FACILITATING TEAMWORK IN THE DESIGN PROCESS: REPERTORY GRID AS AN APPROACH TO EXPLORATORY INQUIRY

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By approaching the Repertory Grid as an exploratory design game and drawing on insight in diagrammatic reasoning we argue that this approach is useful in supporting team work in the design process. In this paper we draw on two courses inviting textile design students to contribute to the development of the Repertory Grid – originated in psychology as a one-to-one interview technique – into a tool for articulation and dialogue. Especially the concept of eliciting bipolar constructs using the triadic difference – asking how two elements are alike but different from a third one – proves to support in-depth investigations, open-ended discussions and the formulation of collective proposals and agreements in the design process.

KEYWORDS
Repertory Grid, dialogue tool, diagram, exploratory design games, design process, textile design

INTRODUCTION

In this paper we propose that the Repertory Grid technique (RG) – originally developed within psychology – can be transformed from a qualitative one-to-one interviewing technique into an interactive, powerful and dynamic dialogue tool. We will argue that especially one step in the RG – the process of eliciting bipolar constructs – seems useful for articulation and dialogue. We are suggesting an approach to teamwork in the design process, which aims to contribute to design practice by drawing on insights from exploration of the potentials of RG in an educational setting. This paper is based on two week-long courses conducted at Kolding School of Design in June 2007 and May 2008, respectively. The students were invited to actively explore RG and contribute to the development of the technique into a tool for articulation and dialogue.

The work of a professional designer includes areas as varied as aesthetic and functional form giving, problem finding and problem solving, trend and market research, project coordination, involvement in multi-disciplinary project teams, and collaboration with various stakeholders such as customers, suppliers and end-users. Looking specifically at the design profession we stress the need for designers to address issues such as their contribution to, communication about, and development of existing as well as future design. We stress that a dynamic interactivity in multidisciplinary groups as well

as interactivity between participants and design material is crucial for an in-depth and meticulous design process. In the process of developing design concepts and design ideas it is commonly accepted that there is not just **one** answer. However, there is always **an** answer. We propose RG as an appropriate dialogue tool in order to achieve and create knowledge in the design process, hence developing **an** answer.
RG is acknowledged as a psychotherapy technique in psychology and as a decision-making tool in product evaluation. In our reflections we draw on insights in diagrammatic reasoning (as described by Stjernfelt, 2007) and the notion of exploratory design games (Brandt et al, 2008; Ehn & Sjögren, 1991).
RG offers an accessible and simple structure which can easily be adapted and elaborated. Furthermore the technique encourages empathy and interaction, which, as stressed by Sanders and Dandavate (1999), is crucial in order to get access to e.g. end-users and other stakeholders' tacit and latent knowledge.

In the following sections we first give a short introduction to RG and our method of applying the technique when teaching design process. We then present the set-up for the two courses followed by the findings. In the analysis we examine the underlying mechanisms of RG, and, based on the findings, we reflect on the benefits of using RG in teaching of design. In the conclusion we point at relevant themes for the design process synthesised from experiences, findings and reflections.

THE REPERTORY GRID

THE PERSONAL CONSTRUCT THEORY

The Personal Construct theory - a psychological theory of human cognition - is the parent theory of the Repertory Grid technique. It was developed by the American psychologist George Kelly in the 1950s (Kelly, 1955) and offered an alternative to e.g. behaviourism and the Freudian approach to psychotherapy. The basic assumption of the theory is that all human beings are scientists in their own lives: We have expectations (i.e. hypothesis), we test them (i.e. bet on them behaviourally and take active risks), we live with the outcomes (i.e. observe the results) and change our minds or ourselves (i.e. modify our theory). Our personal construct system is thus the implicit theoretical framework each of us creates and constantly re-creates when we strive to make sense and give meaning to our lives (Fransella et al, 2004:5-6). Kelly developed the Repertory Grid as an interview technique allowing the client and the psychotherapist, through conversation, to explore the person's construct system, i.e. the way in which the client views the world. Later on, the Repertory Grid has been adapted to other fields including decision-making in product evaluation.

THE REPERTORY GRID APPROACH

Traditionally, RG is divided into four steps: selection of elements, eliciting of constructs, rating, and analysis. In the first step elements relevant for the 'problem' is selected. In the second step, bipolar constructs are elicited. Very often this is done by means of the triadic difference, which is defined as follows: "Presenting three elements at a time and asking 'How are two alike in some way, but different from the third?'" (Fransella et al., 2004:29).

