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Value Driven Design for Playful Technology Enhanced Installations in Public Settings

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ABSTRACT

Art and installations in public settings are often created on commission from a municipality or similar public sector. Within the public sector there are many values that the community strives to enhance. Values related to democracy, inclusion, and aesthetics are but a few. When designing for public environments, the design process might be affected by the need to strive for those values in addition to, or even rather than, the more common considerations focused on user experience or commercial aspects.

In this pictorial we present how identified core values influenced a design process aimed at designing innovative IoT-enhanced playground installations in a public setting. Inspired by annotated portfolios, we explicate how these core values influenced the final design.

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Author Keywords

Value driven design; playful technology; playful internet of things; outdoor play; playing out; public settings; public sector; playground design; democracy; inclusion.

CSS Concepts

• Human-centered computing~Human computer interaction (HCI)~Interaction devices • Applied computing~Arts and humanities~Media arts

SOCIETAL VALUES

This pictorial presents design choices for Internet of Things-enhanced playground installations. Design choices were not primarily made for commercial reasons, and the main goal of the project was, even though it developed a real product, not to make that a sellable product. Instead the design aimed to incorporate and investigate certain values. Working towards the public sector, and working in governmentally funded projects and in research projects, this type of value-based design processes, based on societal values, often occurs. To work value based affects the design process, as well as the outcome. In the design process for this project the values were always in focus. They were identified at an early stage, and the design group aligned, as far as practically possible, all choices towards these values.

This pictorial is not intended to be a thorough study on how to identify values, neither is it a complete guide on how to incorporate societal values in a design process. This should rather be read as an inspirational case study,

a design-oriented paper, or maybe even a manifesto, pointing to the importance of considering how societal values can and should be integrated into design choices. It takes its stance in one case, and is a presentation of concrete manifestations of societal values in an actual design.

PREVIOUS APPROACHES TO DESIGN AND VALUE

Value is a complicated concept, and we may not all even agree on what it means. There are many different approaches to working with values and design.

Among these can be mentioned value sensitive design, in which values are approach through three main angles: conceptual, empirical, and technical [13]. In this approach, a formative design framework is constructed where theoretical constructs are translated through several levels into toolkits, methods and heuristics to help guide the design process [17].

While value sensitive design have a strong focus on turning theory into practical support for design, a more practice oriented approach can be found in Schön [23], where active reflection in action is suggested as one of the forms of knowledge creation in design. By explicitly guiding this reflection, we can put a focus on values in the design process, while following a format that creators also outside of academia are comfortable with.

In this work, we used a similar approach to value sensitive design in turning theoretical values into practical design

considerations. However, we have differing understandings of the meaning of the word 'value'. While value sensitive design mainly is "concerned with what people consider important in their lives, with a focus on ethics and morality" [12], for us this results in an approach focused on protecting people's rights/values. In this work 'values' should rather be read as explicating organisational and personal beliefs/values to incorporate these beliefs in the design process.

While the translation of theory into actionable items in this work is similar to value sensitive design, and

reflection in action was used to make sense of our prototypes, the approach to 'values' are rather inspired by Flanagan et.al. [11], where the act of value design is separated from a traditional passive approach where designers not explicitly consider their assumptions, and risk imbuing unspoken ideals into their design. In contrasting this with deliberately embodying values into design, this latter way becomes a form of political or moral activism, where designer values are communicated to the end user.

IDENTIFYING A WEB OF VALUES

To identify values in public settings is not an easy task. The *municipalities* might be commissioners. Often they in turn get funding from a *foundation* or other *project funder*, who in turn have by-laws and values they expect to be filled by the projects they fund. At the same time in a democratic society the municipality is in the bigger picture run by the public and the values shared by the *citizens*, who of course also don't agree and have different political ideas. This creates an intertwining web of values that affects the design choices, design process and final design.

