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Making Sense: Harnessing Communication through Prototyping

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Abstract: This paper reports on the experiences gathered from an international collaborative workshop where participants were invited to continuously build and prototype their ideas, rather than following conventional stages such as idea generation, visualization and, only later, prototyping. Adopting a hands-on approach proved beneficial in the communication among participants as well as simplifying the design process. By developing quick and approximate prototypes, participants more easily expressed their ideas whilst overcoming language barriers. Furthermore, the prototypes helped participants to identify the key aspects of their proposals and focus on those. Finally, the prototypes also served as useful props to enact the experience of using the proposed artefacts and services. The findings of the workshop highlight that when working with mixed groups of participants with diverse skills, different cultural backgrounds and languages, a hands-on approach can be extremely useful. Prototyping in design workshops here proved valid on both the communication and the creative processes.

Keywords: Prototyping, Workshop, Design Education, Olympics, Making

1. Introduction

During the last decade, design schools across the world have increased significantly in terms of the numbers of courses, the degrees and curricula they offer. It is now commonplace for a design school to train their students in product, interaction, transportation, service, fashion, medical, contextual, conceptual, management, graphic, communication design, among myriads of other denominations. More recently, it has been observed that more effective results are achieved when heterogeneous teams are formed and professionals with different backgrounds and skills work together (O'Rafferty, 2010). Terms like inter-disciplinary, multi-disciplinary, trans-disciplinary, alter-disciplinary (Rodgers and Bremner, 2011) and even un-disciplinary are now very commonly used in reference to the education and practice of design (Bremner and Rodgers, 2013).

Besides professional diversity, also cultural diversity in design schools has increased (Hecht, 2011). Students' mobility across schools from different countries has contributed to build multi-cultural environments where different languages, cultures and lifestyles are brought together. This simply reflects the way our societies, and consequently our professional environments, are evolving. For example, it is common for design consultancies to bring together professionals from several different nationalities. Cultural diversity is welcomed in design. Professionals coming from diverse cultural backgrounds can bring a wealth of perspectives and experiences that enrich the design process, leading to results that encompass greater ethnographic complexity (Brown, 2009). However, such a diversity of expertise, skills, technical and spoken languages raises real issues in terms of communication and collaborative processes. Part of our job as design educators is to explore and train students to engage in ways to work, communicate ideas as well as generate and develop concepts in collaboration with colleagues from other professional and cultural backgrounds.

2. Designing through Prototyping

Designers make and use a variety of different models and prototypes to inform their design and decision-making processes. While these may have traditionally been perceived as highly developed physical models, designers nowadays use both terms to describe any kind of representation that is created to help designers, users and clients to understand, explore and communicate what qualities a product has, and how a user might engage with it. Thus, the terms 'models' and 'prototypes' are widely used to describe a range of design representations, from concept sketches through to a variety of physical, CAD and virtual models that explore and communicate design propositions and contexts (Milton and Rodgers, 2013).

In the context of industrial and product design, prototyping is a phase that conventionally takes place at a later stage of the design process. Normally, the creative process begins with brainstorming techniques in order to map the territory outlined by the brief. Directions are evaluated and explored. Once ideas of possible designs are clearer, visualizations through sketches are produced. Only at a later stage, time and resources are invested for models and prototypes (Lawson, 2006; Cross, 1989). In the past, modelling and prototyping represented a significant investment in terms of time, materials and skills. Recent emerging technologies for three-dimensional printing and rapid prototyping, however, have reduced such investments (Chua, 2003). This is helpful in better and more quickly understanding different design options, their physical features and so on. However, because models need to be created virtually on a computer before being materialized physically, and because any changes need to be made on the computer file rather than the object, the positive impact of these technologies in a collaborative team's workflow is limited. Furthermore, the 3D printing technologies take away one key aspect of the act of prototyping, which is the act of making things manually. The act of making, and especially the act of making together with others, plays an important role in communication and cognitive processes, which is why this was an important part of this workshop.

