The participatory futures method: An approach to co-projecting smart urban neighbourhood places in resource-scarce communities

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Abstract

For smart urban technologies to enhance the current and future urban experiences of residents of cities in Africa, interventions in the urban environments must be considered from an ethical perspective. This is important as urban environments are increasingly becoming the habitat for the majority of people on this planet, and rapidly evolving and increasingly emerging smart urban technologies have the capacity to be immensely socially disruptive.

Responding to the question of how CI researchers can employ participatory methods to better understand the preferences of citizens in African cities for the inclusion of smart technologies in their urban environments, this article initially describes the conceptual design of a novel co-design research method, the participatory futures method (PFM), which integrates concepts and techniques originating in the field of experiential futures with the design research method of generative tools. Thereafter, the iterative refinement of the PFM through a series of pilot workshops involving participants from the neighbourhood of Westbury, a resource-scarce urban community in Johannesburg, South Africa is reflected upon. In addition to descriptions of the workshops, the approach taken for analysing and synthesising the data generated in the workshops is outlined and critically reflected upon with particular regard to the capacity of the PFM method to generate meaningful insights pertaining to the Westbury community's preference for smart places.

This research extends the knowledge of community informatics by articulating how the rigour of experiential futures methods for futures-orientated inquiry can be integrated with the reflective qualities of generative tools capable of eliciting latent needs, to orientate participatory encounters with community members that are meaningful to both the discipline and participants. Lastly, this research provides a detailed account of how participatory research practiced in and with under-resourced communities anticipate the potential positive impact of smart technologies in their urban environments. As such, this study contributes a participatory perspective of CI design research, from and by researchers in the global South, a context often marginalised by Western-orientated informatics research.

Keywords: Futures; Smart Neighbourhoods; Participatory Design; Smart African Cities; Resource-scarce Communities.

Introduction

By 2050, it is estimated that over 70% of the world's population will be urbanised (Benjamin et al., 2011), with 90% of this influx into cities in Africa and Asia (Praharaj et al., 2018). As populations rise, economies stagnate, and climate change impacts, living standards will likely decline (Khatoun & Zeadally, 2016). In resources-scarce communities, typical of many African cities, these future concerns will exacerbate problematic existing environments that, beyond squalor, hunger, overcrowding and poor service delivery (Wutich & Brewis, 2014; Kistruck et al., 2016), remain for many a colonial construct enforcing exotic cultural patterns for urban living many years after 'independence'.

The concept of the smart city (SC) suggests a dawning age of ubiquitous digital systems operating in parallel to or embedded within the built environment. For many, the SC offers the promise of improved city management and services (Gardner & Hespanhol, 2018) that enhance performance, optimise resources, reduce cost and engage more efficiently with citizens (Dustdar et al., 2017). Typically, the implementation of the SC is conceptualised from a 'top-down' planning and design perspective associated with technically inspired creativity, innovation, and entrepreneurship (Kitchin, 2014). While top-down conceptualisations have largely dominated SC discourse, they have been critiqued as technologically deterministic (Bodin, 2017) for reducing access by adding complexity (Schleicher et al., 2016) and generating inequality, frequently to the benefit of the neo-liberal marketplace (Greenfield, 2017). In response, a growing body of literature suggests an alternative 'bottom-up' or citizen-led approach (Staffans & Horelli, 2014). Much of this discourse is framed in terms of citizens' 'right to the city' and emphasises small-scale workings of the city (Gardner & Hespanhol, 2018).[1] Collectively, these bottom-up approaches focus on enabling, including and supporting communities and citizens and, as such, align with a community informatics (CI) model for conceptualising the SC (Gurstein, 2014).

It is also essential to recognise that all considerations of the smart city remain largely projections of a future. As Snow et al. (2016) note, in most cities, technologies associated with the SCs are non-existent or deployed in limited capacities. Consequently, it is more helpful to talk of SC technology (smart technology) than SCs per se. Additionally, it is evident that while smart technologies have the potential to enhance urban life, they also have the potential to widen inequalities further, disenable access, and increase the commodification of public space.

In African contexts, considerations of the SC are extended by the recognition that technology, digital or architectural, is never value-neutral and always carries particular identity, cultural and political assumptions (Al-Hunaiyyan & Al-Sharhan, 2009). Consequently, for African societies that are typically importers of digital technologies and implementation strategies (Huysman & Volker, 2005; Breytenbach et al., 2013), the SC remains a construct, situated in a future time, with the *potential* to introduce new forms of technological colonisation and

[1] 'Rights to the city' is understood here as including the right to access the core resources of the city, to be represented as part of the collective identity of the city, to participate in decision-making regarding policies and design, and the right to the preservation of collective ownership and use of the urban commons and services (Antoniadis & Apostol, 2014).

economic exploitation. Therefore, it is imperative to ensure that considerations are made for how smart technologies are to be deployed in African cities in regard to the needs of cultures and communities within them (Huysman & Volker, 2005). This challenge is not unique to Africa but resonates across the Global South, where similar dynamics of technological imposition and cultural mismatch can be observed (Lin et al., 2015). Addressing these concerns is particularly important for the field of informatics, which by and large tends to under-report on non-western perspectives (Horelli & Sadoway, 2014; Masiero, 2023).

Premised on the notion that the implementation of smart technologies in African cities is an eventuality, a primary research question arises: *How can CI researchers employ participatory methods to better understand the preferences of citizens in African cities for the inclusion of smart technologies in their urban environments?* In response to this guiding area of enquiry, and framed within the disciplinary context of design research, this article, following a CI model, explores how researchers could methodologically engage with residents of an urban neighbourhood to understand better their perceptions of how smart technologies may be positively incorporated into their shared public and parochial places. This exploration is methodologically orientated by cycles of rigour, relevance and reflection that inquire into the role that generative techniques and experiential futures literacies can play in a design research method aiming to highlight everyday activities and experiences of urban residents, the knowledge of which contributes to enabling a socially sustainable transformation of the urban environment (Baibarac, 2014). The outcome of this inquiry is a novel co-design research method referred to as the participatory futures method (PFM).

Initially, the article outlines the theoretical background of the research, highlighting key concepts from participatory design, placemaking, and experiential futures. Thereafter, the study's methodology is outlined, followed by truncated design ethnography that first, introduces the suburb of Westbury, Johannesburg, where the relevance phases of the PFM were applied in a series of co-design workshops, and then proceeds with a reflective description of the conceptual design and application of the PFM. The paper concludes with a discussion of the broader implications and limitations of the PFM within the field of CI, with a particular emphasis placed on the alignment of the method with Gurstein's factors for community 'smartness'.

Theoretical Background

Since its emergence in Scandinavian trade unions in the late 1970s, participatory design (PD) has become a highly influential approach to technology design across multiple fields including Design (for example, Steen, 2011; Sanders & Stappers, 2016), Anthropology (for example, Gatt & Ingold, 2013), Human-centred Informatics (for example, Wright & McCarthy, 2010) and Community Informatics (for example, Botero & Saad-Sulonen, 2008; Stokes et al., 2014). Typically, *Scandinavian* PD involves design researchers collaborating with a community to resolve problems that affect the community. The community identifies the problem and works with the design researchers towards a solution (Steen, 2011). In comparison, *co-design*, while inheriting much of the collaborative traits of Scandinavian PD, involves design researchers initiating and collaborating with participants to generate a final, more widely applicable solution (Steen, 2011). In normative design, participatory approaches involve participants sharing in decision-making

through various stages of the design process with the aim of reconciling a user community's needs with products or services. However, when applied in 'vulnerable' communities such as indigenous or resource-scarce groups, participatory methods are often theoretically informed by a range of critical positions. These include vulnerability to ontological and environmental disruptions brought about by unconsidered implementations of technology (Willis, 2006; Fry, 2019) and 'developmental' notions of progress (Escobar, 2018), inherent power imbalances in social hierarchies between individual participants and between participants and researchers, as well as cultural and language barriers (Hirom et al., 2017).

While notions of participation are central in this study, it is important to note two aspects. First, the novel PFM is orientated towards primary design research and, as such, is concerned with generating knowledge for a broader disciplinary application and rather than targeting the development of specific products or solutions. Second, the primary focus of this article is the design of the PFM. In this sense, while the applied PFM aims to enact a considered and meaningful participatory engagement with a selected community, the community members' participation in the PFM design is limited. However, the value of the PFM design is reliant on its participatory qualities in application.

The specific knowledge area that the PFM is designed to elicit through its participatory agenda relates to a neighbourhood community's past and current experiences of their shared physical and digital environments and their ideal future SCT-mediated expectations for these environments. To this end, the design of the PFM is informed by concepts originating in placemaking, experiential futures and generative research.

Placemaking builds on earlier theorists (Alexander C.,1977, 1979; Gehl, 1987) who approached urban design from the perspective of how the built environment supports human activity, as well as contemporary concepts of the architectural program (Shephard, 2011) that conceptualises place as an emergent, environmentally situated quality of human activity.[2] A central concept of placemaking is that over time, places and their embodied entities are generated into being around human activities (McCullough, 2005). This notion of activity as the primary unit of design for urban contexts and placemaking generally aligns with other community-centred approaches to SC in CI (Baibarac, 2014; Balassiano & Seeger, 2014).

Futures Studies (Futures) is traditionally regarded as a scientific study of probable, possible and desirable future developments. Futures recognises three foundational principles. First, it recognises that the 'future' does not essentially exist (Dunagan et al., 2019). Second, while the future has the potential to be radically different from current expectations, our ability to conceptualise the future can only be constructed from an understanding of the past and present (Dunagan et al., 2019). Lastly, any conceptualisation of the future must be plural, as there are endless potential ways that it can unfold (Candy & Kornet, 2019). As Inayatullah (2008, p. 6) suggests, "alternative futures thinking" implies that, while a particular future cannot always be predicted with any accuracy, "by focusing on a range of alternatives, we can better prepare for uncertainty". In this manner, thinking about the future can help develop the capacity to create a future we desire rather than the one we expect or feel we cannot avoid. Within the broad field,

[2] A strategic method which associates the functional requirements of space with the activities and behaviours that they are envisioned to support.

experiential futures (XF) utilise the creation of design-driven articulations (or design fictions) that, unlike traditional Futures outputs, typically expressed as written scenarios or schematics, to make futures visible, tangible, interactive and otherwise explorable (Candy & Kornet, 2019). Through its material qualities, XF responds to the abstract nature inherent in traditional Futures work by exploiting the continuum of human experience that is "life as it is apprehended, felt, embedded and embodied" (Candy & Dunagan, 2017, p. 137). In summary, in XF design, researchers create speculative design fictions that depict a potential future, prompting participants to reflect on and engage with these scenarios.

Generative tools, a participatory design research method, encourages the creation of design artefacts by participants that reflect their sense of a situation (Visser et al., 2011). The value of utilising generative tools is that experiences often determined by latent needs or tacit knowledge can be difficult to directly express verbally and, consequently, hard to obtain from conventional research techniques (Sanders & Stappers, 2016). Compared to XF, in generative tools, design artefacts, typically accompanied by oral explanations of the 'design', are created by participants to reflect their experience of a situation.

As will be expanded upon in the remainder of this article, in the PFM, the broad considerations and critical perspectives of participation and placemaking inform a mode of enquiry into participants' sense of and hope for their neighbourhood places. From a methods perspective, the creative activities of XF and generative techniques are synthesised to focus on and elicit participants' perceptions of their past, current, and future neighbourhoods.

