ELEVATING CREATIVITY AND CRITICALITY THROUGH GAME-BASED FUTURING

An action research case study in futures studies

Author:
Nicolas A. Balcom Raleigh

Supervisors:
Professor Sirkka Heinonen
Dr.Soc.Sc. Juha Kaskinen

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PROLOGUE

"The future exists in our minds, in the images of our minds, in our expectations, wishes and opportunities we see unfolding, as well as in our fears, threats and risks we see for ourselves or for future generations. In the present these images – which are the future brought to the present – act as the motives on which our deeds and behavior are based. Moreover, they act as a spiritual reservoir for us to differentiate right from wrong, good from bad, beauty from ugliness in our everyday life."
—*Pentti Malaska*[1]

This master's thesis focuses on how creativity and criticality can work together to overcome limits to human understanding to produce desirable futures. It is inspired by the foresight work of Sirkka Heinonen and her futures research team for the Neo-Carbon Energy project—Joni Karjalainen, Marjukka Parkkinen, and Juho Ruotsalainen. My experiences working with her and her team on the Neo-Carbon Energy project have expanded my understandings of how futures research can have global societal impacts.

I had the good fortune of working with Heinonen and the NCE team during two internships with the Finland Futures Research Centre in the summer and fall of 2015 and in various volunteer capacities as a student. The Neo-Carbon Energy project is confronting a key challenge for humanity—how to produce enough energy for us to thrive while limiting the consequences of global warming. While the official scope of the research project is national, concentrating on Finland and its energy needs, the far-reaching potential in this project was immediately apparent to me.[2] The international team of scientists working on this project may find a way to implement an entirely new global energy system, eliminating the need for fossil fuels and nuclear energy, by the year 2050.

My contributions to Neo-Carbon Energy are small compared to those of the wider research team. These included being a group moderator at Neo-Carbon Energy Futures Clinique held at Sitra in Helsinki (Heinonen et al. 2015, 56), a group co-moderator for an experimental CLA Game on Neo-Carbon Energy and one of five co-authors of the game's report (Heinonen et al. 2015b), and a co-author of the report about a Futures Clinique on Neo-Carbon Energy scenarios held with international students at Aalto University (Heinonen & Balcom Raleigh 2015).

When describing the Neo-Carbon Energy project to others I say, "If it works, the world will be free from fossil fuels and nuclear energy." I am usually met with a simultaneous reaction of pure hope—people wish this future could be true—and pure disbelief—a deep skepticism anything about our present situation will change. Meanwhile, a 100 percent renewable energy world by 2050 is highly desirable future for humanity.[3] Not only, according to many scientists, is it necessary in order to keep global warming below a global average increase of 2 degrees Celsius by 2100, it also has grand geopolitical implications.

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[1] From a speech by Malaska at the Society for Futures Studies 30th Annual Conference in 2010 (Wilenius 2014, 65).

[2] In the second of the Neo Carbon Energy researchers' seminars I attended, several students of Christian Breyer, Professor of Solar Energy at Lappeenranta University of Technology, presented models showing how super regions around the world (e.g. Eastern South America) could be using 100 percent renewable energy in 2050. In these models, renewable energy was more cost effective than fossil fuels and nuclear power. (Explore these models at http://www.neocarbonenergy.fi/internetofenergy/, accessed 23.3.2017.)

[3] Ossip Flechtheim (1949) and Wendell Bell (2009, 73-75) emphasize that a special purpose of futures studies is to tackle grand challenges to improve the future for humanity and the environment. The concept of desirable futures is described more in Chapter 1.2.

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A world in which oil, coal, and uranium no longer drive the global energy economy could profoundly rebalance political and economic power among nations. This transformation includes great potential for a world that is more just, equal in wealth, and peaceful.[4] Yet, when I have suggested such potential to others, these desirable possibilities flash into mind for only a moment before quickly being replaced with a profound sense they could never occur.

If deep, all-encompassing, system-wide, and radical changes are needed to address humanity's greatest challenges such as climate change, what futures studies practices will help us achieve these changes? It appears that the trappings of present understandings—worldviews, mental models, convention, etc.—serve to limit what is possible for individuals, groups, and all of humanity. What can break through these constraints? Part of the answer appears to come from a critical perspective—challenging assumptions and questioning why things are how they are. Another part appears to come from a need for creativity—producing new ideas and ways forward. Therefore, the topic of this thesis is elevating creativity and criticality in participatory futuring. Because game-based approaches lend themselves to supporting elevating creativity and criticality, this thesis sets out to develop a futuring game. The intent of this work is to explore new means for applying creativity and criticality to shape desirable futures.

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[4] There is also a potential that a Neo-Carbon Energy system would replicate existing patterns of dominance and disparity—for example, large multi-national corporations could devastate poor communities.

ACKNOWLEDGEMENTS

1   INTRODUCTION

> *"After all, the past is over and done with. Although we can—and often do—change our ideas about it, we cannot change the past itself. The future, to the contrary, has not yet happened. It is open and filled with opportunities and challenges. [...] It invites people to think creatively to understand it and to act creatively to help produce it, even to anticipate things that have never existed before in human history."*
> —Wendell Bell (2009, xxiv)

This thesis develops a futuring[5] game called Metaphor Molecule using an action research approach. The game aims to help people creatively and critically break through limitations on understanding to boldly create new desirable futures. This futuring game is iteratively developed via an action research approach with a goal of elevating creativity and criticality both in the participation experience and the research outputs. The contents and form of this futuring game are taken from a larger futures research project called Neo-Carbon Energy. That project is concerned with technologies and foresight for a 100 percent renewable energy future in the year 2050. This thesis shows how action research can be used to rigorously develop sophisticated new ways of exploring possible futures.

This thesis begins by locating its overall research project in the emancipatory tradition of the futures studies field, describing the Neo-Carbon Energy project and its background, the relevance of an action research into developing game-based futuring, and the research objectives and questions (Chapter 1). Next, the key theoretical concepts of creativity, criticality, Causal Layered Analysis, leverage points, and metaphors are presented and linked together (Chapter 2). The specific approach to action research and data collection used to develop the Metaphor Molecule game is described in Chapter 3. The key components of Metaphor Molecule and their origins in the June 2015 CLA Game are discussed in Chapter 4. The outcomes of the action research iterations are presented and analyzed in Chapter 5. Discussion of how the iterations answered the research questions and fed into the theoretical framework and some conclusions are made in Chapter 6. This thesis has four outcomes. First, it demonstrates how action research can produce novel approaches, connected to theory and informed by practice, to game-based participatory futuring. Second, it produces a new futuring game capable of elevating creativity and criticality. Third, it offers some insights into the Neo-Carbon Energy scenarios. Fourth, it begins to describe how creativity and criticality interact in participatory futuring.

This master's thesis explores how futures researchers can develop game-based participatory elements demonstrably capable of elevating creativity and criticality with a goal of identifying paths toward desirable futures. The focus of this research is on using action research to produce a game-based element which can be demonstrated to increase both creativity and criticality in futuring participants and process outputs. This action research is conducted using an ongoing foresight project aimed at radically transforming the energy system of Finland—and potentially the world—called Neo-Carbon Energy as its basis.

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[5] "Futuring" is a term coined by Jerome Glenn in a 1973 *Instructor Magazine* article and popularized by Edward Cornish (2009, 149), founder of World Future Society, in his book by the same name. It refers to all future-oriented activities including foresight, futures research, futures studies, anticipation, etc. This term makes the word "future" into a verb meaning "to engage in futures thinking, research, or activity," and then makes a gerund of that verb so it can be used as a noun.

1.1   Background

1.1.1   Neo-Carbon Energy

The Neo-Carbon Energy project aims to develop an energy system featuring new ways of storing renewable energy for Finland that is "emissions-free, cost-effective, and independent".[6] The project includes several scientific research and development work packages all exploring possible technology solutions and future societal implications. The foresight work package for the project is led by Sirkka Heinonen at Finland Futures Research Centre. Her research team explores what society and economy of a Neo-Carbon Energy system could be like in 2050 by developing four transformative scenarios all based on an initial premise of 100 percent renewable energy (Heinonen et al. 2016, 9).

The scenarios are being developed through a combination of desk research, participatory workshops called Futures Cliniques, and experimental game-based futuring. In contrast to many futures methods, Futures Cliniques are used to explore "possible, preferable, alternative and surprising futures" while challenging participants to consider "impossible, improbable and nonpreferred futures". (Heinonen – Ruotsalainen 2013.) These Futures Cliniques allow participants to contribute to the iterative evolution of the scenarios while simultaneously supporting participants in imagining new possible futures.

Neo-Carbon Energy is selected as a theme in this research because the project in its entirety exhibits characteristics of creativity and criticality, challenging conventional belief that humanity's energy system will always be dependent on fossil fuels and mined radioactive materials. By presenting bold "100 percent renewable energy" futures the foresight work package presents a critical view toward the present and business-as-usual futures, making space for imagining a world wildly different from what we have today. Because the foresight work package is arguably approached through its own form of critical and creative futuring, the Neo-Carbon Energy scenarios (see Chapter 4.1) are used as the content for the futuring game developed in this thesis.

1.1.2   Game-based Futuring in Neo-Carbon Energy

Game-based futuring can be applied to engage stakeholders in foresight processes and outcomes and simulate possible futures (e.g. Rausch – Catanzaro 2009; Bontoux et al. 2016). Heinonen collaborated with Sohail Inayatullah, the most influential advocate for the Causal Layered Analysis (CLA) method and theory, to produce an experimental CLA Game on Neo-Carbon Energy scenarios at a futures studies conference in June 2015 (Heinonen et al. 2015b). Some stated aims for the June 2015 CLA Game were to elaborate the Neo-Carbon Energy scenarios, attempt to 'raise novel and transformational view-

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[6] The Neo-Carbon Energy project is funded as a strategic opening of Tekes[6], the Finnish Funding Agency for Innovation, and has three partner organizations: VTT which acts as coordinator, Lappeenranta University of Technology, and Finland Futures Research Centre - University of Turku. Its mission, research questions, publications and models can be found on its website, http://www.neocarbon.fi. The webpage for its foresight team at FFRC is http://www.utu.fi/en/units/ffrc/research/projects/energy/Pages/neo-fore.aspx.

points' and add perspectives which may have otherwise gone unnoticed, as well as describe alternative perspectives based on various roles. (ibid., 13.) The June 2015 CLA Game[7] is the origin for the futuring game developed in this thesis.

The June 2015 CLA Game combined methodological concepts from Heinonen and Ruotsalainen's Futures Cliniques with the method and theoretical basis of Inayatullah's Causal Layered Analysis (see Chapter 2.3). The June 2015 CLA Game was different from Inayatullah's original conception of the CLA Game because each group worked on one of the four Neo-Carbon Energy scenarios instead of each group working on only one of the four CLA layers. In the June 2015 CLA Game, each group explored all four layers of CLA—Litany, Systemic Causes, Worldview, and Metaphor—through four exercises. These exercises were reading the front page of a newspaper from the future scenario; identifying systemic causes for the scenario in a PESTEC (Political, Economic, Social, Technological, Environmental, and Cultural) futures table; selecting futuristic roles for themselves in the scenario and considering what were the motivations, threats, allies, enemies; and determining metaphors for these roles.

The June 2015 CLA Game is an example of participatory futuring which arguably elevates creativity and criticality. In this game, creativity was driven by its rules, elements, and activities (Csíkszentmihályi 2014, 140) while criticality was driven by the interconnection of game activities with CLA layers of Litany, Systemic Causes, Worldview, and Metaphor/Myth (see Chapter 2.3 for details). These game activities were to read a newspaper's front page from the scenario, construct models of systemic causes for the scenarios in a PESTEC, imagine characteristics of various roles act in the scenarios, and generating metaphors for those roles. Csíkszentmihályi's concepts of flow and intrinsic rewards (see Chapter 2.1) could have motivated players to engage in these criticality-supporting activities. Because the June 2015 CLA Game can be considered an example of participatory game-based futuring that elevates creativity and criticality, it is taken into use in this master's thesis as foundational to the development of the new game element. A gap this research seeks to address is how it can be demonstrated to have elevated creativity and criticality. Furthermore, the new futuring game builds upon concepts from the June 2015 CLA Game.

1.1.3   Action Research in Futures Studies

Action research is a demonstrated way to link theory and practice in developing new methods or tools for futures research. Ramos (2006) describes the relation of action research to other participatory research and consulting practices, including those popular in futuring.[8] Action research has been applied in several foresight and futures studies including a regional foresight project (Higdem 2014), corporate/organizational foresight (Clemens 2009), action scenarios which explore how actors interact with scenarios (Marchais-Roubelat & Roubelat 2008), participatory city planning efforts (Karuri-Sebina & Rosenzweig 2012) and as means for introducing social learning in urban climate adaptation projects (Albert et al. 2012). Stevenson (2002) proposes Anticipatory Action Learning as an integration of action research and foresight, a concept also championed by Inayatullah (2002; 2006). List (2006) scientifically documents his application of action research to produce new approaches to scenario planning.

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[7] In this thesis, the futuring game held at the Futures Studies Tackling Wicked Problems Conference is called the June 2015 CLA Game.
[8] Using action research in futures studies was the topic of a special issue of *Futures* in 2006. The edition was edited by Ramos, a futures scholar who also runs a practice called Action Foresight.

Following in the footsteps of Ramos, Stevenson, List and others, this thesis continues the project of enriching theory and practice of futures studies through action research. An overarching goal of using action research in this study is to see how it can be applied to articulating and exploring desirable futures. Like List, this application of action research seeks to develop new participatory futuring, particularly of the game-based variety. Unlike Stevenson, this application of action research is more classically researcher-led than called for in Anticipatory Action Learning. What is new in this thesis is the integration of data collecting tools which can show how well the futuring game does or does not accomplish its stated aims of elevating creativity and criticality (see Chapter 3.2). These tools provide a means for rigorous and systematic demonstration of outcomes from the action research. The action research approach used in this thesis is further discussed in Chapter 3.1.

1.2   Relevance to Futures Studies

Some futures scholars call for greater creativity and criticality in futures research and futures studies (e.g. Ahlqvist & Rhisiart 2015). While much has been written about creativity and criticality independently, little has been written about how creativity and criticality interact or work together to produce new understandings, especially regarding possible futures. This master's level study seeks to begin describing this interaction, but stops short of producing new theory. Yet, assuming creativity and criticality are mutually supporting energies, this thesis seeks to demonstrate a means for elevating creativity and criticality in participatory futuring contexts.

Creativity is emphasized as an important characteristic in futuring by many futures studies scholars. Masini (1993, 23) highlights how imagination and creativity are essential for showing what is truly new in futures studies and "preferences, desires, and fears." Miller (2011b) advocates for participatory futuring processes that are open to creative thinking by creating and giving permission to participants to consider varied futures. Hiltunen (2008, 34; 2010, 107) surveyed futurists about how they identify weak signals of possible futures and these futurists identified creativity among the important requirements for being able to detect them. She argues that scanning for weak signals "involves keeping one's eyes open, and having a sensitivity for change, creativity, receptiveness, intuition and a curious mind". These futures scholars value creativity in futures studies for its ability to break free from existing mental models.

Early proponents of the academic field now known as futures studies, such as Ossip K. Flechtheim (1949; 1976) in the 1940s and Robert Jungk in the 1960s, proposed this new field should be an active discipline in which people work to create a better future for humanity. Jungk advocates for people who will experience a particular future to have a voice or role in creating it. (Jungk & Müllert 1987; Masini 1993, 25) This perspective is further reinforced by Bell (2009, 73-75) who cites futurists Amara, Markley, Masini, and Toffler to argue it is completely legitimate for futurists to advocate for preferable futures. Bell further argues that it is possible to "objectively demonstrate many of the values that describe what is most desirable" (Bell 2009, 157).[9] Dator (2002b, 109-110) argues, with reference to Jungk and Boulding, that futures studies seeks to move people beyond passively observing possible futures toward actively describing desirable ones and taking actions toward them. These founding voices in futures studies can be synthesized into a

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[9] In this thesis, Bell's belief in objectivity is considered problematic while his call for futurists to openly make the case for the norms upon which they base desirability of specific future is a worthy goal.

higher order objective for futures research: imagining, describing, and acting toward *desirable* futures.

Many of the first futures research methods developed during the 1940s, 1950s, and 1960s are now considered the standard bearers in the field of futures studies. When reading accounts of the origins of these futures methods—such as those documented in the Millennium Project Futures Methodology (2009) and elsewhere—it is easy to imagine the energetic inventiveness of the early futures field. Futures researchers and practitioners from these early times needed to create new tools from existing concepts as they scrambled to identify meaningful ways to consider possible futures. Today, futures studies, as a discipline, can be said to have a set of recognized methods for engaging in foresight practice and conducting futures research. Best known among these include Delphi, the scenario technique, horizon scanning, trend extrapolation, and mathematical modeling. However, many of these tried and tested methods were created at a time when the primary concern of institution-level futures scholars and practitioners was to explore probable futures while paying less attention to possible or desirable futures (Amara 1981, 28).

It could be argued that what is now known as futures studies has moved from its early days of wide possibilities to a more mature phase featuring a large influence of theoretical and methodological lock-in. Using field-tested methods and well-vetted theory is less risky than introducing brand new ways of approaching futures studies. Having a ready-to-use set of methods is beneficial because it allows more critical attention to be placed on the contents of their application rather than the merits of the methods themselves. The state of the futures studies field in 2016 can be described as one in which few research centers and academic departments have sufficient time and resources available to conduct basic research to develop the field's theories and methods. Instead, resources are more frequently given to applying existing theory and methods to specific "future of X" research projects.

The proven methods of futures studies are not dormant—they are incrementally improved and combined with each other in new ways. Radical new methods are sometimes generated from the world of forecasting practice, yet these often delink from theory and focus on producing specific outcomes. There remains a need in futures studies for a rigorous and reliable toolkit capable of producing new futures studies methods and theory that can help the discipline evolve and grow.

The now common futures studies categories of "possible, probable and preferred futures" were first introduced by Roy Amara (1981). In the early days of foresight, nearly all emphasis was placed on probable futures, yet "preferred futures" relies on a normative perspective, linking it to the project of emancipation. The idea of "preferred" or "desirable" leads directly to the questions of "preferred by whom?" and "desirable to which people?" These questions are not easily answered. Some futurists such as Jungk and Jim Dator have pointed toward the importance of including people who will live in the futures being discussed as one viable approach (Dator 1993, 1). These futurists emphasize that inclusiveness is a key characteristic of participatory futuring.

Participatory futuring as practiced by Jungk through his Futures Workshop was intended to upset hierarchical future shaping with what could today be called future-oriented grassroots mobilization (Jungk – Müllert 1987). However, scholars such as Ahlqvist and Rhisiart (2015, 102) have observed that participatory futures research methods today can serve as a means to reinforce existing power structures and even help maintain a business-as-usual trajectory. They propose a solution to this tendency is to find ways to link methods used in futuring projects to critical theory and critical futures studies. An example of linking theory and practice is Causal Layered Analysis (CLA) which has been cultivated through practice by Sohail Inayatullah (2004; 2005) and others. Contemporary critical futures studies scholars such as Inayatullah, Richard Slaughter, José

Ramos, among others, argue criticality in futures research adds depth to futuring work necessary for generating alternative futures and producing fundamental, radical change. In this master's thesis, the works of critical futurists are a source for the conceptual framework of criticality.

Heinonen and Ruotsalainen (2013, 2) identify one aim of their Futures Clinique approach is to 'openly envision futures that differ deeply from the present'. A measure of differing deeply from the present can be found in how new or novel future images are. Novelty can be difficult to produce from participatory contexts. It is common in futuring workshops for participants to echo back information they received from the workshop organizers without adding new dimensions or depth. It is difficult to think beyond what is already known—to create novel ideas. Yet, in futures thinking, novel ideas are highly valued because they embody high-impact, high-uncertainty images which are helpful in identifying discontinuities.

The reason this thesis on elevating creativity and criticality in game-based futuring is relevant to futures studies is the need for revitalization of the critical futures studies space with new tools. By using action research to develop a new game based on the June 2015 CLA Game, this thesis seeks to demonstrate how a thoughtful evolution of practice can occur while simultaneously prototyping a new, potentially useful tool.

1.3 Research Objectives and Questions

The goal of this thesis is to demonstrate a way to produce a participatory futuring session which can engage people in imagining and acting toward desirable futures. This goal is achieved by developing a futuring game that can be demonstrated to elevate both *creativity and criticality*. To develop this game, an action research approach is used. The new game element is built from concepts and structures developed at the June 2015 CLA Game. A key purpose for using an action research approach is to reaffirm how action research can be used to develop innovative, context-specific, and purpose-fitting participatory futuring.

The primary research question for this thesis is:

> How can *creativity and criticality* be elevated in participatory futuring contexts, specifically in game-based futuring?

The three sub-questions to this primary question are:
1. How can action research be used to create new elements for participatory futures research and generate evidence that creativity and criticality have been elevated in both the participation and the artifacts?
2. What futuring game can be produced and demonstrated to elevate *creativity* and *criticality,* potentially for any research topic?
3. In what ways could the produced futuring game provide insights to the specific foresight project of Neo-Carbon Energy?

Answers to these questions are sought using an action research approach to develop a futuring game in two iterations. This futuring game evolves from the experimental June 2015 CLA Game. The aim of this research is to iteratively create a new futuring game and demonstrate it can elevate creativity and criticality. The working hypothesis in this research is that action research is a viable approach to producing a futuring game capable

of elevating creativity and criticality. Furthermore, when creativity and criticality are elevated, they work together to open pathways for creating ideas which are novel and useful in producing desirable futures. These new ideas break through perceived limits in understanding and help participants articulate new futures.

2 THEORETICAL FRAMEWORK

The theoretical framework for this research project is built from creativity, criticality, Causal Layered Analysis, leverage points, metaphors and their transformation, and a proposed model for the interaction between creativity and criticality. The specific parts of these concepts presented are selected for their usefulness in developing the futuring game.

For this theoretical framework, creativity is approached from organizational and psychological perspectives. Criticality is approached from social theory and critical futures studies perspectives. Causal Layered Analysis (CLA) is both a theory and a method, but in this thesis, only the theoretical dimensions are explored. The concept of metaphor is explored from linguistic and philosophical perspectives, reinforcing its conception in causal layered analysis with attention to how metaphors can change. Leverage points are approached from a systems thinking perspective, with attention to Jay Forrester's (1971; 1975) initial definition of the concept. This chapter ends with a proposed model for the interaction of creativity and criticality. Together, these concepts serve as the theoretical framework for this thesis and the futuring game it develops.

2.1 Creativity

A key aim of the futuring game being developed in this thesis is to elevate creativity. However, creativity is difficult to describe. There is a wide range of creativity research from multiple disciplines. These researchers seek to know what creativity is, how it manifests, how it can be produced, and what strengths and difficulties it can present in various contexts. Inquiries into creativity are approached from many disciplines including psychology, business, management, education, neuroscience, and organizational learning. In addition to perspectives offered from these fields, many futures studies scholars emphasize that creativity is key to thinking of new future possibilities and articulating desirable futures.