STEP 1:
A selection of elements

STEP 2:
The triadic difference forms a bipolar construct,
here smooth >< coarse

STEP 3:
A rating of all elements according to the bipolar construct,
here smooth >< coarse

Figure 1: An overview of step 1-3 in the Repertory Grid approach.

The construct is visualised as a bipolar scale; on one pole the respondent will describe what aspect these two elements share, and on the other pole the respondent expresses what it is that makes the third element different from the other two. In the third step the elements are rated according to the bipolar construct. Traditionally this is expressed by numbers. The fourth step is analysis. This can be performed in various ways, but typically the ratings are placed in a matrix grid and analysed using factor analysis. The name Repertory Grid refers to the grid analysis as well as the repertoire of constructs which a person has developed.

OUR APPROACH TO THE REPERTORY GRID

In our work we particularly see the potential of RG in the second step: the concept of constructs based on triads. The way in which the constructs are identified is what makes RG useful, since it provides a way of describing people's construct systems without prejudging the terms of reference. We find that the process of eliciting constructs provides a basis for articulation and dialogue in the design process, and we also find that analysis can be performed during the negotiation process eliciting constructs and agreeing on ratings. The table below outlines the steps in a traditional approach to RG compared with the way we have applied the technique in the design process.

Traditional approach	**Our Approach**
One-to-one interview	Group dialogue
An investigator questions a respondent	All group members are investigators as well as respondents
The process is facilitated by the investigator	The process is facilitated by the group, based on a design task
The process unveils personal constructs	The process constitutes interpersonal constructs
Subjective	Intersubjective
Elements are chosen either by the investigator or by the respondent	Elements are chosen by the group in a dialogue situation
Constructs and ratings are made by the respondent	Constructs and ratings are made by the group in a dialogue situation
Ratings are often expressed by numbers in a grid	Ratings are often expressed visually on scales
Analysis is performed by the investigator	Analysis is performed by the group in a dialogue situation
Factor analysis is being applied	Analysis is performed by negotiation during the construct-forming, ratings and the creation of 'what-if' scenarios
Output: Appointment of 'best product' or Results are used to form a strategy towards future, preferred situations or objects	Output: Awareness of artistic effects in the design profession or Results are used to form a strategy towards future, preferred situations or objects

Figure 2: Our approach compared with the traditional approach

In the following sections we will demonstrate why we find the forming of constructs and rating scales so useful for an exploratory inquiry based on teamwork in the design process.

EXPLORING THE REPERTORY GRID

Since 2006 we have done extensive research of RG in various contexts. At that time we were already working with articulation and dialogue introducing the students to use the loom as an interactive design tool, and to identify changeable parameters in the textile design process. Previous research, to our knowledge, combining RG and textile design, is focused on developing precise communication about tactile sensation (Moody et al, 2001) and about printed patterns (Homlong, 2006); both use RG as a qualitative one-to-one interview technique. The idea of using RG as a tool for dialogue originated in a pilot study exploring tactile sensation performed by one of the authors in 2006 (Bang, 2007). Among other things this study showed that RG was useful for an in-depth exploration of sensuous qualities.

In this paper we specifically examine two courses planned for textile design students at Kolding School of Design. The first course was intended to study articulation, and the second one was aimed at exploring RG as a tool for dialogue. Both courses focused on analysing existing textile designs as well as developing concepts for future designs. An additional motivation was the expectation that using Kelly's theory of personal constructs would be an advantage, letting the students feel they were experts, developing a (sort of) 'scientific investigation' of themselves.

The students were asked to bring their own fabric swatches and textile objects; they also had access to the school's fabric collection. In both courses the use of RG was introduced through lectures and kick-started in a setting facilitated by the teacher. Hereafter, the students could develop variations of the technique which they found most useful in creating new design concepts according to the instructions. As a result, RG was applied in a variety of ways during the courses.

The students were asked to report their findings in different ways: The initial course had a plenum each afternoon, where students presented and reflected on their investigations, and propositions for further work were discussed. On the last day the students also handed in a written conclusion about their experiences using RG and ideas for further work. In the second course the

groups gave PowerPoint presentations of their findings on the last day. These presentations included design concepts as well as reflections on the perspectives of using RG as a dialogue tool.