Methodological Approach

In response to its explorative research agenda, the study applies and adapts Baskerville and Myers's (2015) Design Ethnography (DE) method. This method advocates for an interventionist and engaged approach, actively participating with people in the field to study the processes and contexts of design. In this case, the particular design context was the generation of the PFM. DE was selected as it accounts for a 'first-order' practice in which ethnographic informed methods guide design activities over 'action' cycles and a 'second-order' reflective narrative that describes and critically reflects on design as a practice-orientated knowledge tradition. As described in Figure 1, the steps of DE were organised into four phases in the study.

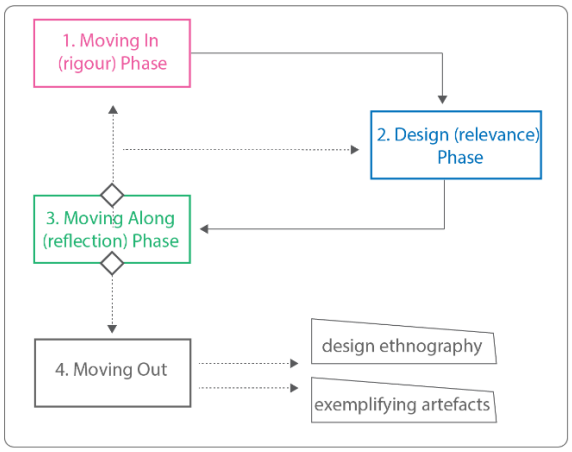


Figure 1: Overview of the application of Design Ethnography.

Phase 1, *Moving In*, focused on the conceptual 'rigour' of the PFM's design and how its various techniques could be applied in a 'real-world' context. The conceptual design and workshop instantiation was informed by related work in urban design, XF and participatory design. In Phase 2, the *Design* phase, the experimental PFM was applied in a series of co-design workshops held in the inner-city suburb of Westbury, Johannesburg, to test its 'relevance'. In the third, *Moving Along,* phase, the practical application of the conceptual design was reflectively evaluated in terms of the participant's understanding and ability to perform its requirements and the quality of data produced during the workshop activities with respect to the methods past, present, and futures-orientated placemaking agenda. While the second requirement was subordinate to the first in terms of the design of the method, it still needed to reflect a level of effectiveness on par with professional design research practice.

The first three phases were repeated over four workshops, each involving six community participants. The participants' ages ranged from 18- 72 and included self-identifying male (70%) and female (30%) participants. Roughly 50% of participants were not formally employed. All participants were sourced by the management of a local youth centre where the workshops were also run. Each workshop took 5-hours and were facilitated by the first author.

Once the procedural activities of the PFM operated as required, and the data was regarded as sufficient to represent the richness of the community's preferences, the project proceeded to the Moving Out phase that involved the data analysis and, after that, the data synthesis.

Two key outcomes of this phase are the design ethnography narrative account and exemplifying artefacts. The design ethnography of this study, presented in the following section of this article, primarily reflects my experience of the PFM design process.[3] While, at times, the voice of participants is incorporated into our reflections, the intent then is to substantiate a shared experience of the workshops or illustrate the character of produced data. This study does not aim to present an ethnography on the holistic spatial experience of the Westbury community,

[3] The use of a singular plural refers to the first author, who undertook the field work.

but only that the PFM has the potential to contribute rich, meaningful insights into such experiences.

As noted above, the study (the Westbury project) involved four workshops, each involving the first three DE phases described in Figure 1. To provide a more digestible narrative in the design ethnography, the experiences of all workshops are converged in the Moving In and Design phase discussions and organised with respect to the three 'techniques' of PFM. Thereafter, a summative Moving Out phase is described.

Lastly, as this work involved human subjects, it was vetted by the University of Pretoria, FEBI Ethics committee, and subject to the South African Personal Information Act. Accordingly, all participants were informed of their rights to withdraw, the right to anonymity, and the scope and reason for data collection.

Co-projecting smart neighbourhood places in Westbury

The Westbury urban context

Westbury is an urban neighbourhood of predominantly Afrikaans speaking, Coloured residents.[4] Westbury was created as a segregated township in the early 1960s during the height of Apartheid. This involved the relocation of the Coloured residents from other suburbs to Westbury and the expulsion of Black African and Indian descent minorities to other areas. Up until the first democratic elections in 1994, much of the resistance to the Apartheid state in Westbury was channelled through the community's dissatisfaction with their spatial environment (Halim, 2018), which bordered on near-slum conditions. Present-day Westbury contains small freestanding houses, densely populated flats in poor condition, multiple parks, sports fields, a library, a large community hall and a youth recreational centre. Public spaces are characterised by urban degradation and uncollected rubbish. Several problematic social factors characterise Westbury. Foremost is its long history of criminal and gang-related activities (Klug, 2016), many of which are organised around control of the drug trade. Furthermore, Westbury, like many communities in South Africa, is also affected by high unemployment, particularly among its youth, poverty in many families, and a strong distrust of government initiatives (Klug, 2016). Contradictorily, Westbury is also home to over 60 places of worship. It has multiple community-run NGOs and upliftment projects, close-knit, hardworking families, and a reasonably well-educated population with its residents well-known for their humour and creativity.

From a personal perspective, I am familiar with the Westbury community as, for most of my life I lived in close proximity to the suburb and as an academic at a nearby university, I have worked with the community on numerous student-orientated participatory design projects. (Halim, 2018). This familiarity with the community in terms of prior experience and shared languages was an asset during the study particularly in regard to interpreting the data.

[4] In South Africa, 'Coloured' refers to a distinct racial group with a mixed-race heritage, shared language, and cultural traditions.

The Participatory Futures Method

The PFM utilises ethnographic practices to contribute knowledge towards design practice in a manner consistent with Baskerville and Myers's (2015) notion of ethnography for design.[5] However, the PFM informed by discursive design (Dunne & Raby, 2013; Tharp & Tharp, 2018), design anthropology (Anastassakis & Szaniecki, 2016) and particularly XF (Dunagan et al., 2019), (Candy & Kornet, 2019) emphasises the role of design making and materiality as unique sites for generating rich and insightful knowledge. From a procedural perspective, PFM aligns closely with the method of generative tools; however, it differs from existing practices in that it integrates a longer-term futures approach informed by XF methods to disrupt participants' expectations of how the future will turn out.[6] From a theoretical perspective, Inayatullah's (2008) notion of futures as inherently connected to the present and past guides the construction of the method.

Consequently, each of the three PFM techniques focuses on one of these different time frames.

Technique 1: Inquiry into the Past

Moving In phase

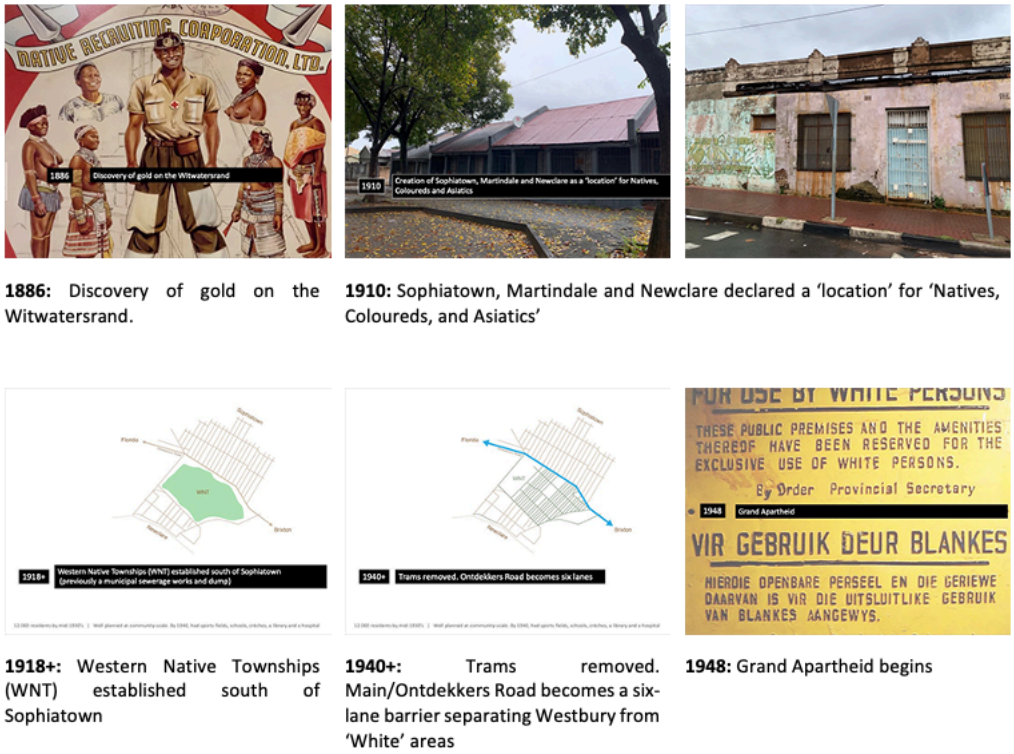
Technique 1 is primarily designed to introduce the participants to the research themes and activities. For the researcher, the value of this phase lies in gaining familiarisation with the community through literature sources and from the participants' responses to what has been written about their community.

Design phase

In the Westbury project, Technique 1 took the form of a digital timeline presentation comprising annotated images and an oral explanation (see Figure 2). Key historical activities of the timeline were also presented on a large-scale print, which participants could edit and add content to.

[5] Typical approaches include methods such as interviews, observations, and product user testing.

[6] XF was selected over discursive design practices as it provides a set of rigorous approaches to futures literacies.



1886: Discovery of gold on the Witwatersrand.

1910: Sophiatown, Martindale and Newclare declared a 'location' for 'Natives, Coloureds, and Asiatics'

1918+: Western Native Townships (WNT) established south of Sophiatown

1940+: Trams removed. Main/Ontdekkers Road becomes a six-lane barrier separating Westbury from 'White' areas

1948: Grand Apartheid begins

Figure 2: A selection of 6/24 slides from the Westbury timeline.

Technique 2: Inquiry into the Present

Moving In phase

For Technique 2, emphasis was placed on applying generative tools to elicit participants' everyday experiences of their current neighbourhood. The purpose of the activity was threefold. First, it sensitised participants to their urban and digital environments and made them comfortable with the creative activities and talking about their work. Second, the knowledge concerns of the activity related to eliciting a deeper understanding of participants' everyday experiences of their physical and digital environments. Third, as the primary focus of the PFM is futures orientated, an exploration of present-day experiences was an essential element for juxtaposing how potential future experiences could differ (Kilbourn, 2013).

Design phase

For the Westbury project, the generative activity was designed as a collaging task, as described in Fig. 4. The process of making the collages and then verbally reflecting on their designs allowed the participants to articulate very natural and unguarded accounts of their everyday experiences in their neighbourhood. The narratives also allowed other group members to add layers of detail, suggest alternative understandings, and collectively confirm views.

