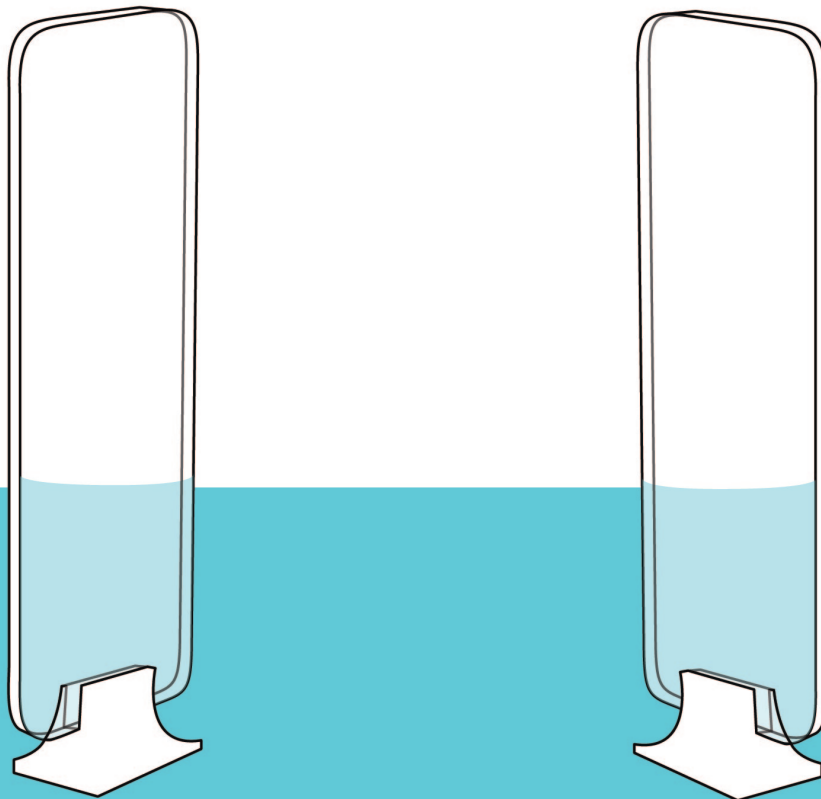


# An Educational Module using Sensemaking elements by Student teams



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Augustus, 2023



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## **Executive Summary**

The main topic of this thesis is sensemaking. Since sensemaking is the process when people recognize a change - whether that is a real change or a change between their inner world and outer world - and how they deal with that. This process is investigated in this research using Form Language developed by Anne Kamp (2018) and providing requirements for an AI that can help the recognition process.

For this research student teams are used as a research subject. They are working in an interdisciplinary way. Different questions on the topic of teams and sensemaking are asked. Some questions are about representing the team and their case experience and this is used to find out more about the recognition of sensemaking.

Sensemaking has not been investigated much in the context of education. There has been research in reflection but not that much on the topic of what people do and how they did that. The outcome of this research is advice on educational sessions using Form Language and AI techniques. Results are gathered using focus groups of these student teams in four different moments in time. A protocol is used which partially is based on literature of Team Science and sensemaking.

The most prominent result is that in the Form Language sensemaking could be recognized. Other results are that characteristics that are seen in literature that are recognized in the groups as well and specified more. Such as, teams talk about habits and have certain complex problems solving techniques. Recognizing the shapes of Form Language with AI comes with some challenges. The first challenge that needs to be solved is the localization of the object which will be worthwhile because these objects do not change. Then user localization is needed which can be done by recognizing hand locations or shoulders. Finally movement recognized. This movement is the most important part as valuable topics are discussed during the moving of the shapes. This will take probably years to develop but, its value to support human expertise is valuable.

# Introduction

Engineers nowadays are expected to work in trans-, multi-, or interdisciplinary teamwork after their university education. To prepare engineers for working collaboratively using knowledge and skills from different disciplines, students need to receive this support in their education while working in these type of projects.

At the TU Delft a teamwork course is provided to different bachelor programs to provide this kind of support. This course can consist of up to six lectures and depends on the faculty that provides it, which lectures are provided and when these take place. The course started its development in 2020 and is currently delivered (started September 2022) for the first official year. The teachers and developers are open to receiving additions to its current state.

One of the bachelor programs this teamwork course is integrated, is in the minor Communication Design for Innovation (CDI). Students from CDI follow different bachelor programs at the Technical University of Delft (TU Delft) and take this educational programme half a year (Minor). These students have two projects during the period of this research for which they are divided in teams of three to five students with different bachelor programs, where it is expected they work interdisciplinary.

In student teamwork in CDI a convergence of different perspectives takes place. In the occurrence of different perspectives, students use sensemaking. They take certain actions, e.g. have a conversation about these differences and decide what to do. Three different perspectives are used in this research to look at how student teams perceive these kind of situations. What kind of differences in perspectives exist are pointed out by student teams is guided by the Sensemaking Metaphor of Dervin (...). In the sensemaking process, different active phases exist that can be observed as Weick's organizing involving sensemaking (2005) and active team sensemaking phases in Klein (...). Team processes influence sensemaking, such as team composition, transactive memory and shared mental model development or conflicts. Transactive memory is how well everyone knows what skills of other team members are and shared mental model is the understandings the team has. The topic for this research is sensemaking of a student team while working on complex problems. The sensemaking literature mentioned before is mostly focused on professional organizations and has not been studied in student teams. Team processes

and complex problem solving are important influences in the sensemaking in this research.

The teamwork course had its first official year and to provide more support, advice for an educational module has been developed in this report which focuses on recognizing sensemaking.

Thus, the main question for this research is:

*MQ: Which elements of sensemaking can be recognized in focus groups consisting of student teams?*

The question is mainly answered by collecting and analysing pictures/video and audio data in semi-structured focus groups at four different moments of the projects of the student teams which use an instrument called Form Language to share their perspective on their project case and team.

A detailed recommendation is provided how an educational module – Form Language sessions - for the teamwork course can be developed based on the collected data and analyses. Co-creation sessions have taken place that provide information on artificial intelligence (AI) methods integrated in an educational module.

*SQ1: How do student teams look at their cases and teams?*

Different elements of sensemaking and team processes can be recognized in the process of acquiring perspectives of the student teams. Students' experience on the content of CDI is used for the advice on the educational module: what is valuable to include and what can be added.

Kamp (2018) developed Form Language to support abstract complex problem solving in groups of urban living experts. Student teams in CDI work on complex cases in their projects. Kamp (2018) wrote that Form language supports the complex problem-solving process by that it creates mutual discussion, contributes to making complexity comprehensible, contributes to clarifying different relationships, contributes to making abstract ideas tangible and contributes to understanding changes and uncertainties. Form Language can make sensemaking in student teams more concrete and visible.

*SQ2: How do student teams use Form language over time?*

Students use Form Language to support explanation about their team and case experience. Part of the answer to this question is to reflect on the way of recording, the usage of starting exercises and the facilitation of the focus groups that affected the usage of Form Language. The way of recording provides information on how AI techniques can be added.

When facilitating focus groups, the facilitator may overlook certain details such as one person saying something relevant while another person is talking. It is possible to have a more rational perspective from a computer system which can provide suggestions on what details a facilitator may have overlooked. Supportive computer systems that collaborate with humans are called Hybrid Intelligence (HI) (...). This is a type of artificial intelligence (AI) techniques. Classical AI techniques are a black box where a lot of data is collected, and the system will generate solutions. This may introduce unnecessary and dangerous biases. When HI is used, there is an interaction between human and machine so there is no machine that makes the decision or just generates the solution, but the human and computer make the decision together.

Recognition of the sensemaking elements is now done by the researcher, but this can be supported by AI methods to gain deeper understanding in an educational module, the Form Language sessions.

*SQ3: How can AI techniques and tooling support recognition of sensemaking in the Form language sessions?*

These questions are answered by using a methodology explained in Chapter 2. Specific methods to answer the sub questions are elaborated on in their respective subchapter. SQ1 in Chapter 3, SQ2 in Chapter 4, SQ3 in 5. The results are discussed in Chapter 6 and conclusions are made in Chapter 7

# **1 Theoretical Framework**

Sensemaking in teams is the main topic of this research and thus literature chosen is the most important part and can be found in Chapter 1.1. Since the complex cases students work on (Chapter 1.2) and team processes of the student teams (Chapter 1.3) influence that sensemaking, they are included in this research. Literature was found in multiple ways: through recommendation of supervisor(s), search in Scopus and snowballing by using a source that provided interesting perspectives.

## **1.1 Sensemaking elements**

The sensemaking that has been observed in this research took place in student teams and on microlevel. Differences over time could be observed. When searching for literature on sensemaking, the most frequently used theory that comes up is by Weick that investigated the psychological and organizational side of sensemaking.

Sensemaking has seven characteristics according to Weick (1996) of which two are: retrospectivity – actions can be observed when they have happened - and it is a social process – it happens when interacting with other people. These characteristics are important in our research as students make sense in teams and events and actions are talked about after they have happened.

Weick (1969) presents a theoretical model (Figure 1) explaining organizing as an active process which uses sensemaking on microlevel. In this process people make sense about changes happening around them.

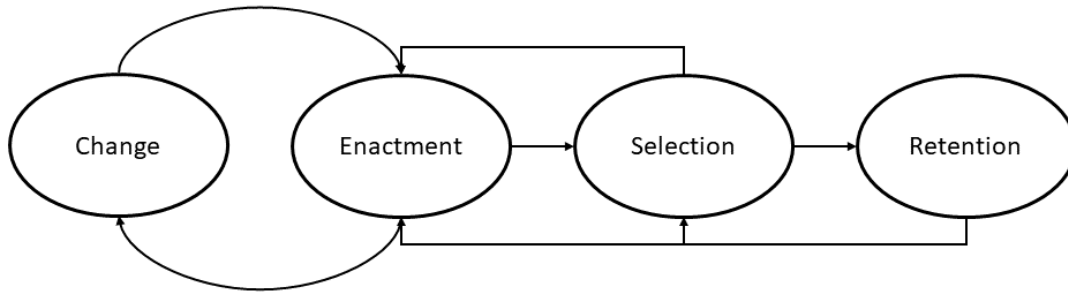


Figure 1: Adapted from Weicks' model (1969)

*Enactment* can happen in two ways: either people notice a difference or change in experience that is used for selection or an action is taken to limit future actions (which produces a change). *Selection* is the use of a structure of interpretations or specific interpretations to reduce the ambiguous meaning of a piece of data collected in enactment. *Retention* is storing the previously ambiguous piece of data as an interpretation that can be used in enactment as past experience or selection as interpretation if the person chooses to.

This model is not used in the research, but for the interpretation of the Usage of Form Language in the discussion in Chapter 4. Sensemaking research in student teams has not been found, but there were three interesting sources of literature where sensemaking in educational settings are used. Sensemaking in education is focused on the interpretation as in Ryan, Henderson, Ryan, and Kennedy (2020) where the student interpreting the information right - making sense of the feedback from teachers to students in undergraduate education. Reyes et al. (2021) are using sensemaking as comparing experiences between teachers in higher education contexts to find a way to restructure a course. Harun et al (2021) focus more on the interactive part of sensemaking where students become aware of their own behaviour when interacting with students from unfamiliar cultures. This source and Reyes et al. (2021) use Weick's sensemaking.

Sensemaking with the focus of design in dialogue is part of this research as sensemaking was investigated in focusgroups. Sense-Making Methodology (SMM) can be used in sensemaking research for analyzing individual or group sensemaking as an action-oriented process with the focus on dialogue (Naumer, Fisher, & Dervin, 2008). The focus of this methodology is focusing on the dialogue instead of thinking of sensemaking as transmission. The visual of the Sense-Making Metaphor (in Figure 2) displays a human moving through time and space encountering situations which make them move across gaps by building bridges with their experience and history bringing a certain 'umbrella' with them, which contains power structures/dynamics, organizational systems, domain knowledge systems and culture/communities (Dervin & Foreman-Wernet, 2013).

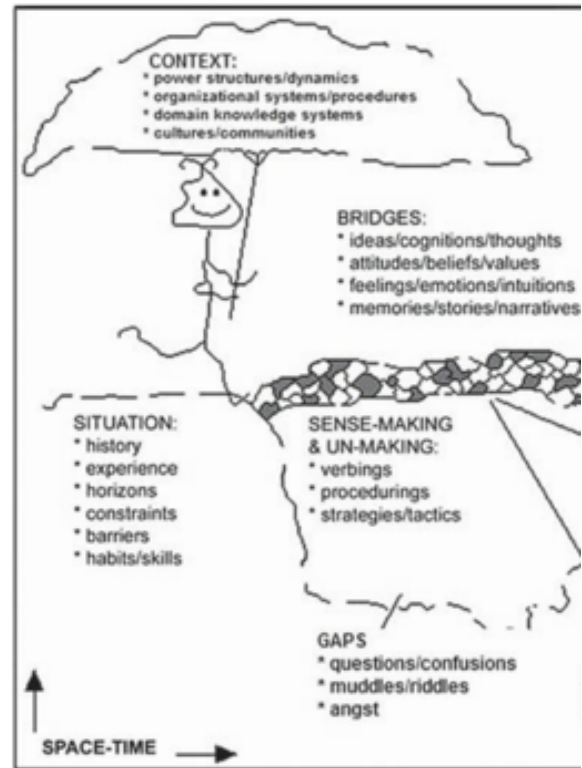


Figure 2: Dervin's Sensemaking Methodology Metaphor from Dervin and Foreman-Wernet (2013)

Questions in Dervin and Foreman-Wernet (2013) are used as inspiration for how to make questions for the other variables in the Metaphor for the protocol of the focus groups. As the students were part of focusgroups, dialogue would be the actions they would be undertaking while making sense. The variables of context, situation, bridges, and gaps are not specifically defined in the literature, but the questions in the source are used and defined how they are used in the research in Chapter 3. Context and situation are used in questions from this metaphor to focus on sensemaking of the team by the students themselves. What history or experience they take with them into the team, what domain knowledge



systems they are familiar with, what skills the team members perceive and the habits the team develops. In analysis power structures within the team, culture and communities students are a part of, gaps and bridges experienced by the team members are added.

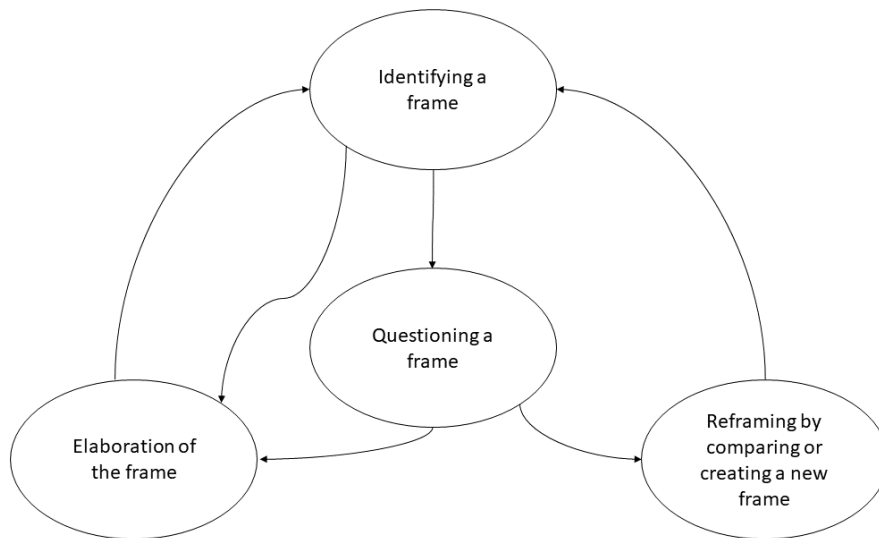


Figure 3: Klein et al. (2010) sensemaking behaviours

As sensemaking was observed in student teams, it is interesting to look at team sensemaking behaviours. Klein et al. (2010) presents a team sensemaking model that uses data and frames: it originally focused on individuals and was cognitive approach which has been modified to include behaviours in sensemaking on team-level. The individual model relates created patterns in data (creation of a frame) or identify a certain frame and that frame is used to consider what is important data. The difference with the team model is that there are different actions that are taken on a team level as can be seen in : first the team *identifies the frame* by formulating criteria or rules, announce it or collaborate to identify it. Second one may either *question the frame*, *elaborate on a frame* or *reframing*. *Questioning the frame* is done by raising doubts, discuss the negative consequences and create rules or doubts. *Reframing* can be done by comparing an existing

frame or creating a new frame. *Reframing by comparing the frame* can be done by voting for frames, forging a consensus or an individual decides the frame. *Reframing by creating a new frame* can be done by suggesting a new frame and this is adopted, rejected or modified. *Elaborating a frame* can be done by directing activities to verify the frame, discuss outliers of the data as temporary or insignificant or extending the frame. A frame can be seen as students applying content of the minor in their teamwork. This is used in Chapter 3.

## 1.2 Complex problem solving

Students work on complex cases and Snowden and Boone (2007) present Cynefin framework about complexity of working environments of leaders in an organization. Individuals can make decisions in five different type of situations: chaotic, complex, complicated, simple and disorder. Every environment (except for disorder) has certain characteristics and ideal tasks, but also danger signals and ideal response to those. The disorder is when none of the other four can be assigned to the context. The important characteristics are displayed in Figure 4. These behaviours and characteristics can be found in the student teams and differences can be used as advice for an educational module.



Figure 4: Adapted from Snowden and Boone (2007)

### **1.3 Team Processes**

As sensemaking is influenced by team effects, it is important to include literature about team effects that may result in those influences. Bell and Outland (2017) have written about understanding team composition (over time) for designing interventions. An educational module is a potential intervention in team composition and therefore this literature source is used in the protocol for the focus groups. Team composition variables that have effect on performance are deep-level characteristics of members (e.g. values, work styles and abilities) which shapes an individual's feelings, thinking and behaviour. Since there are many characteristics that can be taken for evaluation, researchers and practitioners are advised to pick a few considerations that are applicable to the situation. In this research students are building and explaining their team compositions. Team composition and the temporal context is interesting and how team actions influence the team's performance. The performance is not the focus here, but the actions of the team are as they are part of sensemaking.

The temporal context is dependent on the use of time: how much time the students are given, but what is in control of the students in this situation is how they use their time and the difference in priority students can have in reaching long or short-term success. Workload, task division and membership can change over time. Team composition affects how well students adapt to these changing factors. In the current minor design, membership of teams is unexpected to change. In the period of this research it did happen in one group.

Team composition can influence actions taken to reach the team's goal e.g., the extent of engagement and how motivated the team is for the goal over time, but also how well the team can develop a collective awareness of how well they know who knows what (transactive memory system) and team cohesion. An understanding about tasks, priorities, teamwork, and time management (shared mental model) is an indication of a well composed team. Shared mental models enhance team effectiveness (Cannon-Bowers, Salas, Blickensderfer, & Bowers, 1998, p. 222)).

The factors discussed above are integrated in the protocol used for the focus groups in Chapter 3.

## **2 Methodology**

In this chapter the general overview of the methodology used for the research will be shared. First the case used in this research is described in detail, then the overall research design is shared and lastly how the focus groups are organized is written. Details about the different methods to answer research questions can be found in their respective chapters.

### **2.1 Case**

The case for this research is the Minor Communication Design for Innovation at the TU Delft. The minor can be followed by any other bachelor students from the university, meaning that the students attending the lectures were quite diverse in study background. It ranged from mostly technical to more design focused studies. For all lectures the students received some literature to read online and sometimes had to hand in some reflection assignments.

The minor has several courses in the first 10 weeks: C-lab, Sociology and Psychology of collaboration and social networks (SPCSN), Innovation to Teamwork (Teamwork course) and Knowledge to Advice. In the first 10 weeks the students are divided in teams of three to five students. With the same team, they complete a project for C-lab and for SPCSN. The one for C-lab lasts half a year, so the first half is done in the first 10 weeks. The one for SPCSN is only 10 weeks. The teams consists of an mix of 3 to 5 students (from different disciplines). The teams were not completely randomly assigned: there was on purpose a distribution that every team had at least one design related studies (e.g. Architecture or Industrial Design Engineering).

The course content is important to understand as students talk about it in the transcriptions. C-lab is a course for half a year that focuses on a case with real commissioners. In the first 10 weeks the focus is of the analysis of the case and this ends with a problem definition and three solution directions. SPCSN provides the students with theoretical background on collaboration and networking which is applied in a project where students design a serious game. One of the parts taught in this course is about divergence, revergence and convergence. In the diverging phase one focuses on generating options, then those options are rearranged or revisited, and convergence is the technique of selecting options (...?). In

Knowledge to Advice interview methods are covered.

The teamwork course consists of separate workshops (Appendix A.1) tackling a teamwork topic. There are some written assignments related to the content of the workshop. In the workshops the Belbin Team roles (Belbin, 2010) are covered which provide awareness to students in what preferences one has related to team behaviour. Students create a code of conduct that includes what kind of values the students have. There is also an introduction of the learning zone model that has three zones: the comfort zone (too comfortable to learn), the learning zone (where learning happens) and the panic zone (too challenging to learn). Students also learn about how to structure a meeting and how to deal with team dynamics.

## **2.2 Research Design**

To collect data to answer “How do student teams look at their cases and teams?” focus groups were held and videorecorded consisting of the student teams. A protocol was followed and most questions were based on sensemaking and team processes (details in Appendix A.3). Answers to the questions are used to answer the first sub question. Observations are made from the video recordings about the usage of Form Language, a research-based tool which consisted of shapes presented in Figure 5. This is then used to answer the second sub question: “How do student teams use Form language over time?”.

Finally, several co-creation sessions on Artificial intelligence techniques have been held and notes from these sessions are used to answer the last sub question: “How can AI techniques and tooling support recognition of sensemaking in the Form language sessions?”. Finally, all these results are combined into an educational module (Form Language sessions) that answer the main question: “Which elements of sensemaking can be recognized in focus groups consisting of student teams?”

The student teams were asked to voluntarily participate in the research in focus groups. Focus groups is the method used because Interactive Team Cognition (ITC) perspective is used in this research and that calls for studying teams on a team level. Group effects are desirable in this scenario. The timeslots were scheduled for that team, and they were asked for informed consent. Data is stored in Surfdrive which is a secure place only supervisors and the researcher have access to. The informed consent form is added in Appendix A.1.

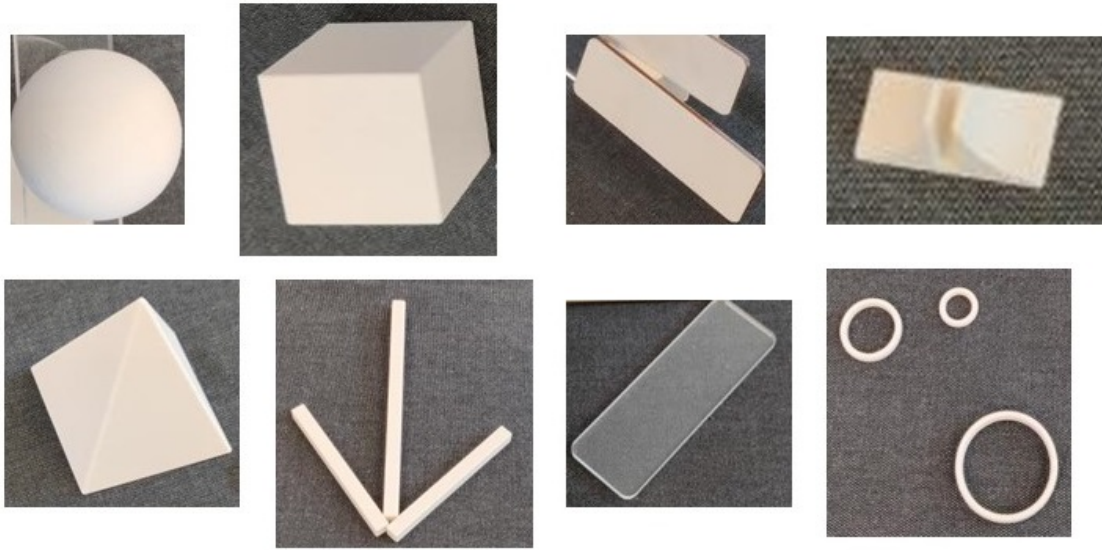


Figure 5: All shapes of the Form language. There are holders for the planks and rings to stabilize balls. Balls, pyramids and cubes come in three different sizes. The sticks also had two sizes.

