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PARDEE CENTER TASK FORCE REPORT

BOSTON UNIVERSITY

Boston University The Frederick S. Pardee Center for the Study of the Longer-Range Future

Games for a New Climate: Experiencing the Complexity of Future Risks

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Occasionally, the Pardee Center convenes groups of experts on specific policy questions to identify viable policy options for the longer-range future. This series of papers, *Pardee Center Task Force Reports*, presents the findings of these deliberations as a contribution of expert knowledge to discussions about important issues for which decisions made today will influence longer-range human development.

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The Frederick S. Pardee Center for the Study of the Longer-Range Future at Boston University serves as a catalyst for studying the improvement of the human condition through an increased understanding of complex trends, including uncertainty, in global interactions of politics, economics, technological innovation, and human ecology. The Pardee Center's perspectives include the social sciences, natural science, and the humanities' vision of the natural world. The Center's focus is defined by its longer-range vision. Our work seeks to identify, anticipate, and enhance the long-term potential for human progress—with recognition of its complexity and uncertainties.

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Supplemental materials on Games for a New Climate, including detailed descriptions of the games referenced in this report, can be found at: http://tinyurl.com/BUPardee-G4NC.

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ACRONYMS AND ABBREVIATIONS

BU: Boston University
CBI: Consensus Building Institute
CDKN: Climate and Development Knowledge Network
DFID: Department for International Development (UK)
DREF: Disaster Response Emergency Fund
ENSO: El Niño—Southern Oscillation
GEF: Global Environment Facility
IFRC: International Federation of Red Cross and Red Crescent Societies
IPCC: Intergovernmental Panel on Climate Change
M&E: Monitoring and Evaluation
MDA: Mechanics, Dynamics, Aesthetics
MIT: Massachusetts Institute of Technology
NGO: Non-Governmental Organization
ODI: Overseas Development Institute
PAR: Participatory Action Research
PETLab: Prototyping, Evaluation, Teaching and Learning Lab (Parsons The New School for Design)
PfR: Partners for Resilience
TASAF: Tanzania Social Action Fund
UK: United Kingdom
UN: United Nations
UNFCCC: United Nations Framework Convention on Climate Change

GLOSSARY

Adaptation: In human systems, the process of adjustment to actual or expected climate and its effects, in order to moderate harm or exploit beneficial opportunities. In natural systems, the process of adjustment to actual climate and its effects; human intervention may facilitate adjustment to expected climate.

Climate change: A change in the state of the climate that can be identified (e.g., by using statistical tests) by changes in the mean and/or the variability of its properties and that persists for an extended period, typically decades or longer.

Climate risk management: An approach to systematically manage climate-related risks affecting activities, strategies, or investments, by taking account of the risk of current variability and extremes in weather as well as long-term climate change.

Collective intelligence: A shared or group intelligence that emerges from the collaboration and competition of many individuals processing information in their own ways but in synergy with each other and which can generate consensus decision-making.

Disaster: Severe alterations in the normal functioning of a community or a society due to hazardous physical events interacting with vulnerable social conditions, leading to widespread adverse human, material, economic, or environmental effects that require immediate emergency response to satisfy critical human needs and that may require external support for recovery.

Disaster risk: The likelihood over a specified time period of the occurrence of a disaster.

Dominant strategy: A strategy that does at least as well as every other strategy in all situations but does strictly better than every other strategy in at least one situation.

Emergent complexity: Surprising or unpredictable patterns of complexity generated from a simple set of rules, such that the whole is greater than the sum of the parts.

Game: System in which players engage in an artificial conflict, defined by rules, that result in a quantifiable outcome.

Game system: A set of components that function together across multiple games, such as a standard deck of playing cards, that enables particular kinds of game rules and play experiences.

Inhabitable games: Playable dynamic models that can meaningfully engage people in experiencing complex systems—to better understand their current or potential role in transforming them—in a way that is both serious and fun.

Pervasive games: Games that expand the realm of play spatially, temporally, or socially, pervading the experience from the domain of the game to the domain of ordinary life.

Resilience: The ability of a system and its component parts to anticipate, absorb, accommodate, or recover from the effects of a hazardous event in a timely and efficient manner, including through ensuring the preservation, restoration, or improvement of its essential basic structures and functions.

Risk: The probability of harmful consequences due to interaction between hazards and vulnerable conditions.

Serious games: Games with an explicit and carefully thought-out educational purpose—not intended to be played primarily for amusement.

Simulation: An operating representation of central features of reality. All games can be called simulations if they draw directly from ongoing or potential events in real life—but not all simulations are games.

Space of possibility: The entire set of possible actions and meanings that might emerge in the course of a game.

Transformation: The altering of fundamental attributes of a system (including value systems; regulatory, legislative, or bureaucratic regimes; financial institutions; and technological or biological systems).

Foreword

The pace of natural and societal changes has been accelerating in recent decades, from the disasters we experience, to the rate of innovation, to the way we play. This report lays the foundation to link two seemingly disconnected topics—innovation in risk management and gameplay. It investigates ways that games can help people from diverse disciplines and sectors involved in humanitarian and development work be more effective, providing innovative ways to accelerate learning and dialogue to better manage climate risk. It creates opportunities to develop improved outcomes in both the near and longer-range future.

Scientists and philosophers have speculated on the role of games in human evolution and culture, suggesting that games may actually be the driving factor behind the development of culture.[1] A set of dice from ancient Sumer, dated about 5000 B.C., may be one of the most enduring objects in our culture, remarkably resembling the common 6-sided dice we still use today. The fact that dice are the earliest evidence of games tells us something about perhaps why games exist alongside other forms of culture: they help us understand the world and survive within it.

By the year 2010, people around the world were collectively investing 3 billion hours weekly playing online games.[2] That is an astonishing amount of time—and still growing. What if more of that energy were dedicated to the serious problems we confront? In recent years, progress in the application of games for humanitarian and development purposes has been rapid. For example, to date, the Red Cross/Red Crescent Climate Centre and partners have co-designed over 25 participatory games, and delivered more than 150 game-based sessions in more than 30 countries in five continents. With just some beans, dice or other simple objects, these games convey the complexity of decisions given new climate conditions, reaching over 3,000 participants ranging from subsistence farmers, to development and humanitarian workers, to donors, academics, businessmen and elected officials. Other organizations have done much more in the realm of

1 See, for example, J. Huizinga's (1955) *Homo Ludens: A study of the play-element in culture.*

2 The book *Reality is Broken* (McGonigal 2011) offers many impressive figures on the scale and depth of gameplay reach. It also lists over 100 examples of serious games, several of which involve climate-related issues.

digital games—notably the World Food Programme, the UN, the World Bank, and Oxfam.

Managing climate risks requires new kinds of decisions in familiar contexts under unfamiliar circumstances—e.g., preparing for an incoming cyclone, addressing the agricultural challenges of erratic rainfall or the infrastructure design challenges of sea level rise. Evidence shows that in these situations people often feel at a loss for practical experience. Decision science has shown elegantly and irrefutably that experience, because of the emotional pathways it triggers, is a much better teacher than exposure to information. Effective solutions often involve a trial and error process, and climate risk management would be easier, and perhaps less scary, if there were some way to simulate this experience.

Games can generate emotional experience while also inspiring individual discipline and collective cohesion—as evidenced by the thousands of athletes and billions of viewers during the recent 2012 Olympics in London. Games can also elicit experiential knowledge of complex real-world problems. Games have been used to simulate aspects of reality in ways that help us understand the science of how we process information to make decisions. As training tools games can simulate changing conditions, plausible decisions, and related outcomes—without a longer and potentially lethal process of trial and error in the real world. Well-designed games can prepare people for critical decisions that need to be made right to avoid creating (or worsening) deleterious future consequences.

The synergies between games and real-world climate risk decision-making are the focus of the Games for a New Climate Task Force. Under the auspices of the Frederick S. Pardee Center for the Study of the Longer-Range Future at Boston University, this Task Force set out to explore the role of games for climate risk management in the midst of what many consider to be a contemporary wave in wealthy societies of "gamification"—the use of games in everything from entertainment to advertising, corporate retreats to group therapy, from online and video games to crowd-sourced games—and as an expression of new frontiers in human culture. Although games are dismissed as puerile in some quarters, evidence is also mounting for the utility of games as a tool in promoting learning and dialogue about some of the toughest problems we face. The genre of "serious games" is rising. New conferences such as Games for Change attract diverse speakers (from Al Gore to UN food aid workers and business entrepreneurs) on how games can be used for augmenting awareness and social change. It is time to get beyond the hype of gamification and try to understand the role of games in

what may well be the defining issue of our time: risk management and development in a changing climate.

A Day of Serious Fun: "Games for a New Climate" at Boston University

This day-long event brought together the Games for a New Climate Task Force, plus 30 participants (BU students and faculty, plus colleagues from other universities, think tanks and businesses), in an atmosphere of intense, serious fun. The event combined gameplay with discussions on the potential role of games in academia, government, NGOs and the private sector. Participants experienced five very different games:

- "Dissolving Disasters" on crop choices among subsistence farmers given changing seasonal rainfall;
- "Urban Trade-offs" on government investments in public infrastructure given rising risk of extreme events;
- "Humans versus Mosquitoes" on dengue fever given climate change;
- "Broken Cities" on managing land use given adaptation and mitigation needs;
- "FAIR" on microinsurance for Ethiopian farmers in safety net programs.

An 8-minute video on the event was produced by the Pardee Center and is available at http://tinyurl.com/BUPardee-G4NC.

After several game sessions held at Boston University in collaboration with the Red Cross/Red Crescent Climate Centre, the BU Pardee Center sponsored a two-day event held on May 26–27, 2012: a full day of gameplay (see text box above), and a meeting of the Task Force. The Task Force includes 12 experts with a great diversity of perspective in terms of:

- background (from climate modeling to anthropology to game design)
- institutional affiliations (from academic institutions to humanitarian and development organizations, and from donors to profit-seeking private sector)
- spatial scales of intervention (from community-level disaster management to national policymaking to global institutional frameworks)

This Task Force's objective is *"to explore the potential of participatory, game-based processes for accelerating learning, fostering dialogue, and promoting action through real-world decisions affecting the longer-range future, with an emphasis on humanitarian and development work, particularly involving climate risk management."*

The meeting in March combined brief presentations, plenary discussions, small group sessions, and intensely interactive participatory activities (including games of course) that led to the collective capture of key ideas presented in this publication.

This Task Force Report is organized as follows: Section One explores the reasons for "Games for a New Climate." Section Two analyzes core elements of climate-compatible risk management and development, highlighting how games can contribute to improved learning and dialogue between local people and policy makers. Section Three offers case studies illustrating how game-based participatory processes can help stakeholders transition from a traditional climate risk management 'cycle' approach to more integrative systems thinking. Section Four discusses some of the potential risks that should be anticipated when designing and implementing game-enabled processes. Section Five synthesizes key insights and recommendations for future steps in game research, design, facilitation, and capacity building for a climate-compatible longer-range future.

As this report goes to print, we are encouraged by the emergence of many new initiatives aimed at integrating participatory games into well-established learning and dialogue processes, from a range of local community applications in projects such as "Partners for Resilience" to various prominent events such as the *32nd Greater Horn of Africa Climate Outlook Forum* (Zanzibar, August 2012) and the *10th Adaptation and Development Days* to be held in the context of the UN Framework Convention on Climate Change Conference of the Parties (Qatar, December 2012). (The latter continues the collaboration between the Red Cross / Red Crescent and the BU Pardee Center.)

These initiatives and applications clearly demonstrate how these "games for a new climate" animate the Red Cross and Red Crescent mission "to improve the lives of vulnerable people by mobilizing the power of humanity," as well as the Pardee Center motto of "analysis for a better tomorrow, today." It is our hope that this publication will trigger even more innovative and widespread use of games for linking knowledge and action, yielding better outcomes in a more uncertain climate.

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1. Why Games for a New Climate?

Humanitarian and development practitioners are confronting an irrefutable challenge: the past no longer elucidates the future. Processes such as global warming, urbanization, population growth and environmental degradation are increasing the threats posed by floods, droughts, tropical cyclones and other natural hazards to people's lives and livelihoods (IPCC 2012). At the same time, our individual and collective ability to understand changing risks is rapidly expanding, owing to progress in fields as diverse as atmospheric science, computer modeling, communication technologies, and innovation in financial instruments. As stated in an earlier Pardee Paper addressing humanitarian challenges, "organizations are adapting to new climate risks, vulnerability patterns and decision capacity. Yet, regrettably, their efforts seem to be outpaced by the changing threats and opportunities. In order to reduce this gap, it will not be enough to simply train existing staff on new tools, or expand the staff and volunteer base: the humanitarian sector needs to fundamentally restructure its relationship to predictable climate-related threats, evolving towards knowledge-based entities that can rapidly absorb and act upon the increasingly reliable information about changing risks" (Suarez 2009).

How can we accelerate learning and dialogue for climate-compatible development in a changing world among very diverse stakeholders? How can we help subsistence farmers, humanitarian and development workers, government officials, donors and other key players to navigate the complex range of plausible climate risk management choices and outcomes? Over the last decade, knowledge-sharing processes have become dominated by a frustratingly unsatisfactory format: "Death by PowerPoint" (Winn 2003), the dreaded sequence of PowerPoint presentations followed by usually insufficient time for questions and answers. Goodman (2006, 71) argues that we are accepting bad, unidirectional presentations as "a fact of life. Low expectations become the norm, and with no real incentive to improve, presentation quality will continue the inevitable slide downward. We can do better." A different approach is needed, an approach that enables inexpensive and creative experimentation in order to trigger breakthrough learning that can help improve our decisions at the pace and scale demanded by burgeoning climate challenges. Effective and sustained adaptation to tomorrow's changing world requires a new praxis today. In the words of Paulo Freire (1974, p36): "reflection and action upon the world in order to transform it."

Participatory games can help us "inhabit" the complexity of climate risk management decisions, allowing us through system dynamics modeling to explore, then test a range of plausible futures. Albert Einstein once said that "Games are the most elevated form of investigation" (McGonigal 2011). Abt (1970) referred to *Serious Games* as combining the analytic and questioning concentration of the scientific viewpoint with the intuitive freedom and rewards of imaginative, artistic acts. Serious games have an explicit and carefully thought-out purpose. They are not intended to be played primarily for amusement—although this does not mean that serious games are not, or should not be, captivating and fun.

Well-designed games, like risk management measures, involve decisions with consequences (Suarez et al. 2011). While games can never fully capture the complexity of climate risk management decisions, through gameplay these complexities can be revealed, discussed, and processed. Through games we can learn how systems work, and the game-based system rewards us as we learn (Macklin and Sharp 2012). Players inhabit, enliven and interpret these systems through play, and are compelled to learn how a game works for the sake of pleasure, discovery, competition and just plain "fun." Games can train us to take a longer view, to practice complex thinking, to examine problem-solving strategies at multiple levels of even planetary scale (McGonigal 2011, 348), and to prepare for targeted action when future need arises.

Well-designed games, like risk management measures, involve decisions with consequences.

The remainder of Section One outlines "why" games for a new climate: as interactive system dynamic models, as creators of meaning through experiential learning, and means to challenge our frequently flawed mental models.

1.1 GAMES AS INTERACTIVE SYSTEM DYNAMIC MODELS

In their seminal work titled *Rules of Play: Game Design Fundamentals*, Salen and Zimmerman (2003) define games as *systems in which players engage in an artificial conflict, defined by rules, that result in a quantifiable outcome.* Some key aspects of this definition deserve further examination in the context of humanitarian and development work:

- *"systems"* Games are made of a set of parts that interrelate to form a complex whole. As a communication platform, games can successfully convey the existence and relevance of system complexity relevant to climate risk.

Trade-offs, feedbacks, non-linearities, delays, probabilities and unanticipated "side effects" are inherent in risk management decisions (Gonçalves 2008), and should be part of targeted learning for government officials and subsistence farmers alike.

- *"artificial conflict"* Games involve tension. Like games, decisions affected by current and future climate conditions involve dynamic and dialectical elements that create tensions between differing ways of understanding and prioritizing climate-related issues: long-term versus short-term, individual versus collective, or local versus national. These opposing forces, including the nuance of interplay, are not easy to grasp through conventional, linear educational approaches such as presentations, plenary discussions, or written text. Additionally, games take place within specifically demarcated time and space boundaries, separated from the so-called *real world* and thus creating a safer environment for exploring the space of possibility.

- *"defined by rules"* Rules constitute the inner, formal structure of a game system, from initial and boundary conditions to cause-effect relationships to parameters defining win/loss states. Rules are common to all players, repeatable and, importantly, limit player action in explicit unambiguous ways. Game rules can be designed to mimic the rules of real-world systems with climate risks, ranging from the laws of physics governing natural hazards, to the regulations and standard operating procedures that shape and limit decisions in humanitarian organizations, to the cultural norms that set subtle incentives and punishments.

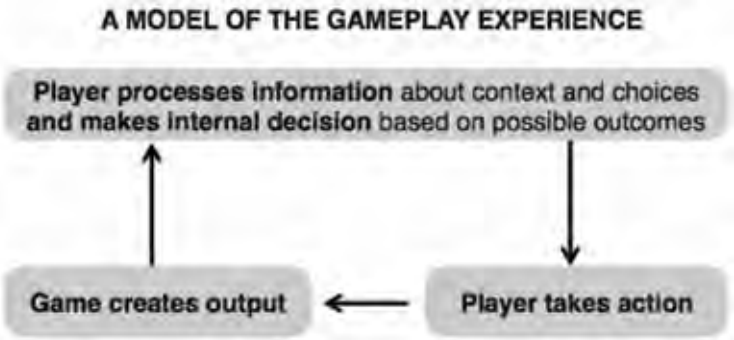
- *"result in a quantifiable outcome"* At the conclusion of a game, a player has either won or lost or achieved some kind of score. In the context of climate risk management, the quantifiable outcome of games can be crafted to help players focus on indicators that reveal the need for improving decisions. For example, Beamon and Balcik (2008) discuss three types of performance metrics in supply chain systems for humanitarian relief: *resource performance metrics*, where the purpose is efficiency (e.g., helping more people per dollar spent by reducing cost of supplies, distribution, or inventory); *output performance metrics*, where the purpose is effectiveness (e.g., reducing death and suffering by reducing response time); and *flexibility*

Games involve tension: long-term versus short-term, individual versus collective, or local versus national.

performance metrics, where the purpose is to improve the ability to respond to a changing environment (e.g., by accommodating fluctuations in volume demand). Similar criteria could be defined for any number of decision contexts, from global climate financing to national development policies, sectoral investments, or community-level initiatives.

For the purposes of learning and dialogue to improve climate risk management, useful games involve emergent systems (revisited in more detail in Section 2.2.2). At the core is what Salen and Zimmerman call a set of "choice molecules": *action → outcome*. In other words, an interaction unit that links a possible choice with its corresponding consequence within a designed system. These choice molecules constitute the units with which game designers create larger, organic structures of designed interaction. Games can take many forms, but are contained within an experiential system described in the iterative model shown in Figure 1.

Figure 1



A distillation of the experience of gameplay, based on Salen and Zimmerman (2003). When a player takes action, the game system creates output by applying rules. This output depends on the player's decision, other players' actions, external forces (e.g., rainfall as determined by a roll of the dice), and context (such as each player's evolving assets and vulnerabilities). Such output becomes information about context and choices shaping subsequent decisions—or determines a win/loss state.

Any real-world dynamic system, no matter how complex, can in theory be distilled to its essential components and relationships to create a model, i.e., a simplified representation of reality that captures enough core dynamics to explain some of the system attributes that matter to us, without capturing it all. Models are dynamic when they can represent change over time, often involving internal feedback loops and time delays that affect the behavior of the entire system. Good models aid us in understanding complicated systems by simplifying them

(Hannon and Ruth 2001): if a modeler identifies essential initial conditions plus key cause-effect relationships, a dynamic model can tell us how each condition will change over time in response to changes in other conditions. There are two important advantages in using participatory games as system dynamic modeling platforms:

- Games allow for the compression of time: players can, in an hour-long activity, inhabit a multi-year or even multi-decadal future, experiencing how today's actions may shape next year's context and choices, which in turn affect the context and choices of the longer-range future.
- Games capture relationships between system elements in a way that gives agency to the person or persons engaging with the model: players' decisions can shape the system, affecting the range of plausible future decisions.

Participatory games have been used for decades to capture system dynamics involving a wide range of real-world decisions (Sweeney and Meadows 2010). Examples include military applications (Barringer and Whaley 1965), energy policy, and disasters affecting communities (Inbar 1966). We argue that "inhabitable" participatory games have unique potential to support initiatives aimed at helping us understand and shape the complex human and natural systems affecting climate risk management—not only by aiding in understanding how these systems work but also by helping us experience what these systems mean to us, and how we may be able to transform them.

1.2 "INHABITABLE" GAMES AS SYSTEMS THAT CREATE MEANING THROUGH EXPERIENCE

We define inhabitable games as playable dynamic models that can meaningfully engage people in experiencing complex systems—to better understand their current or potential role in transforming them—in a way that is both serious and fun. Inhabitable games assign players a role in a complex system with quantifiable decisions and outcomes. Simply put, *inhabitable* games are systems that help us inhabit through gameplay the complexity of decisions about future risks. This differs from the commonly-used approach of role-play games with emphasis on creating stories structured as serial narratives that grow and evolve but lack a system dynamics focus.

Simply put, *inhabitable* games are systems that help us inhabit through gameplay the complexity of decisions about future risks.

To design is to create meaning. Games can be designed so that simple rules set in motion a play experience filled with variety, novelty and surprise, from which meaning emerges—what Salen and Zimmerman (2003) describe as emergent complexity. In this section we focus on games as activities that create meaningful experience for players—in other words, how "inhabiting" a game's formal system can generate experiential learning through play.

