Future mapping

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1. Introduction

In this paper we propose future mapping, an alternative approach to futures research. With future mapping we intend to overcome some of the main problems that we encountered when applying scenario thinking in the area of product design and innovation. Future mapping attempts to develop multi-layered maps of possible futures, which can be used by pro-active companies and innovation teams as an instrument to 'navigate' the future (Munnecke & Van der Lugt, 2006). The approach invites designers to apply their analytical, creative and emphatical skills in a dialogue about future opportunities that lay ahead.

In the past few years we have taught and applied the future mapping approach with various groups of Master's level engineering students, both in The Netherlands and Denmark. We have altered and adjusted the approach as we learned from these experiences.

In this paper we will describe the current state of the approach. The paper is not meant to provide a deep theoretical overview or a thorough empirical study. Rather it is meant to provide a hands-on process description to inform about the method and to enable anyone to apply future mapping.

After describing why we think future mapping is a promising direction for futures research, we will provide a concise overview of the process steps involved. Then we will describe one student project as a case example. We will discuss the various types of future maps produced by the students. We will conclude by making some general observations about using future mapping as a method for futures research, and by proposing some directions for future work.

Futures research

Humans have always busied themselves with envisioning the future. It is one of the main characteristics that separates the human brain from other animals. In ancient Greece, oracles were used to provide answers about the future. Later, people started to construct visions of the future by means of extrapolating current developments. This is still the predominant means of thinking about the future. Trend watchers look at current movements in the world (such as the increase in mobile communications) and extend these towards the future. This is a fine way of dealing with the short-term future or in a stable market. However, in volatile markets, or when looking into the long-term future, forecasts based on current trends may fail. Disruptions may occur that dramatically change the course of events, thus rendering extrapolations useless. We all know of some historical predictions that have gone awry. For instance, *"Computers in the future may weigh no more than 1.5 tons."* (Popular Mechanics, forecasting the relentless march of science, 1949) and *"I think there is a world market for maybe five computers."* (Thomas Watson, Chairman of IBM, 1943). Or how about

"Airplanes are interesting toys but of no military value." (Marechal Ferdinand Foch, Profession of Strategy, Ecole Superieure de Guerre, ±1910). In hindsight we may look at the statements above as being 'stupid' or 'ignorant', while for the times that the statements were made, these were quite reasonable predictions.

We have a strong tendency towards simplifying situations in order to be able to handle them with our limited cognitive capacity. Because we simplify situations we tend to ignore complications and irregularities which, in fact, often shape the future. An alternative approach to preparing for the future is found in scenario thinking, see Wack (1985), Schwartz (1991) & Fahey & Randell (1998). Scenario thinking attempts to get a grip of the future not by means of attempting to predict, but by exploring the range of possible futures.

Rather than regarding the future as something that can be inferred by analyzing and extending the current situation, in scenario thinking the future is regarded as largely uncertain. Therefore the focus of research is directed at developing an understanding of this uncertainty by examining the variability of the consequences of the uncertain factors on the future situation.

In a business context, Royal Shell was one of the first big companies that embraced scenario thinking for long-term strategy making. In recent times, scenario thinking has become an accepted managerial tool. Many international companies like Philips, Ericsson, British Airways and Siemens use scenarios to get a grip on the fast changing-world. In the Netherlands, Dutch telecoms operator KPN has put a lot of effort in developing scenario approaches to deal with the volatile telecommunications market it is operating in. The use of scenarios has also become a popular within governmental policy-making (Dammers, 2000).

The case for future mapping in product innovation

The basic scenario thinking process involves inventorying future forces: forces that can be identified in the current situation, which could potentially change the future situation. These forces are then appraised for the impact that they will have for the company, and for the level of uncertainty regarding the direction that the force will take in the future. Forces with both a high impact on the company situation, and a high level of uncertainty are considered to be 'driving forces'. One can learn about the range of possible futures by developing scenarios based on the potential directions that these driving forces can take. Usually two (or sometimes three) of these driving forces are taken into account as 'scenario drivers', leading to a 2*2 matrix of forces. Then, the four quadrants of the matrix are developed into scenarios. For instance, KPN developed scenarios based on the forces of customers' social orientation (individual or collective) and life attitude (passive, active) (Bouwman & van der Duin, 2003), see figure 1. Varying the extremities lead to four distinct scenarios in which customers have very different attitudes to the telecoms market). These scenarios were then 'fleshed out' in various ways, including scenario rooms and future news broadcasts.

