# A learning space to support group-based learning for design education at IDE.

REALM

# PREFACE

This is a thesis report about a project started by the department Design Engineering at the Delft University of Design. It is the end result of the three phases of the design process. The analysis, synthesis and evaluation are all described in this report. I hope this thesis inspires you and maybe can be of any help.

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# ABSTRACT

The faculty of IDE hosts a lot of students, from which many participate in various group projects. There is a lack of suitable group work spaces. This project investigates how newly desgined spaces could accommodate group work in the coming years. A literature study is done to determine what the new learning culture consists of and what it means for the design of future learning spaces. Then iterative user studies are performed to identify key elements in group work dynamics and the influence of space on group work effectiveness. These studies provide a series of insights and demands that are then incorporated into the design process.

REALM, the final concept, addresses these insights by being a flexible and adaptable setup. With a round design it puts every member of the group at the same level. REALM has a passive state which it blends in with the main hall of IDE, in form and multifunctionality. It also has an active state: a facilitator function that mimics a human facilitator in providing the group with timemanagement and directions during specific phases of the project. These programs can be selected and created via an application accessible through smart device or computer.

REALM not only provides the faculty of IDE with additional group work spaces, but it also fills the gap of a lot of group projects and the absence of an (experienced) human facilitator within the group. Future development could go a step further and implement a greater immersive experience by adjusting the dimensions of the space, the lighting intensity and noise level. The final user study suggests that spacial proporties does influence the effectiveness of certain tasks performed by a group. Also direct sunlight and fresh air contribute to longevity of group effectiveness.
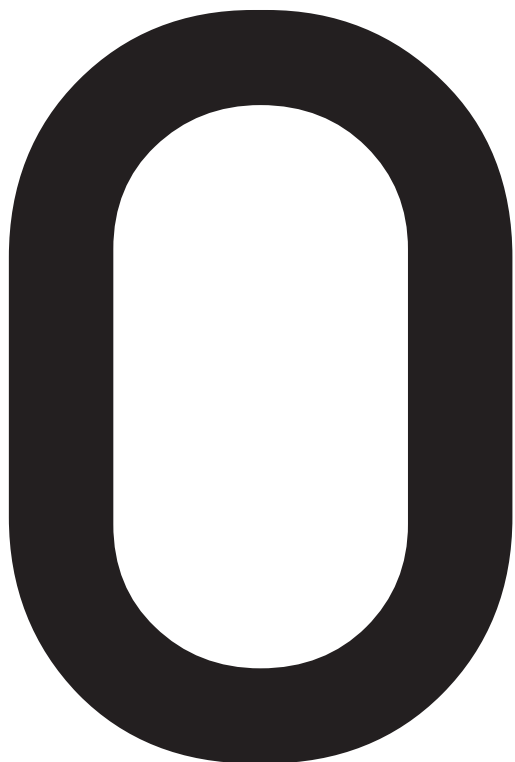This project aims to provide the reader with additional insights on the importance of learning space design and what is can actively do for the effectiveness of group projects within design education.

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# PART 0
# INTRODUCTION

# TU Delft

The present situation presents us with a transition phase between an old learning culture and a new one. Education is changing from the traditional teaching methods to newer methods that are developed around the generation Z. The world is more connected and creating context becomes more important as knowledge is readily available anywhere. Teachers get training on how to alter their curriculum. Whereas, a number of online platforms have been developed to strengthen the teacher-student, teacher-teacher and student-student relationship.
The (near) future of learning embraces the widely and instantly available knowledge and provides the student with a red line (a context) going through that knowledge. The aim is higher involvement by both students and teachers. Knowledge will not only be shared by lectures (low retention rates), but actively used in groups; being in a discussion, put in to practice and teaching others (high retention rates).

*NEW INTERACTIONS*

The distribution of roles between students and teachers changes. Students can become teachers, while the teachers blends in to the learning environment like a coach. Motivation to learn is stimulated by the TU Delft, but ways to facilitate this intrinsic motivation during contact hours are being held back by 1-way teaching methods and their accompanied lecture rooms. The generation Z is brought up with the ability to absorb knowledge from anywhere, anytime. It needs a different environment to thrive in. Lecture rooms focused on one teacher, one point of knowledge is getting outdated.

# Assignment

New learning philosophies arise and ideas on how to incorporate these in a curriculum are developed. But what is needed from a physical standpoint? The traditional lecture rooms (and lecture style teaching) do not provide the right setting to maximise the efficiency in group based learning. They are built on the principles of the 'old' learning culture. A  new learning culture is already forming: online education . How does online education influence the physical learning space? What does the learning space provide for the balance between online education and face-to-face meetings with teachers and peers. Group based learning asks for a different learning space setup. What would be the optimal learning space for group based learning?

## *PROBLEM*

to design a physical learning space that supports group based learning for design education at IDE.

# Approach

To define the new learning culture and explore what it means for TU Delft students. Then co-design with the students to visualise how they see themselves within their new role (as a teacher) in a space created by themselves.

Then answer the above question; what is the optimal infrastructure for a student to be a better student and how to translate this to a physical space, that can be tested, reviewed and re-modelled  to achieve a valuable study to base a final concept on.
The project will mostly revolve around co-design and participatory design research. Students should be involved as much as possible during the design phase. Before this a good basis should be set with a literature study and cases.

This project is completed in 3 phases:

The research phase has to provide a basis to work off. Define the new learning culture, show examples and investigate relevant cases, identify, determine the distribution of roles in TBL and how they impact learning space design. This phase will include a literature study and several cases. Interviews with students using new and old learning spaces will provide a basis PvE.

The conceptualisation phase focusses on the interaction between students and space, further developing a list of requirements. From this point on we narrow down to a new learning space. Co-designing with students gives insights and valuable information on what a learning space should offer a student working in teams. Testing the concepts with user studies will result in a final concept. Decisions during the design process are being made based on

The finalisation phase. The final concept will be tested and reviewed. Ideally this would be done in a actual space. The tests will again include the students. Conclusions and recommendations can be made.

The end result will be a validated design for a learning space that fulfils the needs of the users This visual impression and storyboard will be based on the vision from the research phase and the list of requirements created during the project.
In the first place the expected outcome will be a proposition for physical space including a storyboard with the proposed use scenarios of the space. Further improvements will be necessary and will be included in the recommendations.

*RESEARCH QUESTIONS*

- How can we define "The New Learning Culture" and what does it mean in higher education?
- What makes effective group work and how does is compare to the current situation at IDE?
- How can we intervene in group dynamics from a spacial standpoint?
- What kind of group space is needed at IDE to fulfill the needs of the target group?

# Relevance of the project

The Master Design for Interaction focuses on how to improve the interaction between user and product to make it a better product. This project focuses on how to make the 'product' learning better by improving the interaction between students. Aid them in being as effective as possible when working within teams.

*HUMAN*

Team based learning follows from the principle of actually applying course materials instead of gathering them in class. (2004, Michaelsen, L.K., Knight, A.B., & Fink, L.D) Many (lecture) rooms facilitate an old style of teaching. How does group based learning translate to a physical space? Group based learning is applied in several courses around the TU Delft, especially the 'creative' studies Architecture and Industrial Design Engineering. How could a physical space facilitate group based learning?

*TECHNOLOGY*

The task is to get insight in the interactions that take place in group-based learning in order to co-design a new space that actually helps the students reach a higher level of learning. Technological advancements in learning, sharing content and co-working will have an important role when co-designing a solution to the assignment described above.

*BUSINESS*

The mission of IDE is "Design for our future". This project looks at how education and students evolve. It has a different list of needs and demands than that the current spaces provide.
The human-business-technology triangle will be addressed, with a big focus on humans. They are the center of this project.
The domain of the project will be team based learning in universities, following the culture change that takes place within learning methods and their effectiveness with the generation Z. Students from the TU Delft will provide a good pool of test subjects for this project. The TU Delft benefits from this because new ways to engage your students and teachers will only spark more initiative, deeper knowledge levels and better students.

Michaelsen, L.K., Knight, A.B., & Fink, L.D (Eds). (2004). Team-Based
Learning: A transformative Use of Small Groups in College Teaching. Stylus Publishing, LLC.
Sterling, VA.

# 1

# PART 1
# NEW LEARNING

# A new learning culture

Cultures evolve and learning evolves with it. Kids grow up in a vastly different world then 15 years ago. Knowledge is abundant and everywhere. Kids know their way around laptops and computers better then most grown-ups. This image was sketched 10 years ago, these kids have grown up and are still able to look up everything anytime anywhere. But the educational system isn't as fast paced as they are. Students at universities envy the kids of today, so much knowledge and resources readily available for anyone.

Let's first determine what the new learning culture is about and why it works. Thhe new culture of learning includes two things:

1.  An unlimited acces to an information network that gives a person the resources to learn about anything.
2.  A structured environment with boundaries that allows for complete independent experimenting with the above mentioned unlimited accees to information.

"The reason we have failed to embrace these notions is that neither one alone makes for effective learning. It is the combination of the two, and the interplay between them, that makes the new culture of learning so powerful." (Thomas & Brown) What they mean is that a student, no matter what age, needs guidance through the information overload that exists. A mentor that can provide context, but at the same time gives the freedom to experiment with the gained knowledge. This connection between personal motivation and unlimited acces to information let students to develop commitment to something they care about.

> "... - is how the imagination was cultivated to harness the power of almost unlimited informational resources and create something personally meaningful. The connection between resources and personal motivation led people to cultivate their imaginations and recreate the space in a new way."
>
> (Thomas & Brown)

The above quote could very well apply to groups working together in a flexible learning space that allows them to customize and use the space in whatever way they see fit. This new learning culture tries to awaken the intrinsic motivation and provides a physical environment to do so.

Thomas, D., & Brown, J. S. (2011). A new culture of learning: Cultivating the imagination for a world of constant change (Vol. 219). Lexington, KY: CreateSpace.

*%th graders using iPad's outside for biology leassons*

*FOCUS ON GROUP LEARNING*

Group projects makes up a vast majority of the curriculum at IDE. Group learning happens in different forms. Masterclasses or workshops in which the groups work towards a goal at hthe end of the session. But also meetings with stakeholders and mentors. Meetings with the group only and working together. For a IDE student it is very imporant to feel comfortable in a group as they spend a lot of time with them. As so it seems, interviews suggests that there is a lack in teambonding and effectivity if the group can;t seem to like eachother very well. Not all groups become teams, more on that in part 2. With many students and only so much teachers, a lot of the learning happens within the group. The shear amount of time IDE students spend in groups and not being effective is good reason to focus on improving this effectiveness.

*THIRD TEACHER*
 "The role of structured curriculum and motivated teachers is rarely researched"

"An inspriring room does motivate students, thus makes then better students."

Both quotes are from Sawers, et al. Motivation can be transferred from the teacher to the student, but it also transfers from the environment. The third teacher, the classroom or sometimes the lack of a classroom. The environment sparks enthusiasm or intrigue. The article also states that students were more engaged in an new-style room compared to a traditional space. A motivating space or an inspring-ing space makes a student better. Motivation not only comes from the teacher-student interaction but also from the space that a student is in. A grey basement room (at IDE) doesn't nearly spark as much joy as working in a room in the TU Library with a view and daylight.

Sawers, K. M., Wicks, D., Mvududu, N., Seeley, L., & Copeland, R. (2016). What Drives Student Engagement: Is it Learning Space, Instructor Behavior or Teaching Philosophy?. Journal of Learning Spaces, 5(2).
ISO 690

*NEW LEARNING ELEMENTS*

So what does this new learning culture means for the higher education? Much of the research on new learning methods, group learning methods, the influence of space on learning, etc is done with younger aged people than the target group students at IDE.

These kindergartens or high school are much smaller scale. It is easier to experiment. Kids are also natural learners, they pick up things so fast. Despite these differences there are couple things that we can take away from this. Kids learn best when they feel at ease and can ask questions without being afraid of getting a negative response. This safe structured environent also applies to higher education students. Maybe in a slightly different way. But a place where you can go and meet peers that are on the same wavelength is invaluable. The university always played that role, but in the digital now, that role is becoming more important. The univeristy provides a base line, a guide to right kind of information.

Also these new high schools and kindergartens provide multiple ways to learn and in different energy levels. Sitting down or standing up. By book or wikipedia. It recognized that children learn in different ways. When you move on to universities most of it is still in books or on powerpoint slides. A new learning culture is already forming: online education . How does online education influence the physical learning space? What does the learning space provide for the balance between online education and face-to-face meetings with teachers and peers.

A high level of independence supported by the teacher. Changing the balance and moving the teacher next to the students. Putting the teacher at the level allows a different dynamic in which the student can be leading and follow it's own instincts. Guided from the sideline.

Mentors become learning masters, instead of content masters.

# Case: IJburg College

## *IJBURG COLLEGE*

Several high schools around the Netherlands are working towards a new standard of teaching. The iSchool-program, IJburg college is part of this program, is described in the red box below. The student is the focus point. The best possible learning environment is created per student, this also means that a close collaboration between teachers and even parents is necessary to ensure a perfect climate for the student to learn. The aim for these kind of schools is not only to the teach the "necessary" stuff, but allow the students to explore the things they are interested in. A highly personalised schedule helps the students to keep track of their progress. This happens online or in the "cloud". Per course the teachers have access to this information too. They can adapt their way of teaching to students by using this data.

## *WHAT TO LEARN?*

Open learning environments with experts that are available are stimulating initiative by students in creating their own way of learning. All styles of learning are accommodated, students can choose to engage in a discussion with other students, explore reading material about the subject or talk to an expert that is available in person or online.

The focus on positive moments and skills works highly motivating for the students. This and the chance to work out assignments in their own way, approved by a teacher, really gets students motivated to learn. And that what is about.

An infrastructure where hardware is available freely in different spaces adds value to quick presentations, explanations and sharing of knowledge. The seamless way in which students and teachers use environmental hardware shows how technical barriers disappear. No cables, but a touch of a button to connect and smart software that knows what you want adds to the usability of this hardware.

Because progress is recorded per student, groups are made to specification. Meaning that all strong points are in 1 group, but also the weak points are covered. Students can learn by each other and this stimulated by the teacher too. The natural division of groups can manipulated a little bit to create the group where everyone ca n learn from each other.