In foundational work on experience as the source of learning and development, Kolb (1984, p.38) defined experiential learning as "a process whereby knowledge is created through transformation of experience." This approach has been successfully applied to many disciplines and demonstrated to improve professional practice and the learning process (Gosen and Washbush 2004). It requires the resolution of conflicts between diametrically opposed modes of adaptation to the world: Kolb argues that learning requires abilities that are polar opposites, such as concrete experiencing of events at one end and abstract conceptualization at the other, or reflective observation and active experimentation. Dieleman and Huisingh (2006) make a compelling argument for games in the context of experiential learning for sustainable development, and Sweeney and Meadows (1995) offer specific ideas on how to promote systems thinking through thirty gameplay activities. Collins and Ison (2009) draw on several strands and traditions of learning which offer further insight into the complementary nature of these abilities through different ways of conceptualizing learning.[3]

Director of the New York University Game Center, Frank Lantz and fellow game designers assert that games are the cultural form of systems.[4] They help us make sense of complex systems by placing us into the system where we can enliven its dynamics and inhabit its complexity as an active participant. As a player, it's the relationship between the simplicity and stability of the rules and the complexity and dynamism generated by playing within this set of rules that creates the experience and excitement of a game. While playing is an active engagement with a complex world, it is isolated from the consequences of the real world.

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3 In terms of a focus on what is being learned, Bateson (1972) suggests that first order learning relates to routine learning that takes context as given. Second order learning involves learning about the context of that first order learning, thus allowing comparison across different approaches. Third order learning goes even further: it aims to learn about the contexts of second order learning or, as Bateson notes, to break the habits of level II learning. This suggests a learning system-of-systems that lends itself to game design: as framed by Kitchener (1983) first order learning is about cognition (deals with knowing), second order learning is about meta-cognition (deals with knowing about knowing) and third level learning is about epistemic cognition (deals with knowing about the nature of knowledge).

4 Stephen Heller blogs that in a world of information and systems, games are THE expression of culture. http://imprint.printmag.com/daily-heller/name-that-game.

Thus inhabitable games can provide a unique learning environment: a world in which taking risks and experiencing failure can become the best way to progress and discover how its systems work.

Unlike conventional approaches that often give an answer even if nobody is asking the question, gameplay experiences can first create the "huh?", then deliver the "AHA!". For example, games can reflect human apprehension of something that can't be expressed easily in words or stories: the phenomenon of randomness, and our attempt to tame its wild nature through the reasonings of mathematical probability. Yet games are systems with rules, which operate procedurally and reveal key system dynamics as they generate emergent complexity through play. The relationship between the rules of a game and gameplay always involves a tension, or gap, representing the potential for crisis—and for discovering a viable path to resolve the tension. Bogost (2004) explains how the "possibility space" inherent to games "exceeds the game" and can generate insights that are relevant in the real world:

> It is here that violence becomes possible, but also ideology, learning, emotion. This is a space of crisis, a place where the player admits and questions his own assumptions about representations in the game and in the world, as corporal, cognitive, and evaluative processes. It is not a clean, comfortable place.

The fact that systems are the medium of games, and that game systems actively engage us in learning through failure, point to the reasons why inhabitable games can be so useful in humanitarian and development work. With billions of people struggling to deal with the vagaries of climate risks, we are not doing enough fast enough; we must find ways to better understand why not, and test corrective or innovative ways to approach humanitarian and development work differently. Games can provide a context for experimenting with alternative strategies and for attempting to apprehend problems through their representation as a system where failure is acceptable. The game system lets us inhabit a realistic caricature of reality. Games show us the underlying balances (and imbalances) within a system. Using the metaphor of holistic medicine, games treat things systemically and not symptomatically. However, this isn't to say that the world's pressing humanitarian issues need only a holistic approach. Understanding the genesis of symptoms—or in other words, the outputs of systems that most urgently call for our attention—can also be addressed through

games. In this respect, participatory games may cultivate a deeper understanding and foundation for humanitarian and development decisions and action, can also be diagnostic, and even foster new strategies for their deployment.

A recent book about serious games that explores the emotional and psychological grounding of games in human culture is aptly titled *Reality is Broken: Why Games Make Us Better and How They Can Change the World*. While McGonigal's (2011) assertions that games can improve the quality of lives and solve global problems will be debated for some time to come, her fundamental thesis is incontrovertible: games can help, and reveal some key aspects of what motivates the human being to initiate change. She identifies the feeling of happiness as key to understanding the special way in which we engage in, and are engaged by, games. The rush of anticipation-heightened happiness that comes when a risky move enables us to advance in the game, coupled with the allure of possible reward (winning the game, receiving a prize, or simply bragging rights), is a powerful motivator to try out new behavior. And if the result is unsuccessful, we can learn when and why such risk is best avoided. Games enable us to temporarily inhabit a chosen reality, free from real-world constraints. This freedom empowers us to take calculated risks that are (and thus feel) real within the game system at whatever level the game may target, but do not carry real-world consequences for ourselves, our communities, or the humanitarian and development organizations that are trying to improve real-world conditions. By the same token, games can engender empathy, a powerful motivator, by enabling the player to walk in the shoes of others who inhabit a different reality, facing difficult constraints and trade-offs.

1.3 GAMES HELP CHALLENGE QUESTIONABLE MENTAL MODELS

> *Men love abstract reasoning and neat systematization so much that they think nothing of distorting the truth, closing their eyes and ears to evidence contrary to their logical constructions.*
>
> –Fyodor Dostoyevsky, *Notes from the Underground*

It is precisely because humanitarian and development decision makers must gain a deeper understanding of the underlying systems in which they operate that games can be useful vehicles for learning. Consider this 'test-flight' metaphor: No pilot would dare to fly a commercial airliner without significant training in a flight simulator. Yet, most decision makers are expected to manage organizations, make critical decisions, and implement long-term policy rely-

ing on "theory," "experience," "intuition," "gut feeling," or less. While inadequate managerial, political, or environmental decision-making may lead to different consequences in human and economic terms than crashing a commercial airplane, we often overlook or accept such lack of training because common knowledge suggests that proper "management flight simulators" are not available for such complex systems. This is not, however, the case. Proper methodology to capture behavior in complex systems has been available for decades and a number of researchers have been developing management flight simulators to improve decision-making in diverse areas. These simulators are serious games, which capture all the complexity of the systems of interest (Gonçalves, forthcoming). This inhabitable learning system can illustrate how lack of communication among agencies during humanitarian interventions often results in the duplication of efforts (e.g., placing multiple orders for the same item) and an excess of some items while other needs are ignored. These tools can be used by decision-makers to actively engage with the simulated system, visualize the outcomes associated with specific decisions, and learn about possible strategy choices while avoiding the costly consequences of real-world testing.

No pilot would dare to fly a commercial airliner without significant training in a flight simulator…yet decision makers are expected to make critical decisions relying on "theory," "experience," "intuition," "gut feeling," or less.

The opportunity to learn about complex systems with serious games is tremendous, precisely because of the significant mismatch between the complexity of systems and people's mental models. For instance, complex systems are typically constantly changing, tightly coupled, nonlinear, governed by feedback, self-organizing and adapting. However, people's mental models are predominantly event-oriented, have narrow boundaries, and assume fragmented, linear, modes of operation. Consequently, mental models often fail to capture complex realities.

Let's consider some of the temporal and spatial challenges associated with complex systems. Incremental change takes place through accumulation processes. Tightly coupled and feedback-rich systems cause variables in one part of the system to interact with other parts, making overall behavior difficult to predict. Hence, feedback makes it difficult to distinguish cause from effect. Because causes and effects may be significantly separated in time or space, their relationships may go unnoticed until undesired effects become evident. Nonlinearity can

exacerbate these problems. Complex systems are self-organizing and adaptive, making them very difficult to manage.

Now consider people's mental models, which typically assume that causes lead to effects, that causes and effects are close in time, and sometimes that causes are outside the control of the people impacted by the effect. Consequently, people often dissociate their actions from the set of possible sources of problems in complex systems. Because mental models are also fragmented and have narrow boundaries, people tend to fail to see how actions in one part of the system may cause effects in another. Strategic actions are typically bounded to areas where people have understanding or expertise, but such a narrow approach may limit the effectiveness of policy choices. Failure to properly account for delays, thresholds and other aspects of complexity pose additional problems for people's understanding of systems which are often highly counterintuitive.

Overall, inadequate mental models lead to poor performance in addressing complex systems. According to Sterman (1992) among the "biggest impediments to learning are the mental models through which [people] construct [their] understanding of reality." Sterman (1989a, 1989b) suggests that poor performance in dynamically complex environments arise from people's misperception of feedback and, in particular, from individuals' insensitivity to the feedback that their actions create in the environment. Given the mismatch between our complex social and physical systems and our mental models, and the importance of improving the ability of decision-makers to manage the increasing complexity of humanitarian and development systems in a changing climate, serious games can play a critical role in both formal and non-formal education and training to improve risk management and policy-making decision capacity.

2. Towards a Game-Enabled Climate Risk Management Framework

What I have learned to do, I learned by doing.

–Aristotle

Changing risks, rising uncertainty, shifting production patterns, accelerating population growth, and faster rates of innovation are but a few of the factors transforming the development landscape. At the same time, this changing landscape presents new opportunities for protecting the most vulnerable and promoting human development more broadly. Development interventions could be designed and implemented to build people's capacity to adapt to any change—including climate change (Ludi et al. 2012). To minimize harm caused by climate impacts while capitalizing on these opportunities, a "climate compatible" approach to development is needed (Mitchell and Maxwell, 2010) to simultaneously focus on curbing emissions, promoting development, and building resilience.

What would a climate compatible approach to development look like? While answering this entails multiple angles of analysis, in this report we focus on one core aspect: *climate risk management*—i.e., how to systematically manage climate-related risks affecting activities, strategies or investments, by taking account of the risk of current variability and extremes in weather as well as long-term climate change (Red Cross/Red Crescent Climate Centre 2007). Climate-related phenomena can add layers of complexity to already significant development challenges, such as high levels of poverty and inequality, underdeveloped financial markets and weak governance systems. Given its wide array of impacts on and interactions with wider development, climate change will inevitably have considerable implications for humanitarian interventions and development (Jones et al. 2010).

The remarkable progress in science and technology over recent decades allows us to anticipate future conditions, communicate early warnings and take early action to avoid losses, yet many recent disasters are evidence of a dreadful gap between knowledge and action (Suarez 2009). How can we plan for climate risk management given the scale of the challenge, the diversity of stakeholders, and

the complexity of human and natural systems? The humanitarian sector needs to restructure its relationship to predictable climate-related threats. Can climate scientists and risk managers build common ground to design smart forecast-based decision support systems as well as simple decision-based forecasts? One option is to intentionally evolve towards knowledge-based entities that can rapidly absorb and act upon information about risks: making full use of scientific information on all timescales to routinely take appropriate action before a disaster or health emergency happens (IFRC 2008).

Development and disaster risk management need to be more anticipatory, more inclusive, and more innovative as human and natural systems become increasingly vulnerable to climate variability and change (DFID 2011). We argue that games can engender productive dialogue and accelerate learning for climate risk management. The dynamics of choices and context are in actuality in constant flux. People must consider possible options and make decisions based on (often incomplete) information, take action based on the options deemed most promising, and confront a subsequent set of choices shaped by the outputs of a complex system.

Four decades ago, based on a computer model of unchecked economic and population growth with finite resource supplies, *The Limits to Growth* (Meadows et al. 1972) triggered debate about likely future problems—some of which are clearly manifest today. How do we create modern models that offer a space for users to freely and innovatively contemplate a wide range of possible strategies and engage a broader audience in examining plausible futures? Recently, some of the world's leading scientists suggested using gaming as part of a strategy to "engage the international research community in developing systematic, innovative solutions" to pressing problems related to increasingly frequent natural disasters and rising demand for water and energy (*The Guardian* 2012). Considering games as an integral part of climate risk management is an innovative and bold idea whose time has come.

Considering games as an integral part of climate risk management is an innovative and bold idea whose time has come.

The remainder of this section offers some structuring ideas for linking games with climate risk management. We start with a risk management framework as a base structure, then introduce several perspectives from the literature for thinking systematically about games, and finally propose active integration of game design thinking into risk management, illustrated with examples from climate-related participatory games.

2.1 A SIX-STAGE FRAMEWORK FOR RISK MANAGEMENT DECISION-MAKING

How do we frame games as tools that enable credible and effective learning for managing climate-related risks? To begin, we adopt a framework for risk management and decision-making (Omenn 2001) as illustrated in Figure 2.

Figure 2

The U.S. Presidential/Congressional Commission on Risk Assessment and Risk Management presented this now widely-adopted, six-stage "framework for risk management decision-making" (Omenn 2001).

This framework posits the iterative nature of risk management in six stages:

i. Problem/Context: This stage involves:

- Identifying and characterizing existing or potential problem(s) caused by risky situations
- Considering the problem in context
- Determining risk management goals
- Identifying risk managers with the authority or responsibility to take action
- Implementing a process for engaging stakeholders

ii. Understanding risks: To make an effective risk management decision, stakeholders need to know the potential hazards (in particular those associated with climate and weather events) and the likelihood that they or the environment they depend upon will be harmed. The risk assessment process consists of gathering and analyzing this information.

iii. Identifying and evaluating options: An *option* is a choice among alternatives. Options for potential risk management actions are identified from a range of alternative paths for action based on available information. Effectiveness, feasibility, costs, benefits, unintended consequences, and cultural or social impacts should be evaluated.

iv. Making decisions: What is the best available option? Given changing conditions, at what exact instance should that option be turned from potential action to real action? Who decides? A *decision* is the selection between possible options (including the option of taking no action). Decision-makers review information and options to select the most appropriate solution.

v. Taking action: *Action* is motion with purpose—the intentional fact or process of doing something. It results from a decision, and is intended to achieve an aim.

vi. Evaluation: At this stage, decision-makers and other stakeholders reflect on what risk management actions have been implemented, and how effective they have been. Evaluation consists of the systematic comparison of actual impact against a set of criteria or standards.

Importantly, Omenn's framework explicitly states that:

- the above six steps need not be followed sequentially
- each step is actually centered around the active engagement of stakeholders

It is worth noting the centrality of a homogeneously depicted set of stakeholders, actively engaged in each of the six stages—but not necessarily in the transition between stages. When this framework is put into practice using conventional learning and dialogue processes, there is no easy way to "jump" stages and quickly explore, from the vantage point of one of the stages, how "distant" stages may be affected, and the challenges that may then emerge. It must be recognized that in the operational reality of humanitarian and development work, there is an abundance of sequential, siloed stages dissociated from each other and from the various stakeholders who could and should contribute to think-

ing and acting on the problem: this, of course is contrary to the desired seamless flow through the six phases and to the dynamism, interdependence and, ultimately, oneness of the complex system in the real world. As development practitioners often say: "If it's so easy, why is it so hard?"

Climate risk management often involves no clearly defined problem, no optimal expert solution, and inevitable conflict. Linnerooth-Bayer et al. (2006) illustrate this in a case study on flood risk management in Hungary: the complexity of human and institutional interactions does not fit rigid models, and calls for *collaborative processes that enable the emergence of clumsy solutions*. We know that, in real-world dynamic systems, new risks emerge, new options become available, new considerations affect the decision-making process, new opportunities and obstacles mediate between decisions and actions, and the evaluation of outcomes by various stakeholders can lead to entirely different ways of understanding the problem and its context. Changes in any of these elements should require risk managers and other stakeholders to revisit the relevant 'previous' and 'following' phases in the cycle depicted in Figure 2.[5]

The complexity of human interactions does not fit rigid models; it calls for *clumsy solutions.*

We see games as uniquely suited for dynamically capturing these uncertainties and complexities, and for addressing three main concerns with the commonly embraced frameworks for risk management, particularly those processes that genuinely try to engage stakeholders:

- Progress can be too slow and *iteration rarely happens*. The pace of change in hazards and vulnerabilities often outpaces real-world capability of completing the stages in the cycle. Feedback from evaluation doesn't inform the other stages rapidly enough.

- Learning and dialogue outcomes can be too fragmented and ephemeral. All too often dialogue processes currently used in risk management fail to yield adequate results in part because they create islands of knowledge in a sea of ignorance. Proposed actions based on incremental change and compartmen-

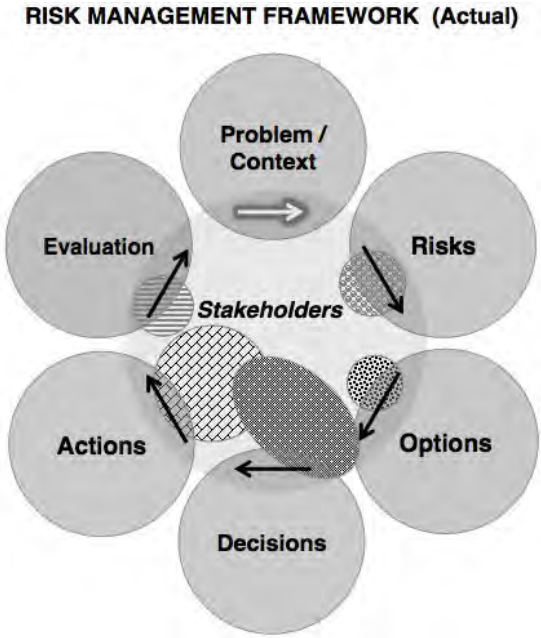
5 There are numerous valuable, participatory approaches in climate risk management and related fields of endeavor, including tailored toolboxes like the Vulnerability and Capacity Assessment (IFRC 2006). But these tend to be very time consuming, and difficult to successfully scale up, especially given the dynamic, complex systemic nature of our climate problems.

talization, will likely be ineffectual and not sustainable due to incoherence relative to the dynamics of the whole system.

- Proposed solutions can be too conventional. Stage-by-stage approaches, despite their allegedly iterative nature, often lead to relative 'myopia.' When stakeholders are thinking about the phase at hand without enough consideration for either future stages or the need to revisit preceding ones, the process is prone to eliciting relatively well-known solutions involving incremental change or modification of certain elements, as opposed to systemic change based on integration of new elements or relationships in the system.

These concerns are compounded by two common tendencies among decision-makers: to avoid information that might refute the assumptions of their mental models—"motivated avoidance" (Shepherd and Kay 2012)—and to steer clear of engagement in issues where losses are inevitable. Additionally, people often evaluate the consequences of committing an action (a commission, such as preparing for a disaster) more negatively than the consequences of omitting an action (an omission, such as ignoring warnings). Omission bias is a preference

Figure 3



Actual processes of learning and dialogue for risk management tend to differ from the ideal framework depicted in Figure 2. Stages are not always tightly linked, stakeholders are heterogeneous, and some stakeholders may be unaware of what takes place in other stages.

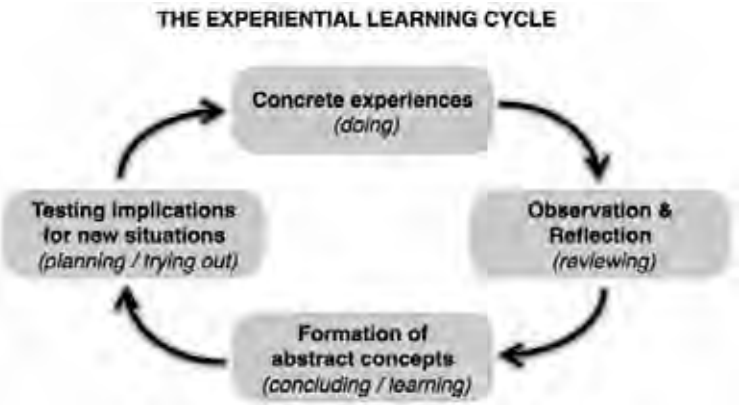
for greater losses arising through errors of omission over smaller losses associated with direct action (Spranca et al. 1991). Tetlock and Boettger (1994) demonstrated that accountability amplifies the status quo effect when change creates victims, even when implementing change could save many more lives. Their study found that lives lost from inaction were considered less valuable than lives lost from changing the status quo, with a ratio approaching 9 to 1 in a scenario where subjects were accountable for modifying the existing *modus operandi*.

Figure 3 interprets how the idealized framework depicted in Figure 2 actually manifests in participatory processes addressing climate risk management. In reality, each of the six stages is somewhat if not completely dissociated from other stages in the cycle, and the set of stakeholders is actually quite diverse, often exhibiting different or even conflicting perspectives and priorities—reflected in different or sole engagement in any of the various stages. For example, climate scientists are often active in risk assessment but distant from decisions and actions, while people in charge of implementing humanitarian actions may be entirely removed from the process that defines problem and context. As a consequence, complex forecasts are issued that do not translate into humanitarian operations because decision-makers cannot interpret their meaning usefully. Decision-makers need information that can clearly be used to establish relevant thresholds for action that could (and should) be monitored.

A variety of processes lend themselves to the incorporation of experiential learning for adaptation to climate change, and some of these draw on the participatory learning and action methodology (see Pretty, Guijt et al. 1995) to increase resilience through learning (Koelle and Oettle 2009). An experiential learning process can increase resilience by enhancing the capacity to anticipate future change in complex systems, and to prepare for such possible change, informed by a collective perception of which future scenarios are most likely to materialize (Suarez et al. forthcoming). We submit that the risk management cycle based on Omenn's widely-used framework can yield much better results if "infused" with the experiential learning cycle proposed by Kolb (1984) and shown in Figure 4.

Experiential learning requires doing, reviewing and reflecting, concluding and learning, planning and trying out what is learned, and then doing it all again, in a new way. Unlike frameworks for risk management which can unintentionally lead to compartmentalization of decision-making processes, the field of game design offers numerous well-tested approaches using rapid iteration that encourage or even force players to inhabit the entire 'cycle,' from concept to evaluation,

Figure 4



The Experiential Learning Cycle (Kolb 1984) with which we propose to infuse and cross-fertilize the Risk Management Framework

as one whole system that is constantly creating, prototyping, implementing, testing, and redefining problems and contexts. Game design theory and practice has much to teach, and the next section highlights opportunities for innovative cross-fertilization in climate risk management.

