How the communication between designers was affected by ActionSketch, a technique to improve sketches in interaction design

Gil Barros, Leandro Velloso

sketching,
communication,
interaction design,
ActionSketch

Sketching is a well-established practice in many areas of design. Sketches and communication are tightly connected because one of the main functions of sketches is to help a designer communicate with colleagues. Interaction design is a new field of design that poses challenges for sketching and considering these challenges we proposed ActionSketch, a technique to improve the process of sketching for interaction design. We conducted four workshops with 24 professionals, followed by a period of continued use of approximately three weeks and an individual interview. Regarding communication between professionals, we found two sets of results: when all designers knew the technique and when some or all of the designers didn't know it. In the first case the technique facilitated the communication and points to three main benefits: verbal explanation was no longer needed; drawings became more evident; presentation of the drawings was less important. In the opposite case it ended being an obstacle. We argue that this is an intrinsic dilemma for the technique, there is a learning barrier, and we can only make the process easier. However, when at least one designer knew the technique it was no longer a barrier and even became a facilitator in critic situations. Given these results, claim that the technique has a positive effect on communication between professionals.

1 Introduction

Sketching is considered a core activity in design (CROSS, 1990; GOLDSCHMIDT, 1991; LAWSON, 2004: 52) and since the seminal work of Schön (1983: 79), who describes the act of sketching as having a "conversation" with the drawing, it has been increasingly clear the importance of sketching and its dialogic nature during early stages of the design process (BUXTON, 2007: 115; FISH, 2004; GOLDSCHMIDT, 2004; LAWSON, 2005: 44; VERSTIJNEN, VAN LEEUWEN, GOLDSCHMIDT, HAMEL & HENNESSEY, 1998).

Since the term "sketch" can be interpreted in several ways, in this article when we refer to sketches we use Lawson's (2004: 45) definition of "proposition drawings", those drawings that the designer creates to propose a possible outcome to a problem.

Sketches and communication are tightly connected because one of the core functions of these drawings is to help a designer

communicate a preliminary design solution to colleagues (BUXTON, 2007: 154; DIX & GONGORA, 2011). This is a crucial step in a strategy where the designer, or team of designers, studies the problem through successive attempts to solve it (LAWSON, 2005: 48).

Interaction design is a new field of design that emerged in the 1990s combining characteristics of industrial design, graphic design and computer science (SAFFER, 2009: 21). It can be defined as "*the design of the subjective and qualitative aspects of everything that is both digital and interactive*" (MOGGRIDGE, 2007: 660).

The field poses new challenges for sketching because it deals with objects that are dynamic (ARNALL & MARTINUSSEN, 2010; BUDGEN, 1995; EIKENES & MORRISON, 2010) and which have "immaterial" qualities (BROOKS, 1987; BUDGEN, 1995; OZENC, KIM, ZIMMERMAN, ONEY & MYERS, 2010), and so traditional sketching practices are sometimes insufficient (BUXTON, 2007: 135).

For example, one way to represent interactions is in textual form, on annotations that describe what happens (GREENBERG, CARPENDALE, MARQUARDT & BUXTON, 2011: 94; SAFFER, 2009: 154). The problem here is that either these annotations don't describe visually how the interaction is done, which leaves too much room for interpretation, or they tend to get very long and cumbersome to read, which hinders the creative process in sketching (VERSTIJNEN et al., 1998).

Another alternative when communicating with a colleague is to complement the drawings and to explain the interaction orally or gesturally (THOLANDER, KARLGREN, RAMBERG & SOKJER, 2008). The problem in this situation is that the interaction is not registered in any physical support and it relies only on the memory of the designers who participated in the conversation.

Considering these challenges for sketches in interaction design, we proposed ActionSketch, a technique to improve the process of sketching focused on interaction design.

In this article we start by presenting the technique and then explain how we conducted a study with 24 professional designers. We present the results from this study and discuss the impact of the technique on the communication between designers.

We argue that the technique improved sketching, resulting in a positive impact on communication.

2 ActionSketch: the proposed technique

The technique is composed of four parts: frames, colours, symbols and rules.

Frames are used to represent the interaction happening over time. They are arranged like a storyboard, just as it's used in film and motion graphics (HART, 2008: 9). This is already a common practice in interaction design (BUXTON, 2007: 282; GREENBERG et al., 2011: 147) and we found it the most suitable for our technique.

Colours are applied to organize the sketch. To better represent the interaction, in other words, the dialogue between the user and the system, we represent each frame with three stages: *initial state*, *user actions* and *system actions*. In order to indicate these stages in the same frame we use three colours for layering (TUFTE, 1995: 53) following this association:

- black: *initial state*;
- green: *user actions*;
- orange: *system actions*.

Symbols are defined to improve consistency in specific situations and to represent elementary user actions and responses from the system. Each of the three stages has a specific set of symbols.