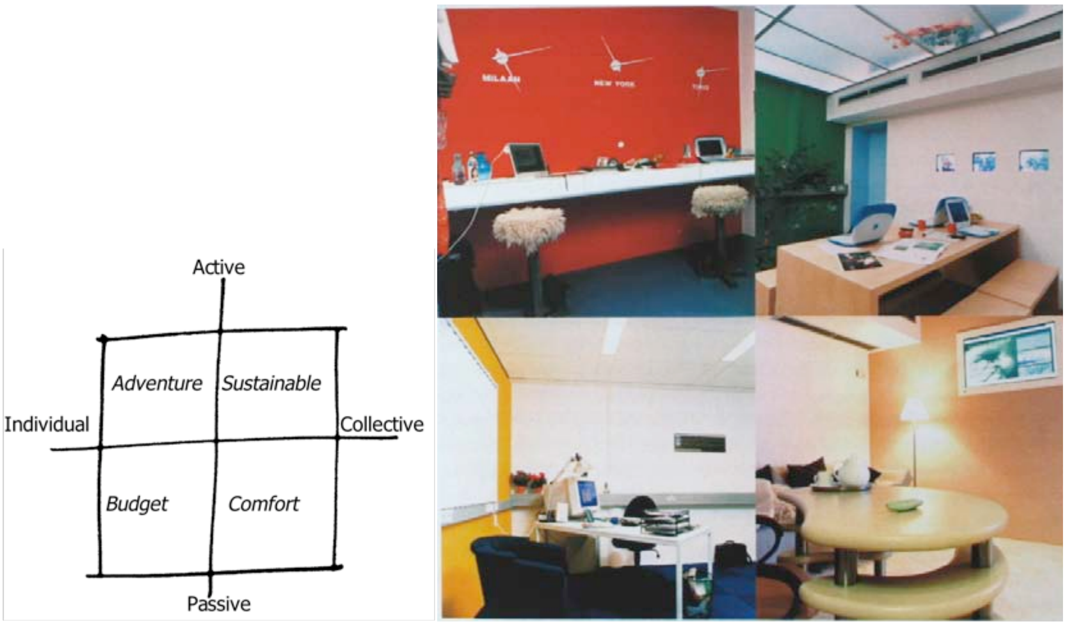

fig. 1: The KPN telecoms scenario matrix and the corresponding scenario rooms.

Considering the ambition that future scenarios aim to provide guidance over a longer time period, we encountered two problems with the scenario approach when applying these in the field of product innovation and design:

1) *Irrelevant information:* Future studies have traditionally been used for political and high-level strategic decision making, which makes them obviously focused on macro-level factors of society. Designers deal with the concreteness of peoples' daily lives. They need to primarily focus on the more contextual and micro-level type of factors.
2) *Too much reductionism*: Oftentimes extensive studies are performed to uncover future forces, only to end up with two scenario drivers. We found that upon selection of these drivers, much of the context richness -provided by the field of forces and their interactions- was lost. Clearly, some reductions in the set of forces need to take place in order to make the future explorations insightful. However, only selecting two scenario drivers does not do justice to the complexity of the real world situation.
3) *Snap-shot quality*: Large efforts are made to develop and flesh out scenarios. For instance, in the KPN case described earlier, rooms were set-up that meant to breath the 'feel' of the four scenarios (see fig. 1). However, changes in the external situation and new insights make these scenarios obsolete rather quickly. For instance, state-of-the-art technology used in the KPN scenarios to communicate high-tech futures became out-dated quickly.
   In scenario thinking projects, there is oftentimes too much emphasis on the final scenarios as artifacts, which makes the underlying dynamics get lost upon completion. Scenario scholars (e.g. Chermack & van der Merwe, 2003) claim that the merit of scenario thinking lies in the process of developing the scenarios rather than in the scenarios themselves. However, we are convinced that in innovation projects, it is useful to have a framework for discussions about the future. But such a framework needs to be more viable and adaptable to the proceeding state of knowledge.

These two issues have lead us to consider an alternative approach that focues on the relationships (between forces, scenarios, ideas, etc.) rather than on individual scenarios, allowing for more forces to be considered. It should be possible to adapt the ‘outcome’ to match the progressing level of knowledge about future changes. We named this approach ‘future mapping’. Future mapping is rooted in existing scenario thinking methods yet fundamentally different in three ways:

1) Scenarios are developed based on clusters of about five forces, and not all forces need to drive all scenarios.
2) Emphasis is placed on integrating the results from the various elements of the scenario learning process: forces, scenarios, opportunities/threats, ideas, etc.
3) With future mapping we heavily rely on visual language to encompass and comprehend the richness of the variety of possible future situations, without leading to chaos. Scenario thinking tends to be primarily based on written language.

2. The future mapping approach

A future map depicts the range of possible futures regarding a certain subject, containing interweaved layers of information, including forces that shape the future, scenarios, future opportunities, potential pitfalls and trend breakers, product ideas, etceteras. A future map is meant to provide an innovation team with some overview with which the team can navigate its efforts towards future innovation.
In future mapping we attempt to maintain an overview of the field of future possibilities, rather than limiting the vision of the future to a few scenarios. The scenarios in a future map are meant to provide concrete outlooks into possible futures. They are not the main focus. Rather, they are elements in a constellation together with the opportunities, threats, ideas, forces, etceteras. Combined they provide overview and insight. Figure 2 shows a simple example of such a future map, using an islands metaphor to integrate the various elements. The arrows refer to driving forces. The islands are future scenarios. Flags contain product ideas. Bridges and dotted lines with ships and rafts depict ways of transition and shared elements of the scenarios.

figure 2: A future map on the future of workspace

Process

A depiction of the principal future mapping process is provided in figure 3. Below, we will briefly describe the various process steps.