2.2 SEEKING INNOVATION IN RISK MANAGEMENT PROCESSES: INSIGHTS FROM GAME DESIGN

"In dreams begin responsibilities," said the poet, and in games begin realities.

—Clark Abt

By the late 1960s, Clark Abt, one of the early champions of game-based learning and dialogue, had already developed simulations and play-based activities for fields ranging from missile exchanges to nuclear disarmament, from international political-economy competitions to urban development and education. As described in the groundbreaking book *Serious Games* (Abt 1970), his work required a technique for integrating complex interactions quickly and clearly. Games offered the ability to combine a rational, analytic component with a creative, dramatic one, composed of "a curious combination of optimistic beliefs in the luck of 'another chance' and a pessimistic respect for the odds, the chances of it all." It is a testament to his prescient, innovative vision and concern for climate risk management that today, Professor Abt teaches disaster management and is supervising a Cameroonian doctoral student researching how games can help the Kenya Red Cross design and implement flood warning systems.

In the remainder of this section we draw from three principal sources of game design thinking that can help climate risk management researchers and practitioners in their efforts to 'begin new realities': Hunicke et al. (2004), Salen and Zimmerman (2003), and Bachofen et al. (forthcoming).[6]

2.2.1 Mechanics, Dynamics, Aesthetics

Mechanics (M), Dynamics (D) and Aesthetics (A) comprise the MDA framework, a game design model formulated by Hunicke et al. (2004), to assist game developers, scholars and researchers in breaking down and understanding the components of a game. The MDA framework allows game designers to reason explicitly about design and learning goals while also offering a useful lens for 'users'—in this case, development and humanitarian professionals—to disaggregate the elements of a game design process. This can help to develop games that may better reflect complex systems and promote the lessons they seek to convey.

A game requires rules, the "mechanics" that define a set of boundary conditions, supported by the narrative: *the particular components of the game, at the level of data representation and algorithms.* Additionally, the MDA framework refers to the "dynamics" of a game system, which describe *the run-time behavior of the mechanics acting on player inputs and each others' outputs over time*.

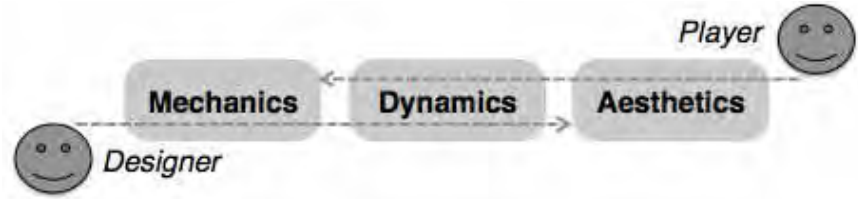
"Aesthetics" are used to evoke *desirable emotional responses in the player.* In other words, aesthetics make a game compelling, memorable, and fun. The MDA framework presents a taxonomy with which designers can distinguish between, and opt for various aesthetic elements when designing a particular game. Aesthetic elements include but are not limited to:

- **Challenge:** Game as *obstacle course* (how to overcome the hurdles that make it hard to get from where we are to where we want to be?)
- **Discovery:** Game as *uncharted territory* (what does our space of possibility look like?)
- **Fellowship:** Game as *social framework* (who is around us and how can we better relate to them?)
- **Narrative:** Game as *drama* (how to tell a story, including its logic, tensions and resolution?)

6 There are numerous resources for people and teams interested in creating games, including the MDA framework described here and, notably, the book *Game Design Workshop: A playcentric approach to creating innovative games* (Fullerton 2008).

- **Expression:** Game as *self-discovery* (how to reveal and make known our thoughts and feelings?)
- **Fantasy:** Game as *make-believe* (how to imagine a reality that doesn't exist here and now?)

Figure 5



A designer can only create game mechanics, aiming to set dynamics in motion that will lead to a desired set of player emotional responses. A player, on the other hand, experiences the game mostly through its aesthetic impact (i.e., the emotions evoked), and through gameplay can figure out the inner dynamics and mechanics of the system (from Hunicke et al. 2004).

In any game, the three MDA elements are causally linked:

- A game designer will seek to develop mechanics that give rise to dynamic system behavior, which in turn leads to the objective of particular aesthetic experiences.
- As players engage in the game they will 'feel' the aesthetics, which set the tone, are borne out in observable dynamics, and eventually in understandable and operable mechanics.

This approach offers a most appropriate way of conceiving how to integrate the experiential learning presented in Section 2.1 into climate risk management, a field that requires coming to grips with data, which can be overwhelming for many practitioners on the ground. Through the mechanics, games can incorporate data sets and analytical research while allowing the player to get a feel for how variables interact, without having to engage in strenuous quantitative activities. Success is based on the creation of knowledge through simultaneously experiencing real or simulated but *tangible* events on one hand, and *abstract*

Games can incorporate large data sets to allow players to get a feel for how variables interact without having to engage in strenuous quantitative activities.

conceptualization on the other. By carefully crafting game-enabled experiences that inspire opposing ways of dealing with climate issues, learning will emerge naturally from the resolution of these conflicts. In terms of democratizing the accessibility and usefulness of data, virtual techniques for data visualization featuring graphs and charts can scarcely compare with the ability of games in allowing people to experience and conceptualize data in new ways (Macklin et al. 2009).

2.2.2 Rules, Play, Culture

In *Rules of Play: Game Design Fundamentals*, Salen and Zimmerman (2003) establish foundations for analytical examination of the game design process structured around three "schema." The ways of acquiring, representing and transforming knowledge they identify are: *Rules* focus on formal aspects, the inner form or organization of games; *Play* focuses on experiential aspects, such as participation, emotion, mental states—that is, how a game is lived; and *Culture* offers a focus on context, the relationships between games and our systems of value and meaning. (Archaeological evidence points to a symbiotic relationship between games, arts and sciences, for example in games cited by Gerdes' (1994) investigation of the roots of mathematics in Africa.) Each are evident in the following selection of lenses from Salen and Zimmerman that can be applied to the creation or analysis of games, and which are specifically applicable to climate risk management contexts.

- **Games as systems for creating meaning**. The goal of successful game design is "meaningful play": when a player takes action within the designed system of a game, the system responds to the action in ways that are both *discernable* (the relation between action and outcome can be perceived) and *integrated* into the larger game system (the outcome of an action is woven into the game system as a whole).
  Climate risk management endeavors should engage stakeholders in ways that are analogous to meaningful play: interactions should lead to a discernable outcome integrated into the larger real-world system.

- **Games as emergent systems**. Systems that are emergent generate, from a simple set of rules, patterns of complexity that are unpredictable or surprising. In an emergent system, the whole is greater than the sum of the parts: the limited set of elements that constitute the system can yield a vast array of plausible combinations and outcomes—what game designers call the *space of possibility* (i.e., all possible future actions and meanings that can emerge in

the course of a game). In an emergent system, interactions between system elements are *coupled* (each interaction links to others, which in turn links to others and thus affects the overall pattern of the system) and *context-dependent* (they change over time depending on what is happening in other parts of the system).

In climate risk management, it is often essential to distill the enormous complexity of the real world into essential elements and relationships. To be useful as a game-based learning tool, the model used to represent reality (be it a hydrological model for flood risk or an econometric model for land use policy) should display emergent complexity.

- **Games as information theory systems**. Information theory is a structural way of looking at signal transmission from a source to a target, without regard to the knowledge-content or meaning of the message. While noise in the system is undesirable, it is a very real aspect of real-world information flows. Noise is what makes possible the popularity of games like "charades" and "telephone" (Chinese whispers) where difficulty and uncertainty in communication constitute the very premise of the game.

  The process of linking early warning to early action is plagued with threats posed by 'noise' in the communication system. The game "spreading the word" [7] *builds on the essential mechanics of 'telephone,' adds a competitive element to put pressure to pass the early warning message quickly…which increases the chances of distorting the message—and leads to hilarious evidence of how communication chains can break down.*

- **Games as systems of uncertainty**. A certain outcome is not completely predetermined (no game would be meaningful if the outcome were known to the players). Probability can be injected into a game to represent the knowable chances of a specific outcome. There are commonly-held fallacies about chance, such as overvaluing the long shot (low probability, high gain choices), the tendency to think that after a run of failures a success is more likely, and the assumption that highly unlikely negative outcomes will not repeat themselves (for example to rationalize living in an earthquake zone).

  Real-world decisions based on probabilistic information, such as whether or not to evacuate based on the forecast of a hurricane that has 25 percent chance of striking in 48 hours, are plagued with decision biases derived from fallacies about chance. Gameplay involving multiple people experienc-

7 See http://petlab.parsons.edu/redCrossSite/gamesSTW.html for footage of gameplay in Bangladesh.

ing a sequence of probabilistic outcomes allows participants to observe and experience that some of their assumptions are not valid—thus improving the chances of better-informed decisions in the future.

- **Games as systems of conflict**. All games are competitive in that players struggle against each other or against a game system. Some games involve player cooperation (i.e., all participants work together to achieve a goal). Shaping victory and loss conditions is a very important component of game design. *Most problems in climate risk management involve insufficient resources to easily satisfy the coexisting needs and wants of different stakeholders. Options based on collaboration and competition may be valued differently by different players, thus leading to a form of conflict that may be resolved during gameplay if people can safely explore tradeoffs within the space of possibility offered within the game system.*

- **Games as the play of simulation**. A simulation is a procedural representation of aspects of 'reality.' As they are abstract, limited and systemic, game simulations usually operate metaphorically. They do not necessarily offer a full representation of the entire system, but by providing a context for deep, engaging, playful interaction, the player's participation brings the represented procedures to life.
  Not all simulations are games. Computer models are rarely explicitly interactive, and even highly participatory simulations aimed at training for disaster response tend to lack the core 'quantifiable outcome' component that can make a playful activity more fun.

- **Games as social play**. From this lens, the relationship between elements in the game system are social relationships. Players make a distinction between "ideal" rules (official regulations of a game) and "real" rules (the code and conventions held by a community of players, shaping how the game is actually played). Participants may broker social power by asserting competing sets of real rules and *game the game* (i.e., players don't merely play within the game, but play with interpretation of rules and propose their own play variants). "Rules of Play" identifies four categories of player roles: *Achievers* (those who seek to advance in experience and power), *Explorers* (those who want to test the space of possibility), *Socializers* (those who place a premium on direct social interaction), and *Killers* (those who seek to harm and frustrate others). *Experienced participatory risk management facilitators are likely to have encountered Achievers, Explorers, Socializers and Killers during workshops*

and trainings. People "gaming the game" can be harmful to carefully designed stakeholder processes. However, this can also be harnessed as a force for transformation of systems with unacceptable imbalances.

- **Games as cultural resistance**. There is a tension between games and their cultural contexts. Resistance emerges from free play due to the friction of movement within the rigid structure of a system. Play never merely resides in a static system of rules, but can affect change in the system through an ongoing process of attempts to transform the rules and their context.
  It is conceivable that, through genuinely participatory risk management processes, a community will realize that it is possible to modify or even transform certain apparently rigid aspects of the system that contains them (be it natural systems like the course of a river, or human systems like a governmental policy). Well-crafted gameplay can accelerate the process of eliciting insights about frictions, and facilitate discussion about possible ways to resist the status quo and propose alternatives.

- **Games as open culture**. Games exchange meaning with their surrounding contexts. The player-as-producer paradigm is a design approach in which players are given the opportunity to act as creative producers within the system of the game, modifying it on formal, experiential, or cultural levels. Games can be seen not as a cast-in-stone package confining play within certain boundaries, but rather as *game systems*: a set of components that function together across multiple games (such as a standard deck of playing cards), that enables particular kinds of game rules and play experiences. Game systems for climate risk management can be intentionally designed to be "open," encouraging participants to depart from a set of given components and a sample ruleset, to create their own new game for their own collectively defined purposes.

Games offer familiar structures that can be redesigned to allow us to play with the unfamiliar. Existing game systems may present key elements that can be infused into playable climate risk management models. Given a specific learning or dialogue challenge, humanitarian and development workers can collaborate with game designers and actual stakeholders to explore ways to use game systems already familiar in the relevant cultural context, and jointly create a playful activity that helps elicit the insights and interactions deemed helpful for promoting climate risk management.

Old Games, New Tricks

A normal deck of cards is the sole material needed for "Weather or Not" (PETLab and Climate Centre 2009). Designed to introduce the basics of forecast-based decisions. It highlights the probability inherent in weather forecasts, and models some of the real-life rewards and punishments Red Cross staff face in taking (or not taking) action.

Two teams of players running in an open field is a basic mechanic for popular games like "Tag." A few additional elements (like a ball) open a whole range of athletic games—not just sports—but also "Budgetball," a team-based game combining fiscal strategy and physical play to model government deficits, or "Humans versus Mosquitoes," a fast-paced game designed to trigger discussion about the growing risk of dengue fever in a changing climate (see Appendix).

A pair of dice and simple objects for counting assets form the core of the casino game "Craps," and of many 'dice and beans' game systems. "Paying for Predictions" is designed to trigger thinking about early warning and disaster preparedness—and to collect data on how humanitarian workers estimate probabilities or show decision biases that impair the cost-effectiveness of risk management interventions (details in Appendix).

What Montola *et al.* (2009) call *Pervasive Games* use the "normal life" mechanics, dynamics and aesthetics: environments, people and information from the everyday world. The best-known example is "Killer" ("Assassin"); students try to hit their designated targets during daily life using a banana (as gun), vinegar (for poison) or an alarm clock (a time bomb). Non-players caught in the action of gameplay tend to get involved in ways that range from active spectatorship to full participation. A team of artists, academics, game designers and humanitarian workers are building on this idea to create a pervasive game on the rising risk of mosquito-borne diseases to inform mobilization in the schools, campuses and public spaces of Metropolitan Boston.[8]

8 Mendler de Suarez, Janot, 2012. Personal communication.

There are two key elements in how people learn and change: competence and consciousness (Hersey and Blanchard 1988). Competence is the extent to which people are able to carry out tasks independently and to feel confident about doing so. Consciousness is the extent to which people are aware of their (in) competencies. Game simulations provide the opportunity for people to realize that they lack certain skills or that there are things that they are unable to do. Repeated gameplay offers a way to develop expertise by evolving from unconscious incompetence to conscious incompetence to conscious competence to unconscious competence (i.e., expertise).

2.2.3 "What's in a Game?" Game Design as a Participatory Tool

Here we introduce a methodology for collective game design created within the humanitarian sector in the specific context of a climate risk management initia-

tive. "What's in a Game?" (Bachofen et al. forthcoming) outlines a simple six-step approach based on Hunicke et al. (2004—see Section 2.2.1) whereby Mechanics are created to mimic plausible decisions and their consequences based on available information, so players can explore the space of possibility (Dynamics) and experience effective arrangements for achieving desirable results (Aesthetics).

1. Define the communication challenge. What conversation should gameplay elicit? What types of decision-making strategies? Identify the AHA! learning moments players should experience.

2. Define key elements that will be used to construct the mechanics, dynamics, and aesthetics. What must be represented in the game?

Who makes decisions? (e.g., farmers, Red Cross volunteers, donors, meteorological service authorities, women, local government, etc.);

What actions are possible? (e.g., invest, trade, collaborate, move, store, sell, etc.);

What are key thresholds, feedbacks and trade-offs players should face during gameplay? (e.g., getting richer by deforesting land; spending scarce resources for privileged information; taking a risk in context of uncertainty, etc.)

3. Define the aesthetics of the narrative. What emotions should play elicit? (e.g., anxieties, tensions, triumph, etc.): Create a narrative featuring elements from Step 2 whereby available information may lead to different decisions that result in one or more expected or unexpected (emotional) consequences. Dynamics of the game emerge in this process. Notably, decisions may be individual, collective, planned or random.

4. Refine the dynamics. Invite participants to act out their stories, encouraging drama, suspense and surprise for fellow designers to experience. Strip away superfluous elements of the story, retaining only the most essential related to decisions, actions and consequences. Refine aesthetic elements based on any feedback.

5. Develop mechanics. Building on the previous steps craft the game mechanics (actions, behaviors, control mechanisms). Carefully consider the most culturally effective dynamic for ensuring gameplay is engaging, memorable, and achieves learning outcomes. At this stage it is very valuable to also engage at least one person with experience in game design theory and practice to contribute ideas

drawing from proven game asset and rule structures.[9] Ensure adequate representation of the attributes and dynamics of the system in question; e.g., specific probabilistic phenomena with dice/cards/roulette, or non-linearities with rules that involve a threshold or feedback mechanism.

6. Play! Test and tweak the game repeatedly, with a view to improving the dynamics, mechanics and aesthetics. Debrief and discuss with participants and co-designers the consequences of actions arising in the game, and how to improve the prototype, and use it with stakeholders.

2.3 TOWARDS A GAME-INFUSED RISK MANAGEMENT FRAMEWORK

Play in one sense is no more than the infection of the familiar by difference.

—Rules of Play: Game Design Fundamentals

As Salen and Zimmerman (2003) suggest, games can help us "infect" what we know about humanitarian and development challenges with the "difference" of an interactive system that allows us to play with possibilities to explore how it could undergo changes given volatile conditions in climate and other fronts. One of the simplest ways in which games can improve implementation of the risk management framework is by bringing to the attention of humanitarian and development practitioners the usefulness of the "choice molecule" concept. Any action → outcome unit within a complex system involving climate risks is likely to be part of a larger organic structure that both affects, and is affected by, choices and their consequences. As such, trade-offs tied to thresholds, feedbacks, delays and non-linearities are hard to grasp through conventional learning and dialogue processes commonly used for stakeholder involvement.

Any *action* → *outcome* "choice molecule" within a complex system is likely to be part of a larger organic structure that affects and is affected by decisions and consequences.

The Risk Management Framework presented in Section 2.1 can be brought to life by carefully designed games that highlight the multiple ways in which stakeholders can navigate the process in iterative and engaging fashion. We now revisit the six stages from Omenn's framework (Figure 4) to infuse them with game-enabled possibilities, illustrating key points with game examples:

9 See Section 5.2 for recommendations on recruiting people with game design skills.

Problem/Context

Identifying a problem is the first and perhaps most important step towards selecting the best action to take in a given context. Yet all too often a diversity of stakeholders actively engaged in problem identification processes results in conflict, as a cacophony emerges of opinions on what exactly is the problem that must be addressed. Games offer a potentially useful avenue for cultivating consensus on what constitutes a problem and what steps may be taken to resolve it. If care is taken to integrate diverse stakeholders early on in the design process, the parameters of the game and nature of "the problem" will reflect the depth and nuance of locally-authenticated perspectives. During gameplay, players with diverging perspectives can explore what exactly it is that presents them with doubt, perplexity or difficulty, and define collectively the magnitude, urgency and importance of a given problem or context.

In the Upstream, Downstream game[10] *an understanding of what may constitute the problem to each player is crucial for assessing flood and drought risk and defining what options to take. The game creates the space of possibility for players to confer in a process of risk assessment that repeats in each successive round. Continuously reviewing and refining understanding of the problem context enables better risk assessment as the game proceeds.*

Risks

Risk assessment can be contentious, underscoring the important roles of both information and judgment in drawing conclusions about the likelihood of experiencing a particular negative outcome. Yet risk is generally measured in terms of probabilities, which tend to be very difficult for people to meaningfully grasp.

"Paying for Predictions" is a game that centers on the assessment of risk as climate conditions change and resources to deal with disaster management dwindle (i.e., estimating the probability of negative outcomes due to likely floods).

Options

Games can offer a way to better understand and leverage a diversity of perspectives and motivate players to think creatively about risk management options. This can release a latent resource in stakeholder processes for identifying and examining viable choices.

10 See Appendix, Section 3.3 case study.

"Ready!" is a narrative-based game of chance where the facilitator starts off with a roughly defined problem and small teams must identify potential actions. To set the game in motion, the facilitator may announce "We have just learned there is high likelihood of a flood striking this neighborhood in the next two hours." Teams have 5 minutes to discuss and propose as many options as possible to resolve the problem.

Decisions

Games provide useful mechanics, dynamics and aesthetics to process the information associated with options in a way that leads to choosing one. In some games, decisions may reflect one player's attempt to independently optimize variables, while others involve negotiation and compromise. Some of the most interesting scenarios involve the pursuit of win-win solutions that allow stakeholders with divergent views to achieve their goals simultaneously. Decision-makers must balance the value of obtaining additional information about available choices against the need for making a decision, however uncertain, within time limits imposed by the game.

The game "Before the Storm" generates decisions as players think through the various options that may be available to them when a particular disaster strikes (see 3.1 and Appendix) As in the real world, information is often imperfect and the effectiveness, benefits, and unintended consequences of any particular decision may not be immediately evident. The game creates a safe space that enables players to experience alternative futures based on identified options and afterwards reconsider whether decisions were indeed worthwhile—or not.

Action

In any game, action is influenced by players' ability to implement their chosen options, as well as by the actions of other players operating in their own contexts during gameplay. Actions are the actual implementation of decisions, and their completion (or not) depends on context (including decisions of others and external events). It is important to note that in actual risk management processes, whoever is in charge of making the decision to act or not at any given time is often different from who is in charge of carrying out the action…leaving ample room for miscommunication, tensions, etc.

The Rockefeller Resilience Game illustrates how there can be a disconnect between decisions and actions: Once an option is selected as the best available choice, players acting as donors may decide to have it carried out—but there

is no certainty (e.g., farmers may not have the resources, time, information or consensus to act), and inaction may prevail.

Evaluation

As the goal in any game is to win, evaluation of what may or may not be an optimal strategy during gameplay drives the learning process. All players actively consider how well they were able to define a problem, understand risks, identify effective options, and make the right decisions and act. Comparison of the impacts of game decisions can take place individually or collectively, in light of new and old information and throughout all stages of gameplay. Evaluating which decisions were effective enough to be repeated (or not) challenges players to identify what worked and understand why for a better winning strategy next time.