More abstract long-term project goals such as democratic values, sustainable development goals and similar can become so abstract that they are not used in the day to day work, thus getting lost in the design process. It becomes a value document on a shelf, or is limited to some inspirational workshops and buzz words for PR-material, instead of a practically useful tool. In this project the core values instead became a checklist to measure choices against. Thus remaining active and relevant throughout the process. Instead of measuring towards for instance customer happiness and sellability, societal values were in focus.

Throughout an iterative design process, the values were updated, tweaked and polished to be implemented in accordance with the design groups understanding of their meaning.

Similarly, the design choices were measured against, and adapted to the values at all times. By treating both design and values as somewhat fluid and possible to understand and develop, it gave the opportunity to understand both design and values better. This way the identified values naturally connected to the more practical understanding of what to do, that is needed for the implementation.

SOCIETAL VALUES IN THE DESIGN PROCESS

More abstract long-term project goals such as democratic values, sustainable development goals and similar can become so abstract that they are not used in the day to day work, thus getting lost in the design process. It becomes a value document on a shelf, or is limited to some inspirational workshops and buzz words for PR-material, instead of a practically useful tool. In this project we aimed to make the core values a checklist to measure choices against. Thus remaining active and relevant throughout the process. Instead of measuring towards e.g. customer happiness, the societal values were in focus.

SOCIETAL VALUES IN THE SANDBOX

In this case we focused on a public playground setting, and the municipality's values related to children. These include, but are not limited to, pedagogical values, inclusion, and accessibility, both in location as well as access to the area. Public playgrounds fill multiple roles, e.g. as a place for learning, a place for pure play, and a palace for relaxation. It's a place for both children and their parents.

IMPLEMENTING SOCIETAL VALUES

Societal values were identified from project goals, application, stakeholders aims etc. and participatory design permeates the whole process. Children were involved in an inventory of needs study, where 20 children workshoped and made collaborative drawings of playgrounds. This was complemented with studying the children at a playground to map their behavior to their orally expressed needs, as these might differ. As an example, in the drawings several voiced the need for long funnel slides. However, when actually playing most children instead choose to play all together at a shorter, broad slide where they could interact and slide together. Further, the municipality had a civic dialogue where citizens, especially nearby residents, contributed with feedback on the playground plans, and during design iterations, children were involved in testing prototypes, being observed playing, as well as interviewed about the experience and given a chance to share their ideas.

After inaugurations, user studies have been conducted in the final playground. As a result of this, the reprogrammable parts of the playground have kept evolving. See later pages for more details on these studies

"TRIPLE HELIX" CONSORTIUM

The project used a "triple helix" consortium with the municipality as project owner. As all partaking organisations had interests in, and actively affected the outcome of the project, we consider them all as stakeholders in the design work.

- 2 Universities: Design and action research oriented researcher involved in design and field studies.
- 2 Companies: Tech and Sustainable development. Design work and implementation.
- 1 Municipality: The partaking municipality is a medium sized swedish town. Officials from the department of urban planning, including the municipality project leader for playground development, was part of the project group.

Government Funding/application	Municipality	Researchers
<ul style="list-style-type: none"> • Innovation connected to internet of things • Democracy • The Global Goals 	<ul style="list-style-type: none"> • Quality play for children • Mediate biodiversity • Robustness • Inclusion 	<ul style="list-style-type: none"> • Play values and diversified play • Interpersonal perspective • Appropriation

Prerequisites and organisational values from public stakeholders, later integrated into the project core values.

IDENTIFYING AND USING CORE VALUES

Workshops, documentation and observations to identify core values.

Setting up the list of Core values (14 values identified)

Defining the why, how and what. Clustering the Core values into a hierarchy of aggregated, underlying values and more direct values.

Service blueprint and actual tool to implement the values.

Here the Effect goals 1 and 2 are shown. They are mapped in a customer journey with interactions (e.g. [25]). The customer journey is mapped against frontstage actions needed to be catered for by the installations and backstage actions, not visible to users but needed for the technical implementation.

Core values were identified in two major ways. First, through workshops designated to find and define core values (1). Secondly, by researchers participating in regular meetings and in conversations identify values mentioned, and lifting them in the group. For instance the municipality representative often mentioned accessibility, thus this was identified as an important value and added to the core values.