2.1. Making as a Language

In most design schools students tend to follow a rather conventional design process that starts with verbal communication (*i.e.* brainstorming sessions), followed with visualizations (*i.e.* sketches and/or computer renders), and only towards the end – resources permitting – it leads to materializing the selected idea in a prototype. One objective of the workshop described here was to question such processes and explore alternatives. We were particularly interested in the act of making as a way to think, communicate and, ultimately, design (Brown, 2008). The method of prototyping ideas in a

swift and approximate way in design is known widely as “quick-and-dirty prototypes”. Quick-and-dirty prototypes are, as the name suggests, rough models built quickly in order to communicate an idea to other team members at a very early stage of the design process. They are used as a quick way to communicate design ideas to others who can then evaluate, reflect and refine things before progressing further. The prototypes are built quickly and with any materials that may be to hand. The focus here is on speed rather than quality. Many design projects have short timescales with very demanding deadlines and quick-and-dirty prototypes can help designers ‘cut corners’ in order to save both time and other valuable resources (Milton and Rodgers, 2013).

The benefits of using quick-and-dirty prototypes are in the ease of modifying and refining the models. In fact, because designers do not invest much time and effort in building these sketchy prototypes, they are more willing to make changes or discard certain elements. Furthermore, the resulting prototypes are approximate and very unrefined. However, this is a positive aspect since it allows a degree of ambiguity that fosters the design process instead of blocking it. The roughness of the prototypes also prevents individuals focusing on the details, which at this stage would be unnecessary and time consuming.

The main reason for adopting quick-and-dirty prototypes as a method during this workshop is related to the difficulties of bringing together students speaking different languages, coming from different cultural backgrounds, and with different expertise and skills. We have learned from previous workshop experiences that when working in mixed groups verbal communication among students can be tiresome and often limits the creative process. In order to address this concern in this workshop we chose to adopt a different approach giving greater importance to the act of making as making can serve as a communication tool to better share thoughts and ideas (Kolodner, 1996). We thought that by providing basic materials to build prototypes (*i.e.* cardboard, tape, PVC pipes) participants would have started manipulating objects together and so share ideas and thoughts.

3. An International Workshop

The CODE (COntinents Design Education) workshop presented in this paper is part of a collaborative project that brings together design schools from the USA, Germany, Italy, Japan, and Japanese-based multinational companies including Fujitsu, Sony, and Toshiba.

3.1. Framework and Theme

While supporting the workshop, the involvement of Fujitsu in this workshop was useful in formulating the underlying theme of the workshop. Fujitsu, as one of the main sponsors for the Tokyo 2020 Olympic and Paralympic Games, developed the workshop title of “Olympics Forever” aimed to explore new ways of storing, broadcasting and building upon the experiences, interactions and memories generated by the Tokyo 2020 Olympic and Paralympic Games. Workshop participants were asked to reflect on the wealth of cultural and social experiences enabled by the Olympics and quickly prototype ideas in the form of installations, devices and services for individual users as well as for the public realm. All workshop participants embraced this challenge with enthusiasm and energy. The “Olympics Forever” workshop was open to any type of outcome ranging from services, interactive installations, spaces and products that would directly or indirectly tackle issues related to the Tokyo 2020 Olympic and Paralympic Games such as the impact on the city and its inhabitants and visitors during and after the event. In the following sections of the paper the organisation of the workshop is explained in further detail.

3.2. Participants

For this workshop a total of 23 students were recruited as participants. Of these, seven were German students, fourteen were Japanese students and two were exchange students from Australia. The workshop was truly interdisciplinary with students representing a number of different disciplines ranging from product design, communication design, interaction design, transportation design and design management. It can be said that the participants of this workshop represented a heterogeneous group of students with no specific skills or expertise. Furthermore, the group included German, Japanese, Chinese and English native speakers. Participants were divided into six groups, with at least one German student and two Japanese students in each group. The composition of the groups was determined according to the level of the students' grasp of spoken English, design experience, age and gender, trying to keep a balance among groups as well as a mix of expertise and cultural diversity within the groups so to better test the effectiveness of making as a method for collaborative work.

3.3. Schedule and Activities

The duration of the workshop was two weeks - a "Research Week" in the first week followed by an "Intensive Design and Make" week. The first week was dedicated to field research and it included visits to Tokyo, in particular to the Yoyogi area where some facilities are still in place from the Tokyo Olympics held in 1964. The goal of the research week was to achieve a sense of what hosting an Olympic and Paralympic event means for a city like Tokyo and to learn more about the local context, culture and ultimately get inspiration and socialize. The second week of the workshop was the intensive week and it was fully dedicated to hands-on design activities. During the intensive week, the workshop was held in a large open space room in Chiba University, where students could design, build their prototypes, and talk to the workshop facilitators. The student teams' final presentations were organized in another room. To start, the workshop participants were divided into six groups and, after an introductory presentation on the workshop theme and methods and a couple of ice-breaking games, they began working.