The focus groups sessions took place in the phases in Figure 6 of the course C-lab.

## 2.3 Focusgroups

Focusgroups consisted of the student teams, but had changing participants that were present (minimum 2 and maximum 5 participants). Different facilitators assisted in facilitating the focusgroups and two sessions were held in parallel to each other. The structure of the focusgroups were: first a starting exercise of 10 to 15 min and then the protocol that is designed to answer the first subquestion which lasted maximum an hour. The sessions lasted for maximum 1.5 hours and were videorecorded. The focusgroups were recorded in two different ways (Focusgroups consisted of the student teams, but had changing participants that were present (minimum 2 and maximum 5 participants). Different facilitators assisted in facilitating the focusgroups and two sessions were held in parallel to each other. The structure of the focusgroups were: first a starting exercise of 10 to 15 min and then the

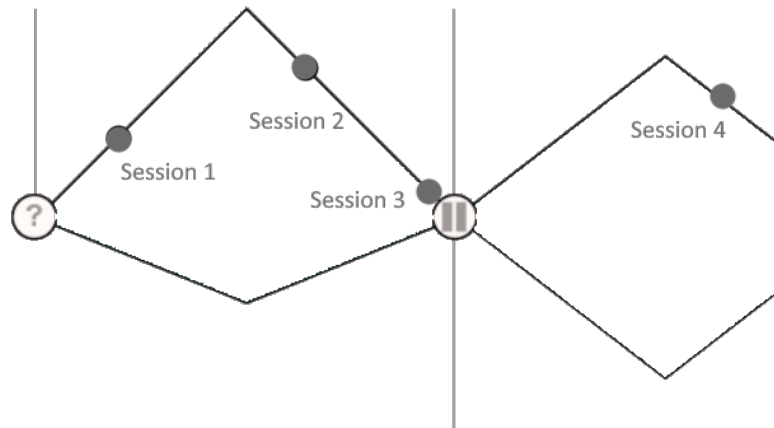


Figure 6: When the focus groups were scheduled in the groups going through design phases of the double diamond in C-lab

protocol that is designed to answer the first subquestion which lasted maximum an hour) with the equipment that was available at the time. There were also pictures taken after a configuration was finished. Every session of the focusgroups started with a starting exercise. The warm up exercise is meant to get into the mindset of abstract thinking with shapes, which is advice in Kamp (2018). The specific descriptions of the starting exercises can be found in Chapter 4.

The protocol used for the focusgroup changed slightly over the different sessions to put the focus more on different parts or make questions more specific. In between the focusgroups the sessions were transcribed and this inspired directions in which more information could be found on the perspective of student teams. Literature was added in session 2 to get specific information on the team processes. Students were also asked on their general Team, Case and Minor content experience which were open questions to get into the topics that followed. The specific explanation of the questions and answers to these questions are used in Chapter 3 and how the Form Language was used to answer Case and Team experience can be found in Chapter 4.

In general the students could use Form Language for every question,



(a) Setting 1

(b) Setting 2

Figure 7: Two different setups for filming

but for Q1 (Individual Background), 2 (Team Experience), 4 (Valence of distance between shapes), 13 (Case Experience) and 23a (Value of Form Language) this was encouraged by facilitators. As how the shapes of Form Language were used is more important in Q1 and the teams are observed from a team perspective in Chapter 3, the usage of Form Language for this question is covered in Chapter 4. Specific explanation about the implementation of the protocol is done in Chapter 3. The whole protocol and its changes can be found in detail in Appendix A.3.



### 3 Students' perspective on their cases and teams

In this chapter the (key) findings are shared that are used to answer: “How do students look at their teams and cases?”. Findings are collected from the answer student teams provided to the questions of the protocol.

The attendance to the focusgroup sessions differed per team as can be seen in Table 1. Another important note is that Group C only consisted of Student 1 and Student 3 in session 1 and were joined by Student 2, 4 and 5 in session 2.

Groups	Members	Attended session
Group A	Student 1	1,2,4
	Student 2	1,3,4
	Student 3	1
	Student 4	2,3,4
Group B	Student 1	4
	Student 2	2
	Student 3	4
	Student 4	2,4
Group C	Student 1	1,2,3
	Student 2	2,3
	Student 3	1,2
	Student 4	2
	Student 5	-
Group D	Student 1	1,2,3
	Student 2	1,2,3
	Student 3	1,2,3
Group E	Student 1	1,2,3
	Student 2	2,3
	Student 3	2,3
	Student 4	1,2,3

Table 1: Attendance of team members per session

The questions of the protocol are divided in topics. Case, Team and Minor Content experience are topics that have no literary background, whereas the others do. The different topics in this chapter are covered

unequally in the protocol over the four sessions, which affected how much data is collected per Group on the different topics. Which topic is covered in which session can be found in the Appendix A.3. Group A, D and B attended the fourth session so their suggestions about the course and the value of the Form language and focus groups are only in these Minor Content Experiences. Group B attended session 2 and 4 so has no data on Sensemaking of the Minor content.

### **3.1 Sensemaking of the Team**

Definitions based on questions of Dervin & Foreman-Wernet (2013) and applied in the research context:

- *Organizational Systems/Procedures*: what the team shares to have done to organize themselves. How is the team organized? (Q6)
- *History/Experience*: Background that students mention that they share or are individual that they take with them in the teamwork. How do you work as a team with different backgrounds? (Q3) Lay down how you experience your own (individual) background (Q1)
- *Habits*: actions that happen often over time by the team. What are habits of the team? (Q7)
- *Skills*: students' skills perceived in the team. What are your skills that you bring into the team? (Q8a)

When looking at the other variables of the Sense-Making Metaphor, some more variables are added:

- *Power structures/dynamics*: perceived power of students over other students and how that changes
- *Cultures*: Culture is how the atmosphere in the team is perceived by the students
- *Communities*: communities students are sharing to be a part of
- *Gaps*: Challenges students encounter in the project or within their team
- *Bridges*: In what way the students overcome the challenges

### **3.2 Team Processes**

Question asked about the characteristics of members of the team is: How do you contribute to the team? Would you want to change anything in that? (Q5b) For the temporal context the perception of the use of time of the students is asked by “Is there a difference in how you deal with deadlines? Can you elaborate?” (Q5c). To know more about the skills and knowledge team members have, Q8b was asked: Do you think you have the right skills and knowledge in the team? And to find the shared mental models of the student teams the question asked was: How did it go when you had to complete a task together? (Q10) The change in motivation was asked in Q9a and Q9b respectively: How motivated are you for the goal you have? What motivates you as a team? The change in workload over time was asked by What was the workload at the beginning of the course/less session? And right now? (Q11) and the change in task division was asked by What kind of task did you have as a member of the team at the start/since less session? And right now? (Q12)

### **3.3 Sensemaking of Minor Content**

The Data-Frame model of Klein was used to zoom into the sensemaking of the student team when integrating literature into their teamwork. Q22a, Q22b and Q22c were asked to find the sensemaking the team had done with the minor content, which were respectively: What literature could you use in this phase of the project? What literature you did not like? How active is literature used to bring change in the team?

### **3.4 Complex problem solving**

Contexts in the Cynefin Framework are interpreted in this research as the case the students are working with, so the project they are working on with C-lab, but also the project from SPCSN. To simplify the framework and use it in this research, the characteristics are grouped in four groups which can also be see in Figure 8:

- Fact-based or pattern-based focus by the students on the case: What do you see intuitively as the solution? (Q14) Do you expect an optimal solution? Or a solution that just works? (Q15) Is it needed to reflect during the search for a solution? (Q18)

- Type of communication needed, the amount and in what way: How much communication is needed for the case? And what kind of communication (so for example direct communication)? (Q17)
- Resources needed for the solution for example best practices or experts' advice: Can you solve the case with best practices? Or expert advice? (Q16)
- Innovation possibility in the case as perceived by students and the comfort level with the methods used to find a solution for the case by the students: Is it possible to create innovation while searching for a solution? (Q19) Is it possible to stay in your comfortzone? Does that affect your creative thinking? (Q20)

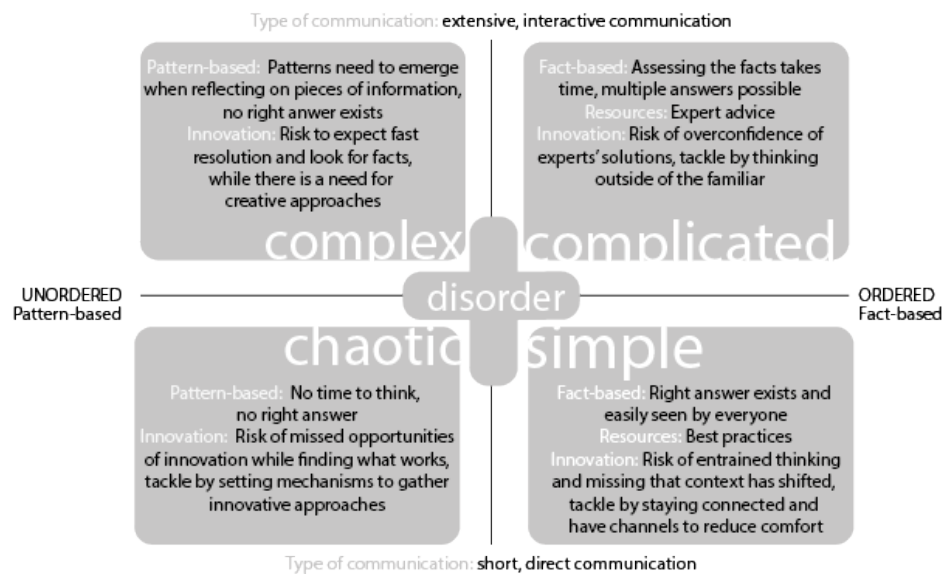


Figure 8: Cynefin Groups in Protocol

Next to the literature focused questions, there were also seven questions asked to start with open questions to collect the perceptions of students in general.

### **3.5 Team & Case Experience**

“How does your team look like according to you?” (Q2) and “How do you as a team experience the case?” (Q13) have been chosen to start first with an open question before asking closed questions about the team and case respectively to see what the perspective is of students without steering to a certain literature topic. And it gets the students in the mindset of thinking about their team or case. This is also the part where the Form language is used mostly. “Are distances positive or negative? Why? Would you change anything about it?” (Q4) is asked to focus on elaboration about their teamwork experience and put a valence on distances in the Form language.

### **3.6 Minor Content Experience**

“What support are you needing for the minor or teamwork course and is not present currently?” (Q23b) and “What did you learn from these focus groups?” (23d) are asked to find the value of the focus groups and the gaps students experience in the minor currently. “If this [ball shape] is Form Language, how would you show what value it has brought to your team?” (Q23a) focuses on elaborating how students used Form language in their team. “What other roles of Belbin do you want to try out?” (Q22d) is asked to see if students are open to exploring other Belbin Team roles.

### **3.7 Results**

The results are structured in the student teams to be able to compare the groups with each other. Every group has results divided in Team experience, Sensemaking of the team, Team composition, Sensemaking of the Minor content, Minor content experience, Case experience.

#### **3.7.1 Group A**

**3.7.1.1 Team Experience** The student team described their experience of the team in session 1 with the similarity in Belbin Team roles, but they all work out differently. Another similarity noticed by the students is the research fields of two students. Differences between students mentioned are creativity, sharpness of one team member and taking care

of the stability in the group. The students experienced the group as well-functioning.

*Facilitator: "What is typically that you bring into the team?"*

*Student 2: "What I add is stability; that not everything becomes chaotic and that we go in a hundred different directions. Student*

*1: "I find it difficult for myself." Student 3: "Me too." Student 2:*

*"You both take it to the next level. There were Student 4 can say: this is good enough, you say: no, no, this still needs to be done."*

*– Session 1*

In session 2 the group is seen as being one unit. Student 3 and 1 have similar working styles and Student 4 and 2 are tackling tasks more and are more strict. The type of shape is again related to the preferred Belbin Team role. The distances to the projects represent who takes the lead in what project and who finish the assignments. Both students present (Student 1 and 4) like this way of working. They contribute that it works well to a good Belbin Team role distribution.

In session 3 the experience of the team is based on the answer in session 2: they are still working towards one goal and the differences are still based on the Belbin Team roles. In this session the connection is added between the team members and they all know what the others do and can do. The distances represent that everyone is well connected.

In session 4 the experience of the team is focused on their change to plan more, which is the comfort zone of Student 1. Student 4 felt more separated from the group, because the workload is too high for them. The team has solved this by taking over tasks of this student: putting the planning on the whiteboard so everyone has an overview and can keep track of the progress. The student is expecting to feel less separated when the workload for them is less and the results of this change shows. The team is currently looking for a new balance.

**3.7.1.2 Sensemaking of the Team** Students talked about history in session 1: what phases they had in life so far or previous attitudes in working, and relating their study background to what kind of tasks they prefer doing.

Part of the organizational system of the team is that everyone had their own task like a contact person, someone who kept track of deadlines and checking that everything is handed in. Some students are the lead of the

interviews and the one who creates designs. Part of the system of the team is that they have their own space, bring music and drink coffee now and then. They also went to a faculty cafe together. They say the culture was comfortable from day one.

There is a power difference within the team: two students are leading the team for the two different projects the team has. In session 3 there is a highlight by Student 2 in change of behaviour:

*Student 2: "I have the idea, if I look at myself, that I'm now speaking up more about my opinion and I'm more direct, because Student 1 and 3 don't do that. Otherwise as a shaper, we will completely do what you want. I need to call more often: is that what we want or not?" Facilitator: "So someone needs to give push-back?" Student 2: "But I do think that is alright..." Facilitator: "I'm not sure if Student 4 agrees" Student 4: "Sure, come at me." Student 2: "This is no battle" – Session 3*

For habits the team shared that at the end of the way they plan for the next week: "Then we have immediately an overview: when we have a lecture, what time we should be at the company etc.". In the third session there was a new habit that whenever a student is late, they bring snacks. This is an implicit rule.

**3.7.1.3 Team processes** In session 2 this group has an understanding about time management and tasks. Students share in session 2 they want to finish in time and start with the next task immediately. They handed in an assignment one day before the deadline. Student 4 in session 2: "We prefer to have free time at Friday afternoon. We have our schedule and plan that way." Tasks were divided in couples and a couple checks the other couples' work. Before brainstorming with the whole group, they individually write down their thoughts. Students shared on the topic of task division two people were in the lead for the different projects, in session 2 this was as comfortable as can be seen above by the conversation between Student 2, Facilitator and Student 4.

Students do not agree in session 3 on whether the team has the right skills and knowledge to solve the case. Student 4 says they all have a different background, but student 1 is uncertain whether they can use their background.

Workload differences over time and priorities on time differ in this group. Students also feel like the workload is dependent on the communication with the case owners in this stage of the project. In session 3 a discussion takes place about the more urgent deadlines are prioritized over the later deadlines, Student 2: “We prioritize deadlines so they are gone. It is chill, because then we always reach deadlines. C-lab sometimes needs time. We missed that last week.”

**3.7.1.4 Case experience** The case is experienced in session 1 as chaotic and a challenge, because a lot is still unclear. Student 4 recognizes the type of assignment from their bachelor program, whereas other students are more used to concrete assignments where the focus is mostly on the implementation of the case owner’s question. The goal of the case is to make the whole company a whole again and that there are multiple ways to get there. The students have a lot of questions at this point.

In session 2 thirteen subproblems have been identified and students are currently attempting to cluster them and find patterns.

In session 3 the students experience balancing, but moving steadily. Everyone knows what the team is doing. They are currently in the process of reverging and slightly converging and have chosen a stakeholder to converge to. The team had interviews which confirmed which they already knew, but also provided new insights.

In session 4 the experience is described with their three solutions and their critical node.

**3.7.1.5 Complex Problem Solving** Thinking about a solution is for Group A difficult as the problem was still unclear as shared by Student 1 in session 1: “It is a bit: here is a problem, there is one”. In session 2 students have found that they knew they had to make a stakeholder group connected to their case more aware of a change in the organization and connecting that to the drivers of that stakeholder. Students also shared in session 2 that reflection is important to see whether one is designing in the right direction:

*“It is always handy to reflect when you’re designing if you are designing for the right problem. It is always useful to look back at the list of requirements and wishes ” – Student 4, session 2*



In session 2 students shared that there is a lot of contact with the case stakeholders to get information about what they want and test solution directions. In session 3 there is a change of the contact person of the case. A break in the communication with the case owners helped the students with reflection. As soon as new information came, they had less time to reflect.

Student 4 was unsure whether innovation is possible to create in session 2 with their solution, but they shared they expected to see that later. Student 4 shared to be comfortable with the methods used, but did not experience that limits them to be creative. The other three students are less comfortable with the methods and therefore felt like they get outside of the comfort zone, but it is unclear whether they are more creative because of that.

**3.7.1.6 Sensemaking of the Minor Content** The Belbin team roles is used by this group in a humorous way and referred to often in talking in the focus groups (an example is shared in subchapter 3.7.1.2 by student 2 in session 3).

Students of this group used the Learning Zone Model (see Minor Content in Background) for their sensemaking.

*“Being aware that someone else is going to make a Canva [design in a dedicated design program], because it is more the specialty of Student 4. Then we are more aware like: Student 3 can do nothing with Canva so then there is understanding from the team: this is new and also a little thrilling if you try something new. ” - Student 3, Session 1*

Group A used methods from Knowledge to Advice (another course in the minor) shared by student 2 in session 3: “We did interviews from the start, from Knowledge to Advice: how do you do an interview? You are the lead questionair and you are the sub questionair. We are the two writers.”

Other literature is seen as support in understanding and explaining what happens, but less useful for deciding what steps to take next in the project.

**3.7.1.7 Minor Content Experience** Whether students want to try out new roles, the two students present are focusing already to try out other roles than their preferred ones.

Students provided suggestions for the minor based on their experience. Student 2 thought the courses were semi-organized: SPCN had a planning per week and C-lab were inspiration sessions for the case. Students find it difficult that the timetable does not match the reality and therefore feels less structured which makes it difficult to plan ahead. Student 1 also shared that they are not used to parts of courses matching to other courses.

Specifically to the teamwork course, the lectures are more useful if moved more to the beginning, because then they can be used more in the minor itself. Attending a workshop and being able to use it in the minor is seen as a value of this course. A potential added value is to conversational reflection into the course:

*Student 4: "But do you think when you are writing a reflection, are you really thinking about it? Because I write a reflection and then I think: I have to do this." Student 2: "That is what I mean, the reflection assignments don't work. The method of teaching and the things you do there, that is what I keep thinking about." Student 4: "Yeah, but not the reflection on paper. I would do reflection with a conversation." Student 2: "On paper you do these because they are compulsory, they are not that effective." – Session 4*

The reflection sessions do not necessarily need to have Form language, but the students saw it as a valuable instrument when team members do not get along. Belbin Team roles were seen as a good icebreaker for the new teams.

The current way of using the focusgroups have unclear value for two students, but Student 1 says it provided a new way of thinking about the team. Student 2 also says they are more comfortable in using abstract shapes, but do not see why that would be useful.

### **3.7.2 Group B**

**3.7.2.1 Team Experience** In session 2 the experience of the team is explained by the common resource which are the different bachelor programs that students are part of. They see it as a basis they can build upon. One student is more comfortable with the methods used (Student 4), while the other can use their analytical insight (Student 2). Other

differences between the students are a sense of humour (Student 1) and being able to summarize a discussion (Student 3). Distances mean that the students work close together: they do understand when one is busier, but do not lose sight on the goal. In session 4 the different contributions are still there, but the focus is more on the team becoming one whole and everyone is on the same level. They feel like they are not just working together. Part of the configuration is the safety of the group.

**3.7.2.2 Sensemaking of the Team** Group B talked about their individual history in phases and their bachelor program. An example is provided from their individual history:

*“I think I had a big change mid-high school. New visions, new perspectives. That is where I build on right now.” – Student 4, Session 1*

**3.7.2.3 Team processes** Students contribute by one student organizing interviews or another reading people and the atmosphere. That last part is the first time this student could use this in a project. Student 4 recognizes parts of their bachelor and links it to the responsibility that that part goes well, but also sees the benefit of different bachelor students present in the minor:

*“In the bachelor you reach a point where everyone uses the same methods and now you see different ways to handle things and that is inspiring and motivating.” – Student 4, Session 2*

**3.7.2.4 Case Experience** The case experience in session 2 is described by discussing what they do or do not know yet. The students are in contact with some people from the case that provide information, but due to the close culture some parts are hidden. In session 4 the students describe the experience of the case by the students looking at the problems and understanding them. They have collected three problems which they are refining for the presentation.

**3.7.2.5 Complex Problem Solving** The only session that this group had on this topic, the group shared it is not working to the ultimate solution, but towards a working solution. They expected that there will

be no best practices used, because the problem was experience to be complicated. This group combined information from conversations with different stakeholders to get a whole picture of the problem. Reflection is necessary to place the information in the perspective of that person.

*“If you get right down to what someone says, you forget that person is talking from their own bias, what important is in our case to realize.”– Student 2, Session 2*

An increase in communication would result into more information about the case according to the group. Students noticed that people are withholding information of personal stories which did come out when students kept on asking questions. The only personal stories that were shared immediately, were already published before.

The methods used are innovative to Student 2, but Student 4 recognized some of the techniques. Instead of being creative, Student 4 noticed that this created structure. Student 2 felt like it resulted in learning something new constantly.

**3.7.2.6 Minor Content Experience** About trying out different Belbin roles, one student possibly wanted to try out another role. Another wants to learn how to try out other roles:

*Facilitator: “Do you want to try out another Belbin Team role?”  
Student 2: “For me, no. Maybe the coordinator.” Student 4: “It would be interesting to try out another role. Or learn how to tackle that.” – Session 2*

The minor feels like the schedule leaves only room for students to plan anything outside of their studies in the evening. Students suggest to provide a purpose to lectures in C-lab and planning of the minor.

Although the students of this group had two sessions, they think Form language sessions can help students think in a different way, feel less pressure to achieve and feel heard. Form language sessions can also be an icebreaker in teams.

### **3.7.3 Group C**

**3.7.3.1 Team Experience** In session 1 the focus is on complementing each other: two students with different backgrounds that are connected.

In session 2 how students experience the team is individually explained, but they do all agree with one perspective: the team is one whole with individuals who possess qualities that are needed. Other additions were feeling accepted and safe, and that the atmosphere allows for everyone to say what they think and want. In session 3 the working style of the students is shared:

*“We were researching in a broad way and at first we thought: we are going this way. But after a conversation and asking questions, it turned out to be different than expected.” – Student 1, session 3*

The clarity of the direction provided the students with a peaceful feeling in the team.