Compared to education given on IJburg College the the TU Delft has, in most cases, a very 1-dimensional educational system. Most courses are based on lectures, notes taken during lectures

IJburgcollege I

and the occasional questions round. At IJburg College the concept "flipping the classroom" is already well integrated. Lectures aren't lectures anymore but small organized conferences where the students and teachers feed of eachother's knowledge. "Lectures" are seen by students before hand as homework, alongside additional information.

This system can be compared to a MOOC as you gain knowledge at home. MOOC's serve individuals and suffice in the need of knowledge with certain topics. But as a standalone educational system this would never work. Students need guidance in the first place, but also need the opportunity to discuss and engage in physical sessions to maximize the effectiveness of these courses.

## IJBURG COLLEGE 2, THE FUTURE

The future of education according to Nico Moens is becoming more community centred. Sharing knowledge and discussing what you've experienced is the part of learning that becomes more important. IJburg College 2 is under development right now and the metaphor is cathedral of education is used. A place where not only students, but also local companies and even parents can come and learn from each other.

Still the student plays a central role, but coming in contact with real situations and extracurricular projects that actually appeal to the modern student is key to the development of every student.

There is a balance to this that needs attention. Still groups get graded together, but have individual reports too. Higher education also involves a lot of project groups. Most of the the time we improve our teamwork skills, but we don't really learn from the whole project. We are responsible for a small part of that project. Did you learn the things expected within the course or did we only get better at the stuff we already knew.

The main point in this case is that IJburg College tries to embrace the curiousness of their students by giving them unlimited acces to knowledge, but at the same time provides them with framework that provides context. The space reflects that too. The students can study anywhere, but if they need guidance or support there is always a place for face-to-face contact with peers or teachers.

# Case: Delft University of Technolog

## PULSE SESSIONS

I participated in a creative session with all kinds of people from the TU. This was for PULSE, the new learning centre of the TU Delft that is for all students, but turned out to be a look into the kitchen of the TU Delft. Not only PULSE was a topic, but basically the whole future for the TU Delft was discussed.

PULSE should develop as the beating heart of the campus having a place for students, teachers, researchers and companies. Quite a few were attending this session. The dean, several education directors, some external representatives of other universities, two members of the Board of Directors, students, professors and other TU personnel all gave input on the future of education on the TU Delft and how this would affect the soon to build new learning centre on the campus.

Studying adapted to the individual student is a key focus point for the TU in the future. With the growing number of students it becomes harder to give every student the same attention. This needs an adaptation of the system now. But it also means all infrastructure (classrooms, lecture halls, project spaces, etc) and online environments should be made compatible with the individual student system. Space should be used effectively around campus, they should be able to adapt to different scenarios of use. With modern technology this should be made possible. The line between online content and real life spaces should fade away. The way of teaching changes, teachers take on the role of experts. They give lectures, do quality control on courses and are available for questions. The relation between students and teachers, professors, researchers, etc. should be improved. These relations are important for the TU to become the worldwide institute they want to be.

## OPENLEARNINGLAB

OpenLearningLab allows the TU to have a place to explore different innovations within education. Mostly technical solutions are tested here and it gives a space to researchers to develop new educational services and products.

Fit with TU Delft future is the opportunity to test new ways of learning. Being the learning interaction itself or creating a highly effective environment per study.

The need for adaptable and flexible multi-functional spaces are expressed by all faculties. Especially the transition from traditional lectures to mixed learning is a key change what affects the way the capacity in rooms is expanded.

The TU Delft also ambitions that teachers of professors embrace new ways of education to keep the attention of students at a high level.

Education on the TU goes from a mass product to a tailor made profile per student. From discipline to mapping the competencies and skills. Education should be adapted to the individual based on their strong points. A personalized curriculum is the next step for the TU Delft. This is a decision supported by the government as the try to stimulate this with an multi million euro injection in higher education to be spent on extra teachers. The TU Delft wants to become a top institute in the world, just as MIT. And they will use the extra investment to reach this goal. A conclusion on how to do this though wasn't really clear. Many suggestions were made and this project is an addition and vision on an approach to accomplish this.

*CONCLUSIONS FOR THE TU DELFT*

TU Delft wants to focus on a personalized curriculum, but works with a massive amount of bachelor students who go to lectures in large amounts. One problem now is capacity for these lectures. To fix this they expand their number of classrooms with a new building. PULSE will provide the desired capacity in an updated way. Open Learning Lab will focus on new ways of education. Trying to reach this personalized education by researching new ways of designing education. This project fits right in with this strategy. Embracing this technological advances in creating an own learning space, online and physical, makes an institution as the TU Delft more effective for every individual student.

This session is a validation for this project as it tries to find a new angle for the personalization of education for higher education. The goal for the TU Delft is to become an institution in the world and named in the same sentence as MIT. A new way of looking at an existing problem like the one in this project (making a student an as effective as possible learner) creates new research and broadens the understanding of learning.

*CONCLUSIONS*

As stated in part 0, a lot of courses are in project form within the IDE bachelor and master's program. This has several reasons, it prepares for the future. Most design studios work in design teams and most other jobs rely on team skills. Creating a mutual motivation within these groups

Not part of the project as we try to analyze the group process and influence of space on group work performance. But structure is needed to 'survice' in the abundance of information streams. This structure is for a large part the responsibility for the ones that teach. And yes, university level education demands a high level of independency, but apparently a good teacher helps in making (higher) education more effective.

IJBurgcollege implements new learning elements succesfully. It makes use of the environemnt to create an open but safe place for the kids to learn. Teachers place themselves alongside the children and guide them towards the answer. The spaces reflect this philosophy. Grand open spaces with options for the students to customize their own learning space.

# 2

# PART 2
# GROUP WORK

# 3 TYPES OF GROUP LEARNING

Search for an article about types of group learning and many different names, types and definitions will surface. Team Based Learning, Group Learning, Community Based Learning, Online Discussion Forums, Peer-to-peer Learning, Prblem Based Learning, etc. Some definitions, some techniques, but all of them can be divide into three types of group learning (Cranton, 1996):

- cooperative group learning
- collaborative group learning
- transformative group learning

These types of learning have in common that they all are led by a teacher of a supervisor. This does not take in account the autodidactic capabilities of groups, which are very much present. Especially in the New Learing era described in chapter 1.

This distinction between the three types of group learning is based on the realtionship the group has with the teacher. Traditional teaching methods are put under cooperative learning, the teacher remains the expert and places itself above the group. New learning sees a shift towards collaborative learning, in which the teacher places itself amongst the students. But at the same time fulfills a facilitator role. This puts stress on the teacher-student 'equality' and asks the teacher to adopt two roles at the same time. The third option would be that the teacher completely detaches itself from the leader or facilitator role and mixes with students. This allows for an open, same leveled interaction with the students. It gives trust and allows the students and teacher to a common goal. This creates a shared commitment. More on this further on in this part.
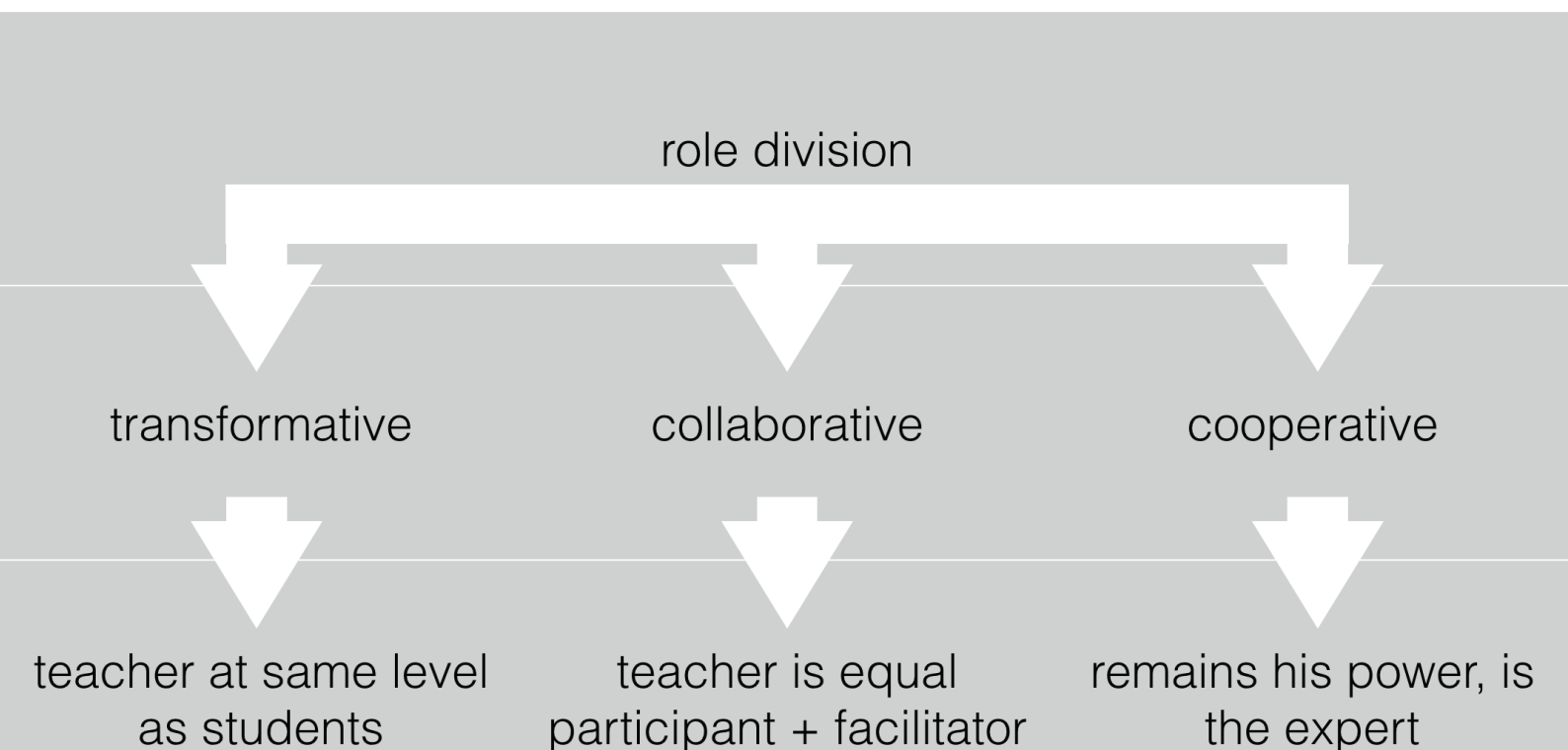
source:
Cranton, P. (1996). Types of group learning. New Directions for Adult and Continuing Education, 1996(71), 25-32.
ISO 690
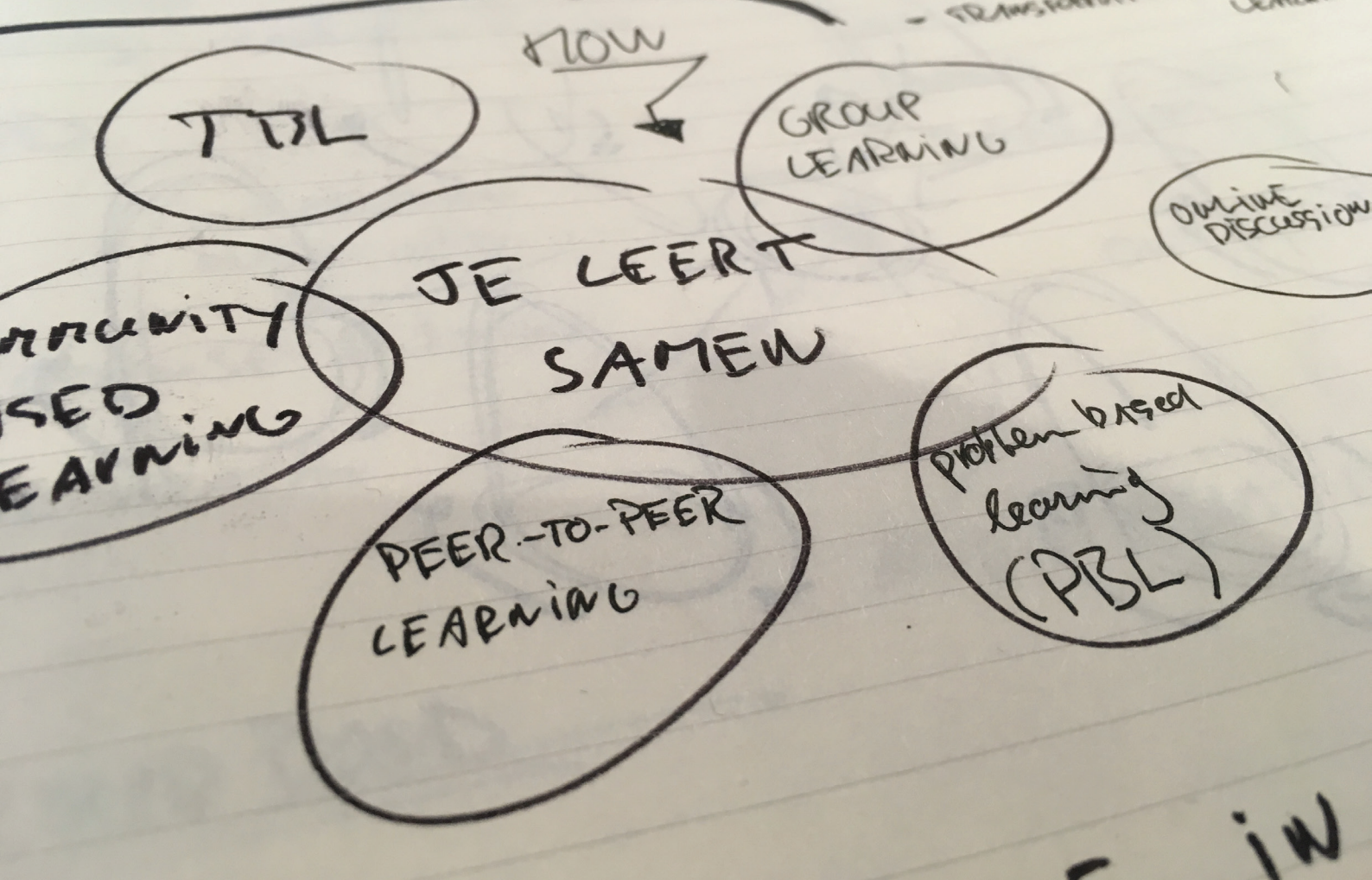
*A mindmap of different group learning types*

*the role division between teacher and group*

role division

transformative

collaborative

cooperative

teacher at same level
as students

teacher is equal
participant + facilitator

remains his power, is
the expert

## SCRUM

Scrum is a framework for completing complex projects. Scrum originally was formalized for software development projects, but it works well for any complex, innovative scope of work.[1]
It defines "a flexible, holistic product development strategy where a development team works as a unit to reach a common goal", it challenges assumptions of the "traditional, sequential approach" [2]
Verheyen describes SCRUM as a framework. "Scrum as a framework describes roles and rules upon principles that help and facilitate people in a low-prescriptive way."[3] This ties in very nice with what Thomas & Brown stated in part 1. A structure, a framework is needed for a student to explore the unlimited source of information available.

