Ideation of IoT services with citizen: coupling GenIoT and AloHa! methods

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Abstract

This paper introduces a methodology for designing service concepts in the specific paradigm of the Internet of Things (IoT). In the frame of the European project ELLIOT - Experiential Living Lab for Internet Of Things -, the Living Lab ICT Usage Lab aims at co-creating "green" services, i.e. services based on air quality and noise measurement. These services are invented in an open innovation setting, by a set of stakeholders and not a given service provider. In this context, the ideation methodology has two main requirements: to design services deeply rooted in people routines but impacting people lifestyle and to design services potentially embedded in the Internet of Things.

The novelty of the methodology lies in the coupling of two ad-hoc methods: 1) GenIoT, a method articulated around a generative technique where "designers" are asked to place probes (fake sensors and/or actuators) in their daily environment, i.e. the target service area, and to report on it to the group, and 2) AloHa!, a bodystorming method enabling "designers" to play not only characters but also intelligent objects in order to co-create service scenarios. After a description of these complementary methods, we provide the first results on the application of this methodology.

KEYWORDS: ideation, living lab, internet of things, bodystorming, generative technique, probes, green services, idea generation, co-creation

Introduction

Internet of Things (IoT) is supposed to be a physical world where everyday objects, rooms and machines are connected to one another and to the larger digital world. In this web of people and objects, individuals as well as things will have their own unique URL and, according to interactions between all these entities, social networks will be articulated with a ring of connected objects. This mash up of "hyper groups" and "hyper objects" will be the next step towards a deeper level of automation in which the user interface has vanished, the explicit control over the world is no longer the rule and where the users will have to understand the dynamic changes of their environment in relation to their social interactions and to their physical behaviours.

The design of IoT based services therefore raises many challenges related to the user experience and requires a deep understanding of users' needs in their real life environment as well as many field experiments; this is why the Living Lab approach appears as the qualification device which has been lacking so far.

Air quality and noise are environmental parameters that do impact people's lives. "Green services" aim at changing citizen behaviours so that they improve the quality of life both in public and private settings (for instance by modifying their transportation patterns or adapt their sport-related behaviour). Citizen, but also city representatives, artists, medical, childcare, transportation, computer and entrepreneurship professionals from the Living Lab ICT Usage Lab are invited to participate to the co-creation of new "green services", from the ideation to the service evaluation steps.

The variety in the stakeholders profiles calls for the implementation of a range of facilitation techniques in order to satisfy many cognitive and behavioural styles and get the most out of the creative group.

The overall ICT Usage lab process for services co-creation includes service exploration, service concept development, service experimentation and service evaluation, all four activities being concurrently run .

The ideation of IoT based "green services" led us to provide specific solutions to deal with three main challenges.

1.When dealing with IoT based services, the objective is not to impose a given technology to support the service but rather to free designers from any fixation bias related to existing services or technology and let them open and willing to consider the Internet of Things paradigm. As a consequence the method for the service concept development has to enable designers to reconsider objects and daily context with a new viewpoint and foresee new affordances.

2.With the concern of the viability of the service and its "green" aspect, the objective of the service is to raise level of awareness (from perception of the air quality level, to understanding of the impact of the air quality in human behaviour) and insure that multiple viewpoints are represented (included business dimensions), hence the adoption of diary and role play techniques.

3.Considering the customer/user experience of the service concept, the objective is to build a service concept from grounded data and use a generative technique, to emphasis on co-creation, and enact the service in order to reach the stage of identification of citizen touchpoints.

The coupling of GenIot and AloHa! methods appears to be an answer to such challenges, even if both methods are still in their infancy and still need to be fine-tuned and complemented.

The ideation methodology we propose for generating IoT services with stakeholders starts by an exploration step where all stakeholders –called below "designers" be they citizen, or representative of an institution or enterprise- are exposed to relevant services and technologies (identified from a benchmarking study) and may report individually or collectively on their experience as a user or from any other viewpoint. This objective of this first[1] exploration step is to start the inspiration process and frame the questions to be addressed (namely the relation to air quality, noise pollution).

The next steps take the designers on a journey from individual introspection –required by GenIoT- to semipublic acting, as per AloHa! , via online idea scaffolding. The idea behind this coupling of both methods is to provide designers with multiple supports and experiences in order to maximize the creativity of the group, but also to approach the Internet of Things along the three experiential dimensions: *say*, *make* and *do*.