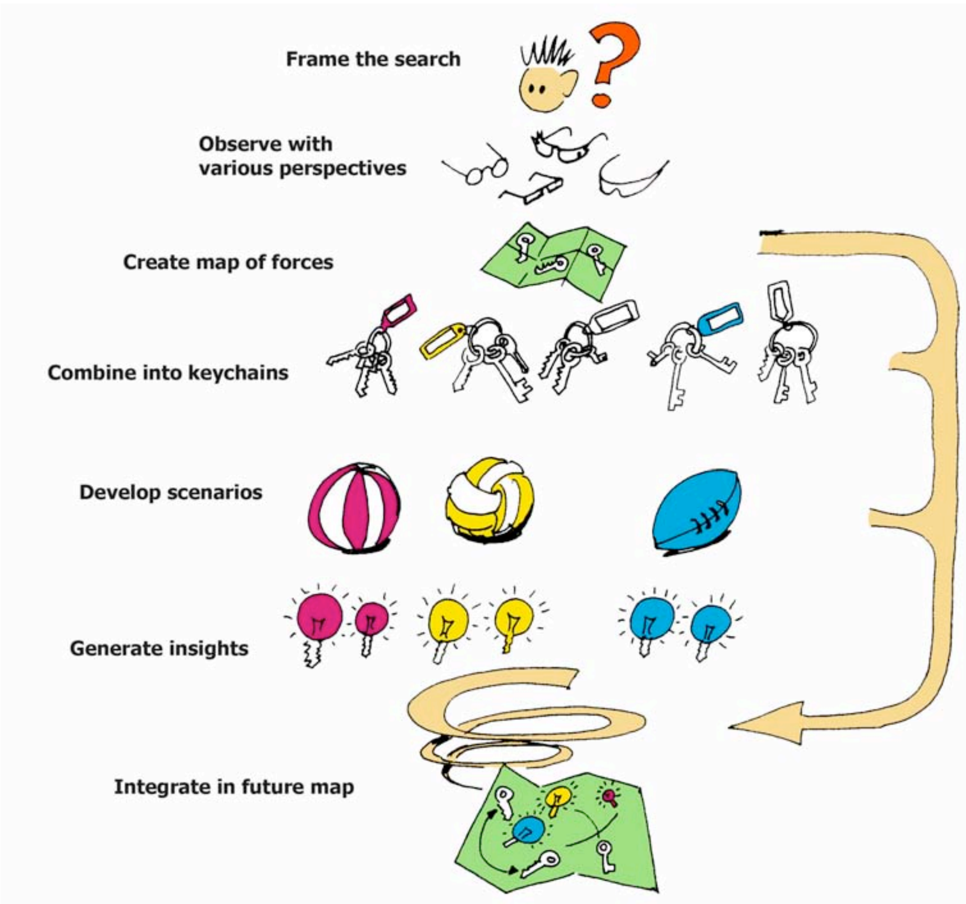

Figure 3: The principal future mapping process steps.

Frame the search

It is essential to frame the search as much as possible, while leaving enough room for exploration. When thinking about the future, it is very easy to embrace macro-level forces, thus developing future visions of the world. However, when applying future mapping in the rather concrete field of product design and innovation, such future visions of the world situation may be less useful; characteristics of product innovation projects tend to call for more local perspectives. When including everything as relevant, the danger is that the scope of the future explorations gets too wide and the future map becomes unspecific.

The future timeframe needs to be considered as well. The future mapping efforts need to be set in a long-term setting to allow for substantial and non-linear changes in the world, while still being sufficiently within reach to be able to construct imaginable and possibly realistic future situations and pathways that lead from the present to these futures. This timeframe can vary a lot. For instance, in the airplane industry, product development projects take many years, which means that scenarios on the future of aviation will need to have a large timeframe of, say, 25 or more years ahead. The telecommunications market, however, is moving very rapidly, which makes it already challenging to make predictions of three to five years ahead.

To frame the search, one needs to continuously have in mind what the objective of the innovation effort is, what kinds of information are needed and how the future map will provide this information.

Observe with various perspectives

By exploring the past and current situation, as well as trend information and existent future visions, elements that will determine possible futures can be uncovered. Here it is useful to take various perspectives. In business studies, checklists for macro-level forces like PESTED (politics, economics, social, technology, ecology, demographics) are often used. In order to develop a comprehensive overview, in the field of product innovation one needs to also consider meso- and micro-level perspectives, including both the individual/social world, and the product/technological world.
Elements that we typically work with are forces, trend breakers, wildcards and early warning signs.

> *Forces* are the principal building blocks of the future. A force can have different directions, which will influence the future situation. For instance, the force ‘outside temperature’ can be ‘freezing’ or ‘hot’ or anything in between. In the future of workspace example (figure 2), the force ‘company protection’ may have two extremities: ‘Open and inviting meeting place ’ on the one hand, and ‘closed system’ on the other hand.
>
> *Trend breakers* are occurrences that may change the direction of a force radically. Just like the impact of a large meteorite may have changed the climate in prehistoric times, causing the dinosaurs to become extinct, in the future of workplace example, terrorist attacks on office buildings -like 9/11- will cause companies to dramatically change their security standards. Another trend breaker could be a Pan-European power failure.
>
> *Wild cards* are, like trend breakers, occurrences that change the course of the future. Except, wild cards are surprising and unpredictable elements. One can include wildcards in order to make the scenarios more imaginative, to enhance out-of-the-box thinking. Wild cards for the future of workspace example may be an outbreak of the avian bird flew, or unlimited bandwith wireless internet becoming available.
>
> *Early warning signs* are first indicators for a change to be coming. The sprouting of crocuses in the garden are a first sign of a change of season. The occurrence of local power black-outs may be the first signs that the larger power-supply system is starting to fail.