Following a brief overview of the workshop's aims and objectives, the participants started exploring possible directions while assessing the materials and tools made available to them. Each group had been given a particular context to focus on such as sport facilities (*i.e.* stadiums and gyms), public spaces (*i.e.* parks and streets), accommodation (*i.e.* hotels and room rentals), convivial spaces (*i.e.* restaurants, bars and cafes), transition spaces (*i.e.* public transportation and stations), and cultural and commercial spaces (*i.e.* museums and shops). The workshop participants were given significant freedom to interpret their allocated context as they saw fit and also in the type of outcome they proposed. The workshop facilitators were available at any time to talk to the groups of students. At the end of each day, the facilitators would provide feedback to the groups. At the beginning of each day, each group would briefly summarize what they learned from the previous day and update the rest of the workshop participants on their plans. Fujitsu designers and managers were present on the first day of the intensive week to provide input on the activities of Fujitsu and their visions for the future, and on the last day, to discuss the final presentations. The ideas and projects produced during the workshop were not meant to be implemented further outside of this intensive week. However, the results were published in a report book and distributed to Fujitsu Design and other partners.

3.4. Materials

During the intensive week of the workshop, students were free to use the materials and tools made available to them. The materials ranged from cardboard sheets to PVC pipes, from rope to plastic

fasteners, paper and plasticine. Tools included hot glue guns, heat guns, cutters, markers, an inkjet printer and so on. These tools and materials do not require any particular skill in order to get participants to produce sketch models (Figure 1).

Figure 1. Workshop Space and Prototyping Materials.

This aspect was important to help overcome barriers that are evident when in a team such as certain team members having higher manual and technical skills than others team members. Usually, the former take the lead over the latter. Furthermore, some basic electronics including sensors, LED lights, thermic printers and the software and hardware to make them work with computers were made available to the student teams. Because the students did not posses the knowledge and skills to use the electronic components, the workshop facilitators were around to help them. Once produced, the prototypes were readily tested thus providing useful feedback for the progress of the design process. Quick-and-dirty prototyping was chosen for this workshop as a method for communicating with team members and presenting ideas to other participants in order to progress efficiently and effectively throughout the design process.

3.5. Workshop Results

The workshop resulted in six design concepts that included services, events, and technologies. The outcomes ranged from a deconstructed capsule hotel where units could be arranged freely, an automatic machine that wraps anything into a gift, a photo-booth where photos are taken only if users cheer loud enough, a mobile application integrated with the public transportation system that allows anyone to be an Olympic torchbearer, a restaurant to foster ingredients, share and improve recipes, and a monument that invites visitors to destroy it while it replicates itself elsewhere. In order to present their final concept designs, students enacted the functioning of the sketch prototypes they built and gave short slide presentations on the final day.

4. Workshop Evaluation

The workshop has been evaluated via an ethnographic approach by observing workshop participants, their interactions, and the overall group dynamics (Bryman, 2001). The first author of this paper was the main organizer and facilitator of the workshop reported here. It was, therefore, relatively easy for him to make observations throughout the duration of the workshop and engage in informed conversations to check on the participants' progress as well as have a sense of their experience.

4.1. Materializing the Intangible

The adoption of quick-and-dirty prototypes as a technique had a clear impact on the workshop participants' design processes. The most evident effect lies in the tendency of students to physically express every aspect of their concepts. Then, the participants would simplify their concepts by physically taking off the unnecessary parts. The possibility of working on material objects seemed to help them to refine their concepts and define the meanings of their proposals. For example, the group that was given transition spaces as a context soon started building a large arch-like structure using PVC pipes and other materials provided (Figure 2).