SCRUM is very popular among corporate businesses because it greatly structurizes a complex design challenge. Thus making a group work faster and more streamlined. Most SCRUM teams have a SCRUM master assigned, someone that keeps track of the progress. But also makes sure no one is making things difficult for themselves by taking too much on their plate. SCRUM is about tackling problems one by one. Working towards a common goal. It also promotes teamwork by having regular updates among teammates. This role division and constant updating makes SCRUM very effective in creating highy effective and efficient teams.

1) https://www.scrumalliance.org/why-scrum
2) Takeuchi, H., & Nonaka, I. (1998). 16 The new new product development game. Japanese Business: Part 1, Classics Part 2, Japanese management Vol. 2: Part 1, Manufacturing and production Part 2, Automotive industry Vol. 3: Part 1, Banking and finance Part 2, Corporate strategy and inter-organizational relationships Vol. 4: Part 1, Japanese management overseas Part 2, Innovation and learning 64(1), 321.,
3) https://guntherverheyen.com/2013/03/21/scrum-framework-not-methodology/

# what is good group work?

Good group work means that the group transforms into a team. A team knows what every teammember excels in and what his/her weak points are. A good team not necessarily needs a strong leader, but it needs a framework. A set of rules made by the team itself, based on proven methods like SCRUM.
All the teammembers have equal roles within the team.
In the academic world this would translate to a shift from cooperative and collaborative learning towards transformative learning.

*FROM THE SAGE ON THE STAGE, TO THE GUIDE ON THE SIDE.*

Transformative learning places the teacher amongst the class it is teaching. This creates a dynamic that encourages leadership and initiative from the students, something that the TU Delft expects from its students. This way the team develops a higher level of intrinsic motivation, the most powerful motivator for any student.
Also instead of just transferring knowledge from one brain to another, students now discover things themselves by discussing and teaching each other. A far more powerful learning philosophy. And according to Bloom[4] with higher retention rates.

4) Bloom, B. S., Engelhart, M. D., Furst, E. J., Hill, W. H., & Krathwohl, D. R. (1956). Taxonomy of educational objectives, handbook I: The cognitive domain (Vol. 19, p. 56). New York: David McKay Co Inc.



*One of the interviewed students.*
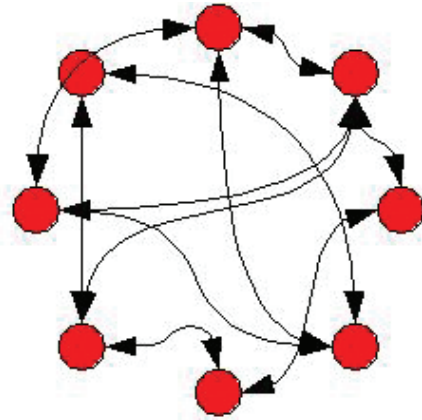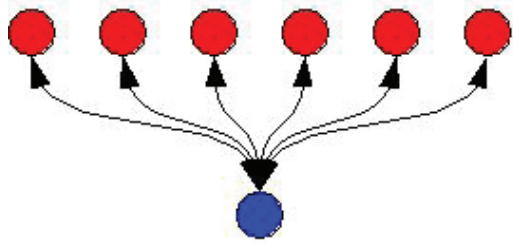
# Not All Groups Are Teams: How to Tell the Difference

## Working Group

- Strong, clearly focused leader
- Individual accountability
- The group's purpose is the same as the broader organizational mission
- Individual work products
- Runs efficient meetings
- Measures its effectiveness indirectly by its influence on others (such as financial performance of the business)
- Discusses, decides, and delegates

## Team

- Shared leadership roles
- Individual and mutual accountability
- Specific team purpose that the team itself delivers
- Collective work products
- Encourages open-ended discussion and active problem-solving meetings
- Measures performance directly by assessing collective work products
- Discusses, decides, and does real work together

*Katzenbach, J. R., & Smith, D. K. (1993). The discipline of teams. Harvard Business Press.*

*GROUPS VS TEAMS*

The above described SCRUM techniques and the transformative learning convert to making teams out of groups. As the above picture describes it is in certain situations not bad to be a group. Maybe even a group with a leader. Some situations would even benefit from the opposite of a homogenous group. Discussion can be very valuable for the opinion of the whole group. The only thing is that timemanagement can be an issue. Unnessary discussions could lead to precious loss of time in an education filled with deadliens.

# Conclusions

If a student needs to be independent, curious and motivated the curriculum should shift from cooperative learning towards transformative learning. In the new learning culture the half-life of knowledge is becoming smaller. Students need someone they can sparr with, not someone who tells them what to do.

Unless, it a group without a common goal. A group of individuals benefits from a facilitator which can steer is the right direction. Groups can be very effective if not homogenous, but it needs a facilitator that can guide the group through a project.

SCRUM can be a very effective framework for groups. It is a pressure cooker for fast paced innovation or development. The team has to share a common goal and should be aware of eachothers capabilities. They are backed by a SCRUM master which basically is a coach on the sideline. It only manages the group. It is a very fast paced process that can be troublesome for newcoming employees or in this case students.

*GUIDELINES FOR THE LEARNING SPACE ARE MADE,*
*TOGETHER WITH THE INTERACTION VISION WE WORK*
*TOWARDS THE CONCEPT PHASE.*

# 3

# PART 3
# NEW SPACE

*GENERATIVE INTERVIEWS*

During this part of the project interviews were conducted in which these topics were discussed. An interesting observation is that all groups seem to work in the same fashion. Most described their day as the follwoing: getting coffee, decide on who does what, everyone does what they agreed on doing, discuss what you did and make plans for what to do before the next meeting. So tasks get divided, but there is no teamwork involved. Everyone does their part and comes together again. Rarely someone steps in and takes the lead in organizing good teamwork.

This chapter basically summarizes the first two parts and cross examines the findings with the results from interviews done with students at IDE. The interviews provided insights from the target group and added valueable perspectives to the findings from part 1 and 2.

*A GOOD SPACE*

The goal for this project is to make a design that fulfills the needs of the target group, acknowledges the tension in group dynamics and steers the group onto a path of greater effectiveness. So what makes a good space. A good space acknowledges the different scenarios or phases a group goes through. A project needs different interactions at the start then at the end. A facilitator could manage a group in that way, but usually none of the group members can fully commit to this role.

The space could contribute to the teambuilding that is neceassary to become av ery succesful team. On the other hand, not all teams are effective decisionmakers. They tend to stretch the decision making process into endless discussing. On the one hand it sharpens the shared commitment and leadership roles, but it sometimes delays the tasks at hand.

For a group to be considered equal the space should elicit this too. Everyone gets the same amount of space. A round or circle set-up would be the way to go. Then every member of the group is equal.

A group can be homogenous or not. If it is, most members will agree with eachother and support the same way of working. This doesn't necessarily mean they are an effective group. A group with strongheaded students can be equally as effective as long as there is a structurized approach to the project. A facilitator could help with this.

Finally, sunlight and air are some very important things. Most interviews somehow ended up talking about going outside as a group to have a coffee or just walk a bit. Enough daylight, air and space around an individual or group can make them more effective.

## EQUALITY VS BEING A LEADER

With the lack of a facilitator that can completely focus on managing group dynamics, there is a tension between being a leader and becoming a team in which everyone takes part in being a leader. Teams have shared leadership, groups often have one leader. In the long run teams are way more effective.

## GROUPS VS TEAMS

Teams tend to take longer before they reach a shared goal, then a group with one leader that sets goal. When time is an issue, which happens quite a bit in design projects, it is sometimes more effective to have a leader, then to homogenously work together.

## INDIVIDUAL WORK VS GROUP MEETING

This was mentioned a lot during the interviews and creative sessions. Many students like to divide tasks and split up, for later to come back together again. It means they have to move, especially if the group meetings take place in the main hall and they need to use the computers in the computers rooms. Also many meetings take place near the cafetaria which during the breaks eis very noisy.

## CUSTOMIZE SPACE VS BEING A NOMAD ON CAMPUS

Another topic that was mentioned often. The shortage in suitable group spaces provides the situation of always carrying around your laptop, sketchbook, etc. Being able to work anywhere is nice, but at the same time s student doesn't have home base. A place where a laptop can be kept safely and all post-its and paper can be put on the wall. Especially creative students need these kind of spaces, preferrably for a period of time.

# interaction vision

Group dynamics develop over time, a group grows in communicating with each other. It is important for a group to develop their own rules, as these will be perceived as their own. Making it easier to follow them.

So when the space tries to steer them in the right direction, it should be done in a subtle way. This subtlety can help flourish the group in a non-obtrusive way. Making teams from a group is an organic process and is done a playful manner.
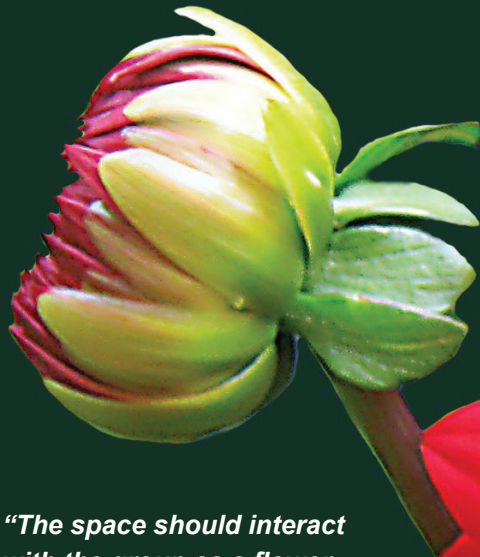
*"The space should interact with the group as a flower interacts with the elements. If it is done right - not to much water, not too much heat from the sun, just the right amount of nutrients - then a flower blossoms."*

## QUALITIES

SUBTLE: A flower needs water when the leaves start to hang.

ADAPTABILITY: A flower adapts to its surroundings, it turns to the sun.

CARING: A natural process of constantly adapting and growing, until flourishing.

EQUALITY: A flower has leaves, all equal as important, together making a round shape.

SOPHISTICATED: A flower is delicate, but beautiful. It has refined shape.

# Conclusion summary

## *CONCLUSIONS PART 1: NEW LEARNING*

- An unlimited source of information.
- A structured environment to engage in the unlimited acces of information.
- Intrinsic motivation for the studen can be created by a different approahc to teaching.
- IDE has a lot of group projects
- TU Delft invests a lot in new individual workspaces and lecture rooms, but hardly any in group focused teaching methods.

## *CONCLUSIONS PART 2: GROUP WORK*

- In the IDE department there is a lack of knowledge in group dynamics among students. Training in group dynamics
- Transformative learning is preferred if the students need to be independent.
- Groups need to transform to teams, only in certain situations.
- Groups can be very effective if not homogenous, but with the right guidance.
- A predertermined group dynamic, like SCRUM, can be very effective in raising the effectivenss of a group
- Discussion and students teaching students greatly increase retention rates of new material.
- A facilitator greatly increases the effectiveness of a group

## *CONCLUSIONS PART 3: NEW SPACE*

- The space should accommodate groups of 6, as most groups within IDE have that many people.
- The space should be a multi-purpose space, flexibility and customization should be key.
- An equal share is expected from all group mates, so the space should reflect en encourage that.
- The space should support the team building process, but not take over this responsibility
- Problematic tensions can be very well handled by taking away responsibility of the group.
- It should have unlimited acces to information.
- A project has many different phases, thus different needs. The space should be flexible in set-up and easy to change.
- The space should have an unobtrusive appeal so it blends in the faculty well
- Interactions between the group and space should be subtle.
- Equality between team members and teachers should be elicited by the space

*ONE OF THREE PROPOSED CONCEPTS IS SELECTED, AND DEVELOPED INTO A FINAL DESIGN.*

# 4

# PART 4
# NEW CONCEPT

# Design explorations

*CREATIVE SESSION*

Combining the results from the creative session and the conclusions drawn from previous chapters, I started exploring several design directions. Especially the tensions found during the interviews, and again confirmed with the creative session, proved fruitful. Together with the focus group of the creative session I explored these tensions by picking these out and starting a discussion. I tried to get them to eloborate their frustrations and have them incooporate the solutions into their concept poster.

The creative session consisted of two parts: part one was a visual representation of their own experiences when working in groups. It acted as a confirmation for things metioned in the interviews. The second part was used to converge all these topics, interactions and tensions into concepts. Three oncept directions that would use the environment or space to create a better group work experience. These three concept directions followed from content created within the creative session and additional intersting findings from the interviews earlier in the project. A more elaborate setup of the creative session as well as the results can be found in the appendix.

The creative session provided very interesting design directions:

*   Being able to work together as a team and split up to do indivdual tasks is an interesting dynamic. Most groups split up and work somewhere else. What happens when this happens in one location. The location or space needs to adapt to these different dynamics.

*   Being a nomad in the faculty requires a person to be flexible and able to set-up his/hers work environment anywhere. On the other hand making a work space your 'own' is a practice that applies to most students as well.

*   A group performs different things in different stages of a group project. A room or space that allows these changes in set-up should be seamless and easy.