To support creativity in the group context of a futuring game, this chapter presents both classic and contemporary creativity research. It starts with Amabile's (1998) ways to support creativity in the workplace and McFadzean's (2001) factors supporting creativity and tactics for breaking paradigms. It next presents Csíkszentmihályi's (2014) concepts of flow and intrinsic rewards in individuals and Amabile et al.'s (2005) model for positive affect supporting creativity in organizations. A visit is made to Csíkszentmihályi's distinction between creative problem solving vs. creative problem finding and discovery. The final concept presented is a nuanced approach to identifying four continua of creative ideas by Litchfield et al. (2015). The chapter concludes by applying the creativity concepts it presents to hypothesize how creativity could be elevated and demonstrated in the futuring game.

Amabile (1998) defines creativity as "how people approach problems and solutions—their capacity to put existing ideas together in new combinations". She argues creativity needs to be original, useful, and actionable in business contexts. She splits business creativity into three parts: thinking imaginatively, expertise, and motivation. Taking "thinking imaginatively" as a given, she defines expertise as a person's access to their own thoughts for exploration while problem solving. Motivation is an individual's desire to apply imaginative thinking and expertise to a specific task.

She divides this concept of motivation into intrinsic and extrinsic forms. She finds extrinsic forms tend to be barriers to creativity, while calling intrinsic forms a powerful

resource in creative outcomes. She proposes the "Intrinsic Motivation Principle of Creativity" which states "people will be most creative when they feel motivated primarily by the interest, satisfaction, and challenge of the work itself—not by external pressures." From this principle, she argues that changing a work environment to improve internal motivation of staff produces faster results than creativity training or teaching staff creativity tools or skills.

Based on research into links between business practice and desirable creative outcomes, Amabile (1998) describes six categories where managerial actions support creativity: challenge, freedom, resources, work-group features, supervisory encouragement, and organizational support. Then, based on these categories, she presents a shortlist of "creativity killers": 1) "undermining autonomy by continually changing goals and interfering with processes"; 2) placing "severe and seemingly arbitrary time and resource constraints" on teams; 3) consistently rejecting new ideas signaling that "any big ideas about how to change the status quo would be carefully scrutinized"; 4) failing to reward hard work to produce new innovations; and 5) allowing political problems to fester so that new ideas are stopped because of political dynamics rather than the merits of ideas.

Reflecting Amabile's ideas about creativity from the workplace context to a futuring game session, it is important for the new futuring game to be challenging but not too difficult, intrinsically rewarding to play, and helpful in opening players to accessing their own "networks of possible wanderings".[10]

McFadzean (2001) echoes the combinative nature of creativity described by Amabile —the need for a wide number of inputs to be brought together. She describes five critical factors for creativity (McFadzean 2001, 273):

- Freewheeling, so that participants produce as many ideas as possible (quantity breeds quality)
- Combining or changing ideas (association)
- Suspending judgement
- Utilizing unrelated stimuli, and
- Using unusual modes of expression

MacFadzean places emphasis on idea generation, alternate modes of expression, and combining or transforming ideas in this model of creativity. She notes that suspending judgement is a prerequisite for the other four factors.

The key argument MacFadzean makes is that the notion that brainstorming is seldom enough to produce truly groundbreaking ideas. She proposes three categories of creative techniques for business: Paradigm Preserving, Paradigm Stretching and Paradigm Breaking. Paradigm Breaking techniques introduce new stimuli and alternative modes for expression. Like its sibling, Stretching Paradigms, once ideas are produced, they are fed back to the problem to generate solutions. She warns that paradigm breaking techniques often face resistance and suggests they are most effective with people who have had experience in creative practice (ibid. 275-280.)

MacFadzean's call for new stimuli and alternative modes of expression as means to producing paradigm-breaking creativity can be applied to the construction of the futuring game. Taking this recommendation as a guide, it is important for the game components to involve means of expression beyond writing things on paper with a pen and talking about them. Additionally, bringing together participants with a variety of perspectives and providing surprising stimuli to them would help elevate creativity.

Csíkszentmihályi (2014, 138-150) proposed in the 1970s a theory of flow, play and intrinsic rewards. His theory was produced by interviewing dancers, basketball players,

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[10] "Networks of possible wanderings" is a concept introduced by Herb Simon describing the range of concepts and ideas available to the mind for combining into new ideas (Amabile 1998).

mountain climbers, and chess players about their experiences in creativity. He argues there is a state of flow people enter when they are wholly immersed in conducting creative work.

He describes several factors which contribute toward being in a state of flow: "merging action and awareness, centering of attention, loss of ego, control of action and environment, and the autotelic nature of flow (ibid., 138-145). The first of these—being highly aware of one's actions without tuning into that awareness itself—is offered as a key signal for detecting a state of flow (ibid., 136). For "centering of attention" he notes that games and their rules are useful for helping people enter a state of flow, until intrinsic rewards kick in (ibid., 139). "Loss of ego" can also be assisted by games because they simplify reality and make it understandable, which helps people set aside their self-constructs which usually mediate between stimuli and response (ibid., 141). The autotelic nature of flow essentially means external rewards no longer serve as the driving goals when a person is in a state of flow (ibid., 145). Summarizing these factors, he argues that flow is connected to intrinsic rewards (ibid., 150): "When an activity is able to limit the stimulus field so that one can act in it with total concentration, responding to greater challenges with increasing skills, and when it provides clear and unambiguous feedback, then the person will tend to enjoy the activity for its own sake."

Applying Csíkszentmihályi's conceptions of flow to the development of a futuring game, for participants to enter a state of flow, they need to feel intrinsically motivated to play the game and feel capable of performing its tasks. The rules of the game and the way that reality is simplified in its components are key to helping the participants enter a state of flow.

From a psychological perspective, great attention has been paid to the role of affect, which includes mood, upon creativity. Affect encompasses emotional states of being, physical postures and expressions, and the general condition of a group of people. A model for how affect and creativity interact within an organization is proposed by Amabile et al. (2005). Starting from previous research providing empirical evidence that positive affect contributes to creativity,[11] they ran their own trials within an organizational-management context and determined that positive affect is important to how creativity is supported in organizations. From that research, they built a model for how affect functions in organizations to support creativity and how that creativity in turn supports affect (Figure 1).

In this theory, positive affect reinforces itself by supporting the situational qualities required for it to occur. For example, positive affect supports cognitive variation in creators, which allow for new associations which drives creativity. Creativity in turn has three paths of influence on affect—it provokes emotion in the creators, that emotion immediately loops back in to support and refine the creative output, and the creative output provokes reaction from others outside of the creativity producing group leading to organization-level events which in turn contribute either positively or negatively to an ambient affect. If the organizational response is affirming of the creative outputs and the creative work of the individuals, it contributes to positive affect in the working environment, which keeps the cycle going. (Amabile et al. 2005, 392.)

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[11] They noted a few of researchers have reviewed historical creative individuals and found that negative affect can also help generate creativity, but these cases tend to be limited to the arts and literature.
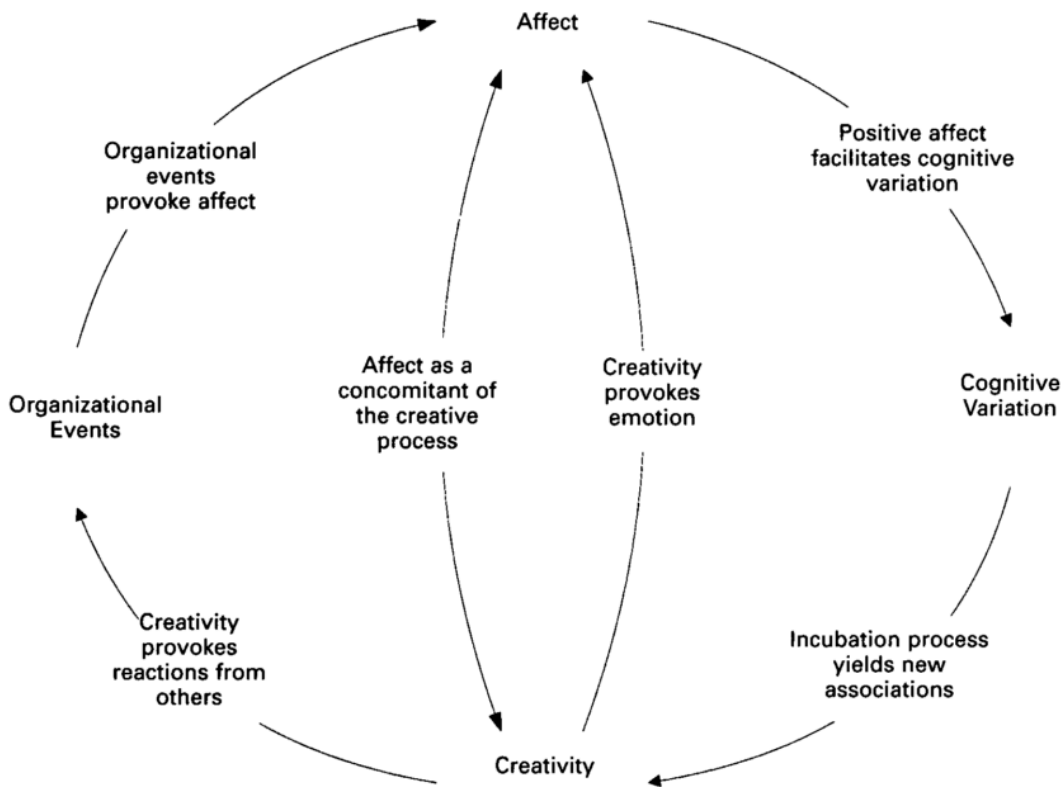
Figure 1. The organizational affect-creativity cycle (Amabile et al. 2005, 392)

Creativity is often discussed as a means for problem solving (e.g. McFadzean 2001). Csíkszentmihályi's (2014, 155–159) makes the claim that creative discovery and creative problem finding is both different and of greater value in science than creative problem solving. He argues it is creative problem finding which leads to changes in how knowledge itself is understood, giving the example of Copernicus (ibid., 159): "The great contribution of Copernicus was not his mathematical-geometrical argument in favor of the heliocentric model of the planetary system, but rather the unstated intuition permeating his work that astronomy, mathematics, and physics must be related to each other." In other words, when used to identify entirely new problems to be solved, creativity can change entire paradigms.

Csíkszentmihályi also notes how rationalistic accounts of creativity tend to miss the emotional and motivational parts of the full experience of a person creatively engaged in problem discovery. He argues for energistic data to be considered in descriptions of creative cognition (ibid. 159-160). Aspiring to achieve some level of creative problem discovery and incorporating motivations and emotions of participants are important to the development of the futuring game.

Litchfield, Gilson and Gilson (2015) offer a nuanced classification system for creative ideas in organizational contexts, linking types of creative ideas to management challenges and temporal orientations (Table 1).

Table 1.   Creative Continua and Their Characteristics (Litchfield et al. 2015, 249)

	Usefulness characteristics	*Low novelty endpoint*	*High novelty endpoint*	*Management challenge*
Foolishness continuum	Low feasibility, low value	Bad ideas	Foolishness	Future orientation, boundary testing
Disruptive continuum	High feasibility, low value	Easy Incremental	Disruptive	Present orientation, immediate implementation
Radical continuum	Low feasibility, high value	Hard Incremental	Radical	Future orientation, attract champion
Break-through continuum	High feasibility, high value	Low-hanging fruit	Break-throughs	Present orientation, make business case

These four continua—foolishness, disruptive, radical, and breakthrough—are derived from a standard definition of creative ideas as ones that are both novel and useful (Litchfield et al. 2015, 242). To produce nuances within that standard definition, they break usefulness into two parts, feasibility and value. From these two parts, four continua are produced with high and low novelty endpoints. Litchfield et. al (2015) argue that a creative idea can be placed on one of these four continua of creativity, allowing for a better understanding of what kind of new idea one is encountering in a creative process. This classification can then be used by managers, or teams, in understanding which novel ideas could be developed into what kinds of innovations.

While other classification systems exist, this one is selected for its applicability to a temporal perspective and for its flexibility in classifying creative ideas. For the futuring game developed in this thesis, these four nuanced continua can be used to reflect upon what types of ideas have been produced, and how near the present or future they are. Such reflections can happen as desk research after the game or during game play.

The futuring game developed in this thesis, if it is to elevate creativity, needs to be itself supported by the theoretical concepts presented above. Of these, attending to the environment and positive affect of the situation is key, as is using the best constructions to make it intrinsically rewarding to play. The game must be challenging enough, yet not too complicated. A mix of divergent and convergent thinking is needed as well. While games lend themselves inherently to problem solving, this futuring game should seek to be more oriented toward problem finding. Finally, the categorization scheme by Litchfield et al. can be used to assess what kinds of creative ideas have been produced.

2.2   Criticality

Criticality can refer to critical theory in the social sciences and critical thinking in educational studies. Criticality, in this thesis, aligns more closely to critical theory and refers to taking a critical perspective toward prevailing understandings of history, the present, constraining circumstances, and possible futures. Specifically, a goal of the futuring game developed in this thesis is for participants to apply a critical perspective to past, present,

and possible futures. The work of scholars who have argued for a stronger role for criticality in futures studies serve as the primary conceptual basis for the term 'criticality' in this thesis. The most visible of these scholars include Jim Dator (2002), Richard Slaughter (1982; 1999), Ziauddin Sardar (1993), Sohail Inayatullah (1990; 1998; 1999; 2005), Ivana Milojević (2003), José Ramos (2003), Riel Miler (2007; 2011) and Tony Ahlqvist (Ahlqvist and Rhisiart 2015).

Ossip K. Flechtheim, the German-American scholar who is largely credited with launching "futurology" in the 1940s, may be said to have introduced criticality to the field. Flechtheim had significant contact with Adorno Horkheimer and others from the Frankfurt School of Social Research, when he was living in the United States to avoid persecution from the Nazis during the 1930s and 1940s. (Auffermann 2015.) Flechtheim (1949) called for the introduction of a science to study the future as a means for assuring the survival of Western Civilization. While his loyalties to Western Civilization do not necessarily match stated aims of contemporary critical futures studies, some of the questions he posed indicate he intended for his proposed new academic discipline to challenge conventional thinking. For example, he asks: "Will our civilization be characterized by a new functional organization, by the elimination of power, and by the growth of an inclusive world culture? Will mankind as an ever more integrated community continually progress towards greater liberty, equality, and fraternity through the use of organized intelligence, world-wide cooperation, and peaceful adaptation?" (Flechtheim 1949, 209.)

According to an account of the origins of critical futures studies by Ramos (2003), it was introduced by Slaughter in his PhD dissertation in the early 1980s (see Slaughter 1982). According to Inayatullah (2004, 6), Critical futures studies gained its footings in the 1990s and 2000s, calling for futures studies to more boldly challenge taken-for-granted assumptions and strive harder for emancipatory outcomes. However, tracing the concept toward its origins, Jim Dator indicates that "critical futurology" was used at least as early as 1970 by Bart van Steenbergen in his article "Critical and establishment futurology" in the proceedings of the 2nd International Future Research Conference in Kyoto. In that article, van Steenbergen pointed out how 'establishment futurologists' of the 1970s largely served the existing order due to political and financial ties. (Dator 2002, 4-5.)

Sardar (1993) also provided a critical and reflexive perspective on the evolving field of futures studies, calling attention to how it primarily promoted the work of white American men and how much of the field was formed to serve military, intelligence, and corporate work promoting Western Anglo-American economic and political interests. Sardar makes his case by dissecting a selection of futurist publications including UNESCO's *Future Scan*, World Future Society's *Future Survey* and Joseph F. Coates and Jennifer Jarratt's *What Futurists Believe* (ibid., 185-186). Sardar argues futures studies colonizes the future in two main ways, the "Columbus affliction" and "More Syndrome." By "Columbus affliction," he means "seek[ing] hitherto unimagined and new arenas to conquer." By "More Syndrome", he refers to Thomas More's *Utopia* and means "appropriate[ing] the ideas, data and experiences of other societies and cultures and project[ing] them as visions of Western, secularized future." (ibid., 181.) Sardar highlights morally problematic features of the new academic field. Sardar's argument can be summarized as follows: It is unethical for the West to colonize the non-West and futures studies had thus far served to colonize the futures of non-Western people, therefore futures studies must address its intended or unintended colonizing effects. Inayatullah (1998, 386) takes this ethical notion further by proposing futures studies should serve to "decolonize dominant views" of the future.

The most visible of contemporary critical futures studies proponents are Richard Slaughter and Sohail Inayatullah. Slaughter and Inayatullah have edited several anthologies on critical futures studies and related themes, recruiting futures scholars to contribute

chapters. These books include influential works in the field such as *The Causal Layered Analysis Reader* (Inayatullah 2004) and *Futures for the Third Millennium* (Slaughter 1999). Richard Slaughter eventually came to call his approach to criticality in futures studies "Integral Futures", while Inayatullah continues to champion the term "Critical Futures Studies" (Audience Dialogue 2007).

Inayatullah (2012, 44) seeks to add a critical dimension to futures research and foresight practices through asking questions, challenging stated and unstated assumptions, disturbing present power relations, and opening alternative possibilities. Slaughter's (1982; 1999) interests are more deeply connected to futures studies education, ecological concerns, and deepening a normative, holistic, and critical perspective. Inayatullah places much of his focus on promoting Causal Layered Analysis (see Chapter 2.3) as a method and theory for incorporating criticality into futures studies while Slaughter advocates for criticality from a wider range of approaches. Ramos (2002), inspired by Slaughter and Inayatullah, developed Action Foresight, a synthesis of futures studies and action research (more detail in Chapter 3.1). Ahlqvist and Rhisiart (2015) also make a call for criticality in the form of deepening the connection between futures studies practice and theory. These critical futures studies scholars all hold commitments to critical theory.

Critical theory originates from the Frankfurt School, officially named the Institute for Social Research, of the 1920s and 1930s and the scholars who have carried on its traditions. The Frankfurt School started as a reinterpreted and reapplied Marxist critique of social structures, but its later directors deemphasized this connection to Marxism in favor of developing a new theory that can exist outside of existing structures. Max Horkheimer coined the term "critical theory" in 1937. (Carr 2000, 208-209.) Carr summarizes Horkheimer's definition of the term into three attributes (emphasis added): "a theory is only critical if it is *explanatory*, *practical* and *normative* all at the same time" (Carr 2000, 211). A commonality between critical theorists and critical futures studies proponents is a dedication to applying research toward goals of challenging the status quo with an aim toward emancipating and opening possibilities for people.

The Frankfort School also held an interest in promoting the emancipation of people from their limiting circumstances. The aims of futures studies have been argued to also be linked to the concept of emancipation. Futures studies can trace origins of some of its key concepts to debates about predetermination vs. free will among Catholic monks in the 16th and 17th centuries (Malaska - Holstius 2009, 85). The concept of "free will" has evolved into, or at least appears as, the term "emancipation" both in Critical Theory and in futures studies. For example, the concept of the "fan of possible futures" as presented by the Futuribles in France during the 1960s (de Jouvenel 1967, 101-104), can be argued to be, at its core, a concept describing free will. To de Jouvenel (1967, 27-28) and other futures studies writers, considering possible futures requires present-day actors to take seriously their roles in influencing what the future will ultimately be like, which implies that people can have at least some role in shaping the future.

Many futures scholars, with varying commitments and relationships to critical theory, argue for a critical perspective in futures research and demand a normative, action-orientation toward futures thinking. Riel Miller (2007, 347) calls for the advancement of futures literacy, "the capacity to explore the potential of the present to give rise to the future." Dator, for example, encourages people to be skeptical of "official views of the future". According to him, most organizations precariously hold continued Growth (or "Business as Usual") as their "official view of the future" while neglecting to consider other generic possible futures: Discipline, Collapse, and Transformation. (Dator 2009, 8, 10.) Referring to futures scholars Jungk and Elise Boulding, Dator (2002, 109-110) suggests futures studies should move people beyond passively observing possible futures toward actively describing desirable futures and taking actions toward these desirable

futures. Dator's student, Stuart Candy (2010, 6) also highlights an assumption among futurists that humanity must take action for the future.

Milojević and Inayatullah (2015, 156) discuss the dangers of borrowing "used futures", future visions created by others in the past, advocating instead for people to actively generate their own visions for desirable futures. Inayatullah (2005, 8; 2006, 658) emphasizes the importance of questioning the present and the future, and offers a framework for approaching this questioning. Inayatullah (2015, 20; 2005, 4-6) also offers a "post-structural futures toolbox" intended to provide spaces for new alternative futures: deconstruction, genealogy, distancing, alternative pasts and futures, and reordering knowledge.

Slaughter and Riedy (2009, 37) call for "critical reflection" by futures researchers and foresight practitioners which includes active questioning of the interests they serve and whether they are opening or closing humanity's options. What these futures scholars argue for is a questioning stance toward the given as well as a willingness to unpack and challenge unstated assumptions. Slaughter (2002, 29) notes that critical futures studies is less about predicting or exploring possible futures and more about re-negotiating meaning. He further identifies how theories about the social construction of reality can be used to operationalize critical futures studies (ibid., 31).

Ahlqvist and Rhisiart (2015) challenge futures studies to live up to its emancipatory goals by making stronger ties between foresight practice and critical theory. Building on Slaughter's thinking, they point to three gaps in current futures practice: an overemphasis of empirical data, an approach to the present that "does not engage critically with its own perspective," and methods that enable a "'free floating' mindset" giving a "misrepresentation of the actual global power dynamics." They propose three emancipatory pathways for connecting critical theory to futures practice: "construction of futures through socio-technical practices", "future-oriented dialectics", and "socio-economic imaginaries". For the first pathway, they argue for developing approaches that can study the construction of "mundane futures" for example by identifying key future concepts, the evolution of everyday futures images, key social practices creating or changing future ideas, and key entities and politics that "frame, build, or change" future ideas. For the second pathway, they describe a "point of conjunction" or "moment of unfurling" in futures processes where two paths, often in opposition, emerge which can be best understood from a dialectical perspective. The third pathway involves probing the boundaries of "socio-economic imaginaries" used by actors seeking to manage and control the future by limiting possible alternatives. To the authors, criticality brings value to participatory futuring by increasing "awareness of alternative paradigms and worldviews" and "encouraging openness and contestability". They propose criticality supports an ethical duty for those engaged in futuring practice to reveal explicitly the implications and choices present in a given situation. They argue that critical perspectives should be part of "the re-politicization of policy-making, enabling meaningful critique, encouraging contestability, and revealing assumptions and power interests."