The game, Dissolving Disasters, involves crop choices in the context of changing rainfall probability. Player decisions can be individual or collective, and given limited time for decision making, usually involve a rushed analysis of what may be optimal for hedging risk. At the end of each round, players intuitively reflect on the problem/context of risks and options to actively re-assess so as to at least match or improve upon their performance in the previous round.

Through this immersive kind of participatory, emotionally and meaningfully experienced learning, games can magnify the connections and accelerate interaction between different stakeholders, iteratively engaging them in multiple stages in the risk management framework. Rather than treating each stage as a sequential self-contained step, interpreting this model through gameplay simplifies some steps to highlight areas intended, without losing sight of the larger system. Games offer a way for different types of stakeholders to engage meaningfully with others who may in reality be responsible for thinking and action in separate stages of the risk management process. In sum, games have unique potential to consolidate learning for more integrated climate risk management by motivating players to internalize connections between the stages and among each other.

Games can cultivate locally-authenticated perspectives and consensus on what constitutes a problem and what steps may be taken to resolve it.

See the Appendix for detailed examples of how the Risk Management Framework is applied in the development and play of specific games.

3. From Sequential to Systems Learning: Game-Enabled Processes

When used effectively, games can be a powerful tool for educating and informing but perhaps more importantly, also experiencing issues.

–Darren Garrett, creator of the successful game "Sweatshop"

Games are one of the most efficient learning tools for teaching complex concepts. Inhabiting the game as a system-of-systems provides cognitive, mnemonic, corporal, and visual markers that help us to understand the dynamics of a complex system from within. The game experience enables thinking pragmatically about systems of relationships, causal webs and cascading pathways, which are in reality increasingly characterized by uncertainties, volatilities and complexity. These must somehow become more readily understood in order to inform decision-making given the challenges of a changing climate.

The concept of dominant strategy is illustrative: Graham (2009) defines a dominant strategy as "a strategy that does at least as well as every other strategy in all situations but does strictly better than every other strategy in at least one situation." Graham further notes that in a game of rock, paper, 'shotgun,' "the shotgun would probably be the dominant strategy."

Figure 6

The Civilized and The Barbarian…"Rock, paper, scissors?" (Repiso 2012) illustrates an individual dominant strategy. Used with permission.

However, in a variety of complex systems a collective dominant strategy exists where all individuals would benefit, but only if a specific set of decisions are

implemented by each and all of the stakeholders in the system. If each individual has good local information but severely limited global information, even when individuals are rewarded for global performance, inability to understand how their own decisions impact the system as a whole may prevent them from taking actions that are consistent with global improvement. In fact, when individuals operating in the humanitarian sector are addressing the pressing needs arising from urgent events, they often focus on improving their part of the system in hopes that maximizing their gain will translate into global improvement…sometimes by intentionally or inadvertently shooting down opportunities for others, which of course affects the performance of the larger system.

The persistence of inadequate decisions and inability to implement a dominant strategy poses a major challenge to effective climate risk management. Decision-makers can learn about available improvements in decision making through the process of discovery and repeated experience provided by serious games: they offer the possibility of compressing time and space as well as controlled experimentation, all of which help participants experience the consequence of their decisions in a short session. This allows them to figure out causal relationships without the distractions, extended delays and confounding aspects present in the actual systems. To be effective, game scenarios must reflect the main trade-offs and delays of the real system and enable participants to face critical situations that make them confront their usual mental models.

Games for experiential learning have no "back seats" as all players actively inhabit a dynamic system.

An *immersive virtual environment* is one that perceptually surrounds the user, increasing his or her sense of presence or actually being within it (Bailenson et al. 2008). Moreover, Bailenson et al. (2008) find the transition from privileged seating (front of the classroom) to sitting at the back to be particularly detrimental to learning and attention. Games for experiential learning have no "back seats" as all players actively inhabit a dynamic system. This enables 'personal recognizance': players can easily bring their own experience, expertise, assumptions and worldview into the game system, in a way that can reveal latent vulnerabilities—and capacities. This tends to flatten organizational hierarchies or power structures, and also gives each individual the opportunity to viscerally experience the 'AHA!' epiphany when achieving a breakthrough in understanding or insight in gameplay.

As they see the drama of simulated reality unfold around them, inhabitable games make participants experience vivid confusion about how things work, triggering a potent desire to figure out how the system works. Facilitators can often see, during crucial instances of decision-making, a "huh?" moment in the facial expression of players asking themselves what is going on. The eruption of the 'AHA!' moment signals an emotional ownership of learning, which is highly motivating, and further strengthened by the context of the game in which other players are also immersed in grappling with the same system dynamics. Hence for the individual and for teams of players, learning outcomes feel authentic and are mutually reinforcing. Thought should be given to ways in which power structures can be accounted for, both in the design and implementation of games, since this will fundamentally shape the likelihood that authentic dialogue will occur.

So games can be used to increase knowledge and mobilize action in many specific ways, including:

- creating opportunities for peer-to-peer learning and dialogue;
- serving as diagnostic tools and as vehicles for imagining alternative futures;
- galvanizing partnerships through co-design processes; and
- motivating a diverse range of players to engage.

The following subsections examine how games can accomplish each of these goals, highlighting some of the benefits they offer for implementation of the risk management framework discussed in Section 2.

3.1 PEER-TO-PEER LEARNING GAMES

Participatory processes for managing climate risks can be enhanced by leveraging knowledge-sharing, experiential peer-to-peer learning, dialogue and consultative discussion. Educational research demonstrates that whether cooperative or competitive, student performance is greater in a social learning context (Johnson, Johnson and Skon 1979), and more factual material is retained by students studying with partners vs. alone (Wood, Willoughby, Reilly, Elliot and DuCharme 1995). Inhabitable games create a common experience across players that cultivates collective intelligence: a shared or group intelligence about the dynamics of a system that emerges from the collaboration and competition of many individuals processing information in their own ways but in synergy with each other. This can help build informed consensus in decision-making. For case

studies of peer-to-peer learning games, see the Appendix for "Before the Storm" (p. 83) and "Rockefeller Resilience Series" (p. 86).

3.2 GAMES AS DIAGNOSTIC TOOLS AND FOR IMAGINING ALTERNATIVE FUTURES

The construct of games for addressing "broken systems" offers an engaging way to both diagnose a systemic problem and also to explore alternative means of addressing it.

When we consider serious games involving climate risks, we observe that effects may play out only after decades of decision-makers' inadequate policies. Policy makers may not have the opportunity to experience the consequences of their implemented policies. System dynamics games provide the possibility for participants to experience the consequences of their decisions over time, and gain appreciation for the structure of the system. Facilitated discussion or debrief following gameplay can incorporate the identification of ways (as revealed by the game) in which "the system is broken" and how individual or coordinated player action can lead to improving it.

As a diagnostic tool, a game can simulate proposed interventions and offer players the opportunity to identify the ways in which a system is broken and, importantly, also test to see if their decisions within an altered reality reveal a path to an alternative future that is more or less desirable than expected. In some cases, players may even discover an unexpected outcome. The ability of active experiential gameplay to reveal differences in the valuation of criteria for decision-making either within teams or across different types of players can also serve as a diagnostic tool to identify preferences, expose under-addressed issues, or reveal the flaws in prevailing mental models. For this reason, inhabitable games provide a remarkable opportunity to educate on the possible disconnects or "broken system" problems in evolving climate risks and explore how corrective action can help. For case studies of games as diagnostic tools and imagining alternative futures, see "Paying for Predictions" (p. 90) and "The Climate and Gender Game" (p. 94) in the Appendix.

3.3 CO-DESIGN AS A BRIDGING PROCESS

Games as participatory design tools have potential to spur dialogue and learning on effective risk management strategies and forecast-based decision-making. Through participatory game design, development practitioners, disaster managers, forecasters and at-risk populations (amongst others) can collectively take

on the role of game designer and explore how a game with rules and complex dynamics can be used to reflect possible actions and consequences of the ever changing real-world systems in which they operate. During the game co-design and gameplay process, stakeholders wrestle with clear organizational, conceptual, financial, and even political challenges that will need to be carefully managed in order to support development and scaling-up of the overall gameplay process. Two co-design process studies included in the Appendix examine the bridging process: first at the community level ("Upstream, Downstream," p. 97, about collaborative resilience-building work in Central America), and second at the organizational level ("VIS-À-VIS," p. 100, about an internal global strategic planning process).

3.4 SERIOUSLY FUN GAMES AS MOTIVATORS

A pleasurable gameplay experience can provide a positively weighted starting point to solicit more active public engagement and support for addressing new or under-addressed humanitarian and development challenges. Games rooted in the old adage that "knowledge is power" can be powerfully motivating. Activities focused on detecting change and assessing the most appropriate responses to experienced and anticipated change results in greater empowerment and self-determination: when members of affected communities are able to take charge of designing and implementing their own responses encourages optimism (Suarez et al, forthcoming). For humanitarian organizations that can be perceived as dealing with issues entrenched in doom and gloom, the fun factor associated with games—the ability of inhabitable games to make people feel good about themselves and about the game system as a shared experience—may offer a unique advantage. The gameplay experience can embody not just the ability to create more meaningful connections to the challenges an organization may face (such as poverty and injustice in the case of Oxfam); it can also raise self-awareness of having a role to play in a complex system. For a seriously fun game case study, see "Humans versus Mosquitoes" in the Appendix (p. 105).

There may be unique motivational ability in inhabitable games to make people feel good about themselves and their shared experience interacting with a game system.

4. "Yes, But..." What Can Go Wrong and What Must Go Right

"About 5 minutes into our first game with adults, a human player ran in to grab a mosquito egg, slipped and fell, caught his foot on the defending mosquito, and popped his ankle out of socket. This stopped play for about an hour while the medics and EMTs got over to him to get him back to Manhattan for care. I felt super bad about it, but it probably could have happened playing any number of games at the festival that day. It is only the second serious injury in Come Out and Play history, and the other one was a broken ankle as well in San Francisco."

—"Humans vs. Mosquitoes" co-creator Ben Norskov,
reporting live from the 2012 'Come Out and Play' Festival

Of course, the very first consideration when preparing to use games for participatory sessions must be safety, but there are many important considerations when planning game-enabled processes. Participation in game-based learning requires some risk-taking, and unless this experience is perceived to be valuable, the participants are unlikely to engage in similar processes in the future (Suarez et al, forthcoming).

What other risks are associated with the use of games for stimulating dialogue on climate risk management and adaptive development? Given that our mental models of systems are imperfect, should we be concerned whether games are 'accurate'? When should these tools decidedly *not* be used? This section examines these and other questions, with a focus on what is needed to make immersive learning games work, the limits to their use, and issues regarding monitoring and evaluation.

4.1 SKILLED FACILITATION—OR NOT?

In order for 'serious' games to be embraced and achieve maximum benefit for participants, skilled facilitators are generally needed to incite reflection, synthesis, and learning throughout the game, as well as in the larger risk management process the game is designed to support. A skilled facilitator is able to encourage

cognitive and emotional engagement as well as critical thinking to achieve the learning objectives.

The facilitators' task is to inspire meaningful dialogue that emphasizes co-learning and instills a sense of empowerment and personal responsibility in understanding climate risks and what we can do about them. It can be dangerous to assume that the game itself is the only article of knowledge, and is self-contained. Learning and dialogue experience is enhanced through a variety of facilitation tricks from setting the stage, explaining the rules, to giving up control of the interactions, sharing power, and guiding debriefing where participants are empowered to co-generate knowledge and act on their new understanding. To stimulate learning and dialogue, it is essential for the facilitator to prompt conversations about strategies and consequences within the game system: *What did you choose to do when information was not available to you? What resulted from your decision?* Whether decisions of action or inaction, consequences need to be explored by fostering dialogue on trade-offs, conflict, and alternatives.

The discussion that follows a game session is where validation, consolidation and coherence converge to bolster deep learning, and a collective intelligence. The sharing of individual and team insights should reinforce a collective processing and shared understanding of what the game reveals about a complex system and its inter-relationships. This is crucial to translating and distilling what has been learned by players through gameplay into the culture of the stakeholders and organizations that matter. If, during post-game discussion, players find that the game has not authentically represented their understanding of reality, the facilitator can recognize that the game is broken, and engage participants in 'fixing' the dynamic model by proposing revisions or redesigning the game to better represent their relevant reality. This approach can create rich conversations for the first step in Omenn's framework ('define problem and context').

Facilitators must know how to ask the questions that help expose constructive ideas—and it is equally important to also defuse any misconceptions. The facilitator of a game-based workshop on early warning and early action in Burkina Faso learned (the hard way) that even when information is delivered "correctly" it may not elicit the desired response: right after playing the game, a participant called his village to tell them he had just learned during the workshop of the National Meteorological Office that rains were expected to be coming their way in the next 3 days…because game discussion had focused on a hypothetical

72-hour forecast[11]. The following discussion further illustrates how a skilled facilitator can be key to avoiding other unintended consequences of gameplay.

Recognizing ethical dimensions of gameplay. Game facilitators assume an implicit responsibility when playing games in specific settings. An experienced facilitator will recognize the need for both the design and facilitation of the game to be suited to the group or communities who will be playing the game. Even if the desired outcomes are open-ended, e.g., dependent upon the direction and depth participants bring to post-game discussion, the facilitator should have a clear idea from the outset of the specific learning objectives of the game.

Games can be used to elicit ideas and priorities that can inform programmatic interventions by government or civil society groups. The use of repeated gameplay to generate data for research should be considered in terms of ethical dimensions, since in essence participants would be "research subjects" given that gameplay would have to do with data collection for an ulterior purpose, not just their learning and dialogue. While games can be crafted as tools for monitoring and assessment, the value of games should also be evaluated by the players who are intended to benefit from their use. In any case it is the responsibility of a facilitator to ensure that participants understand, or better yet see value to themselves in any generation of data from their gameplay.

It is important for all parties to acknowledge that while games can be both a means of delivering messages as well as a way of promoting authentic dialogue and learning processes, issues of power structure and agency must be adequately addressed. Participation does not automatically translate into empowerment (White 1996, Few et al. 2007) and facilitators aware of the potential pitfalls can be better prepared to manage them. A game session may create opportunities for participants 'with a grudge' to let their worst behavior emerge. As White (1996) outlines, participation can range from a nominal form in which organizers seek primarily to legitimate a process while participants are satisfied with inclusion only at a minimum level (perhaps due to competing needs for their time, or feelings of apathy towards the participatory process), to being transformative, where a participatory process spurs empowerment through the active evaluation of options, decision-making and taking action.

Perhaps most importantly, the nature of power relations between top-down and bottom-up interests will determine how meaningful a participatory learning pro-

11 Tall, Arame. (2012). Personal communication.

cess truly is. It follows that pre-existing power relations in particular can impose serious limitations to the meaningful participation of individuals. For example, if a game provides the opportunity for traditionally voiceless groups to engage with others of higher power or status, conflict can ensue—as often results when prevailing power relations are challenged. While games can in theory be a great equalizer, in practice they may even provide a platform on which existing unjust power dynamics are replicated or further entrenched. Notably, the absence of conflict between heterogeneous groups during participatory processes should raise flags for the facilitator about whether the process is genuinely participatory.

Recognizing who participates and how participation takes form is crucial (Few et al. 2007). In reality, a group is rarely homogenous and will have varying capacities to articulate needs and demands. In addition, certain actors will have easier access to participatory processes than others; for example, at the community level, prescribed gender roles may keep women busy rearing children or performing time-consuming household chores that will limit their ability to participate in game sessions and by default be under-represented. At the same time, figures of political authority or special interest groups may disproportionately dominate these processes and influence outcomes in their favor—much to the chagrin of fellow participants. Potential for tokenism, particularly among disadvantaged groups or individuals, can also ultimately serve to perpetuate disenfranchisement. In short, social disincentives to engage in collective action, public apathy, and time costs involved in such participatory processes can adversely affect the type of individuals that will engage in gameplay, and further limit the type of involvement and meaningful participation of others (White 1996).

Finally, the position of power that the facilitator inhabits during the game process may also contribute to the power dynamics of the group. A foreign or highly educated facilitator may be considered an "outsider" and influence the level of involvement of certain participants. Similarly, micro-politics may come into play, when a local facilitator overly entwined in local politics or the topic at hand may resort to overt or covert tactics to influence discussions, outcomes or even seek to achieve personal wins at the expense of collective priorities or with disregard for basic rules of engagement.

Gender-related sensitivities are often the most difficult to constructively manage. The game designed with Kenya Red Cross to foster community dialogue about the differently gendered impacts of climate change cited as a case study in the Appendix incorporates into the rules of the game existing inequalities that

Foot-in-Mouth Disease

The risk of encountering latently explosive social justice issues is a good reason to consult with organizers and local leaders prior to the game event. Facilitators need to be sensitive to those in a position of disadvantage, so as to neither trivialize nor cast a pall of hopelessness on the local context. Prevailing underlying conditions are unlikely to be transformed overnight and a game may reveal, but cannot be relied upon as a silver bullet for even temporarily breaking down power relations. When the game is over, the facilitator may walk away with great satisfaction, having pushed players into discussion of uncomfortable issues, but if the community is left feeling that they have not benefited from the discussion—or worse are left feeling exposed, shamed, or judged, the purpose of the game has failed. A skilled facilitator knowledgeable about and accepted by the community is needed to elicit details from community members as to how they may experience disadvantage, especially if discussion leads into some of the more painful tradeoffs players actually face. Let's say farmers whose crops have failed, livestock are dying, and assets are depleted due to drought may in reality perceive their only survival option is sending their children out to work; this can mean sending young people from rural areas into the cities to seek employment, with the heart-breaking foreknowledge that a certain percentage of their sons and daughters will fall into "evil ways." While an external facilitator may be aware that this is code for girls turning to prostitution and boys to alcohol, drugs or crime, it is up to the community with a skilled and locally knowledgeable facilitator to elicit or raise these types of details in discussion, not an external facilitator or game expert.

disadvantage women and girls. It is certainly appropriate for an external facilitator unfamiliar to the community playing the game to highlight top-level observations (e.g., how when gender roles are mixed up, it is the culturally driven differences, rather than gender differences themselves that compel women and men to experience the impacts of a changing climate unequally). However, it would be inappropriate for an external facilitator (or an unprepared local one) to attempt to force the discussion in areas that could be gender-sensitive, or potentially trigger repercussions that exacerbate rather than resolve problems beyond the scope of a game facilitator to manage judiciously. It should be noted that especially where domestic gender violence or prejudicial behavior in a community could be a later consequence of exposing hidden sensitivities, facilitation around these issues is not to be taken lightly.

Understanding and embracing cultural nuance before and during gameplay. What is appropriate in one setting may not work with others. Just as adaptation and mitigation actions need to be tailored to specific contexts, so do communications and learning interventions. Games must be designed and adapted to meet the needs of specific communities by including game elements that resonate with diverse attitudes, perceptions, behavior and cultural values

and beliefs within the community. Participants will be more likely to react and relate to games if these are illustrated throughout the process. A skilled facilitator will know how to bring in these elements appropriately. Indeed, some games may be more appropriate for certain cultures or genders or settings and less so for others.

Scaling Down to Scale Up

Ideally, before scaling up a successful game in an entirely new context, the participatory activity should be tested to assess risks involving cultural nuance—and redesigned to resolve any unanticipated problems. For example:

In parts of Indonesia dice are associated with gambling, deemed unacceptable by many participants who joined a session of the game "Ready!" (see Section 2.3), forcing a full redesign of game mechanics. Representing the level of difficulty by rolling dice was replaced with throwing stones on a specially demarcated pattern on the ground. If no successful substitution had been found for the game, it would have been appropriate to consider other more culturally accepted participatory methods to trigger learning and dialogue, such as dance and theatre.

In "Humans versus Mosquitoes" (see Appendix, 3.4) players express choosing to protect against mosquito bites by crossing their arms on their chest (a signifier of protection in western cultures). Playtesting the game in rural Uganda, subsistence farmers seemed somewhat uncomfortable, and were behaving in surprisingly risky ways—taking unnecessary risks of being bitten by their opponents and not choosing protection. During debriefing it became clear that they were avoiding the gesture of crossed arms, which signifies death (the posture for burial of the deceased). The form of expressing the 'protection' choice was modified, and gameplay continued successfully.

In a very different cultural context, one student participant in the "Games for a New Climate" Task Force Game Day enjoyed the mosquito game so much that he proposed adapting some aspects of the rules to develop a prototype online version, and was also inspired to create a new card-based game about the role of malaria in agro-ecology, which Prof. Jim McCann of the Pardee Center is introducing in university teaching in Ethiopia.

A skilled facilitator will understand the importance of accounting for issues of language, literacy, gender, power, cultural differences, and attitudes toward risk when adapting and implementing games. He or she will need to skillfully maneuver through communication barriers, differences of opinion, and uncomfortable situations with a view to stimulating rich conversation where participants begin to understand different viewpoints and find common ground. At the same time, it is critical to note that a facilitator is only able to foster a safe space for community members to feel comfortable in sharing their experiences and vulnerabilities if he or she has established rapport and is familiar with

local cultural sensitivities. Immersive learning games that are locally relevant, empowering, and engaging for diverse audiences can allow for power relations to be temporarily broken down and help in shifting the discourse.

4.2 TENSIONS AND TRADE-OFFS

As discussed earlier, games are dynamic system models that are particularly well-suited for capturing the mix of trade-offs, feedbacks, non-linearities, delays, probabilities and unanticipated "side effects" inherent to climate risk management. These tensions give the game its dynamic structure, as players strive to compete and/or collaborate while trying to learn how the system works in order to win.