In the case of the initial state we draw a wireframe by hand, which is already a common practice (BROWN, 2010: 183), and we only add four symbols presented in Figure 1 to improve consistency.
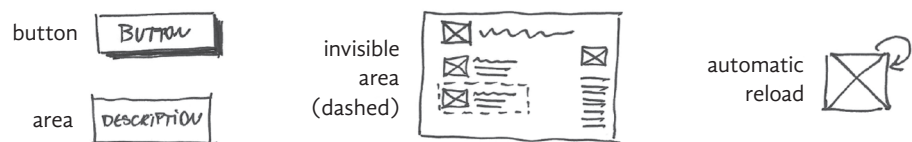
Figure 1 Four symbols proposed for the initial state

- *Button* is indicated by thicker borders on the bottom and right and is used to represent a clickable object.
- *Area* is represented by a rectangle with a label inside. They are used for elements of the screen that can be described in words, such as headers, footers, tag clouds, navigation panes and others.
- *Invisible area* is symbolized by a dashed line and can be used in two situations. In the first one they represent elements that are outside the screen because during an interaction they either entered or exited the screen. In the second situation they are used to delineate a cluster of visible elements that forms a group but which is not delimited by any visual cue.
- *Automatic reload* is represented by a curved arrow on the top right and indicates an element that refreshes itself automatically.

To represent the user actions we propose 12 symbols that cover basic actions that the user can do with a pointing device (typically a mouse) and a keyboard, presented in Figure 2.
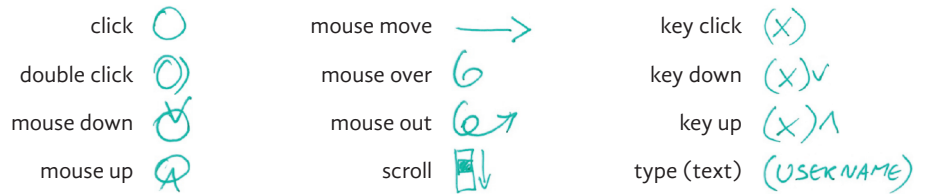
Figure 2 Twelve symbols for the user actions

These symbols can be arranged in three groups, represented by the columns in Figure 2 and which can be described as:

A group for mouse clicks:

- *click*: the users presses and releases the mouse button;
- *double click*: the users presses and releases the mouse button two times, quickly;
- *mouse down*: the users presses the mouse button;
- *mouse up*: the user releases the mouse button.

A group for mouse movements:

- *mouse move*: the user moves the mouse cursor;
- *mouse over*: the user places the mouse cursor on top of an item on the screen;
- *mouse out*: the user removes the mouse cursor from an item;
- *scroll*: the user scrolls through the scroll wheel.

A group for actions on the keyboard:

- *key click*: the users presses and releases a key on the keyboard (the lowercase "x" in the example);
- *key down*: the users presses a key on the keyboard;
- *key up*: the users releases a key on the keyboard;
- *type*: the user types some text ("username" in the example).

For system actions we propose a set of eight symbols that represent actions that the system can produce on the screen: *show*, *hide*, *expand*, *reduce*, *highlight*, *remove highlight*, *move* and *reload*. These symbols are presented in Figure 3.
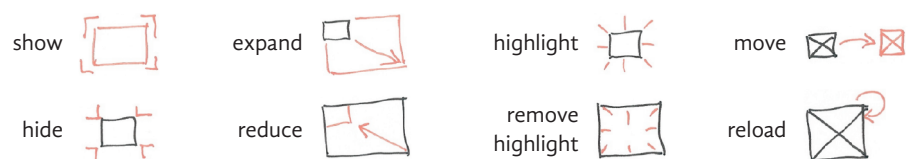

Figure 3 Eight symbols for the initial state

Rules of use are the fourth and last part of the technique. These three rules are meant to help applying the technique, and can be described as:

1. *Draw only what changes between frames*. To make sketches faster draw the whole screen on the first frame, but on the following frames only what changes needs to be represented.
2. *On each storyboard stay focused on just one idea*. This helps to focus on one specific task that the user is doing. For example, each of the tasks "add item" and "remove item" should be drawn on a separate storyboard.
3. *The goal is to express an idea, employ the technique when useful and modify it as needed*. The main purpose of the technique is to help make sketches, not to be a straitjacket. According to the situation it might be better to draw in one way or another, or even to adapt the technique. Customization is expected.

To demonstrate the technique we provide two practical examples. On the examples we have several icons on the screen and we add them to a side panel (labelled "cart"). In the first case the user simply drags the icon on top of the closed panel. We show this example on Figure 4.
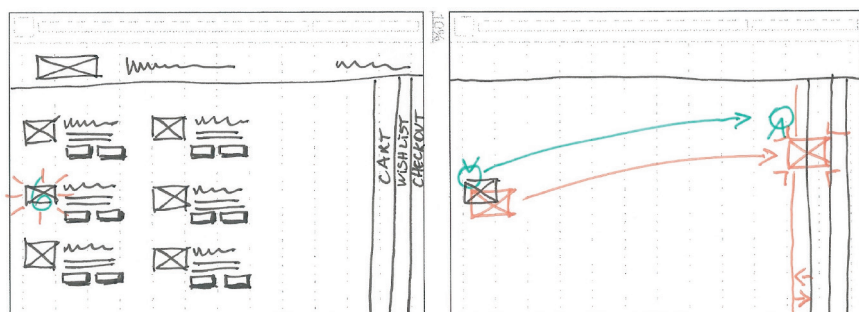
Figure 4 Using ActionSketch to represent how to add an item through a drag and drop mechanism

- Frame one: the user puts the mouse over the icon and the system highlights the item.
- Frame two: the user grabs the icon, drags it to the tab of the panel and releases it. The system carries a shadow of the icon with the cursor and when the user releases it the shadow disappears and the tab moves a bit to indicate that the item was added.