For the purposes of the development of the futuring game in this thesis, criticality is considered both as a force and characteristic. As a force, it acts upon the concepts and understanding of the real and imagined situations of the game. As a characteristic, it is an observable attribute of the participant's dialogue with each other and the artifacts they produce through gameplay. Criticality as a force counters determinism, the belief that the present situation locks us to only one or few futures. Criticality as a characteristic of an interaction or an artifact pulls apart assumptions, investigates given information, and opens spaces within which new understandings and possibilities can emerge. Based on the core ideas of critical futures studies scholars, elevating criticality in a futuring game

should lead to questioning the future, inventing new desirable futures and pathways toward their enactment, opening humanity's options instead of closing them, seeing beyond "official views of the future", testing the limits of socio-political imaginaries, and having a realistic sense of what real power dynamics and voices are in contest regarding a possible future.

2.3   Causal Layered Analysis

Causal Layered Analysis (CLA) is a combined theory and method first attempted by Tony Stevenson and Sohail Inaytullah in 1991 (Ramos 2015, 39). CLA is one of the most recently developed methods in futures studies and was brought to the attention of the futures studies community in the 1990s by Inayatullah with the help of other futures scholars (Inayatullah 2009, 2). It took more than a decade's worth of writing and discourse about this new method before it gained acceptance in the broader futures studies community (Ramos 2015, 41).

Inaytullah (2009, 2-3) points to the works of Johan Galtung, Michel Foucault, P.R. Sarkar, and Richard Slaughter as key influences on the development of Causal Layered Analysis. He was inspired by Galtung's concept of 'civilizational codes' that contextualize actions of nations. He was inspired by Focault's theories for "how particular nominations of reality become naturalized." He was influenced by P.R. Sarkar's conception of the mind as shells or *kosas* which need to be traversed inwardly and outwardly in order to reveal truths and call for seeking insight from "overlapping subjectivity and objectivity". He was inspired by Slaughter's categorization of futures studies into popular futures, problem-solving futures, and epistemological futures and the fact that his proposed typology could evolve as it is brought into discourse.

Inayatullah describes how CLA grew out of his desire to bring four perspectives of futures studies he witnessed while studying futures studies at the University of Hawai'i Manoa School during the 1980s and '90s—empirical, post-structural, interpretive, and an action-orientation—into dialogue with each other (Inayatullah 2009, 1; 2004, 3). To Inayatullah (2009, 3), incorporating multiple ways of knowing helps address complexity in futures because it helps us avoid being blinded to possibilities by relying upon only one theory.

The four layers of Causal Layered Analysis are Litany, Social Causes, Worldview, and Myth/Metaphors. The Litany layer is what is commonly known and unquestioned about the situation. It often is how an issue appears in the media or is presented by researchers. The Social Causes layer contains "technical explanations or academic analysis" of the situation—it seeks to describe the factors causing the situation but does not quite rise to the level of challenging the overarching paradigm. The Worldview layer is concerned with the structures and perspectives that support the prevailing situation and can reveal the different discourses at play in it. The Myth/Metaphor layer is the "deep stories" and "the unconscious and often emotive" aspects of the situation. It is more about images and larger cultural texts that operate at a gut level rather than only in the mind. Inayatullah argues that "articulating alternative metaphors" helps to shape new futures. (Inayatullah 2009, 9-10.)

Inayatullah (2009, 40) notes that CLA is always evolving through its application. It has been used with scenarios in a variety of ways. Andrew Curry and Wendy Schultz (2015, 64-65) describe using CLA in developing scenarios in two steps—the first is to analyze the scenario by working through the layers. The second is to "inflect" the worldview and metaphor layers and, based upon this "inflection", reinterpret the other

layers as a way to develop the scenarios. The "inflection" approach is similar to CLA being used to deconstruct and reconstruct a possible future as described by Inayatullah (2015, 15). Alternatively, he describes an approach (ibid., 18) in which participants create a preferred future, identify its "disowned aspects", and produce a "transformed or integrated scenario" reincorporating disowned elements the preferred scenario rejected. He also notes that CLA can also be used to produce "neutral futures" and understanding the "perspectives of others" free of intentions to change them (ibid., 17). Outside of this last neutral application, it is clear that CLA is often used as a means for improving the current situation and shares this commitment with the emancipatory tradition of the critical theorists.

2.4   Metaphors

Metaphors are commonly thought of as a type of figurative language used in the literary arts. In this thesis, metaphors are considered as leverage points through which participants in game-based participatory futuring can elevate creativity and criticality, opening up conventional understandings. Within the game, these metaphors also serve as leverage points within the system of relationships among participant-created roles. Metaphors can serve as these leverage points because they are a large part of how we understand reality. As Lakoff & Johnson (1980, 46) put it, "Metonymic and metaphoric concepts structure not just our language, but our thoughts, attitudes and actions." A central action in the game this thesis develops is to transform metaphors, therefore it is important to have a theoretical basis for what metaphors are and the ways they can change.

Metaphors have not always been recognized as being a legitimate part of the scientific toolkit. In Vega-Moreno's (2007) literature review of metaphors and psycholinguistic approaches to them, she points to how Aristotle tied metaphors nearly exclusively to the realms of poetry or rhetoric, a tradition Locke carried on in his deep skepticism of texts containing truth obscuring metaphors. In recent times, metaphors have come to be accepted as playing an important role in how we comprehend reality. Using metaphors in science is commonplace and argued to be the means by which we understand several key scientific ideas (Ravetz 2003). Sometimes scientific metaphors block advancements in understanding. An example is the metaphor "Earth is the center of the Universe" which was severely limiting to our understanding of cosmology. Another example is proposed by Epstein (2016) who argues that the metaphor "the human brain is a computer" is blocking us from truly understanding neurology. Lakoff & Johnson (1980, 156-157) argue metaphors shape how people understand experiences, perceive reality, and take actions. They describe metaphors as capable of generating self-fulfilling prophecies: Metaphors shape the perception of reality and "may be a guide for future actions"; these actions in turn "fit the metaphor" cycling into feeding the "power of the metaphor to make experience coherent."

A working definition for metaphors can be stated as relating two unrelated things together to generate new understandings. Lakoff & Johnson (1980, 5) suggest metaphors are "thinking of one thing in terms of another." They also describe how metaphors highlight some characteristics of a concept and "create social realities" for us which serve as "a guide for future actions" (1980, 156).

An example of how metaphors affect perception can be found in a cognitive psychological perspective. A set of experiments by Thibodeau (2016) explored how metaphors persuade people when thinking about socio-political issues such as crime. He tested a hypothesis that people would "show a metaphor framing effect" when presented with a

"conceptually congruent response" to an extended metaphor for a social problem (ibid., 55). The results of his experiments on conceptual congruence, lexical congruence, and framing suggested that a metaphor frame is more likely to influence people toward accepting policy proposals which are described with matching extended metaphors (ibid., 66).

Inayatullah is a strong advocate for using metaphors as a tool in exploring possible futures. He argues that metaphors are an important tool for considering and shaping futures, writing, "Deconstructing conventional metaphors and then articulating alternative metaphors becomes a powerful way to critique the present and create the possibility of alternative futures. Metaphors and myths not only reveal the deeper civilizational bases for particular futures, but they move the creation/ understanding of the future beyond rational/design efforts" (Inayatullah 2005, 6). Metaphors are the deepest of the four layers of Causal Layered Analysis (see Chapter 3.2).

Milojević and Inayatullah (2015) use metaphors as a basis for Narrative Foresight, a participatory futuring method based on storytelling. Narrative Foresight supports participants in "discovering and creating new stories that better meet needs and desires" (ibid., 152). While CLA evolved to hold all four of its layers—Litany, Social Causes, Worldview, and Metaphors—in an equal status, Narrative Foresight places greater importance on the role of the metaphors (ibid., 157; Inayatullah 2005, 7). Narrative Foresight approaches problem-solving by identifying core metaphors at the individual level, and then considering what new metaphor would be more useful to the situation and the individual's objectives. By transforming individual metaphors, their perceptions of their circumstances change, and new futures become possible. (ibid., 159.)

A special edition of *Futures* edited by Inayatullah, focuses on how metaphors can be used in futures studies. For example, Heinonen and Minkkinen (2016) describe how the concept of new vs. conventional metaphors (Lakoff & Johnson 1980, 170 & 172) can be combined with critical futures studies concepts "used futures" and "alternative futures" to interpret and analyze what buildings signal to us about the future. Heinonen and Minkkinen (2016, 166) find metaphors for a set of futuristic buildings and then evaluate the novelty of each building's metaphor as a means for determining if the building is signaling a "used future" or an "alternative/transformational future".

Categorizing metaphors based on their novelty to separate the ones conveying "used futures" versus the ones conveying "alternative futures" could be useful in this action research project as a way to categorize the metaphors produced by participants during the game. Going further, Heinonen and Minkkinen's approach of sorting metaphors into conventional "used futures" and novel "alternative futures" could be used in connection with four nuanced continua for creative ideas proposed by Litchfield et al. (2015) of foolish, disruptive, radical, or breakthrough. Such a strategy may be useful when analyzing the metaphors produced during game play of the first and second iteration.

Heinonen (2000) explores future images of the relationship between humans, nature, and technology in the works of the Roman philosopher Seneca by identifying and deconstructing metaphors for nature found in his work. She categorizes these metaphors into "harmony", "exploitation", and "epistemological expansion." She cites Aristotle's definition of metaphor as "observing similarities in dissimilarities" and takes into use a general definition of metaphor as "a classification or comparison of two or more things by one or more common characteristics". She notes how Finnish anthropologist Tapio Tamminen (1994, 34) attributes a capability for metaphors to provide a "concise description of a complex entity." (ibid., 115-143.)

To transform a metaphor means to change it in significant ways. Transformation can be defined as a "complete or major change process into another state" (Heinonen & Bal-

com Raleigh 2015, 17). Heinonen cites philosopher Ernst Cassirer (1946, 85-87) to describe two competing ways metaphors can be changed: as contracting metaphors or radical metaphors. Contracting metaphors reduce or limit the range of meaning in the metaphor by substituting one concept with another that has a more restricted range of meaning. In contrast, radical metaphors create new categories of meaning. (Heinonen 2000, 36-37.)

Heinonen (ibid., 38-39) gives examples of how either type of metaphor can be traced using chains of concepts connected by 'greater than' symbols. For contracting metaphors, which are denoted by a single greater than symbol, she gives the example of *information society > information communication technology (ICT)*. This notation indicates that the large field of meaning related to a type of complex society characterized by its relationships to information is reduced to the much narrower field of meaning related to the mobile devices, laptops, virtual reality goggles, wearable tech, or whatever else is coming next that facilitates the existence of the information society. Radical metaphors, on the other hand, expands a concept beyond its conventionally understood meanings. These are usually used in the context of religion with a classic example being the concept of water becoming baptismal water. Heinonen borrows the shorthand of *A >> B* to denote a radical metaphor, the above example being denoted as *water >> baptismal water*.

The Neo-Carbon Energy project is an interesting test case for exploring possible applications of the radical vs. contracting metaphors dichotomy. The overall project is focused on developing new technologies and futures for energy. The concept of "energy" in contemporary conversation is taken to mean "electricity." It is an example of a contracting metaphor: *Energy > Electricity*. Yet at a cosmological level, "energy" is a much larger concept and there are many forms of it. Furthermore, additional contracting metaphors could be made: *Energy > Food*; *Energy > Electromagnetic Radiation*; *Energy > Movement*; or *Energy > Chemical Processes in Living Cells*. It is also possible to expand the meaning of *Energy* by forming a radical metaphor such as: *Energy >> Life Force*.

Metaphors aid in understanding the relationships among people and concepts. They hold influence over futures because they are part of how we perceive our circumstances, interpret our experiences, and take actions to achieve goals. One could argue that Cassirer's radical metaphors are a means for generating new ideas capable of producing systemic paradigm-level change. By expanding the scope of meaning associated with conventional concepts, a radical metaphor can expand the range of possible actions and possible futures available to an actor or group of actors who face some set of circumstances. Metaphors also connect to the aims of elevating creativity and criticality. By connecting two or more ideas to change the scope of their meaning, metaphors are similar to the combinative function of creativity. By calling one thing another, metaphors serve to highlight specific meanings and deemphasize others which is similar to the questioning and concept tracing of criticality. Therefore, metaphors are a creative and critical means by which to push to the edges of conventional understanding.

2.5   Leverage Points and Metaphors

The concept of leverage points could be linked to several fields including physics, engineering, business, and systems thinking. In this thesis, its meaning from the field of systems thinking is taken into use. Meadows (2008, 145) credits Forrester, an early pioneer in in systems thinking and a professor MIT School of Management, with introducing the concept of leverage points. Forrester describes how leverage points work in his *Collected Papers*, writing, "Through these key points, a small number of actions will radiate a desirable effect throughout the system" (Forrester 1975, 170). Forrester also describes a

"counterintuitive" characteristic to leverage points, writing that actions believed to be the best ones based on conventional thinking can turn out to have the opposite effect than expected or intended when tested in a system model (Forrester 1971, 110). To summarize, Forrester's key idea regarding leverage points is that they are points in systems upon which actions can change a system's overall behavior. A guiding principle for applying Forester's concept of leverage points is that the obvious choice may not be the correct one. Actions applied to a leverage point in a system can produce outcomes that are desirable or undesirable as well as anticipated or surprising.

Meadows (2008, 145-165), a student of Forrester and influential systems thinking author and professor, discusses leverage points in greater depth, proposing that there are 12 places to intervene in a system. She ranks them by their potential to transform a system, presented below in order of least influential (#12) to most influential (#1):

12. Numbers – Constants and parameters such as subsidies, taxes, standards
11. Buffers—The sizes of stabilizing stocks relative to their flows
10. Stock and Flow Structures—Physical systems and their nodes of intersection
9. Delays—The lengths of time relative to the rates of system changes
8. Balancing Feedback Loops – The strength of the feedbacks relative to the impacts they are trying to correct
7. Reinforcing Feedback Loops—The strength of the gain of driving loops
6. Information Flows—the structure of who does and does not have access to information
5. Rules—Incentives, punishments, constraints
4. Self-Organizing—The power to add, change, or evolve system structure
3. Goals—The purpose or function of the system
2. Paradigms—The mindset out of which the system—its goals, structure, rules, delays, parameters—arises
1. Transcending Paradigms

Meadows argues that acting on a higher level of a system produces a greater change than acting on a lower level. It can be observed in her proposed 12 levels that the more influential the level (e.g. Transcending Paradigms, Level 1), the broader and more conceptual it is in its scope. For example, contemporary issues are frequently discussed in terms of quantifiable statistics and the actions which could produce desirable outcomes for those statistics (e.g. reducing the crime rate or increasing number of business starts), yet numbers are the lowest level, while the highest two categories of paradigm and transcending paradigm are seldom if ever discussed (e.g. new ways of thinking about justice or the relation between human dignity and the work a person does.)

Meadows's places to intervene in a complex system is a helpful heuristic for thinking about how to produce profound change in a system.[12] Discussions about change focus on the least influential levels such as numbers, buffers, and stocks. Meadows's logic is that changing who has access to what information or the incentives or punishments for actors in a system would impact all the less influential levels. At the time this thesis was written, self-organization is held at a vanguard of organizational management—e.g. "teal organizations" proposed by Laloux (2014). Yet, under Meadows's proposed model, the three most influential places to intervene in a system would be to set entirely new goals for the

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[12] Meadows (2008, 147) bases her 12 places to intervene in system on her experiences in systems research and notes they have yet to be validated through empirical research.

system, change the paradigm or mindset which begat the system in the first place, or most abstractly transcend paradigms entirely.

Meadows (2008, 162) defines paradigm as "the great big unstated assumptions" and "deepest set of beliefs about how the world works."[13] Meadows (2008, 164) offers a few means for changing paradigms: point to failures of the old paradigm; speak and act boldly in the new paradigm; place people with the new paradigm in places of high visibility; and work with change agents, not reactionaries, and targeting open-minded people. She argues that paradigms hold great influence over systems, observing people who have historically changed society's unstated assumptions and deepest held beliefs "have hit a leverage point that totally transforms systems" (Meadows 2008, 163). The most influential place to intervene, transcending paradigms, is a call for recognizing humanity's fallibility and limits to knowledge. She argues that every paradigm "is a tremendously limited understanding of an immense and amazing universe that is far beyond human comprehension" (Meadows 2008, 164).

The ideas of changing paradigms and transcending paradigms has strong similarities to the concept of transforming metaphors (see Chapter 2.3). Inayatullah (2009, 12) uses the word paradigm to mean worldview. Following Inayatullah's usage, MacGill (2015) argues for a match between Meadow's changing paradigms level and the worldview level of CLA. Inayatullah (2004, 12) also calls for the deconstruction of conventional metaphors in pursuit of new ones as a means for critiquing the present and opening alternative futures. This thesis claims that by transforming metaphors, the system of its corresponding worldview is also transformed. This thesis argues that Meadow's conception of paradigms also describes the limits of human understanding and knowledge, and while linked to worldview, can be taken as a larger concept. If worldviews and paradigms are the limits to understanding, metaphors are the leverage points of worldviews.

Meadows (2008, 164) argues that paradigm change can be made possible by modeling systems so they can be seen from outside. In the futuring game being developed in this thesis, and in the June 2015 CLA Game, a system of relationships among various roles is formed during gameplay. This actor-based system can be understood as a micro-model of social dynamics producing the worldview of the game.

If we accept Meadow's argument that changing the paradigm and paradigm transcendence are the two most influential places to intervene in a system, then a system of relationships should change if the paradigm it is situated in changes. Because metaphors play such a large role in how we perceive reality, they can be conceptualized in this context as paradigm-changing leverage points. By developing a futuring game that supports participants in identifying and transforming metaphors acting within a system of relationships, new pathways toward desirable futures can emerge.

Furthermore, this thesis argues that creativity and criticality interact in a way capable of expanding conventional understanding and posits that such expansions are linked to Meadows's (2008) places to intervene in a system. From this perspective, any new idea capable of changing a paradigm can create an effect which cascades down to lower impact leverage points and change how the system behaves.

Identifying metaphors and transforming them is a means of aligning a system of various actors toward desirable futures. The act of transforming the metaphors shows the malleability of paradigms—that worldviews can be critically considered and changed. By

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[13] Meadows refers to Thomas Kuhn's (1970, 24) conception of 'paradigm'—a set of commonly held concepts among scientists which guide their scientific inquiry and becomes the 'normal science.' Kuhn (1970, 84-85) argues that when a field of science encounters a problem its paradigm cannot solve, there is a crisis, leading to new research, ending in one of three outcomes: 1) the old paradigm can solve the problem after all; 2) the problem is found to be too difficult using the tools currently available so is set aside for future scientists to address; or 3) a new "paradigm candidate" is launched.

engaging participants in acts of identifying and transforming metaphors as a way to change a system of relationships, the new futuring game has the potential to unlock new possible futures.

3   METHODS AND MATERIALS

3.1   Action Research Approach

The primary objective of this thesis is to demonstrate a means for developing new and innovative participation designs in futures research. To achieve the goal of demonstrating a replicable means for developing new and innovative participation designs an action research approach is used. As an application of the action research approach, an iterative process of planning, experimentation, and reflection is used to develop a new game element or activity.

Action research is a methodological approach that seeks to generate theory through practice and practice through theory. Through an iterative process of inquiry, an action research process generates both theoretical and practical understandings that support change. (Somekh 2008, 5.) Kurt Lewin (1946, 35) is credited for introducing action research in the 1940s because he called for a "comparative research on the conditions and effects of various forms of social action, and research leading to social action". Because action research intertwines theory and practice, proponents argue that it is especially well-equipped to deal with complexity (Dick 2015, 436-437). Action research is chosen as a method for this thesis because of its claimed ability to incorporate situational complexity by fitting a specific application of theory to a specific situation and support ongoing learning.

Editors Brydon-Miller et al. (2004) introduced the first edition of the journal *Action Research* with a description of what action research is, where it originated, and why it is useful. They highlight Peter Reason and Hilary Bradbury's definition of action research as an approach stemming from participatory traditions and democratic ideals aiming "to bring together action and reflection, theory and practice, in participation with others, in the pursuit of practical solutions to issues of pressing concern to people, and more generally the flourishing of individual persons and their communities" (ibid., 10-11). To trace its origins, Brydon-Miller et al. note how action research is influenced by the works of John Dewey and is influenced by contexts such as labor unions and liberation theology. They note the work of sociologist Kurt Lewin in the 1940s as a formative point in the history of the practice. (ibid., 10-11.) The journal editors present their own varied perspectives on how action research is useful, for example Hilary Bradbury argues "Action research must draw power from the premises of pragmatism, the belief that we can know through doing." Action research, according to the authors, posits that action and practice can generate theory. (ibid., 14-15.)

For purposes of time economy, this research only uses two action research cycles to demonstrate how findings from one cycle can inform the theory and practice of the following cycle. In an application with more available time, more cycles could be completed. Additionally, cycles could occur across a series of projects all using a similar set of tools.

A cyclic quality similar to that found in action research is not commonly found in futures methodologies. List (2006, 676) found that the methods included in The Millennium Project Futures Research Methodology version 3.0 do not directly call for iteration. However, a second review finds that the methods Delphi, Normative Forecasting, Morphological Analysis Forecasting, and FAR do in fact mention iteration. While iteration is overtly called for in these methods and implicitly called for in other methods, few futures research methods so far call for an action research approach.

Futures studies scholars have advocated for the value of using action research in futures research and participatory futuring. Bell (2009, 96) argues futurists have commitments beyond those related to knowledge, but also to "creating an anticipatory and action science that has some effect on society." Bell highlights Mannermaa's (1986, 662) principle that a "futures study which does not have any kind of direct or indirect impact on the development of society is totally useless, and cannot be called a futures study." Inayatullah (2004, 11) called action research the "fourth emerging perspective" in futures studies among his topology of "three overlapping dimensions"—the empirical, interpretive, and critical. Ramos (2006) describes the intersecting uses of futures thinking and action research. He lists eight ways action research and futures studies complement each other: participation assists in building an organization's capacity for futuring, providing agency in social change processes, creating demonstrably valid and rigorous knowledge, sharing a systems interventionist viewpoint, a recognition that it is impossible for any group to have a complete view of a situation and that its ways of seeing affect what conclusions are made, attending to visioning methods and frameworks as well as the vision itself, holding democratic commitments, and social innovation (ibid., 645). Miller (2015) echoes a key premise in action research by describing his approach to futures workshop facilitation as "learning by doing" with close attention to empowering participants.

Ramos points to Anticipatory Action Learning proposed by Sohail Inayatullah as a well-developed and explicit combination of the two broad approaches (Ramos 2006, 646). Ramos may have been the first to categorize several specific methods in what he describes as the 'confluence between action research and futures studies' (Table 2):

Table 2.   Three camps in the confluence of action research and futures studies (Ramos 2006, 645):

Action research incorporating tacit futures thinking	Futures studies incorporating tacit participatory action	Conscious and explicit incorporation of the two
- Appreciative Inquiry – David Cooperrider - Future Search – Sandra Janoff and Marvin Weisbord - Action Inquiry – William Torbert - Community action research and organizational visioning – Peter Senge - Total Systems Intervention – Robert Flood	- 'Participatory futures praxis' as described by Wendell Bell - Future Workshops – Robert Jungk - Electronic Town Meeting – Jim Dator - Anticipatory Democracy – Clem Bezold - Participatory futures – Wendy Shultz - Action oriented FS – Erzsébet Nováky	- Anticipatory Action Learning – Sohail Inayatullah, Tony Stevenson, Paul Wildman, Robert Burke - Oliver Markley – proposed 'political action futures research' - Authors in *Futures* special issues on action research – Dennis List, Patricia Kelly, Peter Hayward and Joseph Voros

For the purposes of this research project, the action research approach strives to be an explicit incorporation of futures thinking and action research traditions.

