

IMPACT OF CONNECTED OBJECTS ON SOCIAL ENCOUNTERS

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ABSTRACT

This study focuses on how connected objects could influence social encounters in a mingling event.

Therefore a user study was conducted with Pop Glass; an interactive glass that uses coloured lights to reveal and shape social relations. 29 students participated in a staged mingling event where they were asked to use this object. Two analyses were done; one interaction analysis with an ethnomethodological perspective and one quantitative analysis that was based on annotations of the groups in space and gathered proximity data. The former revealed that even if the lights were off, the glass was used as a topic of talk, ‘toasting device’ and boundary object, making relevant a social past. With the lights on Pop Glass proved to be a talkable, a ‘super networker’ and it triggered a collective sense making process about the experiment itself. The quantitative analysis showed that glass’ lights motivated people to switch groups and act in bigger groups. This verified that in search for meaning people tend to mingle more, which on itself is an interesting starting point for design implications.

INTRODUCTION

Almost every mundane activity in which we engage during the day (e.g., walking, running, meeting other people etc.) leaves a trace in the form of data that can be collected, measured and shared as input to shape individual and social interactions. This data can be referred to as ‘activity traces’ (Dong 2014). The number of connected products that make use of activity traces is growing. Due to their interconnectedness, these products have the possibility to collect and share this kind of information. Therefore they serve all kinds of purposes. Current developments in information technology are creating opportunities for a new generation of connected objects, integrated intimately into the everyday fabric of our lives. Supporting ‘social sensing’—that is, the ability to be aware of someone else’s activity in a social context—is a nascent application domain and research area. These objects have the potential to be socially meaningful by the information they carry out. This study explores the influence of such an object and how it could shape and impact social encounters.

The impact of connected objects on social practices has not been studied extensively. Several studies state that an object’s meaning only arises by how it is used (Brewer 2007, Weilenmann et al. 2014). Brewer (2007) observed this in a study about connected objects that were used as stimuli for social cohesion. She concluded that equally distributed twigs of jasmine blossom in a company could serve the same purpose as long as people used them as such. This verifies that an artefact will only be interpreted as a social object if it is used or perceived in that way. To say that an artefact figures as a social object means that in and through their practical use in interaction, social relations may be constituted and maintained.

Over the years researchers have been proposing different approaches to design for intelligible products

that cue specific behaviour. Norman (2008) mentions that including 'social signifiers' in design—that are the perceivable parts of an affordance— can guide people towards social actions. In addition to that Hornecker (2005) addresses the theme 'embodied facilitation' in her framework on designing for tangible interactions. Embodied facilitation focuses on steering user behaviour by limiting and guiding their actions. To do so she proposes the concepts of embodied constraints, multiple access points and tailored representations. Horn's theory (2013) builds on these ideas and emphasizes the value of designing for cultural forms, which are existing patterns of social activity.

Pop Glass is an example of how connected objects could potentially influence social interactions in a mingling event. This glass vessel visualizes social activity traces in a crowd by giving people who clink their glasses the same coloured light. Every new social engagement preceded by a clink will create a new coloured group. This could give attendants the possibility to sense the social structure in space and guide them towards a more relevant conversation. Besides that, in order to change their colour they have to clink with other coloured glasses. This could give users a trigger to get out of their comfort zones and approach others.

Pop Glass' embodiment in an otherwise mundane artefact seems to address social practices that have been established culturally. In that perspective if users recognize the object as an ordinary drinking vessel it is a social object already. Therefore a focus lies on finding out how Pop Glass' extraordinary features affect the social behaviour of the crowd and in what way it adds meaning to the experience. In other words it will be about how people use this artefact; if they will use the lights to reveal and shape social relations or if it is only about the glasses themselves. The aim here was to retrieve insights for further research and implications to design for social encounters.

