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CHARACTERISATION OF A CO-CREATIVE DESIGN SESSION THROUGH THE ANALYSIS OF MULTI-MODAL INTERACTIONS

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Abstract

The paper presents an investigation that aims at describing the behaviour of designers, designers' client and products' end user in collaborative design sessions, which are characterized by language barriers and significant differences in the background and competencies of the involved stakeholders. The study has been developed within a European project aimed at developing a Spatial Augmented Reality based platform that enriches and facilitates the communication in co-design. Through the analysis of a real case study in the field of packaging design involving a team of ten design actors, the paper analyses with an original joint approach both the gestures and the verbal interactions of the co-design session. After describing the two tailored coding schemes that capture different facets of, respectively, the gestures and the content of the communication occurring between the participants, the paper describes the partial results and the outcomes of the joint analysis, revealing the importance of combining the two forms of study to suitably characterize the behaviour of the design actors.

Keywords: Human behaviour in design, Collaborative design, Creativity, Gestures, Communication

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1 INTRODUCTION

Co-design, meant as the active involvement of clients (customers, end-users), designers and other relevant stakeholders in a collaborative design session (Ulrich et al., 2003), is gaining attention both in academic research, where it is often associated with users-centred or participatory design, and in industrial practices. Indeed, it promises to direct design activities towards the fulfilment of well-focused needs, with intrinsic attention to usability issues and with the potential to take into account functional as well as emotional expectations of involved clients. A wide range of activities can be observed during these co-design sessions, varying from 100% creative, purely dedicated to idea generation, to 100% selection, purely dedicated to review and filtering of ideas. But all of them rely on collaborative interactions between participants as they focus on the horizontally interpersonal aspects of the group work (Li et al., 2004). Our general objective is to analyse these co-design interactions for understanding how clients and designers co-construct their proposals.

Interaction Analysis is defined by (Jordan et al., 1995) as: "an interdisciplinary method for the empirical investigation of the interaction of human beings with each other and with objects in their environment. It investigates human activities such as talk, nonverbal interaction, and the use of artefacts and technologies, identifying routine practices and problems and the resources for their solution".

The first important idea we get from this definition is that interaction analysis lean on direct exchange between people but also on interactions mediated by objects that exist in their environment. Collaborative approaches need designers to communicate and integrate a higher diversity of information (Eris et al, 2014). This lead designers to use design representations like drawings, sketching (Visser, 2010) but also prototypes, 3D models, resources that can be used as intermediary objects (Vinck, 2011) during collaborative design sessions. We observed two main categories of elements that are used by designers: elements dedicated to the description of the designed object, i.e. design representations (Pei, 2009), and elements dedicated to the description of the environment or the context of use of the designed object, i.e. external resources. We include all these elements in the same category, namely artefacts. For the sake of distinguishing the nature of interactions, we differentiate tangible and digital artefacts. A digital representation may be a 2D or 3D computerised representation, a picture, an image, a shape rendering, whatever might be displayed on a screen, like a computer or HD television. A tangible representation is any tangible object that helps the creation, the understanding, or the explanation of the concepts. Hand sketches on paper, printed 2D drawings, printed photos, 3D physical mock-ups, prototypes are considered as tangible artefacts.

From this artefact perspective, the questions that drive this paper are: if designers use such artefacts during collaborative design, which artefacts are specifically used in co-design sessions? How are they involved in co-design interactions?

The second idea we retain is the multi-modality of interactions. Eris et al. (2014) suggest that designers use four channels to collaborate: verbal, textual, graphical and gestural. This study focuses on verbal and gestural interaction including hand gestures, artefact manipulation and gaze. Such a multimodal analysis, using both verbal and artefact-based gestural interactions is necessary to explore the behaviour of the participants in a co-design session and to understand what works, what brings clients and designers to work collaboratively to design a product. Many studies (Bly, 1988; Tang et al., 1988; Tholander et al, 2008) advocated that gesturing influences communication during collaborative design sessions. Gidel et al. (2011) concluded that the use of a table top enhances gestural interaction, which leads to more balanced verbal contributions. However, correlates between the contents of verbal and gestural interactions in co-design sessions with artefacts are still missing.