**3.7.3.2 Sensemaking of the Team** Group C before the merge, talked about their history: the teamwork experience they have, but also used bachelor programs to explain their difference in experience: “In experience, you notice that you study Civil engineering and I study Industrial Design Engineering. I have done quite some interviews before.”. It also resulted in talking about power structure/dynamics as student 3 may take the lead some more as shared in session 1: “I have done more interviews, so I recognize that I’m taking the lead more in that area.”

About the organizational system in the team students said they discuss tasks and one student likes to make lists. Their culture has a tolerance to being 5 to 10 minutes late. After the merge, when the team experienced more clarity in their case, the culture changed by taking it easier so “working from 9 to 5”. The studies of students were connected to what is valued on the end product:

*“The computer scientist said something about the platform: that they find it difficult to change certain things for example, technically. They had knowledge of something that I did not know [...] They said that such ICT companies just work by assignment: like do this and then they execute it” – Student 1, session 3*

Group C experienced a gap by having many questions related to the case and they bridged that by asking questions to the case owner, as shared by Student 1 in session 3 above.

**3.7.3.3 Team processes** The members that worked longer with the case that this group continued with after the merge had more knowledge on the case and this was seen as their contribution. Other contributions to the team were study background in IDE and updating the schedule.

Whenever there was an 'end sprint' – last minute work to finish before the deadline – everyone participates. They experience members of the team are complementing each other well by Student 2: "One is more wait-and-see, the other more concrete. One is less serious, the other more."

There is a difference in motivation between students over time:

*Student 2: "First I was more motivated because I was enjoying myself and now I want to solve the case in a good way." Student 4: "When you get routine in something, motivation decreases a bit. But I got a boost when Student 3 and I joined our group." Student 3: "We were quite demotivated when we entered this group, but when we got the explanation of the case we liked it immediately." – Session 2*

The workload was lower per person after the merge and they feel like they can reach more as a group. After the merge a task division could change, but this did not happen in the students' perspective, except for Student 3 who feels like they can lower their sense of control and that with two students one needs to take certain roles that are uncomfortable, whereas with more people this can be divided more.

**3.7.3.4 Case Experience** The case experience of the students in session 1 is more about their contact with the case owner. Students ask questions about the field that the company is operating in. The case owner is nice according to the students and the atmosphere seems nice. They had two interviews at that moment. In session 2 the case is experienced as complex and is explained by sharing the connections between stakeholders. The client is shown as important. In session 3 the communication between the different parts the students have found out so far is covered. Clients and practitioners have close communication between each other, but their case owner could improve its communication. Students have contact in writing with practitioners and the working group of the case owner. The working group has no clear role division, planning or vision in the students' perspective.

**3.7.3.5 Complex Problem Solving** In session 1 student 3 says that “the problem has not been optimally analyzed yet” so thinking about a solution while there could be multiple, was considered nonsense. Student 1 is expecting that patterns will emerge from the ‘large amount of information’ they received from two interviews. In session 2 the group has been attempting to collect information from the company for their project and the aforementioned students believe that their solution will improve if they can speak to a specific stakeholder group. The group’s choice is to go with a different solution if there is no possibility to talk with their preferred stakeholder group:

*Student 1: “We have presented to them what our plan is for the coming weeks so they might see that they need to act faster so we can speak to clients in the coming two weeks and not in a month.” Facilitator: “Do you think that is reachable?” Student 3: “If that is not reachable, than we can take a different route without speaking to clients. That is possible, but the result what we will deliver will be less.” – Session 2*

The students also share in session 2 that sometimes interviewees provided information that later proved to be different in reality. The students share they need to reflect on new insights and ideas they thought of as a group.

Students all experienced in session 2 they were outside of their comfortzone. Student 1 shared that they felt like they were thinking more creatively. This became evident for them in a creative session of SPCSN.

**3.7.3.6 Sensemaking of the Minor Content** Belbin roles were useful to raise awareness about the team differences. The team used the circle with Belbin team roles to see that they are all on “different ends of the circle”.

The code of conduct was listing values and that was considered easy. About the learning zone model student 3 in session 1 shared how they interpreted this model using their personal experience: “I don’t think I’ll ever get in the panic zone with this minor.”. The meeting skills lecture was not used in the teamwork because, they need different kind of meetings than presented in the lecture.

**3.7.3.7 Minor Content Experience** Attempting other team roles is attractive to two students, but two others do not feel the need to do so. They feel comfortable in their ways of working. One student is perceived as another Belbin team role than their preferred role, but this is no motivation for them to try this kind of role.

#### **3.7.4 Group D**

**3.7.4.1 Team Experience** In session 1 the group found they have similar preferred Belbin Team roles, but there are slight differences. In session 2 the team is described as being more similar and the distances between the shapes are seen as non-negative. In session 3 the team is experienced as fun, the students are aligned, they have a nice foundation and are relaxed. The distances 'feel fine'.

**3.7.4.2 Sensemaking of the Team** Group D shared on the topic of organizational system that the team comes to the university every day and plan at most one week ahead. Their culture is that they can talk well, have fun together and feel safe in the group. The skills in the group are different: some people are fast in their ways of working, others have certain insights that are valuable. Their power structure is flat: there is no leader and they do all the tasks and write at the same time for the assignment.

**3.7.4.3 Team processes** The contribution by students was different: some were working fast and another brought in a piece of knowledge from their bachelor. Students start as soon as possible and attempt to finish as soon as possible. Students write down their answers to questions immediately, instead of one person taking the lead in that.

**3.7.4.4 Case Experience** The experience of the case is shared by combining individual perspectives in session 1. Student 1 studies Industrial Design Engineering and recognizes the design part, but data analysis is new to them. Student 3 follows their bachelor program at the faculty Policy analysis and Systems engineering and also recognizes parts of the C-lab case, however, having a real case is new to them. Student 3 does not use their bachelor program, but focuses on them thinking the solution designed by the students will be a placeholder and not being used by the case company.



In session 2 the experience is combined in one team perspective that students are zooming into the information they have.

In session 3 the experience of the students is described by the case company showing one problem, but the students seeing an underlying problem. The case company wants to improve the customer experience for which they have created a new team, but in order to communicate with other teams, members need to be in different teams to be able to communicate.

**3.7.4.5 Complex Problem Solving** In session 1 Student 2 shared that the case organization has no connection to a targetgroup outside of the organization and that this is the problem. In session 2 this perspective changed as the students realized out of contact with their case stakeholders that they did not see any problem which the students called confusion: the case contact person wanted to have something designed for a new team, whereas the students saw that problem mentioned earlier. Student 3 shared in session 2 that the case organization had to take action: plan and facilitate interaction between their teams. Reflection is necessary to find out what is important from the information they received:

*Student 2: “Well I think it’s so convoluted information we get, we need to do it all time. We don’t get any structured information from them. We got a handout and slides.” – Session 2*

Students expressed in session 3 that the problem found in their case was the first thing they found in the interviews.

In session 2 the students asked questions to their case organization and they got no response. This was different in session 3 as they received replies to their mails and one of the case stakeholders was joining them on campus to work on their case.

Student 1 and 2 in session 2 do not think a lot of innovation will happen in the solution of this case as the organization expressed they want to keep up to speed with the other similar organizations. Being creative could not be assessed at this moment according to Student 1 in session 2 as the students were focused on finding the problem. Student 2 in session 3 says: “I still want to do a transanalysis to look at the kind of future visions that the company might go to. So that we can like show that this is also a very important step to get to.” which is a method that was expected not to be used by other groups. This student felt like they were

in their comfortzone and thus could be more creative. Student 1 shared they experienced something out of their comfortzone – a session that was facilitated to make students think more creatively - that actually made them more skeptical instead of creative.

**3.7.4.6 Sensemaking of the Minor Content** This team used the learning zone model to get more insight/background on doing something different already than they usually do:

*Student 2: “I was already like I want to do this more so it wasn’t because of the lecture” Facilitator: “OK so it was already your own goal that you wanted to” Student 2: “yeah but I guess this yeah give more insight” – Session 1*

The Belbin roles explained how the team worked and why it was so easy to work together. Since the teamsize was only three, the students found it difficult to use the meeting skills lecture in their teamwork.

**3.7.4.7 Minor Content Experience** Attempting other Belbin Team roles than their most preferred one is what Student 2 and 3 are already doing: student 2 takes a leadership role and student 3 uses the role to be more creative. Student 1 does not know if they would try out other roles.

Potential support for the minor as experienced by students of this group is that C-lab could provide more background on the purpose of literature and students prefer to practice and role-play more in the teamwork course.

The value of Form language is according to Student 2 that students get to be aligned better and know what others think. This is also equal to what this student and Student 1 have learned from these Form Language sessions. Student 3 says they do not know whether the shapes of Form Language helped, but they do agree that the explanations were useful. The shapes of Form Language were connected by this student to art: it depends on the viewer.

### **3.7.5 Group E**

**3.7.5.1 Team Experience** In session 1 the team is described by ‘islands’ – students and their differences – and the lines of communication between those. Only one difference is mentioned of Student 3 who is seen as more creative and can act unexpectedly.

In session 2 the team describes themselves as dependent on each other. The projects of the courses in the minor are part of how the team is experienced. Student 2 is the only student that put themselves in the team configurations as a ball: “I’m open to all ideas and trying to understand all points of view.” The distances mean they are close, but not always. The group mention they want to be less chaotic by planning more, but leaving room for improvisation. Student 2 and 3 disagree about structuring the Miro – an online whiteboard which students use for their projects. Student 2 wants to have more of an overview, while student 3 says the chaos stimulates more creativity.

In session 3 the team is described as a neighbourhood: they all have different backgrounds – which separates them – but they come together at the university to communicate. These differences are seen as positive.

**3.7.5.2 Sensemaking of the Team** Group E talked about their bachelor programmes and what the differences are because of that in team members. Another topic is what other communities they are part of outside of the team: “I spend a lot of my time as competition coxswain and coach.”. The skills were mentioned in their contributions to the team. A habit of the team was that one member would always get tea, until there were no tea bags left. The organizational system of the team is that they plan every week and revise that at the start of the week.

Students mentioned once when they experienced a gap and how they bridged that gap:

*“We did a Belbin test and we have no coordinator in the group.  
No clear one anyway. We have decided that this our way to go is.  
That we keep it a bit more free.” - Student 4, session 1*

The gap here is that there is no coordinator and the students build a bridge by deciding to keep it more free.

**3.7.5.3 Team Processes** This group experiences to have the right skills and knowledge and Student 4 shares that “the amount of motivation helps if there is knowledge missing, we will go look for it.” Everyone is a bit better in specific tasks, like writing, but everyone contributes by finishing their tasks. Completing a task together is done by reading for oneself which results in an idea containing tasks that are divided.

*Student 1: "What we also do often is divide and then look at what that person has done and whether I can add something." Student 4: "Sometimes in pairs: who fits best" – Session 2*

The deadlines have become less in session 2, but bigger. Students prefer to have tasks finished before the deadline and plan in that way. Sometimes personal circumstances force tasks to be finished last minute, but communication is good around that topic.

Some students point out that studying in this minor differs from their bachelor in the sense that everything is done in a group which results in "giving up freedom of choosing when to study. That is something I'm not used to." (Student 3, session 2)

**3.7.5.4 Case Experience** In session 1 the case is experienced as unclear. Students could get a glimpse of the story of the company by the interview they had so far and the study material they received. In session 2 the case experience is described by having no contact with their case company. After the interview, the group sent a proposal but, have received no response yet. They are working with their own interpretation so far. In session 3 the students experience having a clearer view of the company, but notice that obstacles that the company has are held back. These are presented in a vague manner.

**3.7.5.5 Complex Problem Solving** In session 1 Student 1 shared their intuitive solution so far, whereas Student 4 found it difficult to do that at the time. In session 2 the students shared they are working on defining the problem before thinking about the solution. The language spoken in the company is something the students had to get used to:

*"It is a company where a lot of different terms are used – jargon – which we had to make our own by reading documents. That helped a lot." - Student 4, Session 2*

Student 1 talked about optimizing systems can be part of the solution in session 2. Reflection is needed according to both Student 1 and 4. It is needed to involve all perspectives from the different team members according to Student 4: "I think next week we'll get thrown a lot of information, at least I hope and then I think it is important that you

look back on it with the four of us". According to Student 1 and 4 there were going to be multiple solutions possible due to the complexity of the company: the amount of challenges they currently have. In session 3 students shared that due to collection of data, there was no moment for reflection yet.

A high amount of communication is needed according to student 4 and that amount is not reached in session 2. The students need to plan appointments which make their time limited and made the conversations also surface level according to them.

Innovation is going to be difficult according to Student 4 in session 2, but awareness can also be a goal according to them. In session 3 the methods followed up until then (interviewing stakeholders) were standard in the students' perspective, but choices made after that could be innovative. Students 1, 2 and 3 all experienced slight discomfort in session 3 with the amount of communication, but Student 2 shared that helped with practicing and learning. Creativity was not necessarily the case here.

**3.7.5.6 Sensemaking of the Minor Content** Belbin team roles were nice to have in the beginning of the minor since in the student's perspective is this prevented any delays later:

*"I think the team roles were handy to have at the beginning, because we immediately found out that we don't have a coordinator. And that you can play into that instead of find out that yourself and that delays the process. " - Student 4, Session 1*

The meeting skills lecture was perceived as different from what is needed in the project, but it is an useful life skill. However, a session later the team also used the meeting skills contents for structuring their online interview with one of the stakeholders of their case:

*"Last lecture was just about meetings and we had some meetings. We kind of divided the interviews with a chair and a note taker rather than just being all there. It was more efficient so I guess we used that from the lecture " - Student 2, Session 3*

**3.7.5.7 Minor Content Experience** Trying out new roles from the Belbin Team roles is not necessary according to Student 1. Student 4 does want to try more action-oriented roles instead of thinking. This is not only because the student prefers that personally, but also because they see the group is lacking this type of team role in their group.

## **3.8 Key Findings**

The key results that are used later in the report are presented below in their subcategory.

### **3.8.1 Team Experience**

All groups focus in session 1 on similarity and differences. Group A and D used the Belbin Team roles in explaining the differences and similarities between students, whereas Group B used the bachelor programs. The other groups mentioned no specific interpretation in session 1. There is a difference in how these interpretations were used: the Belbin Team roles in Group A were used to explain differences between team members, whereas in Group D the students had similar Belbin Team roles and provided extra explanation how it was different. In Group B the bachelor programs were seen as a common resource of the group, but also explained why every student was working differently.

In all groups there is a moment where the connection between the students is important: in Group A in session 3 there is a good connection between the students, in Group B in session 4 and Group C in session 3 there is a focus on the team becoming a single unit, Group D in session 3 said that students are aligned, and Group E in session 2 discuss the interdependency and becoming a neighbourhood in session 4.

### **3.8.2 Sensemaking of the Team**

In the question about individual backgrounds of students which was asked in session 1 study background (Group A, B, C, D and E), individual history (Group A, B and D), and experience (Group C and D) came up. The organizational system of the groups were focused on planning: having assigned tasks in Group A and C, making a schedule a week ahead in Group D and E. In Group A it was also added that they have their own space, drink coffee together and have a drink together. Habits of the team

are talked about in Group A and E. Group A shares that planning for the next week is their habit and whenever a student is late, they bring snacks. In Group E one student always gets tea for the other students.

In the analysis, culture and power differences were mentioned in Group A and D. In Group A the culture is described as comfortable from the first day and two students are taking the lead in the two projects the team do. In Group D culture is seen as being able to talk well, have fun together and feel safe in the group and there is no hierarchy within the team. Group C and E expressed the experience of a gap and how they bridged that gap. In Group C they experienced a lot of questions surrounding the case. In Group E they found out there was a leadership Belbin Team role missing, so they bridged that by leaving it free.

### **3.8.3 Team Processes**

All teams except for Group A discussed contributions made by different team members. Group B shared that one member is contributing by organizing the interviews, while another was able to read people easily which is a skill that was used for the first time by this student in a project. In Group C the members that worked longer on their case were seen as contributing their knowledge about the case. Also updating their planning and having studied a certain bachelor program were seen as contributions in that group. In Group D also the bachelor program of a student was seen as contribution and being able to work fast. The common contribution in Group E is being able to finish their tasks and some are a bit better in certain skills like writing.

Two teams discussed about having the right skills and knowledge in the team. Group A is divided about this as one student is unsure whether they can use their study background in the project. Group E felt like they have the right skills and knowledge and share that if they do not possess something, they felt motivated to find it.

Changes in the temporal context were limited: only three separate topics could be identified. In Group A there is a workload difference and priority difference over time. The workload is dependent on the communication with the case owners and students point out urgent deadlines are prioritized and used more time for than later deadlines. In Group C there is a difference in motivation over time, but also a difference between team members. One student was getting enjoyment from the

case and later wanted to find a good solution. Another student noticed that routine decreases motivation, but got a motivation boost when two students joined the team. From one the two students that joined the team, they were at first also demotivated but got motivation because of the new case that they liked. In Group E discusses a difference in use of time as deadlines become bigger over time and some students are not used to – from their bachelor programs – to have less time to plan for their studies.

### **3.8.4 Case Experience**

Student teams share their perspectives on the case at that moment in time. In session 1 Group C share they have many questions and in session 2 share the connections between stakeholders they have found and which is the most important stakeholder for them. In session 3 the communication between different parts of the organisation is the focus. In session 3 Group A talks about the transparency of actions by team. In session 4 in Group B the students are describing them looking at problems and understanding those.

One common perspective is that students notice withholding of information by case stakeholders. In Group B in session 2 and in Group E in session 3 students notice there is information withheld from them when communicating with stakeholders. In Group D in session 3 feel like the case organisation is showing one problem, but the students seeing an underlying problem. The case experience is also focused events that are happening connected to the case. Group A in session 2 have been clustering the subproblems found so far and in session 4 have found three solution directions and a critical node. In Group C in session 1 the subject of the experience is the contact with the case owner and. Group E in session 1 has held an interview that provided information and the case organisation has provided study material and in session 2 the students have sent a proposal that they are waiting the response for. Group D in session 2 says students are zooming into the information they have.

In two groups (A and D) the case experience in session 1 is described using individual perspectives of the members of the group. Individual differences and perspectives are related to the different bachelor programs students follow. There is one student in Group D that feels unsure whether the case organisation is going to adapt their designed solution.



### **3.8.5 Complex problem solving**

Almost all groups used different pieces of information to come to a problem definition and solution directions. In Group A reflection was needed to see whether a is still fitting the requirements. In Group B and C different perspectives were combined in session 2 to get the whole picture. In Group C it was added that pieces of information conflicted with other pieces of information that could be part of the problem definition/solution. Group E said the case organization faces a lot of challenges and the amount of information collected needed to have reflection by all members of the group.

Group D was the only group that did not specifically mention combining different perspectives, as they did mention a difference in perspective on what the problem is by students and case owner in session 2, but went for their own perspective in session 3.

High amount of interaction is preferred by all groups. In Group A it was shared that interaction helps to gather what the case owner wants and test any ideas the group have. In Group B and E time for thorough questioning is needed to get past surface level information. In Group C information of a specific stakeholder was lacking in order to design a better solution. In Group D there was a period of no response to their questions, but that was resolved in session 3.

The amount of reflection and communication are connected by Group A and E. In Group A a break in communication between the group and its case owner meant more time for reflection. In Group E the data just collected from interviews was not reflected upon and needed that in order to gather insights.

The methods used for the case in C-lab were recognizable to some students. The students that did not recognize the methods, felt outside of the comfortzone which was mentioned in all groups. This discomfort was connected with learning in Group B and E.

There was no connection in any group of discomfort with creativity. There was one student in Group C that noticed an increase in creative thinking due to a creativity workshop in SPCSN. There was a connection with comfort and creativity by one student in Group D: using a technique from their bachelor program in the project.

### **3.8.6 Sensemaking of the Minor Content**

All groups (A, C, D, E) used the Belbin Team roles. They were useful in explaining team differences and in Group E it was mentioned it would prevent delays later in the process. The meeting skills lecture content was overall unused in the teamwork as the size of the team was small (Group D) or different kind of meetings were needed for the project (Group C and E). Group E used the meeting skills content for structuring an online interview. For the interviews Group A mentioned interview methods from Knowledge to Advice.

### **3.8.7 Minor Content Experience**

Students are mixed about trying out different Belbin Team roles. In Group A and D students are already trying out different roles than their most preferred ones. In Group B, C and E there are students open to trying new roles. In Group C, D and E there are students who do not feel the need to act in different roles than their preferred ones. There is a suggestion from a student in Group B to learn how to try out new team roles.

The three groups attending have provided their suggestions for support in the Minor and the teamwork course in session 4. In Group B and D a suggestion came up to provide more purpose to the literature of C-lab. Group D also suggested to have more role-play and practice. Another suggestion from Group A is to have reflection in conversation as the focusgroups had and use Form Language when students do not get along.

The value and learning outcomes of the focus groups as perceived by the same three groups have been asked. In Group A and B it was mentioned the focus groups provide a new way of thinking about the team. In Group A one student said they have learned to use abstract shapes to express themselves. In Group D a student is not sure whether the Form Language helped, but the explanations were seen as useful.

## 4 Usage of Form Language over time

This Chapter provides information about the sub question “How did students use Form Language over time?” by sharing observations made on how students used the Form language in different sessions.

The team and case experience configurations are observed over time: what is taken from the different configurations to the next and what does it mean (for team Subchapter 4.2.1.1, 4.2.2.1, 4.2.3.1, 4.2.4.1 and 4.2.5.1, and case Subchapter 4.2.1.2, 4.2.2.2, 4.2.4.2, 4.2.4.2 and 4.2.5.2). In the observation there are mentions of how facilitators used the Form Language and the configuration students built to represent the impact of Form Language in their teams in Facilitation of the Form Language (Subchapter 4.2.1.4, 4.2.2.4, 4.2.3.4, 4.2.4.4 and 4.2.5.4). What starting exercises were used, which indirectly affected how the students used the Form Language and is also mentioned per group in Starting Exercises (Subchapter 4.2.1.3, 4.2.2.3, 4.2.3.3, 4.2.4.3 and 4.2.5.3). Recordings are also discussed as they provide how well the usage of the Form Language could be recognized on camera in Recordings of Form Language (Subchapter 4.2.1.5, 4.2.2.5, 4.2.3.5, 4.2.4.5 and 4.2.5.5).

### 4.1 Starting Exercise

In session 1 of the focus groups there were two different starting exercises: students had to pick shapes and build a configuration to represent either trustworthiness or trust (Trust/Trustworthiness exercise) or there was an exercise before it (Core Value cards exercise): students pick a picture that resonated most with them today (see Figure 9) and then they represented the backside of the picture which was a value connected with that picture. Then they still built a configuration with trust or trustworthiness.



Figure 9: Value cards

In session 2 of the focus groups there was an exercise introduced (Dixit exercise) to get to know the Form language (FL) which uses Dixit cards. Dixit cards were used because they also had a visual element like the pictures from the Value card exercise.



Figure 10: Dixit Cards

First students had to pick a card and share the reason why they picked the card. Then they think of a word to connect to Dixit card, then they represented the word with the shapes of FL.

In session 3 and 4 the starting exercise was thinking of a word for today and then representing this with Form language.

## 4.2 Observations Focusgroups

Observations of the how the Form Language is provided per group by the team configurations over time, the case configurations over time, the starting exercises and individual background, facilitation and recordings. All group configurations with quotes and labels on what is represented by what shape of the Form Language (e.g. of the team or case) are presented in Appendix A.4 and in Appendix A.3 the configurations are grouped by group without the labels and quotes.