After these idea generation steps, leading to several divergent ideas, the third step, based on classical face to face sessions, allows the emergence of top ideas that can be refined, combined and elaborated in order to describe a first service concept.
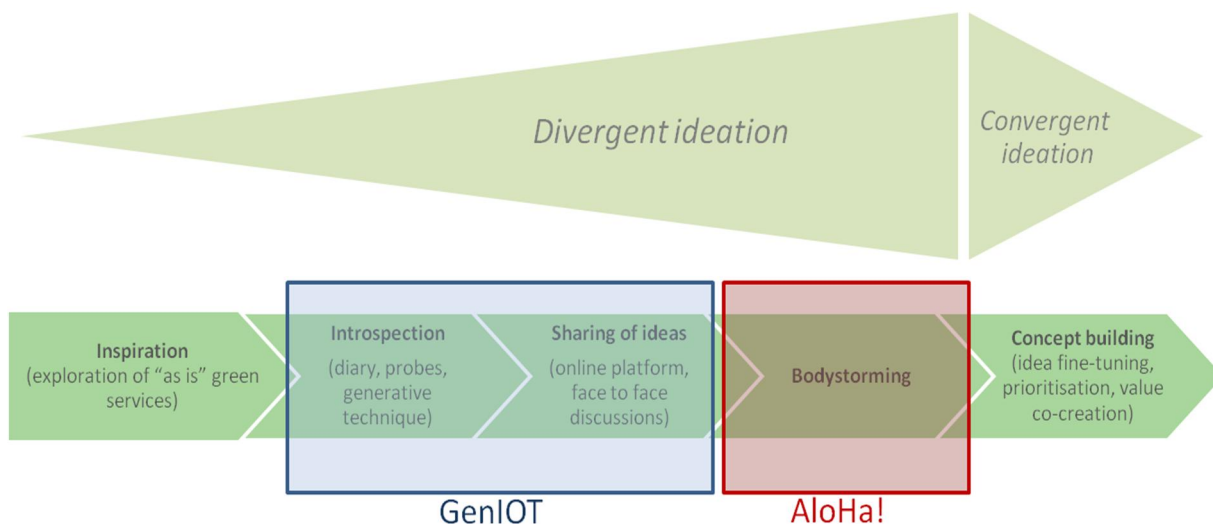

Figure 1   GenIoT   and   AloHa!   within   the   ideation and initial concept development methodology

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[1] More exploration steps will be run for instance during the concept prototyping phase

In this paper, we focus on both GenIoT and AloHa! Methods as parts of the ideation and concept generation shown in Figure 1. We present both methods (procedures, tool kit, expected benefits and challenges) and report on the first results from applying and coupling these methods.

Feedback illustrated is based on a first analysis covering verbal protocol analysis of the transcripts of the workshops (9hours), video analysis (body language analysis), statistical analysis of the content created by the participants in the online tool.

GenIoT

GenIoT provides designers the opportunity to express themselves both via the *say* and *make* dimensions. Indeed, in order to help designers in the ideation process and obtain grassroots findings, the ICT Usage Lab researchers build on the tradition of cultural probes as initiated by Galver et al. (1999) and combine a participatory place-based sensing exercise inspired from Kusnetsov et al. (2010) with a diary exercise and the use of a collaborative idea management tool (Ideastream from http://www.gi2mo.org/).

Designers are provided with a toolkit (cf. Figure 2) and required to place sensor probes in their daily environment, to take a picture of the probe(s) and share it with the group. Sensor probes are cubic silicon magnets.

Figure 2   GenIoT toolkit

Duration of the exercice is between 1 and 2 weeks, so that weekly patterns are captured. Designers are also asked to daily record their feedback on the exercise on a paper template (hence the calendar-like form glued on the envelope used for carrying the material). Depending on participants' attitude and practice, pictures can be either posted online to the group (with or without comment) or they can be kept and shared after the exercise during a synchronous face to face meeting.

Toolkits provided to the designers contain fake sensors and paper-based material that could be used to represent actuators (hence the paper "post it" that can be used to describe an action performed). The idea behind the choice of the toolkit is that ambiguity and visual stimuli are the basis for fostering creativity.

The envelope also contains a log in and password as well as instructions on how to post, comment or vote on the collaborative platform.

Expected benefits of GenIoT

This method falls in what Sanders (2000) defines as a generative one and is used, in its application to the ELLIOT green services use case, to force the designers to think about their intimate relation to noise and air quality level, report indirectly about their own life and start the service ideation.

More generally, GenIoT could be used to document the needs, practices and contexts (instantiation of the triad (anywhere, anytime, anything) that IoT could support) in cases where the IoT service relates to a pervasive topic such as energy (eg. electricity), ressource (e.g. water) etc.

Please note that this sensor placing exercise does not inform on the technical feasibility or best position for sensors but express the interest in gathering data in a given area and communication of this data.

