Outlining the Design Space of Playful Interactions Between Nearby Strangers

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ABSTRACT
Designing interactive technology with an aim to encourage social interaction between nearby strangers is challenging. While there are various social norms, cultural practices and privacy concerns that hinder interaction with strangers, ignoring the other people can be even more detrimental in the long term (e.g., leading to a low sense of community and missed opportunities). In order to better understand this paradoxical design space, we arranged co-design workshops aiming to create ideas of future services where interactive technology playfully encourages interaction between nearby strangers. By analyzing the resulting ideas, we identify various aspects and elements that conceptualize and theorize this so far fuzzy design space. We explicate concepts like *Hotter, Hotter, Changing Other's Avatar* and *Dancing*, and analyze the 60 resulting concepts to identify elements and viewpoints important in this design space. The conceptualization can help ideating future services, identifying relevant research questions, as well as evaluating design solutions with respect to relevant quality attributes.

Categories and Subject Descriptors
H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

Keywords
Proximity-based interaction; playfulness; social interaction; co-design.

1. INTRODUCTION
Everyday, strangers surround us in public places of urban environments. In fact, we may not even know our neighbors or colleagues. Civil inattention [6], i.e., the process of acknowledging the presence of nearby strangers but at the same time blocking further interaction with them, is a common social norm in public places. Cocooning, the common urban practice of creating a personal space by concentrating on mobile media technology [8], further fuels this trend of social isolation in public spaces. Consequently, the threshold for starting a face-to-face conversation with a stranger is high, especially in large cities and cultures where small-talk is not a common practice (e.g., Finland). The benefits of interacting with strangers may not seem worth any potential social risks. Therefore, we argue that with suitable interaction design we could nudge people to focus on the social opportunities rather than on the risks of interacting with strangers. There is room for exploring how to create socially meaningful experiences between nearby strangers.

The "gray mass" of strangers could play an important role in people's lives through lightweight social interaction, which could lead when appropriate to further interaction and collaboration. This overall goal can be approached with different kinds of solutions (dictating social rules, changes of policy, etc.). Our main approach is technological: we explore if and how lightweight, *playful interaction* [19] between nearby strangers—mediated by interactive technology—could lower the threshold to initiate interactions that are meaningful enough to motivate doing so also in the future. However, despite focusing on technological solutions, it is crucial to base the design on a sociological and psychological understanding of social behavior and cultural aspects.

Technology-mediated interaction between strangers in the same area has been explored to some extent. Social matching applications like MeetMe[1] and Skout[2] allow its users to browse others in the same area and connect with them. They provide information about common interests with the other users. The dating application Tinder[3] also uses location information to show potential partners to the user. Location-based playfulness in forms of Ingress[4] and Geocaching[5] provides platforms for lightweight interaction between strangers, but most often these people are not doing the activities at the same time in the same place. In July 2016, the launch of a location-based augmented reality game, Pokémon GO[6], caused interaction between nearby strangers as masses of people invaded public spaces trying to catch Pokémon. This happened even though the social features in the game are minimal. StreetPass[7] in Nintendo 3DS exchanges game content automatically with other users when they come close enough to each other. StreetPass is the only one of these commercial

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[1] www.meetme.com
[2] www.skout.com
[3] www.gotinder.com
[4] www.ingress.com
[5] www.geocaching.com
[6] www.pokemongo.com
[7] www.nintendo.com/3ds/built-in-software/streetpass

examples that intentionally creates interaction between nearby strangers like we define it: people that are so close that they could easily approach each other, assuming that a good reason to do that is provided. StreetPass was used as inspiration for our work, but at the same time we wanted to explore the broader possibilities of interacting playfully with nearby strangers.

Another motivation behind our work and the technological approach is the foresight of direct device-to-device communications becoming more common in mobile platforms. This opens possibilities for discovery of nearby devices and data exchange between them. These technical enablers can be used for different purposes but our interest lies in understanding how this can be used to create meaningful playful interaction between nearby strangers.

With this work, we take a step backwards from a technology-driven approach, and explore the design space of playful interactions between nearby strangers by using co-design [16] as our approach. We argue that such an approach helps the research community to identify meaningful ideals and utopias for the future (i.e., design targets), take experience and social interaction as starting points instead of what is technologically possible, and harness the life experience of people, as this is a topic that everybody has experienced before. We collaboratively ideated and sketched various kinds of solutions (services, apps) with design researchers and students. The resulting ideas were analyzed to identify various aspects and elements that outline and conceptualize this fuzzy design space.

The contribution of the paper for playful interactions with nearby strangers is twofold: first, interesting novel service ideas and, second, the conceptualization and theorization of the design space, based on the analysis of the 60 ideas produced in the co-design workshops.

2. RELATED WORK

Research related to encouraging interaction between nearby strangers stretches over 10 years and has taken many forms. Different means of making it happen have been presented and the research has had different focuses. In the following, we outline this area mainly with regard to match-making between strangers, technology-mediated interaction, enriching gaming experience with co-located other players and encouraging people to interact with interactive technology.