The main purpose of this paper is to characterise interactions supported by the available artefacts in a co-design session, to identify who interacts with whom, and through which type of artefacts. Observations are based on a co-design session in a real context (in-situ) dedicated to the design of packaging for organic biscuits. It involved three professional creative designers, two representatives of the client company and five representative end-customers. The results will also help capturing needs and demands of creative SMEs to support the development of an ICT platform based on Spatial Augmented Reality (SAR) to visualize, create and modify design concepts on a mixed prototype (partially virtual, partially tangible) - Activities of the SPARK project (http://spark-project.net/).

The paper follows with a brief overview of gesture and speech analysis of collaborative design sessions with the aim of highlighting what is already established in the design community and what is missing.

Section 3 presents the experimental approach, the context of the co-design session recording and gives details on the specific design task. Then, after describing the coding schemes for gesture and speech analyses in section 4, the results of a joint analysis are presented and discussed in the last two sections.

2 STATE OF THE ART

During a co-design session, debates between client and designers are structured upon multiple artefacts. Participants are usually seeking two objectives: agreement about existing proposals or definition of modifications based on the existing proposals. Among the different channels used to collaborate (Eris et al., 2014), as previously defined, we pay specific attention to gestural and verbal ones. In our context, interaction analysis focuses on interactions between clients and designers, but also on self-interactions: individual interaction of a stakeholder with an artefact (for instance when he manipulates a physical mock-up). An interaction can, therefore, be verbal (i.e. supported by speech), physical (i.e. supported by gesture), or both, and involves at least two people or a person and an artifact. Literature study shows that authors confronted to these questions often rely on one of these two complementary approaches: verbal or gestural interaction analysis.

2.1 Gesture interaction categorization in design

Gestures have been widely studied for several purposes: communication, creativity and cognitive process, human-machine interfaces development, etc. Authors often refer to (Mc Neill, 1992) who identifies four types of gestures: iconic, metaphoric, deictic and beat gestures. In the field of cognitive design research, Visser (2010) proposed an analysis of interaction modalities in professional collaboration and particularly tried to characterize the link between form and function of gestures in architectural design meetings. This study highlighted the multifaceted nature of gestures and consequently the difficulty to grasp functional and form categories of gestures. Cash et al. (2016), who studied the role of gesture in the communication of design concept, add a target categorisation in their coding scheme. This target categorisation denotes the focus of the participant activity: reflective -toward themselves- or directed - towards one or more participants. Davis (2016), who focused on early stages of the design process, kept only two categories: iconic and metaphoric. She concluded on the importance of metaphoric gesticulations to support communication of solution-scenarios. All these authors emphasize and characterize the communication channel during collaborative design. In addition to this communication channel, Eris et al. (2014) characterise the role of gesturing in a design sketching context as a kinesthetic thinking medium in which the participant explains and debates through the physical activity he is executing. Visser (2010) confirmed this, arguing that some of what is communicated through gestures in design interactions does not exist prior to the start of the gesture; it is created while gesturing instead. However, most of these studies focused on designer's activities held during the production of design representations, mainly sketching. As explained before, this study intends to analyse a wider range of design activities due to the nature of co-design sessions.

2.2 Speech interaction categorization in design

The largest majority of analyses of spoken interactions among designers belong to the domain of design protocol studies. Such behavioural studies observe designers as they talk to each other in collaborative sessions (conversational protocols), or as an individual is asked to say what his/her thoughts are (think aloud individual protocols) or were (ex-post individual protocols) (Jiang and Yen, 2009). This clearly shows that design protocol analyses mainly aim at capturing relevant insights about phenomena, as reviewed in Cross (2001), and cognitive processes characterizing the design activity, as reviewed in Hay et al (2016). Whatever the goal of protocol studies is, the process to carry them out follows a standard procedure: after the definition of a coding scheme to characterize what happens during the design session (i), the activity of designers gets recorded (ii) and transcribed (iii). Then, the transcription of the design discourse gets segmented and classified according to the initially defined coding scheme (iv), which makes the data ready for the analysis (v) and the extraction of relevant conclusions (vi). Therefore, the results of a speech analysis on design protocol strictly depend on the main constructs of the coding scheme. A detailed review of protocol studies is beyond the scope of the current paper, as a tailored coding scheme for analysing the content of spoken interaction has been developed consistently with the goals of the SPARK project, as presented in Section 4.2.

