Paper 5: A shocking experiment: alternative approaches for discontinuity-oriented scenario development

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I. INTRODUCTION

In theory, scenario development is a way to consider future discontinuity. Scenarios are developed to identify discontinuity and thus help to prepare for “surprising” change (Davis, 1998). However, there are indications that theory is not reflected in scenario practice. For example, it is argued that scenarios are too risk-averse, that they often portray the most likely future, that they are mere variations on a current theme (Zeisler and Dyer, 2000), and that they “often ignore the scenario-spoiling ‘wild cards’ of low-possibility futures” (Marien, 2002).

To our knowledge no scientific research of scenario development has looked at the idea of discontinuity. In this paper we aim to fill part of that void by investigating what factors inspire or impair the consideration of discontinuity in scenario development. To this end, an experiment was designed specifically to consider the idea of potential discontinuity. The issue addressed in the scenario study was the future of European salmon aquaculture. We first describe the reasoning behind the design of a discontinuity-oriented scenario process. We subsequently describe the subject of the study, European salmon aquaculture, which is necessary to understand some of the experiment’s output. Finally, we reflect on the process and its output.

II. DESIGN

The main goal of the salmon aquaculture scenario study was to observe how discontinuity is addressed in conditions designed to stimulate thinking about the idea. The experiment involved two stakeholder workshops held in October and November 2003. The study was designed so as to observe how workshop participants interpret discontinuity both in general terms as well as in terms related to salmon aquaculture. To this end, three tests were carried out with approaches for discontinuity-based scenario development: variety in group composition, brainwriting, and perspective-based imaging. Furthermore, we hoped to draw conclusions from the experiment about the effectiveness of a discontinuity-oriented process design.

Preparation for the study involved six pilot sessions that were used to test and refine the experiment’s design. Each pilot session lasted 3.5 hours. The sessions were conducted from September 1 – 15th, 2003. The participant group consisted of seven students in the age group 25-35 from five European countries. The stakeholder workshops lasted for 11 hours in total. Four observers, an audio recorder and a video camera recorded the workshop proceedings.

23 The research described in this paper is elaborated on in: Van Notten, Ph.W.F., Writing on the Wall: Scenario development in times of discontinuity (forthcoming, 2004a). For further information, contact: p.vannotten@icis.unimaas.nl
The case of European salmon aquaculture was the subject of the experiment. We chose salmon aquaculture because it is a relatively new and thriving industry whose activities have large implications: social, economic, environmental, and institutional. The industries’ activities have local effects where salmon is farmed, as well as a global impact with regards to dietary and commercial patterns. Besides, salmon aquaculture is a controversial industry. There are many competing interests as well as uncertainties regarding the impact of farming activities on the physical and socio-economic environment. Moreover, the realisation of a solution is constrained by economic pressures on the industry and the still experimental nature of certain farming technology among others. Lastly, there are no universal solutions if only because remedies to some aspects of salmon aquaculture pose problems for others. Aquaculture’s potential for discontinuous development lays in the stresses on areas such as unemployment, food safety, and wild fish stocks. In short, salmon farming is a wicked problem with the potential for discontinuous change in the future.

Efforts are being made to solve aquacultural problems although much progress still needs to be made. Technological challenges for the salmon farming industry are the production of healthy and safe food, and the reduction of negative environmental impacts. Feed is a crucial element in salmon farming, both in terms of costs and in terms of safety and quality of the end product. A focus of current research is on alternative sources of proteins and oils and alternate technological possibilities contributing to healthy and safe end products. With respect to the reduction of environmental impacts, an alternative to production of fish in marine environments is land-based fish production, which uses closed recirculation systems. Such systems will help contain environmental pollution and the mixing of farmed and wild fish. Closed system farming is also the focus of much current research.

1. **Point of departure: discontinuity-oriented design**

Research of contemporary scenario practice described in Van Notten (2004a) indicated that a middle position between an unstructured and a highly structured design was desirable for discontinuity-oriented scenario development. Therefore, we tried to design an open and flexible process that provided conditions for as constructive and exploratory an exercise as possible. An aspect of the structure involved giving the participants a relatively free rein during the exercises. Moreover, flexibility was built into the process by leaving open the design of the second workshop until after the first had taken place. That way experiences from the first could be used as input for the design of the second. Moreover, an open and flexible approach was also taken to the use of the term discontinuity. No definitions were provided in the experiment. Rather, various discontinuity-related terms such as surprise and structural change were regularly used in the facilitator’s presentations to inspire participants to think in terms of discontinuity. That way it was hoped to stimulate participants’ interest rather than attempting to impose the idea on them and risk meeting resistance.