Create map of forces

From the collection of elements, (the most) relevant forces –forces with high impact and uncertainty- are identified and related to each other by means of a first map of forces, which functions as the scaffolding for the future map. Conceptmapping (Novak & Gowin, 1984) can be used to construct this map of forces. In conceptmapping, graphic overviews are made by identifying, naming and relationships between concepts. See figure 4 for an example of a concept map of forces. Trend breakers, wild cards and early warning signs can be included in such a map of forces as well.

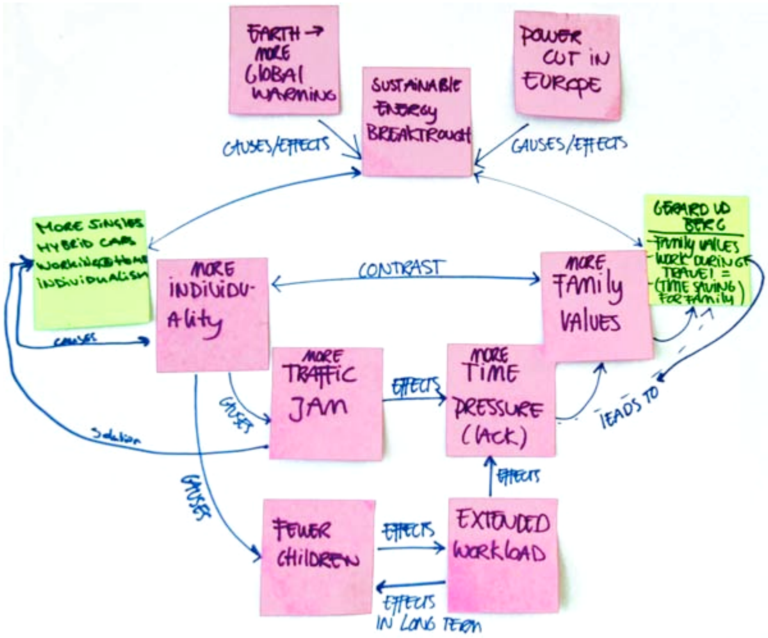

Figure 4: Map of forces in concept mapping format

Combine into key chains

We refer to future elements -such as forces (with a direction towards one extremity) and trend breakers- as 'keys'. Then, these keys can be combined into 'key chains', which are collections of forces that appear to fit together, suggesting an imaginable scenario. It is especially important to include forces that have a high impact on the future situation and for which it is uncertain which direction the force will take. Wild cards can be added to make the key chains more interesting and distinctive. From experience we found that about four to five keys in a key chain works well.
Key chains should overlap in order to be able to relate the various scenarios to each other: the driving forces need to be represented in more than one key chain.
Identity can be given to the key chains by providing them with names or 'hangers'.

Develop scenarios

A selection of the most contrasting, meaningful, imaginative, inspiring, and/or contrasting key chains is then used for developing scenarios. Van der Duin (2001) uses the following working definition: *"A scenario is a set of systematically developed and internally consistent -possible but not necessarily probable- images of future situations, developments or occurrences."* Scenarios provide concrete descriptions of possible contexts of future product use. In future mapping about three to five key chains are developed into scenarios. Of course, new scenarios can be added at a later stage when desired. Means to make these scenarios explicit are day-in-the-life stories, historical timelines, newspaper front pages, personas, rich pictures, etceteras. (see fig. 5 for some examples)