Mobile devices have been seen as a good platform to perform social matching of nearby strangers. Serendipity matched profiles within Bluetooth range for professional use [5]. CommonTies is a wearable wristband for context-aware matching of profiles. The idea is to encourage two nearby strangers to interact with each other by revealing a match through showing the same color on both of their devices [1]. CueSense is a wearable display that aims to provide tickets-to-talk by revealing matches in the social media content of encountering strangers [10].

McCarthy et al. experimented with using proactive public displays to reveal information about nearby people in the context of an academic conference. The revealed information had two purposes, increasing the awareness of other participants and providing tickets-to-talk. Conference participants could make a profile that was stored on an RFID tag attached to their conference badge and made visible on a public display when they asked a question in a paper session or queued for coffee [24].

There have been several examples of mobile applications that enable technology-mediated interaction with nearby strangers. Capital Music provided a way for sharing song choices with nearby strangers and allowed interaction through commenting the songs [29]. DigiDress [27], Scent [11] and TWIN [31] present functionalities like messaging, discovery of proximate users, expressing identity and sharing content with other users. Viewing the profiles of proximate users was found to be the motivation of continued use of DigiDress. Direct messaging on the other hand was not commonly adapted. The user trial for TWIN showed that the motivations to use it were mostly related to fun and entertainment, not to any practical goals.

Paulos and Goodman designed a Bluetooth-based device as well as a mobile application called Jabberwocky for logging and showing encounters with frequently encountered strangers. They believed that such devices could encourage solidarity in public places [25].

Enriching gaming with nearby players has also seen different forms. Bell et al. introduced a location-based game called Feeding Yoshi, where nearby players could see each other on a map and could swap digital resources [3]. In Insectopia nearby players could team up to catch digital insects generated by Bluetooth devices [26]. Szentgyorgyi et al. found barriers for ad-hoc, collocated pick-up games on Nintendo DS with strangers. They included finding gaming opponents, social awkwardness of initiating a game with a stranger, the problems related to joining, and exiting an ongoing game [30]. Looking at a specific Nintendo DS game, Dragon Quest IX, Licoppe and Inada witnessed players appropriating public places for gaming with nearby strangers [14]. A newer version of Nintendo's 3DS handhelds features StreetPass, automatic exchanges of various kinds of game content with players who are within WiFi range. Briceño critiques StreetPass stating that it prevents true social interaction and leads to players viewing each other as in-game currency [4].

Examples of researching the social effects of interactive installations on public places include Jokebox [2] and coMotion [12] a shape-changing bench. Jokebox is a set of two interconnected installations that require two nearby people to coordinate their actions and interact with the devices simultaneously in order to hear a joke as a reward. Jokebox created a "honey pot" effect inviting more people to approach it when others were using it. Interaction was more likely to happen within groups of familiar people than between strangers, but people were also seen championing the device to strangers. Experiencing a sudden change in the shape-changing bench sparked a conversation between two strangers sitting on it, but the conversation did not elaborate further from the bench topic. Yoon et al. proposed encouraging social interaction in informal social environments through collocated play and introduced FishPong, a game for an interactive tabletop to be played with coffee mugs [32].

Stepping away from a prototype-centered approach, Heinemann and Mitchell analyzed a set of breaching experiments, social interventions with the intention of encouraging and supporting collocated strangers to collaborate. Their research revealed how social order of public places indeed imposes barriers to collaboration. Availability, facilitation, perspicuous settings, and perspicuous participants were seen as qualities that encourage and support collaboration [7].

Jarusriboonchai et al. researched the opportunities and challenges of digital tickets-to-talk in encouraging face-to-face interactions between collocated strangers. Offering concrete and collaborative activities was seen more prone to lead to meaningful face-to-face interactions than offering chances for online interactions that

encourage offline interaction or mere self-expression for nearby strangers [9].

All in all, this research area has been strongly driven by design and evaluation prototypes designed by researchers. Only few publications cover more than one idea and analyze the landscape beyond a single design artefact. More importantly, the area lacks theoretical foundations and well-defined terms to describe and analyze various relevant aspects. With this paper, we aim to take a different approach and focus on co-design as a method and conceptualization as the goal of the work.

3. METHODOLOGY

Dialogue-labs is a co-design method developed by Lucero et al. It combines the use of process, space and materials in a structured way and provides a clear step-by-step procedure for a two-hour idea-generation session in which participants first work in pairs and then as a whole group [16]. This section describes how we applied the dialogue-labs method, and what kinds of task and materials were used for sensitizing and facilitating ideation.