Increased awareness about IoT potential applications as well as awareness of air quality and ambient noise was indeed the most reported effect of the method during the genIOT open debriefing sessions *(« Since the first workshop, we are keeping on thinking about it, we pay attention around us.» «When I was walking, I always had a part of my brain thinking: "ah, we could place a sensor here, it would be nice to do this and that" »).*

Another expected effect of this method is related to its public and social aspect: GenIOT could open up the circle of designers and wider the co-creation. It is indeed expected that designers do not only talk about their "homework" to their relatives and/or colleagues but also to their neighbours or any stranger met in the spot where they place the sensors, thereby giving birth to new ideas and acting as a vector increasing the awareness on the application and impact of IoT.

This second advantage was as well reported during the GenIOT debriefing as designers took the opportunity to discuss about air quality and potential actions during family lunches and in the public transportation (*"There was a group of young people looking at me in the tramway; I explained them what I was doing and really enjoyed this discussion with them; they looked surprised", "I discussed about it with my wife and kids over lunch and we went on a brainstorming session").*

Challenges of GenIoT

One of the challenges of GenIoT relates to the engagement in the game. Staying active in producing pictures and willing to share them with other designers requires an continuous commitment that may be difficult to get from all participants. Indeed once designers have been introduced to the rules and given the toolkit, the facilitator has only indirect means to get the designers to do their homework.

During the ELLIOT sessions, while individual participation was satisfying, collective engagement was only partially achieved: the regular emails reminders sent to the group failed to maintain a high picture production/posting and online discussion, as developed below in the experience of the online group process.

The idea management tool could be used for a continuous community management to create and maintain interest in the experiment: designers expressed that they would have appreciated a daily digest of the publication.

Furthermore a good level of trust within the group of designers is required as pictures may relate to intimate settings and self disclosure difficult for some participants.

Designers handled this challenge in a pragmatic way: indeed they framed their pictures in a way that they did not share their intimacy (cf Figure 3 below) .

Figure 3   Fake   sensor   monitoring   the   air   composition   near   a   candle and changing colour if needed.

Feedback on the GenIOT method

Although a test of the method (with 12 participants) was performed in order to set up the documents, tools and process, we report hereafter insight gathered during a 12 days running of GenIOT involving 11 "designers" –both citizen and local authority actors-.We qualify the attitude and experience of the designers during both the individual and collective ideation, give an overview of the production and instill elements for fine-tuning the method.

Attitude towards the method

Presentation of the method occurred after exploration of IoT and green services concepts and examples. Attitude towards the method was globally positive. Designers were told that even if –for most of them- they were not experts neither in IoT nor in air quality, they were experts of their own life and daily activities. Only a few participants were surprised and needed to be reinsured not only about the liberty and degree of creativity they could express within the boundaries of ELLIOT green services topics but also about the main priority that was to identify a problem/need area and not always the solution.

Presentation of the GenIOT rules was guided by the participants, as they were discovering the tool kit. Most of the participants handled the silicon cubes while reading at the color code explaining that each fake sensor were referring to an air or noise measurement. As a consequence, most participants immediately associated GenIOT as a method for helping in visualizing polluted area (*"It is like having glasses that allow you to see the pollution"*). This interpretation of the method made it easy and fun for them to project themselves while placing the fake sensors (*"When I am in a meeting with my boss", "when go walking on the beach"*).

They also immediately foresee the social impact of public placement and were interested in raising awareness on air quality just by placing a silicon in a public place (*"imagine the walking men asking"hey, what are you doing with your cubes?"*). Some even talked about using the cubes to protest or complain about people responsible for pollution (*" We can put them on the four-wheels drives"*).

Potential practical hurdles for placing the probes were as well identified from the presentation of the method (*"what if I go for a run on the beach?", "what if I can't hang it?"*). Some even asked for technical questions (*"what is the sampling frequency of the sensor?")*, showing that they were already mentally projecting themselves while doing the exercise.

Participants also realised that the method requires a constant effort in introspection and analysis of the situation and some expressed concerns about their fear of not finding either the time (*"do we have to do it every day?"*) to play or enough ideas. Many spontaneously asked for the permission to share with their partners, family members the experience, which was allowed as a part of the awareness and co-creation process.

A significant number of the designers (4) did not participate to the face to face meeting but did transmit and explain their ideas so that they could be elaborated by the group. None of this excused participant addressed any critics or doubt about the method. All participants did bring back all fake sensors and all (but one, who found he covered all his activities) were willing to prolong the exercise.

During the review and scaffolding on the ideas posted, designers expressed a positive and constructive attitude both towards the group and the tasks they were asked to perform (group clustering).