After an inventory of needs had been conducted and important values had been identified, a workshop was held with all project partners. During the workshop core values were listed and a hierarchy developed with aggregated, underlying and direct values. The values were sorted and numbered, and then turned into effect goals (2). After the workshop the effect goals were structured by how they related to use, and what would be needed to implementing them into design (3), this was explicated through service blueprints (4) that became the actual tool for implementing the values into the design.

The tool alone is not enough to ensure that the values are integrated in the design. The tool was complemented with a board of experts partaking in all major design choices, meeting at least once per week. A representative from the municipality, a play researcher, a sustainability educator and tech experts all gave their input on choices, to ensure that values were sustained throughout the design process. The values were treated as a living document. Both solutions and values undertook several iterations, with values affecting design as well as new reflections from the design affecting the values. Values sometimes conflicted with each other, and here the group discussed to find good compromises or new solutions. For instance discussing a certain solution might highlight new priorities, that when investigated resulted in identifying the need to incorporate a new core value into the design process.

6 main categories of core values were identified. Each category contained sub-values, in total 17 such values. All the values and how they are integrated into the design solutions are presented on the following pages.

THE INSTALLATIONS

Interacting with the installations

There are in total three interactive installations: one hut the size of a playhouse and with a look inspired by birdhouses, and two big eggs, painted like wild bird eggs. The installations are placed in the outskirts of a traditional playground, between the playground and a neighbouring small forest, with about 5-10 meters in between them. The placement is intended to work as a link between playground and forest, encouraging play also in the forest. The playground and the interactive exhibits were developed in conjunction and share the local nature perspective in its execution.

When not in use the interactive installations pulsate in different coloured lights. When touching one of the sensors on the eggs or in the Hut, a name of a play scenario is spoken out loud and that scenario starts. The scenarios are colour coded, for instance 'the blue scenario', so that children can easily choose scenarios without having to understand any written instructions.

Depending on the scenario, they play on the scenario they were started on, or they play on several installations at once, currently on the two eggs, and this way encourage users to move between them. Even though not currently activated, scenarios could also connect for instance the hut and an egg, or even installations that could be placed in other playgrounds.

Scenarios can be changed and new scenarios added, via a graphical programming interface built on Blockly [5] and accessed through a web browser. After inauguration several tweaks of existing scenarios have been made, as well as adding new scenarios. There are currently seven scenarios running. Three in the hut, and four on the eggs. Here we present some examples.

FACTS ABOUT THE INSTALLATIONS AND THEIR PLACEMENT

Example of scenario: Music scenario

In the scenario each sensor on the egg corresponds to a note. At the start of the scenario the beginning of a children's song is played by the egg. If the user plays the same tunes in the right order, the egg will play the rest of the song, combined with a little light show. Or the user can just create their own music, using the egg as an

The Hut of Stories

Stories about animals are played in the hut. By changing seats, thus activating sensors, the user can decide what happens in the stories. The stories available change depending on date and time of year so there are always new stories to discover for the users.

The hut

- A small playhouse, looking like a birdhouse
- Contains 4 stools, one in each corner.
- The stools contain a touch sensor, sensing if someone sit on (or touch) them.
- Above each stool there's a spotlight that can light up in any color.
- The hut also contains loudspeakers

Physical appearance

- Mimics nature
- Robust materials

Placement

- In a forest glade
- Park with meadow and trees, near urban environment
- Near a new built municipal playground, biodiversity themed

Technology enhanced

- Internet of things, connected to the cloud
- Capacitive sensors
- RGB LED-lights
- Loudspeakers

The Egg

- 1.2 meter high
- 16 locations that can light up in any color
- Each location contains a touch sensor
- Each egg contains a loudspeaker

Example of scenario: Paint the egg

During the scenario, touching the sensors makes them change colours. The other egg mimics the interaction and also changes colour. How this interaction is interpreted and turned into a game is up to the users. For instance users can choose one colour each and compete in first turning both eggs into the chosen colour, or users can collaborate to make both eggs rainbow colored.