3.1 Tasks

The overall task in the workshop was to *think of playful ways to encourage interaction between nearby strangers*. Five subtasks were defined in order to encourage the participants to approach the topic from different angles. The tasks draw attention to (1) what could motivate people to interact with nearby strangers, (2) what would actually happen when encountering a stranger, (3) how to build the relationship during one encounter or across several encounters, and (4) how to take privacy concerns into account. The tasks were named and described as follows:

- *Rewards:* What is a playful and meaningful reward when interacting with nearby strangers? (1)
- *Awareness:* How can people become aware of the playful and social opportunities with nearby strangers? (2)
- *Meaningful:* How can people take appropriate steps with nearby strangers towards real-life connection? (3)
- *Frequency:* What are playful ways to utilize the knowledge of being nearby the same stranger repeatedly? (3)
- *Privacy:* How can people interact with nearby strangers in a playful way so that it both protects their anonymity and leaves room for revealing their identity? (4)

3.2 Materials

Each task was accompanied with some material to support ideation. Three of the tasks were accompanied with a different deck of design cards [20]. We did not want participants spending time learning each deck's set of usage rules, so we decided to use them in our own simplified and consistent way. The decks were divided in several piles and the instructions were to reveal one card from each pile, and use as many of the appearing cards in ideation as feels suitable. At any point, the participants could discard the previous cards and turn around a new combination. There were no other rules regarding how to take turns in ideation. The instruction was simply to *ideate together*.

For the *Awareness* task, we used the Design Deck cards designed in Northumbria University. The cards feature four categories: emotions, technology, personas and issues. The personas are very provocative and issues contain worldwide problems, which result in interesting combinations when picking one card from each category. For the *Frequency* task, we provided PLEX Cards [18]. PLEX Cards are an idea generation tool that is created based on the Playful Experiences framework. To assist in coming up with playful ways to *Reward* interaction with nearby strangers in a meaningful way the VNA cards [13] and a subset of IDECARDS idea generation cards for game designers [14] were provided. IDECARDS actually include Verbs, Nouns and Adjectives familiar from the original VNA, but the set is less extensive than the original set. From the IDECARDS we chose Emotions, Animals and Non-symbols.

The *Privacy* task was supported with a pile of random pictures cut out from magazines spread on a table, out of which the participants could make collages or mood boards [17]. For the *Meaningful* task, pencils and paper for sketching were provided. This was the only ideation station where the participants could sit down. For the final discussion, we provided a set of Playmobil[8] characters, accessories and furniture.

3.3 Participants

We organized three workshops each consisting of six participants. Two of the authors of this paper took part in all three sessions and the remaining 12 in only one session, for a total of 14 individual participants. Ten of the participants were design students from the University of Southern Denmark, and four were research and/or teaching staff. In our participant recruitment we focused on harnessing the creativity of open-minded and visionary interaction designers instead of, e.g., systematic and analytical engineers; this was particularly because the field of research is strongly based on social interaction and interactive technology being a *mediator* or *facilitator* instead of the centerpiece. The ages of the participants ranged between 22 and 41 (average of 28). Six of the participants were female and eight were male. The participants represented nine different nationalities, covering Europe from North to South and East to West, and two countries from South America.

3.4 Procedure

Each two-hour session started with a 15-minute sensitizing phase. We presented three mobile services to the participants in order to get them thinking about different ways of interacting playfully with nearby strangers to them. The main differences between these services relate to the type of content that is shared, how that content is generated and what forms of interaction between users are supported.

The first presented service, StreetPass, is a commercial feature on Nintendo 3DS handheld gaming devices, which can be activated in a wide variety of 3DS games. It automatically exchanges avatars and game-related data between stranger users carrying their devices along with them and passing by each other. The user will find out about the exchange, when they check the device and see a green LED being lit up. The encounter between the user's own avatar and the received avatar can be viewed. It includes a discussion between the avatars, and the encountered avatar reveals something about itself. The user can at any time view the collection of all the encountered avatars. Different games utilize StreetPass in different ways. The user can for example receive gifts from the encountered users, have them fight on their side, compete against them, or see their creations.

The second service, *Next to You* (N2U) is a social mobile application that automatically recognizes nearby users of the same application based on their Bluetooth address. After recognition, it automatically exchanges pieces of profile information called 'whispers' between the nearby users. N2U is based on a gradual revealing of user profiles. The full of the other user builds one Whisper at a time, each time the two users encounter. N2U offers

[8] www.playmobil.com

means to take the interaction further from the automatic exchange. Whispers can be liked and in-application messages can be sent to any collected user. Unlike many social matching applications the profile pictures are not in a central role. The profile picture is revealed only after the two users meet face to face, and prove it by playing a mini-game together.

The third service, *Challenz* is a mobile application that provides a possibility for strangers passing by each other in their daily lives to collaborate over video content by continuing the story that the encountered user had started or continued. Later on, when the two users encounter again, the new parts to the story will be automatically transferred to the previous contributor, as a reward. *Challenz* as well as *Next to You* are research prototypes currently work in progress by the authors.

After the sensitizing phase, the group of six participants was divided into three pairs. Each pair chose one of the five locations with a task to ideate around it and document their ideas. After 15 minutes, they changed to a different task. Three ideation rounds were performed.

After a five-minute break, the pairs presented the ideas they thought as their best ones for 15 minutes. That was followed by a co-design session of 15 minutes, used to elaborate on the ideas within the whole group. As a final group activity, designing an ideal solution summarizing the best ideas was conducted. In this phase, the participants used Playmobil characters together with play acting to discuss and present their ideas. After these group activities six ideas, one for each of the five locations plus another for the final group activity, were chosen for quality assessment. Each participant assessed the six ideas on a 7-point Likert scale (where -3 is very bad, +3 is very good, and 0 is neutral) individually.