The ebb and flow of action research and its popularity in the German-speaking scientific community is briefly described by Popp (2013, 4-5). Action research became popular in Germany in the 1960s. It evolved through the 1970s as an approach "forwarding a

systems-critical and emancipatory claim" but was criticized for being too arbitrary in its applications. Starting from the early 1990s, the term "action research" fell out of popular use among German-speaking scholars. Popp observes the term "participatory practice research" is the currently used label. Popp argues there for a "productivity" in connecting participatory practice research to futures research.

Mary Melrose (2001) describes how action research can have greater rigor in its implementation. Noting the many influences and variations of action research, she makes a short list of key concepts supported by all of these variations, including: "being critical, evaluative, systematic, strategic, participatory, collegial, collaborative, self-reflective about practice, empowering, emancipatory, and having theory inform practice and practice inform theory" (ibid., 161). She argues that an action researcher may choose whether to act as a participant or a facilitator of a research process depending on the needs of the project, but that it is essential for the researcher to keep in mind that she is researching the topic at hand "with" not "on" the other participants. (ibid., 161-162.) She discusses the importance of considering the audience for an action research project in making decisions regarding rigor (ibid., 163-165). However, she warns of applying rigor in such a formulaic way that it detracts from the 'power, philosophy, and theoretical underpinnings' of action research (ibid., 177). Since this thesis is intended for a master's thesis, the action research cycles aim to be appropriately rigorous in their design, execution, observation and analysis.

While it would be possible, and in some cases desirable, for an action research project to have many cycles as the research unfolds, due to time economy, only two are made in this research. Two cycles sufficiently can demonstrate how learnings from one cycle can inform theory and practice to improve a following cycle. Across the two cycles, or iterations, a similarly structured data collection plan is used. The precise mechanisms for data collection are modified in the second iteration based on the strengths and weaknesses observed in the first iteration (see Chapter 3.2).

A complete, playable game is tested for each iteration built from the key game components described in Chapter 4. The game materials and instructions for the first iteration were developed based on the original June 2015 CLA Game and the researcher's own ideas. Modifications to these key game components were made based on analysis and reflection on the data collected from the first iteration. The researcher took a passive role in both iterations, choosing not to play the game himself but rather focus on leading the group through the instructions. The first iteration was held at the Shift business conference with participants randomly recruited from the attendees. The second iteration was held at a vegan café with participants who volunteered from the futures studies program.

3.2   Data Collection and Analysis

The way data is collected in action research affects its rigor according to, according to Mary Melrose (2001). She argues that the data collection must be: appropriate to the particular research context; "inclusive, involving and informing of those supplying data"; practical to producing new information, and systematic as opposed to arbitrary or random (Melrose 2001, 168). According to Richard Winter (1996, 11), the goals for data collection in action research include producing systematic and permanent records as well as recording and organizing opinions that may otherwise be taken for granted. According to Whitehead - McNiff (2006, 64), action research data gathering is more of a dynamic process, analogous to the kind used in journalism in which a researcher needs to select "capture breaking news, explain how the story is unfolding, and offer critical commentary".

Because this application of action research is change-seeking, the data collected needs to support the identification of improvements to the game for a following iteration. To summarize, this thesis needs a rigorous, systematic means for gathering evidence useful in identifying ways to improve how the game elevates creativity and criticality.

In this research, data is gathered from the action research cycles using a social research concept called triangulation. Melrose (2001, 169) suggests triangulation can be a more comprehensive means for gathering evidence because using at least three different means of data gathering helps researchers verify patterns in an observed phenomenon while offering opportunities to highlight points of discrepancy. To use triangulation, data collection uses at least three data gathering methods with each being sensitive to information the other data gathering methods may miss. Additionally, to produce optimal outcomes, efforts are made to minimize how much the selected data collection methods can influence each other's data.

The three primary data collection methods used in this research are 1) pre- and post-game questionnaires, 2) game artifacts, and 3) group interviews. Secondary data collected during gameplay included audio recording, the researcher's direct observations, and 'critical incident' photography. These secondary sources of data were only referenced as needed to clarify facts for the three primary sources of data. All three of the primary data collection tools were modified after being tried in the first iteration and these modifications are described in Chapter 5.1. The data—the game artifacts, pre- and post-game questionnaires, and group discussion transcript—are analyzed for how well the game elevates creativity and criticality with a goal of identifying improvements for future iterations. This analysis both applies the theoretical framework described in Chapter 2 and leaves room for new theory and concepts to emerge from the data itself.

The pre- and post-game questionnaire aims to measure participants' levels of creativity and criticality before and after playing the game (see Appendix 1). The questionnaire is designed based in part upon guidelines and best practices suggested in the Ethnographers Action Research Training Handbook (Tacchi et al. 2007, section 2.5) The same questions are used on the pre- and post-game versions to simplify the measurement of any changes. It is intentionally short and all questions except one have predefined answers so it can be completed quickly before and after playing the game.

The first question is intended to provide a baseline for the participant's perceived limitations on the present situation by asking if they can imagine a 100 percent renewable energy future. The second and third questions ask the participants to select the desirability and possibility of such a future on a seven-point scale. These first three questions together are analyzed to determine if the participants' perceptions about a 100 percent renewable energy future changed after playing the game.

The fourth question asks participants to identify main causes of the current situation. The list of possible answers covers a range of who or what is preventing a transition to a 100 percent renewable energy system—governments, activists, corporations, consumers, developed nations, developing, past generations, or the public. The purpose of this question is to ascertain what level of criticality the participants hold toward the current situation. To analyze the question both quantified (how many items are selected) and qualitative (which items are selected) are evaluated—the number of items showing the broadness of group's perception of causes and the contents of collectively selected and unselected answers indicating points of consensus among the participants. In addition to its five main questions, the questionnaire asks a few demographic questions. These are intended to support transparency in the research and reveal demographic factors which may influence dynamics and outcomes of the iteration. These possible dynamics are noted, but largely left unexplored in this thesis due to time restraints.

Game artifacts produced by the participants during gameplay serve as the second source in the data triangulation. Although there were some differences between the iterations, these artifacts included two-sided role cards, metaphor molecule logs, transformed metaphor atoms, and a score card (see Chapter 4). The game artifacts are analyzed using a hermeneutic process in which the researcher interprets broader meanings from them while establishing how creativity and criticality is present or absent. Additionally, the game artifacts are evaluated for how well the participants understood their purpose and use them during gameplay.

After playing the game and completing the post-game questionnaire, a group interview was held with the participants (see Appendix 2). A group interview not only helps the interviewer, but also supports the participants in understanding their own experiences. One possible limitation in a group interview is how social dynamics among participants can affect who talks and does not talk and which ideas are picked up into the broader discussion (Tacchi et al. 2007, section 2.3.2). To help address these issues, the researcher made efforts to encourage everyone to contribute even when one or two participants were dominating. The group interviews for each iteration were analyzed by transcribing the audio recording of it and coding the text for themes. Thematic accounts were then written and filtered against the theoretical framework, looking both for evidence of the pre-existing theory for this thesis and for new theory. While the questionnaires provide before and after snapshots of the participants and the game artifacts are what was produced, the group interview provided a means for gaining insights into the participant's experiences of playing the game.

Timothy Dolan (2015) explores how the concept of informed consent in research applies to futures studies. He argues that futures studies would be more professionalized if it were to apply an extended concept of informed consent, which includes disclosure of what kinds of policies and outcomes may result from the project (ibid., 120). This thesis takes the position that it is important to the transparency of the research process to describe the risks, benefits, and special interests of the research to the participants before they agree to participate. The participants were asked to sign consent forms before playing the game. This consent form was based on a template provided by University of British Columbia and was modified to fit with this action research approach. A consent form could be considered a passive or neutral part of the research, but in this case, it was observed to have had some influence in both increasing the seriousness with which the participants took the experience and setting their expectations for the research session. The iterations occurred in the same broad steps: participants were greeted and asked to complete a consent form. They then completed the pre-game questionnaire, played the game, completed the post-game questionnaire, and had a group interview.

By using a triangulation approach, various types of data collected from the two iterations can be mixed, synthesized, and analyzed to provide evidence of creativity and criticality as phenomenon. The two iterations are compared and an evaluation can be made of whether improvements made to the game design better supported creativity and criticality in the participants and the game outcomes.

4   KEY COMPONENTS OF THE FUTURING GAME

This chapter describes key components of the futuring game developed through this action research called Metaphor Molecule and connects them to the theoretical framework. The key components of the Metaphor Molecule game are scenarios, roles, metaphor atoms, and metaphor molecules.

Metaphor Molecule borrows and builds upon several concepts and materials from the June 2015 CLA game (see Heinonen et al. 2015). First, front pages of future newspapers are used to introduce the litanies of the Neo-Carbon Energy scenarios. Second, from their roles' perspectives, participants convey the role's worldview by describing what is threatening and motivating of the scenario as well as its enemy and allies. In the June 2015 CLA Game, gameplay ended with the selection of an overall metaphor for the scenario. In this new game, the focus of action is on transforming the metaphors given to each role as a means for transforming the relationships the roles have among themselves and to the scenario.

4.1   Scenarios

The futuring game explores a future scenario. The scenario serves as a stage for gameplay and the world in which participants imagine their roles. Participants collectively select a scenario to play from the scenario quadrants and in doing so, discuss which one would be most interesting to them and why. Their discussion about the scenarios is intended to evoke criticality in the normative sense of using their own ideas to determine which one to play. It supports creativity by introducing source ideas for later use and starting the series of choices the participant makes on their way toward developing intrinsic motivation to play the game as well as they can. For this thesis, the Neo Carbon Energy Scenarios are used in the Metaphor Molecule game (Figure 2).

	Radical startups	New consciousness
Deep ecology ↑ **Ecological awareness** ↓ **Pragmatic ecology**	Society is business-oriented, but economy is driven by a multitude of small-scale startups known for their "radical" values and approaches. Environmental problems are solved commercially. Businesses are drivers of new, ecologically oriented lifestyles.	Deep ecological values and distributed models have led to altogether new kind of consciousness and worldview. Environmental problems are not seen as practical issues but calling for deeper changes in values and mindsets.
	Value-driven "Techemoths" Peer-to-peer approaches are common, but they are practiced in more or less traditional organisations. Markets take care of environmental issues.	**Green DIY Engineers** Engineer-oriented citizens have organized themselves as local communities to survive ecological collapse. Environmental problems are solved locally, with a practical mindset.

Corporate ("Centralized" peer-to-peer) ⬅ **Peer-to-peer** ➡ Neo-Communal (Distributed peer-to-peer)
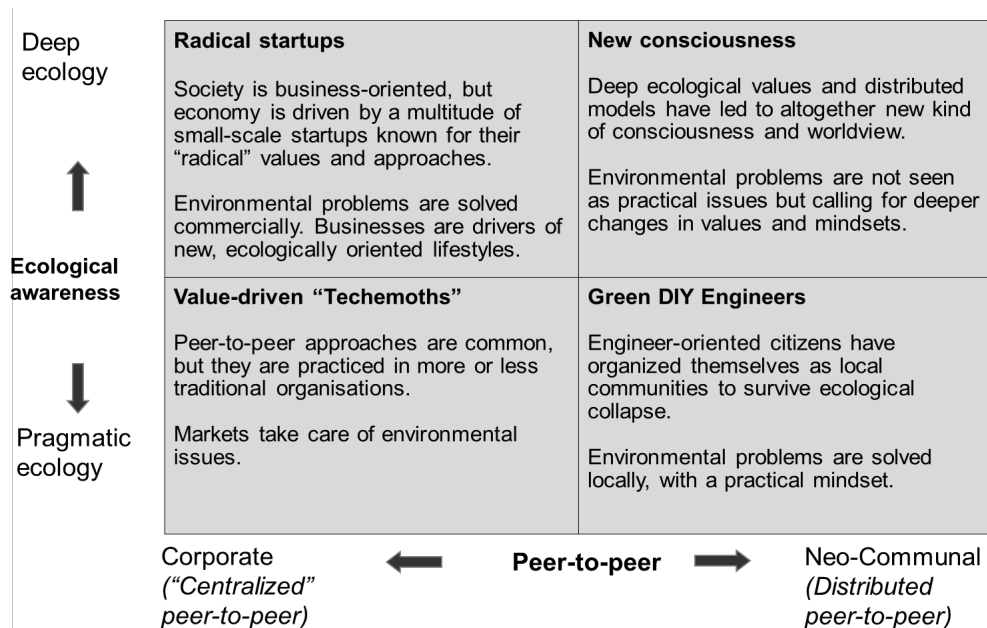
Figure 2.   Transformative Scenarios 2050 for Neo-Carbon Energy
                (Heinonen et al. 2015, 18).

These scenarios are presented along the axes of Peer-to-Peer and Ecological Aware-ness. The vertical Ecological Awareness axes has Deep Ecology and Pragmatic Ecology as its end points while the Peer-to-Peer axes has Corporate ("Centralized") and Neo-Com-munal (Distributed) as endpoints. In each quadrants of these axes are the Neo-Carbon Energy scenarios: Radical Startups, Value-Driven Techemoths, Green DIY Engineers, and New Consciousness.

Scenarios, as a game component, serve the key function of situating the game in the future. If it were not situated in the future, Metaphor Molecule would only be a game, not a futuring game. The scenarios also serve as the interface between the game and larger futures research projects and concepts. While this game uses Neo-Carbon Energy Sce-narios as its basis, any reasonably sized (e.g. fewer than six) set of scenarios could be explored in this game.

4.2   Roles

Roles are a key component of the Metaphor Molecule game—participants create them, give them depth, and connect them as a system of relationships. The roles also help par-ticipants imagine being in the future scenario, a form of experiential futuring proposed by Candy (2010, 3). In the game, participants invent roles using creativity and modify them using criticality. During gameplay, roles are intended to support creativity by sup-porting intrinsic motivation to play the game well and support criticality by bringing mul-tiple perspectives into the game.

The idea of using roles in Metaphor Molecule originates in the June 2015 CLA Game where they were one of four major actions and used to explore the Worldview level of CLA. In that game, participant groups were given as set of pre-defined roles (e.g. CEO of a Techemoth or Synthetic Biologist) as well as a few blank role cards. (Heinonen et al. 2015, 20-22.) In contrast, for the Metaphor Molecule futuring game, participants must invent their roles for the scenario from scratch, a design choice intended to support the participant's intrinsic motivation and keep the future open-ended.

To create a role, a participant completes a role card. The participant names the role (e.g. CEO or Mother of small children), describes how the role intersects with the scenario via an 'individual PESTEC' (Political, Economic, Social, Technological, Ecological, Cul-ture) Futures Table, writes a brief description of the role, and draws a picture. Asking the participants to draw a picture of their roles is a way to encourage alternative modes of expression, as suggested by McFadzean (2001) and Miller (2011b).

An experimental part of the role cards is the individual-level PESTEC futures table (Political, Economic, Social, Technological, Cultural). Usually, a futures table is used to understand a field of possible futures for the purposes of creating alternative future images or future scenarios. A futures table (e.g. PESTEC) aids in deepening a description of a possible future ensuring several key aspects of it are described.[14] Futures tables sup-port both creativity and criticality by supporting systematic and combinative thinking. In "Metaphor Molecule", futures table is intended to help participants to think through mul-tiple dimensions of how their role interacts with the future scenario. The abstract labels were expected to either cause difficulty for participants or prompt more imaginative and varied ideas.

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[14] In the June 2015 CLA Game, the PESTEC futures table was used by participant groups to describe systemic causes within their Neo Carbon Energy scenario. This group activity was tied to the Social/Sys-temic Causes layer in Inayatullah's Causal Layer Analysis. (Heinonen et al. 2015b, 20.)

Roles support the participants in inventing the world they will inhabit and sharing their own thinking about how the scenario would be from various vantage points. They also serve as nodes in a system of relationships.

4.3   Metaphor Atoms

Each role in the Metaphor Molecule futuring game has a metaphor atom, a visual way for placing its metaphor in the center of its worldview (Figure 3).
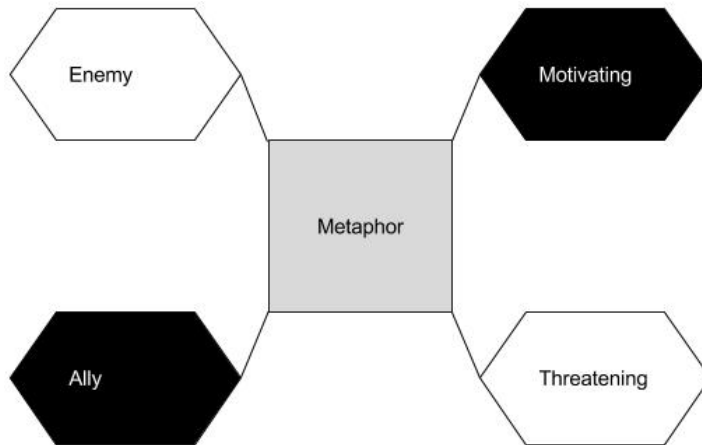
Figure 3.   Metaphor Atom and its Particles

A metaphor is the nucleus of a metaphor atom while its four surrounding elements are its electrons. Placing the metaphor in the center is intended to prompt participants to consider the metaphor as central to the role's worldview. The electrons diagonally across from each other are in relation to each other—in Figure 3, the white electrons are obstacle-oriented (enemies, what is threatening in the scenario) while black electrons are attraction-oriented (allies, motivating). The electrons are positioned this way to support rapid interpretation when two Metaphor Atoms are connected as Metaphor Molecules during gameplay.

The electrons—the ally, motivating, enemy, threatening boxes—are intended to both prompt the participant to think about the role's worldview within the scenario and support participant immersion into the scenario. The categories are borrowed from the June 2015 CLA Game in which participants were asked to imagine how their selected role would be in 2050 and write on their cards what would be motivating and threatening to them from the scenarios, and choose which of the other roles would be worst enemy and best ally. (Heinonen et al. 2015, 22.)

In the Metaphor Molecule game, participants first complete the electrons and then make a metaphor for their role. Changes made to the electrons can change the metaphor, and changes made to the metaphor and change the electrons. Through these transformational dynamics, Metaphor Atom help show participants how metaphors and worldviews are linked and introduce the notion that their transformation can serve as leverage points.

4.4 Connecting Metaphor Atoms

Metaphor Atoms connect to form Metaphor Molecules. They are a tool for describing the relationships among game roles as a system and the perception of metaphors as leverage points. They also support creativity by forcing the association of seemingly unrelated ideas (McFadzean 2001, 272). Finally, Metaphor Molecules support criticality because they are a dynamic, role-based approach to incorporating the metaphor, worldview, systemic causes and litany layers of CLA into a futuring game. The stages of gameplay involving the Metaphor Molecules are expected to be the most important for elevating creativity and criticality.

For the purposes of the game, there are two kinds of molecules—*weak bonds* in which two roles have an enemy or ally in common (Figure 4) and *strong bonds* in which two roles have each other as enemy or ally (Figure 5). During gameplay, four types of Metaphor Molecules can be formed: enemy weak bonds, enemy strong bonds, ally weak bonds, and ally strong bonds.
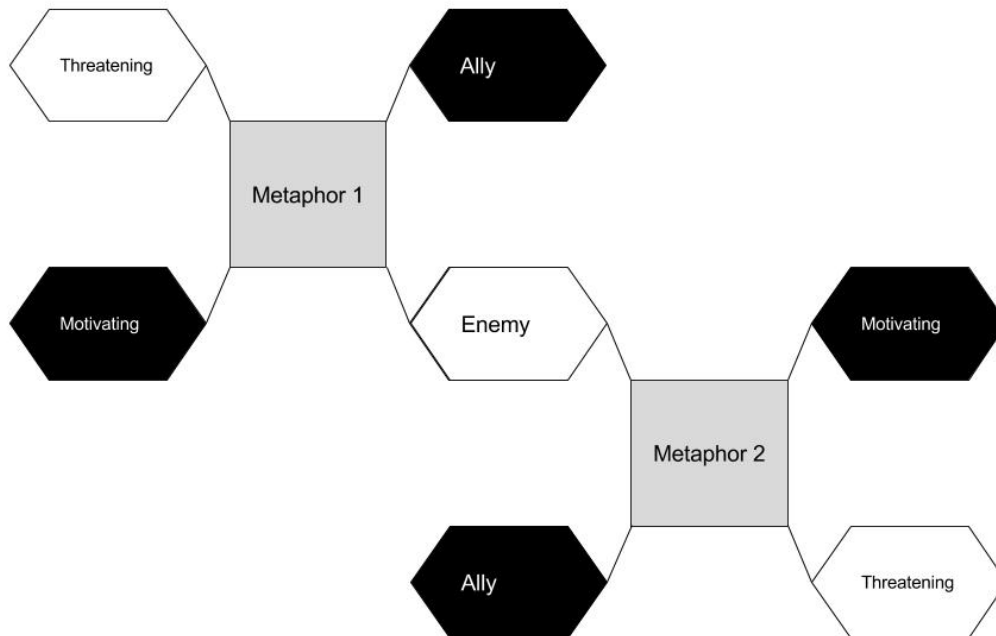
Figure 4.   Weak Bond on a Common Enemy
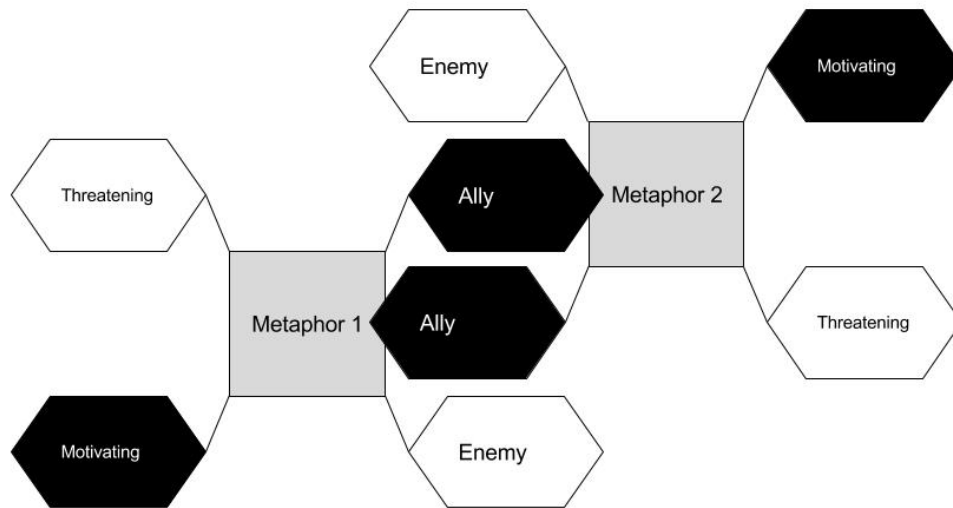
Figure 5.   Strong Bond of Mutual Allies

The structure of a Metaphor Molecule is linked to the layers of CLA. The Metaphor neutrons are the metaphor layer, the contents of the electrons are the worldview layer, the interaction of the two atoms in relation to each other represents the systemic causes, and the outer edge of the that field of interaction is the litany level. A Metaphor Molecule can be read as a story about the roles in relationship to each other.