The initial experiment with RG in an educational context took place in June 2007, in a one-week course for second and fourth year textile design students conducted by Kirsten Nissen. The main purpose of the course was, through experiments, to develop new approaches for stimulating articulation in textile design. 'Articulation', in this case, would have a dual definition: the explicit verbalisation when talking about textiles, and the awareness of the artistic effects at the disposal of textile designers. Thus, the introduction was an invitation to join the work in a laboratory setting, where, through experiments, the potentials of RG in the development of tools for articulation were revealed.
At this first day of the 2007 course the students were asked to try out the use of RG in one-to-one interviews as well as in group discussions. The following days the students were asked to design their own investigations. They could choose to work individually, work in the existing groups, or regroup. They could select populations and triads that reflected a specific intention or they could make random selections. The investigation could concern different levels of textile design: e.g. material, construction, tactility, pattern, colour, function, purpose and style. After the first two days, working with constructs and evaluations of existing textiles, the students were asked to consider if and how RG could be a tool for developing future textiles.

The second experiment was a one-week course set up for second-year textile designs students in May 2008, conducted by Anne Louise Bang. The course was scheduled in the initial phase of a long-term design project introducing the students to various design methods. Here the students – working in groups of 4-6 – were invited to explore RG as a tool for dialogue. The instruction was to design a concept for textiles for lounge, office or transportation textiles. The students were supposed to focus on emotional aspects and were not allowed to develop technical or functional ideas. They were also encouraged to think of RG as a game and invite fellow students to participate in their work during the week.

FINDINGS

A TOOL FOR COLLABORATION

The very first test of the system in an educational setting attempted to mirror the expert-client situation, inspired by Kelly's psychotherapy approach (Kelly, 1955). In an attempt to execute an "unbiased laboratory-setting", the selections of textile swatches and triads were done by the use of a random generator. The evaluation of fabric swatches was executed one-to-one: one student playing the role of a client while another played the role of facilitator whose job it was to guide the client through the evaluation, noticing the client's 'thinking aloud' on pre-prepared forms.
Subsequently, groups of three students were formed. In this set-up all group members played similar roles, collaborating to obtain an agreement about how a set of randomly chosen textiles could be placed on a scale according to a bipolar construct, elicited by the group.
The result of these initial experiments was distinct. Nobody found the one-to-one set-up interesting. "Boring" was the overall comment and the reactions were convincing; during the rest of the week, all students worked in groups, and surprisingly they stayed in the original, randomly formed groups.
One could argue that the set-up of a one-to-one evaluation was an error of judgement because role-setting and purpose were not sufficiently clear to the students. However, collaboration in groups proved to work immediately. This led us to consider RG an appropriate tool for dialogue in the design process. Even though we had experienced RG as a tool for dialogue in a pilot study (Bang, 2007) this experience was a surprise to us. Our knowledge about RG at that time was that the one-to-one set-up was considered **the** way of using RG, and we were yet to discover the potentials of using RG as a dialogue tool.

FROM EXISTING TO FUTURE TEXTILES

The following examples show three different courses of action, using RG in the process of proposing new solutions.
A full-scale approach:

Figure 3: Eight stages on a bipolar scale

This group formed a bipolar construct about the concept of readability (easy to read/difficult to read) of a printed

pattern. Through dialogue and sketching they completed eight designs forming eight stages on the bipolar scale. Due to the complex and ambiguous concept, the group had a hard time discussing their work. Nonetheless, they succeeded in agreeing on eight proposals for new designs based on the bipolar construct.
A mathematical approach: From a triad of three highly diverse textiles, this group formed several bipolar constructs. As a design task they decided to make numerous propositions for what a new textile that incorporates a blend of specific characteristics of each of the three textiles would look like. They developed a system of mathematical formulas and calculated how to blend the properties of the original textiles.
A grid structure: This group worked with the concepts of summer and winter collections taking a starting point in 10 randomly chosen textiles. To clarify the concepts they worked with mind maps in a combination of several bipolar constructs based on the triadic difference. They investigated visual as well as tactile properties, and eventually defined a grid based on which they could make novel and interesting sectional cuts and recommend new textiles for a summer and a winter collection. This group also proposed a flow chart showing where RG should be used in the design process.