APPROACH

This study uses data collected at a user study with Pop Glass. A group of 29 industrial design students participated in a staged mingling event. Most attendants knew each other on forehand. In exchange for their time they received free drinks during the event. In this experiment the colours of the glasses were programmed to change randomly with an ever-changing time intervals. However the participant's task was to enjoy himself or herself while having a drink with a 'Smart Glass', which suggested it to be an intelligent object. Our intention here was to find out how they would give meaning to an evolving structure of colours and how they would use it in interpersonal communication. Some participants were familiar with the initial concept of Pop Glass. The recordings contained both networking behaviour while the Pop Glass' interactive functionality and lights are switched off, and later while its full functionality is enabled.

INTERACTION ANALYSIS

The experiment was video recorded. Microphones recorded speech and a personal body worn sensor measured acceleration and proximity for every participant. In addition Pop Glass held track of acceleration of the glass itself. All participants were asked to fill in a questionnaire before and after the event. Afterwards 10 students were interviewed following a semi-structured approach. Based on this data two analyses were done. First, an interaction analysis was conducted based on the analysis of video footage and microphone recordings. Second, a quantitative analysis was done that studied annotations of the event and data collected by the sensors.

Methodological background

Interaction analysis in this study is pursued from within the tradition of Ethnomethodology whose objects of inquiry are the 'ethnomethods' of social life, or the methods through which people create a sense of the social world as patterned and factual.

Ethnomethodology studies generally include a variety of methods of inquiry; ethnomethodological ethnography (eg. Weider 1974), conversation analysis (eg. Psathas 1995), self-observation (eg. Rodriguez and Ryave 2002) and membership categorisation analysis (eg. Hester & Eglin 1997). The present study uses conversation analysis as an analytic technique for demonstrating the sequential orderliness of and demonstrable sense-making in talk-in-interaction. Our focus on 'pop glass' relies additionally on recent developments within conversation analysis which have brought to bear the the wealth of semiotic resources in interaction other than language (eg. Day & Wagner 2014; Goodwin, LeBaron & Streeck 2011).

Within studies of design, ethnomethodology was influential in the pioneering work at Xerox's Palo Alto Research Center by Lucy Suchman and her colleagues. (see for example Suchman, 1987). To a great extent, Ethnomethodology's influence in design in these early days dealt with what Garfinkel (2002) has called the 'shop floor problem', encouraging us to notice the systematic and mundane orderliness of any setting for its own sake, rather than merely scanning that setting for evidence for theorizing, or 'formal analysis'. Dourish & Button have been influential in encouraging ethnomethodological insights into the role of ethnography in design (eg. Dourish & Button 1998), while Andy Crabtree has argued for

'the constructive involvement of ethnomethodology in processes of innovation in design, the results of which may subsequently be subject to the rationalities and constraints of product development.' (Crabtree 2002:1)

Our ambition here lies closer to Crabtree's 'constructive involvement such that the analyses below are meant to be part and parcel of an on-going, iterative design process.

The activity and its recognisability

As noted above our data consist of a staged mingling

event. Although participants were not instructed to mingle, the event was self-organized as such by them. Mingling as a communicative event, though very common, has not been extensively studied as such. There is however a research core found in the work of scholars such as Erving Goffman, Adam Kendon and Harvey Sacks which informs most work on how people manage to initiate and maintain, both physically and socially, what Kendon (1990) has termed 'focused encounters'. Mingling then is a form of focused encounter which from a social and communicative perspective can be intuitively characterized in the following way:

- 1) Mingling is normatively about creating relatively informal speaking engagements with people we don't know, or don't know very well such that some sort of initial contact with others is accomplished. These engagements are made easier through mingling.
- 2) It follows from 1) that just going up to someone, briefly introducing yourself and beginning to talk about something is OK in this situation.
- 3) What to talk about is not straightforward as there is no pre-ordained topic, however, one can always try gambits such as 'have you ever been here before', 'what about this the weather' and so forth.
- 4) Being informal and somewhat superficial, entering and leaving engagements is easier than, for example, coming late to or leaving a lecture early.

In the analyses below we focus on the role of the Pop Glass in such encounters while at the same time indirectly demonstrating some grounds for our intuitions regarding mingling.