In the second case the panel is already open and has five items inside. When the user drags the sixth item some of the items need to shift place and a scroll bar appears. We show this example on Figure 5.
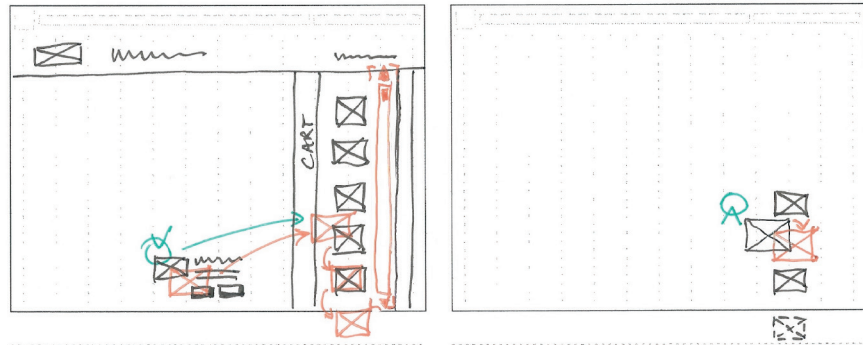
Figure 5 Using ActionSketch to represent how to add the sixth item to the
side panel

- Frame one: the user drags the icon to the desired position. The system moves some of the icons down to free some space and displays a scroll bar.
- Frame two: the user releases the icon and the system snaps it to a grid.

The technique is currently on its ninth version. It was initially based on a literature review, followed by a series of iterations through exercises. We presented earlier versions of this technique in previous studies, but at that point it was just a proposition, before any formal feedback from interaction designers (BARROS, CARNEIRO & COSTA, 2011). Since those studies we performed in-depth interviews with eight interaction designers and revised many aspects of the technique. After that we validated the technique in workshops, which we describe in detail in the next session.

3 Design studies

For our design studies we proposed an introductory workshop to present and practice the technique and collect initial feedback. After that there was a continued use period, when the participants tried to apply the technique in their daily work, and finally an individual interview to collect feedback and materials generated. Figure 6 presents an overview of the whole process.

We carried out four workshops in four different companies, with 24 participants in total. Three of the companies were interactive design agencies and one was an in-house team of a newspaper (workshop 2).
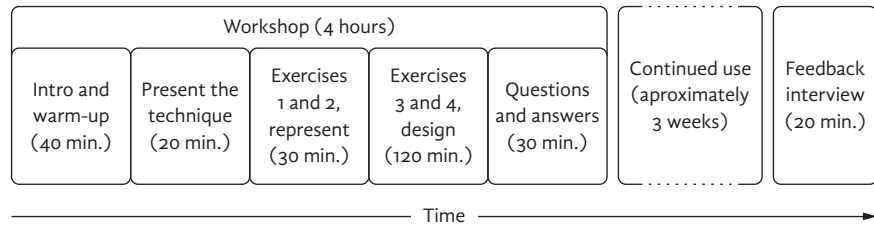
Figure 6 Overview of the workshop, continued use and feedback interview used in the study

Table 1 presents an overview of the participants. In the second column, just as a reference, we have the total number of employees of the company. On the third column we have the total number of participants, who were all co-workers. The fourth column shows the number of participants whose tasks were focused mostly in IxD. The other participants were part of the interaction design team but had complementary roles, such as visual designers, managers and usability analysts.

Table 1 Overview of participants in each workshop

Workshop	Employees	Participants	Focus on IxD
1	150	5	3
2	500	9	4
3	14	6	4
4	60	4	3

As shown in Figure 6, the workshops lasted around four hours each and followed the same structure. An initial questionnaire collected some information about the participants profile and previous practice with sketching activities. Then a high-level overview of sketching was presented and a warm-up exercise proposed (40 minutes). Then the technique was presented (20 minutes) and four exercises that used the technique were proposed.

The focus of the first two exercises was just on using the technique for representation, therefore the participants were asked simply to sketch an interaction that was presented to them (30 minutes). On the next two exercises the focus shifted for designing a solution, thus they were asked to sketch proposed interactions for a series of situations using the technique (120 minutes). Figure 7 shows an example of exercise two, which is similar to the example presented in Figure 4.
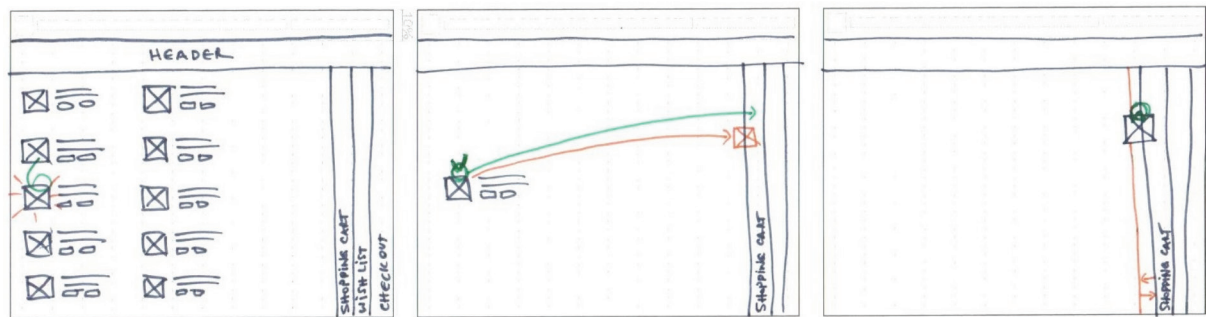
Figure 7 Example of exercise 2 done by participant

The workshops were concluded with a session for questions and answers. The participants also filled a 14 question written survey asking about their initial impressions of the technique, it's usefulness in their work and comparing it with their previous practice (30 minutes).