EASY TO HANDLE AND RECONFIGURE

RG is a technique based on a few and simple instructions, and the students found it easy to operate in a group-setting from the very beginning. It also enabled the students to shape the investigations in ways suitable for the specific purpose: *"[RG] can work on many levels because it is you yourself who define the characteristics of the two poles"* (from audio recording, translated from Danish by the authors).
One group decided, by brainstorming on a transport theme, that they would work with design concepts for seatbelts. They went through the bipolar constructs elicited from 12 materials and chose three which they found relevant for seatbelts: Breathable/non-breathable, soft/scratchy and static/stretchable. They judged all 12 materials on a sliding scale according to each of the bipolar constructs.
During this process they learned why some materials were better suited for seatbelts than others and that a material could be useful in one category and not in the other. Later on, in their presentation, they put it like this: *"We have discovered new tools and ways to analyse textile materials and images"* (from PowerPoint presentation). This shows that the students used RG as a tool for becoming conscious about their knowledge and experiences.

These and the previously mentioned examples of proposing future textiles show that RG is easy to operate, handle, and reconfigure according to specific purposes.

AGREED PROPOSITION-MAKING

Figure 4: Dialogue based on the triadic difference

In order to get a deeper insight into the seatbelt theme one group invited fellow students to elaborate on a selection of nine of the materials by making new triads and at the same time focusing on seatbelts. Based on this contribution the group was able to add images to their elements visualising the achieved knowledge. They continued working with bipolar constructs and triads based on the collection of images and decided to propose a concept for children's seat belts.
In their conclusions about using RG as a tool they stated that, among other things, it was able: *"To provoke a more in-depth discussion and generate an agreed dialogue when considering design solutions"* (from PowerPoint presentation).
Another concluding remark from one group was: *"Discussing the materials in triads helped us understand each other and come to an agreement on what we thought"* (from PowerPoint presentation). With this remark the group emphasised how, through dialogue using the triadic difference, it was able to empathise and to create a common ground for their investigations.

VERBALISATION AND DIALOQUE

In the initial process of learning how to work with the triadic difference one group investigated visual as well as tactile properties of fabric swatches. Through randomly selected triads they discussed and agreed on several bipolar constructs verbalising tactile qualities. In their final presentation the group made the following conclusion on the use of the triadic difference: *"It forces you to describe clearly why, for example, you*

find one sample more attractive than the other" (from PowerPoint presentation). This conclusion shows that the group found the triadic difference useful as a means of verbalising and arguing for a tactile experience. Another group also mentions how using RG in a group setting enables them to improve on verbalisation and dialogue: *"The essence is that we became better and better at finding the words and arguing in favour of them"* (from audio recording, translated from Danish by the authors).

Figure 5: Improving on verbalisation and dialogue

Several of the groups in the first course worked with the same selection of textiles for 2 or 3 days, and two groups formed bipolar constructs based on the same triad for days: *"We could do this for a week – eliciting more and more words (the student refers to bipolar constructs). Every time we do it new things occur" and "You discover how many nuances there are even though they (the selected swatches) at first sight look similar."* (from audio recording, translated from Danish by the authors). This exemplifies how RG stimulates in-depth exploration, and arouses the awareness of the artistic effects at the disposal of a designer.
Another group emphasised how the use of triads enabled them to cope with several elements: *"Often it can seem easier to focus on three elements, rather than on all 12 at once"* (from PowerPoint presentation). The making of constructs and scaling is an opportunity to obtain an overview over a larger selection of different elements.
These examples demonstrate how RG can be used for the investigation of different elements in various ways: one shows an in-depth exploration of only a few elements, and the other shows the use of the triad in an overview of a larger group of elements.

SUMMARY OF FINDINGS

These examples reveal that RG is not only a tool for evaluation but can also be used to design future textiles. RG is offering a way to establish a common ground for dialogue, and furthermore it supports the process of working with open-ended decisions during the design process. Even though we propose to develop RG further as an approach for exploratory inquiry in teamwork it should also be mentioned that some of the students have found RG useful as a tool for individual work.

UNDERLYING MECHANISMS IN RG

Until now we have based our suggestion for using RG as a tool for dialogue on the experiences from teaching. But what are the mechanisms in RG that turn it into an appropriate tool for dialogue? In our discussion we draw on the idea of explorative design games (Brandt et al, 2008) and diagrammatic reasoning (Stjernfelt, 2007).

