

# IDENTIFYING REFLECTIVE PRACTICE IN ONE ENGINEERING DESIGN MEETING.

John Mendoza-Garcia  
Pontificia Universidad Javeriana, Bogotá, Colombia, South America  
Purdue University. West Lafayette, IN.

## Introduction

Conceiving design as a reflective practice, a concept proposed by Schön (1999), is one of many possible ways that we have to understand design. Besides, reflective practice have been presented as one of the key differences that separate the novices from designers with higher expertise. We were wondering how we could determine if engineers, in a design meeting, were showing reflective practice. An analysis of qualitative data (audio transcripts and sketches from an engineering design meeting) was proposed trying to answer this question. The present work presents the first attempt to understand reflective practice defining the categories related to reflective practice.

## Research questions

We will analyze the transcript from a meeting that was hold by engineers. In the meeting they were designing. We will try to answer the following question: How these engineers reflect while designing?

## Method

A group of engineers conformed by seven people (6 men, 1 women), who were designing a product were recorded in video. The group was facing a situation in which product that was developed may receive no more funding for its development since its market possibilities were not clear and a risk of losing money was perceived by the stakeholders. The dialogues from the meeting were transcribed. The sketches they drew were also collected. In this project we had access only to the audio transcripts and the sketches to solve the research questions.

Nvivo was used to code the transcript and the sketches. The author did the coding. one central categories (nodes) were created to interpret occurrences related to Reflective Practice.

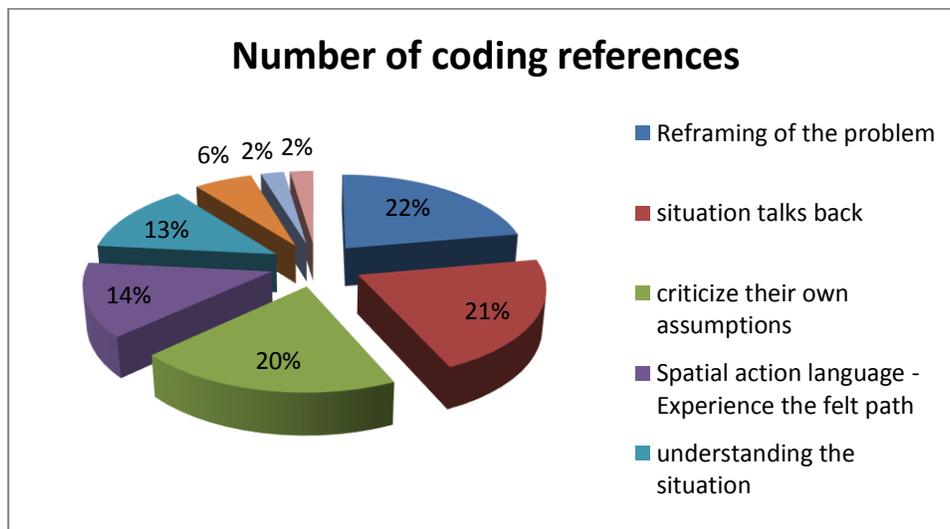
The actions in which Reflective practice was identified , were categorized based on Schön (1999). Although this author develop his topic mainly based on the idea of one practitioner who is reflecting while acting, we will extend this idea to groups since they have clear behavior that can be understood by using these lenses: the group is reflecting while they are doing design. The following categories (sub nodes) were defined to code their actions as reflective practitioners: Criticize their own assumptions, design domains (drawing), look for changing situation, reflection in action, reframing of the problem, situation talks back, spatial action language – experience the felt path and understanding the situation. Some examples of each category are presented in the following paragraphs.

## Results

## Reflective Practice

The Figure 1 - Number of coding references by reflecting action. show us the distribution of all the categories. That were identified from the literature as possible activities that a reflective practitioner do when is designing.

Reflective practitioners reframe the problem (Schön, 1999). In this case, since the main activity in the meeting was a brainstorm of possible applications of the product (Thermal Pen), designers were continuously re-defining the problem by changing their limits and perceptions of the possible applications. Some examples that were coded in this category are extracted from line 192 “for lottery ticket, but there might be other applications” or from 608 “imagine you had one to six instead of a dice picked up the pen and press the button and it pressed”. The results show that the 22% of the activity during the meeting was devoted to reframe the problem.