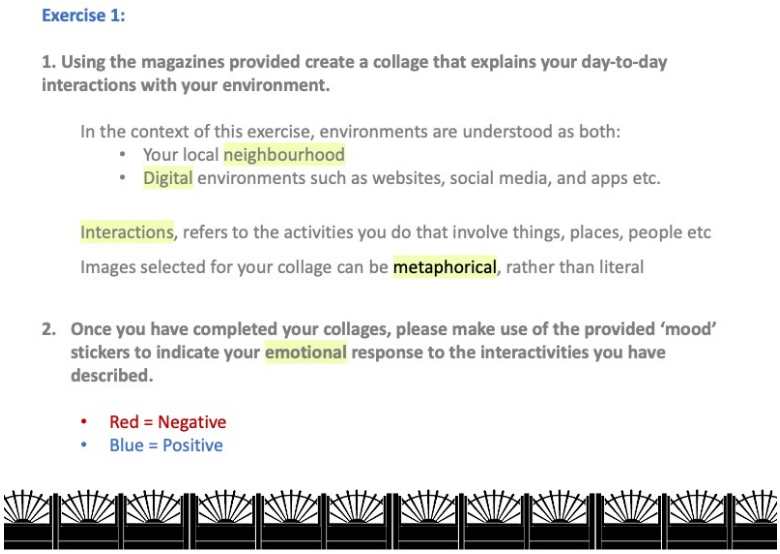


Figure 3: Technique 2's instruction for the collage.

Figure 4: Three examples of collages created during Technique 2.

Technique 3: Mapping the Future

Moving In phase

While the timeline and collage activities are foremost sensitising activities, Technique 3, as the primary activity of the PFM, is concerned with inquiry into the participants' preferred futures. At the level of overview, Technique 3 involved participants using art materials, tools, and techniques to imagine, model, and articulate activities within a prescribed context of a future neighbourhood place.

To ensure the relevance and veracity of the futures setting, the *experiential futures ladder* (EFL) (Candy & Dunagan, 2017) approach to scenario development was implemented, specifically

as it both guides scenario development and employs design fictions to elicit visions of the future. Consequently, this section explains the initial design of the PFM in terms of the four phases of the EFL.

1. *The Setting*

Moving In phase

The Setting defines the scope of an inquiry into futures and typically takes the form of a generic image of the future. The Setting for Technique 3 is the participating community's neighbourhood in a future setting. The distance in time between the present and the future setting is an important consideration. The projected context should be set far enough away from the present to break with the community's normative expectations for their near future but not too far into the future as to break entirely with plausibility.

Design Phase

In the applied example, *New Westbury 2072*, 'Westbury' refers to the existing suburb employing a connection to the present, while 'New' implies a transformation of some type has occurred. '2072' indicates a fifty-year projection.

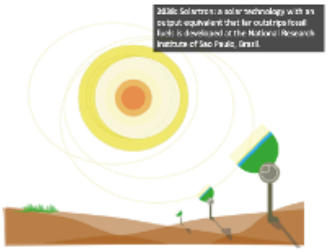
2. The Scenario

Moving In phase

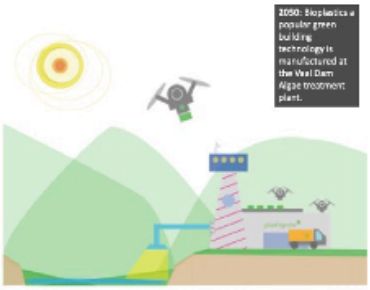
In the EFL method, the scenario is the particular story about the future of the Setting, highlighting specific "narrative proposition and sequence of events" (Candy & Dunagan, 2017, p. 148).

Design Phase

The Westbury Scenario continues the timeline motif used in Technique 1 to imply a direct continuum with the suburb's history. In Fig. 6, aspects of the visual scenario for the New Westbury 2072 project are displayed.



2038: Solartron: a solar technology with an output equivalent that far outstrips fossil fuels is developed at the National Research Institute of Sao Paulo, Brazil.



2050: Bioplastics, a popular green building technology, is manufactured at the Vaal Dam Algae treatment plant.

2056: 30 000 homes manufactured in New Meadowlands in 12 months using Bioplastics. Homes are 'printed' using the latest industrial 3D Tech. House roofing is infused with Solartron energy meshes making New Meadowlands the first carbon zero suburb in South Africa.

Figure 5: Three slides from the New Westbury 2072 Scenario. The full version is in the Appendix, Table 1.

From a narrative perspective, the following concepts inform the design of the 2022-2056 timeline. First, mass urbanisation and climate stress are the fundamental macro forces impacting this future. However, inferred by the 'emergent' technologies of green printable buildings, highly effective solar power and progressive governance, the scenario suggests these issues are resolvable. Second, the 'logic' as to why Westbury can be redeveloped is suggested through the creation of a national sovereign fund as well as new mining and construction technologies. Third, some elements, such as the 'Alpha-Meta' wars and the tank-like house 3-D printer, are purposely fanciful to reinforce the alternative reality and break any direct continuum with reality. The Scenario's narrative is focused on technological development and political change. It purposefully does not address social impact, as the intention is for participants to provide this information later in the process.

4. The Situation

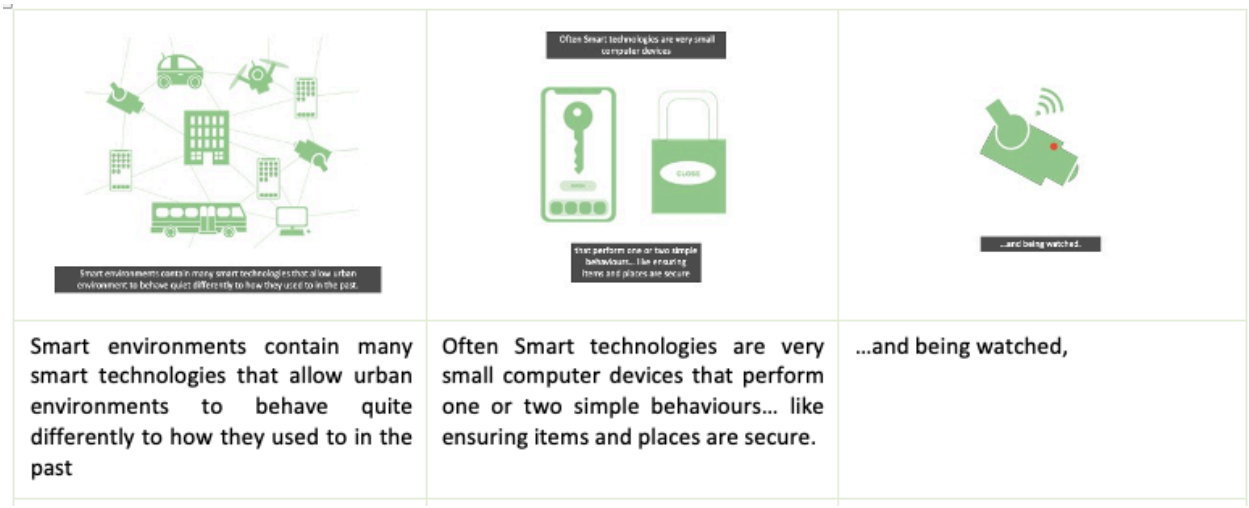
Moving In Phase

The role of the Situation is twofold. First, it suggests the relevancy of smart technologies within the broader world-making of the scenario, and second, it describes the requirements of generative design activity, which the participants practically engage with in the stuff phase.

Design Phase

In terms of the New Westbury 2072 project, the Situation was articulated as an extension of the Scenario narrative describing a city-wide design initiative, 'Okusha Jozi',[7] which involves 'citizen design teams' leveraging emergent technologies in the co-creation of their neighbourhoods. These technologies include the highly speculative building techniques in combination with other plausible smart technologies. In essence, the purpose of the speculative technologies was to remove any barriers to the participant's imaginative 'design thinking' that may result from worrying about how architectural structures would be built. This allowed the Okusha Jozi Situation to focus on smart urban technologies, the technological focus of the research. The presentation (see Figure 6) and accompanying verbal discussion emphasised the resulting behaviours afforded by these technologies in every day rather than overly technical terms. At this point, a disjuncture occurred in the framing of the Scenario as 50 years in the future and the requirement that speculations concerning the role of smart technology be more plausible to be of any relevance. Thus, a tension emerged between breaking the participant's expectations for the near-term future and turning the technological emphasis into pure science fiction. Consequently, our final decision was to go with a 50-year future setting characterised by a 10–15-year technological Setting. In application in the workshops, this dual timeline did not present as conceptually problematic to the participants.

[7] 'Okusha' is the isiZulu word for 'new' while' Jozi' is a popular nickname for Johannesburg.



Smart environments contain many smart technologies that allow urban environments to behave quite differently to how they used to in the past	Often Smart technologies are very small computer devices that perform one or two simple behaviours... like ensuring items and places are secure.	...and being watched,

Figure 6: Three example slides of the Situation. The full version is in the Appendix, Table 2.

The second aspect of the Situation was the design brief that outlined the fictional role of the participants (as citizen-designers in 2062) responding to the Okusha Jozi initiative in the context of the design of New Westbury (Figure 7).

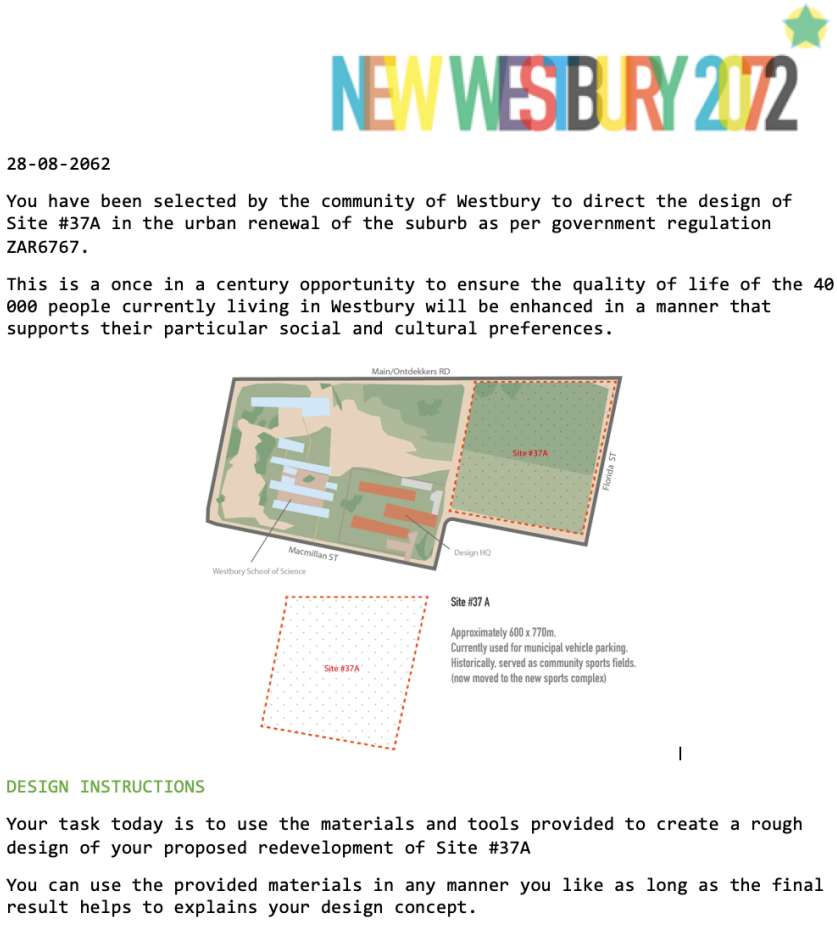


Figure 7: Design instructions for the fictional project.