QUANTITATIVE ANALYSIS

In the quantitative analysis we will focus on interpreting data collected by the proximity sensor and an annotation of F-formation of the event. The proximity sensor registers how many people are in front of the wearer in a range from 2 till 3 meters. It does not measure the distance. It only tells whether persons are in or out of range. Next to that F-formations in space were annotated to create a clear view on how social encounters evolve over time. The term F-formations is referring to when two or more people share a spatial and orientational relationship (Kendon, 1990). This does not necessarily mean they talk, but they are socially engaged on a very minimal level. The annotations of the event were made with a 30 second window. After reviewing the footage from the top view cameras this interval seemed appropriate to capture most of the interactions over time. Every 30 seconds a still was taken from the video and this image was analysed. People that interacted with each other without forming an F-formation were not taken into account in the annotation.

RESULTS

INTERACTION ANALYSIS

We demonstrate here 3 very basic ways in which the glasses figure as social objects in the gathering; as a topic of talk, as a 'toasting device' and as a boundary object (Star & Griesemer 1989) making relevant a social past. We hope to demonstrate more generally below that the glasses were used interpersonally to strengthen social relations.

First, in what are the most common phenomena in our data, the glass is a topic of conversation. As noted above, one bit of work for co-participants in a mingle is to engage in talk and to do so necessitates initiating a topic for that talk. The glasses achieve this status by way of having noticeable features beyond their use as a drinking vessel. In the excerpt below, you will see first that the glasses are used to toast by tapping them together.



Figure 1: Excerpt 1, glasses are used to toast

```
[comm: p15 & P9 glasses tapped together
[
1. P9:  cheers
2. P15:  it sounds like glass
[
[comm: glasses tapped together again
3. P9:   did you see it already↑
```

Excerpt 1¹

We will return to this later but here it suffices to say that toasting with glasses intuitively does something social. After the toast, participant 15 (Line 2) offers an assessment (Pomerantz 1984) that they 'sound like glass' which queues us to something out of the ordinary about the glasses, minimally that they aren't necessarily what they seem. This is confirmed by participant 9 in his response (Line 3): 'Did you see it already',

¹ Transcription notation based on Jefferson (2004): '[' overlap onset, '(.)' micropause (under .1 second), '(1)' pause in seconds, 'comm' comment with '[' indicating onset, '↑' rising intonation, '↓' falling intonation, '=' latching (fast speaker change), ':' elongation of sound

suggesting that there is indeed something historically special about the glasses. We know from our post-event questionnaire that P9 does know of a previous experiment with the glasses.

The glasses are now then the topic of conversation. That the glasses have a history which is relevant to the current business - as an explication of their noticeable features - demonstrates that the glasses are a sort of boundary object such that their relevance in a former activity has relevance here. And, we will see below that that relevancy has to do with the glasses being used to establish social relations in the previous activity.

4. P15: no↓ (.) what is the
[
5. P9: it was an ITD project like two were
ITD do you now ITD the course=
6. P15: =oh wait (.) did samuel uh yea:: OK
7. P9: it is that project and XX I think he's
graduating I' not sure what he's doing now
with
8. P15: what is what is like the function (.) what is the
purpose of this like what does it (.) track
[
9. P9: yea (.) 2
years ago (.) it was like there was a light in it↑ (.) and if
you cheers cheered
[
[comm: attempt then success in tapping glasses together
then the same light would go on

Excerpt 1: continued

Participant 9 offers an historical account of the glasses (Lines 5, 7 & 9), where they come from and how they were used. There was a light in them and when one toasted, the lights of the two glasses turned on. We can readily hear as well as see through the demonstrative tapping of the glasses, that the glasses historically were used as toasting devices, which did something extra - they lit up. That people toast by clicking their glasses is of course already indicative of a particular social relation, ie. a 'toaster-toaster' relation if nothing else. The lighting of the glass, in addition to the actual sound of glass tapping, makes this all the more salient through an enhancement of the semiotic field at hand.