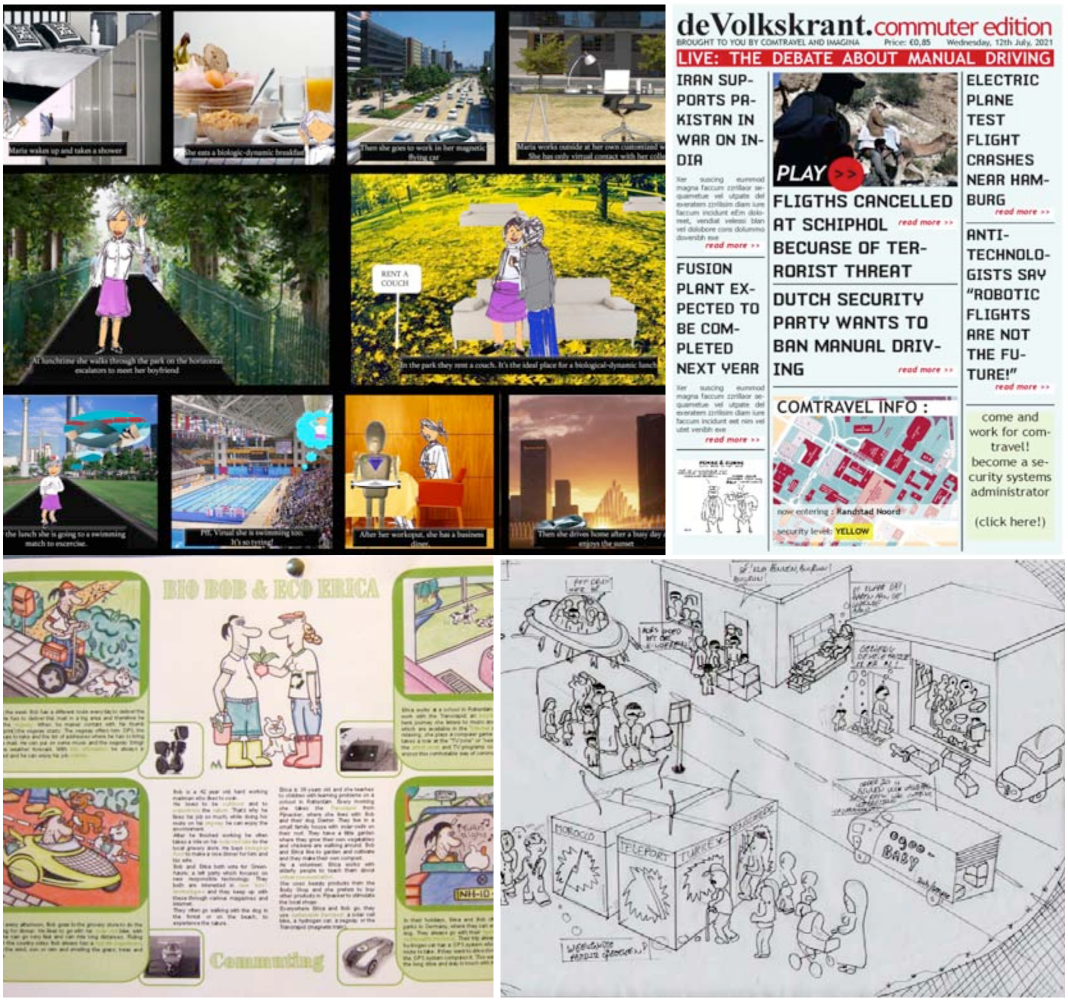

Figure 5: Different ways to flesh out scenarios: Day-in-the-life storyboard, newspaper, personas, rich picture

Generate insights

The scenarios are further examined by exploring opportunities and threats for the innovation initiative at hand, and to generate product ideas that fit the scenario context. Future products will already be part of the scenario visualisations made in the previous step, so the transition to this step will be fluid. The question is posed what the innovation efforts could look like within each scenario. The aim is to generate opportunities/threats and product ideas that are specific to the company and/or the innovation efforts at hand.

Integrate in future map

Scenarios, opportunities, threats, & product ideas are then added to the map of forces. This will lead to a relational diagram uncovering relationships within and between the various layers of elements. As a last step, a future map is created that can be understood and used by the innovation team (see fig. 6). The relational diagram will surely be too complicated, fuzzy and sketchy to make any sense for people not involved in creating it. Using metaphors can help make it possible to comprehend the complexity of the map, without loosing the richness of information.

Fig. 6: Relational diagram (left) is transformed into a future map using a landscape metaphor (right).

For future maps the general guidelines for poster communication are valid, like the AIDA principle (Attract, Interest, Desire, Action) and the 3, 30, 300 seconds principle (poster communication needs to be informative when looking at the poster for 3 seconds, 30- as well as 300 seconds). This suggests various interrelated layers of information that give quick overview, as well as meat to dig into. In addition, we propose the following guidelines for making a future map:

> *Create overview.* A future map may be used for a longer period of time, over the course of an innovation project, or even provide guidance to a company for a longer period of time. Therefore a futuremap needs to be comprehensive and include a high level of detail while staying away from chaos.
>
> *Provide insight.* A future map is self-explanatory. It can be used as a tool within an innovation effort without the makers of the tool being present to explain the meaning of the items on the map.
>
> *Show relationships.* A future map emphasizes the relationships between the elements: Both relationships within layers, e.g. how scenarios relate, and between layers, e.g. how ideas fit within different scenarios. A good future map is well-integrated: elements generated within one scenario track are related to other forces and scenarios (see figure 7). A new constellation is formed that provides insight in the interplay between forces, scenarios, opportunities & threats, ideas, etceteras.