Tension between winners and losers. The most popular games are designed to have winners and losers. While infrequently designed with a negotiation process and endpoint of compromise as the goal, games that provide incentives for players to collaborate can be highly relevant in the context of climate risks. It is crucial to ensure games are grounded in the perception of fair play: whenever there are winners and losers, the results should depend principally on how quickly and how well different players figure out the complex system, that they inhabit through gameplay, rewarding learning and collaboration. Examples of perceived unfairness in how the winner is determined include a sudden change of rules by the facilitator, or the deliberate sabotage of one of the players against a specific opponent.

In games designed for policy success and political alignment, negotiation and consensus building may be indeed the most important elements. The Consensus Building Institute (CBI) has developed a significant number of role-play simulation games aimed at policy and decision-making participants (Islam and Susskind 2012). While CBI games are generally not designed with mechanics that quantitatively capture the system dynamics of the issues they address, they have proven quite successful at helping various stakeholders reflect on the conflicts they face and to experiment with the "mutual gains" or value-creating approach to collaborative problem-solving. Such experiences can and should be integrated into immersive learning games for climate risk management.

Limited "meaningful choice" options. As a simplified representation of reality, a game may not provide as many meaningful choices for action as may exist in real life. Players will likely point to this incompleteness if the game introduction fails to explain reasons for excluding important choices. Games may be

Fishing in the Risk Pool Yields Good Catch

"The ARC Game" was designed to facilitate learning and dialogue on how regional insurance pools can help governments manage the financial implications of droughts. It simulates the essential aspects of the proposed African Risk Capacity.[12] During and after gameplay, the facilitator encourages individuals and teams to explore innovative mechanisms for managing risk. In some cases this resulted in teams introducing additional risk management alternatives into the game. Over eight sessions of gameplay with government representatives from various ministries (including finance, disaster management, agriculture, and early warning) as well as other senior stakeholders from numerous African countries, players have successfully generated new ideas and the deeper exploration of existing alternatives (such as regional strategic grain reserves). Envisioning a menu of alternative mechanisms allows players to grapple with key opportunities and trade-offs that are plausible for managing risk through the proposed ARC initiative.

12 See http://www.africanriskcapacity.org for more about this risk sharing proposal by the African Union.

deliberately designed with limited options in order to elicit understanding of a dominant strategy that proponents want to promote or disseminate, or to invite participants to generate new ideas and even strategic options. This can be particularly useful as a way to engage stakeholders in actively contributing to the formulation of a program that is being developed to benefit them.

Bending and breaking the rules. As a strategy often used in gaming situations and real life, cheating is in essence a trade-off strategy. Lankford and Watson (2007) call it 'ingenuity'—making the rules bend or break to suit the individual or group—and suggest that this is a human trait that can be fostered in the gameplay environment. Human beings typically make everyday decisions that involve trade-offs, involving choice of actions of one particular kind over others based on perceived advantage gained. This is particularly so when the decision or action involves uncertainties in outcomes. Cheating might accrue similar or better gains than not cheating, thereby reinforcing a trade-off behavior not necessarily anticipated in the original design of the game.

Cheating is a choice one makes, but it can also be a behavioral trait that manifests differently across individuals, cultures and circumstances. Hence, following any gameplay it is essential to do a post-mortem analysis of behavioral traits illustrated by a game. Illustrative examples of trade-offs, including bending and breaking of rules, allow both fuller appreciation of attitudes and behavior, and impart a good understanding of the factors influencing informed decisions and actions. As in the real world, there are pros and cons of cheating in games.

Sometimes Cheaters Prosper

Explicitly allowing for the bending or breaking of the rules of play can be used diagnostically in a number of ways—for example by stating that cheating is allowed in a game session. This can be useful to open conversation on issues of corruption affecting climate risk management. A climate risk management game called "Diving into the Regional Insurance Pool"[13] explicitly communicates to players that cheating is 'wrong but deliberately possible': individuals know that if they misrepresent facts about insured disaster losses they are more likely to accumulate wealth, but everybody knows that the entire system may collapse if abused too much—thus bringing all players down. Playing this game has enabled animated, comfortable conversation about the need for safeguards when setting up new risk financing instruments.

13 See a six-minute video of a rich gameplay session on regional insurance instruments held during the UN Climate Conference held in Cancun, Mexico (2010), that involved government negotiators, insurance sector experts and other stakeholders: http://vimeo.com/27571755. As expected by design, one of the players (representing a country) was caught cheating by members of his regional block, triggering a rich debate on the need for real-world systems to set up reliable checks and balances—as well as fair mechanics for the risk sharing instrument.

Games that allow incentives (or dis-incentives) to cheat have inherent limitations that need to be appreciated in any application.[14]

In order to more authentically capture the actual range of decision-making options available within a given system, games may be designed and facilitated to implicitly or explicitly allow bending or breaking of its formal rules. Passive allowance of cheating as a viable real-world strategy could be implicit in omission of a "no cheating" rule when introducing the game to players. In games where it is important for players to exercise their personal predilections with regard to choices of action, some may seek to cheat and conceal their actions, some may seek 'permission' from the facilitator to break the rules, and it may not even occur to others to cheat at all.

Rule-bending can also be a way to ascertain preferences and priorities among groups of players within a game system or scenario—yielding valuable insights to the players, their community or organization in terms of what choices are most likely to be played out in the real world under different sets of conditions or circumstances. Whenever cheating is a factor, it should be raised by the facilitator for reflection during the debrief discussion, to ensure all players benefit

14 Standard economic theory would argue that the decision of whether to cheat is based on (a) the benefits of successful cheating, (b) the probability of being caught, and (c) the consequences of being caught. Yet behavioral science suggests a much more complex and nuanced pattern of forces and contexts influencing that choice. For an entertaining explanation of the evidence on this matter, see: http://www.ted.com/talks/dan_ariely_on_our_buggy_moral_code.html.

from understanding relative perceptions as to what degree of rule-bending may be 'permissible' in different contexts.

4.3 UNIVERSALITY, WILLING AUDIENCE, AND BUY-IN

Inhabitable games can support climate risk management not only among illiterate farming communities but also up the power and finance chain, with heads of institutions, donors, and top decision-makers. Yet, as the Oxfam case study referred to in Section 3.3 (see Appendix) cautions, garnering and maintaining institutional support for a design, development, and deployment process is not a foregone conclusion. As a deeply participatory process, this somewhat unconventional "full immersion" approach to dialogue and learning requires time to take hold; skeptics or even saboteurs of the approach are likely to emerge sooner or later. For example, refining learning objectives across diverse partners in a collaborative game initiative, fine-tuning probabilities based on real-world data, or adjusting the weight of variables relative to each other within a game system can require considerable research, testing, and tweaking; during this process, the game may appear to be flawed or unplayable. Thus, critical voices in the process may begin to erode support for the project.

Clearly there must be room to make mistakes, engage in an iterative process, and discuss limitations of the game before and during deployment. But time is valuable and not everyone will be immediately willing to experiment with this innovative approach. Questions will be raised concerning the justification for allocating human, time, and financial resources to games. Some may relate games with child's play and be reluctant to carve out time in busy schedules,

A Captive Audience May Not Be Captivated...

In a game session organized at a major multilateral organization, a request to film was denied by the communications department, due to concerns about the potential for negative external perceptions should it leak that members of such a serious institution were playing games during working hours. During the session itself, one senior economist stood up several minutes into the introduction, expressed having "more important things to do and this is a waste of my time" and walked out. The facilitators politely acknowledged the validity of such a position, which was clearly not shared by the rest of the participants, and a lively and fruitful session ensued.

In another (unrelated) instance, the exuberant machismo of one participant, driven to clever and entertaining spotlight-hugging behavior, would have derailed a game session had the facilitator not exerted equal and opposite energy to quell this boundless barrage of joke after joke.

or even see gameplay propositions as patronizing. To be taken seriously, those in power may need to experience games to discover their value as a serious approach to learning (for all ages). Finally, it is important for someone wanting to develop a game—particularly for use with any "expert" audiences where resistance to see utility in it may be greatest—to acknowledge diversity of preferred learning styles and not assume that one kind of learning approach is better than another for every person in every instance.

4.4 LIMITS TO GROWTH OF GAMES

Games can take their place within a wide range of interventions. Yet there are important limits to expanding the use of games, which must be considered to ensure that the objectives of a game are realistic and achievable.

Games are chiefly concerned with individual action and collective influence—how an individual or group may, as a result of gameplay, be empowered to reflect back on real life situations and behave differently. Games rely on the medium of human agency to change behavior. Moreover, while games can be useful as a didactic and diagnostic tool to enable groups of people to gain a shared perception of the dynamics of a system, games cannot by themselves create conditions required for more effective humanitarian and development work, such as improved governance, leadership and management capacity, technical expertise, and so forth.

In addition, it is worth reiterating that a game will never reflect the countless complexities present in the real world. As simplified representations of reality, all models are always wrong—but some are useful. Consequently, some elements or relationships between decisions and consequences may be overemphasized while other aspects of reality will be completely left out. Reflection on the limitations of a game and how to improve the model is a crucial element of game design as well as the ensuing learning process.

The discussion in the previous section about facilitation gives rise to concerns about ambitions to massively scale up games. A significant challenge is the external *perception* of games for development. Potential funders frequently consider the use of games as tools to be too simplistic or unreliable to create significant behavioral change—choosing instead to invest scarce resources in more 'serious' participatory methods for learning and dialogue, or in direct humanitarian and development interventions. The onus falls on proponents of this approach to formulate greatly improved monitoring and evaluation techniques

to analyze critically whether or not games are effective and cost-efficient, and how they measure up against other available methods.

What are viable models of taking games and game-based learning to scale?

To reach the transformative impact we envision, playing with much larger crowds will probably be needed, along with some sort of institutionalization, whereby game-based learning becomes anchored in organizations. Early efforts to take the use of games to scale offer important lessons, including:

- Fairly high costs: these include not only design fees but transaction time for designing games and ensuring game designers understand the development challenges, and that development partners and donors understand what games can and cannot do;
- Need for research: robust research designs may not be easy to come up with since it would have to compare game-based learning with some alternative learning method. But what comparable alternative? It is hardly likely that a 'straw man' alternative needed principally for research purposes would be designed with equal enthusiasm and be of the same quality of delivery.[15]

Finally, some may see scaling up the use of games as too dependent on facilitation. Indeed "off the shelf" game packages made available for any users will lead to questionable results if they are deployed in the wrong contexts, or by facilitators lacking the skills and knowledge to fully grasp the caveats of gameplay and debriefing. While open access to games seems like a step in the right direction in terms of transparency, open access to complex or culturally sensitive materials for gameplay could raise cause for concern. At the same time, games that are based on particularly robust mechanics, proven dynamics, and universal aesthetics may be created and disseminated in a self-sufficient package (like out-of-the-box commercial board games), and not require any facilitation. Such games would be valuable for viral dissemination of key messages and mobilizing behavioral change more organically. Indeed, certain games such as "Humans versus Mosquitoes" can lend themselves to modification. In this way, families of games derived from a common base allow for facilitators who lack game design experience

"Off the shelf" game packages made publicly available will lead to questionable results if they are deployed in the wrong contexts, or by facilitators lacking adequate skills.

15 Heltberg, R. Personal communication.

to get creative with game mechanics, dynamics, and aesthetics, adding new options to enhance the game experience in the "then and there" of gameplay.

4.5 MEASURING CHANGE—HOW TO ASSESS EFFECTIVENESS AND JUSTIFY INVESTMENTS?

If you know neither the crisis nor yourself, you are doomed to losing every battle.

—Sun Tzu, *The Art of War*

Recent years have seen increased focus on measuring impacts of change through adaptation (GEF 2010) and development interventions (Levine et al. 2012). Logframe systems[16] have moved beyond quantitative measurement of inputs and outputs to capture a range of qualitative impacts of desired results and outcomes, as well as more sophisticated methods that also acknowledge unexpected outcomes or "catalytic impacts"[17] and less tangible aspects of development such as governance and empowerment. With ever-increasing competition for public funds at the national and international levels, this impact measurement is used to justify spending by demonstrating value or to show effective learning (McLaughlin and Walton 2011). Similarly, we need more analytically rigorous studies examining the effectiveness of games for climate-related risks in comparison to current practices.

4.5.1 Unpacking Impacts

The ability of games to achieve their design objectives offers wide scope for the development of rigorous assessment criteria and methods. Some early examples include a study examining how engineering students perceive experiential learning through games (Andreu-Andres and Garcia Casas 2011), as well as Patt *et al.* (2010) comparing how well subsistence farmers in Africa learned about complex insurance instruments through conventional presentations made by extension officers, versus an immersive game designed to convey the same concepts.

Assessing after-action results from games is particularly problematic. Links to crucial measurable changes, such as policy, are indirect.

16 The "logical framework," or logframe for short, is a grid or table-based system widely used among international organizations in the development sector to present a breakdown of project activities listed on one axis against a set of metrics for measuring results in terms of timetable, budget, risks and assumptions, and qualitative and quantitative inputs, outputs and outcomes measured against stated targets and objectives.

17 The Global Environment Facility has incorporated the concept of catalytic impacts into a "Results-Based Management Framework." See Progress Toward Impact: Fourth Overall Performance Study of the GEF: http://www.thegef.org/gef/OPS4.

Policy impacts can be disaggregated into five key change areas (Jones and Boyd 2011):

- Attitudinal change
- Discursive commitments
- Procedural change
- Policy content change
- Behavioral change

This clarification of influence areas means that M&E can be carefully designed to assess discrete impacts within a particular stakeholder community where a game has been used systematically. Notwithstanding, both linkage and influence are difficult to attribute and the time lag and short funding timelines mean that most project interventions cannot measure impacts years later with stakeholders. This is an issue common to development interventions seeking to attribute policy outcomes to their influence, which is particularly true of games due to the issues outlined in the discussion above. With regards to participatory games, many of the benefits of interaction between stakeholders through gameplay are very difficult to measure, including trust, empowerment and relationship development, which ultimately may influence a person to change behaviors and actions.

Wider-scale application of games requires better study of their effectiveness, including how their usefulness varies across different applications and target audiences. Fortunately, games also offer opportunities to gather data to test their own effectiveness, and even test the effectiveness of other climate risk management interventions through participatory game models.

4.5.2 M&E of Games and by Games—Practical Tips

If Monitoring & Evaluation is aimed at the learning or behavioral change promoted by a particular game, the game itself can generate assessment data, particularly when a game's conceptual design coherently reflects its purpose (Mitgutsch and Alvarado 2012). For example, the same game can be played several times with the same participants and if the game is designed in such a fashion that participants must record their decisions during gameplay, evaluators can assess the evolution of game strategies among participants; this documented evolution can be used as a proxy for their understanding and application of real-world climate risk management options. To generate evidence of whether the change is lasting, or just a temporary response to success and failure observed

in the first rounds, a game can be run several times in a row—or several weeks, months or years later. Of course a key question is whether game-derived learning carries over to real-world situations. To assess outcomes of the game, behavioral change can be measured through regular M&E approaches. Surveys on attitudes would apply before and after gameplay, and criteria for assessment of the design of the game in relation to its purpose remains fertile ground for further research.

Can games contribute effectively to the achievement of risk management outcomes? Posing questions such as whether a game leads to "increased community resilience," one encounters the general challenge of identifying the separate effect of capacity building efforts on final development outcomes. Ideally, this would be measured using an experiment with control groups. For instance, in a project that aims to help local communities better understand and address risks to agricultural production, one could have one set of communities using games as part of the interventions to build their capacities, and another set of communities using more traditional learning methods to generate awareness and transfer knowledge on climate risk information. If both groups use similar physical inputs, and share other factors such as prior capacity, environmental conditions, etc., one might be able to identify the differential impact of the game-based strategy. In practice, however, as with any attempt to improve risk management strategies, double-blind setups are often difficult to achieve, as the success of both groups depends too strongly on too many other factors, including the quality of facilitators for both games and the more traditional capacity-building approaches.

Given a particular project objective, did our games help achieve that objective, as part of a wider range of efforts? In practice, evaluations must mostly settle on this somewhat mundane question. In many cases, the evaluation will have to be qualitative, relying on the impressions of those involved. Of course there is always the risk of extrapolation from one successful game application to a much wider set of potential uses. To avoid that risk, but also to test games on their particular strength—namely that the game dynamics can be somewhat standardized, and interest to play games is fairly universal—a particular focus should be on the ability to deliver at scale.

For instance, community-based climate risk managers are often struggling to undertake appropriate local vulnerability and capacity assessments, which form the basis for participatory planning or risk reduction programs. In practice, these assessments are highly time-consuming, and highly dependent on the capacity of facilitators, particularly when notions such as changing risk and use of

scientific information are concerned. The availability and quality of facilitators, discussed in Section 4.1, is a strong limiting factor in these approaches that need to reach scale (van Aalst et al. 2008). Games could be a way to achieve similar community dialogues, and efforts are underway to test their effectiveness by monitoring attitudes and ability to plan follow-up activities in community-based risk management work, including through the Zambezi River Basin Initiative in southern Africa (Maenzanise 2012).

Games can also contribute to a wider M&E framework, generating evidence on ability to process climate information for effective decision-making, and to test effectiveness of other capacity building efforts. One way is to play the same game with a group of decision-makers before and after a training. Or a game can be played with a community before and after a risk management project aimed to increase their resilience, to test whether a project has achieved the right combination of physical investments coupled with changes in decision-making and improved understanding of any new risk management strategies at the communities' disposal.

Much more needs to be done to solidly justify game-based learning and dialogue tools in development and humanitarian work. Long-term monitoring and tracer studies need to be applied following gameplay and to track the use of games in sets of interventions for specific projects. Games could be integrated as a recurrent element in policy interventions with stakeholder communities rather than being a one-off stand alone; impacts could then be measured accordingly. As previously noted, to design and measure tracers of change amongst the policy influence efforts is more challenging, but not impossible. Within the rural development community, impacts of games can be monitored and measured alongside other interventions commonly used.

5. So What?

The Pardee Task Force on Games for a New Climate has a clear objective: *to explore the potential of participatory, game-based processes for accelerating learning, fostering dialogue and promoting action through real-world decisions affecting the longer-range future, with an emphasis on humanitarian and development work, particularly involving climate risk management.* This report set out to share the main questions, insights and proposed next steps for this new and rapidly expanding field, predominantly with humanitarian and development practitioners (from donors to government officials and from NGO workers to community organizers), but also with professors, researchers, students, game designers, entrepreneurs, and other potential contributors to processes aimed at linking knowledge with action.

We have defined inhabitable games as systems that help us inhabit through gameplay the complexity of decisions about future risks—to better understand our current or potential transforming role—in a way that is both serious and fun. Our work has focused on face-to-face games, involving personal recognizance and "real" interactions, which are playable in any conference venue or under a tree in any remote village. Since our experience has grown primarily through the development of games that by design require no electricity or expensive assets, we have not explicitly addressed digital games. It is of course also clear that digital games carry a lot of promise, not only to reach more people but to experiment with innovative game mechanics and dynamics—such as massively multiplayer online or rapid-response, interactive simulation models that can process data and rapidly perform quantitative tasks beyond the scope of face-to-face games.

We have referred throughout this report to 'changing climate," meaning not only issues pertaining to variability and change in physical variables (like temperature, rainfall, wind speed and related extremes), which pose growing threats to the humanitarian and development objectives, but also more holistically to the social, economic, political, technological and also the cultural, emotional and spiritual forms of 'climate' we inhabit. Games are the medium of systems and we are concerned with the aggregate, constantly evolving state of the systems-of-systems shaping our present and longer-range future. Our exercise in thinking

about games for a new climate points to conclusions on three major aspects: rethinking the space of possibility, recommendations for next steps, and insights for the longer-range future.

5.1 GAMES FOR A NEW CLIMATE: REIMAGINING THE SPACE OF POSSIBILITY

Games amplify our imagination, like cars amplify our legs, or houses amplify our skins.

—Will Wright, creator of the game SimCity

What have we learned from the use of games for climate risk management so far?

Games are under-utilized, yet uniquely suited to address systems at risk in a new climate. Abstract concepts and real-world complexities, when conveyed through linear, conventional communication modalities, consistently fail to engage diverse audiences effectively. Yet systems thinking is increasingly important in an increasingly interconnected, interdependent, complex, volatile and uncertain world.

Games enable us to readily think about global environmental and social change in the context of a structured system, and to explore in a rational yet sensory and creative way the sometimes surprising or counter-intuitive outcomes of our individual and collective decisions—including consequences for ourselves, our community, other close or distant stakeholders (instantaneously or in the remote future), or even for the structure of the system itself. Games are arguably most effective when not prescriptive, rather allowing the imagining and testing of assumptions and other elements that inform and enable alternative futures to emerge through the immersive experience of inhabiting a complex system.

Games are one of the most efficient and effective learning tools for systems thinking. But they can do more. Purposeful use of games has the potential to promote the adoption of a locally-informed global culture of a new climate, grounded in a more holistic comprehension of our vulnerabilities to inherent risks as well as emerging opportunities for climate-compatible development. Towards this goal, we identify three process drivers of climate risk management that games can uniquely integrate through immersive, experiential learning:

- *Acceleration: games can help in accomplishing what is aimed for, faster or more efficiently than other approaches;*

- *Consolidation: desired learning & dialogue outcomes can be deeper, more robust & durable with game-enabled participatory processes;*
- *Innovation: games can cultivate motivated & inspired, out-of-the-box, creative thinking*

At the micro scale (i.e., the gameplay experience), games are purpose-built, so the process of developing learning games is fundamentally participatory at every stage. Game development necessarily follows an iterative, collaborative, analytically rigorous yet creative process that mimics the six stages of the risk management framework:

1) it begins with the definition of the learning and dialogue objectives, relative to a relevant problem and context—especially its key elements, relationships, and boundary conditions,

2) an initial assessment of the climate-related risks which will inform the game system outlined in the previous stage,

3) the identification of options that players must grapple with, with particular attention to trade-offs, i.e., how to elicit different choices that could yield different outcomes based on players' decisions as well as exogenous forces,

4) the structured selection among those choices so that decisions can be made and expressed in gameplay that map to real-world decisions,

Games let players collectively 'inhabit' a complex system and share the "huh?" and "AHA!" moments, which inform mutual learning and set the stage for deep dialogue.