This structure is intended to replace the gates on the platforms of the Tokyo metro. In the group's plan, regular commuters would have been celebrated in a similar fashion to the winners of an Olympic event and would be exposed to a number of historic facts about the Olympic games, just before entering the train. This first prototype was useful for the group to identify some key aspects in their initial idea. For example, the daily ritual of commuters passing through the same path and the resulting sense of participation felt like a strong point in their idea. In the following days, the group refined their concept and the more they refined it, the more they would take away physical elements from the structure they built. The prototype made evident the unnecessary informative structure the group proposed. All those screens providing trivial information about the history of the Olympics soon felt redundant and distracted from the commuter's experience and participation in the event. Physically, the group started stripping off all the unnecessary parts. It was easy for the group to start this reducing process because the components were physically there, even just as a mock-up. So, in the beginning the group materialized each aspect of their concept, then they started a process of "de-materialization" to concretize their design idea.

Figure 2. Participants Building an Interactive Gate for the Tokyo Metro

Finally, the work of this group resulted in a digital application for mobile phones to be used before the Olympics game of Tokyo 2020. In the group's design, the public transportation company would have released a number of digital Olympic flames. If a commuter was lucky enough, he or she would be given the Olympic flame glaring on the screen of his or her mobile phone when it was used to scan in at check-in at the metro station gate. The same commuter would carry this Olympic flame on

his/her mobile phone until the check-out, where the digital Olympic flame would be passed on to the next commuter checking-in at the same gate, and so on. On the final day of the event, everyone would have the digital flame glowing on their mobile phone devices (Figure 3).

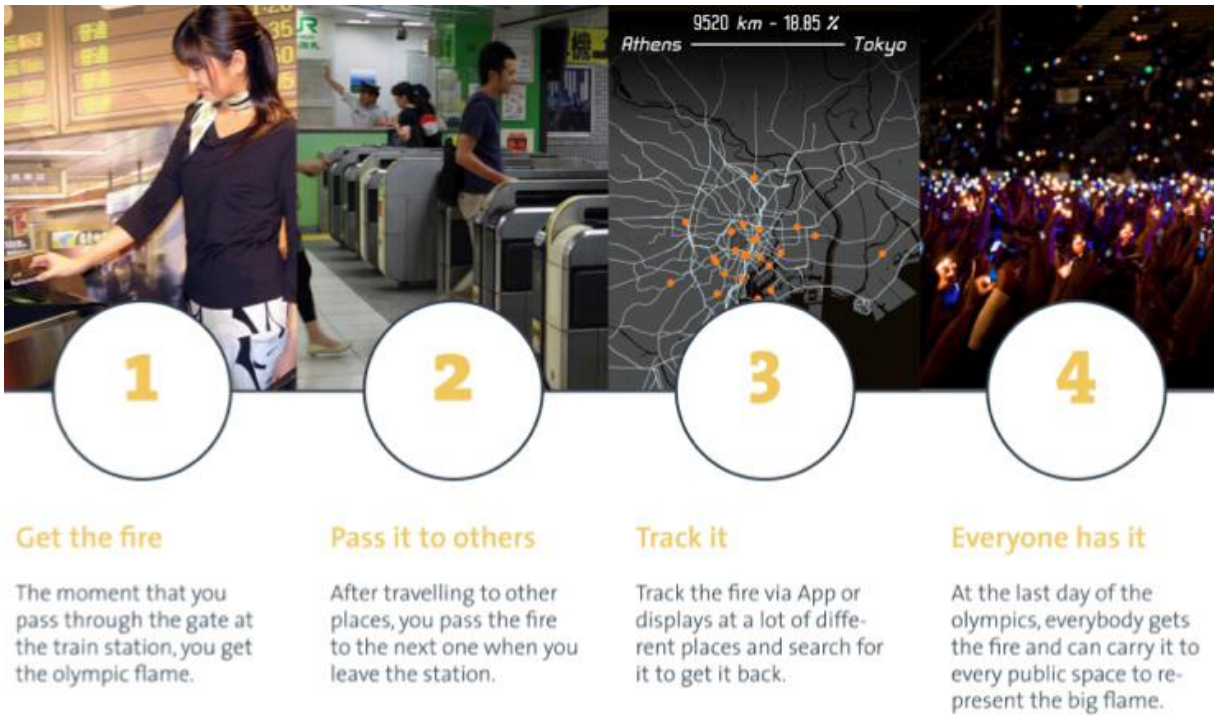

Figure 3. Scheme Explaining the Function of the "You Are Olympic" Concept

Under the title "You Are Olympic", this campaign would make every commuter feel like an Olympic torchbearer and therefore feel more like part of the event. Interestingly, the group initially had to build something big and solid in order to get something intangible like this mobile application.