We turn again to the toast, the tapping together of glasses, to explore how this seemingly simple act gains quite some social complexity when paired with the special glasses of our data. In Excerpt 1 above, the first toast, carried out after P15 had brought himself and P9 a drink in the glass, initiated topical talk about the glass and the toast itself, the tapping of the glasses, was seen as establishing some sort a social relation between P15 and P9. Now, toasting with more mundane glasses than ours occurs quite regularly at festive occasions and the purpose of a toast is often to constitute some sort of celebratory act directed toward one or more of the toasters, 'here's to your health, good fortune, new job, our victory etc.' This sort of toasting does not appear in our data, rather our toasting are clearly artefact

induced. A most obvious example of this 'non-celebratory' toasting can be seen below.

1. P9: analyze it all (1) and now I have to uhh::
[[]
[comm: P16 has moved behind P9, stops between P9 & P15
and clicks P15's glass, then P9's
and now I have to
comm: ca. 1 minute deleted segment where P15 & P9
continue talking
2. P9: should be something really:
3. P15: ok and then you're done
(2)
4. P9: no and then I have I have to make a prototype
5. P15: ahh ok (1) a really expensive prototype
6. P9: yea
7. P15: you have to choose the idea thats the most
expensive right
8. P16: you gotta make ...

Excerpt 2



Figure 2: Excerpt 2, Non-celebratory toasting

As can be seen and heard, P15 and P9 are engaged in conversation when P16 positions himself between them and initiates a toast. This is done almost perfunctorily - there's no hesitation and it is quickly accomplished. And, nothing is said. P16 then stands silently while P9 and P15 continue their conversation. At line 7, there is what is known as a turn-transition-relevance-point (Sacks et. al 1974)- where semiotic resources are so aligned as to allow a change of speaker. P16 takes this opportunity and engages in the on-going conversation.

From this brief stretch of interaction we conjecture that the glass and its use in toasting is seemingly stripped of its celebratory propensity and instead used as a means for the participants to establish that P16 is part of the on-going engagement. His initiation of the toast and the responses it receives ratifies this positioning of him as an available conversant. The successful toasting establishes these three as a group mutually committed to social engagement and thereby upholding a set of social relations amongst them.

Of course, any glass could do in this scenario. Moreover, none of the glasses here are lit up. What is perhaps unusual though is that what the action accomplished does not seem to be something one

normally accomplishes with a toast. We witness this particular use of the toast throughout our data - one-way to enter into a mingle engagement is to begin with a toast. To the best of our knowledge, this is a not a customary purpose to which toasting is put. We believe, however, what, for this activity, seems to be a very conventional practice has arisen because of the special properties of the glass as a boundary object with a special history. Recall the history of Pop Glass - in a previous experiment it lit up in particular ways when used in a toast such that those toasting shared a colour, and recall also that this history, as shown in excerpt 1, was oriented to by mingle participants who either knew of it or even had experienced it themselves. Thus, toasting as a predecessor to engagement has a precedent, and this is carried over into the new experiment. This particular sort of glass has an historical trail which when followed by participants gives rise to a new practice for creating and maintaining legitimate co-participation in an engagement and the social relations it engenders.

Making sense of the event

Another understanding of the toast and its historical precedent is its usefulness in an overriding sense making of the event by participants - why are we here with these strange glasses? What's the catch? Participants are fully aware they are part of an experiment, although the activity as such comes off as a sort of common mingle activity.



Figure 4: Excerpt 3,

1. P3: whuuu
(1)
2. P6: the cola makes it look weird
[
3. P3: yea
oh ni::ce
[
comm: P6 & P3 tap their glasses, P6 then turns to his right and toasts with another person. P25 moves closer to P3

Excerpt 3



Figure 3: Excerpt 3,

4. P25: [cheers
comm: P25 & P3 tap their glasses
(1)
5. P3: huuhuhuh
6. P25: no it doesn't work (.) it doesn't work yet
7. P3: but we're already blue maybe
comm: P6 & P3 tap their glasses, immediately afterwards P3's glass turns red
so then we have to
8. P25: oh well
9. P3: say cheers oh and if you do this
comm: P3 moves glass away from and towards her body 3 times
10. P25: I have no clue
comm: P3's glass now changes back to blue
have no clue what it's supposed to do

Excerpt 3 continued

In this excerpt there are two distinctly different ways of tapping glasses together where two tappings are proper toasts, the one at the beginning of the excerpt and at line 4. The other tapping occasions tests to see what will happen with the glass if one were to toast. Moreover, this 'test tapping' can create social relations, however of a different sort from the toast proper.