Another manner in which we sought to achieve flexibility was by designing exercises that could be conducted simultaneously rather than sequentially. Two exercises were chosen: variations on the brainstorming method, and an approach called perspective-based imaging. Lastly, special attention was paid to the heterogeneity of the group composition based on the assumed that a varied set of participants would stimulate thinking in terms of discontinuity.
2. Brainstorm variations

Group brainstorming is one of the most popular methods for generating creative ideas and it is a commonly used approach in participatory scenario development. With brainstorming participants are instructed to generate as many ideas as possible, and to defer judgement of the ideas until later. Osborn (1953; 1957), who is cited in Nijstad (2000), argues that brainstorming in this manner can lead to the generation of many good ideas, and that creativity is enhanced. Moreover, he argues that brainstorming should be done in groups, and that group members generate more ideas than individuals working in isolation. However, some 40 years of controlled research of group brainstorming has shown that it in fact leads to poorer results in both quantitative and qualitative terms when compared to ideas generated by individuals working in isolation (Nijstad, 2000). Nijstad (2000) therefore, argues that if effective brainstorming is what is desired then working individually is preferrable.

Nijstad cites Lamm and Tromsdorff (1973) when proposing that production blocking is the main reason for the relatively poor performance of group brainstorms. Blocking arises from the implicit rule that in group brainstorms only one person speaks at a time. Consequently, ideas cannot always be communicated the moment that they arise, which might lead to the forgetting or suppression of ideas, or an interference with a person’s train of thought. To avoid blocking, a variation of brainstorming was used called ‘brainwriting’, where participants communicate their ideas in writing rather than verbally.

Brainstorming and brainwriting are both common approaches in participatory scenario development. Invariably, scenario workshops start with some form of brainstorming or brainwriting. Workshop participants are then asked to think of influential trends or ‘driving forces’, uncertainties, and certainties (Schwartz, 1991) or a selection thereof, that might play a role in shaping the future. In scenario practice, the distinction between brainstorming and brainwriting lays in whether workshop participants call out ideas in a group setting or write down ideas individually on post-its, for example. Usually the brainstorming or brainwriting activity ends with a group session when participants are required collectively to structure or ‘cluster’ their proposed ideas.

Although brainwriting helps avoid production blocking, when conducted by individuals in isolation it lacks a number of benefits of group brainstorming (Nijstad, 2000). People tend to enjoy working in groups more than working on their own. Also, people are invariably more satisfied with their work when carried out in a group setting. Moreover, group brainstorming can add to the cohesion of a group and create ownership of the output and resulting decisions. Nijstad (2000) therefore recommends brainstorming in pairs in order to benefit from the advantages of both approaches.

In heeding Nijstad’s advice, all three approaches were experimented with in the pilot sessions: a group, an individual, and a ‘paired’ approach. Instead of group brainstorming, a system of group brainwriting was introduced; an approach not analysed by Nijstad but one that has been used in past scenario development including the Visions study. Group brainwriting involves individuals simultaneously writing ideas on post-its and immediately posting visibly for other participants to use in the generation of their own ideas. In contrast, in individual brainwriting participants are not offered the opportunity to take account of other participants’ ideas. In contrast to the
group and the individual brainwriting sessions, the paired variation did take place in the form of a brainstorm.

The primary aim of the brainwriting session was to investigate whether conducting multiple rounds with tailored questions per round might help extract more ideas about future discontinuity than if only one round was conducted. By setting the rule that the regurgitation of ideas was not allowed, it was assumed that multiple rounds would help extract discontinuous ideas from the participant group that were not proposed in earlier rounds. The group was not informed of the fact that each round would be followed by another in order to ensure that participants would not withhold any ideas per round. The first brainwriting round in the pilot sessions was intended to ‘purge’ the participants of ideas that were foremost in their minds. The participants were asked to write their ideas on post-its and to post their ideas on flipcharts. A second round then took place in the form of an individual brainwriting session. It was intended to elicit those ideas that were less prominent in the minds of the participants than those produced in the first session. Then a third brainwriting round took place in the form of a paired brainstorming session to ensure that all the participants’ ideas were exhausted. Lastly, the group was asked to cluster the post-its around the major themes.

The pilots with the individual and group brainwriting sessions led to satisfactory results in the quantity of the ideas produced. The experiments with the paired brainstorm in the pilot sessions degenerated into extensive discussions. The resulting ideas were markedly lower in quantity than the group and individual brainstorms. Consequently, the paired variation was dismissed, and the group and individual brainstorms were opted for in the stakeholder workshops.

The design of the stakeholder workshops was based on the experiences of the pilot sessions. The design was the same as that of the pilot sessions except for the paired brainstorm. At the first stakeholder workshop a brainstorm would take place in two brainwriting rounds in which participants would be given the task of answering two questions that were designed to elicit ideas about potentially discontinuous developments. In the group session, the group’s task would be to answer the question: “What do you think are currently the important issues for the future of salmon farming?” The second round would involve an individual brainwriting exercise where participants would write down their ideas on different coloured post-its to those in the group session so that they can be easily distinguished. The question to be answered in the second round was: “Are there issues that are currently hidden from view that might lead to surprises in the future?”