Figure 1. Co-design workshops setup.

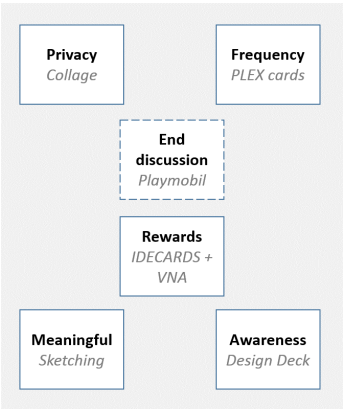

Figure 2. Room, tasks and materials.

A large meeting room was set up to facilitate the process (Figure 1). It included a common area for sensitizing and end discussion. The five tasks were spread out in the room as five separate locations suitable for pair work with the given material. Figure 2 presents an overview of the room, the tasks and the materials.

3.5 Analysis

The co-design workshops resulted in a wide range of ideas of different levels of fidelity and focusing on different aspects of the envisioned system or interaction between nearby strangers. We analyzed the data bottom up, first transcribing the group discussions and identifying individual ideas. In order to objectively measure the quality of the ideas, we calculated the averages of the 7-point Likert scale ratings for the 18 ideas. We then chose the best of those and a set of other ideas to be illustrated as vision sketches that capture the essence of the idea.

The two researchers who took part in every session grouped the ideas according to commonalities and enriched the illustrations with keywords. This led to the identification of the stages through which playful interaction with nearby strangers could go through while becoming more commonplace. The rest of the analysis was an iterative process of going between data, writing, modeling.

4. RESULTING IDEAS

The three workshops generated altogether 60 ideas. They ranged from the conventional (e.g., revealing matching interests and activity partnering) to the futuristic and hard-to-realize (e.g., feeling what others around you feel). Most of the idea descriptions were somehow partial, concentrating on describing some aspects of the envisioned system that were particularly relevant, but leaving others unexplained. The ideas and their explanations reflected the given tasks and materials but were also built on many other aspects such as participants' own experiences and observations of encounters between nearby strangers and their cultural backgrounds.

As we described earlier, each participant rated six commonly chosen ideas from their workshop individually. Table 1 presents these ratings. We describe the seven highest-rated ideas, and relate the presented discussion and conceptualization mainly to these concrete examples.

4.1 Highest Rated Ideas

Shadows (Figure 3) seeks to distract people from their personal bubbles and direct their attention to a nearby stranger by creating a weird moment—a ticket-to-talk—of showing their shadows interacting with each other.

Table 1. Mean ratings ($\bar{x}$) and standard deviations (SD) of the 18 resulting ideas (scale -3 to +3, where 0 is neutral)

	$\bar{x}$	SD		$\bar{x}$	SD
Shadow	**2,7**	0,5	Pattern of meetings	1,0	0,6
Dancing	**2,3**	1,0	Influencing others	1,0	1,6
Hotter, hotter	**2,3**	0,8	Beat up the monkey	1,0	2,1
Honk, honk	**2,2**	0,8	Snake bits	0,7	0,8
Stories of the world	**2,0**	1,1	Show me your colors	0,7	1,6
Change others avatar	**1,8**	1,2	Drones	0,7	1,6
Collective discount	**1,8**	1,0	Make others look funny	0,5	1,4
Fanboy T-shirt	1,7	1,2	Push ups	0,5	1,1
Stranger band	1,0	1,6	Find the A-hole	0,0	1,1

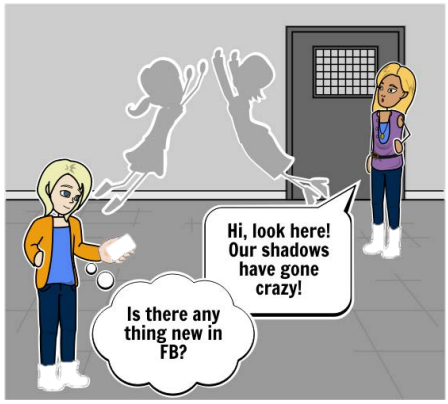

Figure 3. Shadows.

In *Dancing* (Figure 3), the moves of one person in the dance floor are tracked and shown anonymously on a public display for others to imitate. By imitating the moves people submit to the command of the tracked dancer and interact with nearby strangers as part of a larger group.

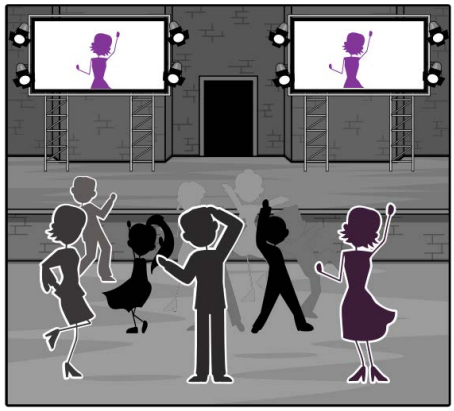

Figure 4. Dancing.

Hotter, Hotter (Figure 5) is based on the children's game Hide the Key, where the hints about the location of a hidden object are given verbally, by saying 'hotter' when a seeker gets closer to it. *Hotter, Hotter* is a game-like application for players to seek other players based on sensing increasing heat when closer to another player. Players need to be in close proximity of each other in order to score points.