EXPLORATORY DESIGN GAMES:

Certain parts of RG resemble what could be called an 'exploratory design game structure'.
Exploratory design games often build on the concept design games as proposed by Habraken and Gros (1987), who define design as follows: "Designing is a social activity that takes place among people who negotiate, make proposals, set rules for their conduct and for the work to be done, and follow such rules. In short, to a large extent, designing involves agreement-making and rule-making" (ibid: 1.2).
Within co-design the game as a structure for interplay between designers, users and various stakeholders has been explored in depth for several years by (e.g. Brandt et al, 2008 and Ehn & Sjögren, 1991). Reporting from a research project working with a participatory design approach Ehn and Sjögren emphasise that the design process is also a process of mutual learning between professional designers and skilled users (Ehn & Sjögren, 1991). In their work with design games they stress that they should be: fast and easy for groups to work with, cheap and flexible to use allowing alternatives to be tested, based on concepts relevant to the actual type of production, and support design discussions of existing and future work and technology (ibid: 249).
In the following we will examine whether RG can be considered as having a game structure; we are drawing on the following definition of design games as suggested by Brandt et al (2008):

- A diverse group of players are gathered around a collaborative activity guided by simple and explicit rules, assigned roles and supported by pre-defined gaming materials.

- The game materials typically point to either or both existing practices and future possibilities.
- The games are played within a confined and shared temporal and spatial setting often removed from the everyday context of the players.
- The purpose of the game is to establish and explore novel configurations of the game materials and the present and future practices to which these materials point.
- At the end of the game, the players will have produced representations of one or more possible design options.

(Brandt et al, 2008:54)

RG was not invented with a game structure in mind. Originally it was an individual evaluation technique, conducted as a qualitative one-to-one interview of life situations or decision-making, analysed by an expert. However, working with RG as a dialogue tool for groups it resembles aspects of a game structure. In our setting the group of players – all future textile designers – is not as diverse as a mixed group of designers, end-users and various stakeholders might be. Having this in mind they still form a group of individual players all playing the role of a designer in a collaborative design team. The triadic difference as a basis for forming bipolar constructs and the following scaling of elements is comparable to the above-mentioned simple and explicit rules. The gaming materials were not pre-defined in the way Brandt et al. describe them as derived from ethnographically inspired fieldwork (Brandt et al, 2008:54). We did not make the game pieces in advance; instead, the students were asked to bring certain materials. The materials were chosen for the specific situation, however, pointing towards existing practice and future possibilities since the game pieces were textile swatches made by the students, cut-outs of existing fabrics, and images of textile solutions (e.g. chairs) and spaces/places. The sessions took place in everyday settings at the school, each group of students defining a workspace. By scaling the materials according to the formed bipolar constructs the students worked with various configurations of the game materials, and through dialogue they made decisions about ways to continue the design process. At the end of the course (i.e. end of the game) all groups of students came up with suggestions for design concepts and design ideas together with an evaluation of using RG. As shown above, there are several common features between the idea of exploratory design games and RG as a tool for dialogue. In the following sections we look at how game-like mechanisms can be further investigated and elaborated by drawing on insights in diagrammatic reasoning.

DIAGRAMMATIC REASONING

Traditionally, we understand a diagram as an image that condenses information clearly and concisely. But the diagram has far more potential. The properties of the diagram have been intensely examined by Frederik Stjernfelt (2007). Drawing on the work of the American philosopher Charles Sanders Peirce (1839-1914), Stjernfelt explains the role played by the diagram as covering "all kinds of deductive reasoning with the emphasis on the 'creative', experimental, so to speak strategic aspect of such reasoning" (Stjernfelt, 2007:xxi).

A diagram can be defined as a skeleton-like sketch of its object in terms of rational relations between its parts. The diagram holds an operational criterion: the possibility of experimentation, resulting in new insights. There are two kinds of insights: simple 'corollarial' reasoning versus more complex 'theorematical' reasoning. Corollarial reasoning refers to conclusions which may be read directly off the diagram, interpreted in a concrete, specific way. An example could be the conclusions made, when reading the instructions in a hotel room of how to escape a fire. Theorematical reasoning, on the other hand, requires the introduction of new variables in the inference process. An (unwise) example of this type of reasoning could be to use the above mentioned instruction as an attempt to find alternative routes to escape a fire.

Hidden information in a diagram can be revealed through experimentations and manipulations, using the transformation possibilities of the diagram, combined with observation and contemplation. As such, this process requires personal engagement and attention. If we only play the role of the observer, we will stay at the trivial level of corollarial reasoning. On the other hand, hidden information can be revealed, if we equip the diagram with transformation possibilities, by the introduction of new variables.