### 4.2.1 Group A

**4.2.1.1 Team Configurations over time** The way Belbin Team roles were expressed in session 1's team configuration, were seen as different by the students and had to have different forms. The 'platform' – the big cube with wooden planks – stood for the common ground that students have. When students were asked by the facilitator to choose which shape is related to which student, Student 1 immediately answers they were the cube. Students with similar bachelor programs (2 and 3) were linked to the ball (and half balls)

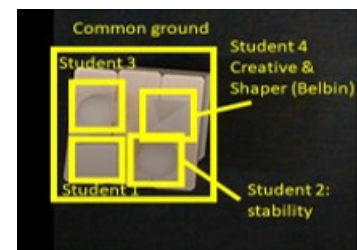


Figure 11: Team experience of Group A in session 1

– which seem in Figure 7 the same and Student 4 is sharper and more creative thus a pyramid.

Student 1 also proposes Student 3 is then the full ball, because that is more intuitive with their Belbin Team role. Student 2 disagrees as they do not feel like a ‘half’ ball and this is solved by putting a full ball on a ring to keep the differences between the shapes, but represent the stability this students adds to the group.

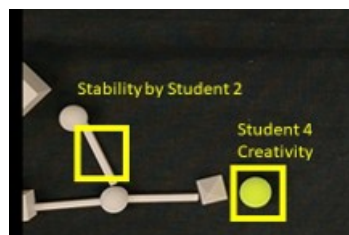


Figure 12: Session 1 without height and more focus on distance

Distances are added and the platform is removed as suggested by the facilitator which can be seen in Figure 8. The cube and wooden planks are removed, but the shapes are kept. Distances are then based on Belbin Team roles of Student 2 and 4, and similar personalities of Student 1 and 3. The creative contribution and clear opinion of Student 4 is added to the configuration when this topic is asked (Q3) in the shape of a yellow ball. After this discussion, the height of the platform is mentioned to be important to symbolize how well the team is doing.

Student 4 took the lead in session 2 in explaining the team experience, although they were not present in the first session. This resulted in discussion about what shapes to take for the team experience, since Student 1 wanted to use the shape they used in the first session:

*Student 1: “Are we all balls?” Student 4: “Yes, we are all balls.”*

*Student 1: “I thought I was a square.” – Group A, session 2*

Student 4 continued in explaining they wanted to make one unit with four different things, which Student 1 agreed with because they recognized the ‘team feeling’. The unity was represented by a pyramid and a ring is put on it to symbolize the project they are currently doing (of C-lab). When the facilitator asked for elaboration on the distances, Student 4 suggested to have equal distance between the members and the pyramid. Student 1 suggested to have a closer distance between student 1 and 3, and 2 and 4 because of similar working styles. At first Student 4 disagrees, but understands that Student 2 and 4 are more ‘strict’ so instead of the distances, the shapes are modified. Two pyramids are switched for two of

the balls. Since Student 4 says – who was not present the last session – that the Belbin Team role of Student 2 is definitely a ball and because Student 1 and 3 are more similar in working style they are the pyramids. Student 4 declares themselves a cube due to their Belbin Team role.

In session 3 Student 4 explained to Student 2 what the group had built last time for the team composition and this is used as a starting point for this time as can be seen in Figure 9. The pyramid is still working towards one goal with the team – the big pyramid - and the small ball, pyramids and cube return as the students. Student 2 also explained what the first configuration was as Student 4 was absent last session: it was about the connection between the students, Student 2 was in the middle and they were all connected. The connection part was added by adding sticks in the configuration, as the connection is now more stable between the students.

The last team composition without the sticks was again used as starting point in session 4 for how it is currently going. The big pyramid was the project and the ring was their goal. Student 1 responded by being in a comfortzone and that was represented by the ring around one pyramid. Student 4 added a stick to represent feeling remote.

*Facilitator: “Do you think that this [stick] can be removed in the next quarter? With how it has been solved.” Student 4: “For now I have to see it first.” Student 1: “In any case we are actively doing our best and actively being busy with it.” Facilitator: “You first want to see the results from*

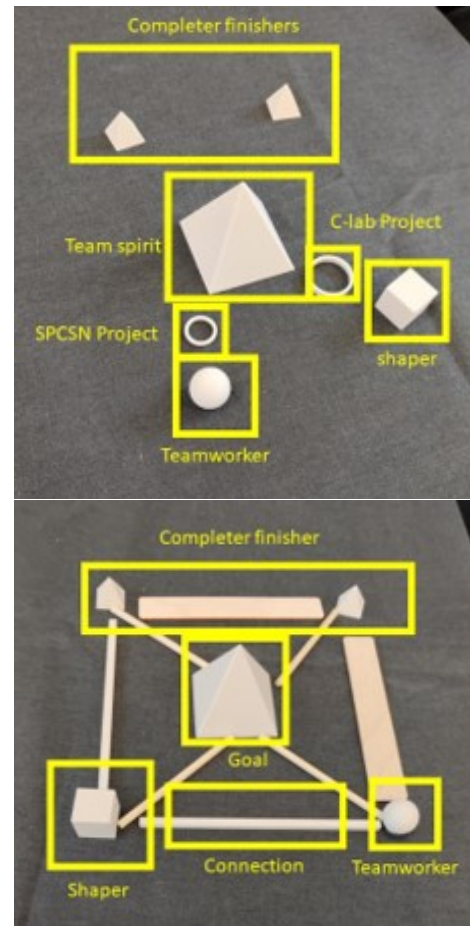


Figure 13: Top is the third session, bottom is the fourth session. There are overlapping elements.



*the rest?” Student 4: “Yes, I first need to see before I can believe it.” – Session 4*



Figure 14: Feeling remote

#### 4.2.1.2 Case Configurations

**over time** In the case experience configuration in session 1 the ‘platform’ returned from the team configuration as the well-functioning team as can be seen in Figure 10 and Figure 7. The initial response to their experience with the case was challenge



Figure 15: Case experience in session 1 with the ‘platform’

which had to be a big shape and the student’s challenge was to make the company a whole according to themselves, which was a big ball. The multiple ways to overcome the challenge were represented by ‘paths’ or the sticks of the Form Language and the questions were random other shapes that were added.

The case experience in session 2 is explained by representing thirteen subproblems that are being clustered at the moment with pins and the

case is a big cube. When talking about student's intuition of the solution for their case, the students describe digital awareness with their case stakeholders (who "need to become digifit"). This was added to the case experience configuration as suggested by Student 4.

In session 3 Student 4 started building for the case and Student 2 helped.

*Student 4: "I don't know." Student 2: "You don't know." Student 4: "I do something nice. Don't you think it's nice? I think it is." Student 2: "That is too long." Student 4: "I can also put this a little lower. I don't know what I think of this. Then put it on the other side." Student 2: "We'll get there!" – Session 3*

The students built before discussing and explaining what they were building. The whole configuration was balancing and represented steady progress. The transparent planks meant that everyone knew what the students were doing at the time. The ring on the pyramid is the problem statement of the case.

In session 4 the students were unsure what shape was the case last time. Student 4 suggested to place a big block and on top of it Student 2 put a big pyramid. The three scenarios for C-lab are represented as well by three cubes. The critical node that students found for that project is the ring right now.

**4.2.1.3 Starting Exercises** The starting exercise in session 1 was the Core Value cards exercise and facilitator joined the exercise. There were two configurations made with trust and three with trustworthiness. The starting exercise in session 2 was the Dixit exercise. Students literally built what they saw in the picture or took the word and made a visual representation of that. The facilitator explains that rings can be used to stabilize the balls. In session 3 during the starting exercise, students wanted to build a common configuration. The starting exercise in session 4 resulted in sharing the plan for the day and the current moods of students.

**4.2.1.4 Facilitation of Form Language** The facilitator in session 1 placed different shapes of FL on the table and explained combinations. For the individual background the students were asked by the facilitator to share something that would be relevant for others to know. The



facilitator made a suggestion in session 1 to build in a way which allowed distances between shapes when building a team configuration and the students accepted the suggestion such as in Figure 12. This was the team composition configuration. Some clarifications were made about the Form language as well here:

*Student 4: "I don't know." Student 2: "You don't know." Student 4: "I do something nice. Don't you think it's nice? I think it is." Student 2: "That is too long." Student 4: "I can also put this a little lower. I don't know what I think of this. Then put it on the other side." Student 2: "We'll get there!" – Session 3*

In session 2 during the team experience question, elaboration on the distances that students have decided is asked which made them rethink their configuration. In session 3 Student 4 wanted to use a yellow ball, but that was not present at the moment.

In session 4 the students built a configuration to show the impact of Form Language. The shapes which represent the students in the last team configuration were used to show the distance from the team to the Form Language. The question was mostly answered afterwards.

**4.2.1.5 Recording of Form Language** Student 4 and 2 fidgetted with the shapes in session 4 which was visible on camera. In session 1 the different two half balls and a full ball are difficult to distinguish from each other in the picture taken. The box with Form language shapes is on the table while building the configurations in session 4.

## **4.2.2 Group B**

**4.2.2.1 Team Configurations over time** For the team configuration in session 1 the big block represented the different bachelor programs that students can build upon as support. Because of the different backgrounds, everyone takes a different position in the space. Both students present felt like they were a stick, but for different reasons: Student 4 could use their experience and Student 2 could use their analytical insight. The ball and cube are attributed to the bachelor programs of Student 1 and 3.

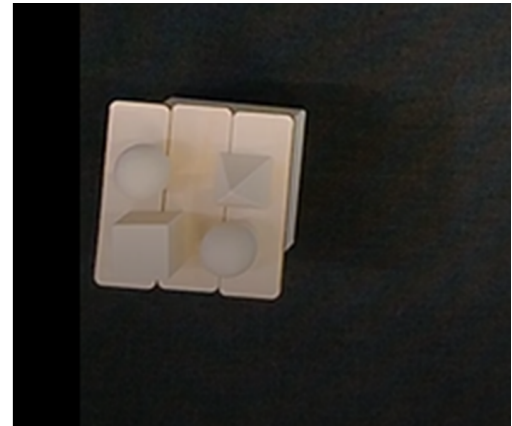
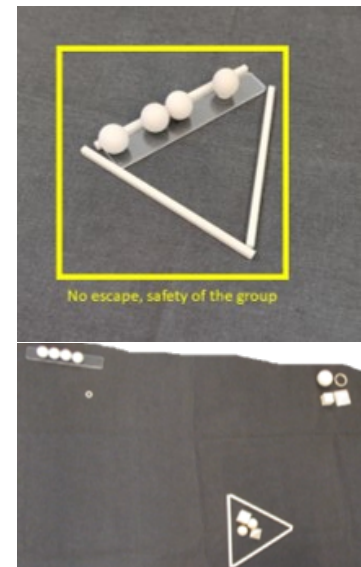


Figure 16: Recordings of Group A. Left is the box on the table during the building process and right the half balls and balls are not distinguishable from above.

The team composition in session 4 was built in individual configurations and these were combined into one using the individual configurations from Student 1 and Student 4 (see Figure 8). Student 4 represented the strong connection between different students and Student 1 said “we are together but you can easily fall”. The triangle in the final configuration is the safety of the group which came from Student 4’s configuration and the balls with plank was from Student 1’s configuration. Student 1 and 3 had different shapes to represent differences between the students, but this was left out in the final combined configuration.



**4.2.2.2 Case Configurations over time**  
Students discussed for the case configuration in session 2 about what the shapes should represent what before students put them on the table:

*Student 4: “Wait, are we the balls? I thought we were the sticks.” Student*

Figure 17: Combining individual configurations (bottom) into a team configuration (top)

2: *"Oh, that is also possible." Student*  
4: *"We are the balls..." Student 2: "I*  
*mostly thought that we could use the sticks to represent direction."*  
Student 4: *"Ah yes, that works."– Session 2*

The culture of the case organisation is represented by putting small pyramids under planks which represented hidden information for the students. Transparent planks represented the interviewees for the C-lab case who provided the students with information.

The balls – students – were kept in the case configurations from the team configuration in session 4. The students are understanding the problems which is symbolized by putting balls behind the transparent plank as if the students are looking at the problems.

**4.2.2.3 Starting exercises** This group did not have a session 1 so they did the Trust/Trustworthiness exercise of session 1 in session 2 and Student 4 and Student 2 both chose to display trust. For the Dixit exercise in session 4, students took either a mood, a feeling or a specific event that happened or will happen that day. The ball was unstable so the facilitator suggested taking a ring to stabilize the ball. The student decided to not use it.

**4.2.2.4 Facilitation of Form Language** One new (to the Form language) participant in session 4 commented on the way the question about team composition was phrased: "How it *feels*". Student 3 and 4 collaborated on building the case configuration in session 1 and Student 1 was not participating.

**4.2.2.5 Recording of Form Language** In session 2 the height of the team and case configuration is not visible on camera. In the same session the legs of the camera are visible on the recording.

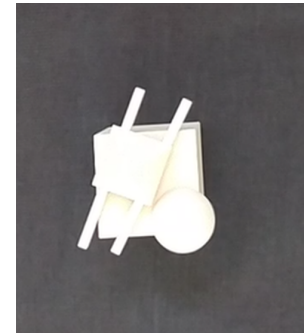
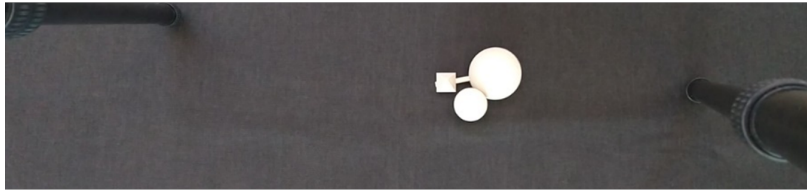
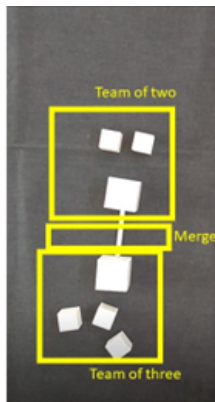


Figure 18: Recordings of Group B. Left the legs of the camera stand are visible in the recording and right the height of the configuration is unclear.

### 4.2.3 Group C

**4.2.3.1 Team Configurations over time** There is a discussion in session 1 about what shapes to take for the team configurations. That students complement each other is what Student 3 wanted to build. Student 1 proposed to have two loose parts that are connected. When the facilitator asked whether similar shapes meant that students were similar, Student 3 shared that equality in a team is important to the student team:



*“I think it is important in a team that you feel equal. So to choose a bigger or smaller block shows you are more important according to my feeling. That does not feel right.” – Student 3, Session 1*

Figure 19: The merge process represented

Session 2 was after the merge of two teams. First the process of the merge was discussed which was represented by a group of three and two students that are connected in Figure 14. This was not seen as how they experienced the team at that moment. This was shared in individual configurations first. Student 2 represented that as merged groups with a common goal. Student 4 also had the unity in the team as one big ball consisting of all qualities needed, with smaller balls around it because everyone is also their own individual. Student 3 shared:

*“I think that I looked at it more dreamy. I think that I felt accepted in the team. I think that is why I chose the round shape. Because I found that an angular shape would seem more aggressive. This feels safe. And everything feels safe, trustworthy and nice. Actually it is representing comfortable.” – Student 3, Session 2*

Student 1 chose to represent also the different qualities present and added that there is a frame that everyone sticks to in their minds and have the same goal. When the facilitator asked to combine the individual configurations, the configurations of Student 4 and Student 1 were chosen and the smaller balls are moved closer to the bigger ball and sticks are added between the smaller balls.

The facilitator encouraged as well to build workload difference for students in Form Language as can be seen in Figure 20. Student 4 placed themselves as a ball on top of the project: being relaxed, less stress. Student 3 used a half ball to show that the ball is going open: they can loosen up the control a bit more and the work can be divided. Student 1 chose a round shape to represent their current relaxed state. Student 2 chose a cube to represent they want to keep a nice atmosphere and the corners are in touch with everyone from the team.

In session 3 the different shapes are based on the bachelor programs and the group is goal-oriented.

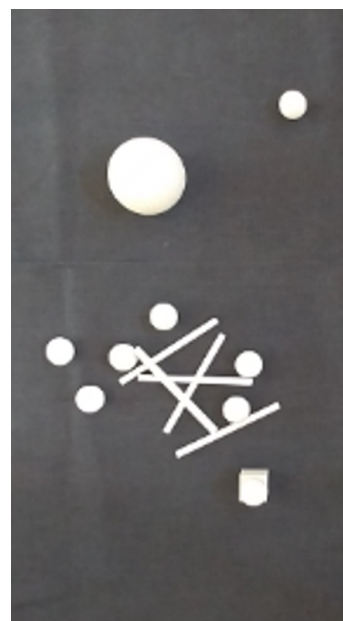


Figure 20: All balls in the middle were the students and everything behind is the contribution to the team

**4.2.3.2 Case configurations over time** The case experience in session 1 is first described as nice, but chaotic as can be seen in Figure 21. Student 3 proposed to make a heap of sticks. Round shapes would represent smooth, and that is something they wanted to avoid in this configuration. Student 1 said a triangle would represent that the students like the company.

In session 2 the case experience consisted of a complex problem and unclarity which Student 3 said needs a lot of shapes. Student 4 explained the case configuration: the pyramids were the stakeholders, in the middle – the yellow ball – represented the target group and the cubes are the eventual goals, but they had a distance between them to show students are unsure which one to take.

Shapes were placed while the question about case experience is answered in session 3. The clients were a ball, the practitioners a small cube, and the case company a big cube.

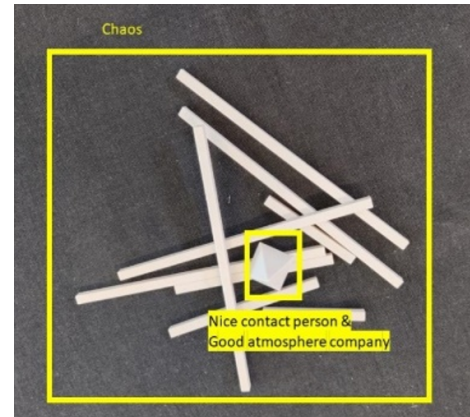


Figure 21: Case experience of Group C in session 1

*“These are the clients and these are the practitioners. They are very close with each other. Because they naturally help each other and the communication is well, but the company wants to transfer the clients and that is not communicated well to the clients and then to the practitioners.” – Student 2, Session 3*

**4.2.3.3 Starting Exercises** In first session which had the Trust/Trustworthiness exercise, students both combined trust with trustworthiness. In the Dixit exercise of session 2 students were either literally trying to copy the picture in FL or the connection with the picture was less obvious. The starting exercise of session 3 is not recorded.

**4.2.3.4 Facilitation of Form Language** “How many shapes can I take?” or “What is this for?” were questions asked at the start of session 1. In session 2, some new students joined and the ball was unstable so the facilitator suggested taking a ring to stabilize the ball. In session 2 there is confusion about whether questions should be answered as individual or groups configurations and whether it needed to be represented by Form Language or not. The facilitator suggested to make a configuration with Form Language first of the merge itself and of the experienced workload difference, before discussing how the team experience was.

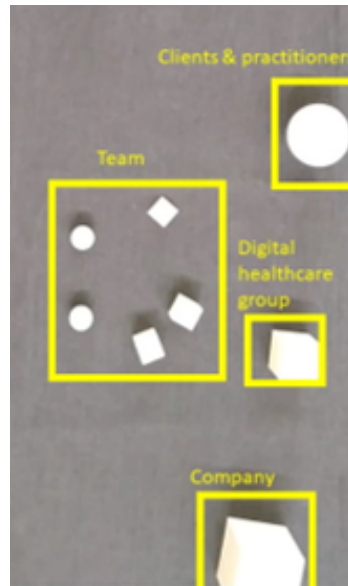


Figure 22: Case configuration session 3

**4.2.3.5 Recording of Form Language** In session 2 and 3 there is a white glow around the objects in the pictures taken. The session 2 video recording does not show that effect, but in session 3 it does. In session 2 the glow happened in the picture taken by a mobile phone. The legstand of the camera is also visible in this recording.





Figure 23: Recordings of Group C. Top is from session 2, bottom from session 3.

#### **4.2.4 Group D**

**4.2.4.1 Team Configurations over time** Everyone was building the team configuration in session 1. What team members contribute to the team is added to the team configuration. Student 2 pointed out that the students all had similar Belbin Team roles, but it worked differently for all of them. They suggested to use the pyramids and Student 1 added they can be placed differently to highlight that difference. There was an idea by Student 2 to have three different pyramids, but these were different size



and Student 1 asked if there is anyone bigger which they agreed that is not the case. The contribution students had to the team were also added later when that question was asked by the facilitator. Student ... proposed to have lenses for all students that are placed differently when discussing the contribution, because they all bring a different perspective.

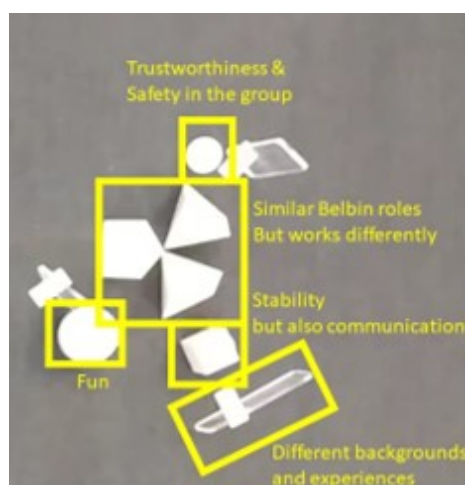


Figure 24: Different perspectives

In session 2 the pyramids returned as Student 3 remembered the students used these last time. Student 1 explained the students are similar. Student 2 liked that the pyramids were coming together in one point.

During the build of the team configuration in session 3, two students were still discussing about the starting exercise. All configurations of the starting exercise were combined to shape the current team feeling. The triangles in this configurations were not the students specifically this time:

*“Three individuals, it’s not like you know this is you or this is me. Just 3 individuals” – Student 3, Session 3*

The triangles were used again for the team configuration of session 4 and did represent the students individually this time, as the results from the starting exercise were put behind every student. Student 3 mentioned that “we need to be creative” during the building process of the team configuration.

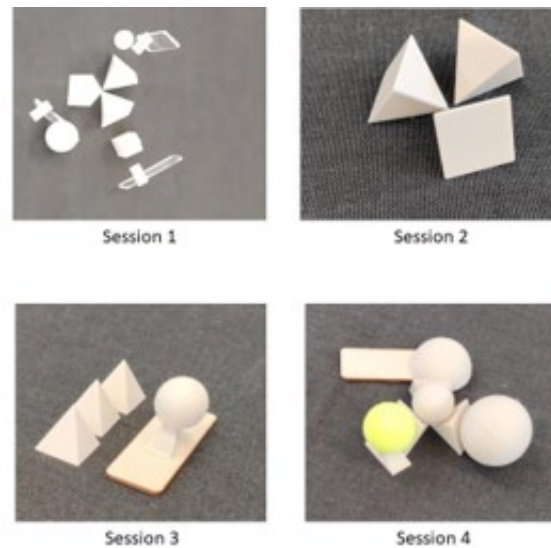


Figure 25: Pyramids return every session in the team configurations

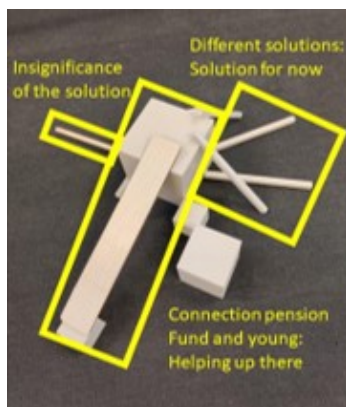


Figure 26: Session 1 case

#### 4.2.4.2 Case Configurations over time

When the case configuration of session 1 was being built, there was not that much verbal communication. Students built individual configurations first before these were combined in a joint configuration. Two students shared their perspective based on their bachelor programs. Student 1 made an unstable configuration because of the uncomfortable part in the case. Student 2 talked about the real case and that is the reason this student chose wood. Student 3 chose a stick as this project is a placeholder for the company in their perspective. All the objects were combined in an balancing configuration that included the placeholder, which gained a personal

perspective by Student 3 as well why their bachelor program is a personal placeholder.