Experience of the individual probe-based ideation

While the authors anticipated that designers would find it easy and instantaneous to go from the situation identification to the picture taking, most of the designers explained that they first thought about one or several ideas/situations then put it into scene and took the picture. As a consequence, the method was found demanding both on the time required and on the logistic side (*"difficult to get together the situation, the idea, the sensors and the camera"*). However the overall experience was positive since GenIOT was described as an experiential learning step: most designers said they increased their (and their relatives') level of awareness of the impact of air and noise pollution and realised the consequences of IoT deployment.

Identifying a situation

Several strategies were activated for identifying the relevant contexts. As expected, they *"start by thinking around [their] umbilicus"*, i.e. reinterpret their daily activities questioning their experience of the air or noise pollution. However, paradoxically, this introspection gave birth to many ideas that were finally not documented in the GenIOT process. Indeed, although designers mentioned not to have censored themselves, some explained that they prefer to bring to light ideas that could be generalised and extended to a broad population (no niche market), or ideas where IoT does bring a value. This issue had already been encountered in the dry-run of the method and the diary was presented in the ELLIOT workshop as a way to keep track of such ideas. But designers did not follow this instruction and an individual interview or follow up would probably help in solving this issue.

Participants said they appreciate to receive the (4) reminders sent by email in order to stay focused in the long run.

As they did not fill in the diary to keep track of the situations/ideas that they considered then discarded, it is difficult to get data on the volume and variety of the wole situations considered. In the next version of GenIOT, the open diary may be replaced by a closed one or even an individual interview.

Some designers expressed their uncertainty about the output they produced and felt uncomfortable as the facilitator choose not to comment any idea posted on the platform in order to leave it to the group members.

Next version of GenIOT will therefore give more weight to the individual feedback and community animation.

However the biggest issue does not related to the method itself but to the fact that the method was applied to the air quality and noise level. Most of the designers, who had no health or cardio-respiratory problems, found it difficult to identify new affordances related to air quality for day-to-day objects. Another run of GenIOT will be performed within ELLIOT targeting a group of people concerned about the impact of air and noise on the health and reported in another publication.

Placing the cubes

Very few problems where reported related to the placing of the probes (although placing the probes on plants such as trees, or in height, next to the light was challenging).

A few designers choose not to take picture but to report on the idea. Despite these participants did not follow the procedure, they report that the cubes did help them in their ideation. Such participants did not see the point in illustrating their idea by an image. Some therefore preferred to report the idea using words.

Taking the picture

Three types of problems related to picture taking of the probes were highlighted (a part from the availability of the camera). During the face to face meeting, participants reported they could not take picture for legal reasons (within a school or hospital for instance), therefore could not document their idea. Others mentioned the difficulty to take a picture while riding a bicycle or to take a wide angle picture.

Posting the idea

Issues encountered in sharing the ideas were actually related to the idea/picture posting process (facilitators got a couple of emails related to password lost and uncertainty about the max size of the pictures). Designers had to insert a login and password, then they were asked to choose an idea category, tag, and legend for posting the picture; documenting the idea was found a little heavy and most participants choose to group their posts in one shot.

Experience of the group process

Online group process

Despite the emails sent to the group every 3 days to call for publication of the picture as soon as they were taken –in order both for us to monitor the engagement in the game and for the designer group to get "food for thought"-, most of the posts, votes and comments, occurred from 3 to 1 day before the face to face session. As a consequence very few ideas could be discussed online and very few ideas were rated online.

However participants reported either staying neutral or be motivated by the fact that they were gaining points when posting ideas, comments or just watching the ideas. Furthermore, designers did connect to the platform to get inspiration.

Face-to-face group process

Conversely, face to face collaboration and co-creation occurred naturally when designers were asked in turn to describe one of their ideas to the group, elaborate it and place it on a chart. Scaffolding of services ideas happened in a respectful and constructive atmosphere. Ideas that were developed or redirected were different than the ones who had the most votes online or that had been commented.

Designers were then asked to cluster the ideas and two complementary leaders emerged but the group smoothly agreed on a common view of the ideas.

The assumption of the ideation methodology is that the GenIoT method provides a common background for the designers so that the AloHa! method could be played efficiently by a benign and caring group. This assumption matches what happened in the frame of the first ELLIOT green services co-creation workshops.