5) an instance where decisions become actions that entail consequences—game outcomes that mimic the consequences of the real-world system, but without the real suffering that would be associated with actual bad decisions or bad luck,

6) and evaluation, where the results of gameplay are contrasted with the original objectives—often leading to the recognition that some or all stages need to be revisited.

During participatory processes, "dialogue" is all too often a series of monologues, guided (or dominated) by those who control the agenda. Games can "break the ice" through the shared common experience of confusion, exploration, failure and

success, collaboration and competition. By enabling players to collectively 'inhabit' a complex system and share the "huh?" and "AHA!" moments across a group of player-stakeholders, games share knowledge. This mutually reinforcing learning experience in groups generates a collective intelligence that can set the stage for deep discussion and truly participatory dialogue. Post-gameplay debrief is an important evaluative step which provides a means to not only share and consolidate insights gained through the common game experience but also to engage players in relating the game to their own reality—including suggesting ways in which the game could be improved, expanded, or adapted to additional purposes.

At the macro scale (i.e., considering the wider use of immersive learning games as a practical tool within climate risk management processes), games offer a platform for building consensus around the understanding of climate risks and how to manage them—or at the other extreme, for identifying and acknowledging irreconcilable differences in how different stakeholders conceive problems and differently value possible solutions. At this level, game-enabled processes also serve the climate risk management framework well by enhancing the chances of actualizing some of its fundamental premises, such as meaningful stakeholder engagement across all stages, and a truly iterative approach not bound by the sequential, linear way in which the framework is often interpreted and implemented. Games can help as a means for linking risks with decisions, testing the outcomes of different actions through gameplay, and evaluating their relative efficacy through post-game discussion on the consequences of players' decisions.

As a game outcome, collective intelligence reflects a highly contextualized co-generated understanding of the dynamic functioning of a particular system.

Games also offer a rich mine of potential data for understanding and diagnosing decision-making. Recording of data incorporated into the design of a game-mediated process can provide evidence to determine to what extent desired results (in terms of learning outcomes) may or may not be played out in real time, enhancing the measurement and assessment of wider results.

For stakeholders to grasp climate risks in a meaningful way, we need to explore new ways to be able to grapple with variability and uncertainty that is context-specific. A key contribution of the inhabitable games explored throughout this report is their proven capacity to get a group of people into an active learning mode and on the same page in coming to grips with complexity,

Tanzania Takes Games to a New Level: the Ground Level

Games engage people in thinking what is ahead.

—Amadeus Kamagenge, TASAF Acting Manager for Systems, Research and Training, after having played the prototype safety net game in Dar es Salaam

As this report goes to press, the Tanzanian government is embarking on a major innovation in the roll-out of a new productive social safety net program aimed at enabling farmers to better manage rising drought risk. In a pioneering use of immersive learning games, the game "Uwezeshaji kaya kuhimili" ('enabling households to withstand') has been designed to be used as the extension tool through which farmers across the country will learn about "TASAF" (Tanzanian Social Action Fund), how its system of conditional cash transfers works, and how participation can be expected to benefit rural families and communities. With support from the World Bank, a game was initially designed to help engender buy-in by immersing decision-makers in the system dynamics of the program. Players took on the role of subsistence farmers experiencing volatile rainfall, and competed against players in the role of TASAF beneficiaries over several rounds representing seasons of erratic rainfall. Through gameplay it became so clear that TASAF would be a worthwhile investment if implemented, that the request was made to design a simpler version of the game in local language to use in rolling out the program in communities. The game design process has been collaborative and participatory, involving game designers, climate adaptation experts and TASAF leadership and personnel. A cadre of 60 national trainers is to be trained in 2012 who will in turn train facilitators in 13 districts across the country. The aim of the World Bank in supporting this innovation is to put an effective and efficient communications tool for taking adaptation measures to scale into the capable hands of the adaptors themselves.

whether in terms of household or community-level risk management strategies or a development or humanitarian organization's internal strategic planning, external programming and projects. All players develop and share new knowledge within the risk management framework as the game system creates new ways to inhabit an iterative process of defining problem and context, assessing risks, identifying options to choose from, making decisions, implementing actions, evaluating consequences, and then again re-examining the problem and context. At the same time, games can provide a peer-to-peer learning experience tailored to a specific set of conditions that allows the players to bring their own diversity of knowledge and experience into the climate risk management problem-solving arena. Collective intelligence, as a game outcome, reflects a highly contextualized co-generated understanding of the dynamic functioning of a particular system.

Games offer a uniquely efficient way of solving problems from a holistic perspective, rather than at the level of discrete variables or interventions. They

give us a means to explore the margins of a problem to see what happens at thresholds—and in particular the moment where a threshold is crossed, to be able to know what likely consequences may be. This is extremely valuable in considering tradeoffs (such as whether to invest time and resources in short-term vs. long-term gains, or individual vs. collective resilience strategies), and within an organization whether to structure interventions for incremental transition within the system (for example introducing drought-resistant varieties to reduce food insecurity in an uncertain climate) or systemic transformation (for example reforming land tenure or labor rights to support farmer or worker-owned cooperatives to build local capacity for sustainable food production and livelihoods).

5.2 ROADMAP TO THE NEXT LEVEL: AN AGENDA FOR ACTION

There are of course many tasks that need to be tackled if we are to exploit the full potential of "inhabitable" games for disaster risk management and climate-compatible development.

Capacity Building: New kinds of partnerships need to be brokered to solve our climate crisis. Participatory tools like game design create the open space for diverse partners to effectively communicate, problem-solve, and democratize learning outcomes. Bringing game designers into the picture can help humanitarian and development organizations create game-enabled tools for consolidating, accelerating, and innovating in participatory processes.

What can be done to build capacity for game-enabled learning and dialogue?

The approach we propose requires substantial collaboration under real conditions, but there is a considerable gap to bridge between the humanitarian and development stakeholders on the ground, game designers (who tend to carry out their work in entirely different institutional and even geographical locations), and other stakeholders (from global policymakers and donors to the most vulnerable and marginalized communities in the developing world), who stand to benefit from the development, use and proliferation of games for a new climate.

- Cross-pollinating: We must reach out in new ways to tap new capacities. If at first it may seem like an unnatural fit (as per game designer Ian Bogost, "it is not a clean, comfortable place"), designing games for a new climate is a space worth exploring. A few very successful events and processes[18] have begun to

18 See, for example, http://www.gamesforchange.org and www.rhok.org for some of the most successful events of this sort, and http://petlab.parsons.edu/redCrossSite/about.html for a concrete collaboration between a humanitarian organization and a game design lab.

build bridges, but much more can be done. We need to create spaces for gamers and climate risk managers to converge, meet, understand their complementarities, and embark on new joint ventures. Today's game design students may constitute a particularly promising asset for climate risk management, as they bring in a rich skillset, a creative mindset, and many care deeply about humanitarian and development issues—they just do not know how to contribute, who to reach out to, where to start.

- Risk taking: We must try new ideas despite the certainty of uncertain outcomes. Game designers embrace failure as part of their iterative process, whereas humanitarian and development practitioners, like most climate risk management stakeholders, have no intention or even capacity to choose to experience likely failure. As in forecast-based disaster preparedness, the fear of acting in vain can be paralyzing. A game model will always be imperfect, but in some cases they may also be "the wrong model" (for example if it proves to be useless or misleading) and the game design process frequently entails abandoning a prototype and starting over with another game model altogether, without certainty at any given stage whether it will ever get to successful completion. As a result, we should expect occasional failure. If we are to create games for a new climate that help correct the flawed mental models which so often lead to failure to act, we must create safe spaces for taking the risk of sometimes acting in vain.

- Learning as we go: We must document, share and study successes and failures. Game design for climate risk management opens up new horizons full of promise but also studded with thunderheads. Knowing how to avoid game design minefields and how to recognize goldmines is something that requires time, brainpower, bandwidth, budget, and experience. Learning from failure aligns with the idea of trial and error—an important concept in invention and innovation, and these "lessons learned" often prove more valuable than knowledge framed as "best practices." Nonetheless, all too often we shy away from admitting failure because in a results-orients world driven by the need to demonstrate successful impact, acknowledging failure is likely to carry with it risks of loss of funding, ending programs, and other ramifications.

Research: The evidence base of games for a new climate needs to be expanded, rigorously assessing whether games improve risk management better than other methods, and whether they may exacerbate one problem while solving another.

We can begin with unpacking how effective games may be for each of the six stages of the risk management framework, how they help meaningfully and appropriately bring in diverse stakeholders, and help them work well both within and across each of the six stages—ultimately testing whether the game-enabled approach can adequately represent the complexity, volatility and uncertainty that characterize our changing climate. Research support should foster:

- Systematizing: We must adapt or create new research methods. There are rich opportunities for developing, testing and evaluating quantitative and qualitative methods for collecting and analyzing data and insights on immersive learning games to advance climate risk management. Climate game research can contribute not only to improving ongoing and planned initiatives for using games at a much greater scale, but also help develop game-based learning and dialogue methodologies to apply games as monitoring and evaluation tools themselves.

- Controlling quality: Study is needed to understand how best to reduce the risk of games going wrong. Only applied research will reduce the real and serious threats that can derail any game-based approach. We must enable the generation of feedback to inform improvements in the iterative design and use of games developed, and also provide donors with benchmarks to readily understand the resource, output, and flexibility performance of games in the context of a wider portfolio of investments. Systematized research can help establish the emerging field of serious games as a credible, useful, perhaps even necessary approach, and inform efforts to deploy them at scale.

- Disseminating: We must adapt or create spaces for sharing knowledge and debates. At present there are a few academic journals and conferences[19] that offer a venue for publishing and discussing game-based innovations. However, they tend not to reach the audience that most matters to climate-compatible development stakeholders; i.e., practitioners, scholars, funders and others in the humanitarian and development fields who play a role in climate risk management. As this field grows, it will be crucial to open new spaces for that growth to be visible—and widely accessible.

Design: Game development endeavors need to be nurtured to educate, innovate, motivate, accelerate and consolidate climate risk management.

19 See, for example, the journal *Simulation and Gaming* (http://sag.sagepub.com/) or the "Meaningful Play" conference (http://meaningfulplay.msu.edu/).

While games for a new climate are in high demand and rapidly proliferating, design and development are still in infancy. Targeted efforts are needed to unleash the evident power of games for:

- Motivating and accelerating: We must implement more, and better. The etymology of the word "implementation" derives from the concept of "filling inside." Given the growing need for doing more, better, and faster implementation of climate risk management, we need to draw from diverse areas of expertise. If natural sciences can help us learn what knowledge is best to fill with, and social sciences can teach us how people can go about the filling, games can not only motivate and accelerate implementation—they can change its dimensions. Games can help us explore the boundaries and pitfalls of what it is possible to implement.

- Consolidating: We must make game-enabled processes stronger, more coherent and whole. There is considerable scope for furthering the role of games in climate risk management initiatives, especially as complementary to a wider suite of methods. While there is fertile ground for examining the ways in which inhabitable games may help to support stakeholder (including donor) buy-in, engagement, decision-making and willingness to implement risk-reducing actions, it is fundamental to invest in the design, monitoring and evaluation of efforts aimed at making games integral to, and fully in harmony with the larger learning and dialogue processes of which they are part. Honest and critical examination of failures as well as successes in game design and implementation constitute a prerequisite for making genuine progress. As signaled in the cautionary notes and tips for success discussed in Section 4, many things can go wrong and it takes work to ensure it all goes right.

5.3 GAMES FOR THE LONGER-RANGE FUTURE: "ANALYSIS FOR A BETTER TOMORROW, TODAY"

Games are intrinsic to human culture across time and geographies, expressing many of the same ideas they did 5,000 or more years ago—yet continually diversifying in form and type—from sports to parlor games, board games to computer-mediated and online games. Common dice still represent the complexity of phenomena in the world and through their simple form, invite us to take them in our hands and roll them. The simple act of rolling results in a great deal of complexity as we try to grasp the subtle relationships between our own speculation, the choices we make based on this speculation, the stakes involved

in taking a gamble, and learning as we play in order to elucidate an overall strategy in the game.

Intentionally constructed games can help humanity tackle a changing climate where complexities, volatilities and uncertainties may be the hallmarks of a "new normal." Climate manifests as an enabler of human endeavor as well as a hazard to our assets and livelihoods. It can be a stressor as well as an amplifier of other natural or man-made stresses that may be experienced as dauntingly complicated, especially when considering the relatively unknowable forces and additional complexities that will shape the range of plausible futures. Those futures become "inhabitable" when the system that can lead to it is distilled into a game. Inhabitable games, as system dynamics models that can be enlivened by players interacting face-to-face, offer a platform to meaningfully engage and transform thinking and decision-making strategies.

Many of today's common yet inadequate unidirectional learning platforms leave decision-makers and stakeholders with little recourse other than passive engagement at best. Participatory games, in contrast, can offer numerous advantages over more linear, traditional forms of teaching and learning. Games have the power to communicate complex concepts in an emotional and engaging yet rigorous and effective way; games can transform passive consumers of information into active players who absorb and retain new information more readily; and games can enable individuals to experience how complex system dynamics and entrenched power relations may be temporarily dissolved and rearranged in a quest to discover the win state. In addition, this "no regrets" safe space created through gameplay can encourage players to switch roles and experience the consequences of their decisions from numerous perspectives.

The ability to question may be equally if not more important than debating the state of knowledge if we aim to better craft and expand the individual and collective choices that can help us shape our future. In this time of unprecedented scale and convergence of economic and political, cultural and technological, environmental and climatic change, the intricate, interdependent and interconnected system-of-systems that we inhabit and increasingly influence impels us to sharpen our ability to ask the right questions about alternative futures and actions. We can use games to test the consequences of decision-making, investigate alternative futures, point us to the questions we should be asking, and open new channels for dialogue. At a moment when the global discourse on climate is diverse and the debate divisive, the potential of games

deserves further serious consideration. By questioning assumptions and allowing alternative futures to be played out, inhabitable games can influence the nature of our discourse and our decision-making—helping us with the syllogism that "the future is uncertain and necessity is the mother of invention, so the best way to predict the future is to invent it."

Games reflect our questing nature, our innate desire to understand the complexity in which we participate as both active and passive agents. In this paper we have defined inhabitable games as playable systems that help us inhabit the complexity of decisions about future risks.

In our fast-changing world of rising risks, these inhabitable games offer much-needed impetus for motivating, accelerating and consolidating a new culture of systems thinking through innovations in learning and dialogue. Games for a new climate are a natural expression of our quest to understand and improve the human condition.

Games for a New Climate Task Force Members

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Appendix

Section 3 Case Studies: "Inhabitable Games"

This Appendix presents case studies to illustrate the arguments discussed in Section 3, through seven game-enabled processes for experiential learning on climate risk management:

Peer-to-peer learning games

- "Before the Storm"
- "Rockefeller Resilience Series"

Games as diagnostic tools and for imagining alternative futures

- "Paying for Predictions"
- "The Climate and Gender Game"

Co-design as a bridging process

- "Upstream, Downstream"
- "VIS-À-VIS"

Seriously fun games as motivators

- "Humans versus Mosquitoes"

Each case study includes a description and synthesis with the following information:

Goal: What was the climate risk management learning or dialogue objective?

Target participants: Who is the game designed to be played by?

Role taken by players: What decision-making responsibilities do participants take?

Min & Max number of players in past sessions: What is the range of participants that have actively engaged in one instance of gameplay?

Duration of game-based session: How much time is needed to explain rules, play, and debrief? (depending on number of players and length of debrief dialogue)

More information: Where can one find materials on the game? (Please note: this Appendix cannot provide enough information for readers to run a game session.)

Designed for: Organization that commissioned the game

Designed by: Individuals who led the design and development process (in alphabetical order)

Sample game turn & iterations

Problem / Context: What are the challenges and opportunities confronted by players? What are the most important changing conditions affecting player performance?

Understanding risks: What are the possible negative outcomes? What probabilities?

Identifying and evaluating options: What are the choices that players can consider?

Making decisions: How do players choose among the available options? (of many, one)

Taking action: How do players implement their decision? (action = motion with purpose)

Evaluation: How does the game reveal the consequences of players' actions? How can individuals and teams assess their current performance and envision plausible futures?

While the games in the selected case studies address all stages of the risk management framework, each case includes a more detailed figure, to illustrate how the gameplay experience emphasizes the relationships between specific stages in different contexts.

System dynamics

How does the game represent the main thresholds, delays, feedbacks, nonlinearities and trade-offs of the real-world system? *How does the gameplay experience get participants to first feel confused and then ask an important question (the "huh?" moment)? Does a crisp answer or epiphany emerge from gameplay or debriefing (the "AHA!" moment)?*

GAME CASE STUDIES 3.1—PEER-TO-PEER LEARNING GAMES

i) "Before the Storm": A game on forecast-based options and decisions

In many developing countries, potential users of forecasts often cannot understand the language and meaning of experts' statements about likely future conditions, and scientists cannot understand why their forecasts are not used. Stakeholders often have very different languages, perspectives, and priorities, and are not accustomed to jointly examining whether action is or is not advisable based on a given forecast expressed in terms of probabilities. To open dialogue aimed at helping information producers and users to understand each other, the Red Cross/Red Crescent Climate Centre joined forces with game designers from Parsons The New School for Design to accelerate the learning processes required to turn early warnings into early action.

A four-day workshop held in northern Senegal in December 2009 convened approximately 40 people who would not normally talk with each other:

- Scientists who produce forecasts at different time scales
- Red Cross workers who must try to understand, communicate and use those forecasts (without acting in vain)
- Vulnerable people—who can suffer or die if an early warning doesn't lead to early action

In order to find or create common ground for future, long-term collaboration among these diverse stakeholders, several tailor-made games were introduced, to create a playful atmosphere as a safe space for expressing confusions and exploring disagreements. One of these games is the card game "Before the Storm."[20]

20 See a four-minute video of "Before the Storm" gameplay in Senegal with humanitarian workers, forecast producers and vulnerable farmers and fishermen at http://www.youtube.com/watch?v=Mpj_EbKdwEo.

Goal: Promote meaningful dialogue among diverse stakeholders about the need to collaborate on turning science-based predictions into concrete decisions

Target participants: Forecasters, humanitarian workers and vulnerable communities (together)

Role taken by players: One community-level Decider (role rotates throughout game), surrounded by Advisors

Min & Max number of players in past sessions: 10 to 40

Duration of game-based session: 1 to 3 hours

More information: http://petlab.parsons.edu/redCrossSite/gamesBTS.html

Designed for: IFRC—West and Central Africa Zone Office

Designed by: Julynn Benedetti, Kurt Bieg, George Bixby, Mike Edwards, Mohini Freya Dutta, Ira Goldberg, Basak Haznedaroglu, Xi Lan, Colleen Macklin, Janot Mendler de Suarez, Claudio Midolo, Margaret Moser, Kelly Nichols, Eric Nunez, Michie Pagulayan, Maya Sariahmed, Alexander Stachalek, Pablo Suarez, Kyle Yang Li, Minhao Yu, Xian Zhang

Figure A-1

The game brings together three types of stakeholders whose roles are tied to different stages of the risk management framework. Through the gameplay process (solid arrows) scientists learn through the experience of decision-making, whereas farmers, fisherfolk and Red Cross staff improve their understanding of science-based forecasts and available options to manage risks—thus achieving the dialogue objective (dotted arrow).

Sample game turn & iterations

Problem / Context: A community confronts the arrival of forecast information about likely weather—not always easy to understand. What is a threat? What to do about it?

Understanding risks: Each turn, a forecast card presents expected future conditions with different lead times—and different levels of complexity in language (from simple but incomplete to technically rigorous but incomprehensible to non-experts).

Identifying and evaluating options: Each Advisor receives four illustrated action cards, each depicting a task that could be carried out before a disaster materializes: such as "evacuate," "preposition tents for shelter," or "wait and see." Advisors may write their own action card if they draw a blank "wild" card.

Making decisions: Each Advisor chooses the 'best' action card from their hand. The Decider chooses from all recommended action cards the one she thinks most appropriate for the forecast. Advisors receive 1 point for a pre-written action card and 2 points for a player-generated action card, if selected (Winner is player with most points by end of game).

Taking action: Advisors choose and place chosen card face down. Deciders select from all available and announce the chosen action.

Evaluation: Advisors may challenge a Decider's choice, generating discussion as the challenger advocates for her choice, the Decider defends her decision, and other Advisors vote to uphold or overturn the Decider's choice—considering real-world constraints and likely consequences of acting in vain or failing to act.

Lively gameplay engages producers, communicators and users of forecast information with very different backgrounds and skills in discussing how to select among multiple plausible forecast-based actions, and considering their merits and risks—including what can go wrong either in terms of "acting in vain" or "failing to act." Differences of opinion lead to rich conversations about the links between what science can say and what people are willing and able to do given vulnerabilities, capacities, cultural norms and other factors affecting whether early warnings trigger early action. Humanitarian workers and community members learn about the potential and limits of science-based forecasts. Scientists confront the irrefutable reality that their technical language is not universal and requires translation into thresholds for action. They also learn that when presented with scientific information, many people will choose to always act on received forecasts, regardless of probabilities. Generating locally appropriate options for forecast-based disaster preparedness at the community level is part of this exercise. Participants in Senegal became prolific proponents of new ideas, creating over 300 action cards (Suarez and Tall 2010). The Senegal Red Cross took this workshop to the vulnerable island village of Doun Baba Dieye in the mouth of the Senegal River where, through gameplay, people felt comfortable exploring and expressing their views and learning from one another, regardless of scientific credentials or levels of seniority.

System dynamics

Thresholds:

Players must assess if forecast constitutes a threat big enough to warrant possible action.