The case configuration was modified with the intuition Student 2 had about the solution for the case:

*Facilitator: "Yeah OK and how do you feel about that? Can you*

*represent that with these blocks?” Student 2: “I think that this is just my insight” Facilitator: “That is OK but I mean we can discuss the different perspectives and maybe combine again.” – Session 1*

For the case configuration in session 2 Student 1 was building and there was again limited verbal communication. The explanation was shared after building by all three students: there is confusion and the students are zooming into the problems. Student 3 changed the shapes in the configuration during the explanation.

For the case configuration in session 3 in Figure 27, the big cube is used again from the previous configurations. Student 1 commented on the way Student 3 attempted to make a balancing configuration: “Why always the difficult things.” Student 3 responded: “Difficult problem.” The big cube was part of the problems that the company assumed are the problem and the students saw the balancing configuration as the problem the case company had.

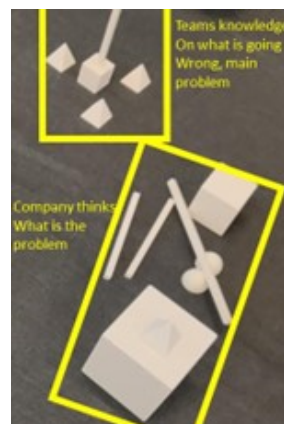


Figure 27: Case configurations of session 3

The cube and pyramids from the team configuration was re-used in the case configuration in session 4. The pyramids – which represented the students are put on the big cube and a bigger cube is put on top of the pyramids. Student 1: “Now we’re squished in between the case” and added later that the lower part is the case and the top part are the case organisation.

*“The case made us understand what they are missing so this is the bigger one. For example the reports that we will do like the presentation it’s just like this part so case is not that important but what we will come up will be really important for them.” – Student 1, Session 3*

**4.2.4.3 Starting Exercises** The starting exercise was not recorded in session 1. The starting exercise in session 2 was the Dixit exercise: adjectives and an action were chosen. For the starting exercise of session

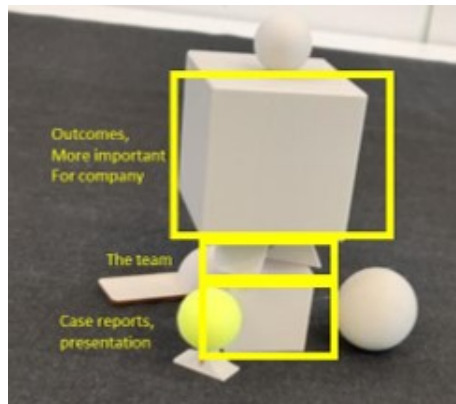


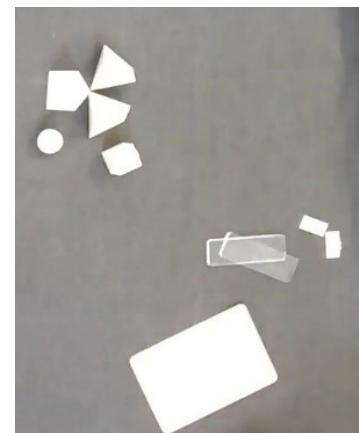
Figure 28: Case experience where students are in between the case

3students used moods or themes of today (with mentioning some events that would happen or happened).

*Student 1: "I had relaxed I guess it was pretty relaxed so I can kind of felt like the shape is slowly" – Session 3*

The starting exercise in session 4 had again moods and themes of today (such as relaxed, fun and tired).

**4.2.4.4 Facilitation of Form Language** In session 1 there was some confusion about whether it is a team configuration and whether students first answer or whether they start with the shapes. Also a student asked whether the case experience should be answered with Form Language. The facilitator asked to represent the intuition of solution in this session. In the fourth session the impact the Form Language had on the team was built by the students. It made the students feel more aligned which is represented by the case configuration that was connected by sticks.



**4.2.4.5 Recording of Form Language** There was fidgeting with the shapes in session 2 on camera visible. In session 1 there is also

Figure 29: Reflection in the video recording of session 1 of Group D

reflection in the video recording. From above the configuration of Figure 29 is not visible completely.

## 4.2.5 Group E

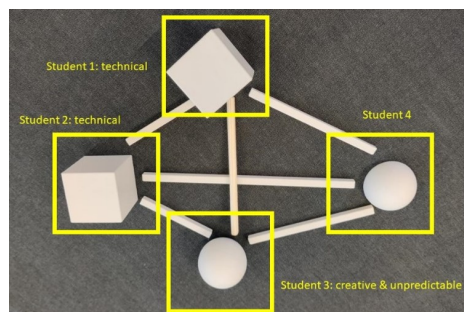


Figure 30: Team configuration with 'islands'

### 4.2.5.1 Team Configurations over time

There is discussion who is which shape for the team composition in session 1:

*Student 4: "We can make islands of everyone and then visualize the lines of communication. That we are different, but that everyone has communication with each other. I think Student 2 is square. You as well actually."*  
*Student 1: "I think Student 3 is a circle." – Session 1*

Some discussions were going on during the team configuration of session 2 that was being built mostly by Student 2 and 4 when a lot of laughing was going on:

*Student 2: "Just take something that you like" Facilitator: "Transparent" Student 4: "But where is the third cube?" Student 2: "It's still there. I like these better [transparent planks]. It is messy, like us. No..." Student 4: "What's that?" Student 2: "This is me." Student 3: "I think with the wooden things, now we have four different things on the projects and that is us." Student 4: "So I'm the ball." Student 3: "They are all touching each other, so they are all working together." – Session 2*

Student 3 explained the cubes are the project and the four planks are the students. Student 2 added that the ball represented them (Student 2 only). Student 3 continued with saying that everything is touching each other which represented their collaboration.

The team configuration was compared with earlier configuration of the team. Student 4 shared that there is a difference between them and commented on the current configuration: "I'd think here like: okay, this is not about us, it is more a feeling of the collaboration." Student 4 and 1 build the case configuration together, the other students by then are absent.

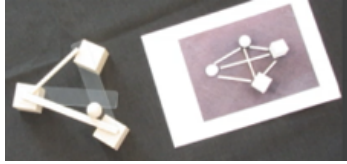


Figure 31: Comparison of configurations of different sessions

Students discussed shortly before building the team configuration in session 3:

*Student 2: "Why is that?" Student 3: "We're all from different places" Student 2: "This should be long" – Group E, Session 1*

The team experience was described as a neighbourhood with pathways between the homes and the university.

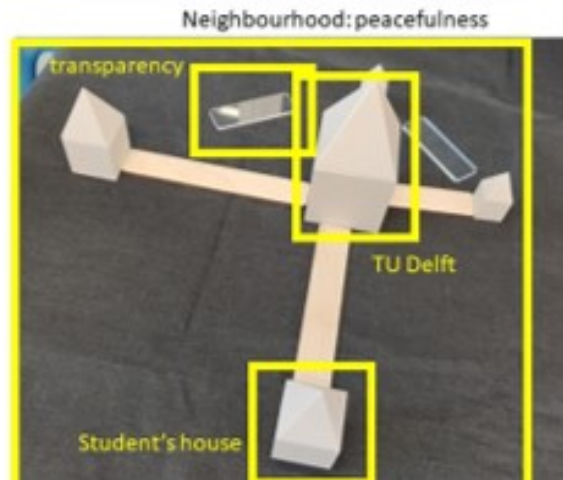


Figure 32: Neighbourhood



#### 4.2.5.2 Case Configurations over time

Student 4 mostly built the case representation in session 1. A wall of wooden and transparent planks was built to share that the team had one interview that provided an insight in the company, but no overview. Student 1 had an intuition about the solution so builds that part: departments that do not collaborate may be part of the problem.

In session 2 the same students were building the case configuration as in session 1. The cubes represented the structure students currently have in their perspective from the company and from that structure loops were being made (the rings in the configuration) to find out how processes worked within the company. They shared that this configuration is more of a wish than how it currently completely is.

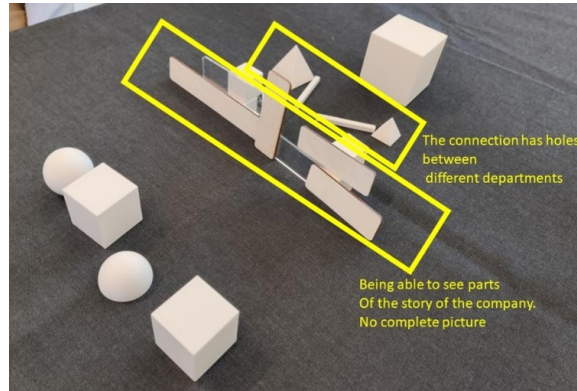


Figure 33: First case experience with intuition about the solution

The case configuration represented on one side the obstacles which could not be seen on the other side – the rings which saw only the positive things of the company: the case company was hiding problems according to the students. The gaps between the cubes represented that during their process the students hoped that information may come through.

**4.2.5.3 Starting Exercises** In the Trust/Trustworthiness exercise of session 1 students chose to represent trust by either making a visual of a trust fall or having elements that they associate with trust in the configuration. Student 2 in the starting exercise of session 2 first chose a word and changed it when starting to build with Form Language. In session 3 everyone had moods and some had events that the whole group experienced in their

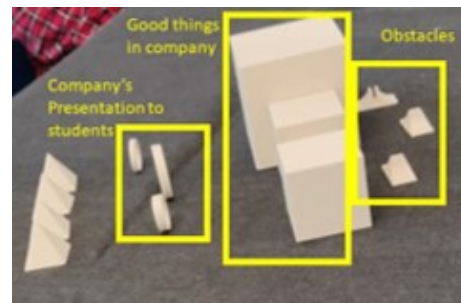


Figure 34

explanation.

**4.2.5.4 Facilitation of Form Language** At the start of session 1 an explanation is given about the shapes of Form Language: that planks can be held up by a shape and that rings can stabilize balls. Some more explanation was needed for the starting exercise: “How it was or how it’s going to be?” and students could choose. Longer transparent planks were preferred for the team configuration in session 3.

**4.2.5.5 Recording of Form Language** The team configuration in session 1 was first built on another table while communicating with the other team members so this is only hearable, not visible. Fidgeting with the shapes is also done in this group in session 2. The case configuration in session 3 was also first built on another table (away from the camera).

## **4.3 Key Findings**

### **4.3.1 Team experience over time & Case experience over time**

While students were building configurations to answer the team experience and/or case experience, there were some discussions on how the configuration should be built. In Group A in session 1 in the team configuration one student did not agree with being represented as two half balls and then these were changed out for something else. The facilitator suggested to remove a platform that Group A built in session 1, but this was also seen as something that is still crucial in the configuration later. In session 2 Group A had another disagreement on the distances: two students were close in working style, but the other two were in some way also similar but different in working style so their shapes were changed. In session 2 Group B one student wanted to use the meaning of the sticks from the team configuration (two students) in the case configuration, but another student attached a new meaning to the sticks: direction. In Group D there was a suggestion to have three different pyramids to highlight the difference between students but, they differed in size so were not chosen because that would someone else is ‘bigger’ than another student. Group E had two different stories while explaining the team configuration of session 1: the planks represented the student according to one student, while another said they were the ball. Both of these explanations were kept.



Students explicitly said when they used configurations from previous sessions. In session 3 of Group A the students started the team configuration by sharing with each other what the other configurations had in the sessions that one of them was not present.

Some groups had patterns in their configurations and others had none at all. Group D had pyramids which represented the students in every team configuration as can be seen in Figure 25. This same group used the big cube in all of their case configurations, but this meant every time something different. Group A had the same shapes for students starting session 2 and used a big pyramid in multiple configurations, but with different meanings (e.g. the case, the goal, feeling of unity). Group E had completely different configurations for their team every session.

Some instances it happened that first individual configurations were built before merging it into a team or case configuration: in Group B in session 4, in Group C in session 2 and in Group D in session 1.

#### **4.3.2 Starting exercises and Facilitation of Form Language**

Facilitator actions that impacted on the behaviour of students were explaining Form Language shapes, asking more questions that were outside of the protocol that resulted in modification of Form Language configurations, and answering questions that were asked by students. Explanation was provided for the rings that could stabilize balls and stands that could make the planks stand up. Shapes that were unclear can be seen in Figure 35. After the merge of Group C in session 2, there were more questions asked about the process and to represent the workload difference. Questions answered were whether the configurations should be made with the team or individual and whether a certain question needs to be answered by using Form Language.

The trust/trustworthiness exercise resulted in trust and trustworthiness configurations. Group B in session 2 and Group E in session 1 displayed

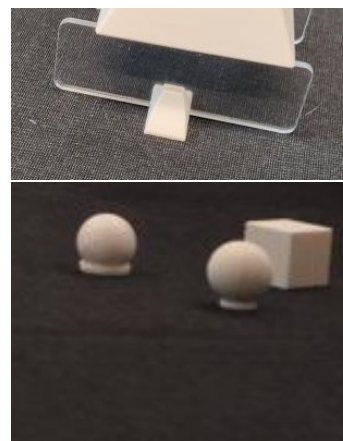


Figure 35: The planks and their holder and the ring and the ball that it could be stabilized, need to be explained often.

trust. In Group C in session 1 Trust and Trustworthiness is combined in both individual configurations. One Core value exercise was recorded. In Group A in session 1 it resulted in five configurations: three trust and two represented trustworthiness.

The Dixit exercise resulted in literal translations from the pictures to Form Language, but some students built a more abstract configuration. In Group A in session 2 the pictures from the cards are literally used. In Group C in session 2 there were students also taking the picture literally, but there was also a configuration that had a less obvious connection to the cards. In Group D in session 2 an adjective and action were chosen.

The Mood exercise resulted in students sharing their story with feelings, moods and events. Group A wanted to build a common configuration for this exercise in session 3 and in 4 they used it to share the plan of the day. In Group B in session 4 a mood, feeling or specific event was chosen for this exercise. In Group D in session 3 moods and feelings were shared that were attached to events as well and in session 4 moods and themes of the day were used.

#### **4.3.3 Recording of Form Language**

Multiple configurations were built in 3D. From above the height could not be seen which meant something to the students in their configurations. There were moments that the picture could contain reflection or objects/actions that do not contain information: the box with Form Language or visibly playing with the shapes in their hands that had nothing directly to do with the building process.

## 5 AI and Form Language

In this chapter information is provided to answer the subquestion: “How can AI techniques and tooling support recognition of sensemaking in the Form language sessions?”.

AI techniques can make recognition of sensemaking easier, as a human is limited to a certain amount of processing and retains interpretations made on data. Computer systems can process data faster, but are limited in making interpretations.

### 5.1 Method

Chapter results are combined with exploratory co-creation sessions with several people working in or studying AI and an experienced facilitator to provide an advice how to add AI techniques to improve the recognition of sensemaking in Form language sessions.

Participant	Role
Participant 1	Professor in AI topics
Participant 2	Experienced facilitator
Participant 3	Student in AI
Participant 4	Principal investigator of a Delft AI lab
Participant 5	Research programmer

Table 2: Participants and their roles in the co-creation sessions

### 5.2 Summary of co-creation session results

Participant 1 wanted AI to collaborate with humans instead of a black box that calculates an optimal solution. They are interested in negotiations and currently is focused on the phase before the negotiation and how big groups of people deal with this: what are the different perspectives? What kind of values and interests do people have? What are their obstacles? Do they need support? They are looking for ways to find out how people can talk more easily about these topics and what their feelings are, but also to see where the main problem lies. Participant 2 is a facilitator of Form language and they express that AI can help them with facilitating a session with a big group of participants. As a facilitator one may

miss some details, because then the facilitator is focused on the general opinion, but an AI may point out some interesting points the facilitator has missed. Only annotating the shapes is not going to be enough. Minutes or transcription is needed to read the pivot points for decision making. In a discussion with Participant 1, 2, 3 and 4 it was expressed that cameras on an angle behind the users of the Form language to recognize the hands and thus recognize the user of the Form language. For some discussions it is important to know who moved what piece of the Form language.

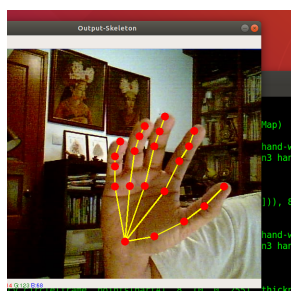


Figure 36:  
OpenPose, source:  
<https://github.com/StrongRay/Openpose-Hand-Detection/raw/master/opencv-dnn.png>

Participant 3 is a student that started with developing an AI for the Form language. He used software (OpenPose) to recognize the hands and used markers to recognize the elements of the Form language. OpenPose will draw a skeleton of a human. There are some challenges with both of these implementations. First, for OpenPose Nvidia processors are required and it requires shoulders to recognize hands reliably. He could only recognize one person at a time in the images. Next, the markers cannot be recognized from far away, so the camera should be close enough. Also, normal paper reflects so the type of paper should be thought of when printing any markers. He focused mostly on OpenPose, so the recognition of the objects is still work in progress. During a demo with Participant 1, 2 and 3 were also present and some more ideas came up: if an AI works, participating in hybrid Form language sessions can

also be made possible. Edge detection may be a good alternative of using markers. Participant 2 added that from experience she can speak that not everything has to be filmed. Mostly the parts when the blocks are moving, because then an agreement is being build. Participant 5 is an academic programmer who took over the process of developing AI techniques around the Form Language. He has focused mostly on the recognizing of the object locations. His technique uses the difference in color: if an object is white, it is a shape and if it is black, it is background. To test this he used some libraries (OpenCV: findContours & minAreaRect) and also wrote his own code to get results quickly. First the contours of the shapes are found, then a box around the objects is being built. Then the shapes are put in the upright position, by calculating how much these shapes are turned.

Using the percentage of background and the percentage of object, he can recognize most of the shapes (fingerprinting).

The current technique has some limitations: from above, some shapes are similar. Although Participant 1 has expressed to Participant 5 that no texture or object modification could take place, he saw no other solution than to place dots on the pyramid and the half ball to distinguish it respectively from a cube and ball. The transparent objects are not recognizable, but they will be replaced by wooden frames that are empty in the middle. Another challenge is that currently the assumption is that the shapes will be filmed from straight above, which makes it difficult to analyze the different objects if they are put onto each other or if they are attached to each other. A last limitation is occlusion: if objects are a bit darker (e.g. when there is a shadow) they may not be recognized as part of the object is recognized as background.

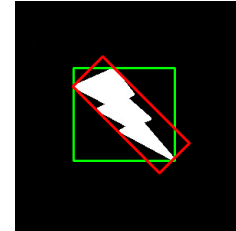


Figure 37:  
Contour  
features:  
rotated  
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.png](https://docs.opencv.org/4.x/boundingrect.png)

### 5.3 Design requirements

The goal of the AI techniques added to the Form Language is to recognize the differences in perspectives. The first step is being able to locate and recognize the shapes of the FL. Considerations as results from the co-creation sessions were that the shapes are not modified, the position of the camera and the similarity of the shapes as seen from above. Modification of the shapes is not allowed to stay close to the user experience that is a result from earlier research. If there is choice made for markers or any paper is used, this should be non-reflective to prevent noise in the image processing. The camera should be close enough to recognize the objects and there needs to be a way to calculate the locations. Usually the latter is done by placing an object with known dimensions in the image so distances can be calculated. The camera should not be on an angle if the method of Participant 5 is chosen and shadows can cause a color change in the objects. This method also recognizes shapes from above and some shapes seem then exactly the same as others. Participant 1 prefers if mobile phones can be used to record images.



Figure 38: Contour detection, source: <https://learnopencv.com/wp-content/uploads/2021/03/image-visualizing-simple-example-of-contour-detection.jpg>

After the recognition of the shapes and their location, who is touching the shapes is the next step. Participant 3 researched the possibility of user recognition and this can be done by OpenPose, which requires shoulders to be visible in images if hands are to be recognized and Nvidia processors are needed. In order to use this method, a camera needs to be placed behind every user to recognize which hands belong to which user.

When it is possible to recognize users and shapes and their locations, recognizing movement of the shapes and what is being said around those moving periods is essential as these are usually heated moments as expressed by Participant 2.

## 6 Discussion

This research had the aim to recognize sensemaking and team process elements in focusgroups. Subchapters discuss the key findings per chapter 6.1, 6.2 and 6.3. The last Subchapter discusses advice for an educational module: Form Language sessions, subchapter 6.4.

### 6.1 Students' perspective on cases and teams

When student groups shared about their Team Experience, Belbin Team roles were used as an interpretation of differences between students by two teams. As this was recently shared with the students in the teamwork course, this was an easy common ground for the teams. Another group used the bachelor programs to differentiate between students. In one group the different bachelor programs were seen as a common resource of the group, which can be seen as the development of a transactive memory.

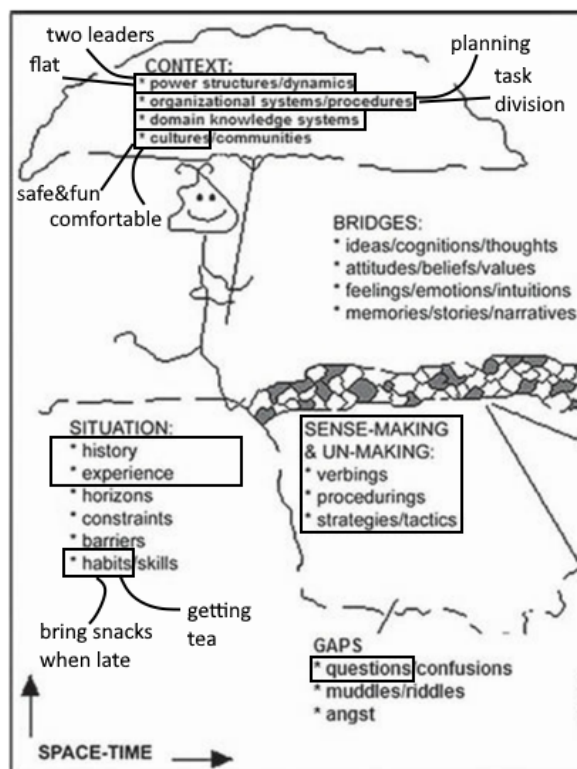


Figure 39: Topics that most commonly returned in the findings

Improved connection between students is mentioned when talking about team experience. This can be seen as team cohesion which is mentioned in Bell and Outland (2017) as a contributing factor to well-composed teams. This can be a topic for further research to see how cohesive the team is. As students talk about this themselves, this could indicate that cohesiveness in teams increase over time.