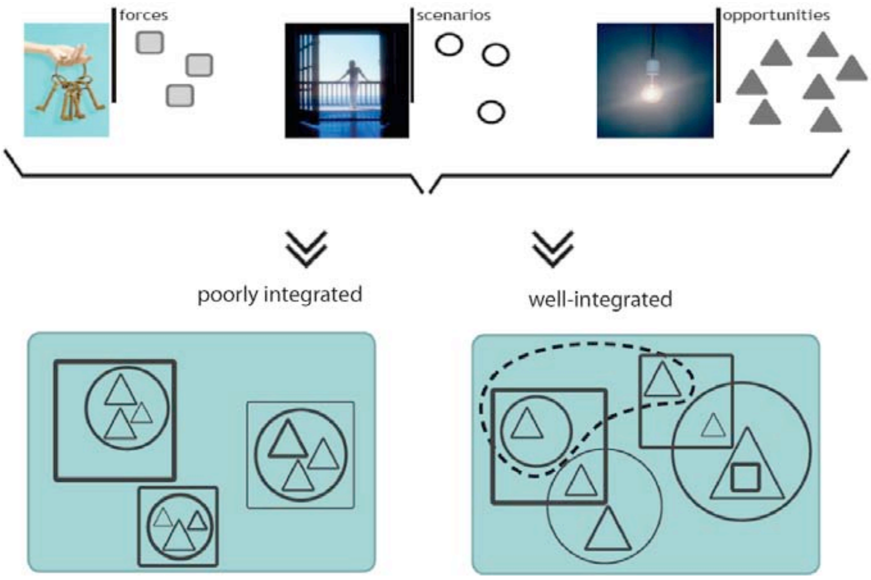

figure 7: Integratedness of the future map

Make it personal yet accessible. A personal style adds to the identity and attractiveness of a future map. However, the future map needs to be accessible to people beyond the creator. The future map in figure 8 has a strong identity and information content. However, some people might find it hard to interpret the information in the map.


Figure 8: Future map on the Future of Workspace

3. Study

As part of the Industrial Design Engineering Master's course 'Context & Conceptualization' at Delft University of Technology about 150 students were involved in a concise future mapping project. Students worked in groups of about 6 students, but they produced their final future maps alone or in pairs, which lead to about 100 future maps. The aim of the project was to produce a future map for exploring the potential for innovation innovation initiatives to enhance the experience of road commuting.

To speed up the process, students were provided with some basic information: Two rather broad scenarios on futures of Europe (Scharioth et al, 2004), and socio-technological graphs that were prepared for this assignment by one of the tutors. In a first session, the students performed a context analysis, leading to a set of forces that influence the future commuting experience. Out of these forces key chains were assembled. As a first homework assignment, pairs of students developed scenarios based on key chains (each pair developed one scenario). In a practical, students then shared their scenarios in the group, generated insights, and combined forces, scenarios and insights in a relational map. As a final homework assignment, students translated these relational maps into future maps that could be used by the hypothetical company's innovation team. We asked student to choose and develop a metaphor with which to harness the complexity of the relational maps.

Results

The resulting future maps varied in many ways, however we could identify some themes. A primary difference was the initial view with which the future maps were set up: either the pathways leading to different futures or the system of forces served as a primary guiding principle. Trajectory/evolutionary trees, subway maps and board games are based on the pathways principle, while machines, buildings and landscape maps were based on the systems principle. Below we will discuss some of the principal categories of future maps.

Trajectory/Evolutionary tree

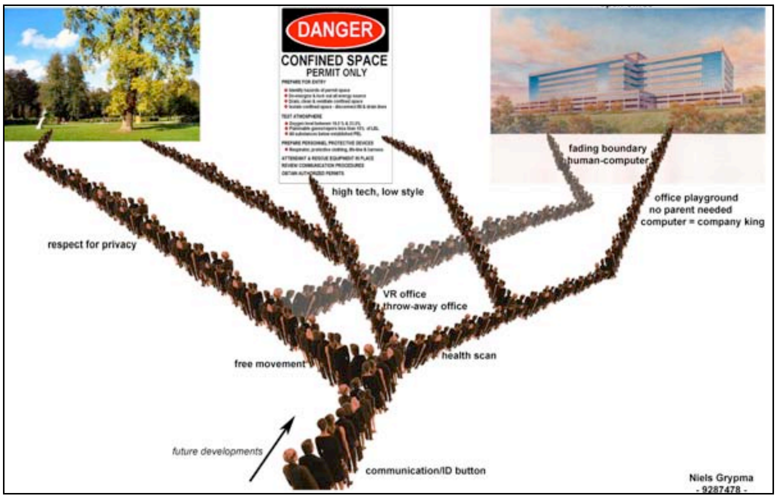

fig. 9

This is a rather straightforward way of producing a future map. A trajectory map (fig. 9) shows the different pathways that lead from now into different futures. Crossings and off-shoots determine the level of integratedness of the map. Various trajectory maps just showed three separate pathways leading to three scenarios, without any interrelatedness between the paths, which makes these maps poorly integrated.
A well-integrated trajectory map provides insight by giving direction. An innovation team can continuously position itself on the trajectory, thus making it fairly easy to navigate. However, trajectory maps tend to be oversimplified: Oftentimes many details and branches were left out in favor of providing clarity.