Each participant received a kit for the workshop containing a cheat-sheet of the technique, some template sheets and black, green and orange pens. These materials were left with the participants after the workshops for the continued use, which lasted three weeks on average. During this period the participants received daily emails both as a prompt to remind them to try to use the technique when possible as well as to collect feedback.

At the end of the continued use we conducted a short individual interview with the participants (20 minutes). In this interview participants reported how they used the technique, its advantages and disadvantages, in addition to other observations. We also collected the drawings made, both during the workshop as well as during the continued use.

4 Use of ActionSketch: results and discussion

A key benefit of ActionSketch was that it improved significantly the representation of the interaction. As one participant said: "*[The technique] allows me to represent things that until then I found very difficult*". And even though the technique uses paper, a static medium, it communicated adequately the interactions, or as another participant stated: "*Although it is static [the drawing], the interactions come to life*".

This improvement of the representation had several effects. We provide a very broad overview of these effects elsewhere (BARROS & CARNEIRO, In press) and in this article we focus on how they affected the communication between designers.

We found two sets of results, one when all professionals knew the technique and another with professionals who didn't know it.

Naturally communication between professionals who knew the technique was facilitated, as it proposes a more uniform way to

represent the interaction: the storyboard structure, colour coding, sets of symbols and the rules.

Also as expected, ActionSketch was an obstacle to professionals who didn't know it. We will first present the results when professionals didn't know the technique, which should divided into two situations: when there was no further explanations beyond the drawings and when one or more professionals who knew the technique were present, and could explain it.

4.1 Presenting the technique without further explanations

Professionals who did not know the technique couldn't understand the sketches without additional explanations. This happened twice, once intentionally, when one participant showed another professional and asked what he understood of the drawing, and another by accident when a colleague casually asked one of the participants about the objective of the workshop.

This reveals that the technique is not self-evident, and that there must be a learning process before using it. We believe that this is an intrinsic difficulty to the introduction of a specific technique: it can be a facilitator for those who know it but requires a learning process for those who don't. The question then becomes trying to reduce the learning process to a minimum, which leads us to the next topic.

4.2 Use of the technique when at least one designer knew it

Since learning is required, we believe that it should be as simple as possible. Here we focus on a specific situation, the process of "teaching" the technique to other professionals during normal working situations, such as meetings.

Three participants reported this situation. They said that, despite a little strangeness at first contact, with a quick explanation of the colours and symbols they were able to show and use the drawings in meetings with other professionals. This indicates that the basics of the technique were very easy to learn and that with a brief explanation it was no longer a barrier.

We have some clues why this might have happened. In the first place, it is based on the current practice of drawing wireframes by hand. While the technique complemented them with new colours and symbols, the discussion of drawings on meetings was not a new procedure.

Second, we believe tried to create symbols that somehow relate to the action they represent, the referent. As examples we have the symbols for enlarge, reduce and move. We also tried to think of the symbols as a system, so the symbol for the click (circle) served as a

base for the other symbols for mouse buttons (mouse down, mouse up and double click).

Finally when choosing the colours we avoided colours which already had some other connotation. For example, we didn't use blue because it is sometimes used in wireframes to indicate clickable text. We also didn't use red because it is often used to indicate errors or to call the attention to something special.

In summary, we believe that the technique was useful when communicating with professionals who didn't know it, as long as there is a brief explanation. We also consider that a learning process is inevitable, but tried to minimize it.

4.3 Communication between professionals who knew the technique

In the situation when all professionals knew the technique the results point to three main benefits: verbal explanations were no longer needed; drawings became more evident; and the presentation of the drawings was less important.

4.3.1 *Verbal explanation no longer needed*

The use of verbal and gestural explanations is a common practice in interaction design (THOLANDER et al., 2008). The screens are drawn but the interactions are only described orally, and the designers need to combine these two in their minds in order to understand the full representation.

By using ActionSketch both the screen and the interaction were drawn and therefore, as reported, verbal explanations of the interaction were no longer necessary. As stated by one participant: "... *[it was] easy to read and explain the interactions*".

This can be demonstrated on Figures 8 to 10, where we have three alternatives for adding friends in groups. In the first case we have icons of friends on the larger panel and they are dragged into groups, shown on the right. In the second case friends are on a panel above and are also added through drag and drop, but not on the group icon, but on the main panel, which shows the members of the group currently selected. The last option, shown on Figure 10 is similar to the second, but friends are on a retractable panel on the right side of the screen.

In the three alternatives the drawings describe both the screen layout and the interactions, and thus there is no need to explain them verbally.