3. Perspective-based imaging

Our interest in experimenting with perspective-based imaging was based on the combination of imaging and perspective-based analysis. Imaging, as proposed by Kates (1996) and Clark (1986), involves the positing of an unlikely event and then constructing a plausible chronology of developments by which it might be realised. Experimentation with the approach took place in the Beyond Hunger (Achebe, Hyden et al., 1990) and the Surprising Futures (Svedin and Aniansson, 1987) studies. In both cases several ‘surprise-rich’ futures were developed using the imaging technique.
The theoretical basis of perspective-based analysis lies in the idea that aspects such as experience, preconceived ideas, and circumstance influence individuals' view of the world. This idea has been presented in various ways in a number of disciplines: philosophy (Kuhn, 1970; Solomon, 1996; Hales and Welshon, 2000), cognitive psychology (Johnson-Laird, 1983), physics (Cohen, 2002), and management science (Schwartz, 1991; Senge, 1993), for example.

However, perspective-based scenario development as proposed by Rotmans and Van Asselt (Rotmans and de Vries, 1997; Van Asselt, 2000) is largely based on cultural anthropological and political scientific research referred to as Cultural Theory (Douglas and Wildavsky, 1982; Schwarz and Thompson, 1990; Thompson, Ellis et al., 1990). The perspectives proposed by the theory are summarised in Textbox 1.

Textbox 1: the Cultural Theory perspectives

<table>
<thead>
<tr>
<th>Cultural Theory’s typology of perspectives</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Egalitarians</strong> hold that all humans are born ‘good’, but that they are highly malleable. Just as human nature can be corrupted by bad influences, it can be positively guided by an intimate relationship with nature and other people. Self-realisation lies in spiritual growth rather than in the consumption of goods. The egalitarian world-view implies a risk-averse attitude. The associated management style can therefore be characterised as preventative. With regard to the capitalist economic system, drastic and structural social, cultural, and institutional changes are advocated. The egalitarian believes that nature is fragile.</td>
</tr>
<tr>
<td><strong>For the individualist</strong>, human nature is based on self-seeking behaviour. Human beings are considered to be rational self-conscious actors seeking to fulfil their ever-increasing materialistic needs. Individualists believe that changes provide opportunities for human ingenuity that will manifest itself through market mechanisms. The individualist is risk seeking, believing that highly unlikely negative consequences of human activity will be resolved by technological solutions. The management style of the individualist is adaptive. Nature is robust, when regarded from an individualist perspective.</td>
</tr>
<tr>
<td><strong>Hierarchists</strong> consider humans to have been born in sin, but that they can and should be educated by good institutions. The role of management is to prevent serious problems by careful control so that the system is kept within its limits. This management style of control can be associated with a risk-accepting attitude. Hierarchists believe that nature is robust within certain limits, and that nature can cope with small disturbances.</td>
</tr>
</tbody>
</table>

The use of perspectives in scenario development (Van Asselt, 2000) involves investigating possible paths to the future on the basis of different perspectives on how the world works and how it should be managed. The development and comparison of these perspectives might lead to new insights about the progress of current developments that are not manifest when viewed from a single perspective (Van Asselt, 2000). Experimentation with this approach took place in the Targets study (Janssen,
1996; Rotmans and de Vries, 1997) and a study for the design of water management strategies for the Rhine and the Meuse rivers (van Asselt, Middelkoop et al., 2001). In the latter study, a stakeholder workshop that included a broad spectrum of participants – from shipping to fisheries, climatologists to policy makers – developed divergent visions of the future by reasoning from the different perspectives. The approach helped participants to understand interpretations of water management that were different to their own.

The experience with imaging in the Beyond Hunger (Achebe, Hyden et al., 1990) and the Surprising Futures (Svedin and Aniansson, 1987) studies, and with perspectives in the TARGETS (Janssen, 1996), water management (van Asselt, Middelkoop et al., 2001), and Shield of Achilles (Bobbitt, 2002) studies suggests that they could be inspirational for discontinuity-oriented scenario development. We decided to try and combine them so that the imaging approach might stimulate participants to explore the future and that the perspectives approach might encouraging participants to do so from several vantage points.

The combining of imaging and perspective-based analysis was tested in the pilot sessions. The participants were split up in break out groups of three people per group. In a first exercise the pilot participants worked solely with the imaging technique. They were asked to think of a possible discontinuous future for salmon farming in 2023, and to describe the events and processes that could occur between 2003 and 2023 that would lead to that described future state. The participants were then asked to repeat the exercise from the point of view of one of the Cultural Theory perspectives. Each group was given a different perspective to work with and asked to answer the question: if hierarchist/ individualist/ egalitarian interests were to be given a ‘carte blanche’, how should salmon farming be developed up until the year 2023? In a reference to discontinuity, the participants were also asked to consider two disruptive events that would be influential from the point of view of the break out groups’ respective perspectives. The perspective-based part of the exercise was based on its application in the water management study, which was combined with the imaging technique proposed by Kates (1996) and Clark (1986).