APPROPRIATION

A fundamental value for well being is autonomy and competence [7]. To be empowered and feel that one can change and affect ones surroundings. Also change offers variations and the possibility to appropriate a space or an interaction [4]. But many playgrounds today are the opposite: they are static and moulded in place [3]. By designing for changeability and appropriation it is possible to cater for democratic play [8].

INTERACTIVITY

! Different scenarios to choose from

! Possible to make choices while playing scenarios

CHANGEABILITY FOR APPROPRIATION

! Easy block programming interface, kids can participate in scenario creation

! Possible to create and change scenarios

! Internet of Things enhanced, possible to change remotely

VARIATION

! Different scenarios and types of interactions

! Interactions changes over time (i.e. Between seasons and days)

! Open end scenarios, free to interpret

INTERPERSONAL & INCLUSIVE

Humans are social, we relate to others [16]. Still many designed experiences, especially tech related, are focused on individuals. Interpersonal design [10] caters for our social needs. This enables social play that fosters crucial societal skills [15]. To enable participation the playground design must be inclusive [24]. Inclusivity includes many aspects such as cognitive and physical accessibility, but also such things as economical means and technology skills are important. It's about lowering the thresholds for participation. This value connects to anti-discrimination, empowerment and democratic values.

♥ COOPERATIVE PLAY

! Several can interact at the same time

! Co-creating experiences

! All ages and cognitive levels can play together

♥ ACCESSIBILITY

! No personal tech, logins etc needed

! No fees or admissions, open all hours

! Re-programmable over time, also after deployment

! For users with disabilities: wheelchair access, multisensory

♥ CHANGEABILITY FOR INCLUSIVITY

! Different scenarios for different interests and abilities

PLAYIFICATION & GAMIFICATION

Play is fundamental to all human activity [14]. Gamification with fast rewards leads to interaction patterns such as competitiveness and addiction [1]. But there is a strength in how gamification creates flow [1]. Playification instead focuses on collaboration, discovery and playfulness [20], but still keeps the flow from gamification. Meaningful playification means including many different play typologies [19], to offer variation of play, not only play types encouraged via gamification.

♥ CURIOSITY DRIVEN

! Open end scenarios - no end goal

! Cooperation not competition

! Easy to design and implement new scenarios

♥ VARIATIONS OF PLAY

! Scenarios for playing music, painting colors, storytelling

! Encourage different types of play

ENVIRONMENT & EMBODIMENT

Traditional screen-based tech tends to ignore the body. With embodied interaction focus is on how our bodies relate to our experiences [9]. Technology can be used to enhance our outdoor experiences [21]. A playground is not only the installations but also the play paths created between them [3]. Integrating nature in the playscape has many positive effects on children's development and helps them create an environmental identity [22].

♥ HYBRID EXPERIENCES

! Multisensory experiences with sound, touch and light

! No screens

! Bodily interaction

♥ NATURE PLAY

! Physical design mimics

! Integrated in nature, nature materials available

! No outer fences and far from traffic, freedom to move

! Weather play (i.e. rain and snow)

! Installations apart but visible from each other, for movement

♥ PLAY PATHS

! Scenarios to encourage movement between installations

LEARNING EXPERIENCES

All play is learning and you can learn through play [8, 14]. Emotional engagement [26], storytelling [2] and experiences [18] are powerful ways of creating playful learning. Especially interactive storytelling can create positive effects on learning, and here mixed reality technology can play a role [6].

DESIGNED FOR SITTING AND LISTENING

STORIES ARE INTERACTIVE AND CHANGES

! Non-linear storytelling

! Different stories depending on day and season

! Possible to reprogram new stories/scenarios

! Capacitive sensors for making choices in the stories

! Roof and calm environment

! Cosy lights

! Lights and loudspeakers above the seats

! 4 stumps for sitting

STORIES ABOUT NATURE

! Over 290 story snippets

! fact checked by educators

! written by an author, narrated by voice actors

! Stories about species and biodiversity

ROBUSTNESS & FUTURE PROOFING

Outdoors, all year round, for many years, in all weathers, unsupervised. Playgrounds are a tough environment. Installations need to be very robust, both physically and technologically. Users will climb, smash, poke, and so on [19]. It is expensive to rebuild a playground, re-programmable installations can make renewing the playground easier.