In our study these situations always occurred at meetings where designers were present, but it seems reasonable to imagine that this benefit should also occur for asynchronous communications, such as email.
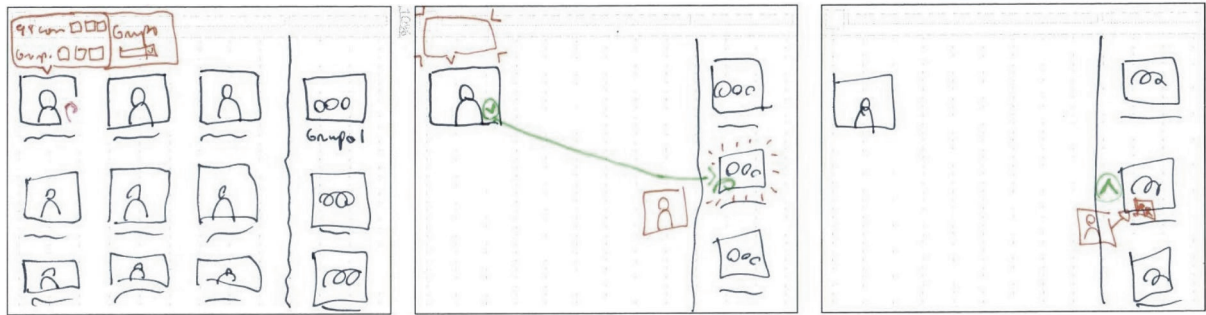
Figure 8 Alternative presented by one of the participants in exercise three
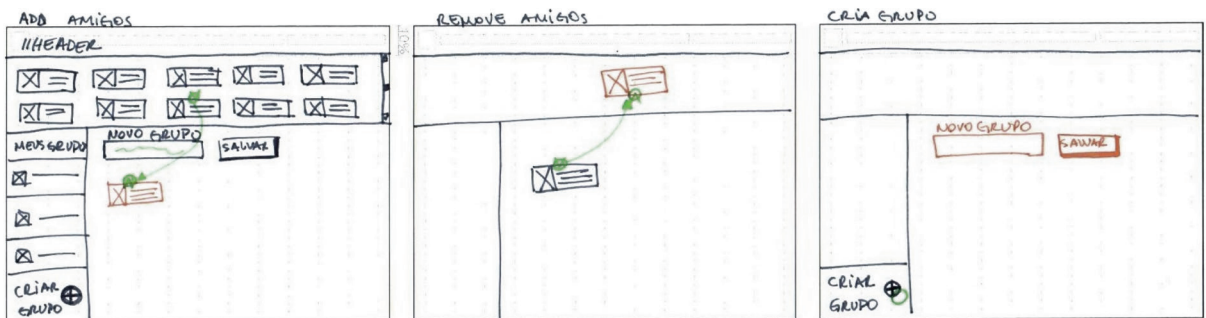

Figure 9 Alternative presented by another participant of the same group
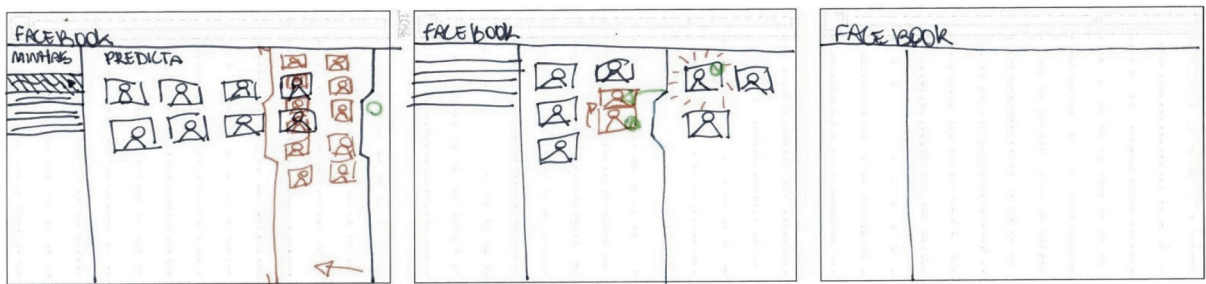

Figure 10 Alternative presented by the third participant of the group

4.3.2 *Drawings became more evident*

It also seems like the meaning of the drawings became clearer, especially because of the shared use of symbols, colour coding and the storyboard.

What we saw as a result of this was that during the workshops the participants spent very little time describing the interactions, and most of the time they were discussing the pros and cons of the alternatives.

Also, notes were little used. This means that it was faster both to draw and to read the drawings, since the information was coded in a more condensed form, the symbols. For example on frames one

and two of Figure 11 we have an example of how symbols were used instead of textual descriptions to describe a mouse over and highlight (frame one), followed by a drag and drop operation (frame two). On the three frames on the bottom we have another mouse over with highlight (frame one), a click which opens an input field with a button (frame two) and how the user fills the field with text and clicks on the button (frame three).