The construction of a diagram is rule-bound. It is a helpful means to identify and specify the elements, relations and rules of the particular case. The experimental phase, using the diagram's potential to gain new insights, requires the introduction of new variables. In this transformative process, we go through, what Stjernfelt names, the Peircian three-stroke engine:

the iterative process of abduction (i.e. we introduce a new variable), deduction (i.e. we experiment by following assumptions) and induction (i.e. we test the results of the experiments). This leads to either confirmation or revision of the variable. In this testing process it is crucial to establish whether the process develops new knowledge about the initial case or not.

Several leading architects of today utilise the diagram as an instrument of thought helping to synthesise new concepts, or, as Stan Allen says, a diagram is "a map of possible worlds" (Allen, 1998:16). Berkel & Boes stress the potential of the diagram to establish a workspace for processes of interactivity: "The location of the diagram is the intersubjective, durational, and operational field where meanings are formed and transformed interactively" (Berkel & Bos, 1998:23).
Additional qualities of the diagram are defined by architects: the diagram works as a "resist agent" (Eisenman, 1999), adding friction to the reasoning process in a beneficial way by "delaying fixation" (Berkel & Boes, 1998:28). As such, the use of diagrams supports an in-depth investigation through open-ended discussions.
Eisenman also stresses the capacity of the diagram to establish abstractions from the specific to the general. Thus he points to the possibility of what he calls 'unmotivation', a discharge of personal desires and motivations: "The diagram works to blur the relationship between the desiring subject – the designer, the user – and the desired object in order to move both subject and object towards an unmotivated condition" (Eisenman, 1999).

REPERTORY GRID AS A DIAGRAM

The instructions for constructing RG as a specific diagram are very simple. The parts of the diagram are the three elements in the triad. The relationship between two of these elements is similarity, in the sense of shared qualities, and the relationship between this pair and the third element is difference. We constantly make the distinction between similarity and difference in the perception of the world, and therefore we are all capable of handling these in a competent way. In other words, we are all able to act as experts.
Thus, the set-up consisting of three elements and two rules of relationships could not be much simpler without losing the possibility of transformation. This makes RG easy to understand and easy to use.
The process of naming the poles of the bipolar construct – granting identity to the elements of the diagram, is what Peirce calls a kind of 'abstraction'. If, in the search of shared qualities in the initial case, we identify something as 'round', we go from the specific instance to the type 'roundness'. As such, we open up to a continuum, a field of possibilities.
Through the construction of the diagram – by naming the poles in the bipolar construct – we explicate everyday rules such as conventions and habits. Likewise, a set of rules, agreed by all participants in a group setting, forms the premises for the subsequent collaborative investigation: The following scaling of elements according to the bipolar construct is equivalent to the introduction of new variables. Thus, the rules of transformation are developed by the participants and function as a common ground for intersubjective exploration.

REFLECTIONS

In the following section, we will present further reflections on the impact of using RG. Here the advantages of the rule-based, game-like structure is emphasised, as well as the benefits of RG as a resist agent, adding friction to the decision process, and eliminating the personal motivation.

ADDING FRICTION TO THE DESIGN PROCESS

In developing a subtle, detailed and substantiated design concept it is crucial to work meticulously and in-depth. For example, this student is talking about how RG is used as a resist agent, forcing the team to find shared qualities in the textiles. This group chose to work exclusively with randomly selected textiles: *"This is the scenario: we sit working with these three (textiles), we spend half an hour considering how on earth can we make a construct from this triad; it has been given to us, we have not chosen it ourselves, but we are really forced to investigate it; we have to find something…Maybe in some ways we enjoy this frustration, that we really cannot see what in the world they have to do with each other…, and then, little by little, we do find how they complement each other"* (from audio recording, translated from Danish by the authors). The ability to keep the process going by implementing friction in the decision process instead of making decisions in a fast and forced way is essential for a good design process. The friction gives all participants in a group the possibility to contribute before the final decision is made.

ELIMINATING PERSONAL MOTIVATION

In the next example, a student talks about the difficulty, but also the necessity, of setting aside or disregarding personal motivation when working in design teams: *"The first day my group worked with a randomly selected pile of textiles, and among them was a piece of woven damask, a hand-woven table napkin that had belonged to my great-grandmother. M, another student from the team, started to say that it could be something else than this particular napkin I knew it was. And I thought: "No, that is not true, it is …." But I could not say that, because I realized that it was not relevant in this particular situation, working with the R.*" (from audio recording, translated from Danish by authors). The student felt the systematic working rules of RG were a help to overlook the personal relations she had to a special piece of textile of her own.