5. The Stuff

Moving In Phase

In the Stuff phase, in response to the design task of the Situation, participants created and explained design fictions suggestive of their preferences for their neighbourhood futures.

Design Phase

In the workshops, participants worked in their groups and were supplied with art materials and tools. Overall, all groups coped well with the technical aspect of the task and created detailed artefacts (see Figure 8). At the completion of each design, they were asked to provide a narrative account of the purpose of the place they had designed, highlighting aspects of their models. Overall, groups produced in-depth and detailed explanations of their models, enjoyed the task, and engaged with the design activity within the scenario setting of the brief.

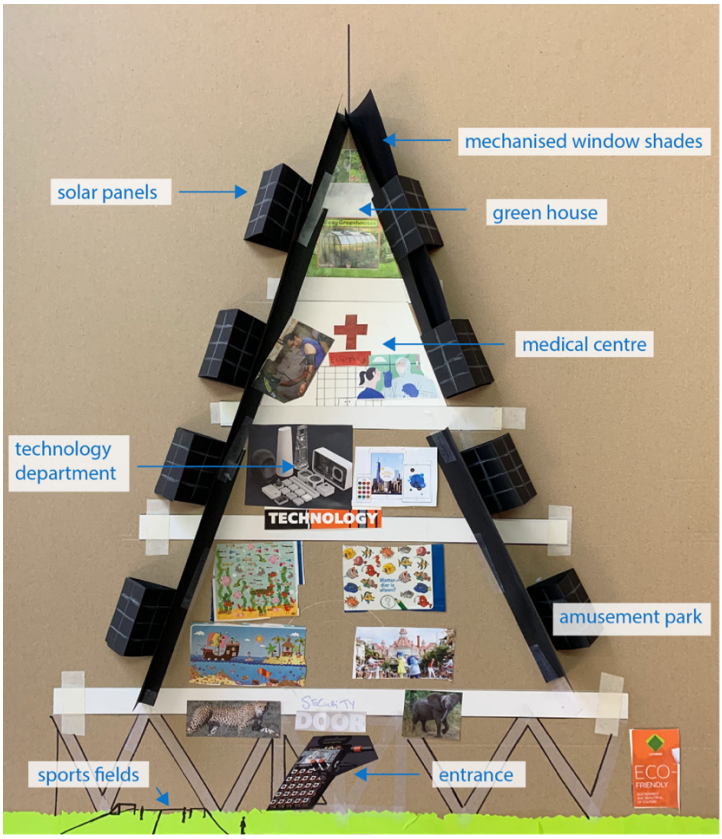


Figure 8: A group's model solution for the New Westbury site.

The oral explanations of the collages and design models were audio recorded, transcribed, and qualitatively analysed, contributing rich 'thick descriptions' of the participants' experiences. The value of the collages and models as standalone sites of analysis was limited outside of the discussion due to their highly interpretive nature. However, they did help to clarify certain aspects of the audio dialogue. The transcriptions collectively contained over 1400 individual lines of participant responses and 480 individual quotes. The data quotes were relatively evenly

distributed in relation to explanations of the 'present' and those of the 'future'. Although each quote from Technique 3 represents a shared understanding of an entire group, the responses of Technique 2 are individual.

Moving Out

As noted earlier, in order to establish the relevance of the PFM, its capacity to generate data capable of informing understanding of a neighbourhood community's perceptions of how smart technologies may be positively incorporated into their shared public and parochial places needs to be demonstrated. Consequently, this Moving Out section describes our approach to analysing and synthesising the data into a series of design insights. It is important to note that our approach to analysis is not fundamental to the PFM. Other approaches to analysis may work equally well. Instead, our approach serves to exemplify an approach and, more importantly, demonstrate the capacity of PFM to produce good quality data and capable of contributing insights relevant to a CI consideration of SCs.

Conceptualising the data

In order to reflect the notion of place as an emergent, environmentally situated quality of human activity, we utilised an activity-centred, deductive conceptualisation of the data for the analysis.

As depicted in Figure 9, coding was first designated in terms of Technique 2, which accounted for the Present, and Technique 3, which accounted for the community's future aspirations. Thereafter, both the Present and Future were sub-coded into seven categories informed by Leontiev's formative framing of activity (Kaptelinin & Nardi, 2012) with additional concepts relating to community aspirations influenced by Hassenzahl's Three-level Hierarchy of Needs (2010), as well as Engeström's (1987) consideration of activity as embedded in social practices. Following Benyon (2014), the data was understood as indicative of a rich, highly complex socio-technical activity system. While Technique 1 did not provide any data to the coding process, knowledge generated in the secondary research and group conversations pertaining to the technique provided a sensitisation to the community's broader historical, cultural and socioeconomic, which assisted in the interpretation of the data.

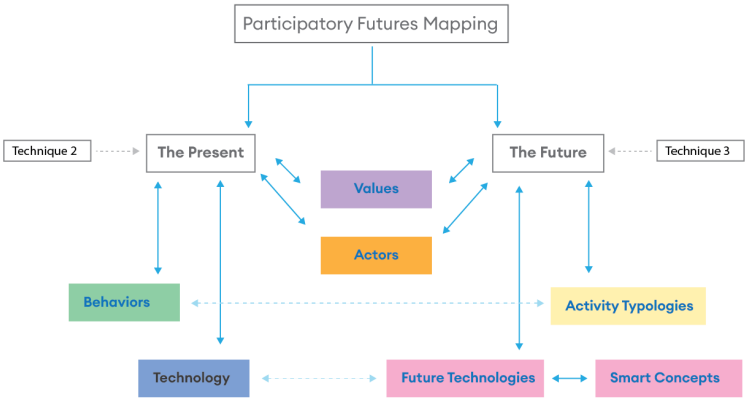


Figure 9. Model of the PFM coding structure.

Analyses of the data

Using qualitative coding software, data fragments were first allocated to the primary seven categories and then inductively re-coded into smaller sub-categories.

The resulting seven categories with subcategories are as follows.

Actors

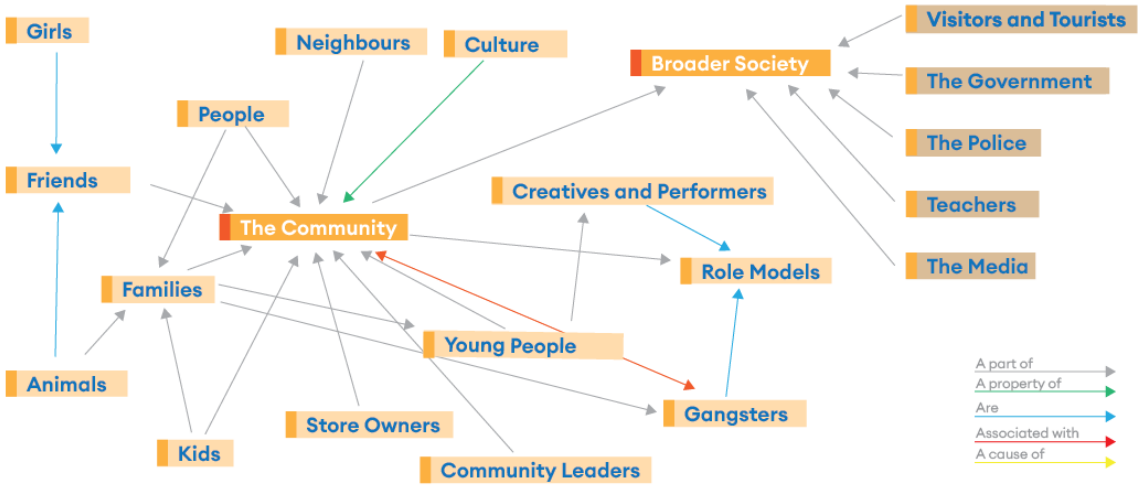


Figure 10: Data schema displaying secondary categories of the various 'Actors' in the community. Table 3 in the Appendix shows an example of this categorisation process. Related to the Actors category

The central social organisational structure of Westbury is a sense of community.

> **A sense of community… that I think needs to be kept, because as much as we as Westbury got all that problems and negatives, there is still a sense of community…To know your neighbours look out for you, you look out for your neighbours. You are there for each other. (Pieter Jordaan)***

As depicted in Figure 10, all subsequent actors are considered 'insiders' or 'outsiders' to the community. The notion of community is firmly equated with Coloured identity. The family plays a vital role within community structures, with many extended family members living together or nearby. Cooking and eating often play a vital role in family bonding. However, there is a degree of intergenerational conflict, particularly between the youth and older generations. Elderly residents tend to mistrust young people, highlighting delinquent behaviour and romanticising the past, while the youth resent being told how to live their lives. The role of the gangster in the community is prominent and complex. Many participants are directly related to a gang member or have been in gangs themselves. While condemning gangsterism, they tend to be conflicted in terms of their affiliations with gangsters. However, overwhelmingly, the participants were very positive about their community and the abilities of members of their community.

* All participant names are pseudonyms.

> **Now, but when you look at Westbury, you get to meet the people. When you go outside, you see the students, everybody you meet and interact with. There's a lot, a lot of richness in these people. You get to meet so much beautiful souls. There may be some broken, but some are beautiful. (Leroy Suiwer)**

Many participants felt they were often portrayed in negative stereotypes (as Coloureds; as residents of Westbury) by the mainstream media and subsequently by broader society.

The Past and The Present: Values

In terms of Values, four dominant themes emerged.

Relatedness-Belonging overwhelmingly describes the strong social connections of participants to their neighbourhood community. Place for the participants is not so much the community's experience of their spatial context but rather how the community is experienced spatially. This notion is captured in the following:

> **I like the energy for me there is always people walking up and down. The street is never empty. I like that vibe. You know, there's always people talking to each other or there's always people talking (Deon Steyn).**

Pleasure-Stimulation refers to two primary factors. First, it recognises participants' enjoyment of their own community's culture. Second, it describes an inherent need for beauty to alleviate the reality of a derelict built environment and the mental fatigue of long-term unemployment. For example:

> **…the thing I've seen with certain areas of Westbury, it's like some places are broken down. But people find beauty and you see them like do like [graffiti] pieces on the walls. (Leroy Suiwer).**

Helping-Empowering describes participants' desire for the upliftment of their community across both human and environmental factors and points to the African philosophy of Ubuntu.[8] For example:

> **Because I think like at the end of the day what we want is, if this blows up [is a success], everyone must benefit. Then we do the same thing in another community. (Ashley Roodt).**

Security-Control describes the participants' overwhelming aspiration to live in a safe and secure neighbourhood and not be routinely affected by criminal behaviour, gangsterism, and drug trafficking and abuse. For example:

> **...because of all, of everything that's happening inside, we rather be safe, so we surround ourselves with safety measures (Wouter Oltz).**

[8] Ubuntu is an African value system that presents a worldview characterised by values such as sharing, empathy, caring and communalism (Chmela-Jones, 2015).

The Present: Behaviours

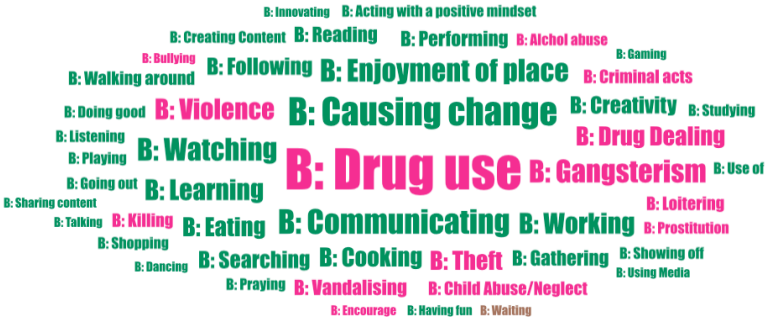


Figure 11: Word clouds indicating primary behaviours in the Westbury neighbourhood.