Another advantage of not using notes, mentioned by three participants, is that sometimes the notes are not considered when others read the drawings. Although this problem shouldn't occur, in practice it does and creates problems in communication. With the technique this problem did not occur.
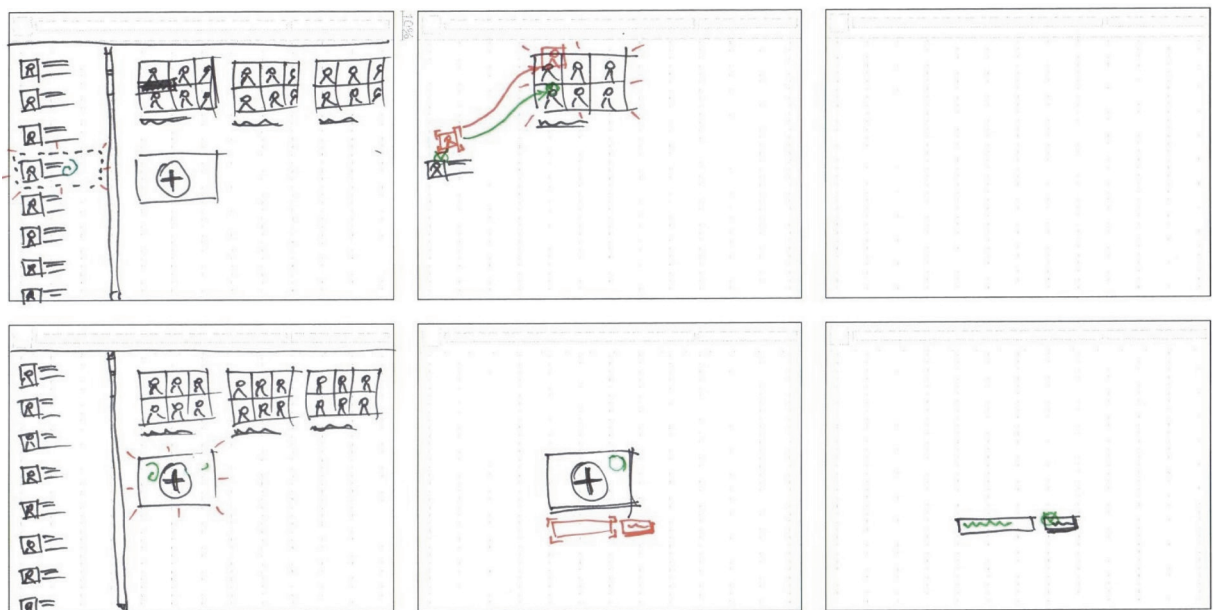
Figure 11 When using ActionSketch the use of notes was much smaller

4.3.3 *Presentation of the drawings was less important*

The third point was that the presentation of the drawings was less important, and the appearance influenced less on the importance of the solution presented. We believe that this occurred because they were all very early sketches and none of them induced the notion of being more evolved than the others.

When there are representations with very different presentations, such as a quick sketch on paper and a wireframe done on the computer, there is a tendency to give more credit to the one with better presentation. (BUXTON, 2007: 107) illustrates this showing how designers simulate hand drawings on the computer to indicate that they are still preliminary.

In our study this situation could be seen in Figures 12 to 14. The first two are the original ideas of the participants and the third is an evolution of both, which was selected to be better designed and prototyped. As reported by one of the participants in this case:

> "… *[we managed] to combine all the ideas without giving more weight to any of them […] it wasn't mine or his idea that prevailed, what prevailed was one that we, together, arrived based on this first input on paper.*"
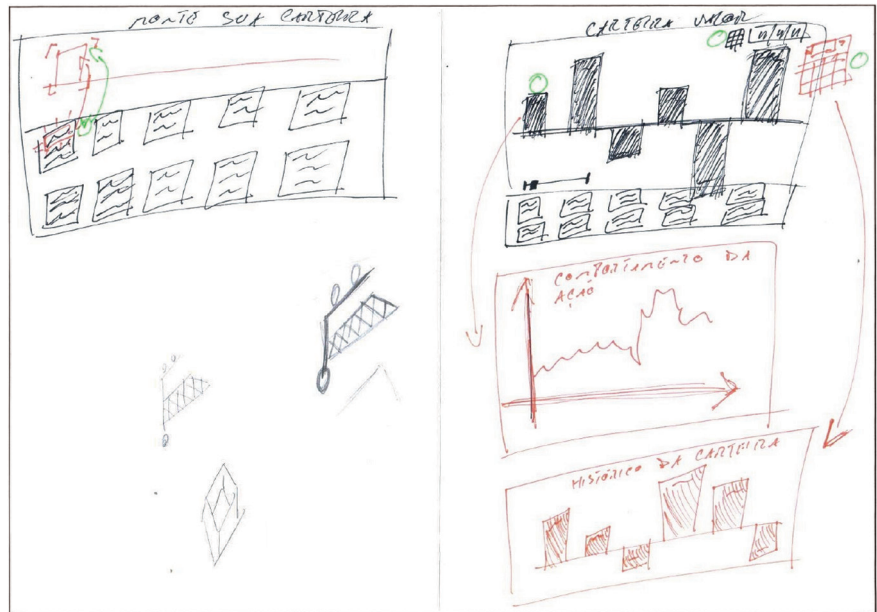