The experiences with the perspective-based imaging at the pilot experiment inspired the decision to continue experimenting with it in a stakeholder context. The stakeholder workshop participants would be asked to develop three contrasting images of possible salmon farming futures in 2023 on the basis of perspectives outlined in Cultural Theory. The participants would be asked to used the following questions as a guideline for the exercise: If either hierarchist, individualist, or egalitarian interests were to have a ‘carte blanche’ to organise salmon farming the way they want in the next 20 years, what would the state of salmon farming be in the year 2023? What needs to happen between now and 2023 in order for this future to occur? What signs were there in the last 20 years to suggest that this future might come about? What events or processes might alter the path of development to the future that you describe?

The participants were to be grouped around the perspectives that most closely represented the stakeholder group which they represented because experience from the water management study suggested that heterogeneous groups might spend a disproportionate amount of time debating the cultural theory perspectives. The composition of the egalitarian group was different from the rest, in part because of the
difficulty in recruiting NGOs who would have been assigned to this perspective. Two of
the free spirits, the clergyman and the Greenpeace spokesperson, were allocated to the
three person egalitarian group to see whether they would provide the novel ideas that
was expected of them. The third member of the group was a researcher.

Textbox 2: process design for the salmon aquaculture stakeholder workshops

4. Group composition
Thirty scenario studies investigated in Van Notten et al. (forthcoming, 2004a, 2004b)
demonstrate that the scenario studies that addressed discontinuity were all conducted in
an intuitive manner, which invariably contained strong elements of group work with a
relatively heterogeneous group of participants. There are indications that group
performance can be improved by selecting a heterogeneous group of participants as
demonstrated by psychological research on group performance in brainstorming
(Stroebe and Diehl, 1994) 24. This has only been shown for four person groups, however.
We aimed to investigate whether group composition has an influence on discontinuity-
oriented scenario development.

The idea of a heterogeneous group compares to the idea of requisite variety (Van der
Heijden, 1996; Van der Heijden, 2000), which in scenario theory is interpreted as the
need to match the variety of events and processes related to the issue of investigation,
with a variety of interpretations amongst participants in a scenario process. Of interest
to our research is whether a heterogeneous group might stimulate discontinuity-oriented
scenario development.

24 This research is described in Nijstad Nijstad, B. A. (2000). How the group affects the mind. Utrecht,
Interuniversity Center for Social Science Theory and Methodology.
A first step taken to achieve group variety for our experiment was to recruit a diverse set of people from each of the following areas: public policy, business, non-governmental organisations (NGO), and the research community. The recruitment process involved gathering groups that have a stake in salmon aquaculture. We selected the groups on the basis of desk research on the current state of affairs in the industry (Vellema and Van Notten, 2003). Potential participants from each group were then identified in the diverse professional networks of the team members and their organisations and subsequently invited. A number of other participants were recruited after searching alternative sources namely the Internet, a television documentary, and a newspaper article. The participants that were ultimately recruited included retailers, a caterer, and a farmed salmon producer, an information service delegate, an oceanographer, a researcher of alternative food sources, and a specialist in tropical fisheries. The stakeholder groups and their delegates at the workshops are described in Figure 1.25

In addition, we recruited people who were not familiar with European salmon aquaculture but who we suspected were able to provide new and different perspectives on the issue. The decision to recruit them was based on the scenario experience of some of the research team members. Examples of participating free spirits included a clergyman who is also professor in business ethics, and the former spokesperson for Greenpeace Netherlands at the time of the Brent Spar affair. Neither had any previous knowledge of salmon aquaculture but they were able to relate to the issue from their respective expertise.

Approximately 25 people were invited to attend the workshops. Eleven invitees attended the first workshop, 15 attended the second. Nine people declined the invitation for a variety of reasons ranging from priority setting, to scheduling problems, to the opinion that his/her expertise was already represented by somebody else.

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25 The names, positions, and organisations of the participants are not listed for reasons of confidentiality.
**Figure 1: Stakeholder groups that were present at the workshops**

<table>
<thead>
<tr>
<th>Salmon aquaculture supply chain</th>
<th>Other stakeholders</th>
<th>Free spirits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Retailer (1)</td>
<td>Regulatory organisation (1, 1a)</td>
<td>Prof. Business Ethics/ Clergyman</td>
</tr>
<tr>
<td>Caterer (1b)</td>
<td>NGO (1b)</td>
<td>Fmr. spokesperson Greenpeace</td>
</tr>
<tr>
<td>Processor (1*)</td>
<td>Boundary organisation (1, 1b)</td>
<td></td>
</tr>
<tr>
<td>Producer (1b)</td>
<td>Branch organisation (1, 1b)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Information service (1)</td>
<td></td>
</tr>
<tr>
<td>Research</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fisheries/Oceanography (1a, 1b)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Innovation &amp; technology (1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Food, health, nutrition (1*)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Legend:

(1) Number of participants from stakeholder group
(a) Attended 1st workshop only
(b) Attended 2nd workshop only
* Participant working for 2 stakeholder organisations
III. ANALYSIS OF AQUACULTURE EXPERIMENT

In the next paragraphs we discuss the findings from the experiment in terms of its three design components. They are described in terms of their inspiring, impairing, or double-edged influences with respect to investigating the idea of future discontinuity.