*   Most groups work as a bunch of individuals that do the things they are good at. They split up doing their own stuff and then later put it together and synchronize their work. A space could help to divide task differently and let people learn from each other. Most teams miss a facilitator to make them more effective, the space could take on this role.
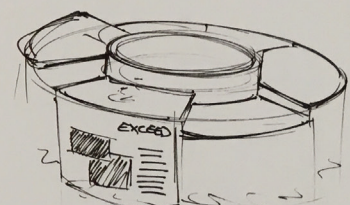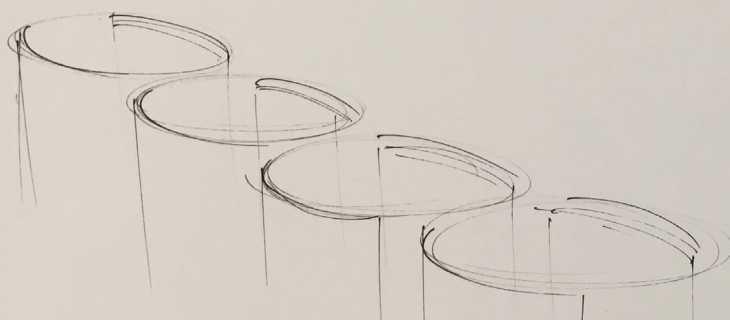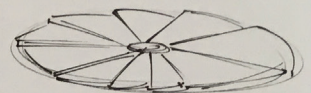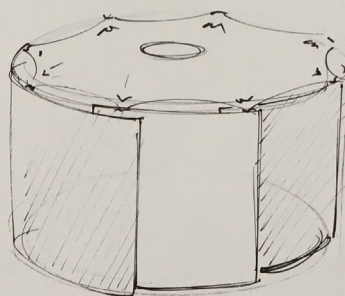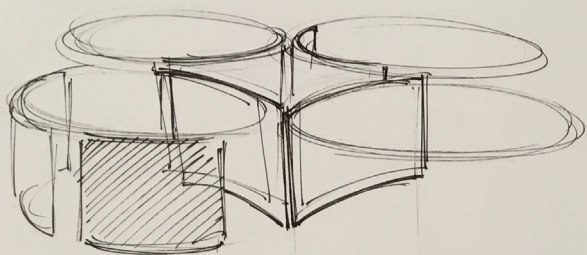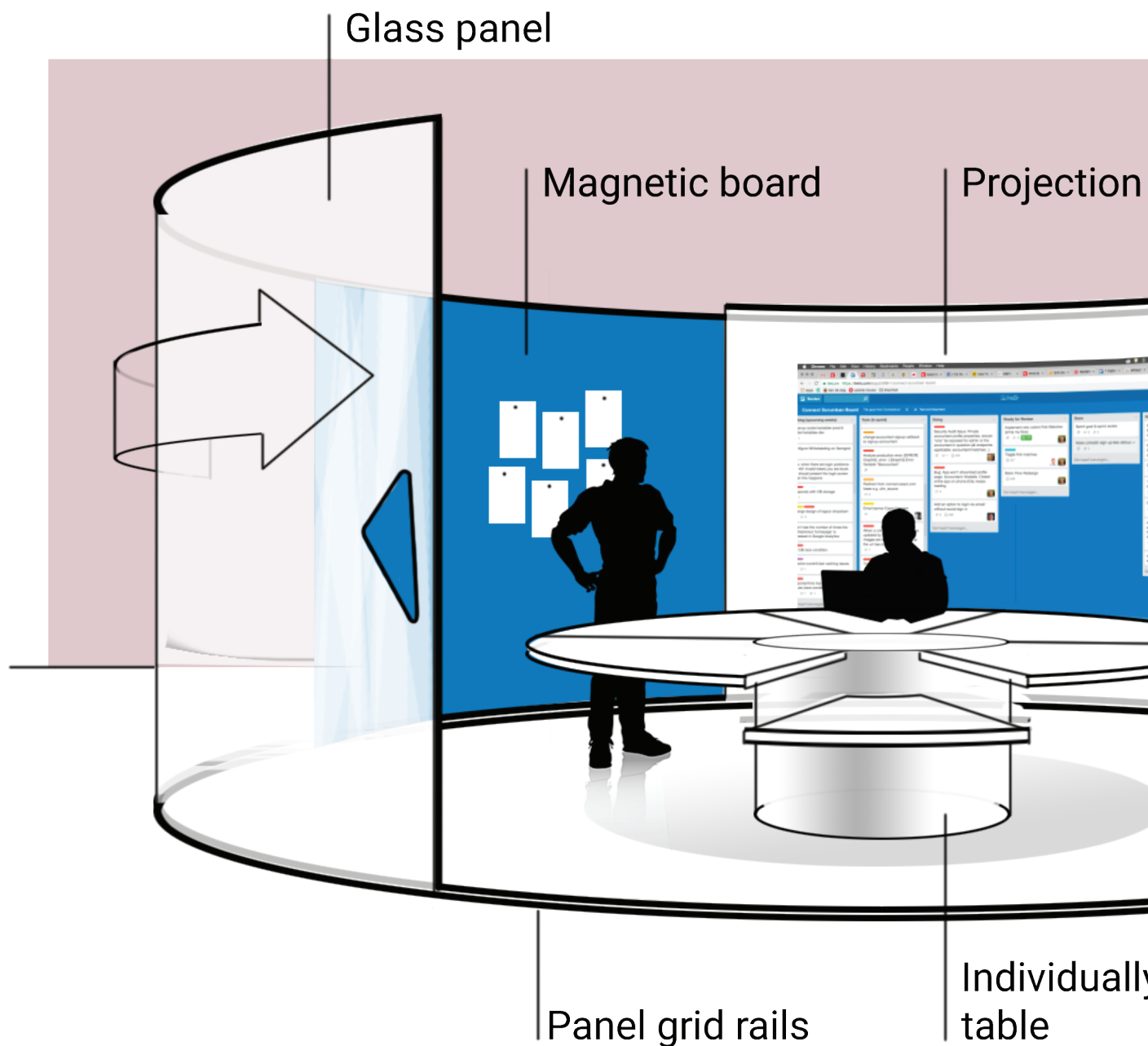
# Concepts

The three design directions were very basic concepts, ideas maybe. A next step was needed to get them to concept level. Each one of these design directions were explored further and developed into three concept directions.

- The first concept lets the group dictate the room. The room easily adapts to different stages during the project and places the group at a round table for equal roles.

- The second concept puts the room in control of the group. By changing physical attributes it 'forces' the group to change with it and stay focused within different stages of the project-day.

- The last concept tackles the individual vs team work styles and tries to incoorporate the needs of both styles into one space.



3



2

Glass panel

Magnetic board

Projection

Panel grid rails

Individually
table
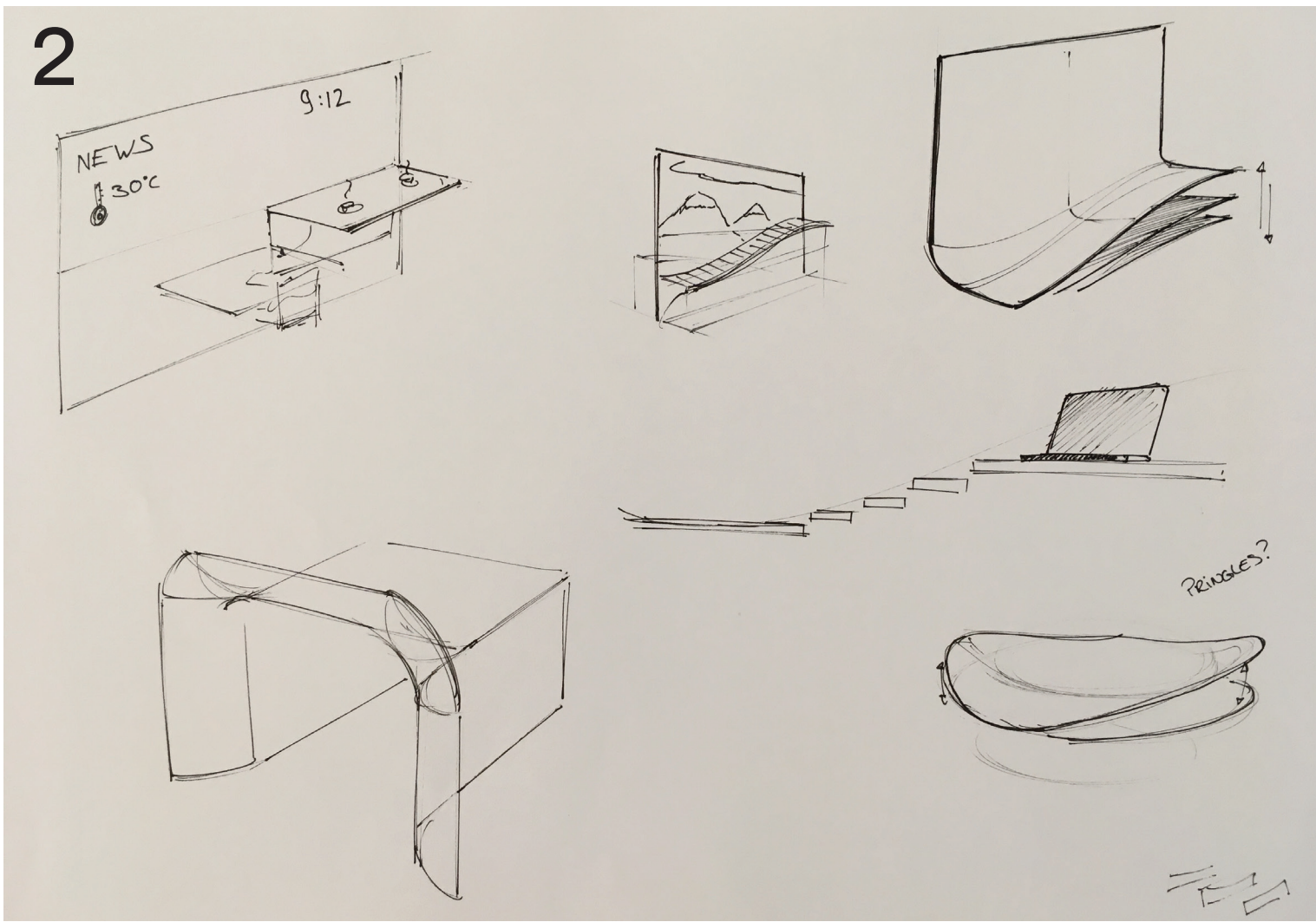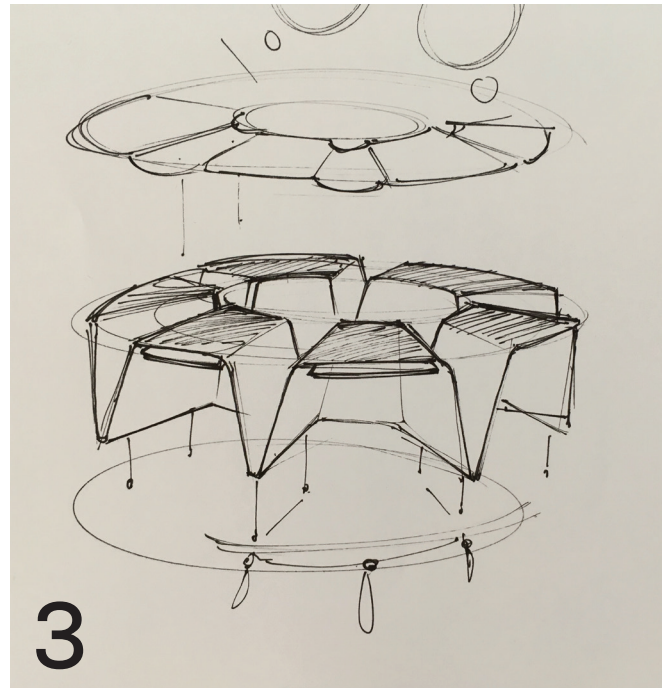
# Concept 1

*FLEXIBILITY*

This space can be set-up in multiple ways. It consits of 4 panels that can individually slide on rails on the floor. Allowing for a very flexible set-up. The panels have different 'finishes':

- a magnetic board for analog storage of group generated content. Such as posters, notes, etc. Or the group's schedule.
- a white-board for brainstorming, to-do-lists, visuals, etc.
- a projection screen of big display to connect laptops or media carriers.
- a big glass panel to act as the fourth panel to potentially close the ful circle. It also functions as another white-board that could communicate stuff to the 'outside' world.

The room is completed by a round table in the middle that allows for individual height adjustment. It even allows for a standing desk. This table acts as a exhibition space too.
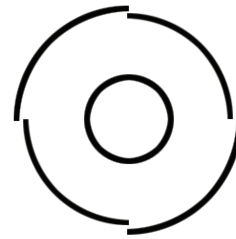
screen | White board

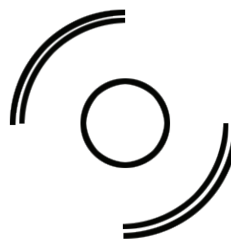Work in groups | Exposition mode

Coffee / Office | Presentation

y adjustable

**FOCUS POINTS**

This concept focusses on modularity, as this space can be multiplied and screens can be exchanged, and customization of the work space. It facilitates multiple 'scenes' for focused group work, a private meeting room, brainstorm room, an 'open office', exhibtion space, etc.

It fulfills the need of a dedicated group space that is flexible in its setup for all the stages of group work. At an interaction level, the group easily can transform the space to a specific setup. It should be an easy sliding door, an easy adjustable table height. But the group stays in control.

# Concept 2

This concept basically takes over the role of the facilitator when entering with a group. A project group reserves the space via an app and selects what the room will be used for the next couple hours or day or week. The room than transforms to a certain preset. This preset adjust the lighting, noise level and height of the table. On a screen a program for that certain part of the program is shown with a schedule for the reserved time and the expected outcome of the session. It will greatly increase the efficiency of the group by provinding them with time tasks. Just like a facilitator would do.

The learning space supports group process management and presents the group with cues to streamline a particulat phase of the group process. These cues are subtle. The table could change in set-up or the music could slowly turn off. The room are semi-closed and allows the group to fully immersse themselves in the project.

light fixtures and speakers are connected with an on board computer that receives input through an app. The student can select a scenario and the on board computer will adjust the room accordingly. Different parts of the project need a different set-up.
The room does not acitvely monitor the people inside, but is could use sensors to determine how many people are inside and adjust the program accordingly.

