructure governance? *Urban Forestry & Urban Greening*, 40 (April 2018), 245-253, https://doi.org/10.1016/j.ufug.2018.09.003

[30] Callum Parker, Martin Tomitsch, Nigel Davies and Judy Kay. 2020. Foundations for Designing Public Interactive Displays that Provide Value to Users. In *Proceedings of the 2020 ACM CHI Conference on Human Factors in Computing Systems,* April 25 - 30, 2020, Honolulu, Hawaii, USA. https://doi.org/10.1145/3313831.3376532

[31] Betty Sargeant, Justin Dwyer and Florian 'Floyd Mueller. 2018. The Storytelling Machine: A Playful Participatory Automated System Featuring Crowd-Sourced Story Content. In *Proceedings of the Annual Symposium on Computer-Human Interaction in Play Companion Extended Abstracts - CHI PLAY '18*

Extended Abstracts, October 20 – 28, 2018, Melbourne, Australia. https://doi.org/10.1145/3270316.3272052

[32] Ronald Schroeter. 2012. Engaging new digital locals with interactive urban screens to collaboratively improve the city. In *Proceedings of the CSCW '12 Computer Supported Cooperative Work,* February 11- 15, 2012, Seattle, Washington, USA. https://doi.org/10.1145/2145204.2145239

[33] Nick Taylor, Justin Marshall, Alicia Blum-Ross, John Mills, Jon Rogers, Paul Egglestone, David Frohlich, Peter Wright and Patrick Olivier. 2012. Viewpoint: Empowering Communities with Situated Voting Devices. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems,* May 5 - 10, 2012, Austin, Texas, USA. https://doi.org/10.1145/2207676.2208594

[34] Lucia Terrenghi, Aaron Quigley and Alan Dix. 2009. A taxonomy for and analysis of multi-person display ecosystems. *Personal and Ubiquitous Computing*, 13, 8 (November 2009), 583-598, https://doi.org/10.1007/s00779-009-0244-5

[35] Sarah-Kristin Thiel. 2015. Exploring requirements for civic engagement via public displays. In *Proceedings of the 30th. British HCI Conference on - British HCI '15,* July 11 - 15, 2015, Lincoln, Lincolnshire, United Kingdom. https://doi.org/10.1145/2783446.2783622

[36] Erin Toolis. 2017. Theorizing Critical Placemaking as a Tool for Reclaiming Public Space. *American journal of community psychology*, 59, 1-2 (March 2017), 184-199, https://doi.org/10.1002/ajcp.12118

[37] Susan Vail. 2007. Community Development and Sport Participation. *Journal of Sport Management,*, 21, 4 (October 2007), 571–596, https://doi.org/10.1123/jsm.21.4.571

[38] Nina Valkanova, Robert Walter, Andrew Vande Moere and Jörg Müller. 2014. MyPosition: sparking civic discourse by a public interactive poll visualization. In *Proceedings of the 17th ACM conference on Computer supported cooperative work & social computing,* February 15 - 18, 2014, Baltimore, Maryland, USA. https://doi.org/10.1145/2531602.2531639

[39] Andrew Vande Moere, Martin Tomitsch, Monika Hoinkis, Elmar Trefz, Silje Johansen and Allison Jones. 2011. Comparative Feedback in the Street: Exposing Residential Energy Consumption on House Façades. In *Proceedings of the Human-Computer Interaction - INTERACT 2011 - 13th IFIP TC 13 International Conference,* September 5 - 9, 2011, Lisbon, Portugal. https://doi.org/10.1007/978-3-642-23774-4_39

[40] Sandra Viña. 2010. Engaging People in the Public Space - ANIMATO a Design Intervention. In *Proceedings of the 11th Biennial Participatory Design Conference,* November 29 – December 3, 2010, Sydney, Australia. https://doi.org/10.1145/1900441.1900490

[41] Vasilis Vlachokyriakos, Rob Comber, Karim Ladha, Nick Taylor, Paul Dunphy, Patrick McCorry and Patrick Olivier. 2014. PosterVote: Expanding the Action Repertoire for Local Political Activism. In *Proceedings of the Conference on Designing interactive systems - DIS '14,* June 21 - 25, 2014, Vancouver BC Canada. https://doi.org/10.1145/2598510.2598523

[42] Ina Wagner, Maria Basile, Lisa Ehrenstrasser, Velérie Maquil, Jean-Jaques Terrin and Mira Wagner. 2009. Supporting Community Engagement in the City: Urban Planning in the MR-Tent. In *Proceedings of the 4th. International Conference on Communities and Technologies, C&T,* June 25 - 27, 2009, University Park, Pennsylvania, USA. https://doi.org/10.1145/1556460.1556488

[43] Niels Wouters, John Downs, Mitchell Harrop, Travis Cox, Eduardo Oliveira, Sarah Webber, Frank Vetere and Andrew Vande Moere. 2016. Uncovering the Honeypot Effect. In *Proceedings of the ACM Conference on Designing Interactive Systems - DIS '16,* June 04 - 08, 2016, Brisbane QLD Australia. https://doi.org/10.1145/2901790.2901796

[44] Niels Wouters and Andrew Vande Moere. 2013. OpenWindow: citizen-controlled content on public displays. In *Proceedings of the 2nd ACM International Symposium on Pervasive Displays,* June 4-5, 2013, Mountain View, California, USA. https://doi.org/10.1145/2491568.2491595