Behaviours in the neighbourhood space of Westbury were categorised into, first, socially harmful behaviour and, second, mundane positive behaviour. Socially harmful behaviours include drug use, gangsterism, drug dealing, crime, violence, killing, prostitution, and child abuse, amongst others. In turn, mundane community interactions are generally viewed as positive by the participants as they enjoy engaging with each other communally. Creative acts such as performing, street art, dancing, dressing up fashionably, cooking, etc., are highly valued communal interactions.

The Present: Technology

Figures 12 and 13 depict key aspects of the technological landscape of Westbury generated during Technique 2's collage exercise. In terms of the participant's digital contexts, it is evident that they engage with a wide range of technologies every day.

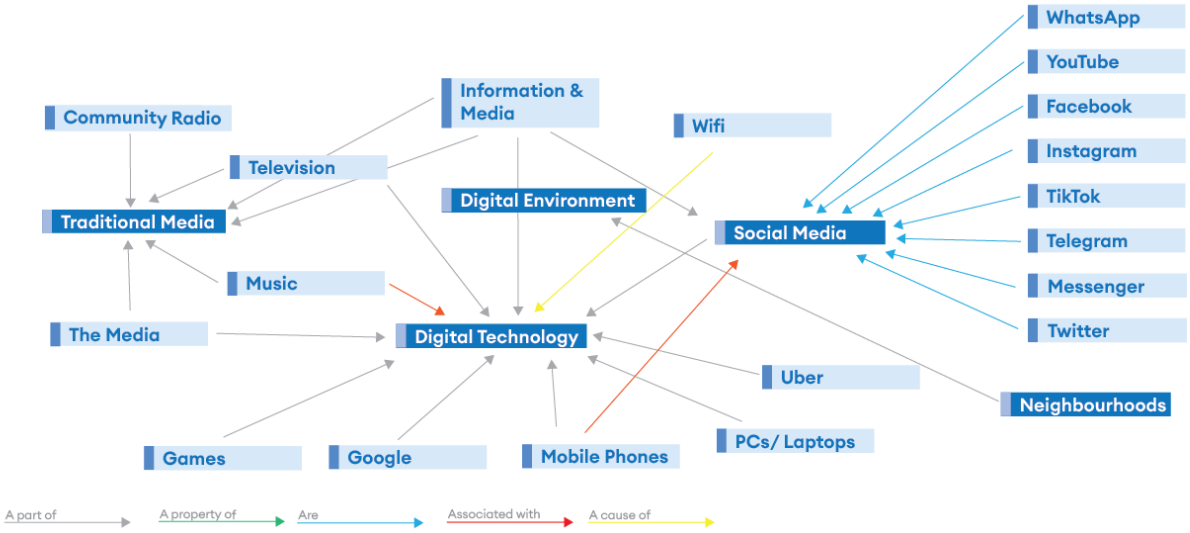


Figure 12: Data schema representing the landscape of physical technology.

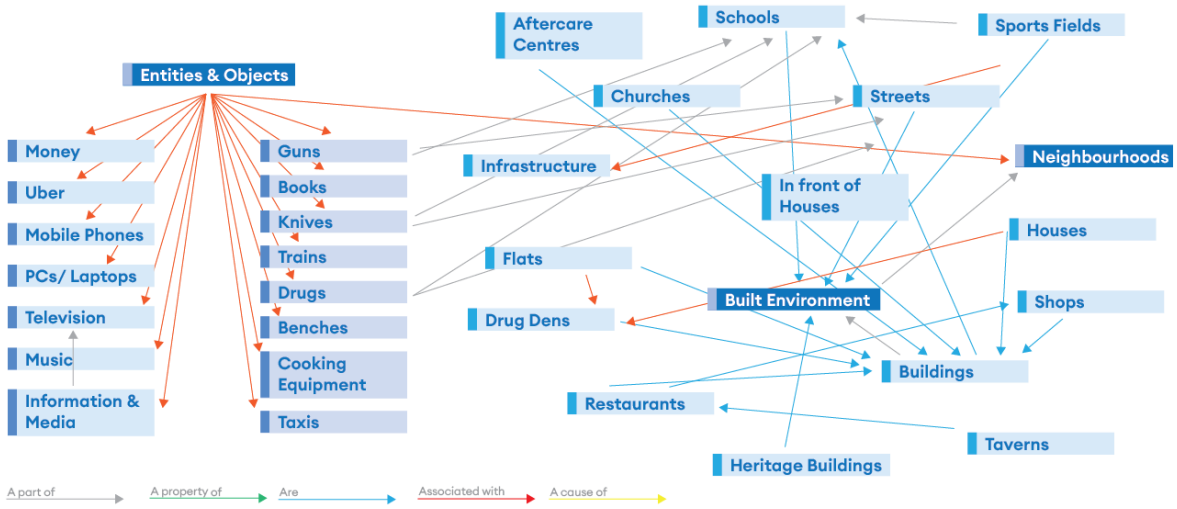


Figure 13: Data schema representing digital technology use.

The technology landscape of contemporary Westbury is paradoxical as many interactions are the type you can associate with many middle-class suburbs in Johannesburg. Residents connect with friends and family in social spaces, meet new people in communal spaces, manage their security communally, go to church, eat out, shop, book Uber taxis for a night out on the town, etc. On the other hand, many of these interactions take place in an intensely stressful environment where, at any time, for example, your child could be caught in the crossfire of rival gangs.

The Future: Activity Typologies

Figure 14: Word cloud indicating key desired Activity Typologies

The Activity Typologies elicited from Technique 3 broadly suggest the types of activities participants would like to see supported in their neighbourhood. The aspirational typologies that stood out for us in our interpretation of the data were a strong preference for creative, cultural and educational spaces, areas to relax and connect with friends and nature, and better retail and public services in closer proximity. Multiple times, participants highlighted their preference for an improved 'village' model over options such as an improved transport grid to connect them to the rest of the city.

The Future: Technological Landscape and Smart Concepts

Figure 15: Word clouds indicating key desired technologies.

Figure 16: Word clouds indicating key anticipated smart technologies.

As suggested in Figures 15-16, the participants' consideration of their Future Technologies yielded several themes. First, there is the integration of digital technology into the urban fabric. These aspects are depicted in terms of smart concepts (pink), enabling technologies, and spaces explicitly connected to blended activities (purple). The remaining technology is typically built infrastructure (blue). During the workshop discussions, it was evident that participants' responses suggested a lay understanding of smart technologies that, while reinforced by the Situation's explanation, suggested prior knowledge. As depicted in Figure 16, design concepts were largely stereotypical explanations of smart technology. However, for us, several interesting insights emerged.

First, the built environment typologies emphasise much of what the participants viewed as currently lacking in their neighbourhood. From a design perspective, these insights were as valuable for identifying community needs, as the suggested use of individual smart technologies. However, as exemplified in the following data snippets, several interesting conceptualisations of how smart technology could be deployed emerged.

Second, the promise of smart surveillance technologies to ensure physical safety in public spaces is highly desirable.

> **You'll have cameras to look at who's coming in, who's coming out**
>
> **There's always a recording of face[s]**
>
> **It detects what weapons you have**

Third, smart technology is associated strongly with sustainable energy, which in turn is designated as a community resource to be shared and help ensure the collective community is more resilient.

> **It's not just the architecture, the building itself is meant to give more energy to the areas, surrounding area**
>
> **A giant solar panel with cells of function. So, because if we have power cuts or power outages in the community, people can get energy**

Fourth, the notion of control and management speaks to better management of public resources and local human control of surveillance, energy, and access.

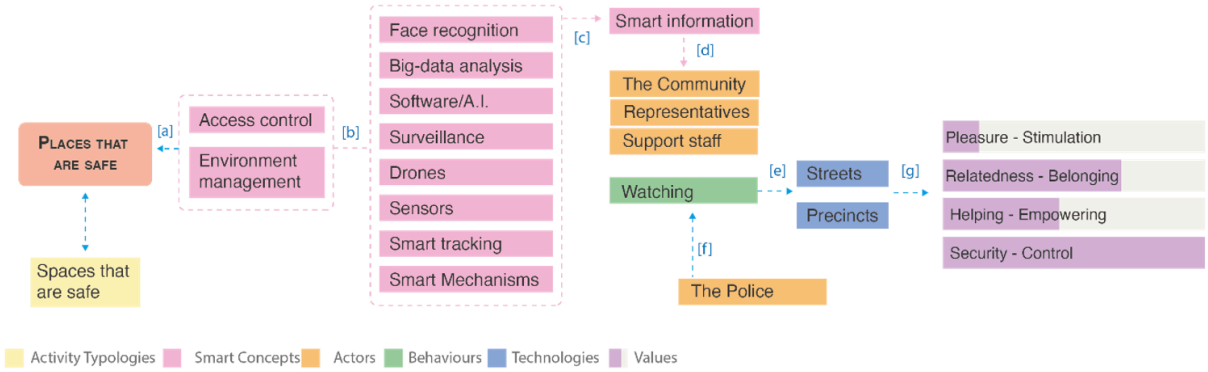
> **Somebody will sit in a small house, or whatever house, with the screens to be able to monitor and make sure that nothing is happening that will impact people's safety.**

Lastly, participants presented a nuanced understanding of smart people and smart capacities. In this manner, they recognised that (a) any upliftment of the spatial environment is conditioned on the upliftment of the community, (b) competencies to engage with an increasingly pervasive technological future are required, and (c) the community contains knowledge that will benefit this future smart society.

> **It is also an environment for generating an income for certain people within the community that have an idea.**
>
> **You can come in, have free wi-fi, connect to the rest of the world, do international courses.**
>
> **A space like the [Youth] Centre but that deals with the new upgraded version of technology. Teaching kids how to work the new world**
>
> **Whatever you want to know these people are equipped with the knowledge that you would want to know about everyone in the community, you can find in the centre**
>
> **It brings hype to the community, so, meaning that people are drawn to the community and when they get there, they get to also learn more about the community, meaning that they are leaving with knowledge.**

The Synthesis Phase

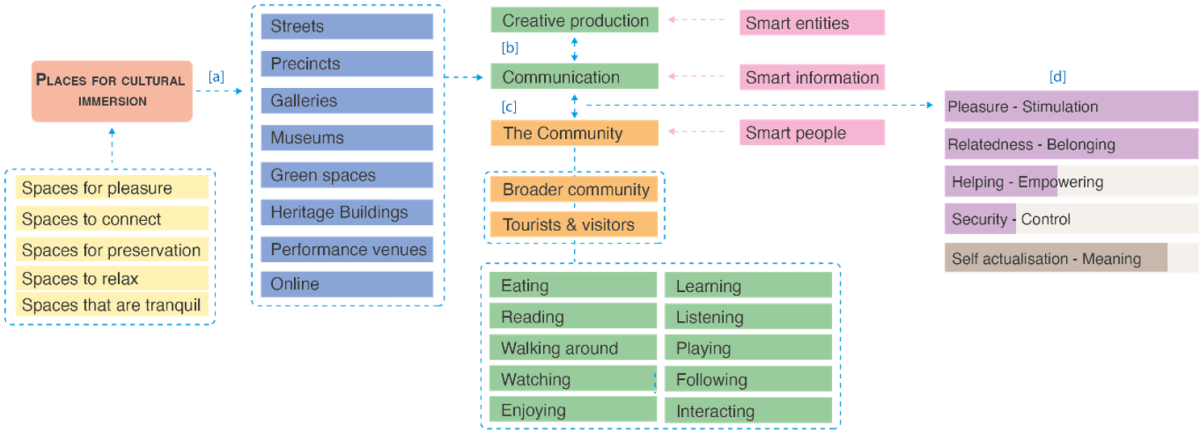
In this phase, data sub-categories from the seven coding categories were used as conceptual 'building blocks' in developing six projective placemaking schemas (PPS) (Figures 17-22). This approach was informed by Alexander et al.'s (1977) design patterns and articulated a projection of how smart technological environments could enable the Westbury community's explicit and latent needs. As such, they represent, as designers, our interpretative insights into the community's aspirations for their future neighbourhood places.