2.3 Joint analysis of speech and gestures interactions

Both gesture analysis and speech analysis have proven to be very efficient in the understanding of collaborative design cognition. Nevertheless, in most cases they surprisingly remained distinct. Even so, Mc Neil (2005) asserts that gestures are closely linked to speech and that gestures analysis is useful because they include all idiosyncratic spontaneous movements of hands and harms while speaking. In the same way, in the field of virtual reality, through the analysis of people using gestures and speech to manipulate graphic images on a computer screen, Hauptmann et al. (1993) recognize uniformity in the way people communicate with both gestures and speech. In the field of design, Suwa et al. (1999) highlight the importance of capturing visual data, including gestures, to capture missing elements in verbal data and to clarify verbal ambiguities.
Furthermore, the understanding of the role of artefacts on collaborative design cognition remained poorly studied and gesture interaction analysis limited to communication studies. As our research question focuses on the characterization of artefact-based interactions, including the verbal and gestural ones in co-design session, our research can be qualified as exploratory.

3 EXPERIMENTAL APPROACH

To clarify the role of speech and gestures in collaborative design sessions and capture their mutual relationships within the design discourse, we organised the research into 6 stages, as described with BPMN notation in Figure 1. The real context of the experiment required a preliminary investigation of common practices during the design sessions (stage 1), as it also helps to develop suitable coding schemes for speech and gestures, with reference to the objectives of the SPARK project (stage 2 - section 4). Below, we describe the experimental setting for the collaborative design session involving designers and clients during a real meeting (reference case study for the protocol analysis) as for stage 3. Stage 5 and 6 respectively address the content of Sections 5 and 6.

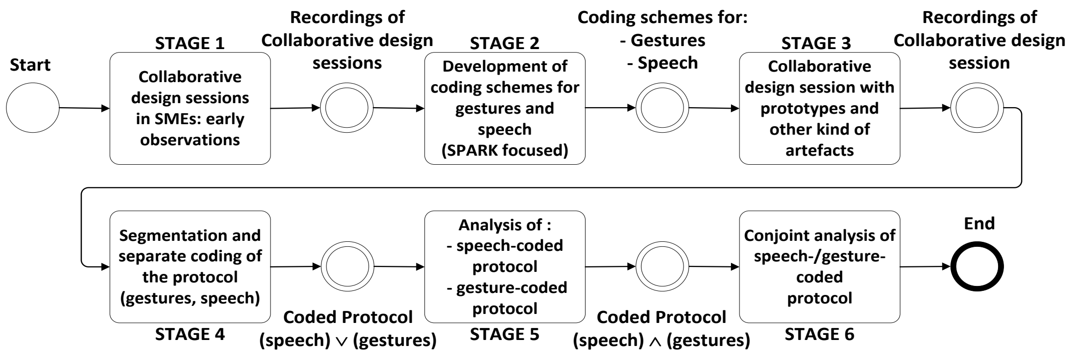

Figure 1. The research approach organized into 6 steps

3.1 Experimental Setting

The case study here analysed is a co-design session involving 3 designers (Artefice, design company), 2 clients (Alce Nero, organic food producer) and 5 end consumers.

(a) (b) (c)

Figure 2. (a) Installed equipment recording the session (b) Discussion between designers and clients (c) tangible mock-ups discussed with red and green sticky-notes

During the session, designers presented the outcome of their previous work on package design for organic biscuits and exposed the proposals to the clients; in return, they collected clients' and end-users' feedbacks and managed a joint discussion on possible improvements, as well as new alternative may emerge. During the session, the participants used paper, pencil, screenshots, laptops, projections, mock-ups, catalogues of the brand, sticky-notes, etc. (Figure 2) to share impressions and provide suggestions on the final composition of the packaging (rearrangement of items' features on the pack front: size, position, color…). The design session was HD recorded for further processing with a full-room A/V coverage (4 cams plus lapel and ambient microphones). Participants agreed to be recorded and to participate the study. After the session data has been post-processed (encoding, synchronisation, formatting, etc..) and two transcriptions have been produced, one describing gestures and a second for speech.