As noted, the first tapping is a toast proper between P6 and P3. At line 2 P6 topicalizes the glass by assessing his glass as looking weird because it's filled with cola, though it is lit with the same blue light as P3's. P3 concurs with his assessment at line 3 and offers her own assessment that it looks nice. Another tapping of their glasses overlaps her assessment. P6 then turns to tap the glass of someone to his right, as if he had expected something to happen with his glass when tapping P3's. Like P9 in excerpt one, P6 has said in our post-event interview that he knew of the previous experiment with the glasses. After tapping his glass with the other person, the glass does not change colour. Thereafter, he stares at his glass for a moment and then joins his new group in conversation. Neither of P6's glass tappings seem to be toasts. They both seem to be test tappings. In the first instance the test tapping seemingly enables his dis-engagement with P3 - the tap failing to change the colour of the glass - and motivates his moving to the group behind him and test tapping again. This tapping

seems to fail as well, but P6 opts to follow the test tapping with engagement with this new group, in spite of it not being a toast proper.

Noteworthy here is that test tapping can enable engagements just as toasts, and also dis-engagements. On this last point, recall that a characteristic of mingling is easily moving in and out of engagements. Vis a vis proper toasts test tapping may seem contradictory since they enable dis-engagement, however, not if we can understand test tapping as a way to make sense of the event as such. Test tapping is about finding out what makes the glasses light up and whether one can change the colour of a lit glass by tapping. In this way, one can make sense of why a glass might light up, i.e. by tapping it with another glass, and the significance of the colour of the light, for example if one's glass lights with the same colour as one's tapping partner or, if already lit, changes to that colour. Sorting out these two phenomena, what lights the glass and what is the significance of its colour would go a long way toward a candidate understanding of why they are doing the mingle.

That test tapping has to do with sense-making generally is further motivated in lines 4-10 in excerpt 3. Here, after the engagement initial proper toast at line 4, the glass is again topicalized, this time by P25 at line 6 where he notes the glass does not work. But what does this mean - what is not working about the glass? Although we know that P25 & P3 report later that they know of the previous experiment with the glasses, we can not know this is what they may be orienting to until they, following line 6, go on to some test tapping. P3's glass does change colour, contrary to her accounts at lines 7 & 9 that one must do a 'say cheers', i.e. tap the glasses, or move them in a certain way. P25 then seemingly gives up at line 10, noting he has 'no clue what they're supposed to do'. Whatever is not working about the glasses, and by extension what the event is all about, is not resolved but, importantly, social engagement is achieved.

To sum up, close interaction analysis reveals participant orientation to three 'mingling guises' of the glasses, which help accomplish mingling as a social activity. First, it is a 'talkable', a readily available topic for talk and thus engagement between at least two people. It is also a 'super networker'. As an artefact with exceptional properties, together with the practice of tapping other's glasses, it makes possible more engagements than would otherwise be the case, for example quick dis- and re-engagement simply to test tap. Finally, there is its role in solving the 'experiment puzzle'. It's physical properties and social past enhance engagement through social convention, eg. various types of tapping, and allows for real-time investigation of what the experiment is all about. Participants seek an account of why the glasses are lighting up and what their lighted colour might have for significance, which, in turn, will provide an account of event as such. The glass, to put it simply, has a very handy design for mingling.