Log in
Team members: 5
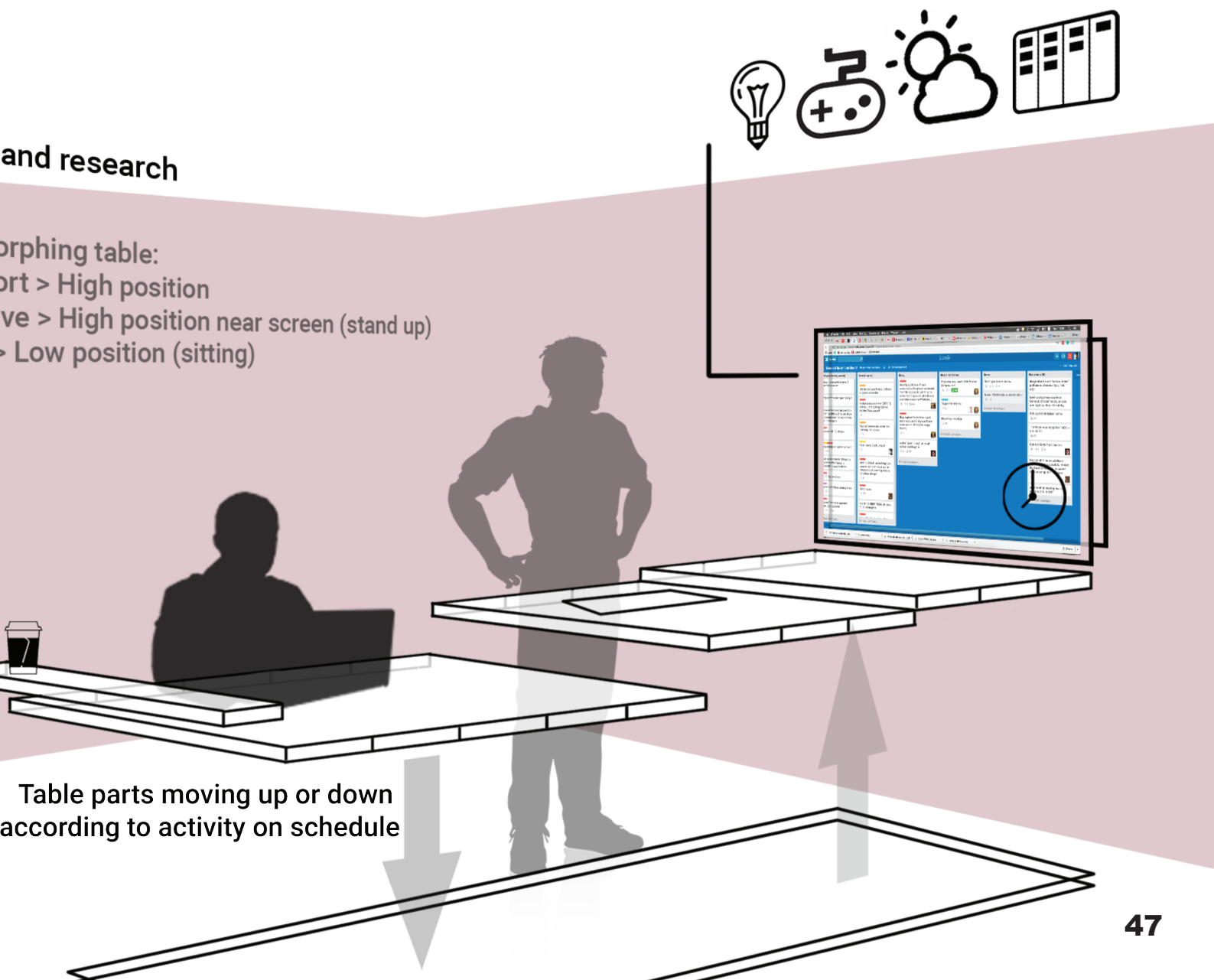Activity: Brainstorm

Time management by m
9:00    - Coffee time = sho
9:30    - Brainstorm = acti
11:00 - Focus = passive >
and so on...

*HOW DOES THIS ROOM CONNECT TO THE FINDINGS IN RESEARCH?*

The space tries to gently steer the group into the right direction by chaning the environment of the room. Research showed that most groups have difficulty being a very effective team. This room tries to take over the facilitator role and let the team be the team. It is hard for someone in a team, which has divided tasks, to do nothing but making sure the team works effectively. Understandable, but also a huge loss for the efficiency of a project group.

and research

rphing table:
rt > High position
ve > High position near screen (stand up)
> Low position (sitting)

Table parts moving up or down
according to activity on schedule

# Concept 3

This concept basically is a chandelier skeleton laced with very very stretchy fabric that can be pulled down and fastened to provide a private atmosphere at a round group table. When released the 'curtains' will go up and contact with the neighbour is restored. Allowing for working in couples or giving a short heads-up.
When all curtains are up, the group members are open for discussion or could start a meeting. The lighting can change to personal preferences and every workspot has an own powersupply.

Roof structure

Super

PULL DOWN!

Easy

Group desk
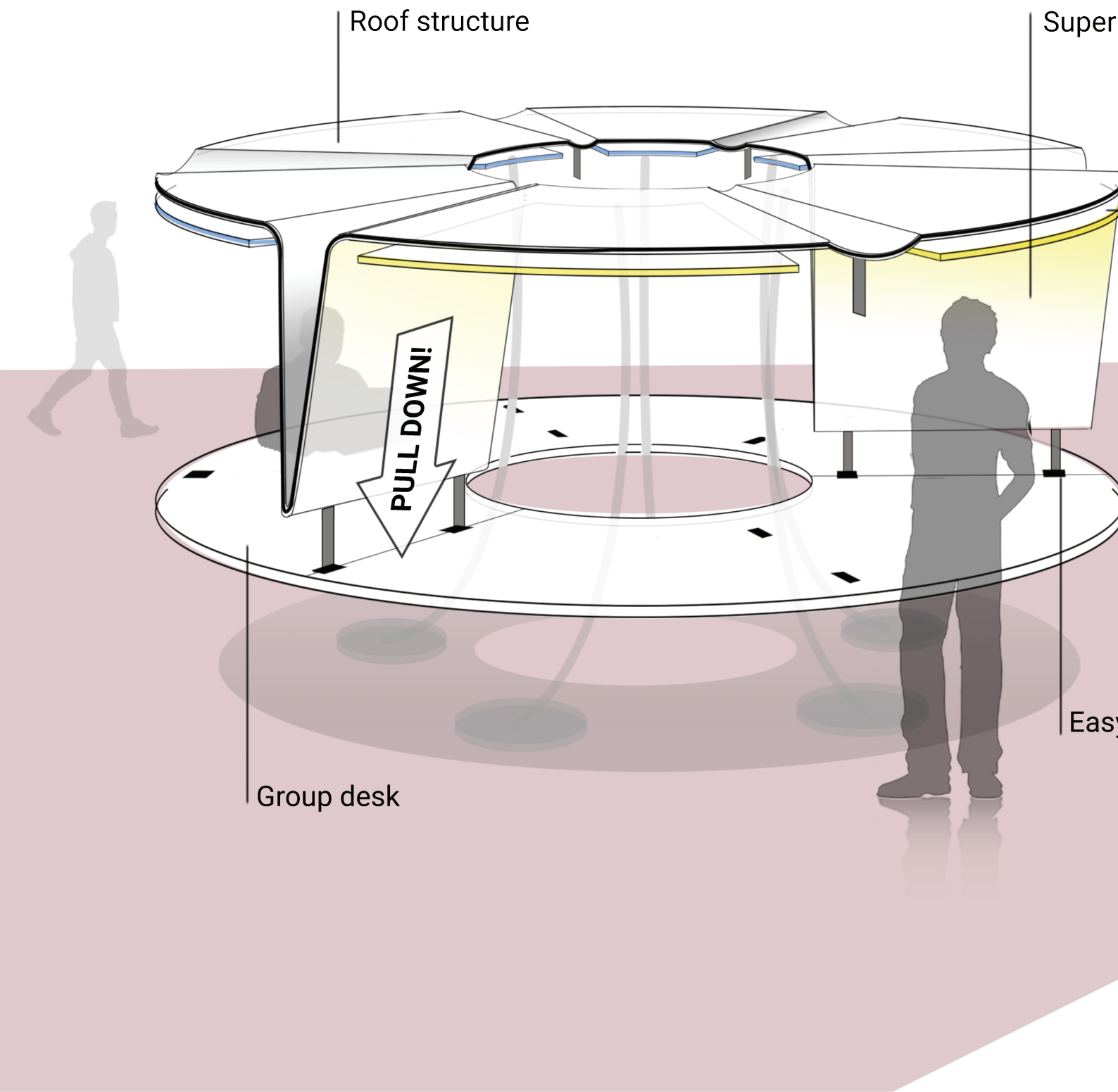
*TENSIONS*

This concept addresses the tension between: dividing tasks in group meetings and individual execution of these tasks. It provides a private feel without being to obtrusive. The fabric used in this concept is an elegant solution, it also reduces sound levels around the user. The lighting at the outer edge can be used to signal that the user is open for discussion or is rather be left alone. It is a low-tech solution for the groups that are in the content creation phase and need to divide tasks.

stretchy fabric

Indirect light
source

y clips

Super stretchy fabric

Indirect light source
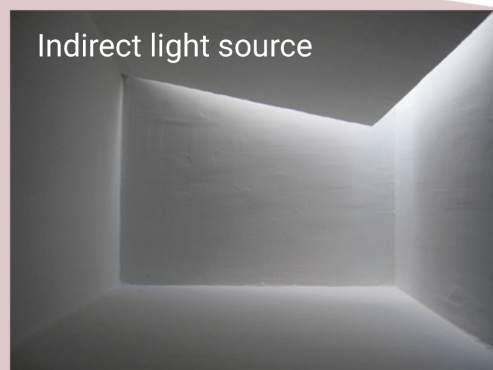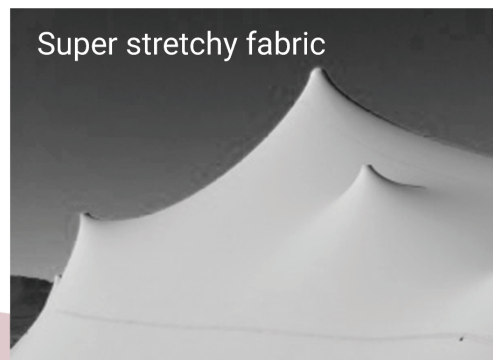
Easy clips

# Final concept

The final concept basically combines the physical design of concept 1 and the facilitator capabilities of concept 2. The round design of the room and the table is a logical step after determining that a group and its teacher should be at the same level. The room is flexible in use and available for all different types of uses. The group that uses this room can choose to work atonomous or be guided by the facilitator capabilities. To access these capabilities, students must log-in to an app and connect with the REALM space.

# REALM

*PANELS*

The space consists of a 'master panel' that encases the other panels. If all the panels are enclosed in this 'master panel' it only shows the table and the panel with the display. The other panels slide out, just like in a geography classroom. It has enough space between the panels to leave magnets and post-its attached. This way the group, when part of a course that reseved the space for a longer time, can easily start from where they left off.

In this base form the room serves two purposes: it could be made into an exhibition space or people can just slide a chair over and work. Then the space is in it's passive state. The room can be setup by hand: adding chairs, sliding out a whiteboard or connecting a laptop to the display for a small presentation. The room can be completely adjusted to the needs of that individual of group.

*ACTIVE / PASSIVE*

This passive state also allows the group to ontrol the setup of the room. Another function of this concept is to let the room take on an active role as a facilitator. The room then needs to be closed up, by connecting all 4 panels. Through an application a program can be chosen that facilitates a specific part of the project. This could be a brain storm session, content creation, etc. Each of these stages has their own physical set-up, that might change during the session.

These changes are subtle, but on a timed schedule. The table rises slowly when it is time to have a group discussion, so everyone finshes up and stand to talk about it.
Or the music turns on when in a brainstorm session. It slowly fades away when it is time to switch assignments. These programs can be created by teams themselves, in the application. Or by teachers. The room acts just as a facilitator. But there is a difference, it cannot adjust the program while being in the middle of it. Not like an actual teacher it can adjust mid-session to ensure a more tailored program and better result. This could be possible if you track and monitor the students.

A possibility would be if the teacher, most of the time overlooking several groups of students, could alter the program. It could log in with the same device and see where they would be within the selected program.

It depends on what level of independency is asked from the group that enters the room. If it was a descision made by that group only to do a session or if it is part of a course.
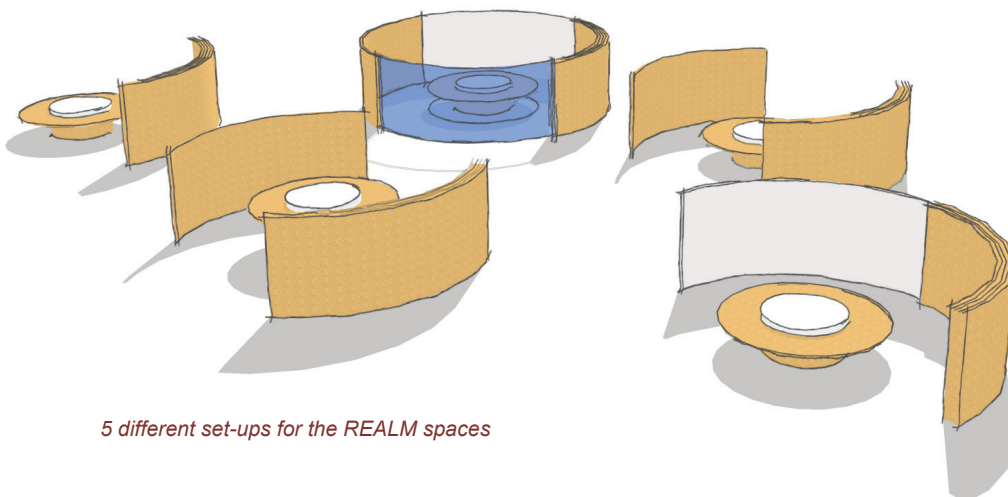


*5 different set-ups for the REALM spaces*

*APPLICATION*

The REALM spaces can act as a facilitator by asjusting the space, the music and the lighting in the space. So the 'master panel' has an built in system that controls these environmental changes. This system can run different programs that are designed and chosen on an application. This application is connected to your student ID and only works if you log in with your NetID.