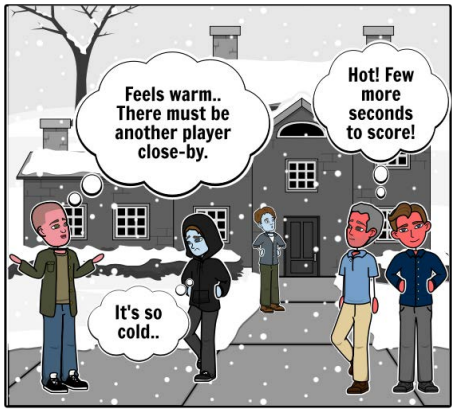

Figure 5. Hotter, Hotter.

Honk, Honk (Figure 6) builds on one participant's experience from the U.S, where others can gesture truck drivers to honk their horns.

...so I was in a car, and you pass by and you are like [does the gesture], and then the guy or girl smiles and then they answer back, and this feedback, sort of, it's just a second but there is a sharing and I found it, I couldn't stop doing it. I did it all trip. And it never happened that someone didn't answer back. ...it's still in my head. Whereas if I think about going more in depth, maybe I don't want to. Maybe then I use different social environment, not an app. If it could be recreated, something like that, that leaves you just a good mood...

We made an illustration of what *Honk, Honk* could look outside of the truck context. The person in the left is commanding the stranger in the right with bodily gestures. The other one responds even though it may be silly as he chooses to obey the rules.

Figure 6. Honk, Honk.

Stories of the World (Figure 7) is a concept for airports. An interactive interface would allow people to view the point of departure and destination of nearby travelers and to subscribe to pictures from their journey. The information serves as a ticket-to-talk and subscribing as a way to share part of their upcoming experience.

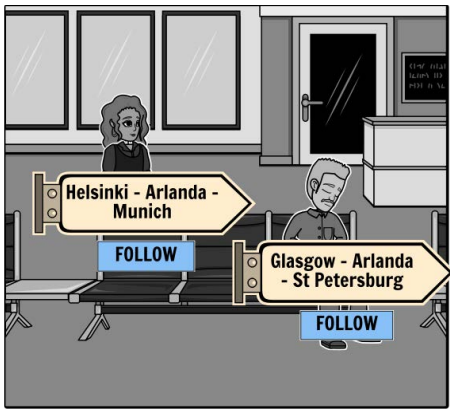

Figure 7. Stories of the World.

Changing Other's Avatar (Figure 8) switches the roles in avatar customization from the owner spending time and effort with perfecting their avatar to giving a nearby stranger a chance to practice their creativity. The idea was that the customization would be done live during a longer encounter instead of having to wait for several consecutive encounters for something to happen.

Figure 8. Changing Other's Avatar.

Collective Discounts (Figure 9) would connect strengers to perform some kind of an act together to receive a discount on a meal, which could be afterwards eaten together.

Figure 9. Collective Discounts.

5. ANALYSIS AND THEORIZATION

There would have been different options to analyze the produced 60 ideas. Looking for example at different contexts of use or kinds of people taking part in the interactions. Our process led us to look at the ideas as descriptions of the systems encouraging interaction between nearby strangers, at the different components they consisted of, and the different roles they had, i.e., what does the system do to encourage people to interact with nearby strangers. Another valuable contribution we saw was describing the different levels of playful interaction the systems enabled, i.e., what do people do or how do they interact with nearby strangers. Third, we looked at how privacy was taken into account in the ideas as it is a relevant consideration in interaction between strangers.

5.1 Systems Encouraging Playful Interaction

On a higher level of abstraction, the systems encouraging playful interaction between nearby people that were identified from the idea descriptions, consisted of one or more parts from the following categories.

- *Interactive personal technology*, for example a mobile device or an interactive T-shirt.
- *Non-interactive personal items*, for example a normal T-shirt of a certain color.
- *Interactive environment modifications*, for example an installation that projects shadows of people interacting with each other when detecting that they potentially could.
- *Non-interactive environment modifications*, for example a specific section in a bus for strangers willing to interact with others.
- *Rules of play,* i.e. knowledge of how to behave when encountering a stranger.

5.2 Roles of the Systems

A central role we can identify from the ideas is *announcing and enforcing the rules*. Having rules is a central element in this design space, as they are to games [17]. The system can announce them through the technology or through the environment, or they can be made known to people through other channels becoming a known code of conduct. Rules can help lower the threshold of interacting with strangers.

Furthermore, the system can allow the user to *prepare for the encounters* for example by defining the content that their interactive T-shirt gifts to others or recording their physical activity to be compared with others. This role is most suitable for interactive personal technology.