Board game

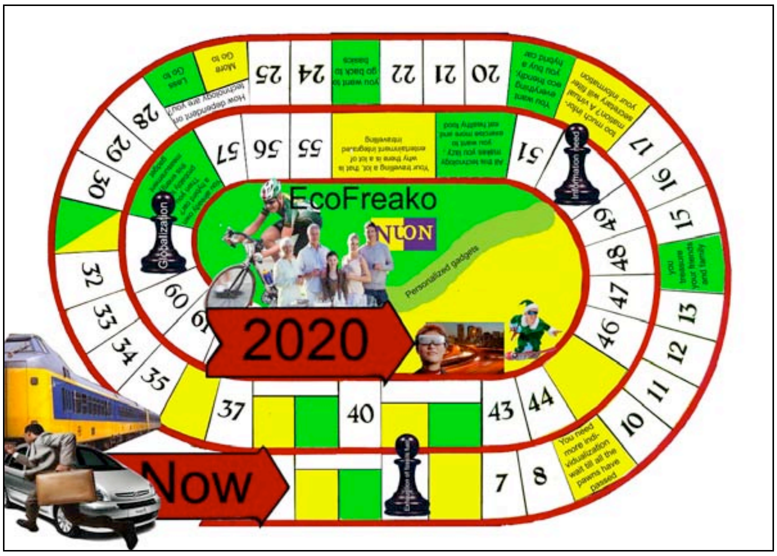

fig. 10

A board game, like a trajectory map, has a clear beginning and end. The game rules can provide a high level of detail. Set-backs and set-forwards can be included to emphasize nonlinearity in the pathway. The board game in figure 10 is the most straightforward example. However, we also encountered a card game in which the pathways could be altered continuously, and a Monopoly game, which did not follow the now-to-future pathway. As we tend to be very familiar with board games, they may be very helpful in conveying a future landscape. However, the stereotypical board game of fig. 10 can easily oversimplify the future landscape, by neglecting interrelationships and alternative future directions.

Subway map

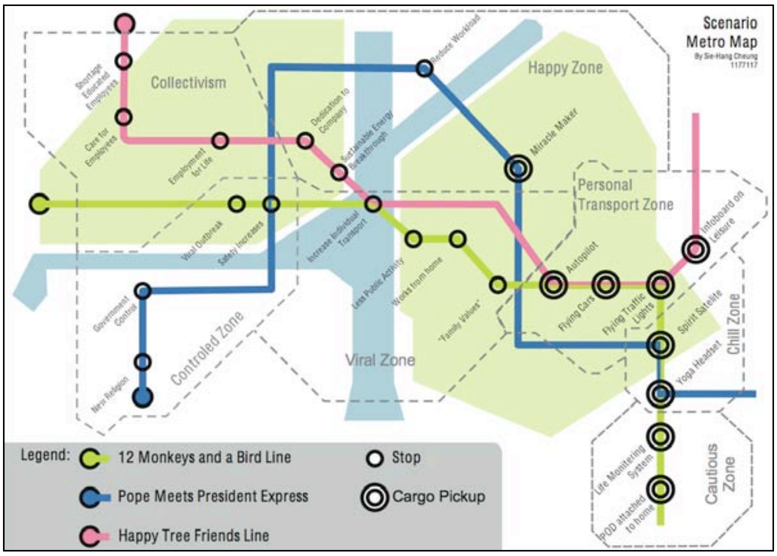

fig. 11

A public transport map emphasizes the proximity and logical order of elements without suggesting a timeline. Additional layers may add extra information, like the river, zones and legend in figure 11. The aim of a subway map is to show as simply as possible how to get from one station to another. Therefore, in real subway maps there is very little detail. In future mapping, the aim is to provide insight into the interrelationships between future elements, which suggests that additional layers are needed that add a greater level of detail.

Machine

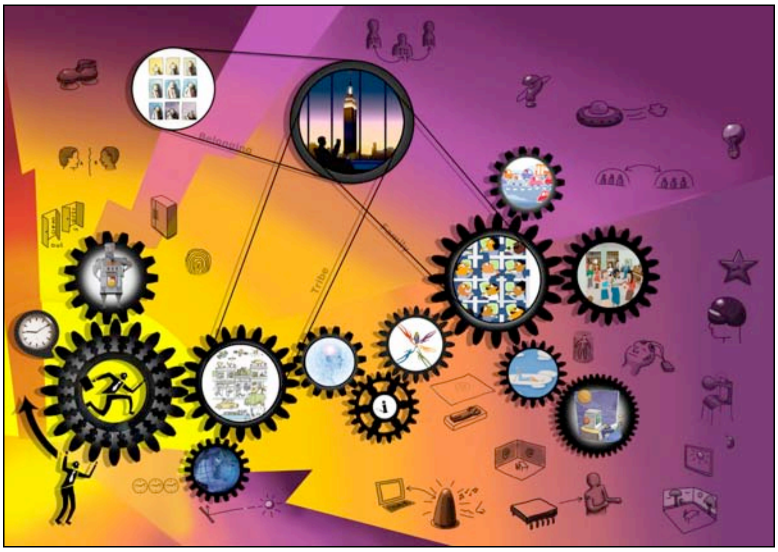

fig. 12

A machine metaphor (fig 12) emphasizes relationships. Cogwheels drive each other in different ways: size determines speed and force. Such a machine can be developed into quite a complicated system, while providing overview through identifying primary and secondary systems, large and small cogwheels, etceteras.
Other metaphors we encountered that provide system descriptions are planetary systems and eco-systems.