In the passive state this REALM space could operate as any other study space. The tables and chairs are there, power sockets are available and wireless internet is everywhere.

If REALM is used by a course coordinator for a longer period of time the panels can only slide out if the space is activated. This way created content can stay on the panels and groups can start from where they left off. If not, then the panels can just be accessed by everyone.

Students could rent this space for a maximum of three in hours, similar to rooms at the TU library. Or they could be reserved by course coordinators for extended periods.

*The facilitator function visualized*

# Use scenarios

These modes can be selected beforehand in the application or custom made using the tool in the same application. These modes are now given names, but they are flexible in use and some 'modes' may be used in a different mattters by the students.
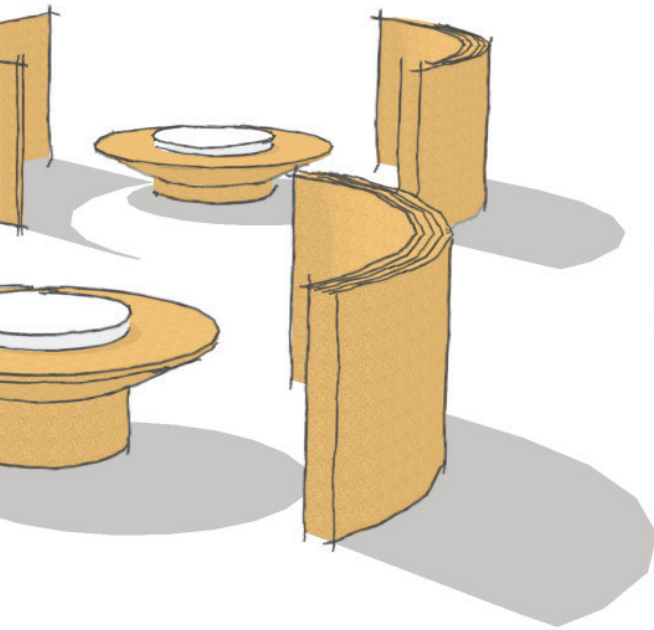
## DECISION MODE

This mode adresses the closed circle in which the group can work, but also the possibility of activating the facilitator functionality for a creative session for instance.

## EXHIBITION MODE

The exhibition mode shows the panels all hidden away in the main body, creating an open space. Still allowing posters to be put op or a video played. The table in front can be adjusted in height and act as a display stand.
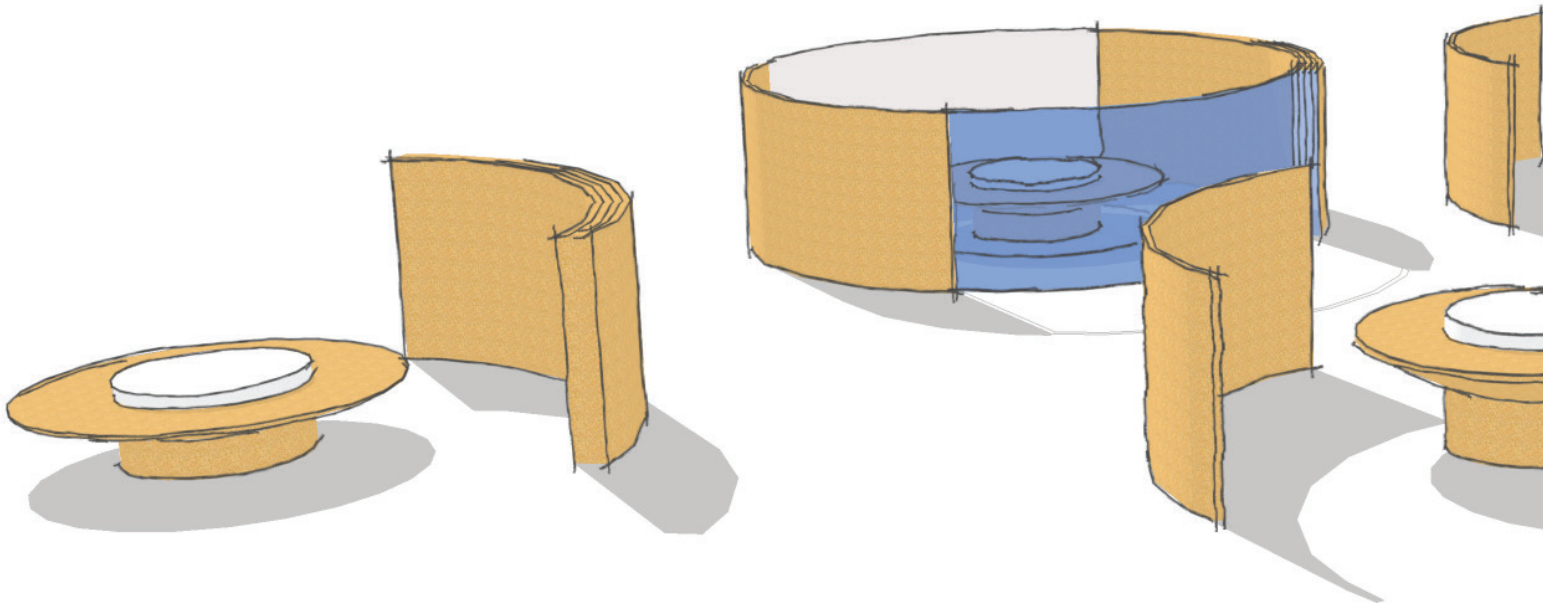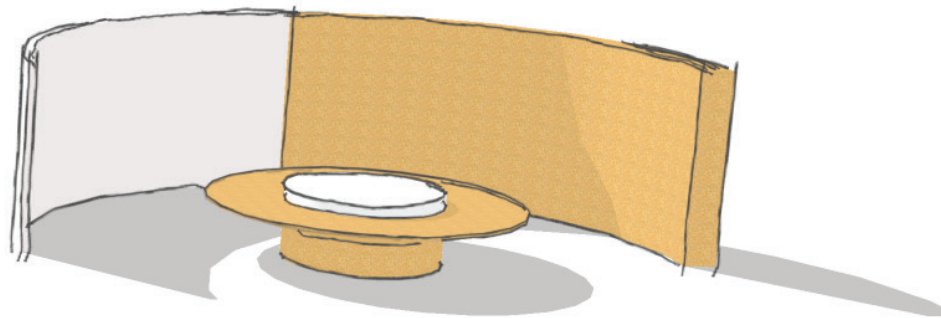
## WORK MODE

This mode is the basic set-up of chairs and the table on sitting height. Two panels can be used to hang stuff or draw on. It is also an open space with not much confinement.



## CREA(C)TIVE MODE

The space can be freely adjusted to the needs of groups that work indivudaully or together or everything in between. Most of the work is sat down. But walking around and drawing on the walls is encouraged. Teachers can easily walk by and participate.

## COFFEE MODE

This mode is the standard setup when not reserved. The space has a high table for active discussions and some short term working. It could also function as public space, where posters could be hung.
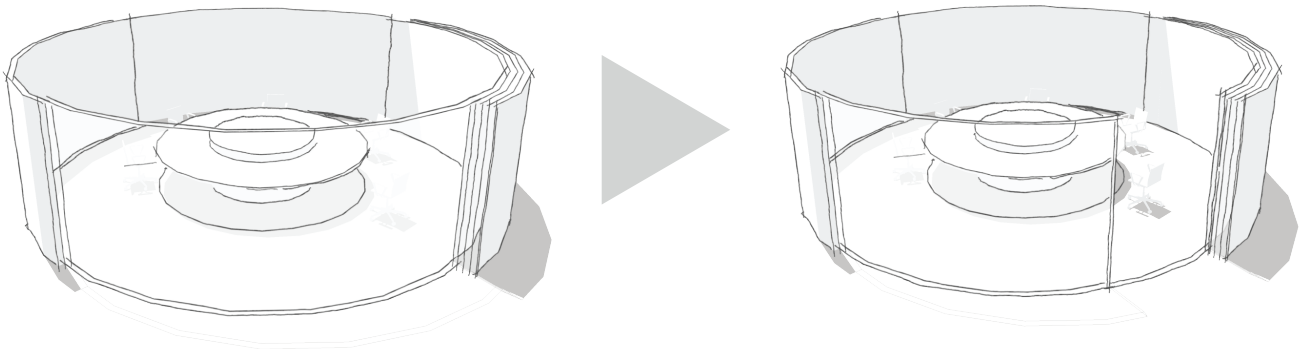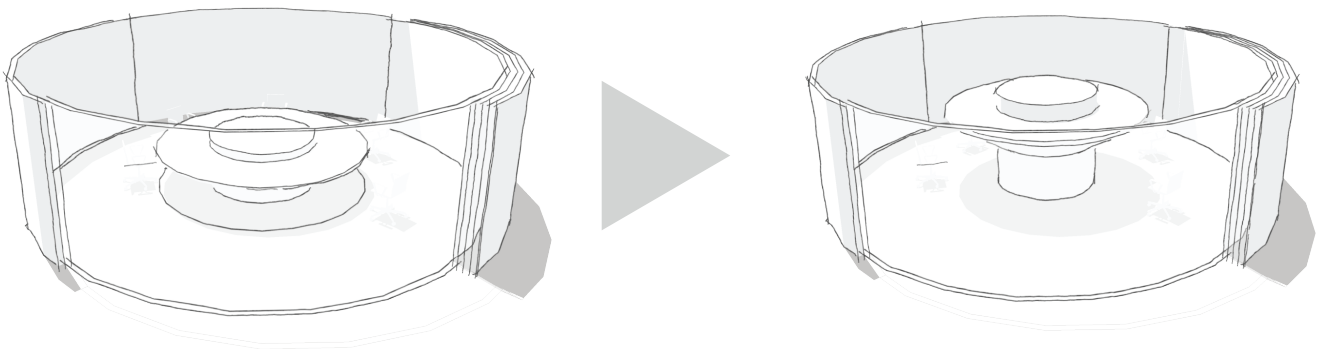
Students reserve a spot via the application, either via their smartphone or laptop. This room is available, but needs to be unlocked by the students.

The students also select the facilitator function, the room will change accordingly. The facilitator will

When the session ends, the room opens up since it is not reserved for the rest of the day. So the space becomes available for all the students. The room still utilizes an extra wall for stuff to be put on. It is accesible from both sides, becoming a less obtrusive object in the environment.
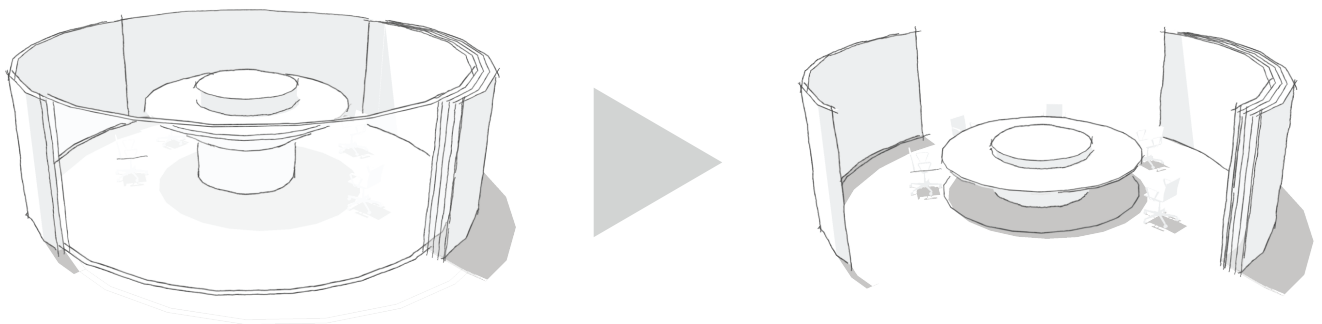
REALM is available as it is not reseved by a group of students or a course coördinator. So it is open. A group of students decides to make use of the space and manually adjusts the panels and height of the table to what they need.
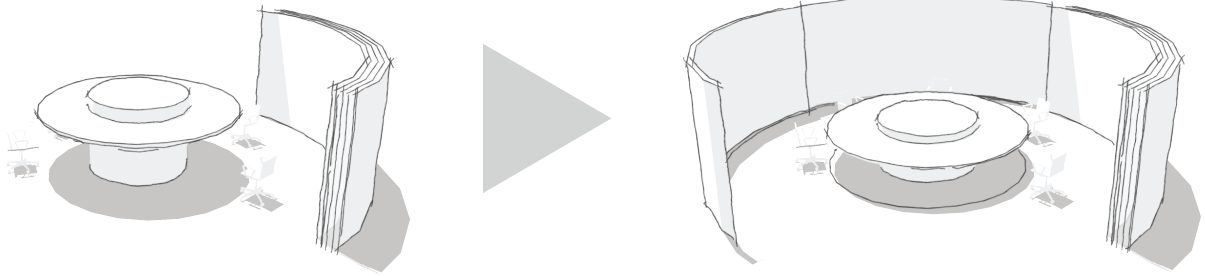


The group is working individually and at the end of the morning they need to make decisions on what to do next. They decide they need some coffee and become a bit more active. The door gets closed and the table raised for standing discussion.
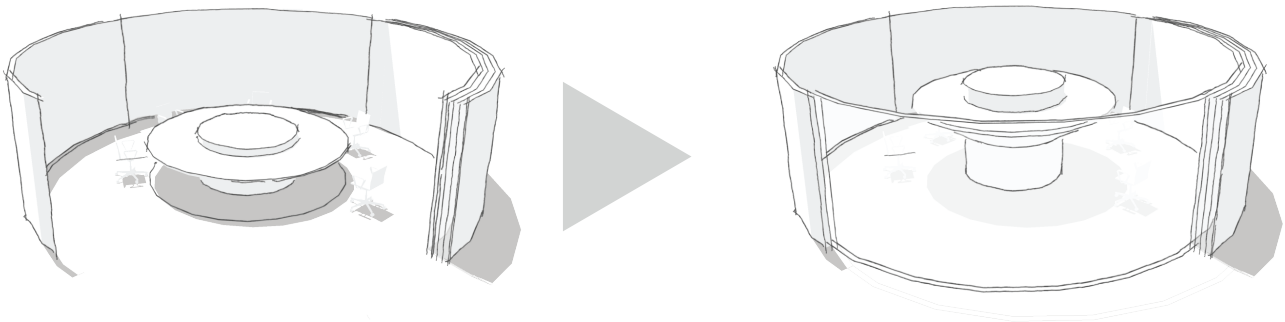