The system can *notify of an opportunity* to interact with strangers. The ideas here were further divided into five categories: (1) Personal information technology that keeps the interest to meet others a shared secret between the users of the same system, like in *Hotter Hotter*; (2) Personal information technology that visualizes the user's interest to meet others to nearby people, also to those who do not use the same system (e.g., smart T-shirts with embedded display to visualize common interests, wearable bracelets or personal social drones); (3) The environment can also take a proactive role in bringing people together like in *Shadows*. Examples of (4) a passive role of an environment in providing awareness of an opportunity to interact included different versions on *Stranger sections,* dedicated areas for people who wish to interact with strangers. Even though the purpose of driving a truck is not to play *Honk, Honk*, the truck could be described as (5) a non-interactive personal item that notifies others of the possibility to interact with its driver through gestures. Without rules and mutual interest to play the mere notification can be meaningless. If you see a truck but do not know the rules, there is no play. If you know the rules but the truck driver does not know them or does not want to obey them, the play ends right after you make the gesture.

The system can assume a role of *ensuring mutual interest to interact* to further lower the threshold of interacting. This can again happen through interactive or non-interactive parts. In the case of encountering a stranger in a *Stranger section*, one can assume that they are willing to interact with others and the context to interact is suitable. Another player playing *Hotter, Hotter* should be ready for the discomfort of someone entering their private space, which makes it acceptable to do so. The vague heat sensations of *Hotter, Hotter* are easy to neglect in an inappropriate context.

Interactive technology can assume the role of *connecting* nearby strangers *to interact through technology*. This could happen for example by anonymously playing a game with nearby strangers or in a face-to-face situation through modifying other's avatar.

The system can *justify* the interaction by providing reasons or excuses to approach a stranger. There are different ways of doing that. The system can provide topics, such as common interests, to discuss, so called tickets-to-talk. The system can demand certain types of interactions as a part of a game, rewarding for obeying and punishing for disobeying as in *Hotter, Hotter*. The system can

create such weird moments that they must be acknowledged verbally like in *Shadows*.

The system may *provide common activities* for the nearby strangers. This can be done with interactive technology, for instance by encouraging performing together in *Dancing*. It could also be a non-interactive solution, solving a problem together in the real world. An interesting and successful version of this can be found from Heinemann and Mitchell [7] where students tied strings to block free access to a pathway, demanding collaboration from people trying to get past it.

The interaction itself and the experience of fellowship that it creates are a reward and motivation for interacting with nearby strangers. The system can take a role of additional *rewarding*. Rewards can be digital such as content or points in a game; or receiving used defined content such as their favorite recipes. They can also be tangible such as stickers that are traded between strangers, or have monetary value e.g. a discount for a meal.

Overall, we could identify a broad spectrum of *roles of technology* in the ideas. Some of the ideas embodied several of these, e.g. first *notifying* of an opportunity and then *justifying* social interaction. We argue that the role(s) strongly depend on the context of activity, target users and type of interaction: for lightweight and short-term interaction *providing a common activity* might already in itself produce positive social experiences, while in some cases the system would first need to *ensure mutual interest* and *prepare for an encounter* before actually *justifying* interaction or *providing activities,* plus *reward* the interaction to add to motivation.

5.3 Levels of Playful Interaction

From the idea descriptions, we identified six levels of interaction, i.e., what people do with the nearby strangers. We next describe the levels and provide examples of playful actions on each level.

5.3.1 Affecting Automatically

At the first level, *affecting automatically*, the nearby strangers leave some kind of mark on each other automatically, no active effort is needed while nearby. They might notice this on the spot, later on, or never. The user's actions at this level happen prior and after the actual encounter. The system enables preparing for the encounter and performs the automatic exchange of data between nearby users. Examples of the actions include the following. (a) Collect others. For example, *Chameleon T-shirts* modify their appearance based on content that they collect from nearby users' T-shirts. (b) Give a Gift. For example, automatically gifting your favorite recipes to nearby strangers whose shopping bag content matches with the ingredients of the recipe. The playful interaction lies in choosing the contents that will be swapped with others and in the surprise of the received content. (c) Compare scores is a form of competition familiar from social gaming. In *Push-ups* the players would prepare for the encounter with other players by doing some physical activities such as push-ups. The level of activity would then be compared against each other, and especially encountering the same player repeatedly could lead to a friendly competition and motivation to be more active. (d) Relay and leave your mark. For example, modifying a received story and passing it forward, where the interaction happens through content.

5.3.2 Sensing Presence

At the second level, *sensing presence*, people become more aware of a nearby stranger. This could happen through the screen of a mobile phone, but could also take advantage of unusual senses, e.g. in *Hotter, Hotter*. Example actions on this level are the following. (e) Observe others i.e. passively receive the signals of nearby strangers. Another idea *Feelings Thief* would allow one to actually feel what a nearby stranger feels. (f) Follow cues e.g. in *Footprints* one would leave a trace of footprints behind. The footprints would fade away as the possibility of reaching the source decreases. Both *Hotter, Hotter* and *Footprints* invite to follow the cues and track down the source.

5.3.3 Interacting Through Technology

At the third level, *interacting through technology*, a technology-mediated mutual agreement to interact or a real-time connection may be established between nearby strangers. The technology mediated connection could be used for example to perform the following actions: (g) Modify something of the other, for example *Changing other's avatar* was considered such an intimate act that it requires agreement from its owner; (h) Compete against others. People could for example gain better benefits in a mobile game by playing against nearby strangers in real time without revealing their exact location.