When a Metaphor Atom's metaphor is transformed during the game, its "electrons" are evaluated and changed to reflect its new entailments. Changes in the electrons of the Metaphor Atoms lead to changes in the Metaphor Molecule—the molecule can break apart, change its type from weak bond to strong bond, or change its classification from ally to enemy. These changes ultimately change the modeled system of relationships among the roles. To give a more practical depiction of how it works, an example of roles connected via their metaphor atoms into a metaphor molecule is depicted in Figure 6.

This example is formed from the roles created during the June 2015 CLA Game by participants playing the Value-Driven Techemoths scenario (Heinonen et al. 2015, 35-37). The highlighted bar through the threats and metaphors of the two roles' and their common enemy indicates the focus of this interpretation. The metaphor (M1) 'closed door' is held by the role Underground Anti-Corporate Hacker and the metaphor (M2) 'luxury jail' is held by the role Marginalized Person. The hacker is threatened by 'corporate autocracy making people not free" while the marginalized person is threatened by "isolation reducing goodwill of others." These two roles with their metaphors share the role Techemoth CEO as their common enemy. The Techemoth CEO's metaphor, not shown in the figure, is "The world is my playground and cornucopia of resources." (Heinonen et al. 2015, 34-36.) Comparing what the hacker and the marginalized person find threatening points to these roles having perceived a restrictiveness emanating from the Techemoth CEO in the form of limited freedom and isolation. Considering the three metaphors in this Metaphor Molecule as leverage points, a transformation of the relationship is possible by changing the metaphor of the Techemoth CEO to one that removes what is threatening to the other two roles in the scenario.
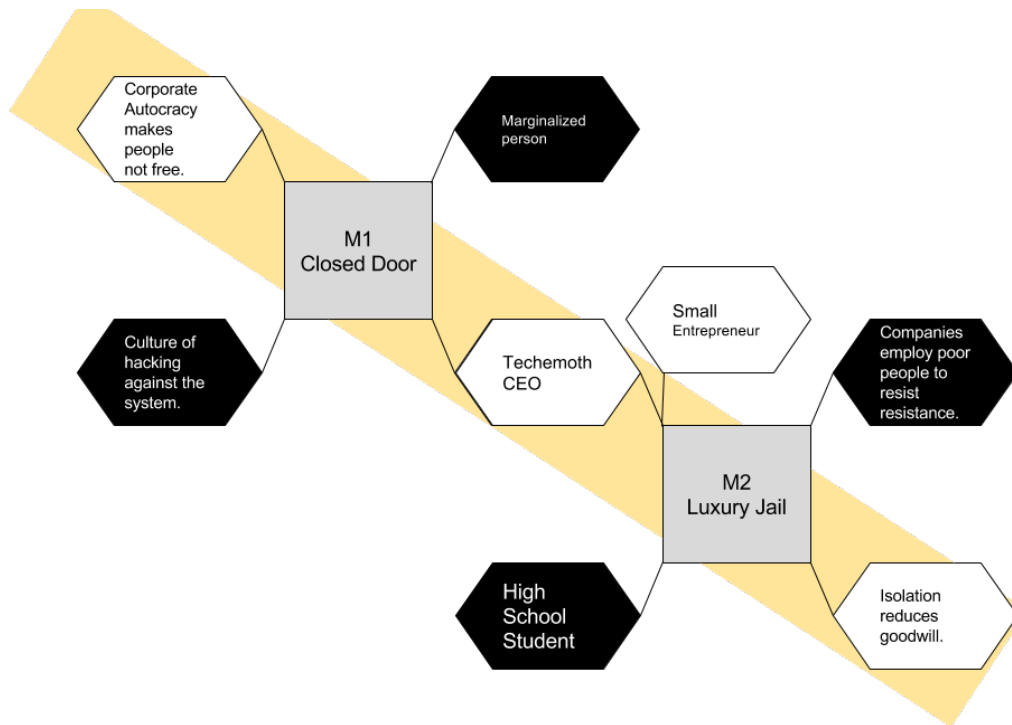
Figure 6.   Example of a Metaphor Molecule built from two roles created by partici-
                pants at the June 2015 CLA Game

This new metaphor could be, for instance, "I am a steward of the world and have a duty to sustainably manage its resources and distribute them fairly". This new metaphor may be able to transform the system of this common-enemy relationship. For example, the hacker may perceive a different threat in the scenario. Instead of "corporate autocracy making people not free" this role may have a new threat of "corporate distribution of resources in not fair enough." With this new threat, the hacker's new metaphor could be transformed to "Robin Hood, stealing from the rich to give to the poor." For the Margin-alized Person, the perceived threat of "reduced goodwill of others" is partly relieved if the Techemoth CEO is distributing resources more fairly. This change may lead to a new threat such as "Relying on the goodwill of giant companies limits what I can say when they do something wrong" which could result in a new metaphor "accept and behave." The new metaphors for these three roles are then reflected into their allies, enemies, and what is motivating in the scenario.

Transforming metaphors to change the relationships among the roles depicted in Met-aphor Molecules are the focal activity of the Metaphor Molecule futuring game. It is the game component in which all parts of the Theoretical Framework come together to elevate creativity and criticality in service of opening pathways for producing new desir-able futures.

5   ACTION RESEARCH ITERATIONS

In this chapter, the two action research iterations of the futuring game Metaphor Molecule are described and compared and the three types of data collected are synthesized and analyzed in relation to the theoretical framework. Additionally, the basis for the changes to the game in the second iteration are described.

5.1   Conducting the First and Second Iterations

The futuring game Metaphor Molecule, built from the game components described in Chapter 4, was tried in two iterations. The first iteration was held in June 2016 at the inaugural Shift business conference at Turku Castle and the second in September 2016 at a popular vegan coffee shop. Both iterations were held outdoors, although the second iteration moved indoors after the weather became too windy and cold.

Both iterations followed similar phases of play—scenario selection, role creation, metaphor atom production, metaphor molecule construction, metaphor transformations, review of transformed metaphor molecules, and scorekeeping (Table 3, see Appendix 3). In both iterations, transforming metaphors of the created roles was the focal action of the game and was expected to serve as the highest point for creativity and criticality.

Table 3.   Comparison of Phases of Play in the First and Second Iteration

First Iteration Game Phases	*Second Iteration Game Phases*
1. Select Scenario to Play 2. Create Roles and Relationships 3. Molecule Construction and Documentation 4. Metaphor Transformation 5. Review of New Relationships 6. Scorekeeping	1. Select a Scenario to Play 2. Create Roles for the Scenario 3. Create Metaphor Atoms for the Roles 4. Build Metaphor Molecules 5. Tell a Story 6. Transform Metaphors 7. Retell the Story 8. Scorekeeping

The first iteration was planned for between five to twelve participants and five ultimately participated. The participants for the first iteration were recruited by distributing 24 printed fliers to conference attendees—some were known to the researcher and others were strangers. Because the participants were observed to have enough time to present and talk with each other during the first iteration, a choice was made to have only five participants for the second iteration. These five participants were recruited via an online sign-up form shared with futures studies master's degree students.

The demographics of the participants in each iteration were similar in two ways. First, all participants came from an academic context and second, the gender balance ratios of the two groups were the same—three women and two men. There were three key differences in the demographics. First, all first iteration participants were Finnish and presumably all played the game in English as a shared international language while in the second iteration only one participant was Finnish, two were from two different non-English-speaking countries, and two were from the same English-speaking country. Additionally, second iteration participants were all students of the same program and knew each other

more than the participants in the first iteration who all came from various disciplines and academic roles. Finally, the second iteration participants were all generally younger, in their 20s-to-mid 30s, while in the first iteration, the participants came from different age brackets ranging from 20s to 50s. These demographic similarities and differences are mentioned because they make transparent the limits to the findings of this overall research (e.g. it remains unknown how this game functions with teenagers or elderly people) and they indicate what additional social factors may have been at play (e.g. intercultural communications, gender systems, or inter-personal familiarity and relationships).

Analyzing the data from the first iteration led to key changes in the second which were intended to improve the game's capacity to elevate creativity and criticality. Modifications were made to the game's objective and scorekeeping system, game rules, metaphor molecule logging, metaphor atom design, pre-and post-game questionnaires, and group interview questions.

The game's objective was a collective one in both iterations—all players were working toward a common goal and evaluated together for their performance. In the first iteration, the objective was to transform the role's metaphors to reduce the number of enemy metaphor molecules. In the second iteration, the objective was to invent a story about the future and then improve it by transforming the relationships among its roles. The game objective was changed to address concerns raised by the first iteration participants regarding how realistic the game was to play.

In connection to the changed game objective, the scorekeeping system was changed from a quantitative one in the first iteration to a qualitative one in the second iteration. The reason for this modification was to give participants a more meaningful result than an abstract number.[15] The quantitative scorekeeping system relied on counting enemy and ally metaphor molecules on the starting and ending Metaphor Molecule Logs and doing math to calculate a numeric score (see Appendix 4, Figure 9). The qualitative scorekeeping system required participants to individually make qualitative evaluations of the desirability, novelty, feasibility and value of the story they created and then combine their individual answers into a collective scoresheet (see Appendix 4, Figure 10). This new scoring system was based upon the four creative continua proposed by Litchfield et al. (2015) discussed in Chapter 2.1.

Changes made to the game rules were intended to invite more dynamic discussions about the relationships produced in the metaphor molecules and remove friction points observed to reduce the state of flow in the first iteration. To encourage dynamic discussion, two additional game phases were added to the second iteration: telling a story about the relationships depicted in the Metaphor Molecules and retelling the story after the metaphor transformations. These storytelling phases were introduced to prompt the participants to enact the relationships conveyed in their metaphor molecules, create rich images of the future scenario, and loosen the structure of the game.

The Log of Metaphor Molecules—essential to scorekeeping in the first iteration—was completely removed for the second iteration for three reasons. First, it appeared to interrupt participant discussions of the metaphor molecules due to the level of detail it demanded (see Appendix 5, figures 11 & 12). Second, leaving it up to the group to improvise their own means for tracking their metaphor molecules could support the group's sense of autonomy and promote their internal drive in playing the game. Third, not providing a pre-defined logging system was a way to test if one is even needed and to discover alternative approaches for the group to track what was happening.

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[15] In the first iteration, the participants asked if "seven" was a good score or not.

The Metaphor Atom design was modified to close a loophole unconsciously exploited by the first iteration participants and to improve the consistency in how participants complete the atom's neutron and four electrons. The loophole took the form of all first iteration participants claiming their role no longer had enemy relationships in the transformed Metaphor Atoms, effectively eliminating all enemy metaphor molecules in the game. To close this loophole, the Friend and Enemy electrons were renamed as Helper and Hinderer for the second iteration because, while a participant could argue she has no enemies among the other roles in the game, it is more difficult to argue there is no one who hinders them from achieving their objectives. Furthermore, a rule was added requiring at least one role to be named for the Helper and Hinderer electrons. To improve the consistency of what was written in the electrons, the phrase "in the scenario" was added to the Threatening and Motivating electron and "of the other roles" was added to the Helper and Hinderer.[16]

The time horizon of 2050 was added to the pre- and post-game questionnaires on four of its five questions (see Appendix 1). The goal of adding this time horizon was to tighten the scope of the question and provoke more divergent answers among the participants if any such differences exist. This change was made because, in the first iteration, the questionnaire—particularly the first three questions—produced very similar answers from all participants and it was unclear if they were answering for "any time in the future" or some more challenging scope of time.

Both the questions and approach to the group interview changed between the two iterations (see Appendix 2). In the first iteration, the researcher stuck to planned questions and asked few new follow-up questions. In the second iteration, the planned questions were changed, and the researcher took more initiative to ask follow-up questions as new topics emerged. The first iteration's question "What stood out as surprising or key moments in the game?" was replaced in the second iteration with a question about how the participants felt at which stages of the game. In the second iteration interview, three questions were added: 1) a planned question about usefulness was added because this characteristic was mentioned in the first iteration interview, 2) a question about new ideas for stopping climate change was added to enrich answers given to the same question on the questionnaire, and 3) a question about how the participants experienced creativity and criticality interacting while playing the game. Of these questions, the first two produced meaningful answers while the last question proved too difficult to answer.

The participants in each iteration selected a different Neo-Carbon Energy scenario (see Chapter 4.1) to play—the first iteration played Radical Startups and the second played Green DIY Engineers. The first iteration participants chose the startups scenario because they were attending a business conference. The second iteration participants selected Green DIY Engineers after discussing the possibility of playing New Consciousness, with one participant unsuccessfully lobbying the others to play Radical Startups instead. In both cases, the selection of the scenarios was observed to help the group understand the four scenarios in relation to each other, give the group a first chance to work together to solve a problem, and initiate intrinsic motivation to play the game.

The first iteration participants created the roles of The Collectorist, Hipster Carpenter, Teenager, Olympic Athlete, and Disgruntled Anarchist. The roles created during the second iteration were Training Mindset/Youth Coach, Journalist/Blogger, Local Sustainability Advisor, Environmental Ministry Position/Left-Leaning Politician, and Dream Developer. Comparing the two sets of roles, the first iteration participants created roles which were less directly related to the big themes of the scenario than the second iteration

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[16] A minor change was made to the Metaphor Atom's nucleus, moving space for the participant to write the Role above the space for Metaphor and connecting the two areas with the word "is" to help reinforce metaphor construction.

participants. The second iteration also created roles that were more career-oriented than the first iteration's roles.

In the first iteration, The Collectorist was initially given the metaphor "Anything goes but together is best"; the Hipster Carpenter was given the metaphor "Peace, Love and Understanding"; the Teenager, "Little Prince, Number One"; the Olympic Athlete, "Head in the Clouds"; and the Disgruntled Anarchist, "No Man is an Island." In the second iteration, the Training Mindset/Youth Coach was given the metaphor "Bridge"; the Journalist, "Sift"; Sustainability Advisor, "Living to help the community and ultimately the world. Will admit when unsure. Never afraid to ask for help/advice"; Left-Leaning Politician, "A reality check, the bigger picture, scraped knuckles"; and Dream Developer, "a door to a new world". (See Appendix 6.)

After creating the metaphor atoms for their roles, participants connected them into metaphor molecules. Through a task intended to encourage the participants to analyze the relationship among the roles as a system, they identified which molecule to transform first. The first iteration group identified molecules holding the Olympic Athlete as enemy as key ones to transform and the second group identified the Youth Coach molecule. The Metaphor Molecules from the first iteration are presented in Table 4.

Table 4.   First Iteration Metaphor Molecules Before and After Metaphor Tranformations

Metaphor Molecules Before Metaphor Transformations
Allies   *Strong Bonds*   Disgruntled Anarchist <> Hipster Carpenter   *Weak Bonds*   Hipster > [Disgruntled Anarchist] < Teenager   Collectorist > [Disgruntled Anarchist] < Teenager   Hipster > [Disgruntled Anarchist] < Collectorist
Enemies   *Strong Bonds*   Olympic Athlete >< Disgruntled Anarchist   *Weak Bonds*   Disgruntled Anarchist > [Athlete] < Collectorist   Hipster > [Athlete] < Collectorist
Metaphor Molecules After Metaphor Transformations
Allies   *Strong Bonds*   Hipster Carpenter <> Disgruntled Anarchist   Hipster Carpenter <> Collectorist   Olympic Athlete <> Collectorist   *Weak Bonds*   Disgruntled Anarchist < [Hipster Carpenter] > Collectorist
Enemies   None.

In the second iteration, a participant volunteered to record the molecules and invented his own system for doing so. Without a predefined log sheet, he chose to indicate when

multiple roles shared another role in common. He also included strong bond connections in the weak bond molecules (Table 5).

Table 5.   Second Iteration Metaphor Molecules Before and After Metaphor Tranformations

Before Metaphor Transformations
Helping *Strong Bond* Sustainability Advisor <> Youth Trainer *Weak Bond* Journalist / Sustainability Advisor / Dream Developer → Youth Trainer Dream Developer / Politician → Journalist
Hindering *Strong Bond* Politician < > Sustainability Advisor *Weak Bond:* Journalist / Dream Developer / Sustainability Advisor → Politician Dream Developer / Politician → Sustainability Advisor
After Metaphor Transformations
Allies *Strong Bonds* None *Weak Bonds* Politician / Journalist / Sustainability Advisor / Dream Developer → Youth Coach Politician / Youth Coach / Sustainability Advisor / Dream Developer → Journalist Politician / Youth Coach / Dream Developer→ Sustainability Advisor Youth Coach / Journalist / Sustainability Advisor→ Politician
Enemies None.

In the first iteration, the metaphor transformations organically led to all five of the metaphor atoms being transformed even though this was not required in the rules.[17] A similar transformation cascade occurred in the second iteration. In both iterations, the groups ended the game with no Enemies/Hinderers. The first iteration, possibly due to the focus on two or three roles in relation to each other at a time, produced more strongly bonded allies. Meanwhile the second iteration produced large weak bond molecules. A participant observed during the group interview for the second iteration that everyone was included by the end of their game, which was a desirable outcome.

Scorekeeping proceeded easily in both groups (see Appendix 4, figures 9 & 10). In the first iteration, the group had a score of 7.[18] In the second iteration, the group was observed to complete the individual scorecards and synthesize the individual scores into the group scoresheet with ease. Their score was a highly desirable future with mid-level novelty on

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[17] Details of these Metaphor Transformations are documented in Appendix 4.
[18] A modification was made to the scoresheet during the first iteration counting the total number of transformed Metaphor Atoms instead of the total number of transformed Metaphor Molecules.

the Breakthrough Continuum. During the second iteration group interview, a participant wondered if they had made an improvement or not. There is greater potential for meaning making in the new scoring system, but for the second iteration participants, it remained too abstract. In some future iteration, this scoring system would become more sophisticated if it were used twice during the game, once after the first Metaphor Molecules are formed, and again after the transformed Metaphor Molecules are formed. That way, the participants could use the scoring system to aim for a specific type of improvement (e.g. increase novelty or switch to a different creativity continuum or increase the desirability).

5.2   Thematic Analysis

This sub-chapter aims to ascertain the creativity and criticality levels for each of the two action research iterations based on the theoretical framework. This thesis hypothesizes that elevating creativity and criticality helps break through limits to understanding and opens new pathways to desirable futures. The theoretical framework suggests this elevation can be supported by using metaphors as leverage points in a system and the game Metaphor Molecule focuses on that action. An analysis of the questionnaires, game artifacts, and group interviews shows that overall creativity and criticality appear to have been elevated in both iterations, but in different ways and facing different challenges.

Part of the creativity dynamics in the iterations can be found in the answers given to the question asking for ideas to stop or slow global warming (see Appendix 1, tables 10 & 11). In the first iteration, the post-game ideas were combinative and expanding in meaning, indicating the participants' thinking had evolved during gameplay. In the second iteration, the post-game ideas were largely the same as from the pre-game, but compressed and narrower in meaning. This analysis indicates that, after playing the game, creativity had increased for the first iteration participants and decreased for the second iteration participants. However, in the group interviews the participants from both iterations described experiencing elevated creativity.

In the first iteration interview, the participants described two ways to categorize the creativity they experienced: useful vs. new creativity, and social vs. individual creativity. All but one of the first iteration participants described creating their roles as a high point of creativity. One participant described creating the roles as "giving something form"—of making something new—while the metaphor transformations was having "a stimulus that encourages me to make modifications with a particular goal". This 'useful creativity' aligns with Amabile's (1998) definition of creativity as the production of novel and useful ideas. A participant found the independent work of creating roles to be difficult and did not like it but had her 'aha!' experiences working together as a group to "change some things and go further." In the second iteration, a participant described how modifying his role in relation to the other roles helped him test his ideas. This "social creativity" is connected to the model for positive affect in a group offered by Amabile et al. (2005) in that the interplay among the participants can produce positive emotions which in turn support creativity.

The second iteration group interview produced evidence the group's positive affect was occasionally hampered by occasional negative emotions such as frustration when discussions became personal while their sense of flow was lowered at times when the rules were not clear. These times of lowered flow included the storytelling stages, which were less well developed in the design because they were new. The importance of clear rules links directly Csíkszentmihályi's (2014, 139) notion that rules support the centering

of attention, which are essential for initiating the state of flow. The second iteration participants also discussed how being an intercultural group contributed to creativity. One participant reported feeling most creative while hearing the other participants present and describe the roles they created. Another hypothesized that some ideas—such as the journalist's work serving as a "launchpad for knowledge"—would have never been developed had the group been of all one nationality. They pointed to intercultural communications supporting their creativity, which is not part of this thesis's theoretical framework, but noteworthy. Their experience is partly explained by McFadzean's (2001) factors for creativity, particularly access to many ideas and new stimuli, and Amabile's (1998) reference to Simon's "network of possible wanderings." The more ideas available to a task, the more possible combinations exist, and the more potential there is for novelty.

Creativity levels for the two iterations can also be inferred by the roles produced during the game. They can be evaluated based on their novelty within their scenario context and the range of domains they introduce. Comparing the roles created in the first and second iterations based on their contextual novelty, the first iteration roles are more unexpected in relation to the themes of the scenario—none of the roles are directly involved with a startup or business life. The second iteration roles were all connected to the theme of DIY community and all roles aimed toward helping a small community survive in difficult global conditions. From this framing, the first iteration roles were contextually more novel and the second iteration roles were less novel.

Another way to consider the creativity of the created roles is by evaluating the variety of domains introduced in the Role PESTEC tables (see Appendix 6, tables 13 & 15). In the first iteration, the roles came from many domains such as sports, family, politics, subculture, and lifestyle. In the second iteration, the roles came from two domains—awareness raising and community governance. Reviewing the descriptions of the roles, the first iteration roles were attributed more complete lives while the second iteration roles were more narrowly career-orientated ones. From reviewing the created roles, the first iteration appears to have had a more elevated creativity during the role creation stage.

Criticality for the purposes of this thesis is explanatory, practical and normative; opening humanity's options; testing boundaries of socio-economic imaginaries; holding awareness of alternative worldviews; supporting openness and contestability of future images; and moving from passive observation to active description (see Chapter 2.2). As a complicated concept, assessing the criticality levels in the two iterations is admittedly challenging. A few approaches are used: 1) comparing the number of systemic causes selected on the pre- and post-game questionnaires between the two iterations, 2) reviewing the various roles for stances toward the scenario, 3) analyzing what the roles perceived as threatening and motivating, and 4) assessing if the way the relationships among the roles were transformed served to open or close the options for humanity.