Places that are safe are created through [a] controlling access and environmental management. Towards these outcomes, there are [b] smart surveillance networks, [c] that support community [d] representatives to monitor public neighbourhood spaces such as [e], and if necessary, enact a response [f]. Lessening the violence and crime in the neighbourhood will give the community a sense of control over their urban environment and community [g].

Figure 17: Projective placemaking schema 1: Places that are safe.

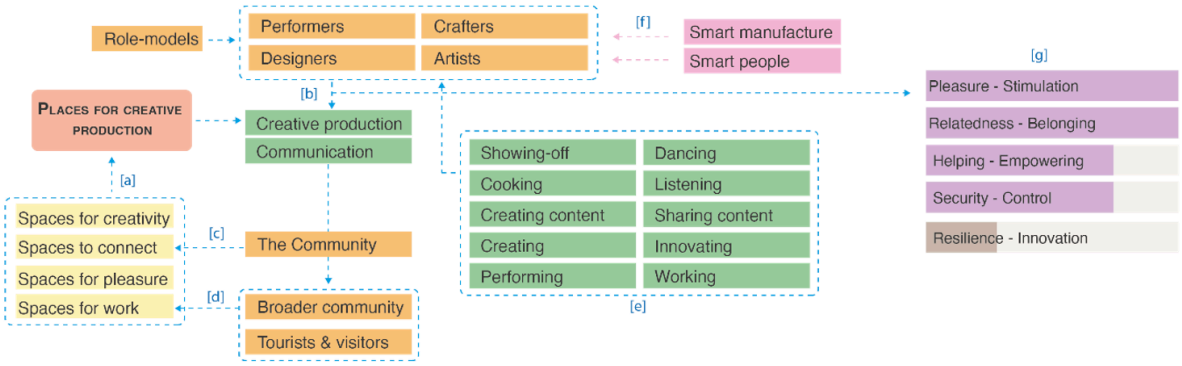
All four groups identified smart technologies as valuable tools for ensuring a secure and safe urban environment. For the Westbury community, the loss of privacy resulting from pervasive smart surveillance was far outweighed by the chance that the current threats of violence, crime and gangsterism could be lessened. In PPS 1 (Figure 17), the potential invasiveness of smart surveillance technologies is lessened by ensuring that the network is located and maintained within community structures. In this service, democratically elected community representatives would manage the technology, ensuring local human oversight. In this manner, autonomous activities within the technological structure would provide information, but the emphasis would be on human decision-making to enact a response. Control and access to data would not extend beyond the community-located monitoring hub and, consequently, not be accessible to external actors.



Places for cultural immersion include typologies such as [a]. Locally generated creative production [b] strengthens the community's shared identity as well as [c] attracting visitors. Cultural immersion allows for [d] a more meaningful, pleasurable, and engaging environment.

Figure 18: Projective placemaking schema 2: Places for cultural immersion.

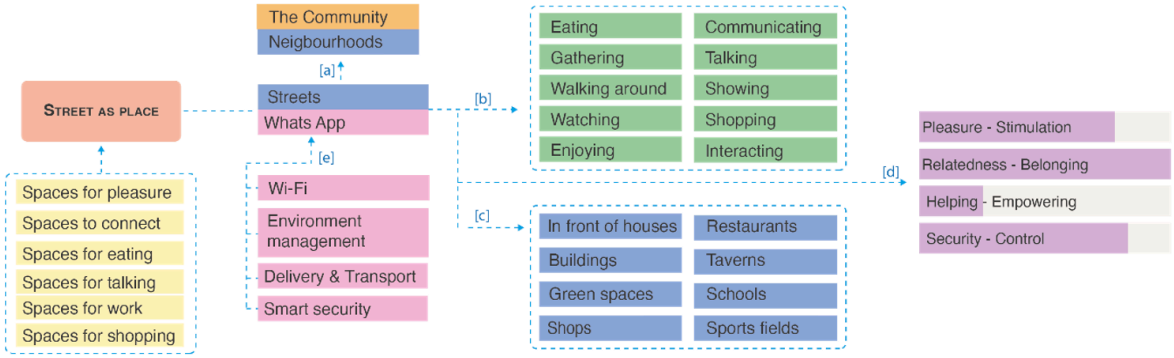
Places for cultural immersion (Figure 18) articulate the desire for the community of Westbury to experience and engage with artistic and creative production in the local environment. Like many others, the community aspires to a more aesthetically pleasing and stimulating environment and recognises that its people have the cultural capacity to create a more pleasing aesthetic environment. Accordingly, aesthetic events, artefacts, and sites produced by community members connect the community internally through the expression of shared cultural experience. The expression of local culture has potential value to broader society, which in turn can lead to employment opportunities and economic upliftment. The opportunities that smart technologies present in this narrative include, for example, augmented informational content ensuring that locals and visitors can have bespoke and meaningful experiences of the cultural landscape of Westbury and rich interactions with physical elements and sites.



Spaces for creativity, work, pleasure, and connection [a] converge in places for creative production. In these places, performers, designers, crafters, and artists [b] produce content that engages both [c] the local community and [d] visitors. Cultural production is enhanced by [f] smart manufacturing abilities that builds resilient and innovative communities [e].

Figure 19: Projective placemaking schema 3: Places for creative production.

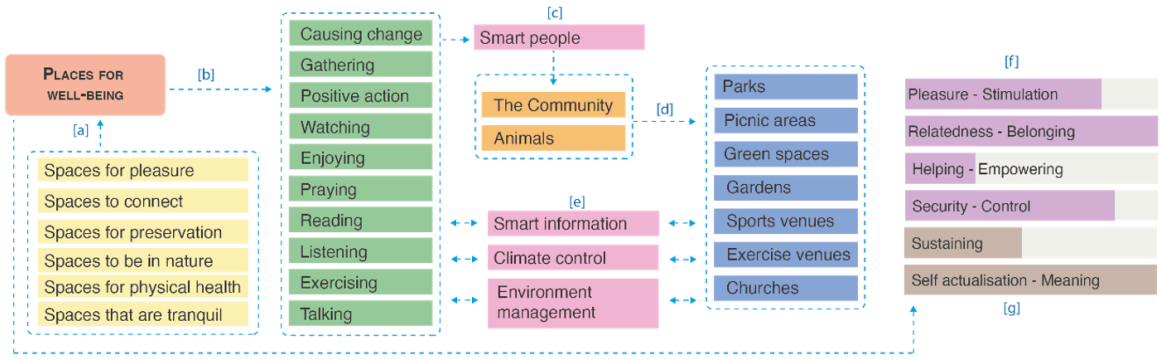
As indicated in Figure 19, the ability of the community to engage with cultural production is important for individual community members as creativity is viewed as an essential mode of generating meaning, self-worth, and income, and generates much pleasure for the maker and the community audience. Creative practitioners often provide viable, alternative role models for the youth compared to gangsters. Lastly, human creativity is recognised as key to building resilient communities in response to the growing threat of technologies associated with the Fourth Industrial Revolution.



Street as space recognises that the [a] primary neighbourhood place is the street, which has both physical and digital layers. Smart technologies [e] provide the opportunity to lessen the threatening aspects while quietly enhancing the positives.

Figure 20: Projective placemaking schema 4: Street as place.

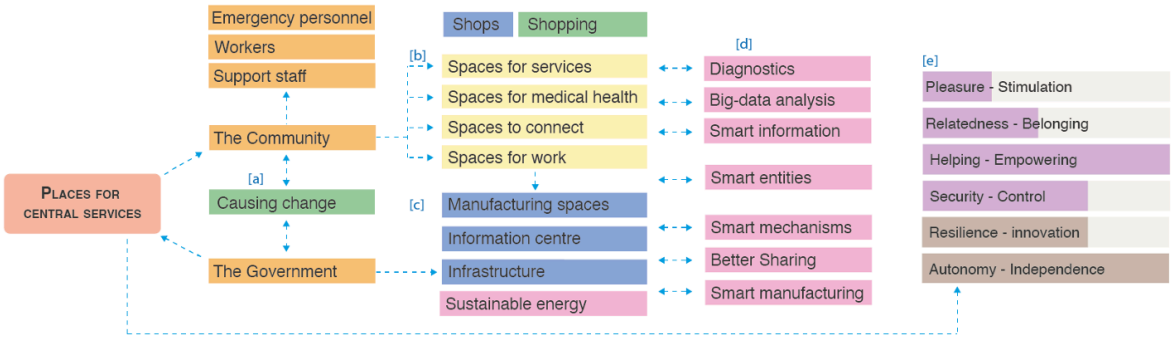
Street as space (Figure 20) recognises that the primary neighbourhood place is the street, which has physical and digital layers. The street in Westbury is a place of community interaction where news, gossip and other social interactions occur. The street is also a recreational site, where the pure enjoyment of walking around and experiencing life intersects with 'being seen' and showing off cars, fashion, and hairstyles. Shopping is also an essential aspect of street life, extending beyond retail to community interactions. Lastly, the street is also an important space for work. While this may include multiple illegal activities, it also includes other more mundane activities such as those of street mechanics and hawkers.



Places for well-being are [a], [d]. In these spaces, individuals seek to connect more meaningfully with their experiences of the world [g], seeking to sustain both mind and body [b], [f]. Places for well-being are supported by ambient smart technologies that ensure a tranquil and well-managed environment [e].

Figure 21: Projective placemaking schema 5: Places for well-being.

Places for well-being (Figure 21) are spaces that emphasise mental and physical health. In terms of physical health, key aspects include sports and exercise facilities. For mental well-being, a focus is placed on tranquil spaces for individual pursuits such as meditation, prayer, and connecting with others through gatherings and conversation. An essential element of places for well-being is a strong need to connect with nature, be that through the enjoyment of green spaces, interacting with or watching animals, or gardening.



Places for central services are partnerships between [a] Government and communities with the aim to deliver smart, accessible, and accountable services. Key aspects of these services are [b] health and [c] energy, which have the potential to be supported by [d] smart diagnostics and energy grids. Collectively, these services would directly improve the quality of life [e].

Figure 22: Projective placemaking schema 6: Places for central services.