♥ ROBUST MATERIALS

! follows EU standards and regulations for playgrounds

! Marine technology

! Robust industry standard components, easy to replace

! Reprogrammable and possible to update

! Built on industry standards and common solutions

! Locally run, remotely changed. Works even if internet connection goes down

♥ FLEXIBLE TECH SOLUTIONS

♥ GRACEFUL DEGRADATION

! Interesting play opportunities, even if the technology malfunctions

RESULTS AND TESTS AFTER INAUGURATION

After the inauguration of the playground, several studies have been performed. At three different occasions, in the fall, winter, and spring, researchers have visited the playground for observations and interviews with users of the playground. After presenting themselves and asking for consent, the researchers took a step back to observe. Afterwards, interviews were conducted with both parents and children, focusing on their experience of the playground as well as tying into observed play behaviour. The observation data was complemented with data logs from the installations, to get a broader understanding of when and how often the equipment was used. The resulting data has been coded, with project values in mind, to evaluate values and effect goals. This is still an ongoing work, and further observations and analysis is planned. In particular, one more session in summer weather will be performed, to thereby cover all seasons. More detailed descriptions of this will be published in forthcoming papers.

The playground is ever-changing, and parallel to the observations, designerly knowledge has been gathered through workshops and design tasks in early school years, as well as through course work at university level. While children needed support and a grown up to help them with programming, they were still able to make pen-and-paper sketches and designs that could be implemented in the playground. The university students were able to implement scenarios that could be taken into the design, and among the currently running scenarios, one is developed by this group. An ongoing work, that we hope to explore further is to find a sustainable way to open up the programming more widely to a broader, and younger audience. Together with the municipally we are working towards classroom education and children's holiday workshops where they could develop, and implement new scenarios for use by all visitors to the playground.

Reprogrammed several times

- The team made an advent calendar scenario for christmas
- Students made a music scenario that was implemented
- New sounds and scenarios added on several occasions, based on feedback

User data

- Total 1588 initiated scenario interactions over 2 weeks in February. Data gained by logging triggering of sensors activating scenarios.
- Installations have been active and working 24/7 since inauguration
- Endured -15 temperature, rain, snow, 1 dm of water around the base and one attempted vandalism with screwdrivers

Examples of scenarios and playground designs by 12 years old - after excursion to the playground and learning the programming tool

“the play interactions [meaning the tech installations] outdoors are cool and my daughter very much likes especially the stories [...] we have never seen anything like this

- Father of a girl (age 3)

“My daughter pretended she was super small, riding on a bumble bee, flying to a small wooden hut with stories in it.

- Mother of a small child (age 1.5)

“I can play music on the egg

- Boy (age 5)

Detail from storyboard. Scenario design by local university students

CONCLUSION

In this pictorial, we present how societal values can be concretely manifested and incorporated in an actual design when it comes to designing playground installations. Using a design research-oriented approach in direct collaboration with industry partners and a municipality, we gathered knowledge throughout the design of an outdoor playground meant for everyday 'real' use. Presenting this through annotated portfolio-inspired illustrations of the installation, we show how these societal values affected the design. Even though the identified 'webb of values' may not always be as easy to define and structure as it may seem from the presentation of this case, we still argue for the importance of having societal values in mind as a design tool, especially in public settings. Values are all interrelated, and may sometimes even be in opposition to each other. By adapting and trying to understand both values, and the design, throughout an iterative design process, we found a way to identify and balance these values against both each other and the design. However, it is important to note that this is one case, and not intended to be a single solution for all situations. It is rather intended as one inspirational case, that might be useful for others designing in public settings. Although not the primary focus of this pictorial, our preliminary tests and studies show that the playground installations are frequently used, well working, and that they enhance play experience and cater for many different types of play. Pointing towards a positive reception of the design from the local public.

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