Figure 12 Idea presented by one participant as initial input
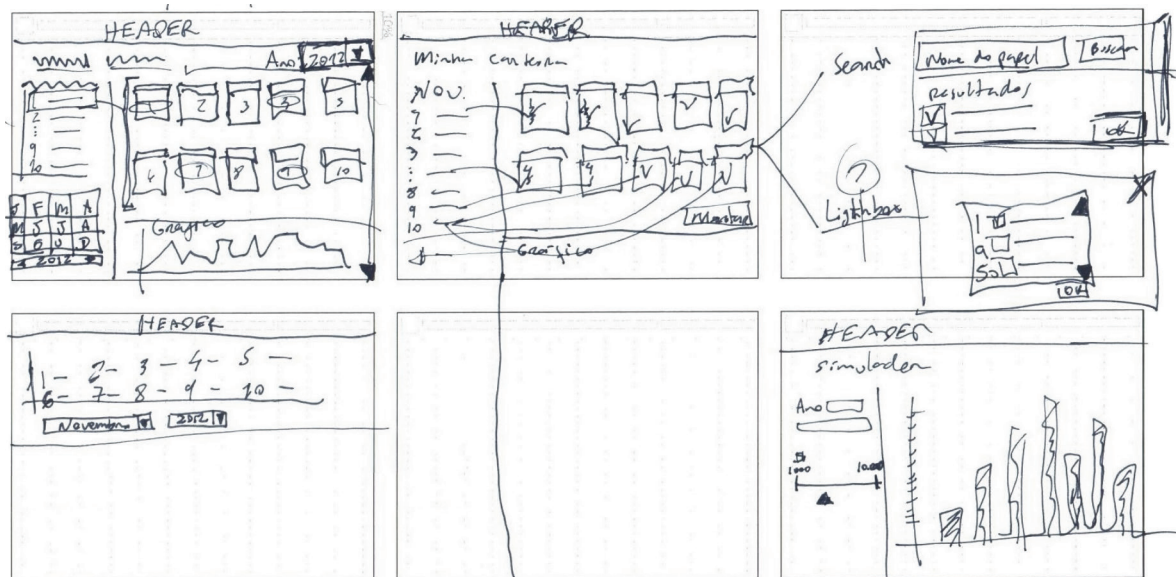

Figure 13 Idea presented by the second participant, also as initial input
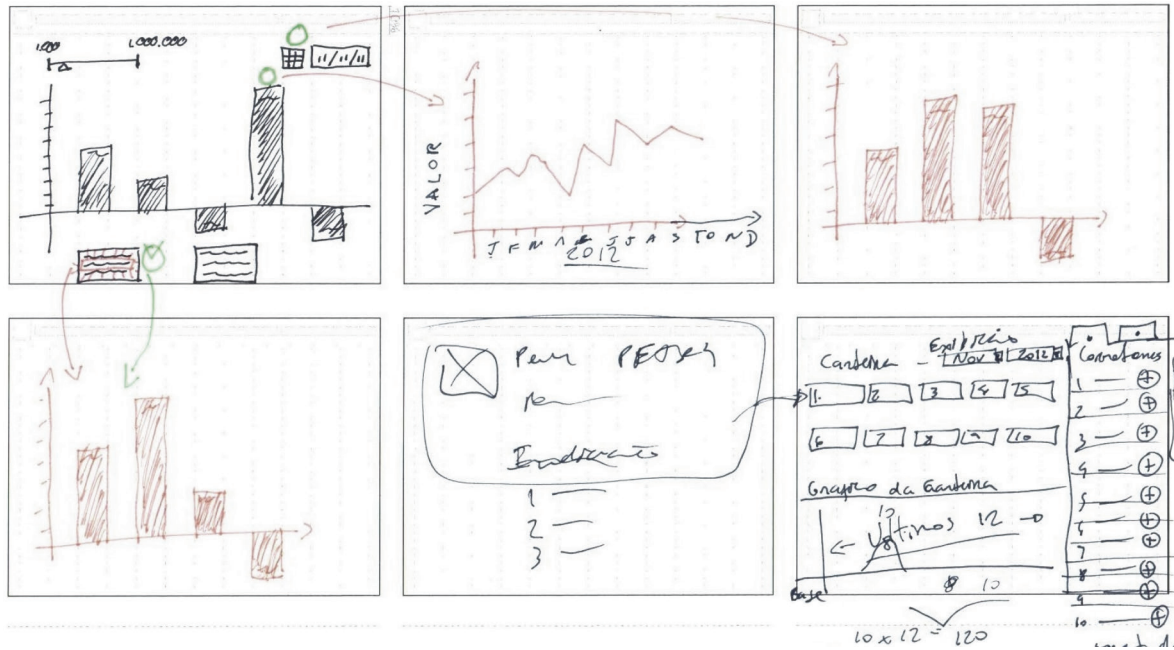
Figure 14 Evolution of both ideas into a third alternative

What is particularly interesting in this case is that one of the participants had a background in IT, and had never sketched a design solution on paper to show to co-workers. He stated that he was particularly surprised with how his sketches allowed him to communicate better with the designers.

This was an unexpected effect, that the technique empowered even someone who would feel very uncomfortable with sketching. For this participant his comfort zone was the computer, and particularly writing code. Even being very pessimistic about his drawing skills, he was enthusiastic about how the technique allowed him to do things that he couldn't do by coding, namely, to communicate faster and better with his colleagues.

One important detail for in this case is that all professionals, regardless of their background, were encouraged to sketch, and that the presentation of the drawing was not an important aspect of the solution. They had the freedom to draw "ugly" sketches.

5 Conclusions

In this article we discuss how ActionSketch, a technique to improve sketches in interaction design, had a positive impact on the communication between designers. We argue that one of the main objectives of sketching is to foster communication, and that by improving the sketches we are also improving the communication process.