QUANTITATIVE ANALYSIS

Our aim was to get insights on how groups evolve over time and how the lights of the glasses have an effect on the crowd. To do so the annotated f-formations were mapped over time; see Figure 5. This graph presents the amount of groups and their size over time. Individuals in this graph are participants who do not form an f-formation at that point in time. The lights in the Pop Glasses started to go on at the 12-minute interval and all the glasses were on at 21 minutes.

As can be seen in Figure 5 groups with a larger number of people seem to arise briefly after the first Pop Glass goes on. From that time on until the 27 minute mark three peaks of large groups evolve: 14 minutes (two groups of 7-9 people), minute 18 (three groups of 5-6 people) and minute 20 (two groups of 7-9 people). After these peaks the amount of groups per size seems to stay equal until the 41th minute. The video revealed that a group of six people split up in three groups of two.

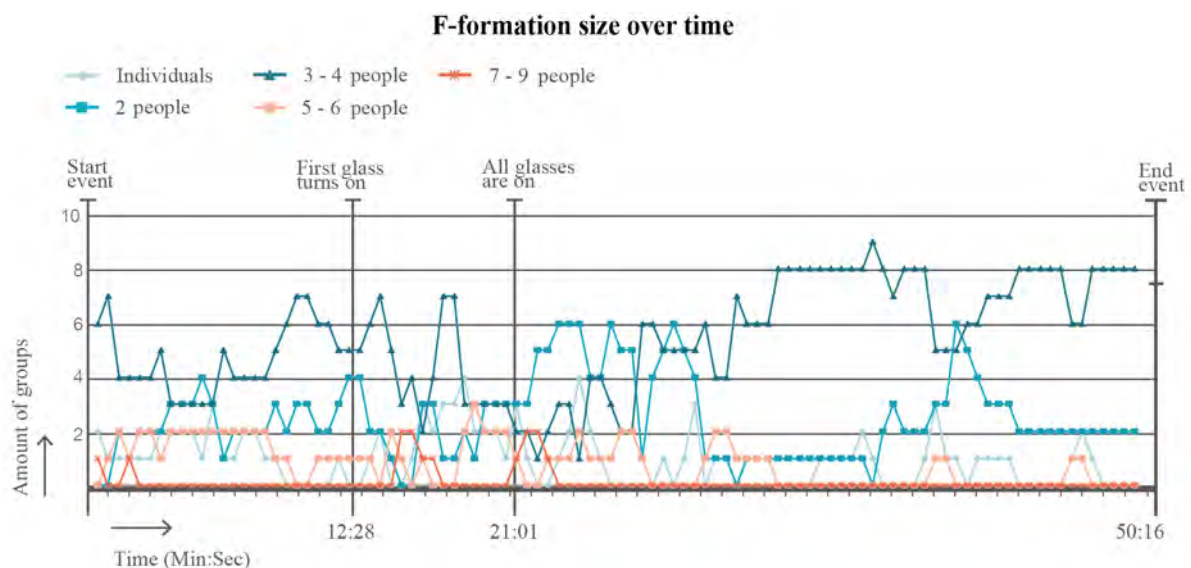


Figure 5: F-formation amounts per size over time

Cumulative probability neighborhood size

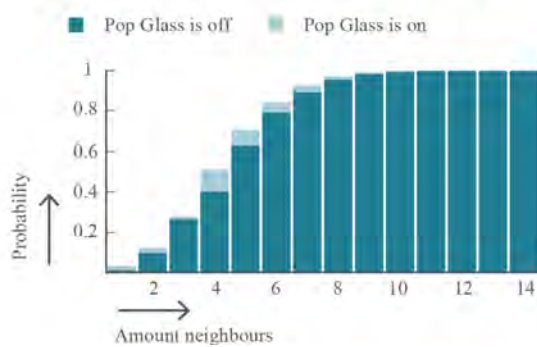


Figure 6: Cumulative probability of neighbourhood size after

People that switch groups in one interval over time

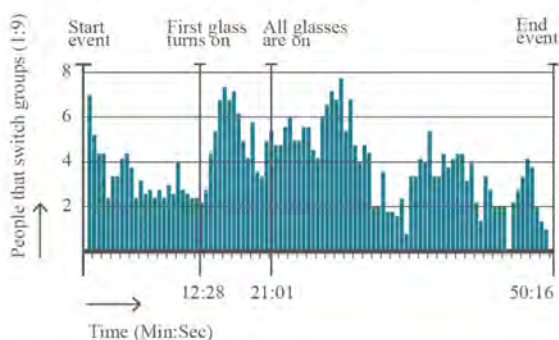


Figure 7: Amount of participants changing groups over time in an average of 9 intervals