4 CODING SCHEMES DESCRIPTION

4.1 Coding scheme for gestures

As described in Section 2, the literature study showed that gesture analysis has been at the centre of several studies. However, this literature does not provide a relevant framework for supporting this interaction analysis from the point of view of the effect they have on the design object. We have a functional approach of gestures rather than a cognitive one. Therefore, we created our own analysis coding scheme that we tested during a pilot session in the same company on another project. It is based on three elements: the client(s), the designer(s) and the artefact(s) used to support their interactions. This led to two groups of interactions (Figure 3): *with artefact* (interactions 2, 3 and 4) and *without artefact* (1, 5 and 6). In the case of designers/clients interactions, we put a special emphasis on the originator of the interaction: '*a*' when the client was initiating the interaction, '*b*' in the other case. Each interaction supported by an artefact was subdivided into two categories: *digital* and *tangible*. In this context, the *digital artefacts* category included any kind of representation displayed on the multi-touch screen and the *tangible artefact* category included physical packaging mock-ups, printed sheets of the packaging alternatives drawings, sticky-notes that will be posted on the white board, or personal notes. A first attempt for coding interactions with this first version of the coding scheme did not allow us to code all gestures that we observed.

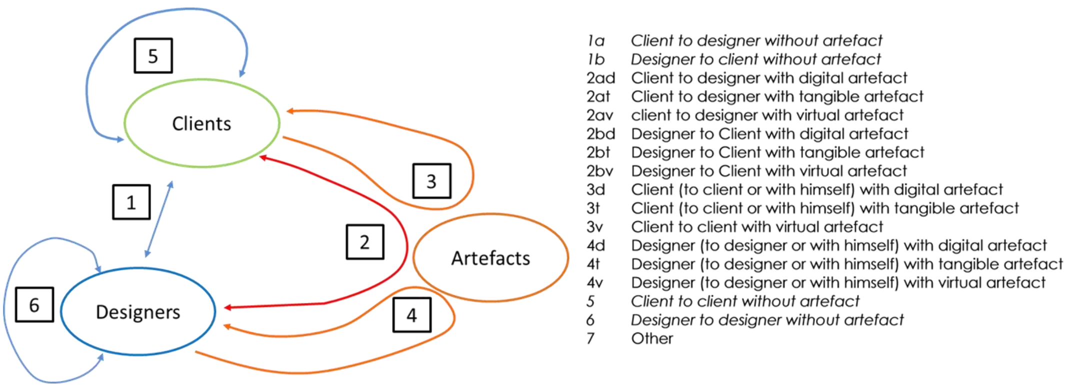

Figure 3. interaction analysis framework and gestures coding scheme

The first issue was that participants were gesturing without handling or pointing any available artefact. These gestures in the air seemed to be crucial for the dialogue between participants. We decided to define a new type of artefact, called "virtual", as the observed gesture often seemed to simulate or mimic the use or the shape of a non-available artefact.

The second issue was related to the fact that several interactions may occur at the same time in parallel. We faced this problem when several participants were interacting at the same time, but their attitude proved that they were taking part in different interactions (eye gaze, body orientation...). As we wanted to keep traces of every interaction with artefact occurring during the session, we decided to create a marker called 'Aside'. This is not to be considered as a new category, rather a marker and it does not interfere with the quantitative analysis.

The category 'Other' was created for coding every interaction that did not belong to other categories. It included for instance social interaction or any gesture with artefacts not considered as design-related.

4.2 Coding scheme for speech

As well as for the coding scheme of Section 4.1, the analysis of speech does not aim at clarifying the cognitive processes emerging during the collaborative design session. It rather aims at capturing the content of the dialogues among the session's participants, with reference to what characterizes the design proposal. To this purpose, the coding scheme has been developed in order to highlight the items (the kind of data an ICT platform should manage to support a co-design session) and the related features (the potential actions on items the ICT should embed for an effective interaction with SAR-based artefacts) that the participants mention. Table 1 collects the coding scheme for speech, respectively with reference to items and to their features.

Consistently with what was done for the coding scheme about gestures, the constructs of Table 1 have been defined after a preliminary observation carried out on a pilot test case in the company, whose results are not presented in this paper. Items are mutually exclusive from each other. They refer to components of the packaging, which are central elements of the interaction. Features are attributes of Items. They provided indications about the characteristics of items that designers, clients or end users would like to keep as they were, in case of appreciation, or transform, in case of dislike.