5.3.4 Interacting With Face-to-Face Gestures

At the fourth level, *interacting with face-to-face gestures*, the interaction is short, bodily and mutual like creating an eye contact, smiling at each other, making gestures and replying to them. As the earlier quote related to *Honk, Honk* showed, this kind of interaction can be experienced as meaningful as such. Examples of actions on this level are: (i) Control others i.e. taking an active role in initiating interaction for example raising a hand to a truck driver to demand a honk in return. (j) Obey interaction rules for visual cues, like the truck driver honks to horn when they see someone raise their hand.

5.3.5 Interacting Verbally

At the fifth level, *interacting verbally*, a face-to-face conversation is started between nearby strangers. There are different actions that can lead to a conversation: (k) Obey interaction rules for a physical context e.g. *Stranger sections* provide a known context for communicating with others in there. (l) Act politely e.g. *Hotter, Hotter* demands players to be uncomfortably close to a stranger, to invade their personal space, thus making conversation a way to alleviate the discomfort. (m) Use tickets-to-talk e.g. *Stories of the World* provides information about the point of departure and destination to be used as topics of conversation. (n) Share a weird moment e.g. *Shadows* tries to spark a conversation through showing something unordinary that connects the strangers to have a discussion about it.

5.3.6 Acting Together

At the last level, *acting together*, nearby strangers would act together also on a physical level. Example actions on this level are: (o) Collaborate for a mutual reward e.g. in *Collective discounts* people would form a group, then perform something together and finally go and eat together. (p) Exchange something tangible for example stickers in form of one's home country. (q) Perform together e.g. Dancing can be seen as a collective performance among people choosing to imitate the shown moves.

We call these levels of interaction, but it does not mean that a higher level would necessarily be better, or that a higher level would include or be preceded by all the lower levels. Some ideas such as *Hotter, Hotter* provide possibilities for interaction on several levels. It is also possible to jump over several levels as in *Dancing,* going from *sensing presence* directly to *acting together*.

5.4 Privacy

Privacy is often seen as an important issue when thinking about interaction between strangers. If and to what extent this is true on different levels of playful interaction between nearby strangers

calls for more research. Here we describe how privacy was taken into account in the produced ideas.

Many of the ideas (e.g., *Dancing, Hotter, Hotter, Honk, Honk*) did not include sharing of any personal information. In *Dancing* the visualization of the dancer is anonymized. Anonymization could serve several purposes. It creates mystery around the tracked dancer *('who might it be?')* But at the same time, anonymization supports the fact that the idea is not about finding out who the dancer is, but dancing together in synchrony. Anonymization also removes the effect of the looks of the individual dancer. In technology-mediated interaction with nearby strangers, being able to interact without revealing exact location was discussed as a way to preserve privacy.

Ambiguous information like in *Hotter, Hotter* does not point immediately to a certain person, except in case of having very few people around. There is a degree of ambiguity to sensing heat. It is not necessarily clear who is the source of it and whether you have reached the peak value. It might even be that the heat is not coming from the system, but felt otherwise. Sensing heat can also be a private secret; it does not reveal you as a player to outsiders. Gradual revealing i.e. revealing more information each time the strangers come nearby each other, was introduced during sensitizing, and later came across in some ideas. Encouraging interaction only between people with matching interests was discussed, but it was not a common topic. *Stories of the World* the one system that shared the most private information was still based on choosing to share.

5.5 Evolution of Playful Interaction

We saw a path of evolution, consisting of three different stages, that playful interaction between nearby strangers could go through while becoming a more widespread phenomenon. Two of the seven highest rated concepts were found at each stage.

5.5.1 Stage 1: Rare Users and Awkward Situations

Before technology-supported interaction between nearby strangers becomes mainstream and natural, it may need to be forced. Technology will help the few users to discover each other and give excuses to approach others. There is definitely a sweet spot to the frequency of encounters with other users. If they are too rare, it does not make sense to play, especially if it requires wearing specific gear. On the other hand, too frequent encounters could take the fun out of it. The concepts *Hotter, Hotter* and *Shadows* relate well to this stage. *Hotter, Hotter* embraces the awkwardness and makes it a central element of play.

5.5.2 Stage 2: Empathy Among Growing Number of Users

When technology that supports interaction between nearby strangers becomes more common, recognizing those to play with is not a problem anymore. The interaction can be lengthier and personal, as in *Changing other's avatar;* or be based on commonly known rules such as in *Honk, Honk*.

5.5.3 Stage 3: Natural and Mainstream

At the last stage technology that supports interaction between nearby strangers becomes natural and common, and it interweaves with our daily practices. *Dancing* and *Stories of the World* represent this stage. Dancing in synchrony with nearby dancers and repeating dance moves shown on a screen are things that happen already today. Revealing your point of departure and destination to nearby strangers in an airport as described in *Stories of the World* may not be an act that everyone is ready to take, but we saw that it as a natural continuation of sharing for public in social media. Airports were also otherwise discussed as good contexts for playful interaction between nearby strangers. People spend a significant amount of time there with interesting people around, but the intention is necessarily not to take the interactions to a very deep level.