Additionally the proximity data from the worn sensors was analysed. Readings from 20 minutes before and after the glasses went on, were compared. The people that the proximity data registers are called neighbours. A total of people in one reading are called a neighbourhood. These neighbourhoods were computed with a sliding window of 3 seconds. A cumulative probability distribution of neighbourhood sizes was plot before and after the lights were on. In the outcomes we can see a difference in the probability to have a higher number of neighbours. When the Pop Glasses were on the probability to have more neighbours is slightly higher; see Figure 6.

Switching groups

We used the annotations of f-formations over time to calculate the amount of people that switched groups over time. Every person that talked to new people after one interval of 30 seconds was taken into account. Figure 7 shows the average of group switches that happened in 2 minutes around 1 interval (average of 9 intervals). This creates a clear picture on changes over time. Figure 7 shows that there are more group switches between the 13th and the 29th minute in comparison to periods before or after. There is also a peak in the beginning of the event.

DISCUSSION

The extraordinary behaviour of the glass seems to affect the way people use the glass and also how they mingle. The glasses have proved to be a topic of talk, a ‘toasting device’ and a boundary object even without the interactive lights inside the glass being on. We noticed that these functionalities do not only arise because of Pop Glass’ embodiment in an ordinary glass. Probably its history as a previously interactive object or the idea of interacting with a ‘smart’ system impacts how people perceive and act with these objects.

When the Pop Glass turned on, new interactions seem to occur. When finding meaning behind the ever-changing lights, Pop Glass was a perfect ‘talkable’ for the participants. Besides, it did evoke people to tap their glasses with others, which seemed the key to make quick dis- or re-engagements. They both played a role in solving the ‘experiment puzzle’ to answer the reason for their participation. Part of this ‘puzzle’ evokes a quest to find meaning in the product itself. This experiment would have had two instigators; one about why and how the lights in the glasses turn on and a second about why the glasses show and switch colours. In both scenarios the act of making sense seemed to draw people into interacting with others. Therefore this can be seen as a successful mingling activity.

When comparing the outcomes of the interaction with the quantitative analysis we seem to find results that verify our previous story. The participants will most likely have tried to get an understanding about the glass throughout the event. However, their mingling activity only seems to be impacted by sense making when the first glasses turns on. The quantitative results indicate that as soon as some of the glasses light people have the tendency to switch groups, see Figure 7. This could be accounted to their urge to understand why they are there and to see if their action could affect the glass. Next to that participants seem to interact in larger groups while doing so. The only time when similar size formations occur is in the very beginning of the experiment. The amount of people that switch groups also has a peak in those intervals. It can be postulated that these outcomes have similar groundings, but a follow up study should point that out.

Another interesting outcome from the quantitative data is that the effect of the glasses on people’s mingling activity seems limited. It takes about 20 minutes after the first light goes on until the amount of people switching groups or the amount of large groups stagnates. People seem to have found an acceptable answer to their questions.

Explicit implications for design cannot be determined after having reviewed both analyses. Nevertheless outcomes from this study do imply some interesting directions in the field of giving meaning and mingling. The process of making sense of an artefact, seems to affect social encounters provided that the object is expected to be responsive to interaction with others.

When designing for social activity guiding people in a sense making process could be beneficial. Nevertheless its effects seem limited. In this case maintaining interest while keeping the user questioning a product's functionality seems quintessential, yet paradoxical. However, finding a balance between making sense and not making sense might just do as a design challenge.

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