The last example stems from a group presentation, where the students describe the experience using RG: *R: "…It became easier to verbalise…You have switched off the subjective way you feel about the textile, made by yourself. You can observe that you are distancing yourself from the fabric….." H: "The first day we could not help adding personal opinions, but then we found out how the tool [RG] works, and then it just went fast, and there were not that many discussions. R: ….. and we quickly learned to argue (in favour of our opinions), didn't we? H: Yes, and we quickly came to an agreement. It was more difficult in the beginning, maybe, but in the end we agreed much sooner because we had leant to navigate the system"* (from audio recording, translated from Danish by the authors). This quote exemplifies how the students regard RG as facilitating verbalisation and substantiated investigations, how RG encourages investing time in the inquiry, and how RG allows a distancing from personal relations to an actual case. Finally, it shows how the students through their collective inquiry constitute a regional ontology and establish agreed premises, supporting quicker and easier decision-making.
A group from the other course made the following observation: They wanted to push the process and decided to rate a group of elements on a chosen scale without making triads. They found that without the constructs elicited from triads it took a lot of discussion to agree on common concepts and that it would have saved time if they had used the triadic difference as an approach to the discussion.

CONCLUSION

As teachers and design researchers we have experienced RG as a powerful tool for interactivity in the design process.

Figure 6: Group discussion

We argue that by approaching RG as an exploratory design game and drawing on insight in diagrammatic reasoning it is possible to access and activate the following focus points: RG helps explicate the elements, relations and rules. This is beneficial for the design process in two ways: firstly; RG supports articulation and verbalisation, which stimulate dialogue and in-depth discussion. Secondly; simple and explicit rules make the system easy to understand and to work with, and this makes the participants feel comfortable and 'operational'. At the same time the few and simple rules also leave the system open to reconfigurations and creation of new ideas. As such, it helps the participants come to an agreement about the premises, and establish a common ground from which they can collectively develop the system and their findings. RG also works as a resist agent, setting aside personal motivation, and thus stimulates the process of open-ended discussions and the formulation of collective proposals and agreements.

RG can be seen as a simple entrance to complex design challenges: The triad is instantly defined either consciously or randomly, and the similarities and differences are based on common knowledge and experience. Three elements forming two relations is the simplest possible variation and yet sufficient to design the diagram. Thus, through rule-bound transformations, the game is set for the development of future design concepts.

CHALLENGES

Some critical remarks should be added about the properties of RG. The elicitation of the constructs and the granting of identity to the poles of the bipolar scales can easily be understood as the approval of traditional and fixed dichotomies like warm/cold, dark/light and soft/coarse. But the process of eliciting the construct

from the triad builds on the identification of shared qualities in two elements, as opposed to a different quality of the last element. Thus, 'opposed qualities' need not be identical with 'opposite qualities'. Similarly, we have seen examples of beneficial investigations using constructs such as soft/cool and cold/refreshing[1]. But the use of such untraditional constructs also holds a risk of misunderstandings. According to Kelly's theories, a person's construct represents the truth as they understand and experience it. In the same way, an interpersonal construct, elicited in a teamwork setting, certainly is not objective, and not necessarily easy to understand for people outside the group. The ability to communicate the results of the teamwork to an outside party then becomes crucial. If the results are used in factor analysis, it could be seen as a problem that not all elements can possibly be included in all constructs, and that RG makes it possible to elicit constructs on several levels of abstraction. Since factor analysis is not our goal, we consider this irrelevant, but still it can cause misunderstandings. Instead, the possibility of answering on different levels of abstractions can be seen as a positive challenge for the working team.

FURTHER WORK

This paper is based on research from design education. We use this laboratory setting to take advantage of contributions made by design students – the future designers. Until now we have conducted a few pilot studies with end-users, design professionals and other stakeholders. Further studies and projects will contribute to the development of RG as a an approach for exploratory inquiry giving participants from interdisciplinary project teams, end-users and other stakeholders an opportunity to take advantage of the inherent potentials of RG.

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[1] The words 'cold' and 'refreshing' are almost similar words in Danish: 'kold' and 'kølig'.