Per a quantitative analysis of the question about causes of the present situation in the pre- and post-game questionnaires, the two iterations had differing criticality dynamics. The first iteration group collectively selected seven more causes in the post-game questionnaire than they did in the pre-game. The second iteration group, on the other hand, had roughly the same higher criticality at both the beginning and the end of the game (see Appendix 1, tables 6 & 7). The second iteration participants' unchanging and high level of criticality before and after the game in the questionnaire matches how two of these participants described having the same level of criticality throughout the game during the iteration's group interview.

Criticality can be found in perspectives toward the scenario assigned by the participants to the roles they created. Several of the roles created in both iterations were attributed some critical perspective. For the first iteration and the Radical Startup scenario—the best example was the Disgruntled Anarchist who has a "startupper" big

brother and questions the quality and durability of products and services in a world filled only with flash-in-the-pan often short-lived companies. A subtle questioning of the scenario is given in the role of the Collectorist, who is attributed an off-and-on financial life and the Teenager who longs for the civic culture from his grandparents' times. For the second iteration and the Green DIY scenario, the role carrying the most criticality toward the scenario was the Dream Developer, who sought to help individuals achieve their dreams and prosperity in a time of practicality and scarcity. The Journalist/Blogger grew up in a "bad culture" due to the isolation of the community. The Sustainability Advisor and Left-Leaning Advisor pointed to the difficulties of bringing people together into a sustainable way forward. The Youth Coach highlighted the need in the scenario to pass on new, low-consumption, ecologically conscious values to the children. These critical stances attributed to the roles are ways the participants introduced contestability to the given futures presented in the scenario. Furthermore, by engaging with the scenario through the roles they created, they moved from passively observing the scenario in the prior game stage to actively describing what the possible future would be like.

Criticality can also be assessed in the metaphor atoms produced for the roles (see Appendix 6, tables 14 & 16), specifically what the roles found threatening and motivating about the scenario. In the first iteration, The Collectorist found the commercial materialism of the Radical Startups scenario to be threatening, the Hipster Carpenter believed technology and startups should not decide the future, the Anarchist felt threatened by the scenario's loss of long-term purpose, and the Teenager was afraid of the rising protest from drop-outs. Meanwhile, the Olympic Athlete identified herself to be the greatest obstacle to her own success. In the second iteration, the Mindset Coach felt threatened by the policies and rules of the small Green DIY Engineers community, the Journalist was threatened by extreme localness stopping the wider distribution of knowledge, the Sustainability Advisor was concerned about the DIY community's emphasis on engineering interests and self-motivation, and the Dream Developer felt threatened by overwhelming practical-mindedness crowding out big thinking. For both iterations, the variety of threats perceived by the roles surfaces negative characteristics of the scenario's dominant regime. The role-based threats from the scenarios highlight practical challenges of daily life, normative ideas about what the scenarios should be like instead, and explanations for how society functions. A similar argument could be made for what the roles found motivating.

The presentation of Metaphor Atoms in both iterations was observed to serve as an efficient means for the participants to communicate the worldviews of the roles they created. For instance, one second iteration participant, during the group interview, identified hearing the other participants present their roles and describe why they thought the role was important to the scenario as a time of heightened criticality. Consideration of alternative worldviews is a key part of Causal Layered Analysis and a key task for critical futures studies.

While worldviews were not specifically mentioned during the first iteration group interview, values were. One participant described how the scenario acted as a system and "we all wanted to be good citizens to that system." She also observed how "all of our norms, our values, were measured against that instead of some kind of absolute goodness or badness." Regarding the transformational action of the game, she observed "we made good values even better, and somehow that didn't feel realistic". Another participant observed how the game aimed to convert values of the roles, which reminded him of Robert Dahl's proposed mini-popular, or deliberative democracy, in which academics, experts, and the public discuss an issue and try to find consensus. Values are linked to normativity. Additionally, the work of fitting individual values into the scenario's systems can be understood as a form of describing the future instead of observing it.

Transforming the metaphor molecules required participants to keep in mind the relationships among the roles to each other, the relationship of the roles to the scenario, and the goal of improving those relationships. The levels of criticality and creativity can be assessed by analyzing if the transformed metaphors expanded in meaning and became radical or contracted and became more conventional (see Chapter 2.4).

In the first iteration, the Olympic Athlete did not expand or contract, two of the role metaphors contracted in their scope of meanings, the Disgruntled Anarchist metaphor expanded, and the Teenager was not transformed at all. The first transformation which led to the others was the Olympic Athlete. While her metaphor transformation from "head in the clouds" to "feet on the ground" did not expand its meaning, it did serve to make her role more a part of society and lose its enemies. The Collectorist transformed her role's metaphor by contracting it from a structure holding two meanings, "anything goes" and "together is best" to a structure holding only the one meaning "together is best" making the range of possible meanings less complicated. The Hipster Carpenter's metaphor became more practical, contracting from the broad virtues of "Peace, Love, and Understanding" to narrower action orientation which opens up more acceptance for the startup scene. The Disgruntled Anarchist metaphor expanded in the number of possible interpretations than the more focused "no man is an island." The Teenager did not have a metaphor transformation, yet changes in the other roles inspired what he found threatening and motivating to switch from passive statements to more active ones. (See Appendix 7, tables 17-21.)

In the second iteration, all five metaphors expanded in meaning through their transformations. The Sustainability Advisor's metaphor expanded from of a personal mission statement focused on service to others, fallibility, and openness into a personal virtue of "selfless inspiration", thus increasing its scope of meaning. The Journalist/Blogger's metaphor expanded from "sift", describing her work as not removing any knowledge while distributing it in small bits people can understand, to "Launchpad for knowledge," which implies setting people out toward greater enlightenment or even emancipation. The Dream Developer's metaphor expanded from "a door to new worlds" to "Green Door". When presenting his metaphor to the group, he described how doors relate to possibilities—if you open a door and nothing is there you can always close it and move on to another one. By making it green, he added positivity, sustainability, and safety to the original meanings. The Youth Coach's original metaphor of "bridge" referred to a path and connection over an otherwise unpassable place, a way of overcoming an obstacle. Transformed into "Shift," its meaning expanded to mean an energetic shift from an old culture to a new culture, pointing toward new ways forward. The Left-Leaning Politician metaphor was "a reality check, the bigger picture, scraped knuckles" and transformed to "Equal Responsibility". The first metaphor was a call to action for the people while the second was a political virtue both for herself and the wider public. If expanding meanings of the metaphors is a key to them serving as leverage points, it could be argued that the second iteration group had better success in using them in that way. (See Appendix 7, tables 22-26.)

The aim of elevating creativity and criticality is to support breaking through conventional understanding. Data gathered in the first three questions of the questionnaire provides evidence for whether the participants in each iteration had a change in perception about the feasibility, likelihood, or desirability of a 100 percent renewable energy future.

Before the game, one participant in each of the iterations answered "No" to the first question, indicating they could not imagine a world that no longer uses any non-renewable fuels. The other four participants in each group answered "Yes" indicating they could imagine it. No participants in either iteration changed their answer to this first question after playing the game. The symmetry of the answers to questions in the two iterations is

likely a coincidence. Had the two No's turned to Yes's, it would have represented a dramatic change for those two participants. However, these two participants reported holding a strong belief that it could not happen—the first iteration's naysayer argued it is impossible for anything to hold a state of being 100 percent a certain way and the second iteration naysayer was convinced it would require the complete fall of Western Civilization— an extremely unlikely event—before it could happen.

For the second question about the desirability of such a future, nearly all the first iteration participants and all the second iteration participants marked it highly desirable (6 or 7). For the third question regarding the likelihood of a renewable energy future, the first and second iteration pre-game answers differed. The first iteration participants gave mixed answers with two participants answering lower likelihood and three answering middle to higher likelihood while the second iteration participants all answered middle to lower likelihood.

After playing the game, the first iteration participants made very few changes to their answers for the first three questions, only one participant changed his answers by slightly reducing desirability from 7 (the highest) to 6 and increasing the likelihood from 2 (nearly the lowest) to 3 (not quite the middle). This indicates the game did little to increase the participants' already existing assessments of the likelihood of a 100 percent renewable energy future. For the second iteration, all participants made no changes to their answers to the first two questions while three participants improved their assessments of how likely it is for the world to completely stop using non-renewable energy by 2050. One of these three participants, Participant 1, changed her answer dramatically from the lowest likelihood (1) to slightly above the midpoint (5), while the other two only increased their assessments by one. These changes in the second iteration indicate that playing the game helped some participants see a 100 percent renewable energy future as more possible.

Yet probably more important than most of the second iteration group moving at least a little toward thinking a 100 percent renewable future was more probable by 2050, several reported during the group interview finding new types of solutions for the challenges of global warming and new avenues for thinking about possible futures. For instance, the creation of the role of the Youth Coach as a means toward mindset change and transition was a new and inspiring idea to another participant, who said she had had sports coaches her whole life and had never considered how coaches could set larger values. Another participant described usually feeling depressed when thinking about climate change scenarios, but found hope in focusing on the community scale. Yet another participant described how she had not considered how education drove key dynamics in the scenario. And another described how before she had thought only about the policy dimension and after playing the game, she understood how having a collective mindset, in which people fully understand why change is needed and have a vested interest in it is key. These reflections from the second iteration participants indicate that new perceptions were opened to them.

6 DISCUSSION & CONCLUSION

6.1 Elevating creativity and criticality in game-based futuring

It is time to return to the primary research question of this thesis, "How can creativity and criticality be elevated in participatory futuring contexts, specifically in game-based futuring?" Based on the analysis of the data collected from the two iterations, combining play and inquiry into game-based futuring supports elevating creativity and criticality. By taking the form of a game, this type of futuring supports creativity by evoking positive affect from participants, providing rules and structures which initiates and sustains a state of flow, helping participants suspend judgement to allow creative dynamics to occur, and forcing connections of concepts into novel combinations. Game-based futuring also provides space for participants to test boundaries of a possible future by openly challenging assumptions, discussing how real or imagined circumstances could be changed both in the present and future, and actively describing more desirable futures.

A challenging part of elevating creativity and criticality in game-based futuring is detecting the elevated states of these characteristics without simultaneously lowering them. Two of the data collection tools in this research, the Metaphor Molecule Log Sheet in the first iteration and the questionnaires in the second, were observed to reduce levels of creativity and criticality. The delicate solution is to find the balance between collecting comprehensive-enough data to meet the research goals and interfering as little as possible with the phenomena being studied via the game-based approach. It could be argued, however, that some of the data collecting tools themselves support reflection and thereby support criticality.

The scorekeeping system developed in the second iteration, inspired by the nuanced continua of creativity proposed by Litchfield et al. (2015, 249; see Table 1), was observed to support participants in taking a critical, or at least a reflective, perspective toward their collectively produced creative work. The second iteration produced evidence of the potential for tools like this continua-based scoring system to support participants in folding creativity and criticality together to consciously steer their group creative process. In some future iteration of metaphor molecule, it would be worthwhile to experiment with introducing this creativity continua assessment tool earlier during gameplay so that it can be used more actively by the group to set their own creativity target (e.g. a highly novel story on the radical continua) for the game. Such a step would support the internal drive of the participants while simultaneously encouraging a critical perspective toward what kind of creative outcomes are most worthwhile to pursue.

The metaphor transformation stage of the game was observed in both iterations to simultaneously call for greater creativity and criticality from participants. Furthermore, the action of transforming metaphors was observed to produce significant changes to the system of relationships among the roles of the game. This observation suggests that elevated creativity and criticality work together to produce metaphor transformations as system interventions.

Producing a futuring game in pursuit of theory-driven goals also required creativity and criticality from the researcher. Creativity was required in planning the iterations, designing game materials, defining the game rules, and inventing improvements to the game. Criticality was required in linking game materials to the theoretical framework, analyzing the data of the first iteration for improvements, and being open to making bold modifications as the data indicated. These requirements were found to function as an additional learning loop in the research process.

6.2   Using action research to create new futuring games

When action research is used to create and to develop futuring games, the approach can produce new ideas and generating evidence of how well those ideas reach the intended goals. Because the approach to action research applied in this thesis sought to improve an object of research through planning, observation and reflection, it proved to be a practical yet rigorous way to design and improve the participatory futuring game. In the case presented in this thesis, a balance was struck between rigor and fluidity—iterations were systematic in their data collection and facilitation, but new ideas suggested by participants were sometimes tried on the spot.

The first iteration demonstrated that action research can be used to create a game. At the minimum participants were observed to understand what they were doing was playing a game and approached the activity with a spirit of playfulness. The second iteration went further and showed how action research can structure experimental improvements to a futuring game. In this case, some parts were improved—for instance placing greater attention on problem discovery by giving the group latitude to select which metaphor molecule had the greatest influence on their game's system of relationships. If there were future iterations, the Metaphor Molecule game could be improved even more.

The iterative nature of action research allowed for the creation of the new futuring game and the tools for evaluating its outcomes to occur alongside each other. Examples of the tools co-evolving with the game was the addition of the 2050 time horizon to some questions on the questionnaire, the modification of the interview questions, and the total reinvention of the scoring system for the second iteration. The need for this co-evolution is evidenced by how some tools did not work as intended, for instance participants in both iterations found it difficult to report their experiences with criticality during the game. If there were a future iteration, the questions about criticality in the group interview could be improved based on the previous iteration experiences. Modifications could also be made to the game materials so that participants more readily understand how to use them.

Generating evidence of any phenomena relies on the quality of data gathered. Using triangulation in gathering data helped produce a more comprehensive view of what happened during each iteration. For example, a second iteration participant's account of her criticality during the group interview were contradicted by changes she actually made to her post-game questionnaire. Synthesis of the three types of data tended to produce more dynamic insights. However, analyzing the game artifacts often focused on assessing the creativity and criticality game outcomes while analyzing the group interviews and pre- and post-game questionnaires often focused on understanding the creativity and criticality the participants experienced.

A tension in making this action research arose between thoroughness of data analysis and speed of iteration. It was assumed at the beginning of this research project that iteration would occur quickly, producing viable results which could be analyzed and translated into meaningful improvements. Because of this tension, a researcher using action research to develop new participatory futuring appears to have a choice between making more and faster iterations with lighter analysis or making fewer iterations with heavier analysis. In the case of this research, the latter choice was made. In a more practical situation where a researcher or practitioner needs to produce a viable futuring game more quickly, doing more iterations with lighter analysis may produce a more fitting outcome.

Another choice to make in using action research to develop new futuring games is whether to use an open or closed process. The process used in this research was closed— the researcher was primarily responsible for the research outputs and participant involvement was limited to being a participant in iteration sessions. These choices were

appropriate for this game because only the researcher was responsible for producing a thesis from the work and it would have been unfair to ask participants to do more of the research work itself. However, action research can be applied in a more participatory way in which the group plays a larger role in authoring the futuring game produced or even the research design itself. In such a case, close attention would need to be paid to how credit is given to all authoring and contributing parties, developing analysis systems in which all could participate in learning from each iteration, and clarifying responsibilities in how outputs can be used.

As was discussed in Chapter 3.1, action research is argued to be a suitable method for handling the complexity inherent in a research context. Indeed, complexities were encountered in both iterations—everything from environmental factors such as sounds, unexpected music, weather to personal factors such as stress, mood, and existing relationships among players to social factors such as cultural backgrounds, inter-cultural diversity of the group, perceived gender expectations, and scripts of behavior in the specific setting (e.g. a conference or a café). The flexibility of action research as a method allowed for many of these complex factors to simply be part of the study without reducing the validity of the findings. In fact, it can be argued these details added richness to the research by introducing surprise micro-findings (e.g. when a truck idles briefly next to your participants, their affect becomes more negative). In a more open and participatory action research approach, in which the participants were more involved in developing the game, some of these complex factors could be dynamically addressed during the game session.

An action research approach can be used to develop theory and practice in game-based futuring. Taking an action research approach fosters creativity and criticality in the development of the game itself, which contributes to the quality and practicality of the resulting game. It is easy to imagine a third, fourth, and fifth iteration of the Metaphor Molecule game being helpful in its evolution. Through thoughtful iterations, it would become more valuable as a tool for futures research and foresight consulting practice.

6.3   The Metaphor Molecule game and its generalizability

The Metaphor Molecule game was designed to have Neo-Carbon Energy scenarios as its main content. However, it could also be used to explore any set of scenarios, if they are few enough in number and easy enough to understand during gameplay. This game could also be used as a part or after a scenario making process to help immerse stakeholders in the scenarios. It has first been developed as a scenario exploration tool, but it is possible it could be used with futures research methods other than scenarios. For examples, it could be used for a classic Jungk-styled Futures Workshop or an organizational visioning process.

Perhaps the greatest contribution Metaphor Molecule can make to participatory futuring is its capacity to re-humanize the future. In discussions of future driving forces, technology convergences, and other futures studies topics, people and the dynamics among them are often left out of the picture. Since the Metaphor Molecule game focuses attention on roles and their relationships, it can be helpful in identifying ways to bring a set of future relationships into greater harmony or understand potential dynamics among future people.

6.4   Assessment of value generated for Neo-Carbon Energy

One of the research questions of this thesis asks, "In what ways could the produced futuring game provide insights to the specific foresight project of Neo-Carbon Energy?" Both iterations of Metaphor Molecule generated some potentially valuable insights for the Neo-Carbon Energy project.

In the first iteration of Metaphor Molecule, the roles you would expect to find in the Neo-Carbon Energy Radical Startups scenario such as startup founders, investors, business regulators, or startup customers were not the roles created by the participants. Instead, they chose to create roles on the peripheries of startup culture, most of whom could be characterized as ordinary people (see Appendix 6, Table 13). The one more extraordinary role was the Olympic Athlete. In thinking about the Neo-Carbon Energy project's Radical Startups scenario, this role can serve as a metaphor for a startup founder. In other words, a startup founder is an Olympic Athlete and the market is an international sporting event. The entailments of this metaphor include: work is a sport; fine tuning your startup idea is training to win a gold medal; and fame, glory, and wealth are yours if you succeed. This metaphor is an easy fit with present-day startup culture. Therefore, like the Olympic Athlete, some startup founders have their "heads in the clouds" and would benefit themselves and society by transforming that metaphor to "feet on the ground." If many founders grounded themselves in their communities with concern for the well-being of society, the startup scene could transform from one that can be perceived as only helping rich and privileged men become richer and more privileged into one in which people of all walks of life—women, students, immigrants, elderly, children, and minority groups—are empowered to produce value and benefit from creating scalable businesses grounded in true societal needs. The other roles created in the first iteration questioned the implications of a regime of radical startups for themselves and society. The teenager had a generational nostalgia for the society of his grandparents while the disgruntled anarchist found the sustainability of craftsmanship and communities to suffer. The perspectives of these roles point to less tangible social dimensions of the scenario related to trust, community, and quality.

Similar to the first iteration, the second iteration participants created a set of roles for the Green DIY Engineers scenario that are not commonly considered—no engineers or makers appeared (see Appendix 6, Table 15). A couple of these roles, the youth coach and the journalist, especially after their metaphor transformations, were focused on the work of education and knowledge sharing. The group identified the youth coach/mindset trainer as the most influential role to transform which raises the question, who supports education and knowledge sharing in small communities of the Green DIY Engineers scenario? In a world where so much has gone wrong and small communities are left to vie for themselves, spreading knowledge and supporting holistic thinking would be quite important to sustaining a 100 percent renewable energy system for the long haul. Their created roles also highlighted the need for new approaches to governance, collective action, and inspiring innovation.

The experiential qualities of the Metaphor Molecule game also contributed value to the Neo-Carbon Energy project. Because of this research, ten people have actively imagined what it would be like to be in one of its four scenarios. These acts of immersion could be argued to have opened up new possibilities in the minds of the participants and planted seeds for new 100 percent renewable energy possibilities. In this way, it has shown it can function as an interface between the larger Neo-Carbon research project and the public. It can provide a two-way flow of ideas and inspirations.

6.5   Limitations of this study

One limitation of this research is that it itself was a creative process and as such introduced some cognitive bias in the researcher. This bias could have at times excessively highlighted the successfulness of the futuring game, or conversely, overemphasized its failures. Since scientific research should be open-ended—the outcomes of this research could not be a foregone conclusion. Therefore, sincere efforts have been made to overcome possible cognitive biases such as re-evaluating data to ensure conclusions are valid.

Another limitation is that participants for both iterations only came from academic backgrounds. While this limitation made the two iterations more like each other, it remains unknown how well the game can elevate creativity and criticality for people further away from higher education, such as midcareer business people, planners, or high school students. In future, iterations could be run with these groups or mixes of groups to gain a better understanding of its range of applications.

6.6   Possible future applications

A key strength of the Metaphor Molecule game is its emphasis on roles, social relationships as systems, and potential for change through metaphor transformations. Because of the game's emphasis on roles, it is well suited to situations in which people are attempting to work together to improve their common situation. It also has shown some capability for extending a group's empathetic reach to people and identities different from themselves. Applications of the Metaphor Molecule game could be easily found in organizational development, visioning, and policy making. In the two iterations and along the way of producing this research, the participants mentioned several possible uses for the Metaphor Molecule game, ranging from organizational planning to personal futuring. These uses included helping people find a role for themselves in a future scenario such as a startup or a workplace transition, supporting policy making, identifying dynamics among a group of people and how to improve them, finding limits and obstacles to desirability in a scenario from various perspectives, inventing new desirable futures, encouraging intercultural understanding, or inventing new actors to help resolve the world's biggest challenges. The participants came up with these possible uses without any prompting.

A challenge to participatory futures research projects with time horizons of 35 years or more is to imagine the implications of a possible future on future people. As we grow older, we ourselves change, so it is never as simple as imagining our current selves in a future time. It is understandably difficult for anyone participating in a futures workshop to think beyond their own lived experiences in the present. The tendency to be trapped by present understandings unfortunately limits the novelty of future images produced and tends to produce futures images which are merely reflections of how people perceive the present. Through further development and iterative action research the Metaphor Molecule game could evolve into an important tool for supporting futuring participants seeing futures from perspectives of imagined future people who have significant differences from their own present-locked selves.

Fundamentally, Metaphor Molecule appears to be best suited for elevating creativity and criticality in service of supporting empathy toward others in the development of desirable futures. Perhaps it could be used to stop an armed conflict, avert global warming, or begin a holistically desirable radical societal transformation.

6.7 Where to go from here

This thesis has been built on the assumption that elevating creativity and criticality is valuable to shaping desirable futures through participatory futuring. This action research case study showed how elevating creativity and criticality are worthwhile objectives for participatory futuring. This research could go forward in many directions—four of these possibilities are described below.