**Figure 1 - Number of coding references by reflecting action.**

The members of the team, while discussing, are also expressing out loud the “the voice” of the product, which talked back to the designers and make them think twice about a solution and encourage them to look for alternatives. In these cases there was a need to think or reflect about characteristics of the product and find other alternatives. One evidence can be found when they talked about the duration of the battery in lines 516:

“this kind of thing based on kind of powers that we're using now use in battery life that we were experiencing before and if you get the same efficiency out of batteries that we've done on some of the printers you might use in terms of battery about forty five seconds so erm but that would be the worst case I think that it's not really usable for that kind of thing unless we find a better way of doing it”.

Here we see how the product talks and says that the current battery is not good enough for achieving the ideas of the new product. 21% of the coding accounted for by “situation talked back” was perceived in the transcript by the codifier.

The group also shows how did they confirm and criticize their own assumptions, also a characteristic of the reflective practitioner. Examples were found when they were looking for clarification of assumptions (line 126: “Are you assuming that this is the colored media here?”), differences among materials (line 167: “Why’s that different from metal?”) and when checking for confirmation (line: 1673 and 1674: “I mean, the battery life seems to exceed cassette life several times, doesn’t it?”). In this transcript it was identified that 20% of the activity that the designers were doing accounted for by “checking/criticize their own assumptions.

Smaller proportions were found in activities like using spatial action language (14%), in which the designers were trying to identify the user experience, understanding the situation (13%), and in the use of one of the domain language of drawing when they are speaking (6%).

### Discussion

The results show that in this case, the evidences of reflection were identified mainly in three categories: Reframing the problem, situation talks back and criticize their own assumptions. We believe that these results are influenced by the method and goal of the meeting. The brain storming method is used to encourage creativity and it promotes the need of perceiving the situation from different perspectives, and also requires being aware of what the problem or situation says back. Likewise, we think that the high score accounted for by the category of criticizing their own assumptions is due to their reliance in their own and previous experiences when generating ideas since there are no evidences, at least in the transcripts, of the use of information related to the product, the market or the customers. Without these information, they have to rely on their previous experiences and need to devote be more aware of their own assumptions.

The use of the language of design in the meeting can be explained by the following quote from Schön (1999):

“Utterances refer to spatial images which they try to make congruent from one another. As they become more confident that they have achieved congruence of meaning, their dialogue tends to become ... inscrutable for outsiders (1999, p. 81)

The sketches extracted from the meeting shows an instantiation of this quote. As we see in figures 3 and 4, outsiders barely could perceive and understand what they are about. We also believe that, if we ask the designers, after some days what the sketch mean, probably just few of them would have a barely idea of their meaning, because these sketches are attached to the words that were said in that moment. In order to be able to recall what they mean, it might be necessary to recall the whole conversation.

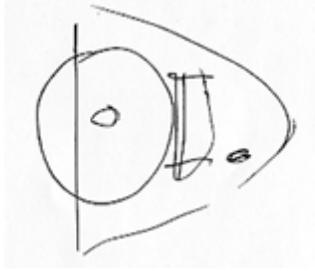


Figure 2 - Example 1 – Sketch from the meeting

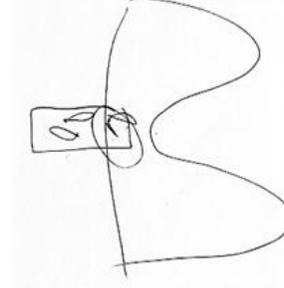


Figure 3 - Example 2 – Sketch from the meeting

The low accountability for the use of the design language might be related to the difficulty associated with the perception of the design language. Since designers were doing the sketch at the same time that they were writing, maybe in the transcription this fact is not easily perceived by the coder.

### Conclusion

The dynamics of the meeting, its agenda, goal and method, played a crucial role in what the participants are able to show and contribute. In this case, the meeting was product oriented, so the reflection was influenced by the situation since the re-definition of the problem was required to consider the meeting a success.

### Acknowledgements

This work was possible thanks to Dr. Robin Adams, Professor of the Department of Engineering Education at Purdue, and the professor from the class of design, cognition and learning. She provided the data we analyzed, and guidance to understand better the reflective practice.

### References

Schön, D. (1999). The reflective practitioner. Retrieved from <http://sopper.dk/speciale/arkiv/book49.pdf>

John Mendoza-Garcia

He is a PhD. student and a research assistant in the School of Engineering Education at Purdue University. He has been a professor of the Department of Systems Engineering at Pontificia Universidad Javeriana in Bogotá, Colombia, since 2005. He is wondering how STEM students develop skills like systems thinking and how its development impacts design of tangible and intangible artifacts. He is also interested in topics related with social awareness and motivation in engineering. E-mail: [mendozag@purdue.edu](mailto:mendozag@purdue.edu)