Table 1. Coding scheme for speech analysis: Item-based constructs and related descriptions (cols 1,2); Feature-based coding scheme and related descriptions (cols 3,4)

ITEMS		FEATURES	
Coding scheme about items	**Speech parts referring to elements on the design proposal characterized by …**	**Coding scheme about features of items**	**Speech parts referring to parameters of items on the design proposal concerning the…**
Texture	…background motifs/patterns	Position	…geographical location
Logo	…brand distinctive graphics	Orientation	…degree of rotation
Image	…a computer generated picture	Size	…length, width and/or depth
Photograph	…a photograph of a real object	Number	…the amount of items
Text	…what expressed by words	Content	…conveyed information
Icon	…non-brand symbols	Colour	…chromatic content
System Parts	…a material part of the whole	Material	…properties of substances
Whole	… the design proposal as a single entity	Look	…quality and style
		Presence	…item introduction or removal

5 RESULTS FROM SEPARATE ANALYSIS

5.1 Results from gesture analysis

Figure 4 highlights that most of the interactions are supported by different types of artefacts (88%). Less than 12% of the interactions do not involve artefacts; this confirms the importance of the artefacts involved in a co-design session. Overall, it supports our underlying hypothesis of the predominance of artefact-centric interactions in co-design sessions.

The results also spot that clients tend to use digital artefacts (10,4%) and virtual artefacts (16,2%) to communicate with designers, both representing almost 1/3 of the interactions of the whole session. On the other hand, designers mainly express themselves using tangible artefacts (17,4%), as they mostly use the paper prints of the design alternatives as a basis for their interactions. This allows them to move more freely around the table. We can notice that interactions initialised by clients are more frequent than those initialised by designers (35% Vs 26%). In turn, clients are real actors in the co-design process and are more than simple validators of design proposals.

Interactions between clients appear to be also important, especially those involving the tangible artefacts (17%) used when clients discuss between themselves manipulating or pointing at a tangible artefact available on the table. We observe the same phenomenon with the designers who mostly communicate between themselves through tangible artefacts (14%).

One important point that is uncovered by this study is the role of virtual artefacts. These artefacts are by nature neither physical nor digital; however, they behave as actual artefacts in the interactions between stakeholders. Around 17% of the total interaction time was involving virtual artefacts. Here virtual artefacts can be considered as cognitive artefacts (Normann, 1991) since they act as amplifiers of the message to be conveyed and have a representational dimension as physical artefacts. We outline here the imaginary dimension (Athavankar, 1999) of these artefacts that may enhance their creative or evocative power. An interesting perspective could be to study the functions of these virtual objects during co-design and the potential impact of SAR technology on the creation, manipulation of these virtual objects. Additionally, we noticed that clients used these artefacts to express their thoughts during communication with designers. It may also be explained by the lack of other available artefacts, which lead them to express their thoughts through some gestures in the air.