After everyone goes for lunch, the space transforms to an open space. When positioned in the main hall REALM can function as an extra set of cahirs and a table to have lunch.
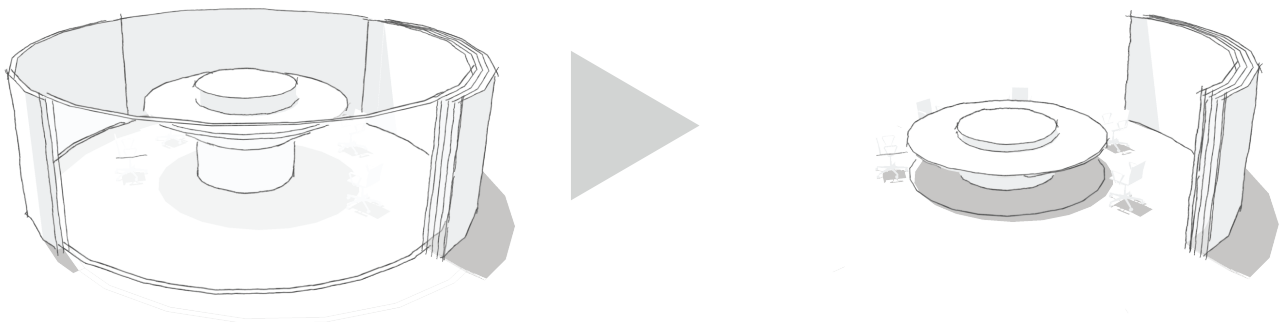
*IN CONTEXT*

This image shows that the space can be put in the existing IDE faculty without compromising the open vibe of the main hall. And function as a closed of group working pods. When opened they function as any other table.
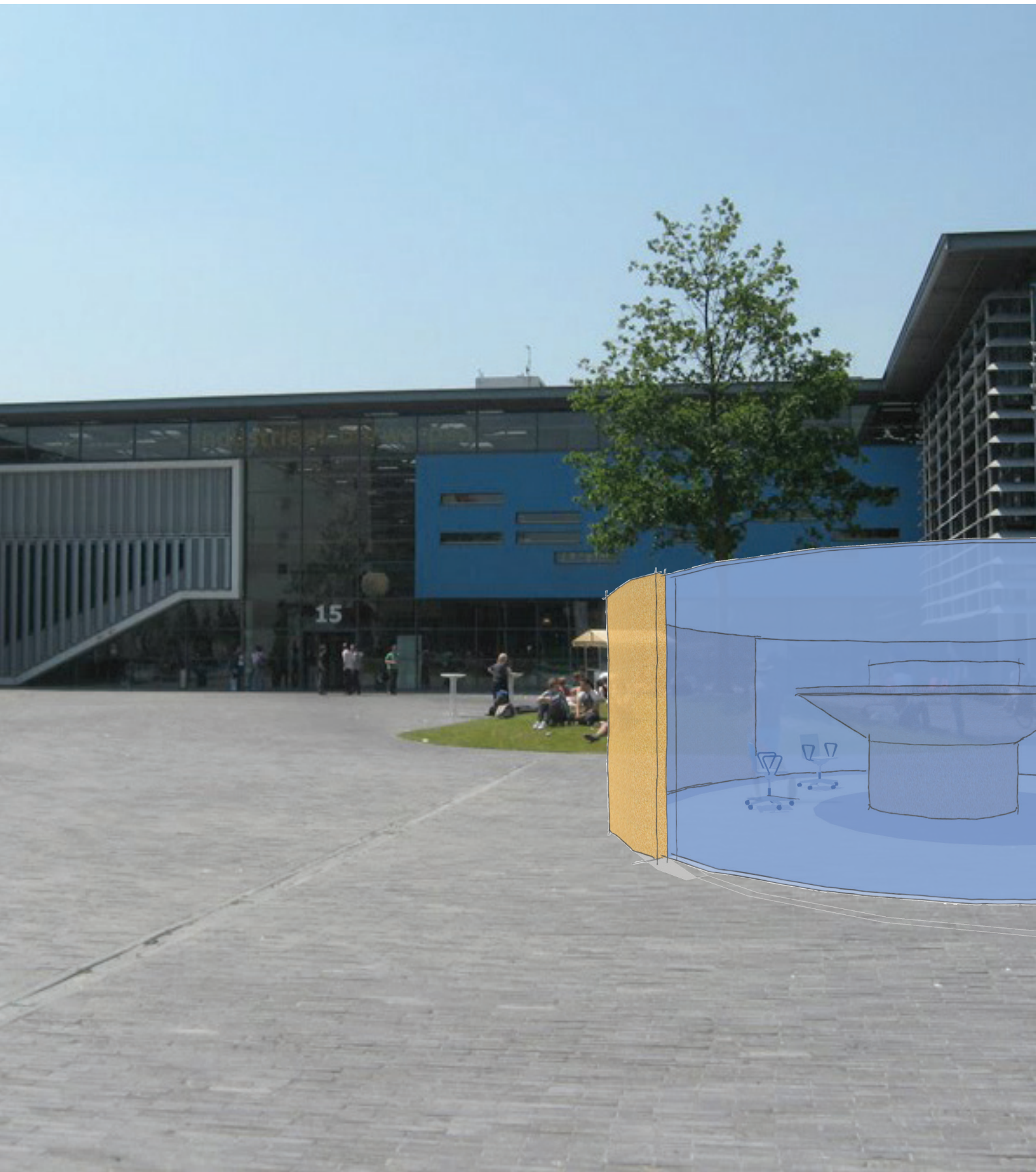
## IN CONTEXT

REALM can also be placed outside. If further developed as an outdoor proof concept, it can very well function as an outdoor facility. Fresh air and natural light improve energy levels as found in the research phase of this project.

# 5

# PART 5
# CONCEPT TESTING

# User test

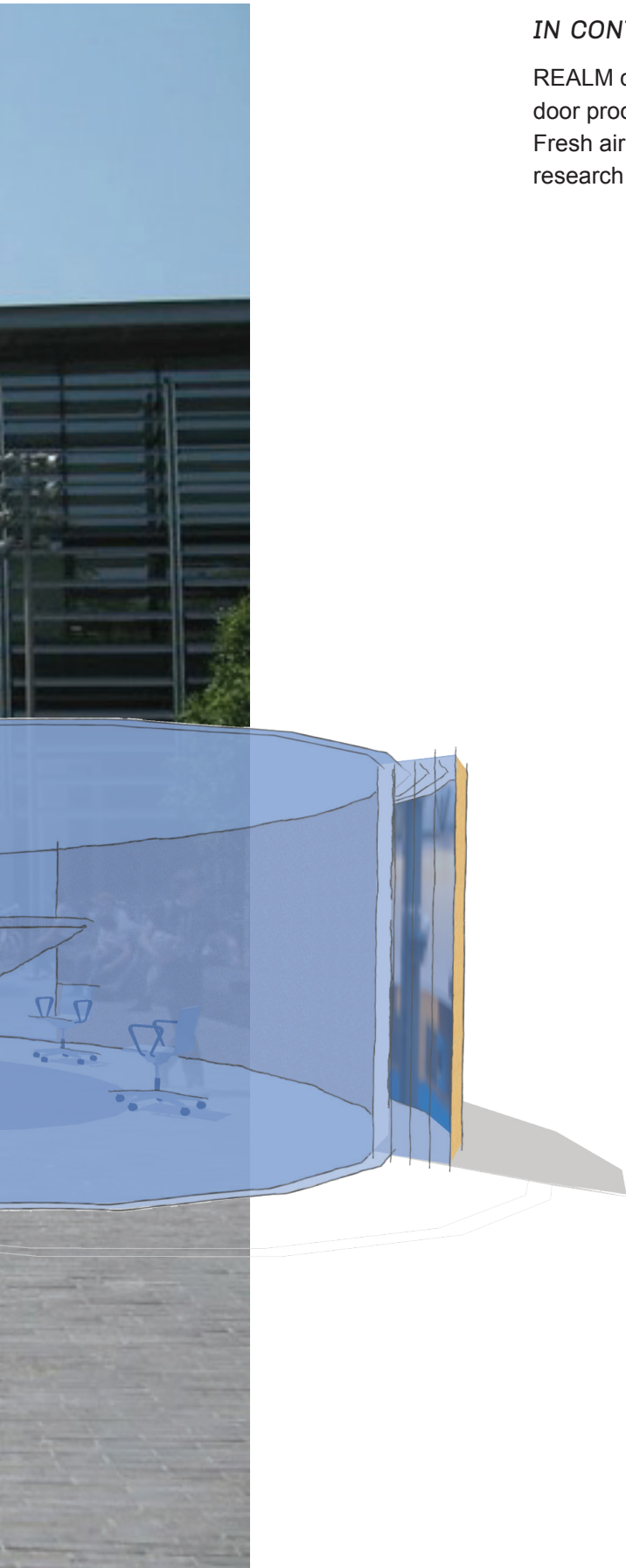The concept is well thought out, but it always used the assumption of a generous space in which the group could make an custom setup. As described in part 3 a space can influence the group and make it more effective in certain phases of the project. REALM focusses on changing the flow of the group, and raise the efectiveness, by taking on a facilitator role. A group is considered more effective if similar results in productivity can ben made in less time. Thus, wasting less time discussing the approach in stead of the actual content of a project.

In this part of the project the optimal dimensions of a space are researched per activity. These activity are taken from the scenarios made in part 4.

*WHY DO WE TEST*

The goal of this test is to find out what the spacial perception does to the workflow and effectiveness of a group at work. By performing predescribed tasks, within the natural course of a group work day, it is questioned if the original diameter, 8 meters, of the space is sufficient. Or not.
The original concept is based on a very spacial assumption of a large diameter round space. Different sizes of rooms have different influences on the interactions within a group and thus shows a differ-ent way of communicating and working. This test tries to match the characteristics of a large or small space to being afffective in different group tasks.
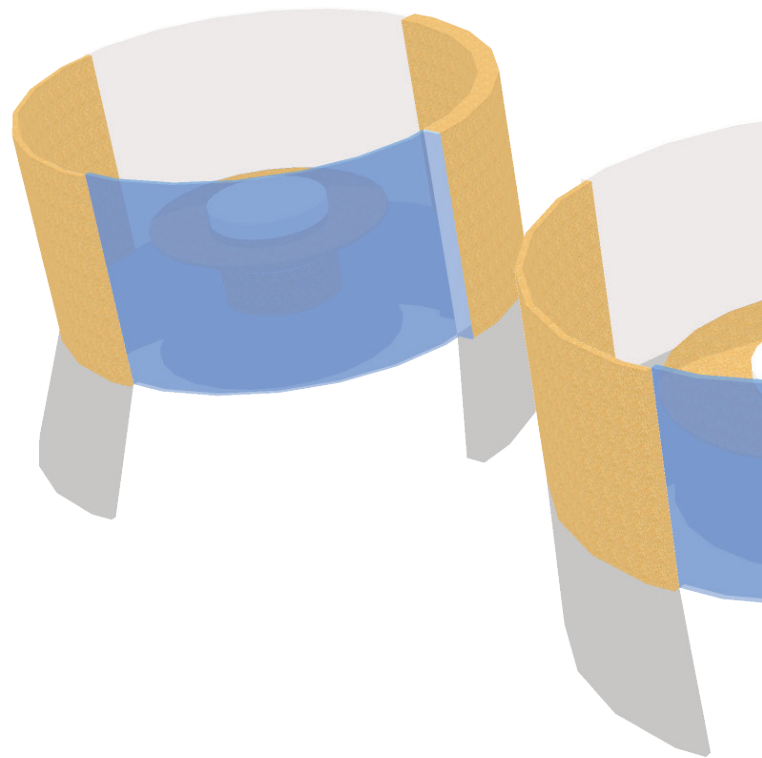
*TEST DESIGN*

The test group was not aware of the meaning behind their assignments. They were told afterwards and sparked some valauble insights that were noted and used in the recommendation part of this project. Also these groups were fairly autonomous in how they worked. They have experience in group work and facilitating a bit.

The groups get 3 exercises each.