We conducted workshops with 24 professionals, followed by a period of continued use in their actual working practice for three weeks in average. From this study we were able to see that:

- The technique requires a learning process, which we consider inevitable and tried to minimize.
- We have some indications that the learning process was actually very brief, since the technique was useful even in meetings when most of the professionals didn't know it and a brief introduction was sufficient. We argue that this was achieved by a careful consideration when creating the symbols and choosing the colours of the technique.
- By using the technique the verbal explanations were no longer needed, which made the process of presenting and reading sketches easier, and should foster asynchronous communications.
- ActionSketch also made the drawings more evident because it proposes a shared structure for sketching. This improved the discussion between designers, because they spent less time explaining the alternatives and more time considering their trade-offs. It also reduced the use of side notes, which are sometimes ignored.
- The technique also lowered the importance of the presentation of the sketches, which was particularly helpful for professionals with less drawing skills.

Given these indications we believe it is possible to say that ActionSketch has a positive effect on communication between professionals. Undeniably the technique imposes a barrier to learning, but we do not see a way to avoid this, just to make this process easier, something we tried to achieve.

Acknowledgement

References

ARNALL, T. & MARTINUSSEN, E. S. (2010). Depth of Field: Discursive design research through film. *FORMakademisk*, 3(1), 100–122.

BARROS, G. & CARNEIRO, G. (In press). A technique to improve sketches of rich interactions. In *Proceedings of the 12th Brazilian Symposium on Human*

Factors in Computing Systems (Forthcoming). Manaus, AM, Brazil: Brazilian Computer Society.

BARROS, G., CARNEIRO, G. & COSTA, C. Z. (2011). A tool to improve freehand sketches of rich interactions. Presented at the DESIRE '11 Second Conference on Creativity and Innovation in Design, Eindhoven, Netherlands. Retrieved from http://formato.com.br/projetos/desire_2011/

BROOKS, F. P. (1987). No silver bullet: Essence and accidents of software engineering. *IEEE computer*, 20(4), 10–19.

BROWN, D. M. (2010). *Communicating Design: Developing Web Site Documentation for Design and Planning* (2nd ed.). Berkeley, CA, USA: New Riders.

BUDGEN, D. (1995). Design models' from software design methods. *Design Studies*, 16(3), 293–325.

BUXTON, B. (2007). *Sketching User Experiences*: Getting the Design Right and the Right Design. San Francisco: Morgan Kaufmann.

CROSS, N. (1990). The nature and nurture of design ability. *Design Studies*, 11(3), 127–140.

DIX, A. & GONGORA, L. (2011). Externalisation and design. In *Proceedings of the Second Conference on Creativity and Innovation in Design* (pp. 31–42). New York, NY, USA: ACM. doi:10.1145/2079216.2079220

EIKENES, J. & MORRISON, A. (2010). Navimation: Exploring time, space & motion in the design of screen-based interfaces. *International Journal of Design*, 4(1), 1–16.

FISH, J. (2004). Cognitive Catalysis: Sketches for a Time-lagged Brain. In *Design representation* G. Goldschmidt & W. L. Porter (Eds.), (pp. 151–184). London, UK: Springer-Verlag.

GOLDSCHMIDT, G. (1991). The dialectics of sketching. *Creativity research journal*, 4(2), 123–143.

GOLDSCHMIDT, G. (2004). Design representation: Private process, public image. In *Design representation* G. Goldschmidt & W. L. Porter (Eds.), (pp. 203–217). London, UK: Springer-Verlag.

GREENBERG, S., CARPENDALE, S., MARQUARDT, N. & BUXTON, B. (2011). *Sketching user experiences*: the workbook. San Francisco: Morgan Kaufmann.

HART, J. (2008). *The art of the storyboard*: a filmmaker's introduction (2nd ed.). Amsterdam; Boston: Elsevier/Focal Press.

LAWSON, B. (2004). *What designers know*. Oxford: Architectural Press.

LAWSON, B. (2005). *How designers think*: the design process demystified (4th ed.). Oxford: Architectural Press.

MOGGRIDGE, B. (2007). *Designing Interactions* (1st ed.). Cambridge, MA, USA: MIT Press.

OZENC, F. K., KIM, M., ZIMMERMAN, J., ONEY, S. & MYERS, B. (2010). How to support designers in getting hold of the immaterial material of software. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (pp. 2513–2522). New York, NY, USA: ACM. doi:10.1145/1753326.1753707

SAFFER, D. (2009). *Designing for interaction*: creating smart applications and clever devices (2nd ed.). Berkeley, CA, USA: Peachpit Press.

SCHÖN, D. (1983). *The Reflective Practitioner*: How Professionals Think in Action. London, UK: Temple Smith.

THOLANDER, J., KARLGREN, K., RAMBERG, R. & SOKJER, P. (2008). Where all the interaction is: sketching in interaction design as an embodied practice. In *Proceedings of the 7th ACM conference on Designing interactive systems* (pp. 445–454). New York, NY, USA: ACM. doi:10.1145/1394445.1394493

TUFTE, E. R. (1995). *Envisioning information*. Cheshire, Conn.: Graphics Press.

VERSTIJNEN, I., VAN LEEUWEN, C., GOLDSCHMIDT, G., HAMEL, R. & HENNESSEY, J. (1998). Sketching and creative discovery. *Design Studies*, 19(4), 519–546.

About the authors

Gil Barros
<gil.barros@formato.com.br>
PhD, FAU-USP, Brazil

Leandro Velloso
<leandrovelloso@usp.br>
PhD student, FAU-USP, Brazil