Another group went through a similar process of materialization and de-materialization. The group that was assigned convivial spaces as a context started straight away thinking of tools that would encourage interaction in a restaurant. The first attempts were ironic; almost jokes that the team members felt compelled to prototype in order to learn more about their direction. The props they made included chopsticks with LEDs that lit up when crossed with others, a call-button for a waiter that makes someone's chair vibrate and similar other tools (Figure 4). Their idea was to offer to the guests some tools that would generate unexpected interactions. While building all those quick-and-dirty prototypes and testing them with other participants, the members realized that in a convivial environment more intangible aspects related to food usually trigger interactions. The aspects that spark conversations range from recipes, traditions, ingredients and flavours. So, the group finally designed "Seedling", a restaurant where customers can pick up the available ingredients from a vegetable garden, seed vegetables for future customers, and so share existing recipes, modifying other people's recipes or invent new ones and share them through a digital system. As a result, the group made a rough prototype of a machine and its interface that customers could use to input their recipes. Similarly to the other workshop participants, this group had to make a number of failed physical experiments before identifying the intangible value of tradition and knowledge that is hidden behind recipes and cooking.

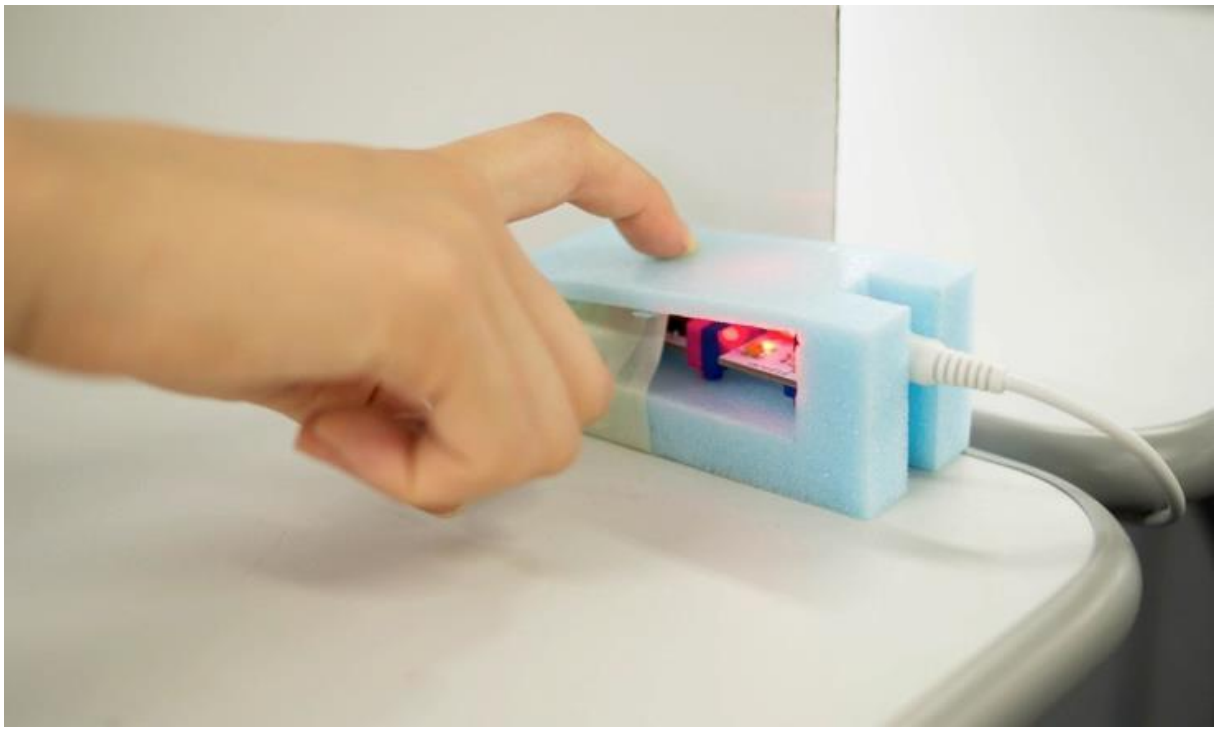

Figure 4. Prototype of a Waiter Call Button that Causes Chairs to Vibrate to Elicit Interactions