•    making a plan for the day
•    facilitate an effective brainstorm / co-op session
•    working individually in the same room and help eachother

These three group interactions all affected the design of REALM in spacial terms. After all the three exercises we discuss how the space in which they worked affected the interactions during the individual exercises.
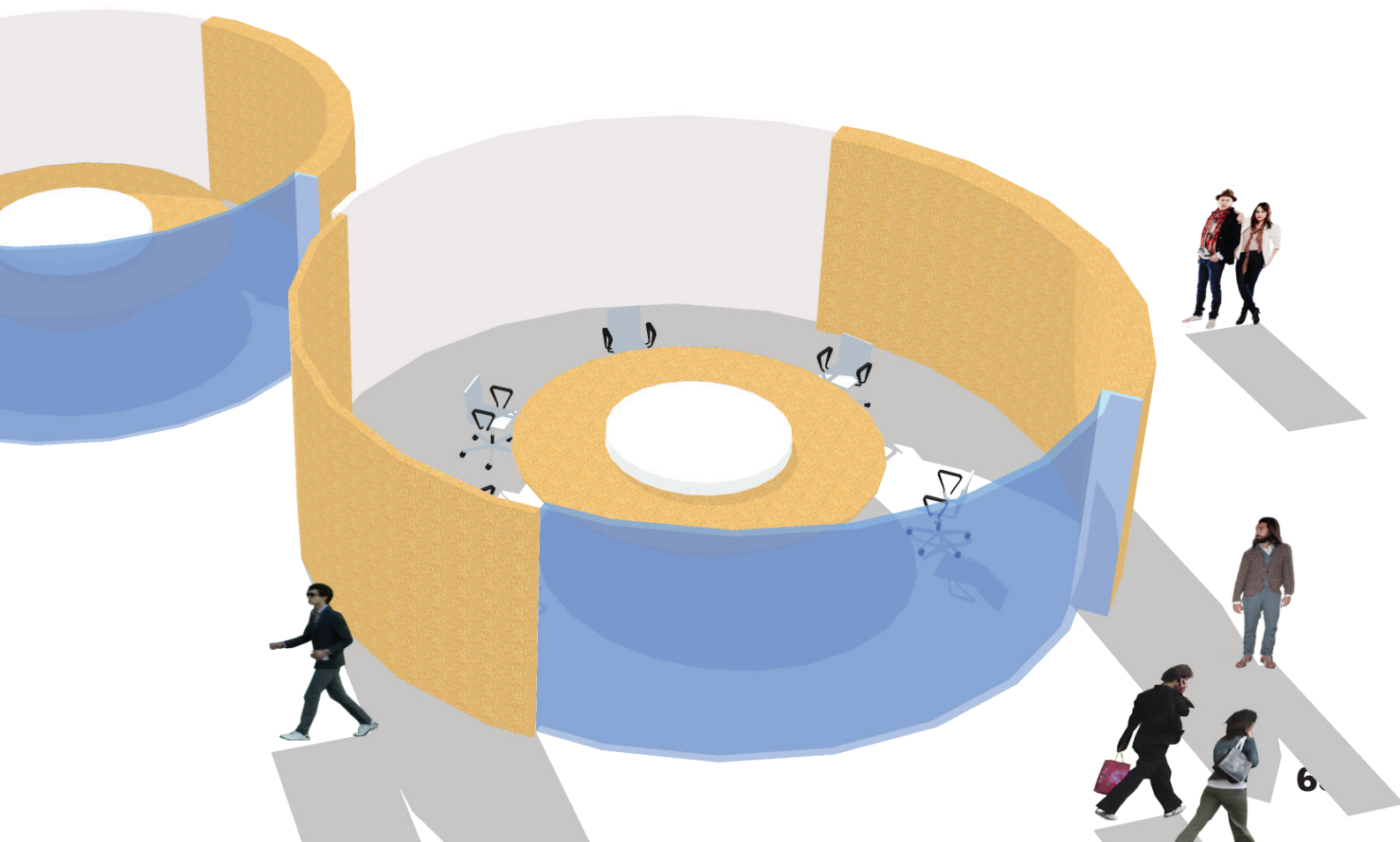
*TEST GROUPS*
Two groups of students of the faculty of IO were tested. This is group 1 and 2. Group 3 worked at the Architecture faculty. All groups were experienced in group work and worked fairly autonomous. To not disturb them too much I asked them to incooperate their own tasks of the day. With the elements added which I described on the previous pages.

All three groups knew eachother fairly well as they were working together for a couple weeks already. Group 1 was put together by me and groups 2 and 3 were pre-existent.
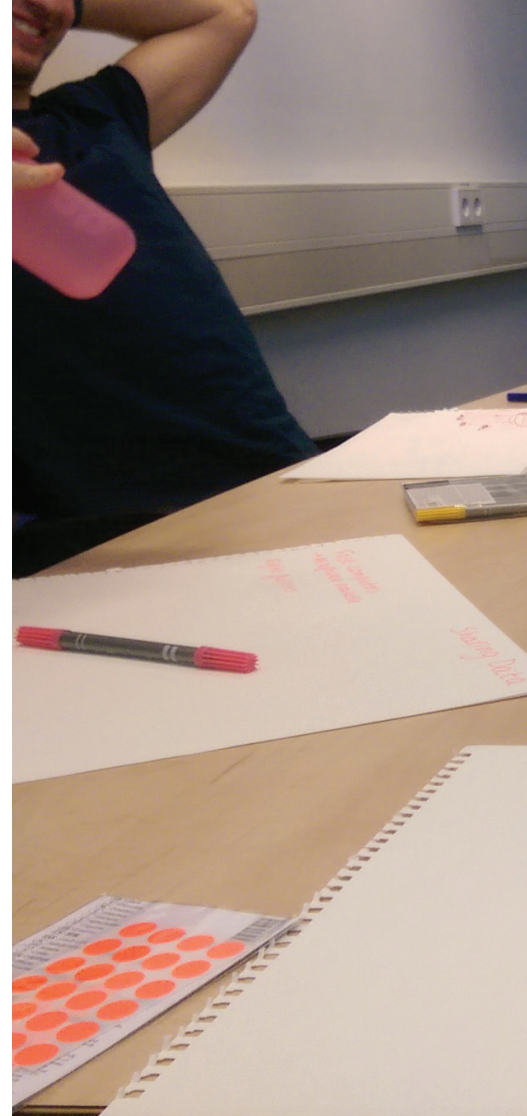
group 3

group 1

group 2

# conclusions

*RESULTS*

Overall the groups came with their own initiatives for creating the specific tasks given. Only group 3 needed some advice on how to fill in the brain storm.

All groups found exercise one short but useful in creating a llitle bit of oversight on what they were do-ing that day. When sat down not much energy is put in the first exercise. Group 2 showed, with having the coffeecorner around the room, that standing up and getting coffee actually raised the awareness level and gave this exercise a different vibe then with the other two groups.

Exercise two was conducted by group 1 and 3 by tackling one group members specific problem he and she was facing in their individual tasks. Group 2 brainstormed about a common group problem. Only group 1 made one guy responsible for leading the session in exercise 2.

The three groups more or less performed exercise three very much the same, but there was a big difference with group 1. Unable to move during the last exercise made for a chaotic atmosphere, peo-ple started talking 'over' the table, instead of standing up and talk quietly next to eachother. Also the cramped space with group 1 proved useful for exercise 1, but eventually resulted in a group that sat down during all threee exercises.

*CONCLUSIONS*

A natural leader is doesn't always stand up. Group 2 was the only group that dispatched one member as a facilitator during exercise two. In this case a room like REALM would definitely help group 1 and 3.

Standing and walking gives a short exercise like planning the day a more refreshing and active feeling. Walking around is not always preferred, but in these superficial exercises it actually helps. Also standing and raising the awereness levels helps keeping things short and effective. A room in which groups work should have a standing element.

They say sitting is the new smoking. Group 1 sat down during all three exercises and they looked fatigued when they finally stood up. A more active approach to certain aspects in group work can benefit the work rate and level of attention during the day. This will eventually result in a better performing group.

Space plays a big role. Enough space allows for walking and standing and spacious workspots in the same space. On the other hand a smaller, but espescially a smaller table make for more intimate interactions. Group 1, with the smaller table, said working together and discussing was easier. When you have to walk around or speak loudly to adress everyone it doesn't work either.

One could argue that the space, or at least, the table should change in size during all phases of a group working day. To even further influence the groups performance. The facilitator function of REALM could incoorporate this in the future. The main contribution to the design of REALM is that the space does affect how effective a group works in. And if it could change physical attributes to match the needs of the group it would make for a very powerful concept.

*CONCLUSIONS OF THE PROJECT AND REFLECTION ON THE DESIGN PROCESS.*

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# PART 6
# CONCLUSION

# Conclusion summary

### CONCLUSIONS PART 1: NEW LEARNING

- An unlimited source of information.
- A structured environment to engage in the unlimited acces of information.
- Intrinsic motivation for the studen can be created by a different approahc to teaching.
- IDE has a lot of group projects
- TU Delft invests a lot in new individual workspaces and lecture rooms, but hardly any in group focused teaching methods.

### CONCLUSIONS PART 2: GROUP WORK

- In the IDE department there is a lack of knowledge in group dynamics among students. Training in group dynamics
- Transformative learning is preferred if the students need to be independent.
- Groups need to transform to teams, but only in certain situations.
- Groups can be very effective if not homogenous, but with the right guidance.
- A predertermined group dynamic, like SCRUM, can be very effective in raising the effectivenss of a group.
- Discussion and students teaching students greatly increase retention rates of new material.
- A facilitator greatly increases the effectiveness of a group.

### CONCLUSIONS PART 3: NEW SPACE

- The space should accommodate groups of 6, as most groups within IDE have that many people.
- The space should be a multi-purpose space, flexibility and customization should be key.
- An equal share is expected from all group mates, so the space should reflect en encourage that.
- The space should support the team building process, but not take over this responsibility
- It should have unlimited acces to information.
- A project has many different phases, thus different needs. The space should be flexible in set-up and easy to change.
- The space should have an unobtrusive appeal so it blends in the faculty well
- Interactions between the group and space should be subtle.
- Equality between team members and teachers should be elicited by the space

### CONCLUSIONS PART 4: CONCEPT

- REALM has an facilitator function that helps groups be more effective during group work.
- REALM can be reserved and a selection can be made for a specific activity that will be facilitated.
- The spaces have the ability to adapt to all kinds of passive use scenarios.
- They TU Delft could first test at the faculty of IDE and later expand to even outdoor locations.

### CONCLUSIONS PART 5: CONCEPT TESTING

- A human facilitator doesnt always present itself within a group, REALM could fill the gap.
- An active posture during group work raises effectiveness. A room should provide this functionality.
- Spacial design plays a big role in the effectiveness of a group, other factors like sunlight and fresh air should be implemented as much as possible to ensure longevity to an effective group.
- The functionalities of REALM could be even more immersive, sound, lighting and changing dimensions could be part of REALM in the future.

# Answered research questions

- How can we define "The New Learning Culture" and what does it mean in higher education?

The new learning culture is defined by unlimited acces to information and knowledge, while operating in a safe bounded playground. Higher education has a big step to make in terms of curriculum design, learning space design and motivated teachers. Especially group projects could benefit from the new learning culture.

- What makes effective group work and how does is compare to the current situation at IDE?

Group work can be effective in two ways. Sharing a commitment to a goal and everyone knows how to get there in the best possible way. A group can also be effective if it has to perform under time pressure and it has a strong leader. The current situation at IDE is that most groups don't have a shared commitment or a strong leader.

- How can we intervene in group dynamics from a spacial standpoint?

Space can motivate the individual and possibly the group. But a space can take a leading role in becoming the facilitator that dictates what needs to be done by changing the physical and non-physical  atributes in a space. Sound, light and a scripted program can already take over the facilitator role. More immersive experiences would be possible at a higher state of automation.

- What kind of group space is needed at IDE to fulfill the needs of the target group?

As described above IDE has lots of groups that struggle to be effective. A space that facilitates certain parts of the group process, thus intervening with group dynamics, could improve the effectiveness of the groups. At the same time it could help form a better band and make better team.
In terms of flexibility the group spaces should not be obtrusive for the other students, they could even take on other passive roles as extra individual workplaces or an exhibition space.

# Recommendations

*RESEARCH*

Space is a factor in how effective a group works. But is there are many other factores that affect the effectiveness of a group. The overall condition of the body and mind can be affected by food, fresh air things that can be tested by simply going outside or providing the test groups with proper nutrition. factors that apply a bit more to this project could be a color study or working with lighting. To create an even more immersive experience when the facilitator mode is activated

Group work apparently doesn't always have to involve becoming a team (part 2) . But the effectiveness of a group is raised if everyone knows what the other groupmembers are like. Further research should point what the facilitator can and can't do to expose the capabilities of a group beforehand. If a student makes a user profile to use REALM, it could be wise to see if this personal profile can be expanded to a level in which REALM knows how to adapt it's facilitator function to specific kinds of individual behaviour.

*TU DELFT*

Since much projects are group projects at IDE, it would benefit from actually teaching on how to be effective within a group and manage a group. The biggest take-away from this project is that the curriculum could use some kind of course on being a project manager and an effective group leader. It relies to much on natural leaders now, while many students would benefit greatly from such experience later on in their careers.

On a different note, the space that is presented in this report poses a viable option for the TU Delft to research the effects of space design on group work. Or even individual work. This project used group work as a base, but individual performance can be affected just as much by a space. I think it would be good step if the TU Delft continued resaerch in space that dictate certain dynimics within the group.

*HARDWARE*

This project presents a concept, one that has a thoughtful design, but it still needs a next step. If REALM becomes fully automated, so not only the facilitator function, it needs more designing. Wiring, construction plans, etc. That all should be developed.

*SOFTWARE*

The facilitator function needs development in terms of voice acting and wrting programs that can react on input from the students. The application that is an integral part of the interaction bewtween students and REALM also needs development.
Again the level of automation determines how much is needed terms of developing software.

# reflection

I believe the concept of this project is very strong and I really believe that managing group work is a bit of a subjugated child in the IDE curriculum. during this project I realized two things: the first, students at IDE have so much potential that sometimes goes unnoticed because of a couple of people that naturally take on the role of a leader. Completely normal behaviour, but it would be such a valuable experience if every student could develop that part of their competences a bit more.
Two, that there are very little really good group spaces on IDE. Most groups swerve around the main hall gathering square tables to be able to work together. a faculty with so much group projects should really take a look at how effective those spaces actually are.

*PROJECT*

This project and Marieke gave me the chance to do again something I really love doing, which is to create a future vision and design something that fits into that vision. And while doing that stumbling upon discoveries that proved to steer the project in ways I never predicted.

I'm grateful for the freedom that was given me to discover in this project. It all came together by the guidance of my mentors. Which gave me a lot of structure and advice, I can get carried away sometimes. But that is a good sign, it means i liked doing this project.

My academic writing is not my strong point and because the project went so fast, it was sometimes hard for me to keep up with the writing and making the report.

The user test was conducted on short notice due to unseen circumstances with the original plan. I was planning on building a round space with some kind of curtains to mimic the roundness in my concept and then let the groups perform certain tasks and talk to them afterwards. But then holiday time came and the main hall of IDE was being restructured. Eventually I went a different route, but I still managed to get valauble insights in the spacial design of the room.

The approach changed during the project to a more leading role for the designer. The first part of the project was fairly much researched based, but it quickly became more of a project where the designer is guided by the target group, rather than strictly basing dimensions and functionalities on very strict research work. I think a good designer dares to take on this role and responsibility.

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