A critical number of Advisors are required to overturn a Decider's choice.

Delays:

Forecast cards impose likely future conditions for various lead times (the extreme event is forecast at a later time, but action must be taken now).

Feedbacks:

Dialogue among Decider and Advisors allows players to revisit their initial choice of action.

Trade-offs:

Advisors know arguing strongly may impair relationships with other players in future turns.

Each turn makes players focus on a specific risk, and work through a cycle to address options, decisions and collective evaluation. The important "huh?" moment usually comes when they see other players proposing choices that seem to not make sense given the forecast. The "AHA!" moment involves a sudden awareness of the need for communication and mutual understanding between forecasters and users, given the validity of their differences.

ii) Rockefeller Resilience series: Games for co-creating collective intelligence

To the extent that the game system is dynamically robust, the outcomes and results will "feel" real, and the experience of dawning realization in so-called 'AHA!' moments generates knowledge that constitutes authentic learning. Inhabitable games offer a simulated cross-section of reality where the system rules define possible interactions and potential outcomes that may not be known or predictable—even to the game designers. However, the sense of owned knowledge is personal, and players also come away with a sense that their personal understanding of the system dynamics is shared by the other players. This is refined through successive rounds of play, and consolidated in post-game discussion into a shared understanding. This collective intelligence is strengthened by the dynamics of the game design in the emotional experience of a shared struggle contextualized by the aesthetics, and in the empathy for actual vulnerable people that emerges from experiencing immersion in the mechanics of gameplay.

Thus can experiential learning games be used to aid in consolidating understanding across a team or entire organization. Game-based processes can be designed for redefining or deepening of an organization's mission, institutional-

ization of a knowledge base, or even horizontal integration of vertical hierarchies to release latent capacities constrained by operational or protocol structures. They can also generate insights and new knowledge, help to mobilize consensus as a tool in strategic planning processes, and elevate the level of confidence in making and carrying out decisions that may otherwise 'feel' risky (as a departure from business as usual) or because the rewards entail delays, and trade-offs are uncertain. The Rockefeller Foundation decided to experiment with the use of games to enhance a structured introspective process to deepen the organization's understanding of its mission, and to bring to light gaps or disconnects as well as potential for new linkages and opportunities within and across parts of the organization.

Goal: Enable members of a donor organization to explore and understand together more deeply the concept of "resilience," especially from the perspective of a beneficiary

Target participants: Rockefeller Foundation staff and leadership

Role taken by players: Most play as subsistence Farmers organized in Villages (teams), a few play role of external Donors

Min & Max number of players in past sessions: 8 to 50

Duration of game-based session: 45 to 90 minutes

More information: http://www.youtube.com/watch?v=wKHiTV9TaAQ

Designed for: Rockefeller Foundation

Designed by: Kippy Joseph, Janot Mendler de Suarez, Cristina Rumbaitis del Río, Pablo Suarez

Sample game turn & iterations

Problem / Context: Farmers begin with very few seeds. Extreme rains can ruin a harvest any year, unless farmers plant a crop suitable for the coming rains. Farmers that don't produce enough food must eat their savings (if any) or be forced to migrate to a shantytown. Donors can allocate their limited budget to support Villages before or after the rains—with variable effectiveness and uncertainty as to results. How to build resilience?

Understanding risks: A die represents rains (6 too much rain, 1 too little). After a few seasons, climate change emerges by substituting the toss of the die with the flip in the air of a truncated cone, to simulate the new, less-understandable probability of rainfall.

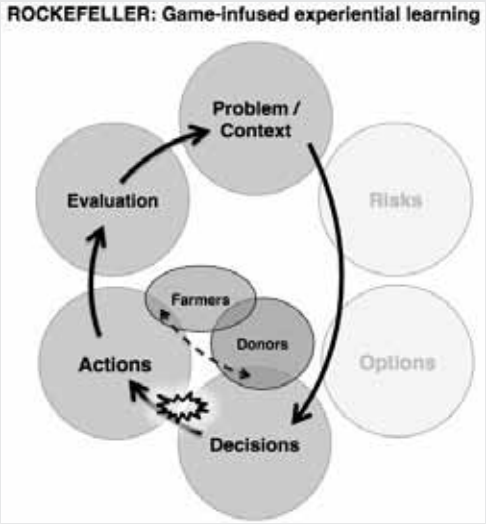
Identifying and evaluating options: Maize is the cheapest choice with good yield in normal years, but fails in drought and is washed out by extreme rains. Flood-resistant rice and drought-resistant cassava cost more, but yield food despite bad rains. Donors can help through disaster response, or by guiding Farmers' crop choices.

Making decisions: Individual Farmer decisions lead to collective Village patterns of exposure to risk (if all Farmers choose maize, the entire Village may have to abandon the game due to crop failure). Farmers can discuss whether to plant riskier maize or reduce their risk by investing in other crops. Donors and Farmers can discuss how to allocate Donor resources.

Taking action: A countdown represents the rainy season: Farmers must manifest their decision by walking to the area of the room designating their crop choice, where they may find seeds offered by Donors (Farmers may make the opposite choice, letting Donor investment go to waste). If crop failure threatens Farmer food security, Donors must decide how much to give in disaster response or to keep for guiding future Village investments.

Evaluation: Players see their assets grow or dwindle based on how well their planting decisions match actual rains. When climate change is introduced, players find it harder to understand new probabilities of extreme rains—and to make decisions accordingly. The different performance metrics of Farmers and Donors lead to different priorities.

Figure A-2



The learning objective of this game (dotted arrow) is to enable Rockefeller Foundation staff (donors) to gain a deeper and more holistic understanding of resilience by "walking in the shoes" of some of their beneficiaries: subsistence farmers. The gameplay cycle (solid arrows) highlights the risk of decision-to-action breakdown.

Most participants in the Rockefeller Resilience Game[21] were Foundation staff, joined by invited experts to engage in a fictional narrative where they became subsistence farmers facing a very simple depiction of climate risks and basic options. A few players assume the role of external donor, with an opportunity

21 See a short film about one of the sessions of this game (also known as "Dissolving Disasters") at http://www.youtube.com/watch?v=wKHiTV9TaAQ.

to guide farmers' decisions by delivering timely and targeted resources. The farmer-donor system is coupled and context-dependent, leading to emergent complexity: vulnerability evolves over time, and it isn't easy to complete the donor-farmer dialogue before the next rainy season. Donor decisions often fail to materialize as farmer actions—whether due to disagreements, changes of mind, or lack of time. This feature (a result of what the MDA framework would describe as an obstacle course through uncharted drama-filled territory) prompted intense emotional reactions and raised important questions about the strategic and tactical choices of the organization concerning its stated aim of enhancing resilience. While real-time evaluation of gameplay was making people redefine the problem and its context, in each round this affected players' perceptions of 'real world' choices currently confronted by the organization.

One of the takeaways from such a game experience is a deeper and expanded mutual understanding of specific dynamics of the system the game caricatures. In the Rockefeller case, the shared game experience was helpful in providing proxy markers for discussion about the organization's framing concept, resilience. Ensuing discussion from a systems perspective connected the dots from the individual level to community, national, external donor and global levels; this systems-based discussion raised issues such as whether to support incremental transition from a less desirable state to improved conditions, or whether to support fundamental transformation of the entire system, and what to measure in designing meaningful monitoring and evaluation at both the project and program level over the life of the organization.

However, it is the resilience experience created by the game which will likely best be remembered: enabling people who in actuality inhabit an elite and risk-insulated universe to experience what it felt like to walk, if ever so briefly, in the shoes of the economically and culturally distant intended beneficiaries of much of their work. In the words of one participant reflecting on her game experience: "I was a farmer." Not "I played a farmer"—but rather: *I can now personally relate in a way that feels genuine to a system in which I am a distant player. By playing a game, I felt what it feels like to have to make farming decisions with changing patterns of rainfall, limited access to resources, uncertainty as to the extent of potential donor assistance coming at the right time or addressing the right problem, and the risks of making decisions based on new information and opportunities, which may or may not increase my resilience to climate impacts over time. If I make the wrong decision, or if it takes me too long to figure out what the donor is offering to be able to take advantage of it in time for this growing season, my family goes hungry and*

I physically have to abandon our village to search for survival in a shantytown. The empathy experienced through the game, linking donors to their beneficiaries, may be one of the more profound learning outcomes of the Rockefeller Foundation's game-based resilience dialogue.

System dynamics

Thresholds:

Farmers lacking savings can't invest in drought/flood-resistant crops; so are more vulnerable.

Farmers without sufficient food must migrate to shantytown (leave the game).

Donors have limited funds, and may see their investments depleted without promoting resilience among Villages.

Delays:

Bad outcomes in one turn can substantially limit choices in subsequent turns.

Feedbacks:

As Farmers and Donors figure out the system, they may develop different understanding of what constitutes more resilient choices for the Village; deliberately limited interaction between them forces sharpening of communication during the brief time allocated.

Trade-offs:

Rapid accumulation by taking collective risks augments chances of escaping poverty, but can also threaten the well-being of an entire village.

One of the key "huh?" moments occurs when players realize they have no idea how to make choices given climate change. The "AHA!" moment usually involves realizing that resilience cannot be achieved without diversification and dialogue.

GAME CASE STUDIES 3.2—GAMES AS DIAGNOSTIC TOOLS AND FOR IMAGINING ALTERNATIVE FUTURES

i) "Paying for Predictions": A game on the cost, value, and use of early warnings

As discussed in Section 2.1, despite increasing availability of forecasts to help anticipate likely conditions at different timescales, the humanitarian movement regularly under-utilizes this information, often resulting in missed opportunities to take early action and prevent avoidable loss of life and assets. This pattern can be to some extent understood, given donor preferences for funding more visible disaster response over more elusive disaster risk reduction (few donors embrace

the logic of "invest now for deferred benefits much later to prevent something that may actually not happen"). Still, there are things that could be done with available resources to better address predictable risks. To this end, the Red Cross/Red Crescent Climate Centre, as part of an American Red Cross project, designed the game "Paying for Predictions."

"Paying for Predictions" triggers reflection by focusing on just three stages in the risk management framework—creating an intense experiential learning iterative process (see Figure 4 in the Task Force Report): a rapid cycle of "doing" (during

Goal: Trigger reflection around the value of acquiring and using forecast information about extreme weather events, especially given climate change

Target participants: Humanitarian workers. Also donors, forecasters, government agents

Role taken by players: Disaster Managers at the provincial level, in 'national' teams of three

Min & Max number of players in past sessions: 6 to 60

Duration of game-based session: 30 to 120 minutes

More information: www.climatecentre.org

Designed for: American Red Cross, with partial support from CDKN

Designed by: Janot Mendler de Suarez and Pablo Suarez

Sample game turn & iterations

Problem / Context: Floods lead to expensive disaster response, yet are often predictable, so investments in preparedness and risk reduction could make humanitarian work more cost and outcome efficient, but if floods don't materialize there is a risk of wasted investment ('acting in vain').

Understanding risks: Rainfall depends on a roll of the dice. One die represents regional rains (shared by a 3-player team, hidden under a cup), and each player's personal die represents local rainfall. Each turn, a sum of regional and local dice equal to 10 or more triggers provincial flood. The cost of disaster preparedness is 1 bean, before the roll of the dice. If a province experiences flood any players who did not invest must pay 4 beans. Players start with 10 beans and will play 10 rounds. Lack of beans leads to humanitarian crisis.

Identifying and evaluating options: At the beginning of the game, national teams can bid for an early warning system: Half of the teams—the highest bidders—will be able to see the forecast (i.e., the value of regional rain rolled) before making their decision whether to invest in disaster preparedness, for all 10 rounds of gameplay.

Making decisions: Players must discuss the value to their team of having access to the forecast and determine how much to bid for it. This requires them to imagine plausible future alternatives (with versus without the early warning system).

Taking action: A countdown ends the bidding: Each player must place 0 to 10 beans in the team's cup for the national bid. Highest bidders get the forecast. Over 10 turns, players take disaster preparedness action by standing up and paying a bean, or staying seated to indicate no action. The Disaster Manager with most beans at the end of the game wins.

Evaluation: At the end of the game players reflect whether it is useful to have access to the forecast, and how much would have been the ideal bid.

Figure A-3

The game "Paying for Predictions" is designed to trigger reflection among humanitarian workers about the value of acquiring information about predictable risks. The cycle of play makes participants evaluate whether they invested too much or too little in accessing a forecast to support their decisions, given scarce resources.

the decisions stage), "reflecting" and "learning" (during the evaluation stage), "planning" (right after the risks stage, upon learning of the forecast probabilities revealed each turn by the regional dice), and "doing again." With relatively simple rules, the simulation game drives participants through the cycle, forcing them to grapple with changing chances of disasters as they decide whether or not to invest in forecast-based flood preparedness. Through many consecutive turns, players discuss options and strategies among their peers, also observing the decisions and consequences of fellow players. Each participant can develop a broad and deep understanding of the long-term value of seasonal forecasts for humanitarian work—as well as their short-term limitations.

By allowing seamless data collection, this game offers a remarkable opportunity to learn how different humanitarian workers process probabilistic information—revealing biases and errors of risk estimation and judgment that, like the best M&E endeavors, clearly point to areas that an organization must improve. Importantly, data (from more than 10 sessions on 4 continents) shows that gameplay itself can accelerate learning about common errors; this can help people improve how they link early warnings with early action in the real world. In terms of the MDA framework, there is a strong element of self-discovery, as individuals must express their risk preferences and making their ideas and feelings known to fellow team members while collectively discussing how much to invest in bidding for the forecast—one of the richest learning and dialogue moments in the game.

System dynamics

Thresholds:

Players who run out of beans cannot avoid a humanitarian crisis.

Players who access the forecast must determine the value of the regional die at which they should invest in preparedness. Should they stand up if a 5? What about if they get a 4…?

Delays:

After several rounds, climate change is introduced by replacing the 6-sided regional die with an 8-sided die (substantially increasing probability of flood in all provinces, making for a delayed positive effect for those who invested in the early warning system).

Feedbacks:

Investing too frequently in preparedness may leave insufficient beans for future action.

Trade-offs:

While forecast access is desirable, bidding too much for predictions can leave a team without enough beans over the 10 rounds of play to take action when need arises.

Players must constantly compare the risks of acting in vain versus failing to act.

The moments before the bidding countdown offer one of the most intense "huh?" moments in all of the case studies described here, as players grapple with the complexities of the system they inhabit: how much is a forecast worth to me…to our team…to the other teams? Post-game debrief dialogue reveals a diversity of "AHA!" moments, but a consistent lesson emerging from debrief discussion is that many people invest too little or too much in preparedness in early rounds, gain a better sense of the system and probabilities as the game evolves, and then converge towards the dominant strategy of investing in preparedness only at the right level of risk.

An inhabitable game can offer a very precise way to see how a new course of action for adapting to changing climate risks will play out. The increase in probability of flooding in "Paying for Predictions" captures almost exactly the 2008 seasonal forecast of unusual chances of extremely wet conditions in West Africa, which led to the first-ever launch of an IFRC emergency appeal based on seasonal forecast (Braman et al. 2010). Simulating the occurrence of variable climate conditions where status quo action is increasingly risky (traditional climate patterns no longer inform the present) reveals how different adaptive decisions result in individual and/or community consequences that need to be understood over time.

ii) "The Climate and Gender Game"—bringing overlooked linkages to light

Addressing disparities in power dynamics is an important feature of games and is, moreover, a crucial aspect of knowledge co-production. Games can be constructed to mimic social injustice, enabling players to inhabit a slice of reality that is experienced as unjust or unfair in the way different players' opportunities and outcomes differ relative to others.[22]

Kenyan farming communities are experiencing more extreme droughts as well as floods, sometimes in the same district or at the same time in different parts of the country, so the Red Cross/Red Crescent Climate Centre worked with the Kenya Red Cross and PopTech to design a game that matches a new initiative in the village of Matuu to introduce drought-resistant cassava as an alternative to maize, and also simulates intermittent flood risk. Existing gender asymmetries include land ownership (over 90 percent of the land belongs to men), and unequal access to credit or fertilizer, which often accrue lesser benefit to women from farm work than their male counterparts (Fones-Sundell et al. 2012). In discussion with Red Cross leadership and staff from drought-stricken districts, the game designers also learned that when crops fail and no savings are available, farming families must put their last assets, their children, to work—and this can have very dire consequences, consequences that are markedly different for girls vs. boys. Departing from the game system used for the Rockefeller Resilience Game, designers stripped out all donor components, and infused the planting decisions with the "broken" element of gender differences.

22 See Section 4.1 for more on the influence of power dynamics and the ethical dimensions of gameplay.

Goal: Help subsistence farmers explore the option of planting drought-resistant cassava over time, and help Kenya Red Cross open community conversation about the differential impact of inequities confronted by women in a changing climate

Target participants: Subsistence farmers and humanitarian workers

Role taken by players: Subsistence Farmers playing in 3 'village' teams, initially one predominantly women, one mostly men, one mixed; then with all players randomly allocated the role of male or female

Min & Max number of players in past sessions: 10 to 60

Duration of game-based session: 45 to 90 minutes

More information: http://www.youtube.com/watch?v=R8eRhS2XnCA&feature=youtu.be

Designed for: Kenya Red Cross, PopTech, Nike Foundation, and Rockefeller Foundation

Designed by: Muli Elijah, James Kisia, Janot Mendler de Suarez, Pablo Suarez

Sample game turn & iterations

Problem / Context: More frequent droughts are making traditional maize an unreliable crop. Existing gender asymmetries tend to exacerbate climate-related disadvantages for girls and women (women start with less assets and have more limited access to farming inputs).

Understanding risks: A die represents rains (6 too much rain, 1 too little). After a few seasons, climate change emerges (toss of the die substituted with flip in the air of a truncated cone, to simulate the new, less-understandable rainfall). In time, some teenage girls become pregnant, adding to the food needs of struggling rural households.

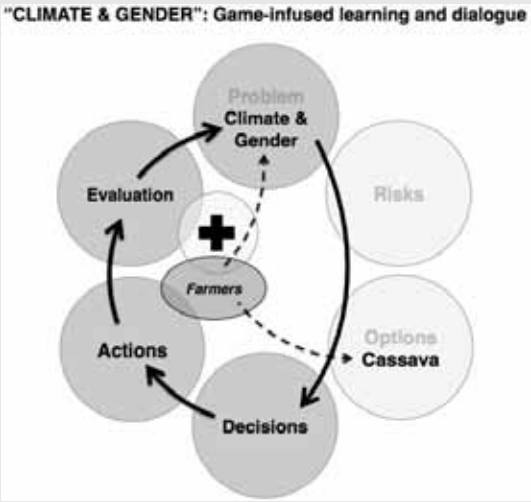
Identifying and evaluating options: Maize is the cheapest choice with good yield in normal years, but fails in drought and is washed out by extreme rains. Flood-resistant rice and drought-resistant cassava cost more, but yield food despite bad rains.

Making decisions: Farmers can discuss whether to take the riskier path of maize or to reduce risk by investing in other crops. Individual Farmer decisions lead to collective team patterns of exposure to climate risk; gendered teams allow observation of differences.

Taking action: A countdown represents the rainy season: Farmers must manifest their decision by walking to the area associated with the crop of their choice.

Evaluation: Players see their assets grow or dwindle based on how planting decisions match rainfall. When climate change is introduced, players find it hard to understand the new probabilities of rainfall extremes; after a few rounds it becomes clear that droughts are more likely than before. When gender roles are weighted, it is evident that women are differentially disadvantaged by climate shocks due to existing inequalities; when gender roles are switched, it becomes clear that women are equally (if not more!) likely to pursue successful risk management (planting) strategies.

Figure A-4



The "Climate and Gender" game was created with two objectives: help subsistence farmers explore the option of drought-resistant cassava, and help the Red Cross elicit farmer conversation about the inequities confronted by women in a changing climate. The gameplay cycle has an emotional peak with farmer actions but encourages evaluation.

The Kenya Red Cross is now using this game[23] to simulate the opportunities for climate risk management that can be opened through alternative planting decisions, and also to elicit deep conversation within affected communities around the differential implications and life-choice consequences of climate change for women and girls vs. men and boys.

System dynamics

Thresholds:

Farmers lacking savings can't invest in drought/flood-resistant crops; so are more vulnerable.

Farmers without sufficient food must migrate to the city in search of work (leave the game).

Delays:

Bad outcomes in one turn can substantially limit choices in subsequent turns.

Important "huh?" moments occur when both male and female players in the fictional role of "female farmers" realize that there is essentially no way for them to individually reverse the initial disadvantage women experience as a result of their gender in the game. The "AHA!" moment often comes at the end, when everybody sees that 'real' women in the role of males perform at least as well as their male counterparts (often much better), and that it is within the power of the community to change gender inequalities, or at least begin to openly discuss them.

23 A nine-minute training-of-trainers video of the Climate and Gender Game, filmed during gameplay in Matuu (Kenya) is online at http://www.youtube.com/watch?v=R8eRhS2XnCA&feature=youtu.be.

GAME CASE STUDIES 3.3—GAMES FEATURING CO-DESIGN AS A BRIDGING PROCESS

i) "Upstream, Downstream": climate, disasters and ecosystems in Central America

The game design process can assist decision-makers to formulate and address the right questions. In February 2012, Nicaragua and Guatemala country teams of the Partners for Resilience (PfR) program met to discuss key communication challenges in promoting learning and dialogue about disaster risk, climate change and sound ecosystem management for communities facing drought and flood risk in Guatemala and Nicaragua. The PfR program includes organizations with different but complementary priorities, including the Red Cross, CARE, Wetlands International, and Cordaid. In one afternoon, representatives of PfR country teams completed the six steps for participatory game design (outlined in Section 2.2.3), and shortly thereafter took the newly designed game to play in rural communities in Nicaragua.