Places for central services (Figure 22) express the community's need for public services and infrastructure to be localised to ensure better accessibility and accountability. In terms of accessibility, locally situated health centres and welfare offices are regarded as essential. In this regard, the role of smart technology in diagnostics, procedures, and home delivery was highlighted. There is a clear desire for local control over municipal services such as energy and water supply. The ability of smart infrastructure to run large-scale solar energy resources that powered the neighbourhood was mooted by several groups.

Returning to the community

At the conclusion of the synthesis phase, the final PPS were presented to a focus group of six participants involved in the earlier workshops for evaluation to ensure they reflected the community's needs. Feedback was largely positive, with minor suggestions incorporated into the final versions.

In concluding the ethnography, the last aspect of the study we would like to reflect upon is our perception of the value of participation for members of the Westbury community. First, in terms of the participatory nature of the workshop, participants felt strongly that this type of community involvement was important and absent from previous 'upliftment' projects.

> **This was the first project, where we actually say what we want. We didn't ask for the bridge, we didn't ask for this other [such as] the parks (Mikael Brendt).**

Second, although the activities were described as enjoyable, participants took the exercises (and the research agenda) very seriously.

> **It was challenging because I really had to pull myself towards myself. Like in the exercise, I had to share my story on that board, like I really need to think about what I'm saying because what I'm saying is going to affect the next person if it this goes according to plan. So, my, my actions today can benefit someone tomorrow (Ashley Roodt).**

Lastly, the participants unanimously recognised the value of exploring the interconnectivity of past, present, and future states as important, with some very insightful and nuanced responses, as evident in the example below.

> **I think we need to know where we come from, like really know where you're coming from, in order to where we are going, so we know like what we want to better in our communities, you know what we have had before, and what we haven't had. This is now an opportunity for us to decide and choose what we actually want for our future (Keenan Solomons).**

Discussion and Conclusion

Given the strong likelihood that SCTs will be a pervasive feature of city spaces, it is imperative to understand better how neighbourhood communities perceive their value to ensure these technologies enhance rather than disrupt urban life when implemented. This is particularly important for African communities, many of which have a history of urban dislocation, scarce resources, limited financial means. In response to these concerns, this article describes the conceptual design of the PFM design research method, a subsequent evaluation of the conceptual design of the PFM to establish real-world relevancy in the applied context of a series of co-design workshops involving neighbourhood residents of Westbury, Johannesburg, and the subsequent analysis and synthesis of the data generated in the workshop resulting in six primary placemaking schemas, each representing a scenario suggesting how SC could enhance the neighbourhood's places. Lastly, a short account of the community participants' evaluation of the six placemaking scenarios and the workshop experience was provided.

Work that applies participatory techniques to explore a given community's desires for their emerging techno-urban environments is not new in the CI community. For example, Baibarac's (2014) Urban Spacebook platform, conceived to understand better everyday urban practices in Dublin, Ireland or Renyi et al.'s (2022) use of digital software to aggregate the urban technological needs of a variety of neighbourhoods in neighbouring Germanic countries. However, while these examples utilise ICTs to enable participation, the PFM applies participation to co-anticipate potential benefits of emerging technologies. In this regard, it shares a longer-term strategic focus that aligns with Stokes et al.'s (2014) 'planning and design' agenda. Accordingly, the PFM focuses on how SCTs could support a community's experiential contexts and preferences for their neighbourhoods rather than the details of specific technological implementations. Lastly, while urban design theorists outside of CI have generally recognised the value of utilising speculative approaches to participatory considerations of the city (for example, Fry, 2017), the PFM provides novel concepts to CI design research practice regarding the application of XR literacies in its three techniques, and by doing so ensure increases the methodological rigour involved in the exploration of urban futures. These literacies include the application of design fictions to increase the experiential qualities of future scenarios, as well as the inclusion of the methodological techniques of anchoring future considerations in the past and present (Inayatullah, 2008) and the use of Candy and Dunagan's experiential futures ladder (2017) to structure systemic exploration of futures.

In addition to these methodological aspects, the PFM provides an alternative approach to engaging with neighbourhood residents, arguably improving their participation experiences.

As noted in the *Returning to the Community* section, residents found the workshops engaging, meaningful and enjoyable. They identified the value of the enquiry and felt the experience made a positive contribution overall. Participants reported learning more about their neighbourhood and each other's knowledge and abilities and, by doing so, recognising the agency of their community. One example of the positive impact of the workshops is that one of the participants working at the local youth centre appropriated the third technique of the PFM to get elementary-aged children to think positively about their futures.

While the novelty of the PFM in these regards is evident, an equally important factor is its 'relevancy' in providing insights that align with a CI model of the SC. In terms of quantity, the four workshops generated over 550 distinct data 'quotes' of the quality cited in the participant's response exemplified in the study. These quotes directly informed the six placemaking scenarios listed in Table 2. From a CI perspective, the quality of the insights can be equated with the degree to which they respond to the notion of the 'smart community' that enables and empowers communal quests for well-being (Gurstein, 2014). To this extent, Table 2 suggests how Gurstein's model of 'smartness' (Table 1) relates to the placemaking scenarios generated in the Westbury project's PFM.

Table 1: Summarised representation of Gurstein's model of smartness (2014)

Factors	Relevancy
Smart Community Planning	Support of citizen involvement in the delivery of services
Smart Community Governance	Providing a means for public oversight of municipal spending
Smart Community Health	Decentralised health facilities and support workers
Smart Community Citizenship	Location based digital interaction among citizens regarding issues of local interest with information accessed locally and aggregated to support decision-making related to in municipal planning and design processes
Smart Community Infrastructure	Facilities structured so that citizens can report on issues concerning public infrastructure
Smart Community Resources	administrative decentralization and structured so as to be responsive to local circumstances and requirements
Smart Community Dwellings	Digitally enabling public and municipal land use

Table 2: The individual factors from the model of smartness are aligned with the placemaking scenarios.

PFM placemaking scenarios	Gurstein's factors for smartness
Places that are safe.	Smart Community Planning; Smart Community Health.
Places for cultural immersion	Smart Community Planning.
Places for creative production	Smart Community Planning; Smart Community Health.
Street as place.	Smart Community Dwellings.
Places for well-being.	Smart Community Planning; Smart Community Health.
Places for central services	Smart Community Planning; Smart Community Citizenship; Smart Community Resources.

Consequently, the argument can be made that the PFM provides insightful knowledge of the type relevant to a CI model for SCs.

In summary, the PFM presents a viable method for co-exploring a community's preference for the inclusion of smart urban technologies into their neighbourhood places. While the methods application in the four co-design workshops held in and involving residents from Westbury is limited in terms of providing a holistic account of the community's urban

experiences, which future work could resolve for Westbury and other suburbs in Johannesburg, the PFM does provide a range of concepts and techniques capable of eliciting a quality of understanding that extends beyond technological solutioning to inform considerations of smart community placemaking.

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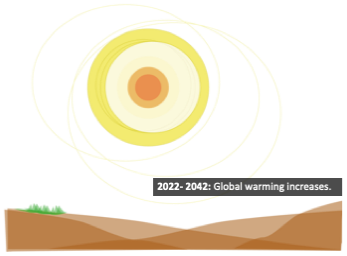
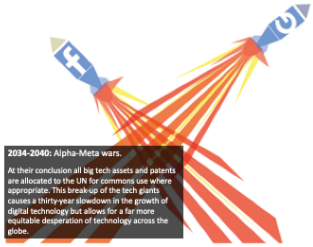
Appendix

Table 1: Images used in the Scenario timeline for Technique 3. Each image was presented as an individual slide.

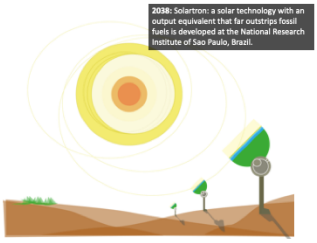


2022- 2042: Global warming increases.

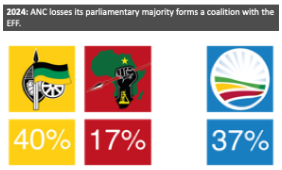
2022- 2042: Urbanisation due to rural food shortages and extreme weather patterns. Life in the city is characterised by overcrowding, poor services, and aging infrastructure.



2034-2040: Alpha-Meta wars. At their conclusion all big tech assets and patents are allocated to the UN for commons use. The break-up of the tech giants causes a thirty-year slowdown in the growth of digital technology but allows for a far more equitable dispersal of technology.

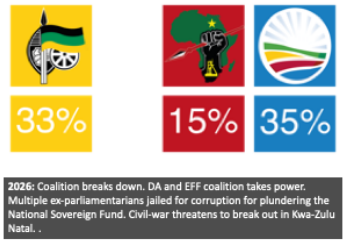


2038: Solartron: a solar technology with an output equivalent that far outstrips fossil fuels is developed at the National Research Institute of Sao Paulo, Brazil.

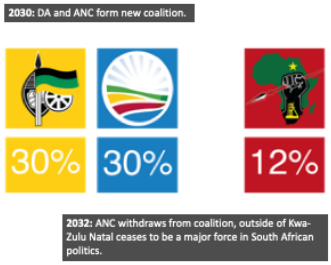


2024: ANC losses its parliamentary majority and forms a coalition with the EFF.

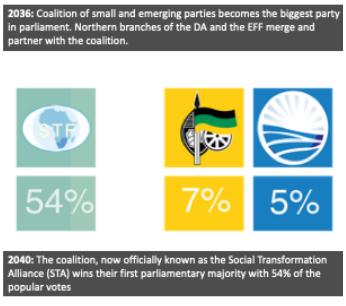
2025: All mines and telecommunication companies are taxed across the board at 40% with profits going into a newly established National Sovereign Fund.



2026: Coalition breaks down. DA and EFF coalition takes power. Multiple ex-parliamentarians jailed for corruption for plundering the National Sovereign Fund. Civil war threatens to break out in Kwa-Zulu Natal.



2030: DA and ANC form new coalition. **2032**: ANC withdraws from coalition, and outside of Kwa-Zulu Natal ceases to be a major force in South African politics.

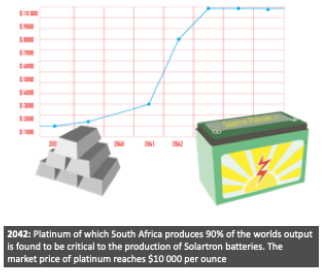


2036: Coalition of small and emerging parties dominates parliament. Northern branches of the DA and the EFF merge and partner with the coalition. **2040:** The coalition, now officially known as the Social Transformation Alliance (STA) wins their first parliamentary majority

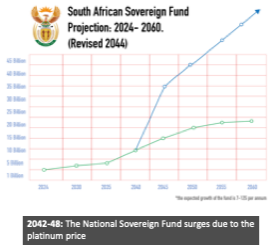
2042: The STA's Okusha Ukusa (New Dawn) strategic plan for development is launched.

This plan emphasises:

- Mega smart cities to cope with densely populated urbanism.
- Agricultural protection zones: to manage food and better protect the natural environment.
- Promotion of digital technologies to make cities more liveable and democratic.
- Design agenda: Creative communities working together can make a difference.



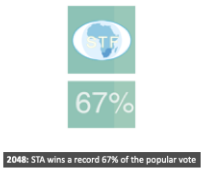
2042: Platinum of which South Africa produces 90% of the world's output is found to be critical to the production of Solartron batteries. The market price of platinum reaches $10 000 per ounce.