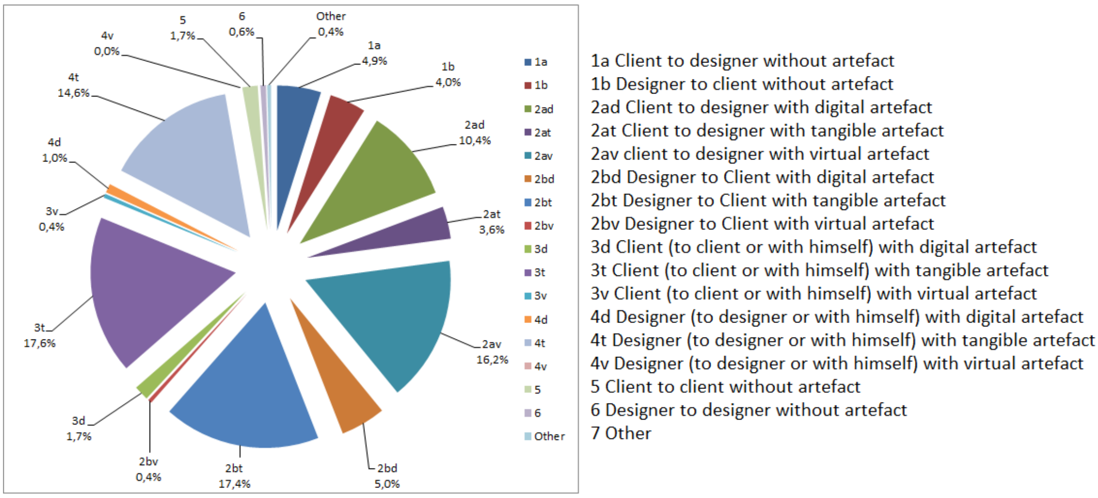

Figure 4. Results of gesture interactions analysis[1]

Another result indicates an important percentage of aside interactions; they are the interactions that occur in parallel between subgroups during the session. They count as 28,5% of the total interaction time. This indicates the necessity to handle this type of situations in the SAR environment.

Gesture interactions indicate a high level of activity through artefacts of all types. However, we have no indication at this level on the content of these interactions and especially on the purpose of the speech associated that could help us to understand if gestures we observed are linked or not to artefacts handled, pointed or drawn in the air, as instead achieved with the joint analysis described in Section 6.

5.2 Result from speech analysis

Figure 5 collects the results of speech analysis, showing the distribution of the different coding (items and features) over a total time of interaction (TTI) corresponding to approximately 30 minutes (1784 seconds). The results of the two categories of coding are separately presented.

Figure 5-a shows that both Icon and System Part have not been mentioned. For Icon, these depends on the fact that the typical stamp for organic product is not in the front side of the design proposal as the customers directly associate the brand logo and the corporate identity to that product category. On the contrary, the absence of system parts reflects, as recalled in the introduction, that the coding scheme addresses both the purposes of package and product design and, in the former, system parts are mainly graphical contents. On the other hand, more than two thirds of the occurrences have been coded as photographs (42%TTI) and text (27% TTI). This suggests that these items are the ones that mainly capture the attention of the participants. These results, however, do not clarify at all who puts the higher interest in these topics; whether this depends on designers asking for feedbacks or on clients that want to express their opinions. A conjoint analysis can also help clarifying such uncertainty.

Figure 5-b, in turn, shows that also Material and Number of items are almost negligible (3% TTI). As for Material, this depends on the pure graphical evaluation of the design proposal (an end user spent a few seconds asking if the mock-up she interacted with provides a similar touching experience in reality). The scarcity of time spent talking about Number of items is more surprising, since one can expect that the number of photographs or images might be increased or decreased. To this purpose, the 3% of whole coding (Figure 5-a) suggests that the composition of the design proposal was already well balanced

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[1] The figure displays the results of the gesture interaction as a percentage of the total duration of the interactions. Each category is therefore a percentage of this duration.

without requiring the introduction or the removal of more items of the same kind. However, a significant amount of "Presence" also shows that single items on the design proposals have been suggested for addition or removal according to the discussed topics. Again, a conjoint analysis helps to distinguish if this feature change depends on a feedback request from designers, on clients and end users expressing opinions about the design proposal, or both.