GenIOT production

Quantity of the ideas documented was not high (average of 2,90 ideas per designers). Designers were people who did not have cardio-respiratory problems and were volunteering for thinking on air quality and noise in relation with urban mobility. They tend to consider themselves as small pollution agents. In their awareness process they tend to disregard industrial and more generally external pollution and emphasis internal pollution. Indeed, although the idea of collecting data for highlighting polluted zone or lobbying was mentioned by one participant, designers preferred to focus on a pollution they feel they control: home pollution. Moreover, as expressed above, designers disregarded ideas they felt were too specific to their case that they considered not relevant for the wider population. As a consequence target of the IoT services are not niche markets but the wide public.

Functional complexity of the IoT systems described by the designers is low. The average number of sensors per service is 1,67 and the actuator is often a data visualization setting or a multimodal (visual, audio or haptic) alert. Even in the case of IoT service using 2 sensors, actuators are not regulated according to 2 values ($f(x,y)$) but follow two rules, one for each of the sensor data ($f(x)$ and $g(y)$).

The data gathered during the ELLIOT workshop does not allow establishing a link between the GenIOT method and the level of maturity of the ideas. Indeed some designers focused on the identification of the contexts in which an IoT service would be relevant and did not consider actuators, some even did not place the sensors in the picture but just mentioned it in the legend (case of the air pollution related to recycling centers for instance) . Conversely, others, who found it important to specify the whole service would document it only if they could cover the whole process, as a consequence, a more elaborated service.

Variety of the idea was high, although one idea was developed under various declinations. Indeed, as showed in Figure 4, application of IoT for opening and/or closing the window depending either on pollen, noise or industrial pollution (incl. car pollution) was the most frequently documented idea. However the level of automation of the window was not consensual: half of the designers opted for a fully automated window while other claimed that they should stay in control and just be warned of when they should close it (by themselves).

Figure 4   GenIOT pictures expressing a similar ideas of an IoT service

While all proposed sensors were used at least once in the set of ideas, noise, pollen and industrial pollution are the most used sensors. Public space (streets, parks, public transportation), as well as domestic settings (home, cars) are the most frequent context of the services. Very few of the citizen-designers did mention their working premises; conversely the designers representing an institution or profession focused on their working premises. It seems therefore that the perceived role of the designer within the group did influence the designer in the performance of GenIOT.

Even if the GenIOT production was sometimes auto-censored by the designers and would have benefit from an extensive animation of the online platform and/or an individual interview, the services sketched by the designers were indeed embedded in their daily routines. The overall process was found demanding but instructional. Scaffolding and co-creation based on the GenIOT production did worked well and enhanced the group cohesion and maturity, however the designers, influenced by GenIOT did stay at a low level of automation and complexity of the service. The AloHa! method was then applied in order to complement this approach.

The AloHa! method

While GenIoT used designers creativity to foster the IoT and air pollution awareness process, Aloha! used such a designers awareness to foster their creativity.

The aim of this method is to create services that do offer a value for the user or stakeholder vs. techno-push services that only serve as demonstrators and fail in meeting their audience. However AloHa! requires from designers another type of participation and activating other cognitive and behavioural skills.

Another bodystorming method ?

The AloHa! method is rooted in the service design domain where both improvisation (incl. brainstorming) and role playing have been used for fostering innovation and highlighting user needs since decades as highlighted by Medeler and Magerko (2010).
It builds upon the notion of "bodystorming" coined by Simasarian (2003), whereby participants not only project themselves (at a rational and controlled level as they could do while reading a usage scenario) in an given role but do enact as the character they play, therefore live a deeper experiential learning and go through another cognitive process as well as group processes.

However the AloHa! method extends this approach as it requires participants to enact not only as human characters but also as "intelligent" objects, giving them the opportunity to reconsider their affordances and explore new usages and functionalities that could be fulfilled if these objects could communicate. As depicted in Figure 5, the method relies on a toolkit with cards describing persona, objects, communication media and place. Characters of the role play have been defined as per Cooper's recommendation (1998) for building persona, on the basis on questionnaires and interviews on the themes related to the green services. This is why characters are also called personae. Objects belong either to generic categories such as furniture, house infrastructure, small appliance, clothes or jewellery or to a set of object potentially inspiring for green services (Baby buggy, walking stick, medical spray, car, bicycle helmet, key holder or green watch).

Figure 5   AloHa! toolkit and its relation with the scenario elements

Figure 6   AloHa! game process

One AloHa! match follows a 3 steps approach: casting, networking, acting that was introduced to the designers with the above Figure 6.

The method starts with a casting stage where designers choose their role either from a persona or an intelligent object card. Cards are printed recto/verso and can be worn as a necklace.

After some time to interiorize their character, designers are asked to network the ones with others "characters" or "intelligent objects" in order to unveil needs and bits of services they could provide. Several groups may arise, putting into light several pieces of service scenarios or concepts. Designers are asked to meet and work together until they feel they bring value to the service they are co-creating with the other players.