To begin this co-design process, PfR partners (henceforth "co-designers") agreed that the communication challenge to be addressed would center on the role of climate-related information in decision-making at the community level, and how neighboring upstream and downstream communities could work together to manage consequences related to flood and drought risk, and deforestation.

Goal: Promote, among vulnerable communities that share a river watershed**,** learning and dialogue about disaster risk, climate change and sound ecosystem management

Target participants: Members of rural villages who either suffer from—or contribute to—rising levels of flood risk due to deforestation

Role taken by players: Subsistence farmers. Half the players are Upstream (in sub-basins with forested land, steeper, not-too fertile soil), half are Downstream (more fertile soil)

Min & Max number of players in past sessions: 8 to 24

Duration of game-based session: 1 to 2 hours

More information: www.climatecentre.org and http://vimeo.com/45150733

Designed for: Partners for Resilience (PfR): CARE, Cordaid, Netherlands Red Cross, Red Cross/Red Crescent Climate Centre, and Wetlands International

Designed by: About 30 members of PfR-CentralAmerica; workshop facilitated by Pablo Suarez

Sample game turn & iterations

Problem / Context: Communities confront risk of crop failure due to drought or floods. To deal with shocks, Upstream farmers usually have only one choice: cut trees to sell wood. There is little interaction between Upstream and Downstream farmers, and thus no exploration of how risks could be managed at the river basin level.

Understanding risks: Average rains in the watershed are represented by the roll of a die: 1 means drought for Downstream farmers. Each Upstream farmer rolls an additional individual die representing local conditions in the mountains (if the sum of watershed and local dice equals 10 or more, Upstream farmers experience floods, triggering crop failure and loss of young trees). Increased deforestation in an Upstream sub-basin makes flooding more likely. When half the Upstream farmers (or more) experience flood, Downstream farmers' most fertile plots are also flooded. After a few rounds, the watershed die is replaced with an 8-sided die, augmenting the risk of extreme rains. Farmers who lack enough food must leave the game.

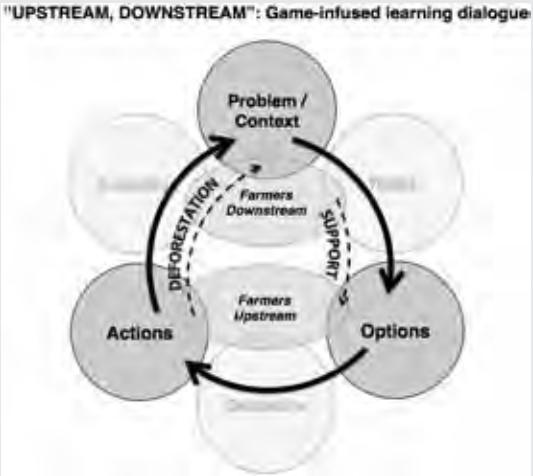
Identifying and evaluating options: Each farmer can plant crops, plant new trees, or cut and sell trees. There are no restrictions on exchanges between farmers (loans, gifts, renting land, etc.).

Making decisions: Players can discuss options, but must make individual decisions.

Taking action: A countdown ends the planting season: each player should have planted beans or trees, cut forest, or left the land fallow. After the rains farmers must secure consumption by selling crops or trees, or seek support from neighbors or an external donor.

Evaluation: At the end of each turn players reflect whether their individual and collective strategy is adequate to manage the risk of disasters.

Figure A-5



All risk management stages are part of the 'Upstream, Downstream' game process, but two kinds of connections emerge vividly during gameplay: how upstream deforestation creates a flood problem downstream, and how downstream farmers can support communities upstream, providing options so they are not forced to cut trees.

Two videos[24] capture the essence of a gameplay session that convened farmers from two Nicaraguan villages (one upstream of the other). During playtesting in the Nicaraguan village of Moropoto, players jointly came up with an innovative strategy to address changing risks: that downstream farmers would support their upstream neighbors (with loans after disasters and with subsidies to plant new trees in order to reduce risk of flood induced by deforestation) in what basically amounts to payment for ecosystem services—an environmental management approach that had not yet been introduced in the Moropoto area but was formulated independently by players.

The emotional journey for each player can be described as going from the experience of challenges (i.e., climate risks seem almost impossible to manage due in part to the consequences of other people's actions) to fellowship (i.e., working with farmers from other villages along the shared river opens new

System dynamics

Thresholds:

Players who run out of beans must leave the game.

Upstream deforestation increases risk: more landslides upstream and flooding downstream

Delays:

Tree planting has delayed effects: seedlings must survive two years without regional drought before they can be harvested for wood or reduce risk of landslide & floods.

Feedbacks:

Lack of options among upstream farmers leads to deforestation, increasing flood risk downstream—making downstream farmers look upstream as part of their own system.

Trade-offs:

Deforestation is a short-term solution for upstream farmers, with likely negative long-term consequences for communities in the entire basin.

After a few rounds, all players realize that options for Upstream farmers are too limited: on their own, their only survival choice is to cut trees. Once climate change is introduced, Downstream farmers realize that upstream deforestation is their problem too. The sharpest "huh?" moment comes when players ask themselves whether the system leads to unavoidable defeat… The "AHA!" moment arrives when Upstream and Downstream farmers start exploring options to give upstream farmers more choices (through some form of payment for ecosystem services) such as subsidized tree planting in the upper basin, or allowing upstream farmers to get higher yields by planting in some of the more fertile plots in the lower basin.

24 See four-minute video with gameplay in the village of Moropoto (Nicaragua): http://vimeo.com/45150733 and an overview of the Upstream, Downstream Game rules and facilitation at http://vimeo.com/45097866.

horizons for understanding and addressing the problem), to make-believe (i.e., in the simulated future, inter-community collaboration leads to climate-compatible development). From the lenses described in Section 2.2, the game evolves from a "system of conflict" to the paradigm of "game as open culture," in which players created a mechanism of payment for ecosystem services. An intriguing and powerful aspect of game development is that the very dynamic process of game creation can spur creative thinking that generates constructive ideas both for game use and around real issues. It is recommended that the planning process remain open to potential discoveries of the creative process itself.

ii) "VIS-À-VIS": Game design as a strategic planning tool for Oxfam America

In 2011, Oxfam launched a process of strategic planning for setting the direction of its future work. Resulting from a review of global trends and forecasting for understanding the world and the challenges faced in tackling poverty and injustice, Oxfam America observed that increasing inequalities, scarcities and volatility were global trends shaping the geo-political world and affecting diverse but related issues such as economic growth, climate change, food security, energy and political instability. This led to the consideration of the potential utility of conceptualizing these trends as a lens for framing the future work strategy and for assessing the growing challenges of ending poverty and injustice.

How to communicate these complex, abstract concepts and methods simply and concretely enough to spur meaningful reflection and strategic rethinking of future work?

Indeed, communicating the need to embrace complex concepts and approaches to analysis can prove daunting and, in an NGO setting, discussions on changes in broader methodological and analytical frames for assessing a system can present an additional challenge.

In this strategic planning process, a game seemed a well-suited heuristic tool to make the case for adopting renewed systems analysis and new organizing principles for future work. If well designed, a game could effectively boost understanding of a strategic vision anchored in the organizing principle of vulnerability as a function of inequality, volatility and scarcity and could help staff explore ways of better approaching the complex dynamics of an increasingly integrated global system. The key—and inherent challenge—was to represent in a simple way these complex relationships and causal webs concretely in terms of drivers and symptoms.

With this in mind, Oxfam engaged game designers to co-develop VIS-À-VIS (Volatility-Inequality-Scarcity), a game where players experience how complexity plays out through a number of relationships and choices around real and relevant issues including food, natural resources, climate, and political instability, and for addressing the issues of poverty and injustice.

The initial design was grounded in a set of four imaginary countries representing key typologies, with players attempting to keep people in their countries from falling into extreme poverty or even dying as natural disasters and food price changes triggered hunger and extreme poverty. However, this design resulted in player experience focusing too much on disaster response, and thus failed to capture the complex systems dynamics that Oxfam trends research was uncovering in relation to vulnerability and volatility. In other words: it did not represent the concrete focus of Oxfam's work or its approach to humanitarian assistance. Critique triggered deeper engagement and collaboration between Oxfam and the game designers, including the use of game trials to develop the game. This resulted in a board game covering rural, peri-urban, and urban terrain in a fictional country.

Goal: Trigger systems-thinking about how Oxfam's core concerns (i.e., Reversing hunger, poverty, and inequity) are impacted by the inter-relationships between growing volatility, inequality and scarcity

Target participants: Oxfam America leadership and staff; potentially global Oxfam, and public

Role taken by players: Government, two NGOs ("Ecotopia" and "Social Justice Now"), a national farmers' cooperative, and corporate actors ("Gigafarma" and "Megaminerals"). Teams of 6 or 8 compete as different countries, each team sharing one board

Min & Max number of players in past sessions: 6 to 12

Duration of game-based session: 1 to 2 hours

More information: *Stay tuned—game still under development as this report goes to press*

Designed for: Oxfam America

Designed by: Clay Ewing, Janot Mendler de Suarez, Kimberly Pfeifer, Pablo Suarez and Lien Tran; with input from Oxfam America leadership and staff

Sample game turn & iterations

Problem / Context: Different stakeholders have different objectives regarding their own or the population's land use; achieving objectives may require forming alliances or blocking others' pursuits.

Understanding risks: Population growth and urbanization put pressure on political stability. Climate change triggers food and economic shocks that compound inequality and scarcity, also leading to instability.

Identifying and evaluating options: Options include acquiring land, converting land to the player's preferred use ('natural' or 'transformed'), or giving incentives to the population to relocate. Each type of action requires sufficient resources in specific combinations of natural, social and financial capital.

Making decisions: Each round, all players have limited time to confer and negotiate; strategies include trading resources, sequencing actions, and making promises about future use of capital (in its various forms).

Taking action: Action is taken by 'spending' specific combinations of resources to implement changes on the board. Then a roll of the dice dictates population changes on the board. Economic or political crises may emerge as a cumulative result of player actions and population dynamics.

Evaluation: During the negotiation phase of each turn, outcomes of actions are assessed in order to revise strategies. At the end of the game, debrief discussion focuses on the dynamics of volatilities in terms of how climate change impacts, in the context of population and urbanization trends, trigger cascading shocks related to food, fuel, migration and political security.

Figure A-6

The game objective (dotted arrows) is to foster understanding of Oxfam's core issues through the lens of a Volatility-Inequality-Scarcity system dynamic. It is achieved through multiple rounds of gameplay (solid arrows) whereby stakeholders focus on negotiating options, and experience the consequences of decisions and actions.

The process of developing the VIS-À-VIS game for Oxfam offers valuable reflections on key challenges of developing and using games in the NGO context, the critical components of such efforts, and the potential for use of games by NGOs. While some may seem common sense or obvious, the significance of these lessons learnt cannot be overstressed, especially because their relevance in terms of investment may not be so obvious at the outset.

How to get a game structured to fit the specific culture of an organization?

It is critical to early on have the game structured in a way that broadly reflects how the agency works so that members readily see their work (and themselves) in the game. Without this, during trial runs of the game players will focus on any inaccuracies in the ways in which the game reflects the agency, consequently curtailing the ability of testing the game's utility through actual play.

Strong collaboration between agency staff and game designers during the game design process is vital to match game mechanics to an organization's outlook and approach to work. Additionally, staff must provide substantive details of their areas of work in order to assist game designers in linking mechanics with authentic content along with the intended lessons. For example, while a game designer may consider using food aid as a bridging mechanism in gameplay to illustrate relational aspects of different kinds of volatility in the context of Oxfam's work, this could actually become a distraction because Oxfam does not focus on food aid in humanitarian operations and because it would contravene the agency's stance on U.S. food aid.

How to acquire support, buy-in, and commitment for a game process?

Buy-in is essential[25] to see game development through to a useful end product, yet can be laborious to acquire. There are three principal reasons for this. First, games are not a dominant or mainstream tool for communication in international development NGOs, so it takes significant effort to convince members of an organization to endorse testing their utility. Second, there is a risk involved in investing significant resources in an alternative communication tool that does not have a guarantee of resulting in an actually usable game. Third, a sense of progress can get lost in the amount of time and number of iterations involved in getting a game right. Because game design involves both significant risk and level of investment in terms of amount of time, funds and staff time for input into a co-design process, the development of the game must have support or champions, both at a leadership level and among staff through various parts of an agency.

25 For more on willing audience limitations, see Section 4.3.

The very process of game design offers members of the organization the chance not only to understand the utility of the game but to participate in envisioning its purposes for the agency. Games take time, including staff time, to build as they involve the coupling of various types and layers of game mechanics with actual relevant content on which the organization seeks to communicate. Getting the content accurately represented by the game mechanisms in order to generate the desired messages and lessons can be laborious. But generating an understanding of the utility of a game in communicating messages and offering a means to realize lessons also takes place during the collaborative construction of a game. In addition, it offers the chance to shape content that can establish a sense of ownership, while having a hand in its creation can in turn sustain support for the vision and process of game development and deployment.

System dynamics

Thresholds:

A player wins when a quantitative goal is reached (for example, for Ecotopia "25% of land is secured as National Parks," or for Megaminerals "25% of land ringfenced for mining").

If population density exceeds a certain level, a political crisis ensues, triggering migration and government loss of influence (social capital is depleted).

An economic crisis is triggered if national resource pool of social, natural or financial capital runs out.

Feedbacks:

Population dynamics have cascading effects that increase system volatility.

Climate can trigger changes in food and fuel prices which affect resources needed for action.

Trade-offs:

Each of the players finds that her long-term objective (i.e., winning condition) cannot be achieved without negotiating alliances with other players with potentially complementary but also competing interests, triggering analysis of the trade-offs between collaboration and competition to achieve the best outcome.

Most players experience the initial "huh?" as a profound confusion about how the actions of other players will affect their own outcomes, generally reaching "AHA!" as a result of a breakthrough in team negotiations. A second "huh?" comes as players struggle to understand the cascading effects when cost of energy, climate-related events and other shocks introduce additional stresses, and a collective "AHA!" during debrief discussion about how these shocks compound system volatility, inequality and scarcity.

While the VIS-À-VIS game remains under development at the time of this writing, early positive response to the game has generated rich internal discussions about problems, context, risks, choices, stakeholders—and has triggered ambitious ideas for uses of the game beyond internal planning purposes with the realization that this game could well go on to become a constituency and outreach communication tool.

CASE STUDY 3.4—SERIOUSLY FUN GAMES AS MOTIVATORS

i) "Humans versus Mosquitoes": a game for dengue awareness in a changing climate

Developed in late 2011, a team of graduate students and faculty at Yale University and Parsons The New School for Design decided to create a game to raise awareness about an under-looked risk factor aggravated by climate change: dengue fever—due to increasingly favorable environments for the mosquito vector. Because there is no treatment or cure, to reduce dengue risk it is important to motivate people to take preventive action and clean up mosquito breeding sites. To make the game accessible to both adults and youth, a simple game mechanic, similar to the "rock, paper, scissors" game, was adapted in two formats for half a dozen players, one which can be played standing at a table, and a field version that is played like a game of "tag."

Goal: Raise awareness of rising risk of dengue given climate change

Target participants: Schoolchildren in areas at risk of mosquito-borne diseases. Also parents, humanitarian workers, health practitioners, educators, government officials, and donors

Role taken by players: Half the players are Mosquitoes, half play the role of Humans

Min & Max number of players in past sessions: 6 to 18

Duration of game-based session: 10 to 30 minutes

More information: http://humansvsmosquitoes.com

Designed for: Red Cross / Red Crescent Climate Centre

Designed by: Sophia Colantonio, Clay Ewing, Mohini Freya Dutta, Lauren Graham, Eulani Labay, Vanessa Lamers, Ben Norskov, Kanchan Shrestha, and Lien Tran (through a collaboration between Yale University and Parsons The New School for Design)

Sample game turn & iterations

Problem / Context: Mosquitoes attempt to bite Humans and lay eggs to reproduce. Mosquitoes may infect humans with dengue fever (a disease for which there is no vaccine, cure, or specific treatment). A changing climate may tip the scale in favor of mosquitoes.

Understanding risks: Humans may fall sick with dengue if Mosquitoes bite them too much and they run out of health (indicated by blood units). Mosquitoes may not be able to survive in that region if Humans successfully clean up their breeding grounds. Before each turn a card is drawn to show changing risk conditions affecting Mosquitoes and Humans.

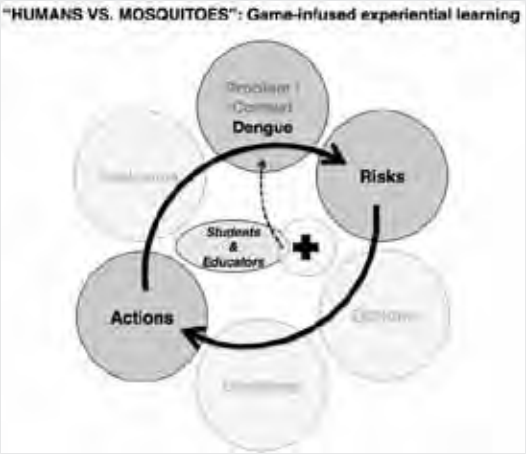
Identifying and evaluating options: Mosquitoes can either bite a Human (to get blood for breeding), or lay an egg (which can only be done with human blood). Humans can either protect from Mosquito bites (using repellent, mosquito nets, etc.), or attack Mosquito breeding grounds.

Making decisions: For a very brief period before each turn, teams can discuss a strategy (whether to pursue predominantly attack or defense, how to protect team members, etc.).

Taking action: A rapid countdown establishes the instant when all players must simultaneously act (as in the game "rock-paper-scissors"). In the tabletop version, Mosquitoes can either point to a Human (bite) or point to one of three breeding grounds (& lay an egg by adding one unit blood to it), while Humans can either cross their arms (protect from Mosquito bites) or attack a Mosquito breeding ground (by pointing they can remove a blood unit). If a Mosquito bites an unprotected Human, she draws one blood unit from the attacked player (a Human falls sick and must leave the game if all blood/health units are lost). In the field version, players run as some try to tag others, and eggs are laid or attacked.

Evaluation: At the end of each turn players have almost no time to think about results: the next risk card is shown and players must make action decisions before the imminent countdown.

Figure A-7



The fast-paced game 'Humans vs. Mosquitoes' takes only a few minutes to learn. Gameplay involves a rapid sequence of assessing changing risks and taking action, leading to raised awareness about the rising threat of dengue and other mosquito-borne diseases and the role of climate change.

The rules of this quick and intense game[26] capture the basic dynamics of how changing climate conditions increase mosquitoes' chances of success. It is deliberately designed to be playable in vulnerable communities, and the game mechanic is adaptable to other climate-sensitive vector-borne health threats. Gameplay sessions in over 10 countries have raised dengue awareness by motivating students, Red Cross youth and other stakeholders to learn more about this climate risk management problem.

Although designed to primarily target schoolchildren, its effectiveness for adult audiences was evident during the UN Climate Conference held in 2011 in Durban, South Africa: the enthusiastic participation of members of parliament from African and Latin American countries, as well as the head of the International Federation of the Red Cross—Africa Zone, along with youth from across the world, led to memorable "huh?" and "AHA!" moments and concrete ideas for scaling up the game in Ugandan schools. Humor was also contagious when one team of mosquitoes launched psychological warfare by buzzing loudly signaling likely attack. A Climate and Development Knowledge Network (CDKN) grant has provided funding for game designers from Yale and Parsons to deploy this game to study practical application and policy implications in selected African and Asian countries.

System dynamics

Thresholds:

Humans who run out of blood/health units must leave the game.

If all eggs are removed from a breeding ground, one of the Mosquitoes dies.

Every second counts for improving team strategy, but discussing for too long may leave players unprepared to take action in time for the rapidly-approaching deadlines.

Risk cards may change the thresholds for Mosquito breeding or Human health.

Trade-offs:

Investing in an attack strategy can lead to success, unless the opposing side anticipates intentions and counterattacks the exposed vulnerable elements of the system.

This fast-paced game makes players flow repeatedly through a cycle that focuses on two key steps: assessing risks and taking action. After a few rounds, when the changing climate creates favorable conditions, a "huh?" moment vividly materializes: how can Humans ever win this game? The "AHA!" often emerges collectively during debriefing: Humans must design a collective strategy within the first few rounds, and implement it without flaws to remove breeding grounds before the Mosquito situation goes out of control. This serves as a good starting point for discussion about what can be done in the 'real' environment to reduce the risk of mosquito-borne diseases.

26 See http://humansvsmosquitoes.com for complete rules and other materials.

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The Pardee Center Task Force on Games for a New Climate was convened by Pardee Visiting Research Fellow Pablo Suarez on behalf of the Pardee Center in collaboration with the Red Cross/ Red Crescent Climate Centre.

The Task Force members include a dozen experts from academic institutions, humanitarian organizations, other non-governmental organizations, and game design firms with backgrounds ranging from climate modeling and anthropology to community-level disaster management and national and global policymaking as well as game design. The members met in March 2012 at Boston University in a day-long session that combined brief presentations, plenary discussions, small group sessions, and intensely interactive participatory activities (including games of course) that led to the collective capture of key ideas presented in this publication. They also participated in a separate day-long event with BU students and faculty and others that combined gameplay (featuring five of the games described in this report) and discussions on the potential role of games in academia, government, NGOs, and the private sector.

The Task Force was convened to "explore the potential of participatory, game-based processes for accelerating learning, fostering dialogue, and promoting action through real-world decisions affecting the longer-range future, with an emphasis on humanitarian and development work, particularly involving climate risk management." This report is the outcome of that effort, providing a detailed exploration of the current and potential ways in which games can be used to help a variety of stakeholders—including rural farmers, humanitarian aid workers, scientists, policymakers, and donors—to both understand and experience the difficulty and risks involved related to decision-making in a complex and uncertain future.

For more information, visit http://tinyurl.com/BUPardee-G4NC.

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