The first possible direction is to develop the theoretical framework by investigating how creativity and criticality interact as forces or behaviors in participatory situations. While attractive to think about, this interaction was largely left unexplored in this thesis due to time constraints. The specific nature and typologies of interactions between creativity and criticality would be a strong contribution to the fields of organizational creativity, educational studies, and futures studies. Further work could be done to develop tools for collecting data about the interaction between creativity and criticality. A possible research question would be "How do creativity and criticality support each other in producing new ideas, insights, and understandings in group processes?"

The second possible direction is to experiment with participatory action research (Kemmis et al. 2014) instead of the more traditional researcher-led model used here. In participatory action research, all participants consider themselves to be researchers. A participatory action research approach could be valuable in situations where it is important for the participants to feel ownership of their output—in this case the new futuring game. One potential case would be to bring stakeholders from multiple organizations together to create a futuring game as a means for popularizing the results a futures study they sponsored. Developing a futuring game using participatory action research would require a deeper understanding of best practices in establishing an equal footing among the participants and empowering them to engage in the action research process. It also may require the development of tools for rapidly sharing and collectively reflecting upon the outcomes of the iterations.

A third possible direction is to explore futuristic computational approaches. While this instance of Metaphor Molecule was built for humans to play together in small groups, it may be possible, as artificial intelligence (AI) and quantum computing advance, to run the game as a massive-scale agent-based simulation. Such a simulation could either invent its own roles or take inspiration from a set of social media accounts (e.g. Facebook profiles) or some other data source. Once the roles were generated, and their metaphor atoms completed, the AI would be able to produce optimal metaphors among perhaps thousands of roles to obtain some desirable future. Scaling back from this radical idea, it may be more useful to use ICT to collect the real inputs of people from a large organization to simulate how they would help or hinder each other. Such a simulation could help anticipate possible pitfalls in group dynamics and aid in preventing future unproductive conflicts among staff. However, these computationally driven possibilities for Metaphor Molecule pose a great risk of dehumanizing real people or groups. To counter this risk, it would be essential to aim such endeavors at supporting human agency.

A fourth possible direction is to use Metaphor Molecule as an experimental entry point for discussing intercultural futures. Intercultural communication is one of the most difficult challenges facing many organizations. Complications frequently occur in organizations and society when words and their meanings and intentions are misunderstood by people from different cultural backgrounds. Meanwhile, the second iteration participants found playing the game with people from multiple cultural backgrounds expanded the group's range of available ideas and perspectives, contributing positively to their creativity and criticality. Because the game emphasizes roles and transforming social systems,

it is a good candidate for synthesizing the theory and methods from intercultural communications and futures studies into a possible new subfield called intercultural futures.

Any of these four possible directions would contribute to knowledge about developing new game-based futuring games and provide new insights into how people can elevate their creativity and criticality in pursuit of new ideas and understandings. At the very least, this research has shown there is great potential in people elevating creativity and criticality in collaboration to widen their thinking and produce new combinations of ideas.

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APPENDIX 1 – PRE- AND POST-GAME QUESTIONNAIRES

PRE- & POST-GAME QUESTIONNAIRE – ITERATION 1

Age: ___ Gender: Man / Woman / _____ Nationality: _____

Occupation: _____ Industry/Field: _____

1. Can you imagine a world that no longer uses any non-renewable fuels (oil, coal, natural gas, uranium, etc.)?

   Yes   No

2. How *undesirable or desirable* is it for the world to stop using non-renewable fuels?

   Very Undesirable 1   2   3   4   5   6   7 Very Desirable

3. How *unlikely or likely* is it that the world will completely stop using non-renewable fuels?

   Very Unlikely   1   2   3   4   5   6   7 Very Likely

4. What in your opinion are main causes for the world's present day reliance on non-renewable energy sources? (Check all that apply.)

   _ Needs of industry
   _ Ineffective grassroots/citizen activism
   _ Lack of action by national Governments
   _ Too slow action by international organizations
   _ Too much government regulation
   _ Greed of corporations
   _ Unchangeable consumer behavior
   _ Energy demands of Developing Countries
   _ Energy demands of Developed Countries
   _ Lock-in from decisions of past generations
   _ Too few people care
   _ Other (describe): _____

5. Briefly describe one way (or more) that global warming could be slowed, stopped, or reversed by 2050. (Feel free to continue on the back of the page.)

Figure 7.   First Iteration Pre- and Post-Game Questionnaire

PRE- & POST-GAME QUESTIONNAIRE – ITERATION 2

Age: ___   Gender: Man / Woman / _____   Nationality: _____
Occupation: _____ Industry/Field: _____

1. Can you imagine a world in the year 2050 that no longer uses any non-renewable fuels (oil, coal, natural gas, uranium, etc.)?

    Yes   No

2. How *undesirable or desirable* is it for the world to stop using non-renewable fuels by the year 2050?

    Very Undesirable   1   2   3   4   5   6   7 Very Desirable

3. How *unlikely or likely* is it that the world will completely stop using non-renewable fuels by the year 2050?

    Very Unlikely   1   2   3   4   5   6   7 Very Likely

4. What in your opinion are main causes for the world's present day reliance on non-renewable energy sources? (Check all that apply.)

    _ Needs of industry
    _ Ineffective grassroots/citizen activism
    _ Lack of action by national Governments
    _ Too slow action by international organizations
    _ Too much government regulation
    _ Greed of corporations
    _ Unchangeable consumer behavior
    _ Energy demands of Developing Countries
    _ Energy demands of Developed Countries
    _ Lock-in from decisions of past generations
    _ Too few people care
    _ Other (describe): _____

5. Briefly describe one way (or more) that global warming could be slowed, stopped, or reversed by 2050. (Feel free to continue on the back of the page.)

Figure 8.   Second Iteration Pre- and Post-Game Questionnaire

Table 6.   First Iteration *Post*-Game Questionnaire Answers with Changes from
Pre-Game Questionnaire in Parenthesis

Question \ Participant Code	1	2	3	4	5
1. Can you imagine a world that no longer uses any non-renewable fuels (oil, coal, natural gas, uranium, etc.)?	No (Same)	Yes (Same)	Yes (Same)	Yes (Same)	Yes (Same)
2. How *undesirable* (1) or *desirable* (7) is it for the world to stop using non-renewable fuels?	1 (0) [19]	6 (-1)	7 (0)	7 (0)	6 (0)
3. How *unlikely* (1) or *likely* (7) is it that the world will completely stop using non-renewable fuels?	4 (0)	3 (+1)	5 (0)	2 (0)	5 (0)
4. What in your opinion are main causes for the world's present day reliance on non-renewable energy sources? (Check all that apply.)	2 items checked (+1)	7 items checked (+2)	5 items checked (+1)	4 items checked (+1)	7 items checked (+2)
5. Briefly describe one way (or more) that global warming could be slowed, stopped, or reversed by 2050. (Feel free to continue on the back of the page.)	2 ideas given (+2)	1 idea given (0)	1 idea given (-1)	2 ideas given (+2)	1 idea given (-1)

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[19] Changes are presented as positive or negative numerals in parenthesis. A positive number indicates the participant marked their answer that much higher in the post-game questionnaire. A negative number indicates the participant marked their answer that much lower. A zero indicates instances where the participant had no change in the number of items.

Table 7.   Second Iteration *Post*-Game Questionnaire Answers with Changes from
               Pre-Game Questionnaire in Parenthesis

Question \ Participant Code	1	2	3	4	5
1. Can you imagine a world in the year 2050 that no longer uses any non-renewable fuels (oil, coal, natural gas, uranium, etc.)?	Yes (Same)	No (Same)	Yes (Same)	Yes (Same)	Yes (Same)
2. How undesirable (1) or desirable (7) is it for the world to stop using non-renewable fuels by the year 2050?	6 (0)	7 (0)	7 (0)	7 (0)	6 (0)
3. How unlikely (1) or likely (7) is it that the world will completely stop using non-renewable fuels by the year 2050?	5 (+4)	4 (+1)	4 (0)	3 (+1)	1 (0)
4. What in your opinion are main causes for the world's present day reliance on non-renewable energy sources? (Check all that apply.)	6 items checked. (+1)	6 items checked. (+1)	5 items checked. (0)	4 items checked. (0)	4 items checked. (0)
5. Briefly describe one way (or more) that global warming could be slowed, stopped, or reversed by 2050. (Feel free to continue on the back of the page.)	1 idea given (0)	1 idea given (-1)	2 ideas given (+1)	1 idea given (-2)	2 ideas given (0)

Table 8.   First Iteration Pre- and Post-Game Questionnaire answers to question about causes for present day reliance on non-renewable energy compared

Answers given to question: "What in your opinion are main causes for the world's present day reliance on non-renewable energy sources? (Check all that apply.)"	Pre-Game Participant Selections and Total						Post-Game Participant Selections and Total					
	1	*2*	*3*	*4*	*5*	*Total*	*1*	*2*	*3*	*4*	*5*	*Total*
Needs of industry		x		x	x	3		x		x	x	3
Ineffective grassroots/citizen activism						0			x			1
Lack of action by national Governments					x	1		x			x	2
Too slow action by international organizations						0					x	1
Too much government regulation						0						0
Greed of corporations			x	x		2			x	x		2
Unchangeable consumer behavior		x	x			2	x	x	x	x	x	5
Energy demands of Developing Countries		x			x	2		x			x	2
Energy demands of Developed Countries		x	x	x	x	4		x		x	x	3
Lock-in from decisions of past generations		x	x		x	3		x	x		x	3
Too few people care						0		x	x			2
Other: Costs of renewable technology	x					1	x					1
Participant Totals	1	5	4	3	5	*18*	2	7	5	4	7	*25*

Table 9.　　Second Iteration Pre- and Post-Game Questionnaire answers to question about causes for present day reliance on non-renewable energy compared

Answers given to question: "What in your opinion are main causes for the world's present day reliance on non-renewable energy sources? (Check all that apply.)"	Pre-Game Participant Selections and Total						Post-Game Participant Selections and Total					
	1	*2*	*3*	*4*	*5*	*Total*	*1*	*2*	*3*	*4*	*5*	*Total*
Needs of industry	x	x			x	3	x	x			x	3
Ineffective grass-roots/citizen activism	x		x			2			x			**1**
Lack of action by national Governments		x	x	x	x	4	x	x	x	x	x	5
Too slow action by international organizations						0						0
Too much government regulation						0	x					**1**
Greed of corporations			x	x		2		x	x	x		**3**
Unchangeable consumer behavior	x	x		x		3	x	x		x		3
Energy demands of Developing Countries	x	x				2	x	x				2
Energy demands of Developed Countries	x	x				2	x	x				2
Lock-in from decisions of past generations			x			1			x			1
Too few people care			x	x	x	3			x	x	x	3
Other: Costs of renewable technology					x	1					x	1
Participant Totals	5	5	5	4	4	23	6	6	5	4	4	25

Table 10.   First Iteration Participant Ideas for Slowing or Stopping Global Warming

Partici-pant	Pre-Game	Post-Game
1	Great catastrophes, lack of food/environmental crises & refugees	Sanctions, normative atmosphere/culture [in question, she circled the word "slowed"]
2	Distributed energy solutions organized via sharing economy	Minipublicus of deliberative methods to decision making
3	*Sticks:* Banning as many of the harmful actions as possible (cf. Burning the cornfields after harvesting in Brazil) *Carrots:* develop "consumer clean-tech" sector as well as possible.	Opportunities to non-consumption should multiply.
4	[no answer given]	Solar energy [heart] Get people (women especially) to read/learn stuff about it!
5	Cold Fusion produced smaller scale OR through government non-commercially.	Cold Fusion widely implemented as free solar, gov't non-commercially.

Table 11.   Second Iteration Participant Ideas for Slowing or Stopping
             Global Warming

Participant	Pre-Game	Post-Game
1	Using alternative energies	Using alternative energies
2	Limitations to meat consumption for example by severely restricting the availability of especially cattle meat; and promotion and government support for alternative protein sources.	Limitations to cattle
3	Increase global awareness of a previous generation engraining in our minds that we <u>need</u> to use fossil fuels. This idea is outdated, but perpetuated by many corporations who do not want the expense of adapting because it's not profitable.	Still removing the idea that fossil fuels are <u>requirements/necessities</u>. Stop letting money lead the world.
4	Require a set timetable for companies & city's infrastructure to retrofit and make the fines for non-compliance quadruple the cost of the actual upgrades or changes. Heavily tax drivers to fund increase in public.	Heavy tax of the polluters. Way more than their yearly profits.
5	1. Reduce the price of renewable technologies. 2. Regulate where necessary (forbid the use of non-renewable resources after the economic conditions for transformation are created.)	1. Cut down the costs of renewable technologies. 2. Where necessary, forbid the use of non-renewable resources after economic conditions for switch to renewable energy are present.

APPENDIX 2 – GROUP INTERVIEW QUESTIONS

First Iteration

Reflect upon the game session. What moments, if any, stand out in your memory?

If a creative idea is a novel, yet useful one, are there any ideas that were produced while playing the game which you found to be more creative than the others? What were they?

If criticality is taking a critical perspective toward current understandings of a situation, including assumptions, mental models, and other conventions, were any ideas produced in the game that you found to be more critical than the others? What were they?

Planned, but not asked: How did you feel while playing the game?

Planned, but not asked: What new thoughts, if any, do you have about energy, global warming, and climate change based on playing the game?

Second Iteration

What emotions did you feel at which parts of playing the game?

If a creative idea is a novel, yet useful one, are there any parts of the game which you found to be more creative than the others? What were they?

If criticality is taking a critical perspective toward current understandings of a situation, including assumptions, mental models, and other conventions, did any part of the game help you have a critical perspective more than others? What were they?

Can you describe any experiences while playing the game where you were both more critical and creative than usual?

What new thoughts, if any, do you have about energy, global warming, and climate change based on playing the game?

What uses or applications can you think of for this game?

APPENDIX 3 – GAME RULES FOR BOTH ITERATIONS

First Iteration Game Rules

Six Phases of the Game

1. Select Scenario and Read It
2. Create Roles and Relationships
3. Build and Document Metaphor Molecule
4. Transform Metaphors
5. Review of New Relationships
6. Scorekeeping

How to play

1. Select scenario to play and read it

- As a group, review the four provided scenarios and select one to play. Be quick so you have more time to play the game.
- After selecting a scenario, one player reads the litany out loud.

2. Create Roles and Relationships

- Each player takes a blank Role Card.
- On the Role Details side, describe a role you'd like to play in the scenario. Be as specific, yet brief, as possible. These details will help you and the other players understand the role.
- After all players ready, each player presents their role details.
- Flip your card over to the Metaphor Atom side. Imagine your role's life in the scenario. In the indicated spaces, fill in what is "threatening" and "motivating" to your role as well as which of the other roles are "worst enemy" and "best ally". Leave the metaphor space in the middle blank.
- Each player presents what is threatening, motivating and who is worst enemy and best ally for their roles.
- To complete the Role Cards, each player comes up with a metaphor for their role in the scenario and writes it in the Metaphor box on their Role Card.
- Each player presents their role's metaphor.

3. Build and Document Metaphor Molecule
In this stage, your group will build all the possible combinations of Metaphor Molecules from the roles created in phase 2. There are two ways Metaphor Atoms connect: as Strong Bonds (two roles hold each other in the same relationship, either as enemy or ally) or as Weak Bonds (two roles have a common enemy or ally).

- Explore Alliances
  - Connect cards by **mutual allies**. Mutual Allies are two roles that identify each other as Best Ally. Document these on the "Metaphor Molecule" Log.

  o Connect cards by **common allies**. Common allies are two (or more) roles that share a third role as an ally. Document these on "Metaphor Molecule" Log.

- Explore Enemies
  o Connect cards by mutual enemies
  o Connect cards by common enemies

4. Transform Metaphors

Select any enemy molecule to transform.

- Reassemble it on the game board.
- Read the molecule as a mini-narrative: "The role __ with metaphor ___ feels threatened by ___ in the scenario. The role __ with metaphor __ feels threatened by __ in the scenario. These roles [are in directly in opposition to each other] / [share role ___ with metaphor ___ as a common enemy]."
- All players work together to create a new metaphor(s) for the role(s). The goal is to create new metaphor that fit the roles but would transform the molecule into a friend-based one.
- When new metaphors are created to everyone's satisfaction, the roles' players complete new metaphor atoms based upon the new metaphor for their role and place it on their old molecule.
- Repeat process for all enemy roles or until group is satisfied with how many metaphors have been transformed.

5. Review New "Metaphor Molecules"

- Follow instructions from phase three to build and document all "metaphor molecules":

  - Metaphor Atoms are assembled into all possible Metaphor Molecules.
  - All Metaphor Molecules are documented as they are assembled.
  - All Metaphor Molecules are read out-loud as narratives.
  - Document them on a new log sheet.

6. Scorekeeping

- Count the number of transformed "metaphors atoms."
- Compare the "Metaphor Molecule Log" from the start of the game to Metaphor Molecule Log from end.
- On both lists, the number of Ally/Friendly molecules are counted.
- The number of Ally molecules on the beginning-of-game list are subtracted from the number on the end-of-game list.
- The result is the score. Example: The players had 5 friendly molecules at the beginning of the game. At the end of the game they have 8 friendly molecules. The group's score is 3.

Second Iteration Game Rules

"METAPHOR MOLECULE" GAME RULES - ITERATION 2

Welcome to this game of Metaphor Molecule on the Neo-Carbon Energy scenarios for 2050.
Revision: 3 September 2016.

GOAL OF THE GAME

To work together as a group to invent a story about the future and then improve it by transforming the relationships among its roles.

EIGHT PHASES OF THE GAME

1. Select a Scenario to Play
2. Create Roles for the Scenario
3. Create Metaphor Atoms for the Roles
4. Build Metaphor Molecules
5. Tell a Story
6. Transform Metaphors
7. Retell the Story
8. Scorekeeping

HOW TO PLAY

1. Select a Scenario to Play
- Review the set of scenarios and choose one to play. This should only take a few minutes. If a consensus can't be reached, select a card randomly.
- After selecting a scenario, one player reads out loud the scenario's "headlines from the future".

2. Create Roles
- Each player takes a blank Role Card.
- On the Role Details side, describe a role you'd like to play in the scenario. Be as specific, yet brief, as possible. These details will help you and the other players understand the role.
- After all players are ready, each player presents their role details to the group.

3. Create Metaphor Atoms for the Roles
- Turn to the role card to the Metaphor Atom side.
- Imagine your role's life in the scenario. In the indicated spaces, fill in what is "threatening" and "motivating" about the scenario to your role as well as which of the other roles "hinder" and "help" your role in accomplishing its goals. These are your Metaphor Atom's electrons. For now, leave the metaphor space in the middle blank.
- Each player presents their role's Metaphor Atom electron.
- With metaphor for their role in the scenario and writes it in the Metaphor box on their Role Card.
- Present the metaphors of your roles to each other.

4. Build Metaphor Molecule
- Place all Role Cards on the table with Metaphor Atom facing up.
- Connect their electrons to each other in all possible combinations. There are two ways Metaphor Atoms connect: as Strong Bonds (two roles mutually hold each other in the same relationship, either as enemy or ally) or as Weak Bonds (two roles have a common enemy or ally). As you form molecules, describe them out loud. You'll form four kinds of molecules:

> Helper molecules
> Connect cards by **mutual helpers**—two roles that identify *each other* as **helpers**.
> Connect cards by **common helpers**—two roles that share a third role as a **helper**.

Hinderer molecules
Connect cards by **mutual hinderers**.
Connect cards by **common hinderers.**

5. Tell a story

- As a group, select the one Metaphor Molecule you believe has the *greatest influence* on the scenario and reassemble it on the table.
- The roles involved in the selected Molecule work together to tell a story about the relationship depicted in the molecule. One way to start is to read the Electrons of the roles. For example, a Hinderer Molecule could be read as:

"The role __ with metaphor ___ feels threatened by ___ in the scenario.

The role __ with metaphor __ feels threatened by __ in the scenario.

These roles [hinder/help] each other because _____."

- The story may be told sitting down or performed as an improvisation, whichever is seems most fun for the group.
- Other players may chime in, adding their role's perspective to the story, as they are inspired to do so.

6. Transform Metaphors

- The goal of this step is to make the story and overall scenario *more desirable* for all the roles.
- Assemble the Metaphor Molecule from step 5 on the table.
- All players work together to create a new metaphor(s) for the role(s) in the metaphor that would transform the relationship between the roles and to the scenario into a more positive one.
- When new Metaphors for the atoms of the Molecule are created to the group's satisfaction, the players who created the affected roles take Metaphor Atom Revision cards and create new Metaphor Atoms for their roles.
- Other Metaphor Molecules may also be revised during this step, following a similar process.

7. Retell the story

- Assemble the revised Metaphor Atoms into Metaphor Molecules.
- Select the one with the *greatest influence* on the scenario. Tell a new story based on it.
- All players may chime in.

8. Scorekeeping

- Each player takes a score card.
- Reflecting on the second version of the story, each player scores the retold story using the following means:
  - Analogue Scale, Low to High:
    - Desirability – How desirable is the future it describes you (and not your role)?
    - Novelty – How original was the overall story and the future it describes?
  - Two choices: Low or High:
    - Feasibility—How feasible is the story? Could it happen? Two answers: High or Low.
    - Value—How valuable was the story to the overall scenario? Two answers: High or Low.
- Everyone shares what they wrote.
- The group synthesizes the independent scores onto a large score card. This is the game's score.
- Interpret the score: The desirability stands on its own. More desirable is better than less desirable. The answers to Feasibility and Value, according to one perspective on creativity, places the story on one of four continuums:
  - **Low Feasibility, Low Value = Foolishness** (higher novelty means it is more foolish) This is good for boundary testing. This is good for testing possible futures.
  - **High feasibility, Low Value = Disruptive** (higher novelty means it is more disruptive) This means the story could start happening immediately. Was it more about the present?
  - **Low feasibility, High value = Radical** (the higher the novelty, the more radical) It is difficult for the story to occur, but if it did, it would be super beneficial.
  - **High feasibility, High value = Breakthrough** (the higher the novelty, the more of a breakthrough) If this story happened, great things could be achieved. What case for it could be made in the present?