When groups are formed and service scenario is starting to arise, participants are asked to refine the scenario by using a systematic approach and specifying not only what information but also how they communicate to each other's (they may use the "how"/media cards as a visual support) and describe better the context and time of the scenario (supported by "when"/"what" cards).

At this stage, upon facilitator or participant request, designers may switch persona/object in order to provide their input as another persona or as subject expert matter.

Ultimately, when the scenario is described, the group of designers enacts the scenario on the "theater scene" in order to explicit all knowledge and conditions required for the service to be viable and adopted.

Expected benefits of AloHa!

Benefits of the method come from the serendipity in which objects may communicate, and from the projection of the actors into personae. Persona cards are thought in order to maximize the viewpoints on a given area (for instance on air pollution and IoT for the green services) and cover a composed but relevant sample of the potential human actors. Generic "Intelligent" objects from the object cards have as well been chosen to cover the domains which have already given birth to several augmented objects (as summarized in Kuniavsky (2010)).

Furthermore, the AloHa! method does not only support innovation via the creation of objects/actors dialogues but also via the systematic description of these communications supported by the media/"how" cards and the scenario bodystorming.

Challenges of AloHa!

Such a method puts a heavy burden on the participants/designers profiles as they are required not only to demonstrate an experience and networking mindset as for any living lab experiment but also they should be flexible enough to enact in relation with people they may not know and demonstrate the cognitive plasticity of thinking and feeling like an object embedded in an IoT world.

The ultimate objective is to facilitate the co-creation of a service concept where the knowledge, social and business dimensions, as defined by Bifulco and Santoro (2005), are considered. However, AloHa! ideation builds on the instant

inspiration and may need to be fine tuned or even deconstructed in order to accommodate for different viewpoints. As a consequence, it is difficult to anticipate the type and robustness of the IoT service concepts generated via AloHa!

One of the assumptions for placing GenIoT before AloHa! is that designers would first learn about the possibilities offered by the Internet of Things perspective, then get acquainted with their co-creators, therefore speeding up the AloHa! process. Indeed, one other major challenge of the AloHa! method is to find a good balance between time spent for running the exercise and efficiency in terms both of designer experience and service innovativeness.

Feedback on the AloHa! method

We report hereafter the first results from four games run with four different groups, with an emphasis of the observations performed during the games played within the ELLIOT project and after having run the GenIOT (with the 11 "designers" mentioned above). Feedback on the AloHa! method is presented following the phases of the game: attitude towards the method, experience of the method, experience of the group process, quality of the production.

Attitude towards the method

After an initial surprise effect, participants be they amused, doubtful or excited, tend to choose cards representing persona. Indeed, the objects cards were often chosen as a second or only choice. Choice of the object or persona card may depend on the knowledge and proactive attitude towards IoT, further data are needed to conclude. Designers were asked to stand up for networking; observation of their body language showed that most participants were cooperative, willing to experiment the method.

Throughout the networking period of the game designers demonstrated a constructive spirit, walking and smiling to the others, and when asked to play on stage, none of them refused or showed embarrassment, even when they were acting as an object (cf Figure 7 including a participant acting as a helmet or a buggy). During the first sessions, some participants mentioned the need to write down ideas for not forgetting them in the hurry of finding a partner for scenario. Indeed, a few participants expressed that they were so used to think with a pen and paper that they could not focus and be effective during AloHa!.Possibility to use post it for note taking was therefore added in the ELLIOT green services session; those were seldom used but did allow participants to stay in the co-creation loop and "park" ideas on the post it when needed.

Figure 7   Designers enacting IoT green service scenarios

Experience of the method

A first standalone run of the method during Lift France 2011 conference underlined the importance of the physical arrangement of the room (acceptable air quality/temperature, noise level, freedom for moving within the room) and the physical placement of the cards (both for choosing them and while networking). The dry-run showed that the level of description of the personas needs not to be too detailed in order to leave the room for creativity and empowerment of the role.

Both the speed networking and the scene performance were lived as creativity lift. Indeed, as reported by a designer, the time pressure during the networking made them "*tend to think aloud, letting out both good and bad ideas*" and they realised that they could speak freely as in some cases and collectively scaffold realistic scenario, "*bad ideas were adapted by the others so that we could play them*". Being in the action, having to play live on the fictional stage was as well a creative experience. Indeed, many designers tried and adapt the collective scenario in order to make it more detailed and plausible, sometimes going further than what they would have imagined in a traditional discussion : "*as we are here [on stage], we have to invent, otherwise there is a silence in the air. We are not blocked [..]. We can imagine the craziest scenarios and we are not even scared*".