When talking about Sensemaking of the team, the question about individual backgrounds made students talked about study background (domain knowledge systems), individual history and experience. Organizational system was focused on task division or planning. In

one group their own space was part of that system. Culture and power differences were mentioned in analysis in two groups: in one group there are two leaders whereas in the other group no leader exists. Both cultures are described as comfortable and one group mentioned it is safe and fun. In two groups an example is found how a gap is bridged. This started with a question and ended with what strategy or action the students have undertaken. When using the questions on this topic of the protocol, these answers can be expected. Deeper understanding about sensemaking of student teams can be reached if questions were added on bridges, such as what their attitudes or feelings in the situations were in which the students were making sense.

Contributions were discussed by all groups except for one. In some groups these were more specific than others. These contributions can be tracked over all sessions to investigate them more and see the development of the transactive memory as this is well-developed in well-composed teams (Bell & Outland, 2017).

Having the right skills and knowledge in the team is important for the team composition as well (Bell & Outland, 2017). This could not be found completely in these student teams right now. In the educational module this may be developed more.

Three temporal team processes were individually found in one group. An experienced workload difference is found in one group that related it to communication with their case owner and using more time for shorter deadlines. The deadlines were seen in another group as a difference in perspective on the use of time. These factors were in Bell and Outland (2017) factors that make or break the composition of teams. This could be explored in a more consistent way by asking these questions in all different sessions to capture the differences over time. It could also be a question that is answered with the help of Form Language where students need to represent distances between shapes to share how the workload is. This could make their experience of workload differences and deadline management more concrete and measurable between sessions.

A last group talked about a difference in motivation over time. For multiple members the merge of two groups was a part of this as it provided the teams with a motivation boost. Another student shared that they first liked the case and later was more motivated by finding a solution. Seeing



that there was a motivation boost for that one team that merged, this could be a great addition to add purposely into an educational module where students are temporarily part of the team of other students.

When talking about Case experience the perspectives of students were shared at that moment in time which makes it possible to see how their experience changed over time and talk about the sensemaking they have undertaken.

Individual perspectives about the case experience are in two groups first shared before they are combined into a team perspective. This can be interesting to see what individuals think before a collective experience is made. Sensemaking as a team is then happening in the session itself. This will be covered in more detail in Usage of Form Language findings. Stakeholders withhold information according to three student groups, which is why more interaction can reveal that hidden information. High interaction is preferred by the students, for some groups this was the reason (to reveal the hidden information). These results align with each other.

Students are solving complex problems with their case for C-lab. Almost all groups used different pieces of information to come to a problem definition and solution directions, which is the pattern-based part of the Complex environment of Figure 40.

Group D was the only group that did not specifically mention combining different perspectives, as they did mention a difference in perspective on what the problem is by students and case owner in session 2, but went for their own perspective in session 3. This can be seen as being in the simple context of the Cynefin Framework in Figure 41 as students were assuming that the problem that was noticed by them was evident for everyone. Their mindset of being in the simple problem solving mode may have happened because they had for several weeks less contact with their case stakeholders. To have interaction with their case and receive new inputs is thus important to keep being in the complex problem solving mode. This could also be solved by including temporarily new members in the projects as mentioned before.

The amount of reflection and communication are connected by Group A and E. In Group A a break in communication between the group and its case owner meant more time for reflection. In Group E the data just collected from interviews was not reflected upon and needed that in order to gather insights. Advising student teams to have moments of reflection

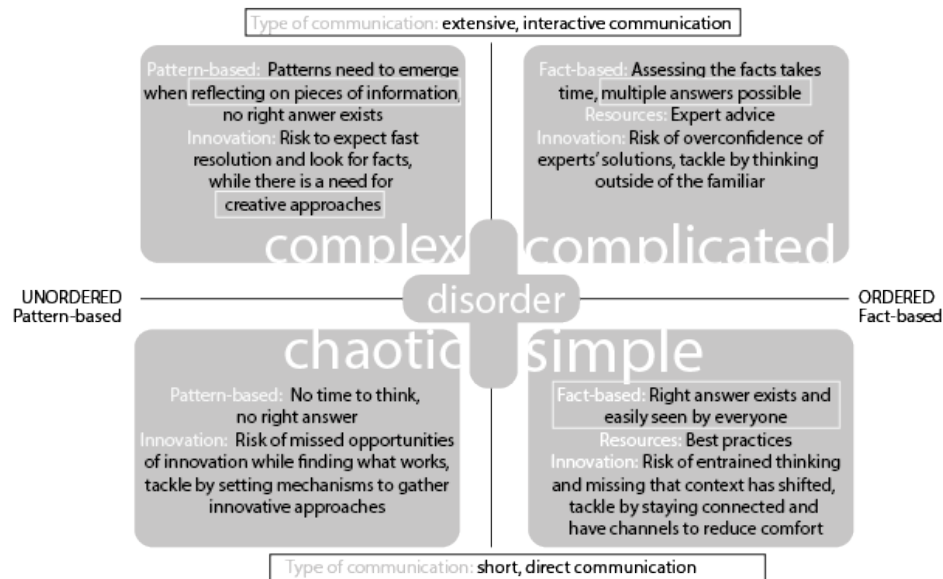


Figure 40: Complex problem solving behaviours noted

and breaks in their contact with their case stakeholders (or use breaks in contact) for reflection may result in increased performance in complex problem solving.

The methods used for the case in C-lab were recognizable to some students. The students that did not recognize the methods, felt outside of the comfortzone which was mentioned in all groups. This discomfort was connected with learning in Group B and E.

There was no connection in any group of discomfort with creativity. There was one student in Group C that noticed an increase in creative thinking due to a creativity workshop in SPCSN, but there was no clear link with the comfort level of the student. The reason there was no connection with discomfort and creativity, which was aiming to see if students were stuck in their comfort zone, was that the question could be more specific. For certain students, the methods used in the minor were recognizable and this may result in them becoming too comfortable and not creative enough. Although that may not be the case as the methods aim to stimulate creativity in a structured way. The question was now phrased quite open, but it may be more effective to be specific like: how many ideas students could generate and if this was contributed to certain methods they used. Or ask specifically if they could generate enough ideas, if they felt stuck.

This is something they probably can recognize easier.

There was a connection with comfort and creativity by one student in Group D: using a technique from their bachelor program in the project. There is research in Positive Psychology – Broaden-and-build theory - that presents that whenever anyone is in a positive mood, a person has more resources and thus can encourage one to include new ways of acting and thinking (Compton, 2004).

In Sensemaking of the Minor Content, the Belbin Team roles are used by the students as frames. The meeting skills lecture was used by another group in a different setting than intended: an online interview which can be seen as reframing a frame. For the same setting another group used methods from Knowledge to Advice which was more using the frame.

Some students in groups want to try out different Belbin roles than their preferred ones, others do not feel the need for that. Purpose for the literature was unclear in two groups that was connected to their project. Two other independent suggestions were to have more practice and role-play, and have more reflection in conversation as the focusgroups were doing. A new way of thinking about the team was seen as a value by students in two groups. In one group the explanations were seen as helpful. One student asked if it was possible to learn how to try out different team roles.

## **6.2 Usage of Form Language over time**

Students were building the configurations to answer how their team and/or case experience was. A discussion took place on how these configurations should be built. The discussion resulted in changes in the configurations or meanings attached to the shapes within the group or by intervention of the facilitator.

This can be seen as live enactment and selection by Weick (2005). Students are creating the configuration together and attaching meaning to (parts of) the configuration. This process can visually be followed on camera.

In some cases explicit references to shapes having a certain meaning by students were made that was created in previous sessions. References could also be recognized as meanings that were created earlier, were reused in some groups. This can be seen as Weick's (2005) retention.

In one group there were different configurations per session. This could

be explained by the changing members in that group and the amount of influence they had in the building process. Meanings from previous sessions can only be reused if those members present bring up that meaning as the shapes are not evident in what they (can) represent. This means if members from previous sessions do not bring up these meanings, they may be left out.

Individual configurations were sometimes built before a collective configuration was built. This was also found in the answer to the protocol in Subchapter 6.1: individual answers were provided to case and/or team experience. This could also be seen as live enactment as one can observe how the collective perspective on their team or case is created. Individual configurations can be encouraged before building a combined team or case configuration. This was not intended in the design of the focusgroups, but provided more results and make it easier to recognize Weick's phases of sensemaking of the Form Language.

There were three different starting exercises used to get into the abstract thinking of Form Language, but all were using different concepts to represent for the students. First it was trust or trustworthiness or core values. Then there were abstract pictures. Last there were moods, events or feelings. The Dixit exercise made students use literal parts of the picture which was not the intention of the exercise, so this would be less recommended in focusing on abstract thinking preparation. The other three exercises are possible options for a starting exercise.

The configurations of Form Language were in 3D: the vertical and horizontal distance was used by student groups. This means that recording from above, as has been done in the focusgroups, is not enough to recognize later what kind of shapes were used on the vertical axis. Pictures were taken after a configuration was finished and these were taken on an angle to make sure that horizontal and vertical were visible. This finding is important for including AI techniques and tooling which will be covered more in Subchapter 6.3.

### **6.3 AI and Form Language**

There are several challenges with recognizing the shapes of Form Language and their locations. Shapes need to be recognized and so far the options used is to record from above or use markers. As modification of the shapes is less preferred, recording from above is the current used method which

results in shapes not allowed to touch each other (and maybe invisible shapes for the camera) as a challenge.

The next challenge is the position of the camera. The camera should be close enough to recognize the shapes and, when taking the method where is recorded from above, should not be in an angle. Any modification of the shapes under an angle may result in an unrecognizable shape. Either a fixed angle should be chosen, like top view, or the angle should be known so images can be modified. The unrecognizability happens also with shadows or other light modifications (called occlusion).

In most research done in Computer Vision, neural networks are used or feature and/or template matching that takes large amounts of data to process. For the object detection and localization of the shapes of Form Language this is recommended. If the same setup as in the focus groups is used with one camera above and a black background, this would be easier to do. Occlusion is less a problem when using trained algorithms like in Tian, Feris, Liu, Hampapur, and Sun (2011). The downside of this approach is that it takes a lot of time to make these trained algorithms and a large amount of data to be reliable. The benefit of this approach is that it can be used in many occasions later as it depends on the set of Form Language that is currently present which is not expected to be modified any time soon.

Next to occlusion and shape modifications, there is also a challenge with separating different shapes from each other such as balls and half balls. This challenge can be solved by adding another camera from the side that can be combined. The difficulty with this is if there is going to be training of data, the side angle chosen should have a similar background as well.

A last challenge with recognizing the shapes and their location is the shape localization. To calculate distances an object with fixed dimensions can be put in the screen. This is less preferred. If none of the cameras are moved during the process, which did not happen during the focus groups, the camera's could also be calibrated in a short amount of time with an object at the start. The known dimensions of that object can be compared with the objects later appearing in the screen.

When it is possible to detect shapes and localize them, user detection is also preferred. OpenPose so far is the only option researched which had specific requirements such as shoulders need to be visible and Nvidia processors are required. In top view vision, only hands are seen which

makes it more difficult to recognize the hand from what user. An option is to use markers in this scenario. Non-reflective paper can be used on bracelets to mark which hand is belonging to what participant. Training this data is less recommended as this involves choosing participants with a range of different type of skin tones and hand sizes.

Shapes are being moved by users of Form Language and these are important moments. The detection of the hands and the movement of shapes are important. This requires the tracking of the objects. With the earlier trained data for object detection and storing the different frames of video data in moving periods this may be easy to do. An interesting approach is to use 'hotspots'. Shen, Edwards, Miele, and Coughlan (2013) annotate objects that blind people touch and will speak about it to the blind person when it hits a hotspot. Kinect was used in this research: a RGB with depth camera. A skeleton of the hand was made and hotspots on the object were assigned. When the blind person touched the hotspot, text to speech would be generated. Eventually the shapes and their meanings discussed need to be connected by AI techniques to see the different perspectives in video recordings. As there are many steps beforehand, this is a step that will take place way later in time. The result may look like in the pictures of Form Language in Chapter 4.

Audio needs to be transcribed and using Neuro linguistic processing around the moving periods in time labels can be provided to objects. Moments that are interesting to look at the meaning that users connect to the shapes. To limit the amount of data stored, whenever someone is talking, recording can start. Voice activity detection works with difference in energy levels between signal and noise. Ramírez, Segura, Benítez, De La Torre, and Rubio (2004) present a voice activity detection algorithm in noisy environments. It may also first be done by pressing a button, but this depends on the facilitator remembering to press that button. Who is talking needs to be separated in the transcripts. Wang, Olson, Ojemann, Rao, and Brunton (2016) have combined neural scans with speech and video detection. The problem with speech detection was whether the speaker was speaking or there was some other audio source. For this, a second microphone is recommended.

## **6.4 Educational module: Form Language sessions**

Form Language sessions should include verbal (non-written) reflection. Students from all teams present in the last session of the focus groups shared that thinking about their teams in a different way was useful to them and would be interesting to include in a verbal way. Written assignment are abundantly present in the minor currently.

Form Language sessions could include a focus on Belbin Team roles. All student teams use the Belbin Team roles at some point. When using Belbin Team roles, an emphasis can be provided on the relative position to others in this team. In Bell and Outland (2017) team-based composition models are advised to consider the individual standing relative to others.

Including a temporal membership change in the Form Language sessions may increase the team's motivation as happened before in one group when they merged. It may increase team composition variables as mentioned in Bell and Outland (2017). Furthermore, it may increase complex problem solving behaviour of students. When the case stakeholders are unreachable for a period of time, it may provide student teams with new inputs that they can reflect upon. In a Form Language session (when have formed a more stable bond) members from different teams can be mixed.

Form Language can be used in the educational module for icebreaking in the teams and conflict resolution. Students shared that Form Language may be useful in times of conflict and to get to know each other better. Conflicts can divide or build teams, such as process and task conflicts which can increase teams' outcomes (De Wit, Greer, & Jehn, 2012). If process conflicts is about how to proceed or changing responsibilities, these can be an evaluation on their standards and procedures which may improve outcomes. Form Language is designed to help with complex problem solving (Kamp, 2018). Thus this may be an instrument that can be used in the educational module at the start of the teams and have it close by whenever a conflict arises in teams.

Working in complex cases result in transformative learning experience for the students. Student teams share their perspectives in that moment of time and this is also connected to events that are happening connected to the case stakeholders. Transformative learning is effecting change in the frame of reference (Mezirow, 1997). A frame of reference are the associations, values, concepts, feelings and conditioned responses one

has. The interactions the team has with the case, result in a change in the frame of reference of students. This can also be seen with the Form Language configurations that change over time. This can be another angle in which the Form Language can be used to recognize and follow this over time. A starting point for the frame of reference change can be the code of conduct in which values are asked or the other courses that ask for values of the student teams.

Sensemaking with Form Language influences the students' thinking. Embodied cognition Wilson (2002) has six different perspectives, among the most relevant to this thesis are: cognition is situated, the environment is part of the cognitive system and off-line cognition is body based. Situation of cognition means that when cognitive processes are carried out, information is still perceived and that affects the processing. The next perspective is that cognition is not only about the situation and the cognition inside of the head. It is also about their interaction. The last perspective is about cognition happening and being influenced by other sensorimotor processes such as moving your hands for example. Mental models improve problem-solving relative to abstract approaches.

Students had discussions about the configurations which can be seen as Form Language enactment and selection and used shapes from previous configurations which can be seen as Form Language retention. This is the part that mostly could include all the phases since meaning was made in the focus groups themselves. Including AI techniques as described before, may support the facilitator of Form Language sessions as when the images/videos are labelled, this may provide the facilitator with insight in parts that they may have missed and can ask questions about in the next session to reach a deeper understanding in the sensemaking of student teams.

## **7 Conclusion**

How students look at their teams is divided in different subtopics and these all provide a unique perspective. Sensemaking of the team provides the topics for conversation around sensemaking that have currently been found in student teams. Complex problem solving results show that high interaction and moments of reflection are important. Sensemaking of the minor content show that students use literature as frames and sometimes



reframe methods to fit into their way of working. Team processes were visible to some extent, especially the contributions students made.

How student teams currently used the Form Language, sensemaking of Weick can be recognized in the Form Language configurations.

In order to add AI techniques, an extra camera should be added, data should be trained to recognize the shapes and position of Form Language, a bracelet with markers can help detect users and recognizing movement periods provide the way to find the meaning to shapes in audio transcripts. That last part is the support that can be provided to a facilitator to improve recognition of sensemaking in Form Language sessions.

Form Language sessions consist of AI techniques, verbal reflection on the team and their sensemaking behaviours, and can stimulate transformative learning and embodied cognition.

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## **A Appendix**

### **A.1 Informed consent**

You are being invited to participate in a master research study titled “A collective support tool for continuous learning of teamwork by students”. This study is being done by Conchita Martin Hoogerwaard from the TU Delft.

The purpose of this research study is to understand how students make sense of teamwork and learn to work together. Students from the Minor Communication Design for Innovation are invited to participate in 4 video-recorded focus groups (video will only contain hands of students and audio has voices) and a short questionnaire after every session. The data will be used for developing a tool to learn outside of the course and provide improvements to the course. We invite you to answer the questions as honestly as you can and actively participate in the focus group session and fill in a questionnaire. There are no emotional, physical or reputational risks expected with participation in the study.

As with any online activity the risk of a breach is always possible. To the best of our ability your answers in this study will remain confidential. We will minimize any risks by keeping the records completely anonymous. Your participation in this study is entirely voluntary and you can withdraw at any time.

For further questions, please contact Conchita Martin Hoogerwaard.

PLEASE TICK THE APPROPRIATE BOXES	Yes	No
<b>A: GENERAL AGREEMENT – RESEARCH GOALS, PARTICIPANT TASKS AND VOLUNTARY PARTICIPATION</b>		
1. I have read and understood the study information dated _____, or it has been read to me. I have been able to ask questions about the study and my questions have been answered to my satisfaction.	<input type="checkbox"/>	<input type="checkbox"/>
2. I consent voluntarily to be a participant in this study and understand that I can refuse to answer questions and I can withdraw from the study at any time, without having to give a reason.	<input type="checkbox"/>	<input type="checkbox"/>
3. I understand that taking part in the study involves: <div style="margin-left: 20px;"> ■ 4 video recorded focus groups (only hands visible, voices can be recognized) and a short questionnaire.  ■ The questionnaire will be completed by the participant </div>	<input type="checkbox"/>	<input type="checkbox"/>
4. I understand that the study will end at the end of my master thesis	<input type="checkbox"/>	<input type="checkbox"/>
<b>B: POTENTIAL RISKS OF PARTICIPATING (INCLUDING DATA PROTECTION)</b>		
5. I understand that the following steps will be taken to minimise the threat of a data breach, and protect my identity in the event of such a breach, data will be anonymised where possible and all information will be stored in secure locations that can only be accessed by the study team . only anonymous data will be stored (transcriptions as well as video material).	<input type="checkbox"/>	<input type="checkbox"/>
6. I understand that the (identifiable) personal data I provide will be destroyed at the end of my master study (December 2022).	<input type="checkbox"/>	<input type="checkbox"/>
<b>C: RESEARCH PUBLICATION, DISSEMINATION AND APPLICATION</b>		
7. I understand that after the research study the de-identified information I provide will be used for writing a report for my master thesis. Anonymous quotes and video images and video shots out of the focus group may be used in the writing of this report. Also anonymous quotes of the questionnaire may be used in the report.	<input type="checkbox"/>	<input type="checkbox"/>
9. I agree that my responses, views or other input can be quoted anonymously in research outputs	<input type="checkbox"/>	<input type="checkbox"/>
<b>D: (LONGTERM) DATA STORAGE, ACCESS AND REUSE</b>		
10. I give permission for the de-identified video and transcripts that I provide to be publicly archived in TU Delft repository so it can be used for future research and learning.	<input type="checkbox"/>	<input type="checkbox"/>

## Signatures

\_\_\_\_\_  
Name of participant

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

I, as researcher, have accurately read out the information sheet to the potential participant and, to the best of my ability, ensured that the participant understands to what they are freely consenting.

Conchita Martin Hoogerwaard

Researcher name

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

Study contact details for further information:

Conchita Martin Hoogerwaard

## A.2 Teamwork lectures provided by CLAS

Lecture name	Content
1. Introduction to Teamwork	Role of teamwork in engineering Principles of successful teamwork Teamwork agreement
2. Teamroles	Different teamroles Your role: pitfalls, strengths Relationships between roles Creation of a successful team
3. Decision making & meetings	Step model of decision making Acceptation of decision Meeting techniques
4. Effective communication	Different communication styles Communication and the effect on others Communication levels Insight in miscommunication Verbal / non-verbal communication Constructive feedback giving and receiving
5. Team dynamics	Behaviour and the effect on others Different phases and group forming Conditions that stimulate or hinder collaboration Conflict styles, management and negotiation Building constructive relationships
6. Cultural diversity	Recognize and accept cultural differences and similarities Influence of cultural diversity on communication Handling differences in practice

Table 3: Source: Landlust & Temming, 2021



### A.3 Protocol per session

No	Question	Topic	1	2	3	4
Q1	Lay down how you experience your own (individual) background	Sensemaking of the Team	x			
Q2	How does your team look like according to you as a team?	Other questions	x	x	x	x
Q3	How do you work as a team with different backgrounds?	Sensemaking of the Team	x			
Q4	Are the distances negative or positive? Why? Would you want to change anything about it?	Other questions		x	x	
Q5a	Are there any differences in knowledge, motivation and/or orientation?	Other questions	x			
Q5b	How do you contribute to the team? Would you want to change anything in that?	Team processes		x		
Q5c	Is there a difference in how you deal with deadlines? Can you elaborate?	Team processes		x		
Q6	How is the team organized?	Sensemaking of the Team	x	x	x	
Q7	What are habits of the team?	Sensemaking of the Team	x	x	x	
Q8a	What are your skills that you bring into the team?	Sensemaking of the Team	x			
Q8b	Do you think you have the right skills and knowledge in the team? How do you see that?	Team processes		x		
Q9a	How motivated are you for the goal you have?	Team processes		x		
Q9b	What motivates you as a team?	Team processes			x	
Q10	How did it go when you had to complete a task together?	Team processes		x		
Q11	What was the workload at the beginning of the course/last session? And right now?	Team processes		x	x	
Q12	What kind of task did you have as a member of the team at the start/since last session? And right now?	Team processes		x	x	

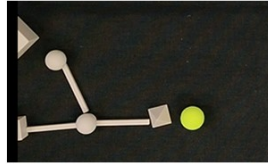
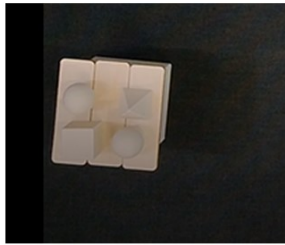
Q13	How do you as a team experience the case?	Other questions	x	x	x	x
Q14	What do you see intuitively as the solution?	Complex Problem solving	x	x		
Q15	Do you expect an optimal solution? Or a solution that just works?	Complex Problem solving		x		
Q16	Can you solve the case with best practices? Or expert advice?	Complex Problem solving		x		
Q17	How much communication is needed for the case? And what kind of communication (so for example direct communication)?	Complex Problem		x	x	
Q18	Is it needed to reflect during the search for a solution?	Complex Problem solving		x	x	
Q19	Is it possible to create innovation while searching for a solution?	Complex Problem solving		x	x	
Q20	Is it possible to stay in your comfortzone? Does that affect your creative thinking?	Complex Problem solving		x	x	
Q21	[Show picture of the configurations of Form Language of previous sessions] What do you remember about the last time you put together the configurations?	Other questions		x	x	
Q22a	What literature could you use in this phase of the project?	Sensemaking of the Minor Content	x		x	
Q22b	What literature you did not like?	Sensemaking of the Minor Content	x		x	
Q22c	How active is literature used to bring change in the team?	Sensemaking of the Minor Content		x		
Q22d	What other roles of Belbin do you want to try out?	Other questions		x		
Q23a	If this [a ball shape] is Form language, how would you show what value it has brought to your team?	Minor Content Experience				x