5. Group composition

Our aim was to have the experiment provide further indications about the influence of a heterogeneous group composition on thinking about discontinuity without expecting conclusive evidence. Such evidence is difficult to achieve with an exploratory design as ours where systematic comparison of observations is problematic. One reason for this is the lack of a satisfactory manner to measure or benchmark the results through a control group, for example. The group that participated in the pilot sessions was too dissimilar to the stakeholder group for it to be used as a control group. Furthermore, the concept of a control group was in itself problematic for the experiment because of other aspects of the experiment could not be controlled. Examples of these aspects include mood and personality of the participants, which would ensure that no one experiment would deliver the same results.

As explained earlier, the composition of the group of participants was heterogeneous. It represented a kaleidoscope of different affiliations with salmon aquaculture and related issues. The group at the second workshop was not only larger but also more diverse than the one at the first workshop. Participants of the first workshop voiced their concern about the fact that members of the business community had withdrawn their participation shortly before the workshop. The business community was better represented at the second workshop, much to the appreciation of the several participants who felt that the discussions benefitted from the commercial parties’ contributions.

The participants’ reflections that were discussed in ten-minute feedback sessions at the end of each workshop provided some indications of a relationship of group diversity to thinking about discontinuity. Numerous participants voiced their appreciation of the group variety indicating that it ensured that discussions addressed the ‘big picture’ and that they did not get bogged down in details. Moreover, some participants indicated that the group variety made them open their eyes to new ideas and interpretations. Although participants were enthusiastic about the process and the exercises delivered a host of ideas about discontinuity, the participants’ reflections only provide indirect indications that group variety contributed to discontinuity-oriented thinking.

The only clear indications that group heterogeneity stimulated discontinuity-thinking were provided by the constructive roles played by the two free spirits. One consciously took an extreme position in the perspective-based imaging exercise to stimulate the rest of the group to come up with and deliver eccentric and novel ideas. S/he did so by inviting other participants to look beyond current salmon aquaculture and drawing on analogous cases of social taboo and the downfall of industries such as fur and tobacco. Also, the free spirit posited the idea that commercial fishing would no longer exist in Europe in 20 years time, which would be a discontinuous development. All of these ideas were adopted by the rest of the group. Therefore, there are indications that group variety contributes to discontinuity-oriented thinking. The contribution of free spirits appears to be especially inspiring for exploring the idea of discontinuity.
2. Brainwriting

The result of the brainstorm and clustering process is presented in Figure 2. The ideas from the second brainstorming round are presented in italics.

The primary aim of the brainwriting session was to investigate whether conducting multiple rounds with tailored questions per round might help extract more ideas about future discontinuity than if only one round was conducted. The leading question in the first exercise, the group brainwriting session, was “What do you think are currently the important issues for the future of salmon farming?” The participants were not specifically asked to name potentially discontinuous issues. Forty ideas were proposed,
a small number of which might qualify as discontinuous including incidents such as food scares, the discovery of dangerous substances in farmed salmon, and the collapse of the aquaculture market. A comment about the topic of media attention pointed to its the potentially discontinuous impact: “a BBC documentary can be a blow, the impact of which would last for years”.

The leading question for the second, the individual brainwriting session, was specifically designed to stimulate ideas about discontinuous developments: “Are there issues that are currently hidden from view that might lead to surprises in the future?” As in Visions, no definition of surprise or other discontinuity-related terms were provided in order to have participants work with their own interpretations. Some follow up questions were raised in order to clarify the question. The facilitator then emphasised the idea of discontinuity in the exercise, adding, “Perhaps on the basis of the ideas in the first [brainwriting] round, you can think of ideas that might surprise the other participants. What kind of hidden, unexpected developments might befall us [the salmon industry] in the future?” In order to encourage participants not to hold back in proposing eccentric ideas, he added that there was no such thing as a bad idea. The facilitator intervened once during the exercise to encourage participants to come up with issues other than those directly related to salmon. He used a war in Pakistan and the collapse of the European Union as examples.