We observed that making quick-and-dirty prototypes helped participants materialize intangible aims, whether it was participation, interaction, a sense of belonging or knowledge. The physical presence of the prototypes also made it easier for the students to identify and eliminate features and props. So, the further participants would progress with this technique, the more the prototypes were becoming smaller, while their objectives would become more ambitious (*i.e.* get the whole city to participate in the Olympics, get people to collaboratively build new recipes and grow vegetables for future guests, etc…). in this sense, the use of quick-and-Dirty prototypes helped the participants to better understand the key aspects and aims of their concepts whether it was participation, or interaction, rather than focusing on the way things look.

4.2. Acting as Prototyping

Prototyping the artefacts also produced another effect. It pushed students to enact the use and the function of the designed services and experiences. As a result, the physical prototypes turned into experience prototypes. For example, one group found their design direction at an early stage. They noticed that in Japan, the way things are packaged and wrapped plays an important role. In many ways, in Japan the packaging is more important than the content and the care put in the wrapping is a peculiarity of Japanese culture. They thought that visitors coming for the Tokyo 2020 Olympics would like to bring some authentic souvenirs back home. At the same time, they noticed the abundance of machines in the public space of Tokyo. In particular, they were attracted by “Purikuras”. These Japanese style photo-booths take photographs, apply distorting and decorative filters and print them for 3 or 4 Euros. So, they developed “Purikupack” a machine where people could introduce any artefact and this would be transformed into a souvenir wrapped in paper bearing a photo of the tourist on it. The group built a cardboard machine, big enough for a member to sit inside with a phone and a printer. In this way they role-played the function of the machine (Figure 5). The humoristic and fun value of the concept emerged clearly because the experience of such a service was well simulated.