However, a difference has to be highlighted between the Aloha! workshops performed in a standalone mode and the one coupled with GenIOT. Indeed when performed in standalone, many designers complained that, while they felt comfortable with the method, they had difficulties applying it to the green services topics « *Sometimes, I felt a little bit frustrated to have to deal with air quality*". In the coupled Aloha! sessions, this concern was only raised once. The order in which the coupling should be done may therefore help designers focusing on the project theme in a more natural way.

Experience of the group process

Informal and fun atmosphere was reported as the top positive feature of the sessions (together with efficiency). While seriously brain and body storming, designers spent much time laughing and appreciated the playful ambience (cf Figure 8).
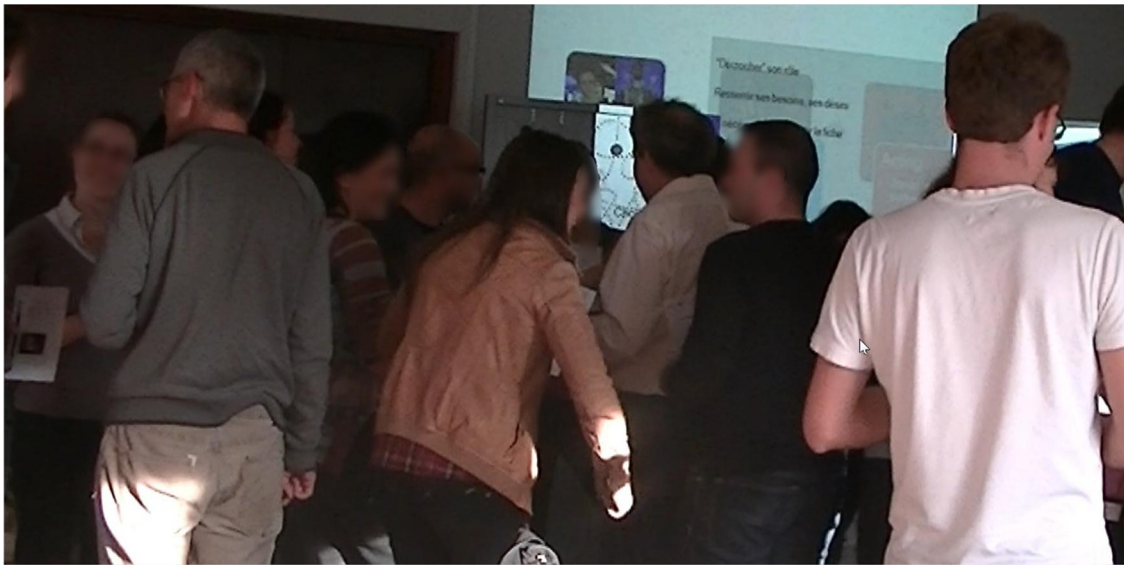

Figure 8   AloHa! networking phase (incl. a designer acting as a walking stick)

Despite strong and competent personalities present in the group, we did not observe influential behaviour nor authoritarian leadership during the networking and scenario building: as designers were standing up and free to walk away, they tend to approach and stay close to the people they could build and co-create with. Regulation of the group therefore happen without any external intervention.

During the networking period, designers tended to present themselves to others without adapting their presentation to their interlocutor. Moreover, they very rarely acted as an intermediary, linking together two other participants (with an exception for the "medical spray" object and the "asthmatic girl"). This behaviour may be due to the time pressure.

Moreover, designers playing the persona role had the propensity to connect with objects and not other human beings, while designers playing the intelligent object role would meet both humans and objects. This may support the hypothesis against

which scenario were built around objects functionalities and affordance vs. human goal or activities. Such an hypothesis of a functional driven (vs. context and goal driven) design is as well reinforced by the fact that when asked about the scenography of their play, most of them did not think carefully about it and were just able to ask for a "street" or "office" picture to be projected behind them (cf. upper picture in Figure 7).

A crystallization phase could easily be identified for each play: when a group of designers felt they had enough material to build a scenario, they were inclined to stay in the group and started to talk louder and joke. It is like they were relieved to have made it, to have found partners for building a meaningful service.

As this stage the facilitator asked for details and reminded of the additional cards for a systematic description of the service. Usage of the cards may have be perceived as too restrictive or not relevant. During the ELLIOT workshops, communication and place cards were hardly used: most designers spontaneously detailed the scenario because they were rehearsing for the stage performance and not as systematically as they were instructed to do.