Building

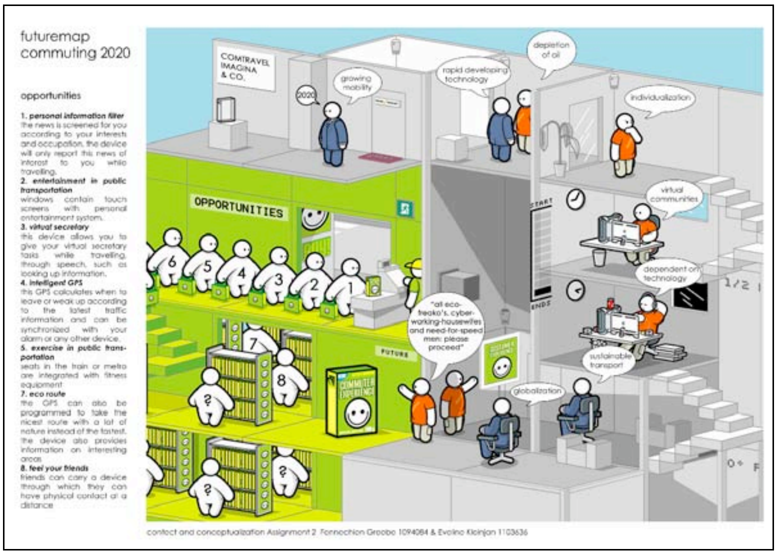

figure 13

The building metaphor (fig. 13) allows for developing a variety of settings and situations in the different rooms, while showing relationships by means of doors, elevators, or infrastructure (electricity and phone lines, etc.). Sometimes, the different floors are used to organize various layers of information (scenario floor, idea floor, etc.). A building tends to be a comprehensible structure, which makes future maps based on this metaphor accessible, yet it allows for a good level of detail.

Landscape

figure 14

Landscapes, like archipelagos, mountains, cities, etceteras, make it possible to include an almost unlimited amount of elements and relationships (see fig. 14). Because it is so easy to add many elements, without necessarily needing to relate them, the challenge is to keep the future map accessible and understandable. This makes it important to develop the stories behind the landscape, and make sure that the reader of the future map will be able to understand these stories.

Other

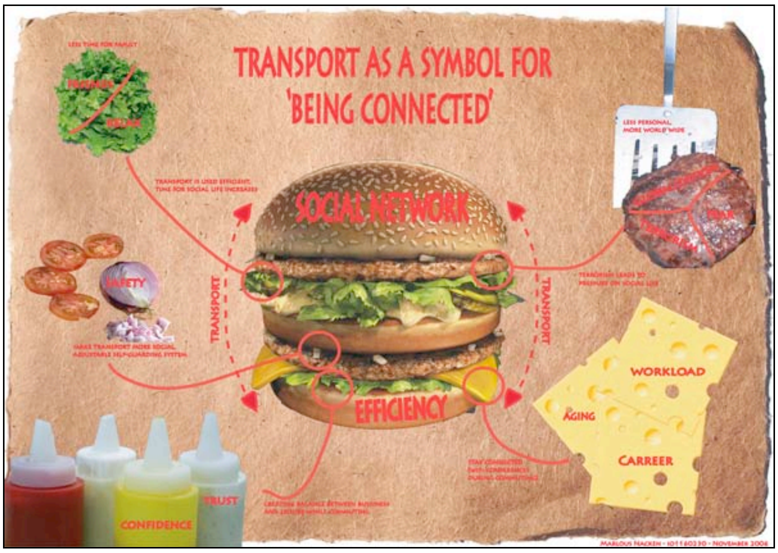

figure 15

Students used many other metaphors to harness the complexity of future maps, varying from medieval paintings, soup recipes, laboratory set-ups, etceteras. Some provided a very strong means to harness the complexity in the future map. But the metaphor may also be confusing, and therefore obscure the meaning in the future map. Especially as the relationship between the subject matter and the metaphor was sometimes far from evident. In figure 15, the future of commuting is seen as a burger sandwich, and the ingredients refer to the driving forces that determine the taste of the burger.

4. Discussion

In general, we found that students were successful in producing inspiring and personalised future maps. The maps provided insight and overview on the interplay between the most important driving forces, scenarios and opportunities/threats. However, the maps did not manage to be sufficiently comprehensive and self-explanatory. Scenarios, forces and opportunities were identified but not visualised or explained in a rich way. So, several layers of more detailed information were missing. This makes these future maps suitable for providing a quick overview. But they do not suffice in providing a longer-lasting framework to help innovation teams navigate the future. Of course, the student project was very brief, and therefore it is understandable that students could not reach the desired level of insight. However, in future projects, we will especially stress the need for rich and detailed information in the future maps.

In future work we aim to perform a series of in-depth future mapping studies in practice, in order to deepen our understanding of the approach. If we can perform these future mapping studies within an actual company, we will also be able to examine how future maps are actually used by innovation teams as a tool for guiding them in their product innovation efforts.

5. Conclusion

Even though we are still refining the approach, our experiences the past few years lead us to be convinced that future mapping is an powerful alternative method of futures research. Future mapping fits the main philosophy of scenario learning, in which scenarios are a means for learning about future dynamics, rather than resulting artefacts. Future maps can provide a rich framework of alternative futures by encompassing multiple driving forces, scenarios, opportunities/threats and ideas, as well as by emphasizing relationships. However, the qualities of a designer are needed to translate the complex and multi-layered information into a well-integrated future map with tangible future visions.

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