6. DISCUSSION

By analyzing the 60 resulting ideas of systems that would encourage interaction between nearby strangers, we have identified various roles of the systems, levels of playful interaction and privacy considerations. When designing interactive technology with such social aims, particularly the roles and the levels of interaction are central elements to consider. Furthermore, we presented seven of the 60 ideas to inspire refining them, develop fully new ideas, or implementing interactive prototypes of them.

To point out other sources of inspiration, Lundgren et al. defined a design and analysis framework for collocated mobile experiences [22]. While their focus is not on nearby strangers nor on playfulness, their four perspectives (*social*, *temporal*, *spatial* and *technology*) and the different properties related to these nevertheless enrich the conceptualization of the design space. Our theorization focuses particularly on the roles of technology and levels of interaction, which previous work has not covered this extensively and in this context.

In his thesis Designing for Social Interaction [21] Ludvigsen defines four levels of interaction, *distributed attention*, *shared focus*, *dialogue* and *collective action*, where the context of interaction is co-presence in interactive spaces. We defined nearby strangers more loosely as people close enough to reach each other easily. Unlike in Ludvigsen's case, our strangers could have a wall between them or just pass each other on the streets. His first level, "distributed attention, being in the same space, somehow aware of the others there" is more passive than our first two levels Affecting automatically and Sensing presence. Affecting automatically creates exchange between people even though they might not notice it and Sensing presence is about making some of the strangers stand out from the rest of the grey mass. Shared focus, directing attention to a same thing, is likely present in some of our ideas as well like in *Shadows* and *Dancing*, which are based on projection in space. As the idea descriptions did not focus on it, but rather on the next level where people were already interacting, it was left unnoticed. For his next level Dialogue, he uses also another term, co-exchange, which could then expand Dialogue to cover also our more detailed levels of interacting through technology, with gestures and verbally. The highest level collective action is similar to our acting together.

Mayer et al. have looked at making social matching on mobile devices context aware from a more theoretical perspective [23]. They found out that the context matters in whether matching is relevant in the first place. Contextually rare or odd qualities may be a more relevant reason for matching than just matching based on similar interest. It is unclear what kind of role a social match has in lightweight playful interactions between nearby strangers. People anyway play online games with strangers and in our approach there is no such strong intention to take it to a personal level as with social matching. Suitable contexts to encourage play between nearby strangers need to be considered, but they are most likely different from suitable contexts for introducing a nearby social match. Contextual rarity may be one relevant signal in playful interaction as well.

Some of the previous research on justifying interaction does not look too promising. Learning about common interests i.e.

receiving tickets-to-talk was found to have its limitations in resulting in face-to-face interaction [9]. And, as the research on the shape-changing bench shows [12], the surprise of that kind of an intervention may easily spark conversation, but the challenge is to make it somehow meaningful and not just stay on the level of mutually acknowledging that something weird just happened. But what would happen, if some interesting rules and rewards were combined with providing tickets-to-talk? Or what would the verdict be if the aim of the shape-changing bench was only to make people exchange smiles with each other? More research is needed to understand the meaningfulness of interacting on different levels, as well as to understand what kind of combinations of roles successful systems should have.

One relevant question is whether we really need interactive technology to encourage interaction between nearby strangers. All of the roles for a system encouraging interaction except *prepare for encounter* and *connect* can be implemented without technology, and the system does not have to perform all roles, so the answer is *probably not*. However, technology can be built to support the process all the way from supporting automatic exchanges between nearby strangers to getting people who share the interest to play with strangers together to interact on different levels. Technology can announce and enforce rules that lower the threshold to interact by defining what is expected from people and how they are supposed to behave during encounters.

Regarding methodology, we argue that the choice of method and participants was particularly fruitful to outline the design space in a human-centric way. The process resulted in a good number of desirable futures (even *utopian*) that could serve as design targets, and these allowed detailed bottom-up analysis to theorize the area. One concern of ours was that the applications used to sensitize participants to the topic might affect the ideation to a great extent. On the contrary, the resulted ideas presented a wider range of design possibilities in every sense. Another concern was related to researchers taking part in the design process in every session instead of taking a role of an objective observer. We felt that, instead, it allowed us to build on top of what was discussed in earlier workshops, and that our role consisted of facilitating and moderating the ideation session. In such a role it was possible to give room for our partners to speak and ideate rather than us or specific other participants dominating the discussion. Overall, based on the amount and variety of ideas we argue that using dialogue-labs as a method and design researchers and students as participants was a good choice for exploring a design space that the participants have experience of. Nevertheless, as the ideas tended to be described only partially, we could have arranged additional sessions to expand and elaborate the most promising ones or merge some of them.

7. CONCLUSIONS

We reported the co-design of playful interactions between nearby strangers. Our three design workshops produced 60 ideas. The analysis of the ideas revealed different levels on which the interaction can happen, different roles for systems encouraging interaction between nearby strangers, and different ways of handling privacy in this setting. This knowledge can be used for designing new service concepts for interaction between nearby strangers. Our work explored the research field of nearby strangers in a new way theorizing it and pointing out to relevant future research questions.

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