The 21 ideas that resulted from the second exercise were arguably more novel and discontinuity-oriented than those produced in the first round. Examples include discontinuities such as the collapse and bankruptcy of the aquaculture industry, the demise of edible fish, the realisation of a closed aquaculture system, and salmon becoming herbivorous. With respect to the quantity of ideas, the second exercise produced approximately half of the ideas of the first exercise. On the one hand, it appears that the majority address abrupt discontinuities because they appear to address events rather than processes. On the other hand, many abrupt discontinuities such as bankruptcy, technological breakthrough, and consumer boycotts suggest the development of more structural change or gradual discontinuity. It is often unclear whether the ideas of the second round speak of abrupt or gradual discontinuity. The reason is that the ideas were described in such rudimentary terms and only a few were discussed with other participants that it was often difficult to know what underlying events and/or processes were being referred to.

Our analysis shows that the discontinuous ideas concentrated on three categories: environmental impacts, technological breakthroughs, and commercial and consumer developments. Both positive and negative discontinuities were named in the first two categories. Environmental calamities include contamination of wild fish stocks and disease to the extent that wild salmon become endangered species. Positive developments in environmental terms include the closing of the salmon aquaculture system so that there is no more burden on the environment. Discontinuity in commercial and consumer developments show a similar pattern between the positive and the negative. On the one hand ideas proposed include consumer boycotts and a general turning away from eating fish, and the bankruptcy and demise of the industry. On the other hand, one proposed idea speculates on the possibility on the massive expansion of the Chinese market for salmon. Technological breakthroughs include the discovery of alternative protein sources for fish feed and the earlier-mentioned closing of the aquaculture system. Arguably salmon becoming herbivorous is a positive discontinuity.
from a technological and commercial perspective, but perhaps not from an ethical and environmental one perspective. Besides individual discontinuity-oriented ideas there was also an entire cluster that appeared to address the concept given its name, system change, which the participants gave it. It contained ideas such as pollution, organic salmon farming, and the creation of new products and production systems as a result of warming or cooling of the seas.

A second aspect of the brainwriting session was to investigate whether interaction between participants through the sharing of ideas would stimulate thinking in terms of discontinuity. However, there was little to distinguish the group activity in the first round from the individual one in the second because participant interaction hardly occurred in the group session. The interaction between the participants in the group brainstorm was supposed to take place as participants posted their post-its on flipover charts. However, despite encouragement by the facilitator, the interaction failed to materialise as participants remained seated until they had written down all their ideas. Therefore, on the point of investigating the effects of the interaction between participants the experiment failed to deliver any conclusions.

From our observations we conclude that on the basis of brainwriting by individuals on their own, it is worthwhile to have multiple brainwriting rounds in order to extract ideas on discontinuity. The first round is intended to purge the participants of the most obvious and prominent ideas. This offers the opportunity for focusing on discontinuity in subsequent rounds.

6. Perspective-based imaging
The perspective-based imaging exercise aimed at confronting different perspectives on salmon aquaculture with one another. In so doing, new insights pointing to potential discontinuity might become apparent to participants.

The image of the future created by the hierarchist group is one where European salmon farming is a less intensive, differentiated, locally-based industry. This is the consequence of a series of abrupt environmental calamities of “Chernobyl-like proportions” in the middle of the described trajectory to the future. The calamities include the discovery that wild salmon is no longer able to find its way back to their spawning grounds as a result of interbreeding with farmed salmon, and, later, the presentation of evidence by a renowned fish authority that there is no more wild salmon to be found anywhere. According to the hierarchist group, these events breathe new life into the decaying European Union as it becomes the facilitator of a public debate on how to create ‘honest salmon’, a certified label for farmed salmon. The EU also becomes the enforcer of subsequent legislation.

A possible cognitive barrier to considering discontinuity was demonstrated in the individualist group’s process. The session was characterised by a strong sense of agreement as well as an arduous process in adding detail to their image of the future. At the beginning of the exercise all the four group members offered their ideas about the individualist’s future of salmon aquaculture. This did not immediately lead to interaction or discussion between group members. However, when one member offered the analogy of the life cycle of wine – from an exclusive product to a commodity item – the rest of the group was quick to close ranks behind it unquestioningly. The observer of
the exercise noted the enthusiastic sense of agreement in the somewhat repetitive group discussion that followed.

However, once the group was challenged to add detail to the general idea that they were in agreement on the group began to struggle. Neither the participants nor the facilitator saw the questions of the task description as a manner to help establish the details. When it came to filling in the details, two group members even withdrew from the exercise altogether while the other two members were strongly reliant on the facilitator to help them. The willingness of the group to subscribe to one idea and, when pressed, their struggle and unwillingness to provide detail suggests that groupthink might have occurred. Introduced by Janis (1982), the concept of groupthink refers to the phenomenon where loyalty to the group is given priority over the need for sound decision-making. As a result, group members conform to the dominant mode of thinking, voluntarily or involuntarily, and no critical analysis of the issue under investigation occurs. Groupthink is not restricted to decision making contexts and it is also addressed in scenario literature (Van der Heijden, 1996). We argue that group think might impair discontinuity-thinking because the pressure to conform might make a group unwilling to consider unconventional ideas including those about shocks and structural change.