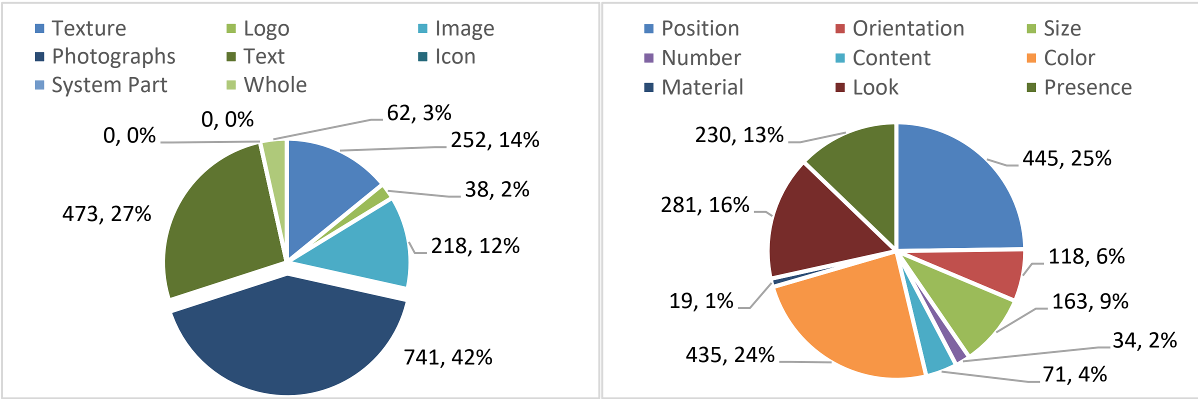

Figure 5. Speech analysis - left side (a): Items; right side (b): Features

About two thirds of the TTI (65%) have been spent discussing on Position, Colour and Look of items, which appears to be the most relevant elements for the evaluation of a design proposal for package design. This consideration, as for the previously mentioned ones, needs to be confirmed by the analysis of mutual interactions between designers and the other participants to the collaborative design session. A uniform distribution between designers and others would more likely highlight the request of opinions from designers and the related feedbacks from clients. On the contrary, an unbalanced distribution towards clients would suggest that these features are the most effective in creating appreciation or dislike during the evaluation of packaging design proposals.

6 RESULTS FROM THE CONJOINT ANALYSIS

For processing such conjoint analysis, we adapted our respective corpus (gesture and speech) in order to synchronise the data. It has been done in two main steps: to adjust the time segmentation; in case of 'aside' interactions, to keep only the gesture interaction related to the verbal interaction occurring at the same time. The separate analysis of gestures and speech highlighted that some topics (items or features) and some gestures occur more frequently than others. In order to check the advantages coming from the combination of the analysis described in Sections 5.1 and 5.2, it appears convenient to focus the attention on topics and gestures occurring more frequently. Figure 6-a graphically shows the frequency of interactions with digital, tangible and virtual artefacts with reference to the items (text, images, photographs and textures) verbally discussed at the time of the interaction, as designers and clients just seldom mentioned logos, icons, system parts and the whole composition of the package. Figure 6-b, in turn, shows gesture-based interactions with reference to the full set features presented in section 4.2. The graphs show Client-to-Designer interactions (C2D) and vice versa (D2C) as these interactions are the ones that more frequently occur during the recorded co-design sessions. Both graphs show that C2D interactions occur more frequently than D2C. This supports what we already anticipated in Section 5.1: designers have instruments to clearly describe what they are referring to, as there is a clear prevalence of interactions through tangible artefacts (17,4% of Total Time of Interaction -TTI) and an almost complete absence of interaction through virtual artefacts. On the contrary, clients usually interact through digital and virtual artefact (26,6% TTI). This shows that clients refer to something tangible, when available, and that they resort to hand gestures in order to address design proposals shown on TV screen (see Figure 2-b) or shape concepts by hands presumably to reinforce what they can just verbally refer to. Entering into the detail of the conversation related to the interaction, Figure 6-a highlights that photographs played a relevant role in the entire discussion. However, beyond them, designers more frequently seem to discuss about the graphical elements (images and texture) they are proposing through tangible artefacts (e.g., mock-ups), presumably to gather feedbacks about end users and clients' expectations. On the other hand, clients' commentaries more frequently refer to text (yet after photographs). As clients usually refer to more detailed and contextualized items while designers are more used to abstraction, we can hypothesize that this reflects a potential mismatch in shared external representations between designers and clients, depending on their different background knowledge, which results into potential communication barriers.