An hypothesis was that a trustful, open and very connected group will lead to a more quantitative and varied output in terms of service concept. Data obtained from the running of Aloha! with four groups can neither support nor contradict this hypothesis. However the size of the group seems to be determinant of the group process and production. Within large groups (>=25 participants) the noise and heat generated by the networking effort does not guarantee an optimum experience. Moreover the high number of potential combination tends to extend the networking time and resources to the expenses of the service details and rehearsal. Large groups can therefore be used for generating a wide spectrum of ideas and explore for instance an activity (such resting, eating etc..) or a geographical area (such home related services, working related services, skying related services).

On the other hand, when the group is small (<=6 participants), designers attempt to build a scenario encompassing all participants, therefore skipping the networking phase until they realise that building a scenario from the beginning with the whole group is much harder that starting with dyad, triad and extend the group.

As it is a rather intensive exercise, we do not recommend playing it a second time in a row.

AloHa! production

One AloHa! run typically takes 1 hour and leads to an average of 1 scenario per 4 participants. Acting of the scenario lasts in average 4min. The number and type of sensor in AloHa! sessions was very similar to the ones of GenIOT, however the service concepts were developed with more details, as bodystorming of the scenario requires to further explicit the idea than a picture posted in GenIOT.

Most of the intelligent objects created during the four sessions fall under the "augmented object" category. The "joker card" allowing to add an intelligent object to the list, was used but not for creating a new object (as the Carrotz rabbit for instance). Such augmented object offer new functionality and/or new affordances (e.g. helmet with head up display to indicate preferred itinerary or the baby buggy that changes color depending on the air pollution).

Whereas GenIOT production depicted the sensored data and the display of the information sensored, AloHa! scenarios describe more elaborated communication paths, and involve more persona. Scenarios are as well situated in a longer time horizon and gives the objects more decision power. Designers did observe spontaneously that "*objects become more autonomous* [in AloHa!] ", "*decision becomes transparent to us, and [objects] may actually help, as we don't need to know whether there is pollution as a preventive action has been taken*". However, the scenario generated in AloHa! were very often challenged when AloHa! is finished and designers take the time to rationalize their behavior and start to envision more aspects. For instance designers noticed that "*Humanisation of the object tend as well to increase the machine to machine communication [M2M]*" and some of them expressed their fear of a decrease of human-human communication to the profit of M2M. Beyond this classical attitude towards technology, the lesson from such discussion is that AloHa! does meet its objective as an experiential learning of the concept of IoT.

AloHa! is effective in co-creating user centered IoT service concepts as well. However, the balance between the various aspects of the services design was only partially addressed. The main focus was indeed the temporal sequence of the actions, the touch points with the various actors; the economic and technical viability of the service was only a peripheral issue. Further sessions including more entrepreneurs and economical actors need to be run in order to understand whether this pitfall stems from the method or the designer profile. In the meantime, a classical brainstorming for developing, merging and prioritising both AloHa! and GenIOT service ideas is required to go further from ideation to concept development.

Conclusion

This paper tackles the participative ideation methodology followed by citizen and stakeholders for designing IoT based services concepts, i.e. the very early stage of the design cycle. GenIoT, the first method presented here, complements the AloHa! method not only because it is situated, i.e; provides in situ data, but also because it adds the third experience design research dimension to the "*say* " and "*do*" dimensions already covered by the AloHa! method, namely, the "*make*" dimension.

Moreover, the methods address various cognitive style and personalities traits: while GenIOT requires a continuous exploration of self-behaviour and lifestyle, requires some logistical preparation and asks to share potentially intimate settings, activities or even fears, Aloha! is an intensive one shot improvisation exercise calling for interpersonal skills.

Both methods presented above -GenIoT and Aloha!- address individual and collective creativity as well as individual and collective awareness on IoT and, in the case of the ELLIOT green services use case, awareness on air quality and noise pollution. Evaluation of the single method is therefore complex on the methodological viewpoint and does require further research. Both methods being already demanding from the designers viewpoints, finding an appropriate balance between running the methods (maintaining the fun, experiential and creative aspects) and evaluating them was found challenging (for instance some cognitive style evaluation questionnaires had to be removed from the initial protocol in order to keep the participants fully involved in the discussion) .

Initial feedback gathered on the single methods allowed however to compare the two methods since they were applied to the same theme and, for one designer group, to the same participants. The methods appear complementary not only for what regards the cognitive skills involved and the level of IoT awareness but also their outcome in term of service ideas: GenIOT service concepts were really grounded in daily practices, with mainly a short term implementation, requiring low level of automation and involving one user. AloHa! allows to extend this vision with more futuristic concepts, a more elaborated service where autonomous objects and stakeholders interact.

However both methods are demanding for the designers in terms of cognitive, logistic and temporal load.

Acknowledgements

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