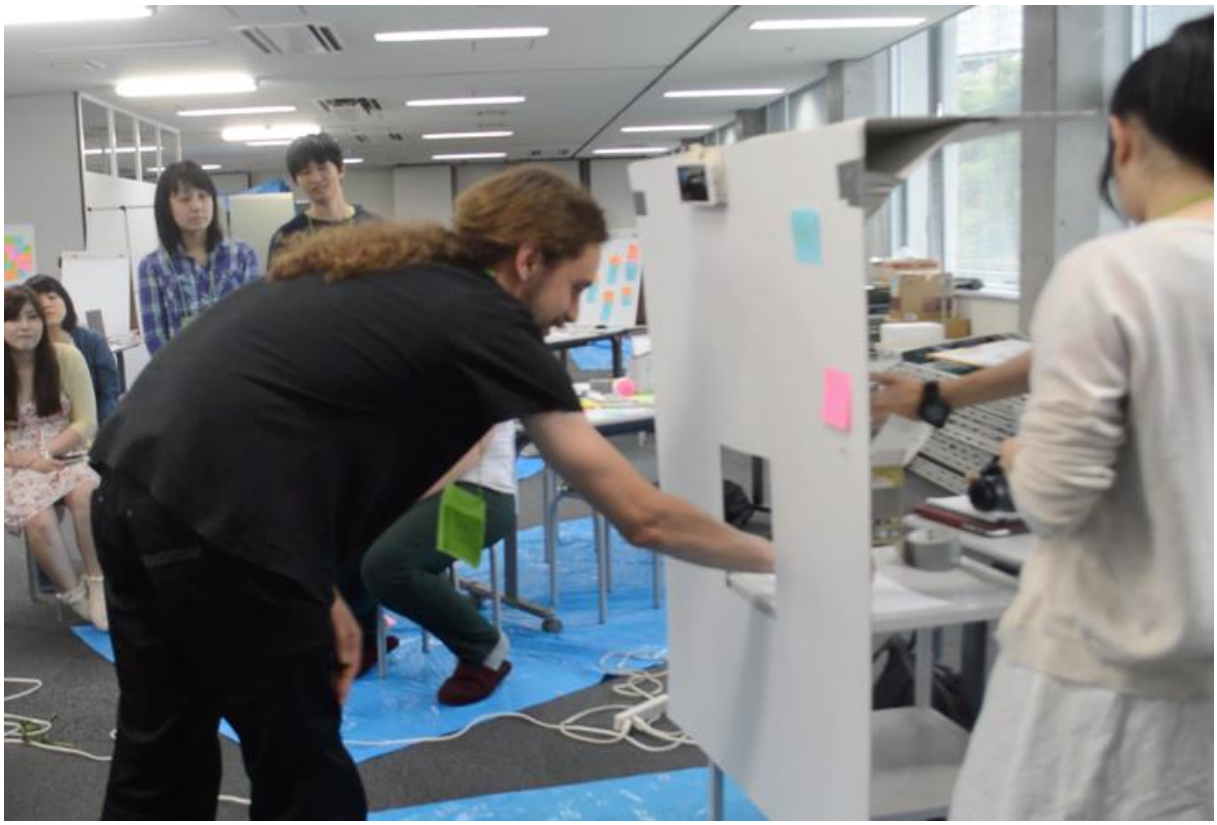

Figure 5. Participants Enacting the Function of "Purikupack"

Another group also focused on the photo-booth concept. They designed a photo-booth that takes a short video when the user shouts as to celebrate. Users can get frames of the video printed on their ticket, while these videos are collected and used for a series of interactive installations in the public spaces of Tokyo after the Olympics, so as to leave a lasting memory in the space. Also, this photo-booth was quick-and-dirty prototyped and enacted during the workshop and final presentation. Other groups followed a very similar process. We observed that the approximate physical prototypes where extremely useful for participants to simulate experiences, discuss their concepts internally, and communicate them to an audience in an engaging way.

4.3. Making Sense Together

The goal of communication in a collaborative team is ultimately the one of creating meaning. This process is not linear, but it comprises iterative cycles of trials and errors, building on one another's ideas, and being inspired by what is being shared by other team members. When barriers related to cultural differences, expertise and – above all – language are present, this process becomes harder. The quick-and-dirty prototyping approach adopted in this workshop helped participants to express themselves and exchange ideas quickly. Observing the participants handling the materials, building and modifying the models was like observing people having a conversation. Simply, instead of using words and their hands to gesticulate, they were using them to build objects and shape their ideas (Figure 6).

Figure 6. Participants Communicating while Modifying their Prototypes

The materiality of such an approach made clearer the message they represented. Obviously we do not advocate that “making” could possibly replace “talking”. In fact, making rather facilitates and supports verbal communication. By working in such a way, the participants that are not fluent in a certain language – in this case English – have better opportunities for expressing themselves, avoiding the lead being taken by native or better speakers. So, the methods adopted in the workshop also proved efficient to enhance communication among and with the participants.

5. Conclusions

“Olympics Forever” was a collaborative design workshop between German and Japanese students, supported by Fujitsu. The peculiarity of the workshop reported here lies in the adoption of a hands-on approach from the very early stages of the design process. Workshop participants collaboratively built “quick-and-dirty” prototypes while their ideas were still being shaped so to facilitate the design process and the communications among them. The workshop proved useful in better understanding how to create more effective and engaging design activities, particularly when working with diverse groups of students. Moreover, it is important to provide the right tools and methods so that participants can generate and refine their ideas, communicate with each other and present to an audience. From the workshop undertaken here, three key findings can be highlighted. First, by persuading workshop participants to prototype their ideas from the very beginning of the design process, students were able to identify the valuable elements and meanings of their concepts more easily. By prototyping ideas in this way, students give a material presence to every aspect of their ideas and only then do they commence an editing process that gets rid of the unnecessary parts of their projects. This helped students to easily understand the key aspects of their concepts. Second, by handling and manipulating physical materials we noticed that communication among participants was both more effective and efficient. The workshop participants with poor spoken English skills could show and share their ideas or intervene on someone else’s concepts by modifying the rough prototypes. Furthermore, because the prototypes were made in a quick and approximate fashion they were relatively easy to change. Third, the physical nature of the prototypes pressed students to enact their functioning and the services or interactions they entail. This resulted in more compelling and clearer presentations that allowed students to find flaws in their proposals. In conclusion, when working with mixed groups of participants with diverse skills, cultural backgrounds and different native languages, a hands-on approach can be useful. Quick-and-dirty prototypes proved themselves valid on both the communication and the creative processes. In the future, we plan on running more thorough studies to learn more on hands-on approaches and the advantages they offer in comparison to more traditional ways of working.

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