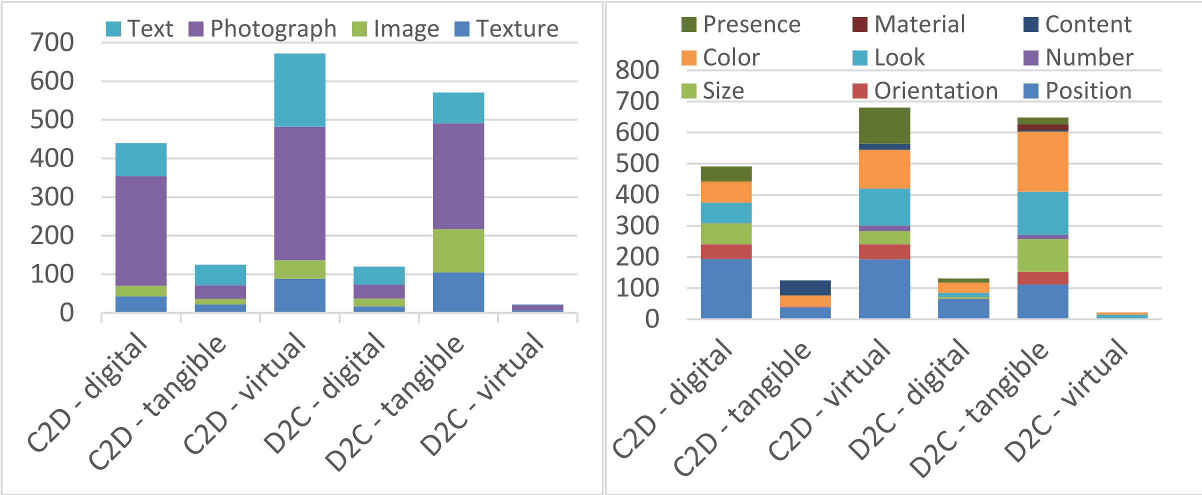

Figure 6. Combined results of gestures and speech; a- left) items and gestures (seconds); b-right) features and gestures (seconds)

Furthermore, it is interesting to consider the ratios of textual items considering the different artefacts used for the interaction, which follow a different pattern with respect to the overall discussion. Designers mostly use digital artefacts to refer to textual items (39% D2C-digital; 14% D2C-tangible; 9% D2C-virtual), while clients mostly opt for tangible artefacts (20% C2D-digital; 42% C2D-tangible; 28% C2D-virtual). This suggests that text might require a more fine-grained information processing that needs a closer (tangible) interaction with an artefact, as it appears hard to externalize knowledge about textual items with just speech and distant gesture interactions.

Figure 6-b on features and gestures joint analysis presents some expected and some surprising results. Position is the most frequently mentioned feature (whatever the interaction is), since it is paramount for the definition of the composition of the overall package. The large amount of time spent to discuss the presence of items in C2D interactions also confirms the need to discuss of the package composition. On the contrary, features that people would more easily express by hands, such as size and orientation (as touch-HCI allows to change) are not particularly frequent in the interactions with virtual artefacts (13% C2D-virtual and almost absent in D2C-virtual). Moreover, it is also surprising that features as colour and look, which one can hardly describe by hands, are among the most frequent features presented in C2D virtual interactions (Colour 19% C2D-virtual; Look 18% C2D-virtual). The almost uniform distribution of these items also in interactions from clients to designers with digital artefacts (Colour 15% C2D-digital; Look 15% C2D-digital) shows that the digital artefact (and the tangible as well, for which this interaction is missing) might not be sufficiently representative to describe what the client would like to express by spoken words. The strong prevalence of C2D-virtual interactions over TTI also suggests that new communication channels (artefacts), and related enabling technologies, are required to facilitate knowledge externalization processes from Clients to Designers.

7 CONCLUSION

The paper proposes the joint analysis of gestures and speech to elicit the behaviour of designers and clients in a collaborative design session. Compared with gesture analysis and design protocol analysis accomplished separately, as typically proposed in literature, the joint analysis allows investigating more in detail the role of gestures through and with artefacts, and their impact on the co-design process.

We applied the joint analysis to a real case study involving designers from Artefice (Italian design company), their clients Alce Nero (organic food producers) and exemplary end-users.

The analysis highlighted the differences between the participants both in terms of the object of the design discourse (more or less abstract) and the communication means (with digital or tangible artefacts). The case study also revealed a significant portion of the interactions from the Clients to the Designers went through gestures not referring to any digital or tangible artefact, but rather to gestures in the air that

seemed to mimic some features of a non-available artefact. The study conducted so far does not allow claiming whether this is due to a lack of appropriate communication means, or to a lack of knowledge and representation skills. Those options shall be investigated in the follow-up of this research activity, together with the general role played by those virtual artefacts in co-design sessions.
Beyond showing the advantages of such joint analysis, the study also confirmed the potentially relevant role of an ICT platform for supporting the interaction in a co-design session, since digital artefacts occurred quite frequently both in Designer-to-Clients and Clients-to-Designers interactions. This is aligned with the expectations of the SPARK project, within which this study is conducted.

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