Q23b	What support are you needing for the minor or teamwork course and is not present currently?	Minor Content Experience				x
Q23c	What did you learn from these focusgroups?	Minor Content Experience				x

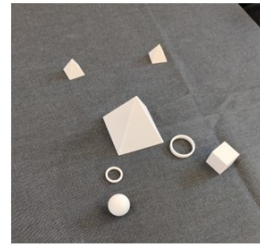
Table 4: Focusgroups protocol and topics that the questions relate to. The number represent which session of the focusgroups the questions were asked

## **A.4 Form Language Configurations by Students**

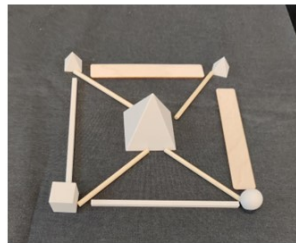
## Team



Session 1: left is on a platform, right has a focus on distances



Session 2



Session 3

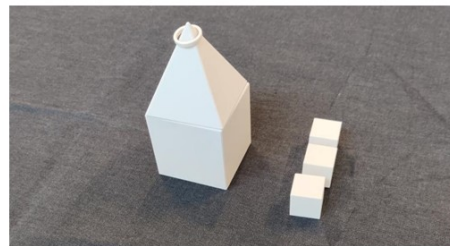


Session 4

## Case



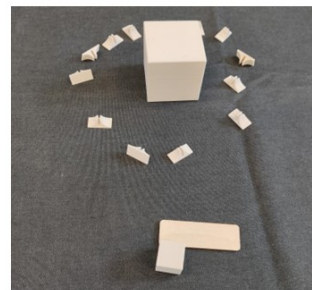
Session 1



Session 2



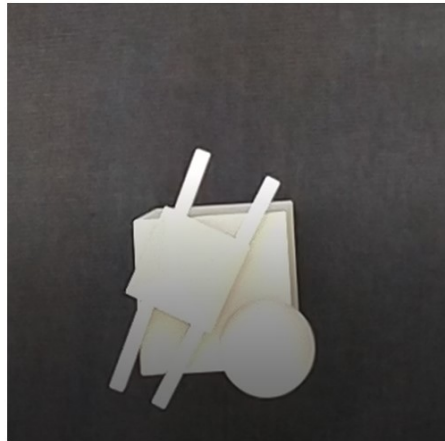
Session 3



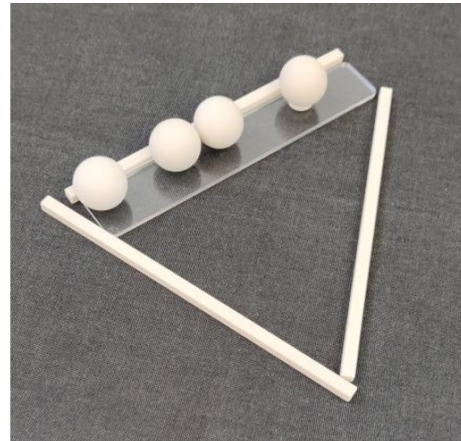
Session 4

Figure 41: Configurations over time by Group A

Team

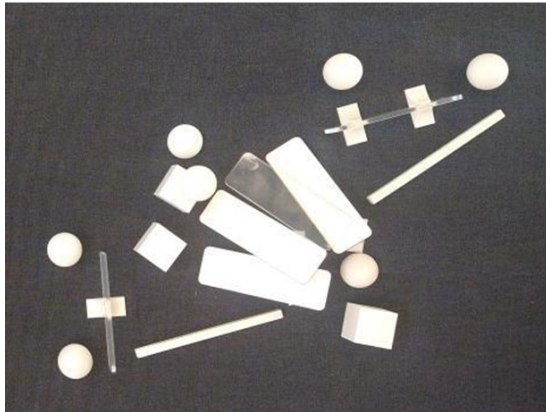


Session 2

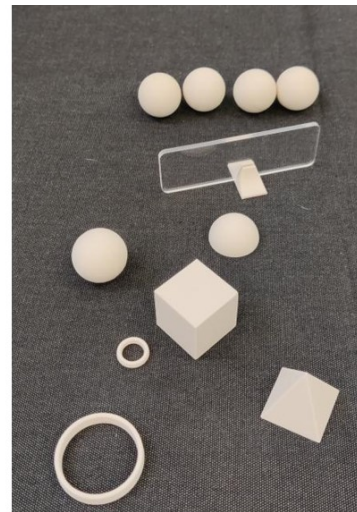


Session 4

Case



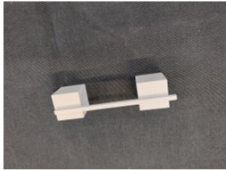
Session 2



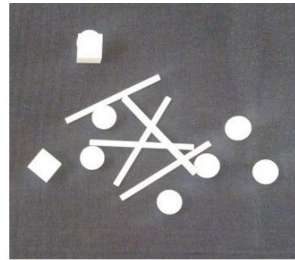
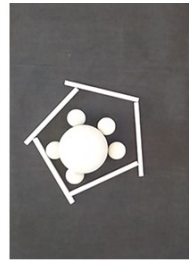
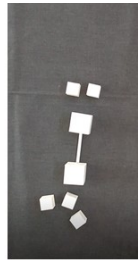
Session 4

Figure 42: Configurations over time by Group B

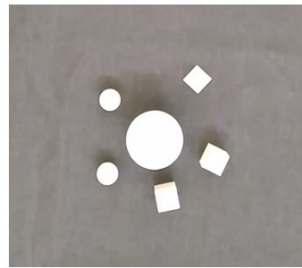
## Team



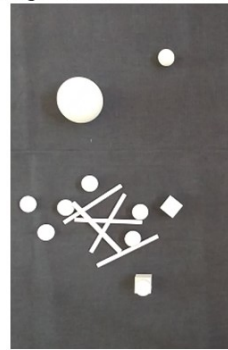
Session 1



Session 2 left to right: merge of teams, initial team composition, organization of team and how is it going the past few weeks



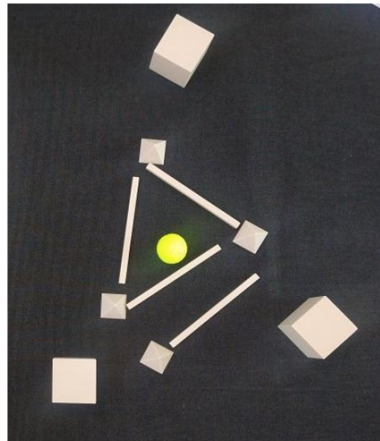
Session 3



## Case



Session 1



Session 2

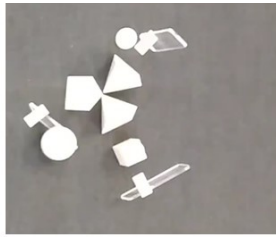


Session 3

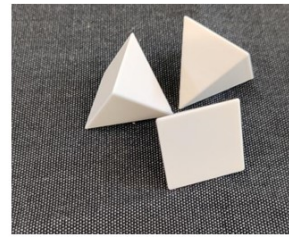
Figure 43: Configurations over time by Group C



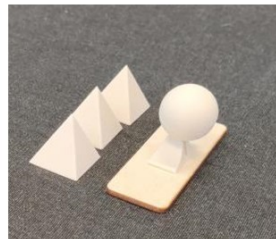
## Team



Session 1



Session 2



Session 3

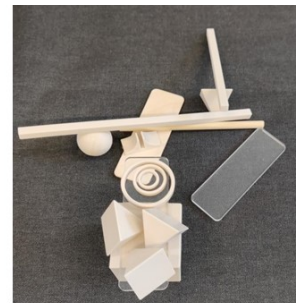
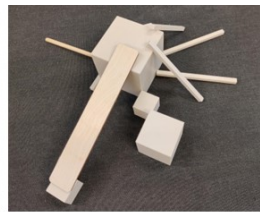


Session 4

## Case



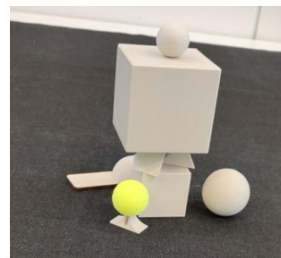
Session 1



Session 2



Session 3

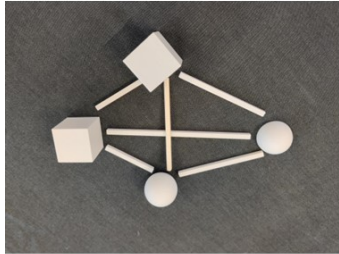


Session 4

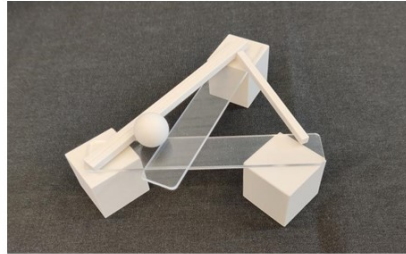
Figure 44: Configurations over time by Group D



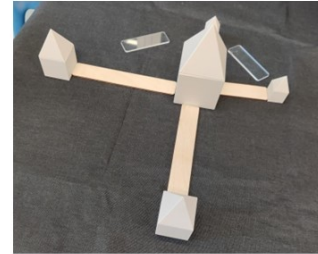
## Team



Session 1

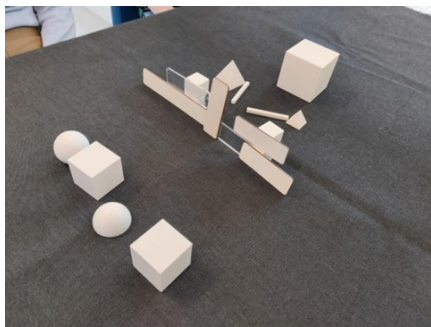


Session 2

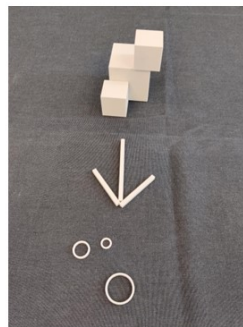


Session 3

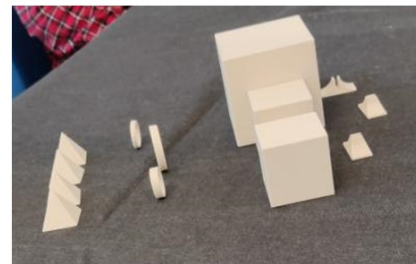
## Case



Session 1



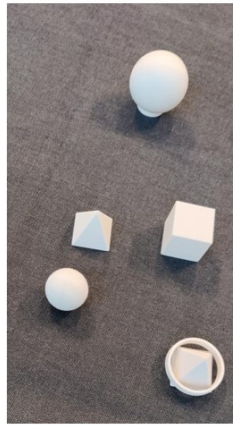
Session 2



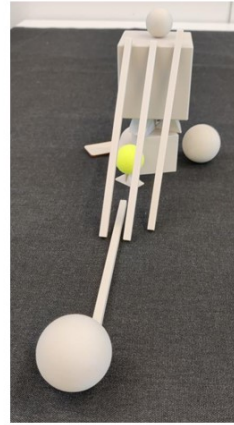
Session 3

Figure 45: Configurations over time by Group E

## Form Language Impact



Team A



Team D

Figure 46: Value of Form Language

## A.5 Meanings attached to shapes

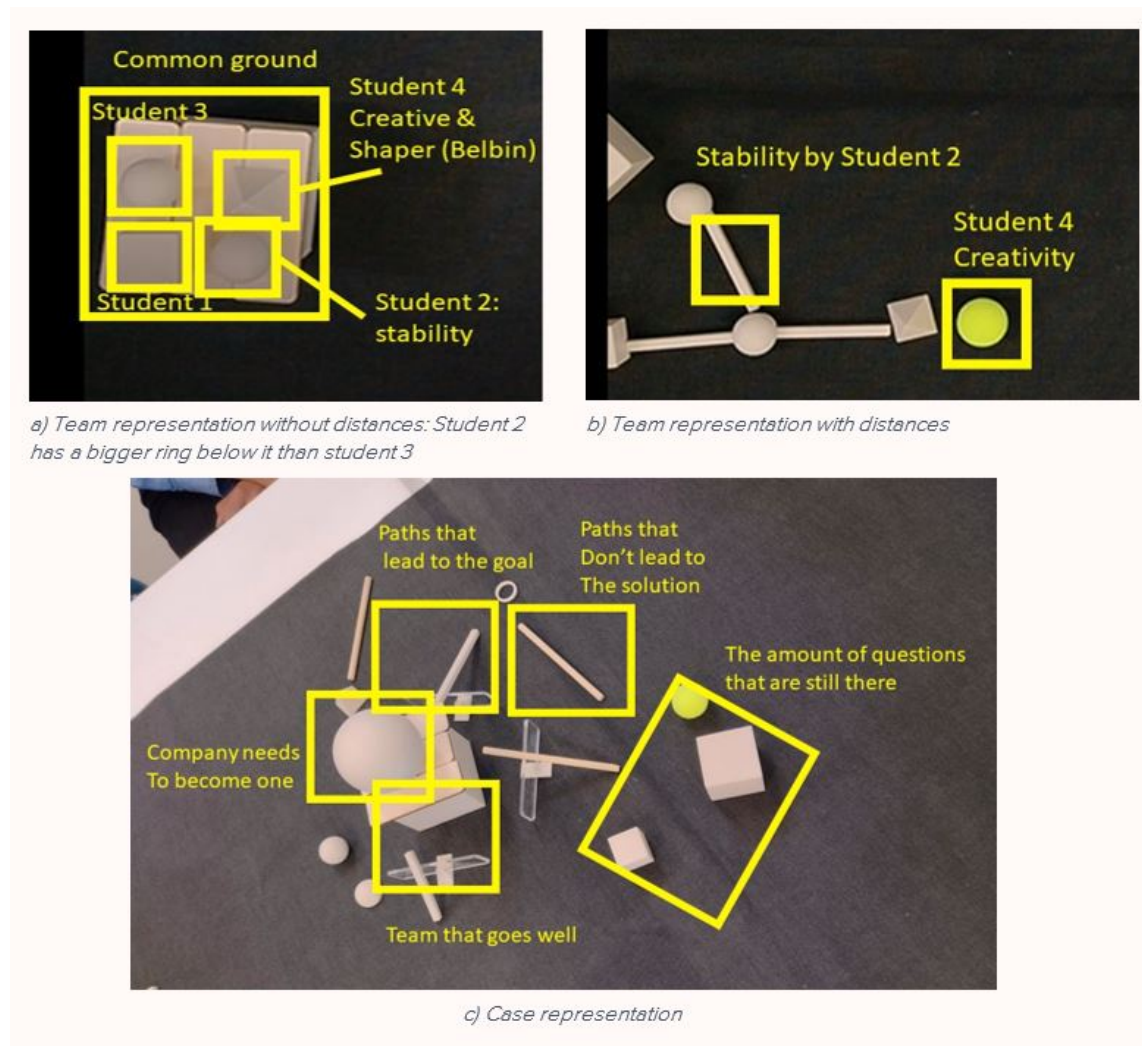


Figure 47: Session 1 Group A

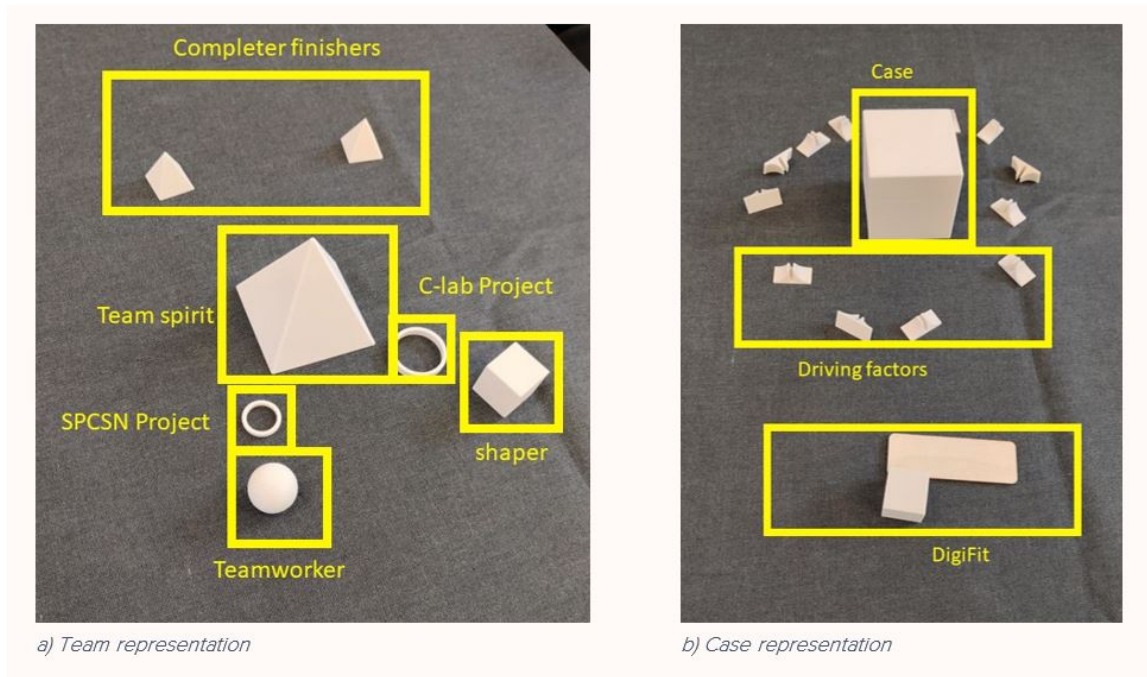


Figure 48: Session 2 Group A

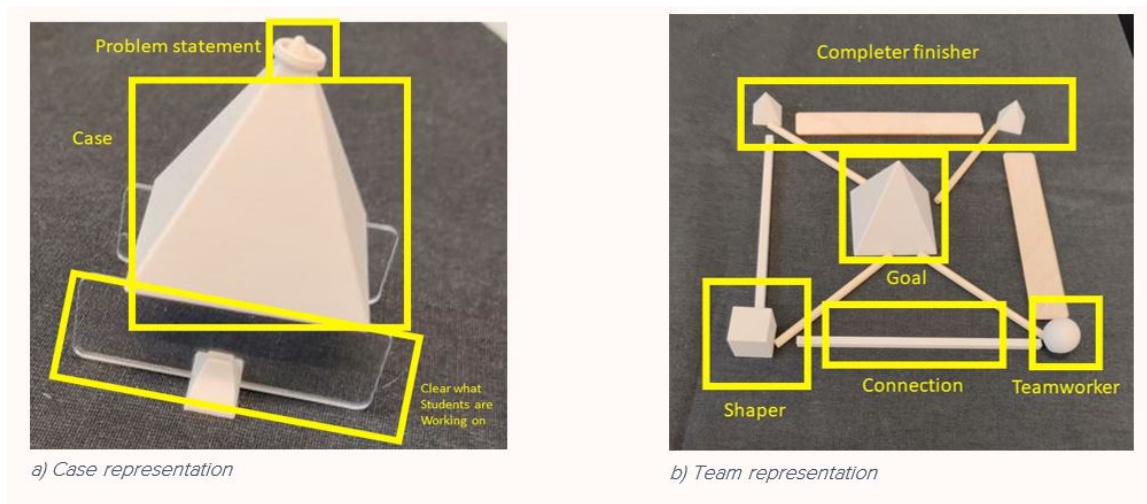


Figure 49: Session 3 Group A

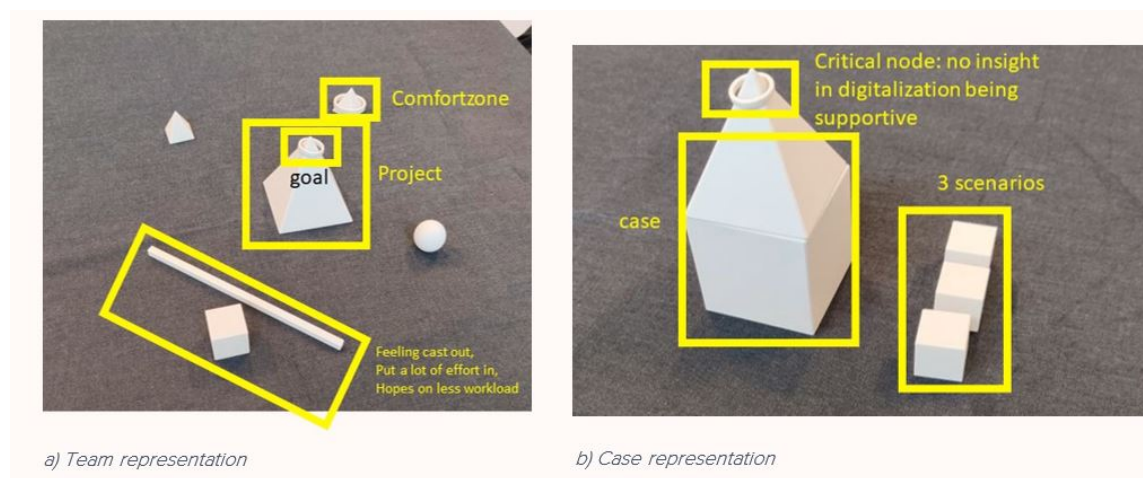
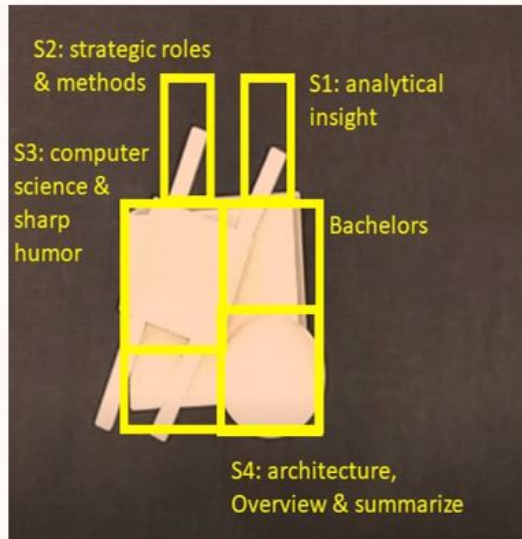
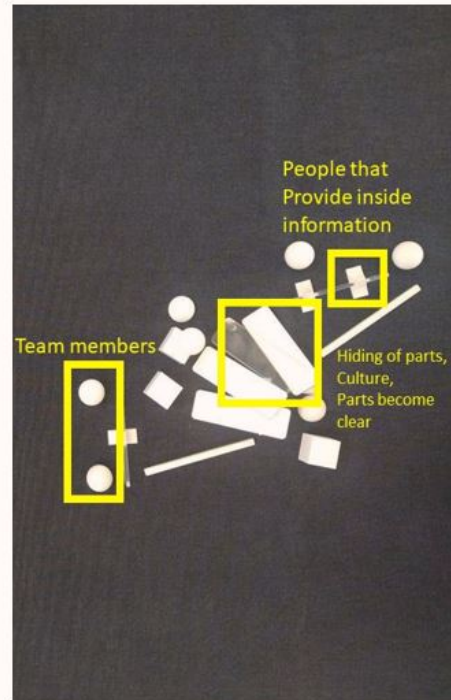