APPENDIX 4 - SCOREKEEPING SYSTEMS

Figure 9.   First Iteration Completed Scorecard
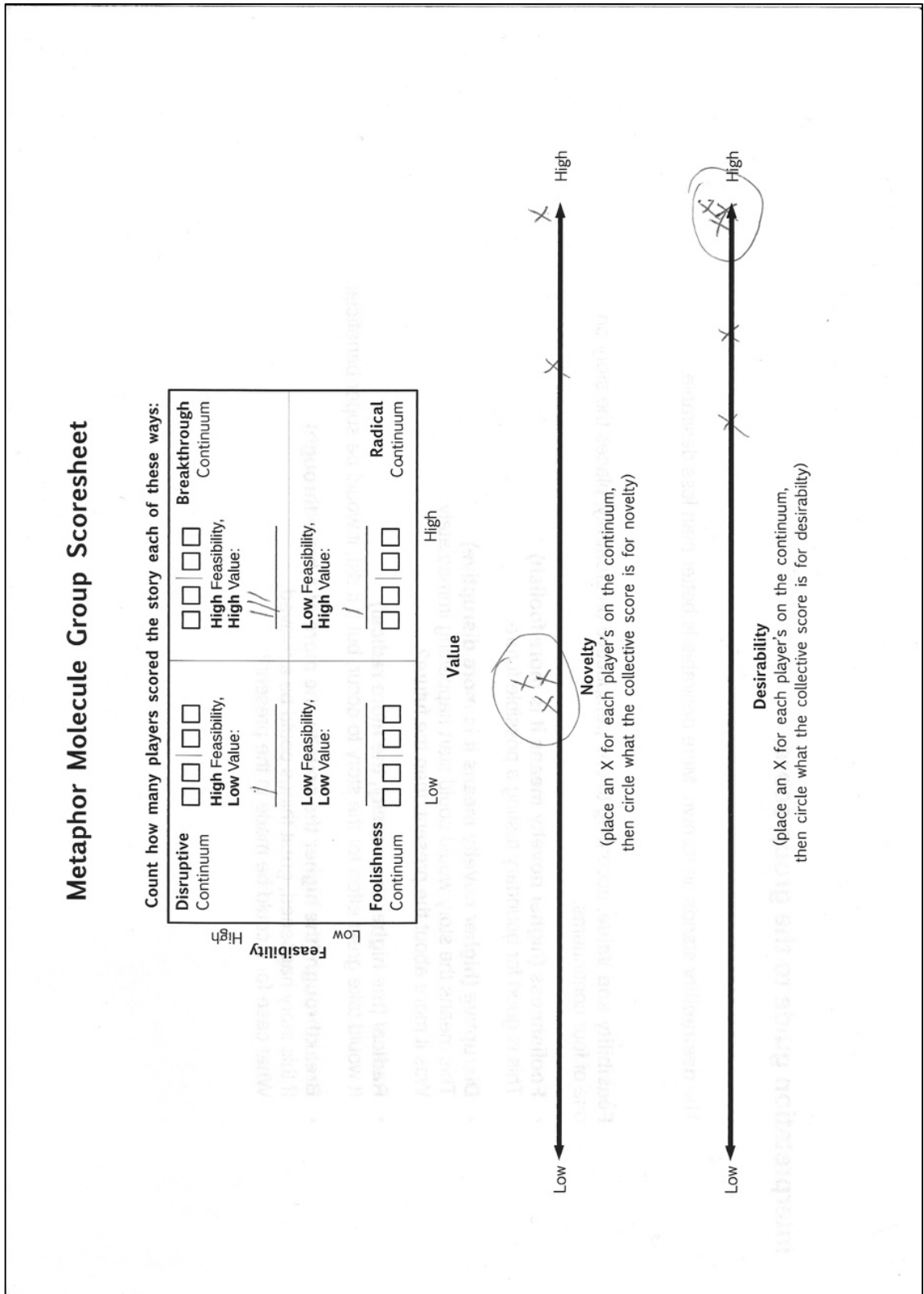
Figure 10.   Second Iteration Completed Group Scoresheet

Table 12.   Reasons Given on Second Iteration Scorecards for Rating the Feasibility
              and Value of the Game's Retold Story High or Low

	Feasibility of Retold Story	*Value of Retold Story*
High	*Participant 3:* Smaller communities feel more connected therefore sustainability of life can heavily influence lifestyles. *Participant 4:* Someone has to make a framework and most don't want to be that person. *Participant 5:* Counselor and Politician will have no better choice than to follow the true power, => they will become more collaborative.	*Participant 1:* It transforms the society. It changes the old norms. *Participant 2:* Selflessness admirable. *Participant 3:* Shows the moral drive humanity truly has towards bettering the world and our lives. *Participant 4:* We're very likely to collapse society in the near future.
Low	*Participant 2:* Probability of seamless co-operation seems unlikely, too selfless.	*Participant 5:* changes are not big.

APPENDIX 5 – LOG OF METAPHOR MOLECULES

Log of Metaphor Molecules – Starting or Ending

Figure 11.   First Iteration – Starting Log of Metaphor Molecules
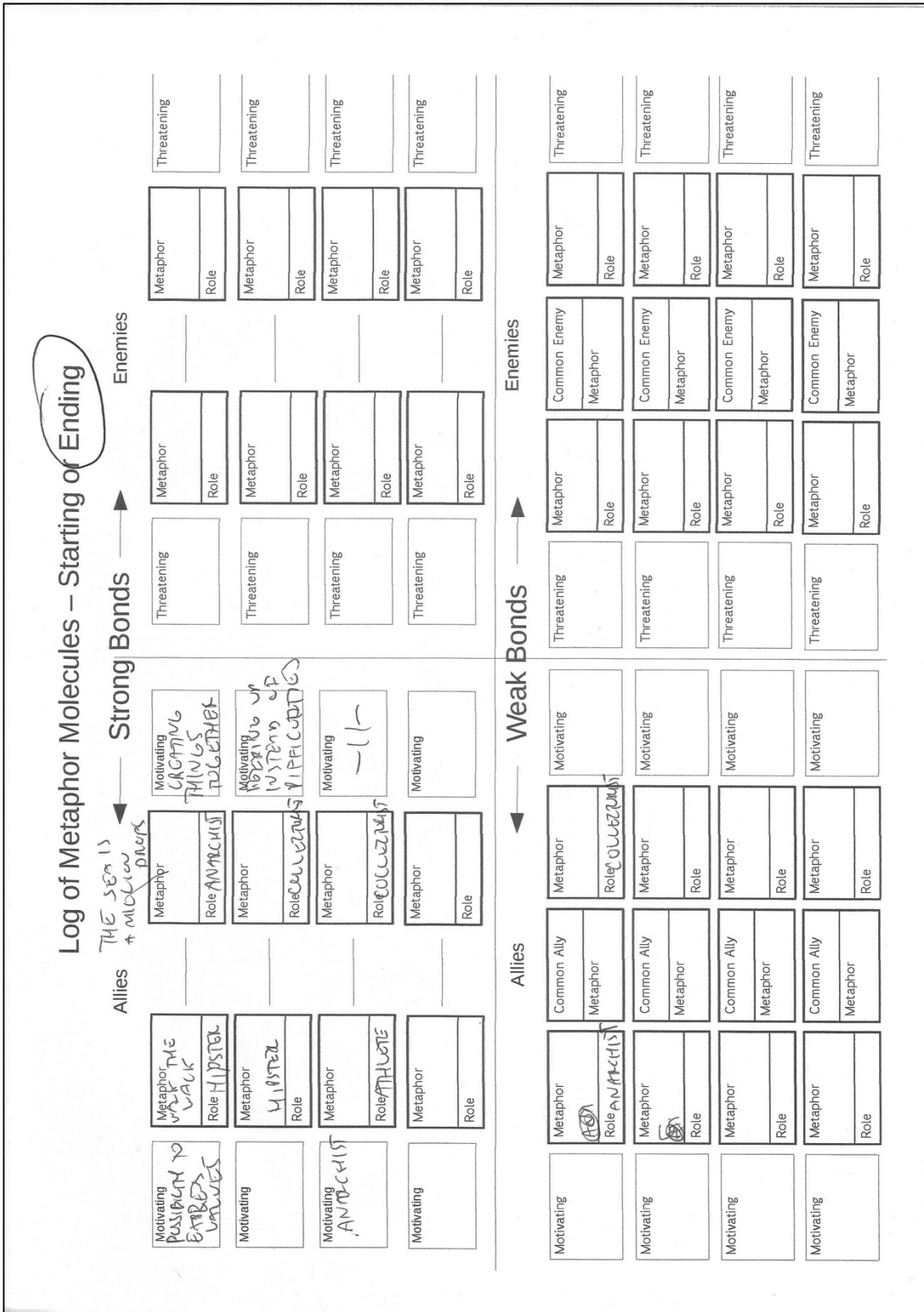
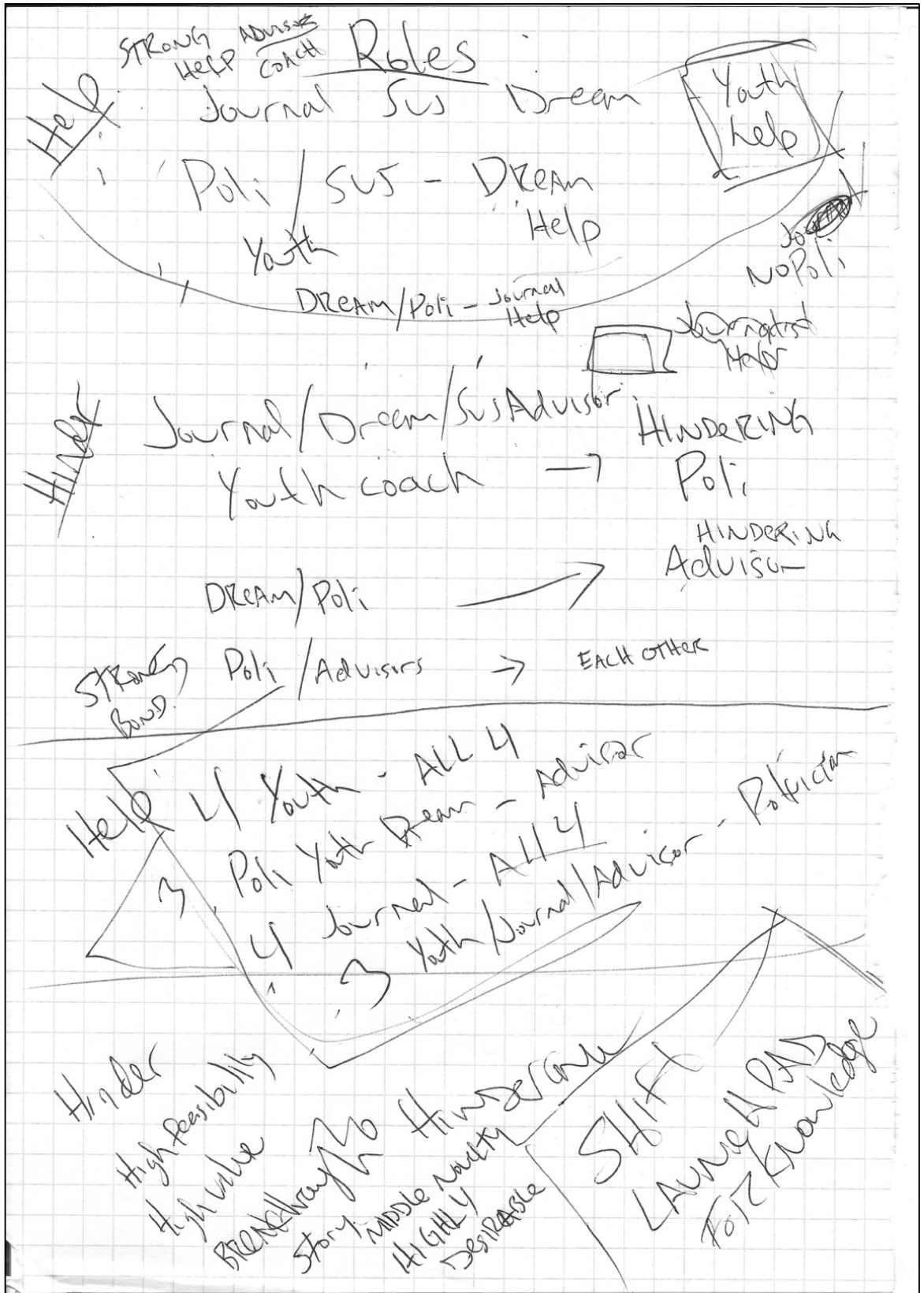Figure 12. First Iteration – Ending Log of Metaphor Molecules

Figure 13.   Second Iteration - Improvised Log of Metaphor Molecules

APPENDIX 6 – CREATED ROLES AND METAPHOR ATOMS

First Iteration

Table 13.   First Iteration Roles Created by Participants—their Political (P), Economic (E), Social (S), Technological (T), Ecological (E) and Cultural (C) Dimensions within the Scenario and their Descriptions

Role Card	Participant				
	1	2	3	4	5
Role	Collectorist: New Profession /Attitude	Hipster Carpenter	8th Grader / "Teenager"	Olympic Athlete	Disgruntled Anarchist
P	Following, governing	Not for me	Conscious youngsters	Not interested	Anarchist
E	Scarce, Varying, OK at times[20]	Money is not of value	Rich parents	Possesses a Lamborghini	Distaste for wealth
S	"Anything goes", unlimited	Friends & large gatherings (i.e. incremental society)	High education valued at home	Very social	Neo-Middle Class
T	Data-oriented	Retro is cool	Hyper-connected Networker	Keen on new things!	Mind expanding bio tech augments
E	Deep ecology +	Love it	The benefits of $	-	Resisting "The Ecology of One"
C	Asian minded	Arts, crafts, music	Visual culture immerser	Speaks 4 different languages	Acts in theater a [illegible]
Desc.	- Female 30 no family - Following some Asian DE[21]+ gurus, their incentives - Improving + controlling communities.	Age: 24 Family: Rich parents, only child. Story: Startup CEO dad and lawyer mom: Tech + Art important in the family.	A boy about to get an awakening of some kind; to start engaging socially unlike his parents – more like his grandparents.	28-year-old female, boyfriend, dog. Wants to be the best in everything and is very confident.	Younger brother of successful social startupper. Dislikes trends of consumerism. Energy is now sustainable, but communities and craftsmanship isn't.

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[20] Due to an error, participant 1 received a draft version of the role card in which Economic was presented as Income.

[21] D.E. refers to Deep Ecology.

Table 14.   First Iteration Comparison of Metaphor Atoms

Original Metaphor Atoms	Participant				
	1	*2*	*3*	*4*	*5*
Role	Collectorist	Hipster Carpenter	Teenage Boy	Olympic Athlete	Anarchist
Motivating	Deep minded thinking from others	Societal values might evolve from the startup scene	Grandparents' cool stories of making a differ-ence	Hipster Collectorist	The possibility of working only from the desire to cre-ate.
Threaten-ing	Commercial Materialism	Technology and startups shouldn't de-cide about the future.	Afraid of the ris-ing protest from the drop-outs.	~~Anarchist~~ Myself	Loss of long-term purpose.
Ally	Tries to have as many as possible, talk-ing persons who don't <u>do</u> so much.	Disgruntled Anarchist Collectorist	Disgruntled An-archists ~Sense of good old be-lief/ skepticism	Teenager	Hipster Carpenter
Enemy	Athlete Individualists? Those consum-ing too much. Teenager?	Athlete	Hipster Carpen-ter ~antipolitical big brother of some friend.	Anarchist ~~Myself~~	Athlete
Metaphor	Idealist? "Anything goes but <u>to-gether</u> is the best"	Peace, Love and Under-standing	Little Prince N.O.	"Head in the clouds" 💛	No man is an island.

Second Iteration

Table 15.   First Iteration Roles with Political (P), Economic (E), Social (S), Techno-
logical (T), Ecological (E) and Cultural (C) Dimensions and Descriptions

Role Card	Participant				
	1	*2*	*3*	*4*	*5*
Role	~~Coaching Young People~~[22] Training Mindset	Journalist at an online newspaper	Local Sustainability Advisor	Environmental Ministry Position – Planning/ Communication (Left leaning lobbyist/Karl Rove-like)	dream developer (seller)
P	-	leftish	Central, for the people	Expose bad politicians. Research to push green laws/policy.	liberal
E	-	access to equipment	equal earnings	smaller carbon footprint	upper-middle class
S	no boundaries in religions, openness.	bohemian	Equality and Respect	foster real life collective action	a married man with 1-2 kids
T	-	knows way around information technology	Only for betterment of the world.	hydroponic farming/less of it	early adopter
E	-	DIY Person	Mixture of comfort and responsibility	Push end to pesticide use	100% green views
C	sharing	Grown in [bad] Culture	Widespread and accepting. Mutual Respect for All.	~~Making these things as the only accepted option~~[23] diverse	Mix of everything, although has genuinely European roots
Desc.	- Young but there is no limit of age in this role. - He/she can do different/various tasks in different training fields.	Distributer of knowledge over Internet-based platform. 30-years old, husband + 1 child. Educated internationally to apply locally.	40s, wife and 2 kids. Globalist. Locally oriented to contribute to better world in its entirety. Background in politics, environment, philosophy. 1 of 15 advisors from varying disciplines elected annually.	I research and craft language for laws & Policy related to the environment or lobby to get laws passed or certain language included. 40, possible children, long-term spouse.	30-40, self-educated, earns a living by creating innovative ideas (dreams), lives in a detached house in natural environment but travels often, "citizen of the world."

Table 16.   Second Iteration Comparison of Metaphor Atoms

Original Metaphor Atoms	Participant				
	1	2	3	4	5
Role	Youth Trainer	Journalist	Sustainability Advisers	Left Leaning Politicians	Dream Developer
Motivating from the scenario	Local networks; Scarce resources; Less boundaries; Sharing	DIY local nature	Local DIY focus on survival	Journalist Engineer-oriented	Domination of rationality; No states or corporations
Threatening from the scenario	Policy; Rules of local community	local nature = stops the distribution of knowledge	Engineering interests; becoming self-motivated	Sustain-ability Adviser; Citizens	Too many practical people
Helping of the other roles	Dream developers; Sustainability advisers	Youth Trainer	Youth Councilor raising awareness; Dream enabling deeper "risk" taking.	Dream Developing; Citizens	Coach; Journalist
Hindering of the other roles	Politicians Leaders of communities	Politician	Skepticism of Politicians; Journalists w/ dramatic agendas for clickbait.	Anarchists Practical mindset	Politician; Advisor
Metaphor	Bridge	Sift	Living to help the community and ultimately the world. Will admit when unsure. Never afraid to ask for help/advice.	A reality check, the bigger picture, scraped knuckles	a door to new world(s) (shall cause change, development, improvement, growth)

APPENDIX 7 – METAPHOR TRANSFORMATIONS

First Iteration Metaphor Transformations

Table 17.   Metaphor Atom and its Transformation for The Collectorist

The Collectorist				
Enemy	*Threatening*	*Metaphor*	*Motivating*	*Ally*
Athlete Individualists? Those consuming too much. Teenager?	Commercial Materialism	Idealist? "Anything goes but <u>together</u> is the best"	Deep minded thinking from others	Tries to have as many as possible, talking persons who don't <u>do</u> so much.
Transformed to				
0	Too strong individual values	"Together is best"	Keeping up instead of difficulties	ALL

Table 18.   Metaphor Atom and its Transformation for Hipster Carpenter

Hipster Carpenter				
Enemy	*Threatening*	*Metaphor*	*Motivating*	*Ally*
Athlete	Technology and startups shouldn't decide about the future.	Peace, Love and Understanding	Societal values might evolve from the startup scene	Disgruntled Anarchist Collectorist
Transformed to				
[drew a line to indicate nobody]	Not everyone shares my values	Walk the Walk	Start-up scene allows me to express	Anarchist Collectorist

Table 19.   Metaphor Atom and its Transformation for 8th Grade Boy/Teenager

8th Grade Boy/Teenager				
Enemy	*Threatening*	*Metaphor*	*Motivating*	*Ally*
Hipster Carpenter ~anti-political big brother of some friend.	Afraid of the rising protest from the drop-outs.	Little Prince Number One	Grandparents' cool stories of making a difference	Disgruntled Anarchists ~Sense of good old belief/ skepticism
Transformed to				
"Collectorist"	Mainstream is suspicious to start with	Little Prince Number One	Making a difference socially	Anarchist

Table 20.   Metaphor Atom and its Transformation for Olympic Athlete

Olympic Athlete				
Enemy	Threatening	Metaphor	Motivating	Ally
Anarchist ~~Myself~~	~~Anarchist~~ Myself	"Head in the clouds" <3	Hipster Collectorist	Teenager
Transformed to				
[line to indicate no one]	Injuries & Mortality	Feet on the ground ☺	Anarchist	Myself Collectorist Teenager

Table 21.   Metaphor Atom and its Transformation for Disgruntled Anarchist

Disgruntled Anarchist				
Enemy	*Threatening*	*Metaphor*	*Motivating*	*Ally*
Athlete	Loss of long-term purpose.	No man is an island.	The possibility of working only from the desire to create.	Hipster Carpenter
Transformed to				
[blank]	Lack of cooperation	The sea is a million drops.	Creating things together	Hipster

Second Iteration Metaphor Transformations

Table 22.   Second Iteration Metaphor Atom and its Transformation for Youth
              Trainer/Mindset Trainer

Youth Trainer / Mindset Trainer				
Hindering	*Threatening*	*Metaphor*	*Motivating*	*Helping*
Politicians Leaders of communities	Policy; Rules of local community	Bridge	Local networks; Scarce resources; Less boundaries; Sharing	Dream developers; Sustainability advisers
Transformed to				
~~politicians~~[24]	Rules of local community	Shift	Scarcity of resources	Sustainability advisers Dream developers Journalist Politicians

Table 23.   Metaphor Atom and its Transformation for Journalist/Blogger

Journalist/Blogger				
Hindering	*Threatening*	*Metaphor*	*Motivating*	*Helping*
Politician	local nature = stops the distribution of knowledge	Sift	DIY local nature	Youth Trainer
Transformed to				
~~politician~~[25]	same	Launch pad for knowledge	same	Youth Trainer Politician

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[24] Participant crossed out Politicians to indicate there were no longer any hindering roles.
[25] This participant also crossed out Politicians to indicate there no longer any hindering roles.

Table 24.   Metaphor Atom and its Transformation for Sustainability Advisor

Sustainability Advisor				
Hindering	*Threatening*	*Metaphor*	*Motivating*	*Helping*
Skepticism of Politicians; Journalists w/ dramatic agendas for clickbait.	Engineering interests; becoming self-motivated	Living to help the community and ultimately the world. Will admit when unsure. Never afraid to ask for help/advice.	Local DIY focus on survival	Youth Councilor raising awareness; Dream enabling deeper "risk" taking.
Transformed to				
Dream Developer Detachment from Reality	Disagreement with Ideals	Selfless Inspiration	Local DIY Focus on Survival	Youth Politician Journalist

Table 25.   Metaphor Atom and its Transformation for Left-Leaning Politician

Left-Leaning Politician				
Hindering	*Threatening*	*Metaphor*	*Motivating*	*Helping*
Anarchists Practical mindset	Sustainability Adviser; Citizens	A reality check, the bigger picture, scraped knuckles	Journalist Engineer-oriented	Dream Developing; Citizens
Transformed to				
Differing priorities Citizens	Tinkering	Equal Responsibility	Practical mindsets Engineer-oriented	Youth Coach Journalist

Table 26.   Metaphor Atom and its Transformation for Dream Developer

Dream Developer				
Hindering	*Threatening*	*Metaphor*	*Motivating*	*Helping*
Politician; Advisor	Too many practical people	a door to new world(s) (shall cause change, development, improvement, growth)	Domination of rationality; No states or corporations	Coach; Journalist
Transformed to				
Politician	same	Green Door	same	Journalist Coach Advisor