The image of the future developed by the individualist group described a blossoming fishing industry with a diversity of healthy products. Technological innovation, such as widespread, closed-system fish farming and mobile fish farms at sea, would contribute significantly to the realisation of the individualist’s image. The group described abrupt discontinuities such as a BSE-type food scare, and the damaging health effects of poisonous chemicals in farmed fish. Like in the egalitarian image, these abrupt discontinuities were scattered throughout in the individualist image.

The role of the ‘free spirits’ as providers of novel ideas was demonstrated in the egalitarian group. Two of the three group members were recruited as free spirits. The group members considered it their task to posit “the extreme perspective” so as to ensure that the output of the break out groups as a whole was highly divergent. As one of the group members described it:

If one wants to posit and ecological [egalitarian] perspective […] then we should develop an extreme image [of the future]. Otherwise it’s no fun! Otherwise it would be like the council of EU ministers of agriculture; you end up with a compromise.

Accordingly the group set about developing an image of the future that reasoned from the presumption that by 2023 there would be no more fishing industry and salmon aquaculture in Europe. Such a future is a discontinuity in itself given the large expansion of the industry in recent decades. Abrupt discontinuities that the group considered were health scares, European famine, fish stock collapse, the disruption of the fishing and aquaculture industries after bombings in traditional fishing villages, and a Greenpeace protest involving the dumping of farmed salmon in front of a supermarket. Gradual discontinuities other than the decline of the industry include continued pollution leading to a deep mistrust of sea-based products, a taboo on fish and meat products across society and the socio-economic impact thereof, and the emergence of a
stigma on associated industries, much like the tobacco and the tobacco industry in recent decades.

On the basis of the participants’ output, we argue that perspective-based imaging exercise appears to be inspirational for thinking in terms of discontinuity. One participant suggested that because participants had regarded the future from the vantage point of a stereotype rather than from their own perspective, the resulting storylines should be used as general inspiration for scenario development but not as a point of departure. Overall, the groups considered a large variety of discontinuous events and processes ranging from social-cultural changes, health and disease, environmental disaster, to economic progress and decline, and technological mishaps and breakthroughs. The participants generally regarded discontinuity as a negative idea when considering their frequent references to crises and calamities.

In conclusion, we argue that perspective-based imaging appears to be a promising approach for discontinuity-thinking because of the potential insights of future possibilities when viewing an issue from numerous vantage points.

IV. REFLECTIONS ON THE EXPERIMENT

With respect to the open methodological structure of the experiment, the issue of definition of discontinuity in particular provided some interesting results. No definitions were provided in the experiment. Rather, various discontinuity-related terms such as surprise and structural change were regularly used in the facilitator’s presentations to inspire participants to think in terms of discontinuity. That way it was hoped to stimulate participants’ interest rather than attempting to impose the idea on them and risk meeting resistance.

There are indications, however, that the participants’ interest in discontinuity was probably not kindled enough. To illustrate, the only recorded indication of an awareness of discontinuity’s central role in the experiment is a free spirit’s comment that he saw it as his/her role to provide eccentric, extreme ideas about potential future developments. Moreover, discontinuity-related ideas were usually only proposed when that was explicitly asked of the participants. There are only a few indications of participants’ contributing ideas about discontinuity without being directly prompted by the facilitator, his/her presentations, or other aspects of the experiment’s design.

On the other hand, the aquaculture experiment also demonstrated that the perception that discontinuity was not a prominent issue in the study did not mean that the idea did not feature in the output. Although the aquaculture experiment did not go as far as the development of scenarios, there is evidence that the same phenomenon occurred. Indeed, the exercises produced a relatively large number and diversity of discontinuities as we show in the next section.

On the basis of our observations we conclude discontinuity was not a consistent and prominent feature during the workshops, despite our intentions to achieve the contrary. However, we should also ask what improvements to our discontinuity-oriented process design might help to inspire participants to take the idea of discontinuity as their point of departure during the exploratory study, even if reasoning from the idea does not come to them naturally. Given the above observations, it is possible that references to the idea should be made more distinct in discontinuity-oriented scenario development.
Although there were regular references to discontinuity in the various presentations that were prepared by the research team, the idea was only one of many communicated to the participants. An improvement to the process design might therefore be to verbally emphasise and elaborate on the idea of discontinuity in introductory presentations and to actively support participants during discontinuity-oriented exercises. In any event, efforts should be made to ensure that discontinuity remains at the forefront of participants’ minds throughout the exercise.

With respect to the group composition, numerous participants voiced their appreciation of the variety indicating that it ensured that the ‘big picture’ was discussed, and that it made them open their eyes to new ideas and interpretations. However, the only clear indications that group heterogeneity stimulated discontinuity-thinking were provided by the constructive roles played by the two free spirits. Furthermore, despite lack of conclusive evidence, we argue that it is at least conceivable that the diversity of the group as a whole also contributed to the variety of discontinuity-rich output from the exercises.