2042-48: The National Sovereign Fund surges due to the platinum price.

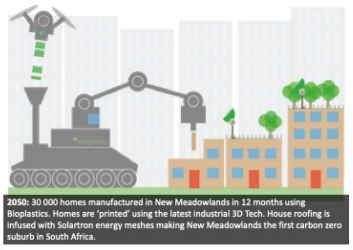
2046-48: All national assets including financial transactions secured through blockchain technology.

2048: South Africa achieves 100% free 9G WI-FI penetration. Employment declines by 25% to 20%.



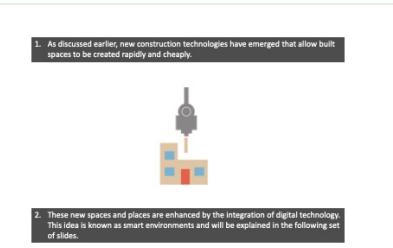
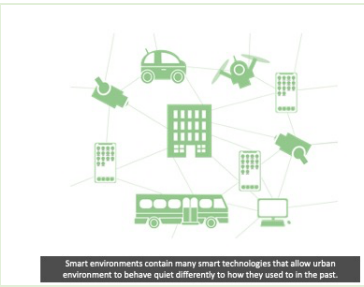
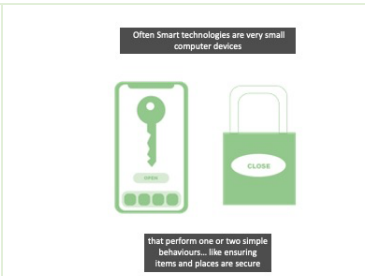
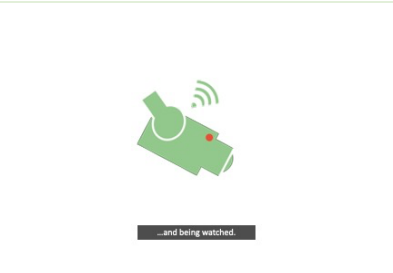
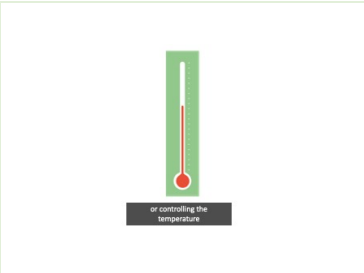
2048: STA wins a record 67% of the popular vote.

2050: Bioplastics, a popular green building technology, is manufactured at the Vaal Dam Algae treatment plant.

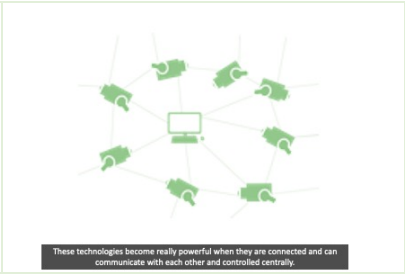


2056: 30 000 homes manufactured in New Meadowlands in 12 months using Bioplastics. Homes are 'printed' using the latest industrial 3D Tech. House roofing is infused with Solartron energy meshes making New Meadowlands the first carbon zero suburb in South Africa.

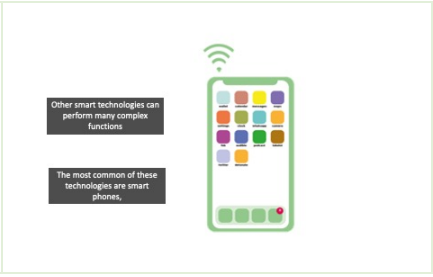
Table 2: The Okusha Jozi 'Situation' for Technique 3. Each image was presented as an individual slide.

		
2060: STA lunches the Okusha Jozi strategic plan for Johannesburg (formerly known as Joburg Mega City), emphasising the renewal of urban communities.	Central to Okusha Jozi is the use of citizen design teams to co-create particular areas of their neighbourhoods, to ensure that redevelopment does not destroy what people like about their suburbs, while removing problematic aspects.	While community design teams are expected to represent community interests, there are a couple of basic technological principles that can aid the team's thinking.
		
1. As discussed earlier, new construction technologies have emerged that allow built spaces to be created rapidly and cheaply. 2. These new spaces and places are enhanced by the integration of digital technology. This idea is known as smart environments and will be explained in the following set of slides.	Smart environments contain many smart technologies that allow urban environments to behave quite differently to how they used to in the past	Often Smart technologies are very small computer devices that perform one or two simple behaviours… like ensuring items and places are secure.
		
…and being watched,	or controlling the temperature	and the surrounding climate,

or the light.

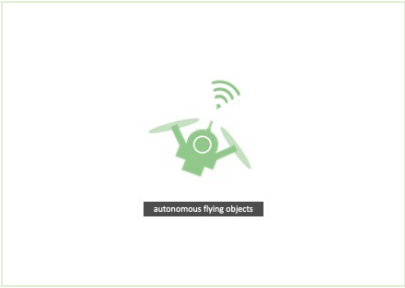


These technologies become really powerful when they are connected. and can communicate with each other and be controlled centrally.



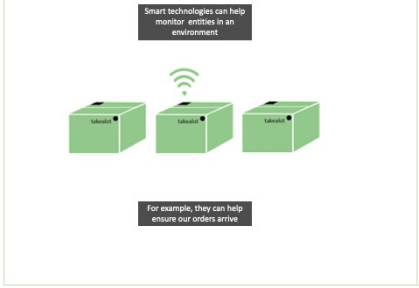
Other smart technologies can perform many complex functions. The most common of these technologies are smart phones,

autonomous vehicles,



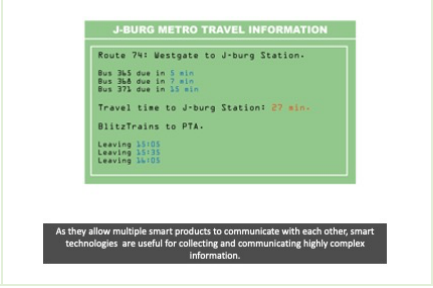
autonomous flying objects,

and homes and buildings.

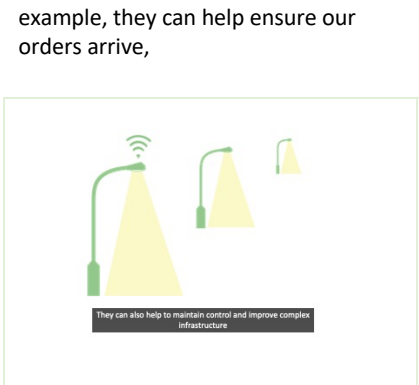


Smart technologies can help monitor entities in an environment. For example, they can help ensure our orders arrive,

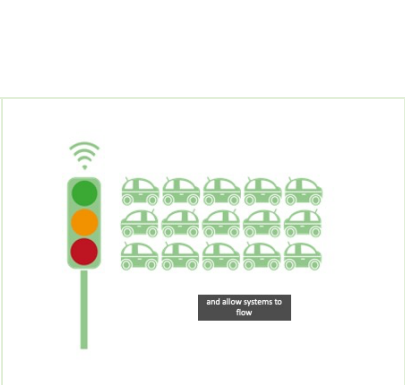
as well as our transport.



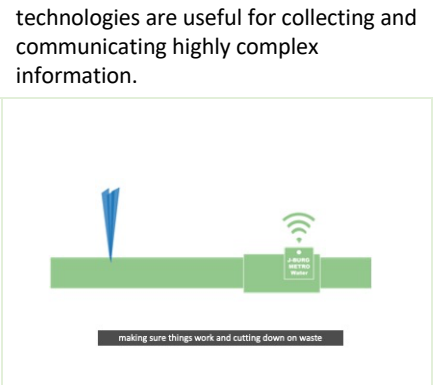
As they allow multiple smart products to communicate with each other, smart technologies are useful for collecting and communicating highly complex information.



They can also help to maintain control and improve complex infrastructure …



…allow systems to flow better



…making sure things work and cutting down on waste.

and generally assisting to make life easier for residents.

(text from final slide)

In summary, from a design perspective, smart environments allow us to control:
The State of Entities:

- Open/Closed
- On/Off
- In Use/Available
- Their position
- Their interaction with other entities
- Their interaction with people

The Character of Environments:

- Hot/Cold
- Light/Dark
- Dry/Wet
- Who has access?
- Available information
- How entities work as a system

Table 3: A short selection of the 'Actors' coding process generated in Atlas.ti software program.

Number	Reference	Actors	Document	Codes
1:25	¶ 119	there are facilitators to assist you	Appendix C1.docx	A: Support Staff, Helping/Empowering, Smart people
1:27	¶ 125	connect with a lot of the community	Appendix C1.docx	A: The Community, Relatedness/Belonging
1:31	¶ 153	drones to deliver the medication to. People that come here like the older people.	Appendix C1.docx	delivery or transportation, Drones, Helping/Empowering
1:35	¶ 186	If you have drones coming to deliver food,	Appendix C1.docx	delivery or transportation, Drones
1:44	¶ 213	and smart cars to take the people home, and for the students who don't know how drive, or for staff	Appendix C1.docx	Cameras, delivery or transportation, Smart Cars
1:49	¶ 240	a place where kids go and do their things,... What most of us like is it could be a safety net where they can grow inside, not being there outside	Appendix C1.docx	A: Kids, Security/Control, Spaces where children are safe
1:50	¶ 252	they can move...they are remote control, smart roof	Appendix C1.docx	Control and Management, Smart mechanisms
2:1	¶ 9	a concept of a community in a building	Appendix C2.docx	A: The Community, Buildings, Relatedness/Belonging, Spaces to connect
2:7	¶ 12	So, this thing (window shade) could move, open up nicely, light could come in for the plants grow.	Appendix C2.docx	Climate control, Smart mechanisms
2:9	¶ 25	the technology department (3rd floor) that's in control, the shutter, the solar systems, and basically the door.	Appendix C2.docx	Access control, Control and Management, Smart mechanisms, Sustainable energy
2:10	¶ 31	cameras monitoring, and the metal detectors, and sensors.	Appendix C2.docx	Cameras, Smart mechanisms, Surveillance
2:26	¶ 115	where shows can take place for kids, you know anything to do with fun activities. Children is welcome, families you can bring your families, and parents, and it has everything to it.	Appendix C2.docx	A: Families, A: Kids, Spaces for pleasure, Spaces where children are safe
2:31	¶ 169	I think it'll be more technology will be more improved by data	Appendix C2.docx	A.I Data analysis, Software/A.I
2:32	¶ 172	I think it will be more sort of self-care	Appendix C2.docx	Diagnosing, Software/A.I
3:2	¶ 9	underground parking, basically, as you come into the entrance your car is being monitored and will be taken underground.	Appendix C3.docx	Control and Management, delivery or transportation, Parking spaces, Smart mechanisms, Spaces for storage
3:20	¶ 15	Here is one space in future, where we can come together, and we can have honest discussion, because right now in our country, presently, the old ones want to solve the young one's problems and the young ones the old problems. And that's how it works, it was so divided, we are still segregated.	Appendix C3.docx	A: The Community, Relatedness/Belonging, Spaces for talking
3:31	¶ 63	place to get away and study, a quiet place	Appendix C3.docx	A: Students, B: Learning, Spaces that are tranquil
3:38	¶ 87	all workers are employed from the community	Appendix C3.docx	A: Maintenance Workers, Relatedness/Belonging