Figure 50: Session 4 Group A



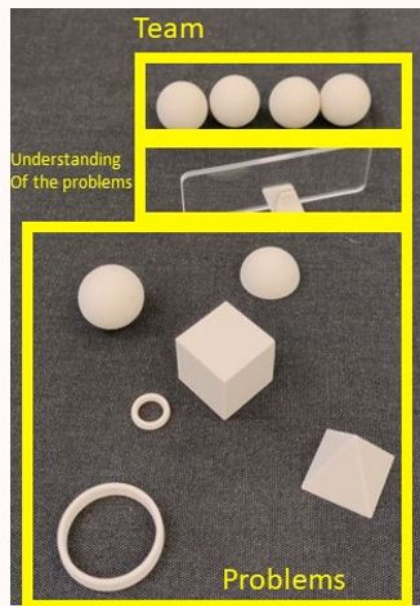


*a) Team representation: The height is representing that the blocks help each other to become higher*

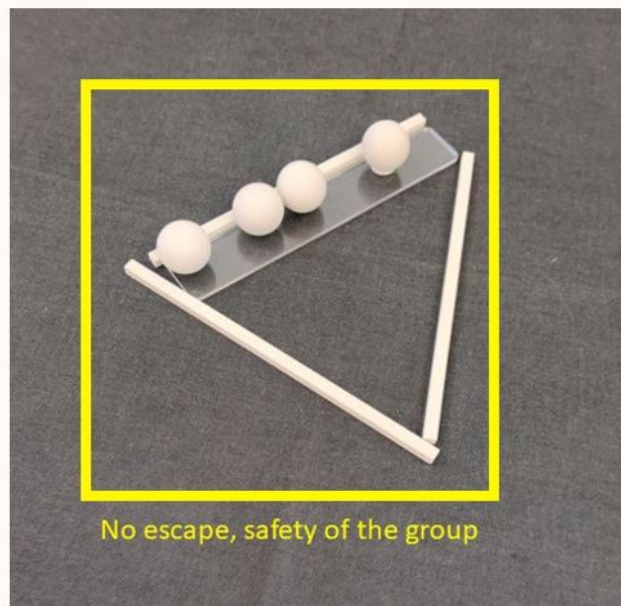


*b) Case representation*

**Figure 51: Session 2 Group B**



a) Case representation



b) Team representation

Figure 52: Session 4 Group B

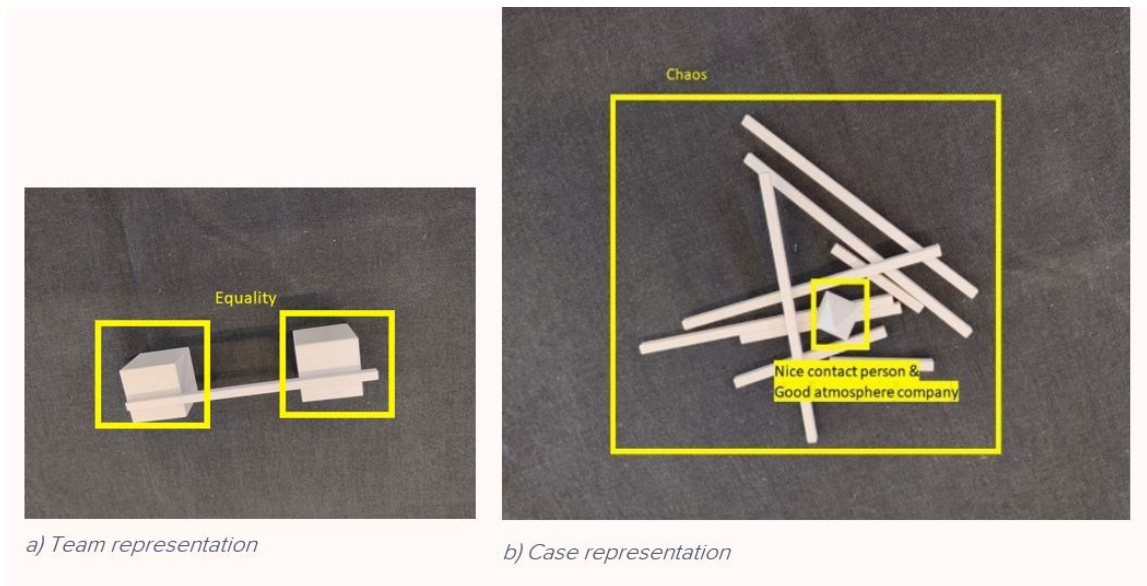
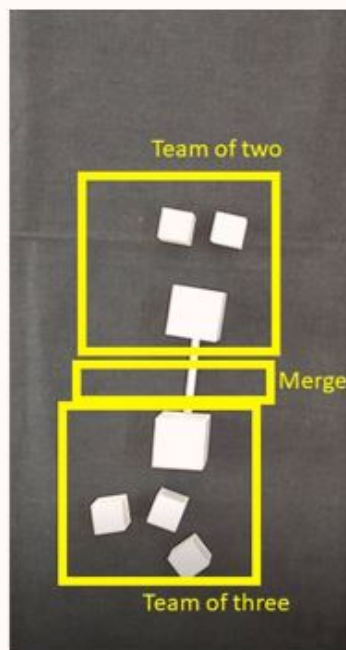
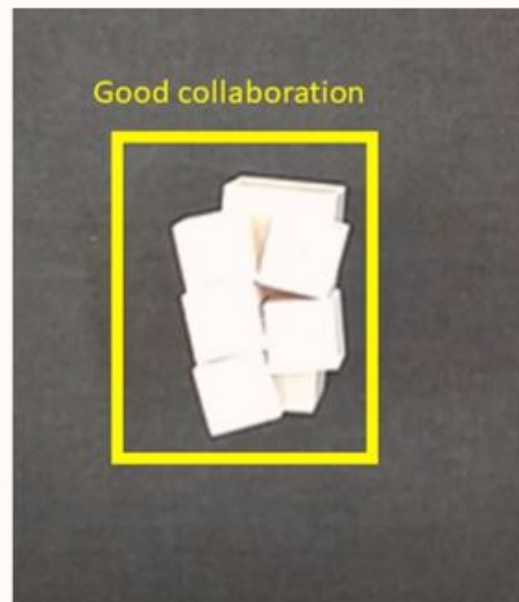


Figure 53: Session 1 Group C

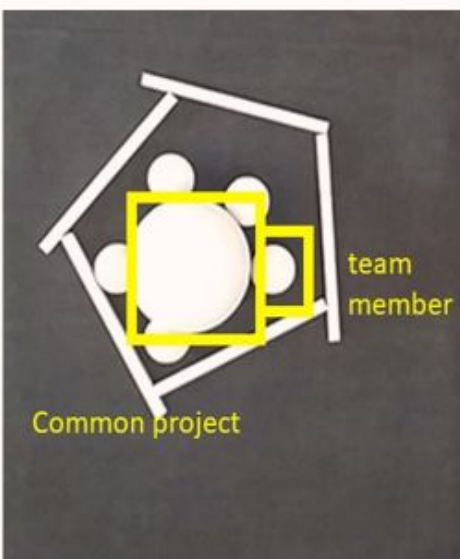




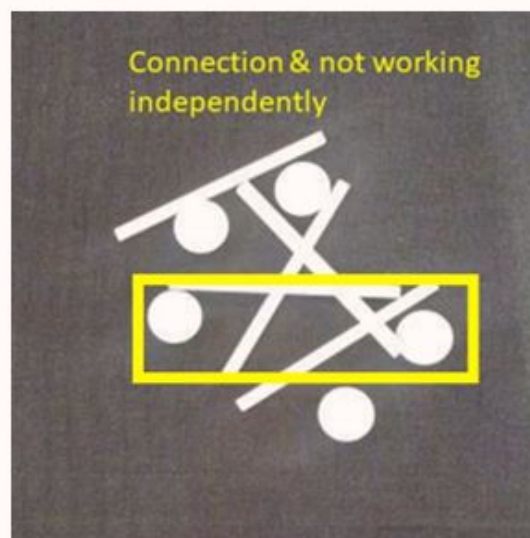
a) The merge



b) Current collaboration

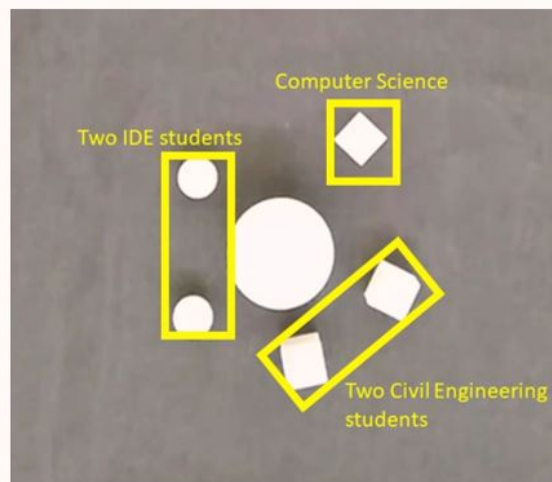


c) Team representation (start)

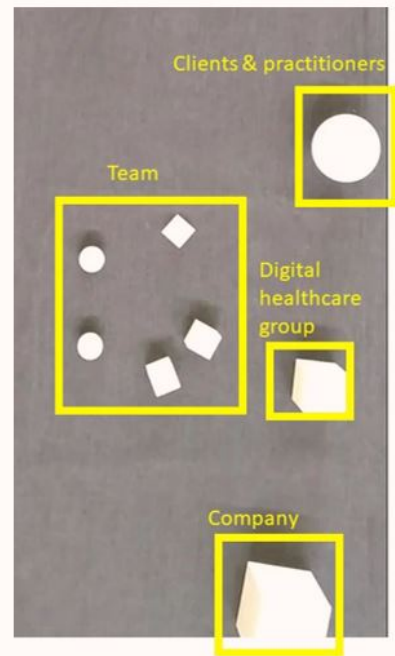


d) Team representation (end)

Figure 54: Session 2 Group C

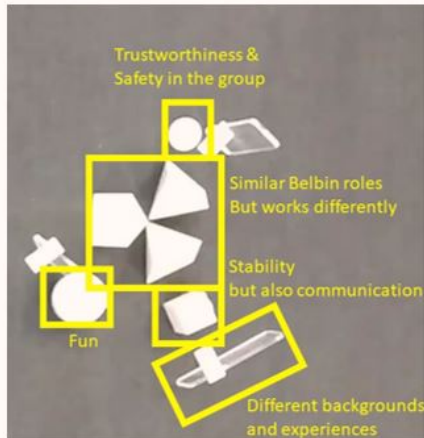


*a) Team representation: Computer science is a pyramid, Civil Engineering Cube and IDE ball.*

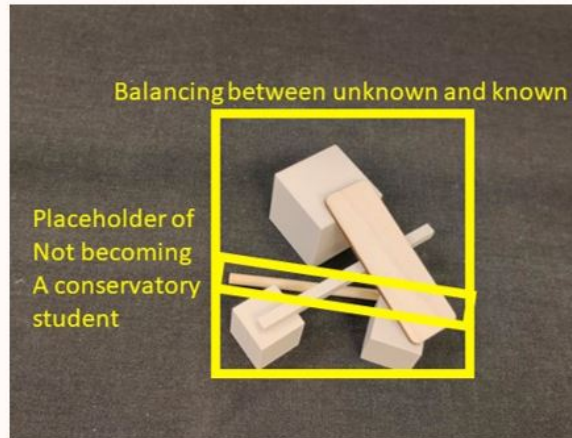


*b) Case representation: Clients and practitioners are both one half of a ball.*

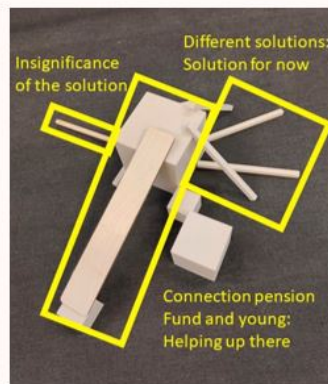
**Figure 55: Session 3 Group C**



*b) Team representation*



*b) Case representation*



*c) Solution representation*

Figure 56: Session 1 Group D

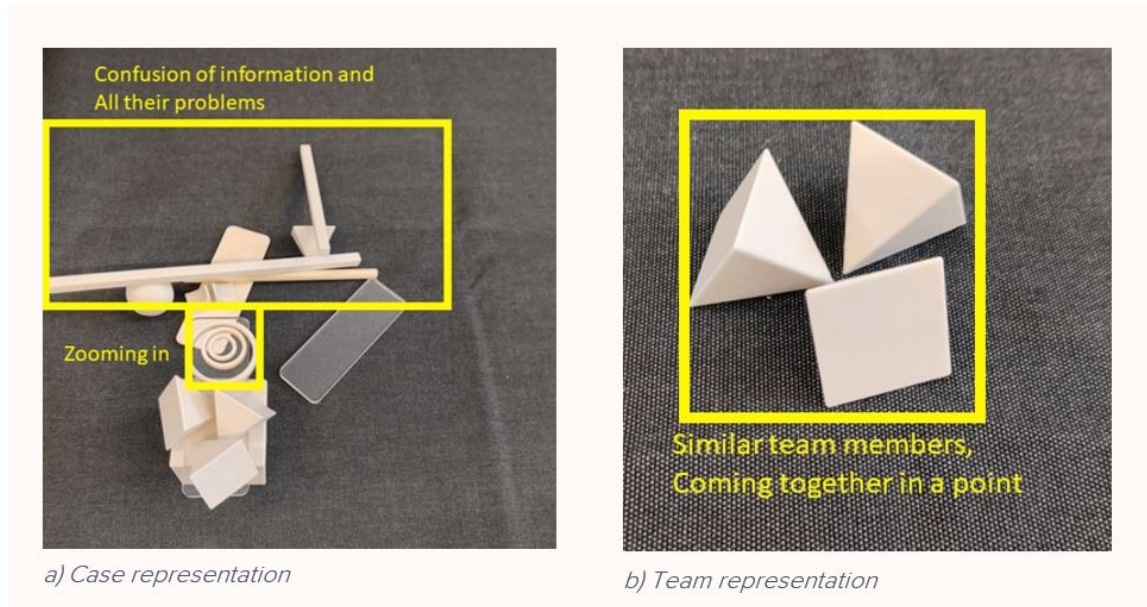


Figure 57: Session 2 Group D

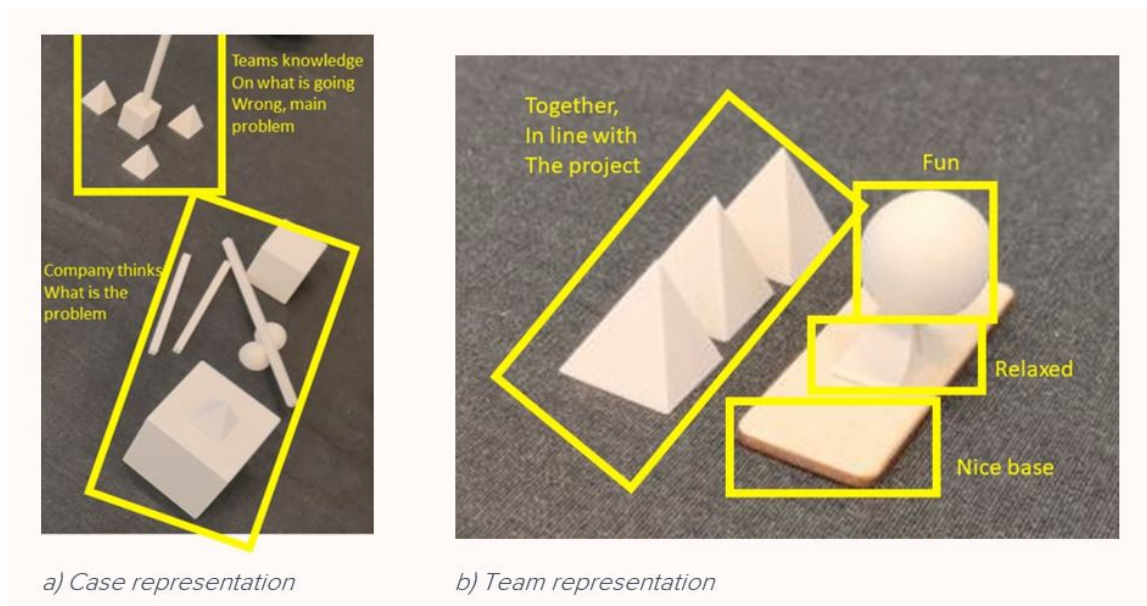


Figure 58: Session 3 Group D

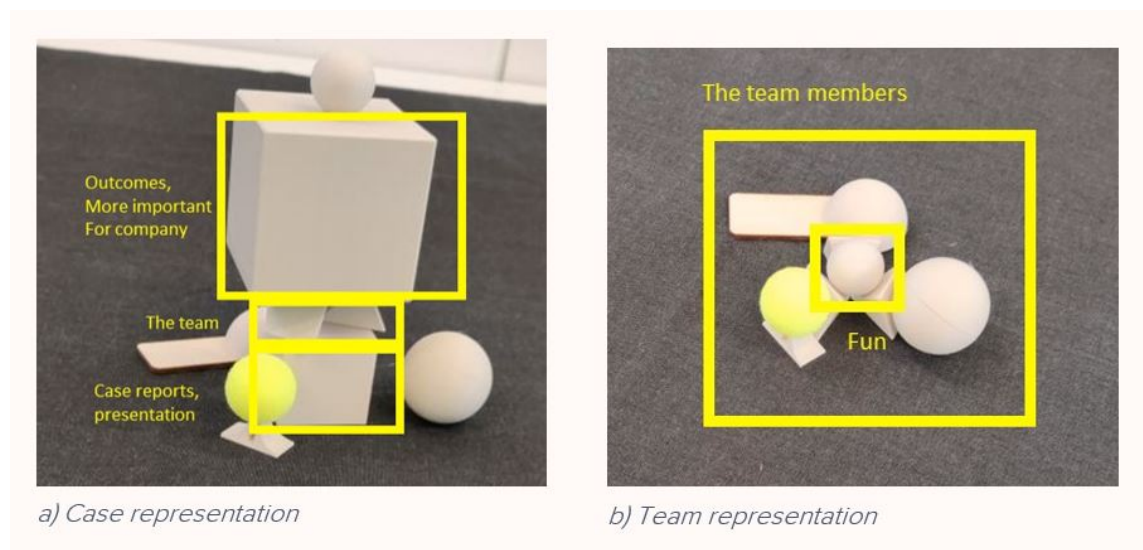


Figure 59: Session 4 Group D



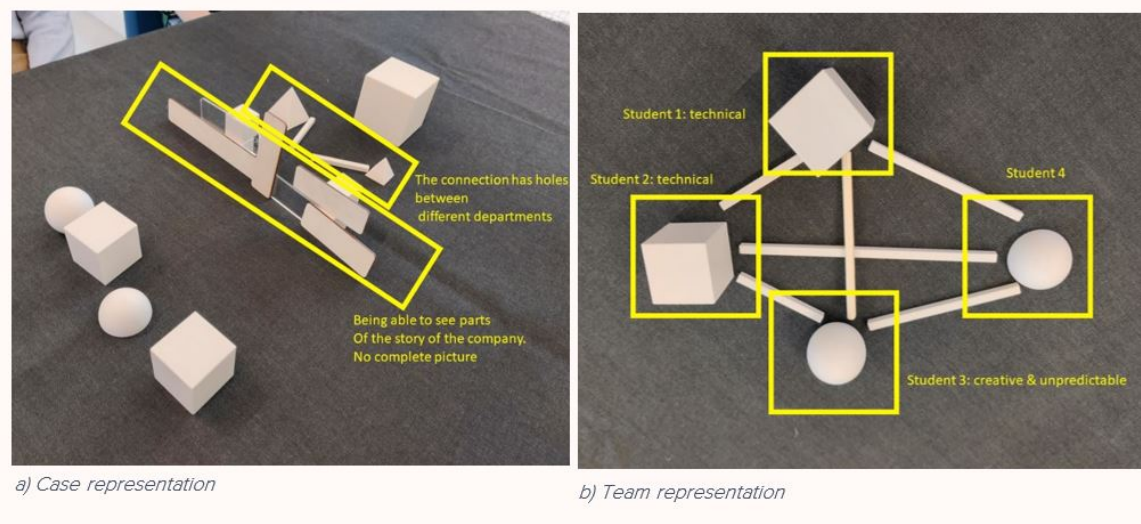
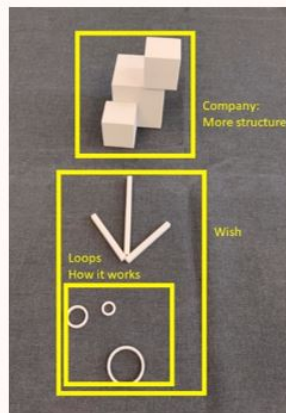
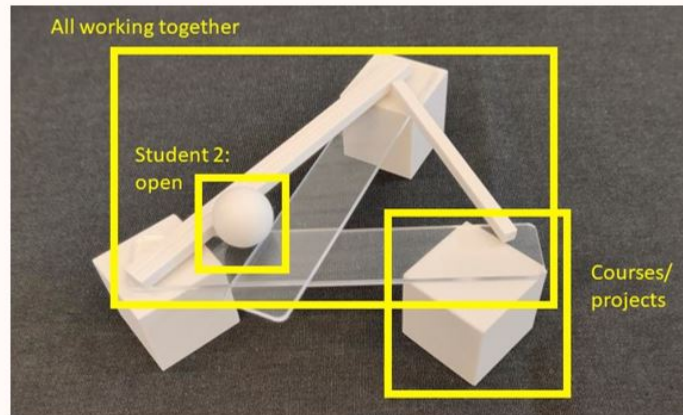


Figure 60: Session 1 Group E

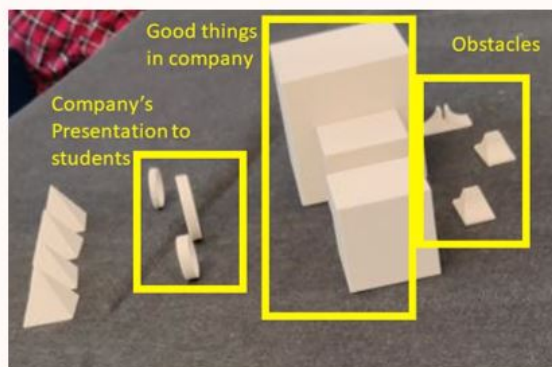


a) Case representation

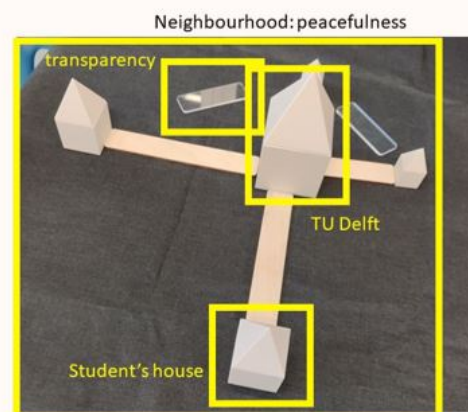


b) Team representation

Figure 61: Session 2 Group E



a) Case representation



b) Team representation

Figure 62: Session 3 Group E