Brainwriting in multiple rounds is also a promising approach for discontinuity-oriented scenario development, as the experiments’ results demonstrate. A first round is used to extract the ideas that are foremost in participants’ minds, and a second is used to press participants’ to think beyond the obvious and conventional lines of thinking. In so doing, the second round can be geared towards inspiring thinking about discontinuity. However, creating opportunities for participants to be inspired by one another’s ideas might be beneficial to the quality and quantity of the ideas on discontinuity that are produced. The experiment did not provide insights regarding the benefits of group interaction, so this remains an issue for further research. We also found perspective-based imaging to be inspirational for thinking in terms of discontinuity. The approach inspired participants to consider a large variety of discontinuous events and processes.

The participants did not appear to find it difficult to consider the future. The apparent ease with which participants considered the future might have been inspired by the imaging technique’s backward-looking approach where the path from a particular point in the future to the present is investigated rather than vice versa. Such a backward-looking approach allows participants to distance themselves from the present, which is more difficult in a forward-looking approach where the present is used as a point of departure. Another inspiring factor might have been the perspective-based approach. Numerous participants expressed their approval of the approach as a creative way to consider future possibilities and to make contrasting interpretations explicit.

Three categories of discontinuities arose out of the brainwriting exercise: environmental impacts, technological breakthroughs, and commercial and consumer developments. Five types of discontinuities emerged from the perspective-based imaging exercise: social-cultural change, disease and health impacts, environmental disaster, economic progress and decline, and technological mishaps and breakthroughs. Therefore, the experiment provided discontinuity-rich output, despite indications that discontinuity was not prominent in the minds of the participants and the facilitator. This suggests the effectivity of the discontinuity-oriented methods in stimulating thinking about an idea that participants do not consider naturally. A question for further research might be whether a keener awareness and appreciation of discontinuity in the participant group would produce different output.
V. CONCLUDING REMARKS

In this paper we described an experiment designed in order to observe participant behaviour under conditions intended to inspire discontinuity-oriented thinking. Flexibility was built into the process in independent nature of the methods in that they might be used simultaneously rather than sequentially. Other methodological decisions included not using a predefined concept of discontinuity in order to kindle participants’ interest in investigating the concept themselves, and making regular references to discontinuity during the course of the workshops in order to avoid the idea slipping off the research agenda. The experiment also centred on four methodological issues: group composition and two methods: brainwriting and perspective-based imaging.

It does not appear as though the open definition of discontinuity kindled interest in investigating the idea. However, the lack of a definition did not seem to impair discontinuity-thinking but the question remains whether presenting the participants with a predefined concept might have lead to a different result. Similarly, the regular reminders of discontinuity in the various powerpoint presentations only partly caught on with the participants beyond taking the requested steps as proposed in the exercise.

There are indirect indications that a heterogeneous group composition served to broaden the discussion, and introduce new ideas and perspectives to varying degrees. The two methods inspired the exploration of discontinuity. The staggered nature of the brainwriting sessions was effective in generating ideas about discontinuity. The perspective-based imaging exercise inspired participants to consider a large variety of discontinuous events and processes.

The aim of testing an open and flexible approach for discontinuity-oriented scenario development appears to have successful in several areas. There were many indications of factors that inspire discontinuity-thinking. The evolutionary paradigm is the main impediment to the exploration of discontinuity that we came across. In any event, the salmon aquaculture experiment demonstrated the complexities involved in discontinuity-oriented scenario development.
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Presentation 5:

Salmon aquaculture

Exploring discontinuity – an experiment

- open methodological structure: incl programming discontinuity, group variety, free spirits, parallel approach
- Methods: staggered brainwriting, perspective-based imaging
Staggered brainwriting

Two rounds:
1. Extracting the ‘obvious’:
   “What do you think are currently the important issues for the future of salmon farming?”
2. Focus on discontinuity:
   “Are there issues that are currently hidden from view that might lead to surprises in the future?”

Perspective-based imaging

- Perspectives: Cultural Theory - Douglas and Wildavsky (1982), Schwarz and Thompson, (1990), Thompson et al. (1990)
Cultural Theory Perspectives

EGALITERIAN
- nature fragile
- people good & malleable
- ecocentrism
- prevention
- equity & equality
- risk-aversive

HIERARCHIST
- nature tolerant within limits
- people sinful
- partnership
- control
- stability
- risk-accepting

INDIVIDUALIST
- nature robust
- people self-seeking
- anthropocentrism
- adaptation
- growth
- risk-seeking

Conclusion: Inspiring factors

Open structure
- Flexible facilitation
- Independent vs interdependent steps
- Group variety & free spirits
- Programming discontinuity

Methods
- Staggered brainwriting
- Perspective-based imaging

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