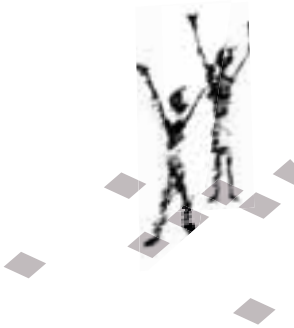

The Systems Thinking Playbook for Climate Change

A toolkit for interactive learning

giz

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The Systems Thinking Playbook for Climate Change:
A Toolkit for Interactive Learning

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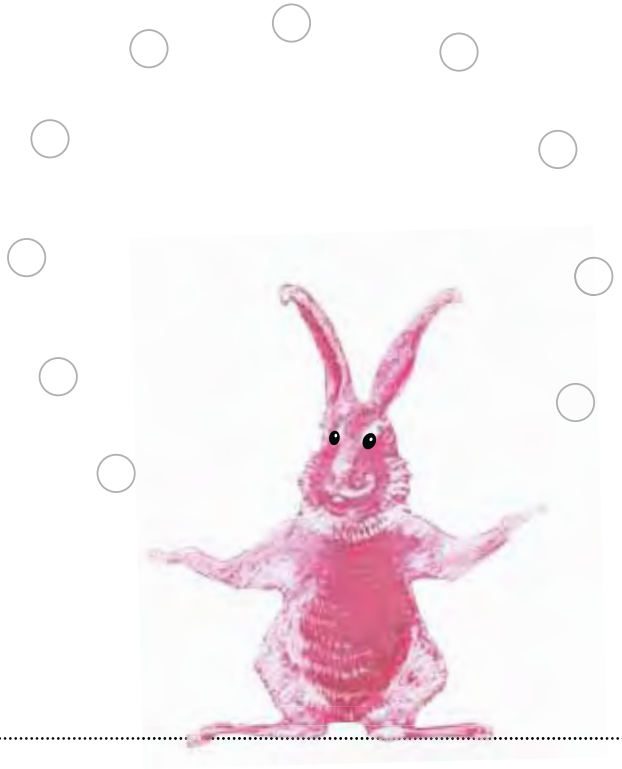
Linda Booth Sweeney, Dennis Meadows, Gillian Martin Mehers



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preface

Rising emissions of greenhouse gases (GHG) are causing global climate change with the potential to threaten our species' very existence on this planet. There is an emerging consensus on this threat, yet total annual emissions of greenhouse gases continue to rise. They rise in all countries. They rise annually in the nations that signed the Kyoto Protocol, and they rise in the nations that did not. The rate of increase declines slightly when economic problems reduce economic growth. One nation's true contribution to global greenhouse gas emissions may be obscured, if that country imports energy-intensive goods from another nation, but shifting CO_2 emissions from one country to another does nothing to improve the global climate. Global emissions still continue to grow.

Why? – We have a paradox: emissions are growing despite rising concern about the climate change they cause. It is possible to identify several reasons for this paradox, most of which lie outside the scope of this book. But one important reason is relevant here. People do not understand the dynamics of the climate system.

Because people do not understand the dynamics of the climate system, they easily make mistakes that are potentially lethal in their consequences. People assume, for example, that when climate change becomes obviously detrimental, there will still be time enough to make changes that will avoid disaster. They assume that solutions for destruction of the present benign climate can be found using the same paradigms and policy tools that threaten the planet's hospitableness in the first place. They assume that the relevant consequences of an action will appear near in time and space to the action itself.

Preservation on this planet of a climate that can accommodate our species will require drastic changes. Those changes are generally known but they are not politically viable. At the very least, political feasibility will require a widespread

understanding of the causal relations between the human activities that generate GHG emissions and the eventual biological, chemical, and ecological features of the Earth's climate.

Exhortation is a weak stimulus for action.

When I hear, I forget
When I see, I remember
When I do, I understand

What can be done? – Simple interactive exercises, we call them 'games' or 'strategic exercises', have the potential to help participants understand by doing. In *The Systems Thinking Playbook for Climate Change*, we present 22 games that will be useful to those who are trying to communicate with others about the causes and consequences of climate change. These simple exercises can facilitate the process of communication and education.

This book is a companion to the GIZ publication *Climate Change Information for Effective Adaptation* that set out to "enhance the capacity of practitioners and decision makers in developing countries by translating relevant aspects of climate change research into their every-day working contexts." That GIZ publication summarizes the basic science of climate change and suggests how one may use historical examples and current data to perceive and demonstrate the effects of climate change on local weather. However, once practitioners have identified local effects of climate change (e.g. on precipitation patterns, temperature levels, wind fluctuations, and sea level), there remain two important challenges: First, inspire local citizens to care about the effects and, second, help them to formulate and implement effective policies. Meeting those challenges requires communication and education.

Greenhouse gas levels will continue to rise as long as people make fundamental mistakes in their perceptions of climate change's causes and consequences. The 22 games present in *The Systems Thinking Playbook for Climate Change* do not constitute a self-standing course on climate change, any more than a few spices constitute a meal. However, practitioners who use these games can enormously enhance the appeal and the effectiveness of their verbal presentations about climate change and climate policy. We intend that this book will help practitioners in their efforts to help citizens perceive climate change, diagnose its causes, anticipate its future consequences, and effect constructive change.

dynamics of the climate system

When using the 22 games in this book, it is important that the game administrator understands climate change. This will enhance imagination and creativity. The following example of behavior relates to climate change.

Think of a bathtub -->

It can be affected by an inflow of water through the faucet and by an outflow of water through the drain hole. The content of the bathtub at any moment is the cumulative difference between inflows and outflows. Obviously, climate change is enormously more complex than a bathtub. Nevertheless, the bathtub example does offer some important insights about greenhouse gases and how they influence climate change.

When the inflow of water into the tub exceeds the outflow, the tub contents increase. When inflow and outflow are equal, at whatever level, the tub contents remain constant. When the inflow is less than the outflow, the tub contents will decrease.

Now, assume that you have left the drain hole unplugged while the water is flowing in. As long as the amount of water being put into the tub by the faucet is more than the amount of water flowing out the drain, the level of water in the tub will increase. When the water level eventually rises above the level you want, you will begin to close the faucet. However the water level does not start sinking immediately. Only eventually will you reduce the faucet inflow until it is smaller than the drain outflow. Then the tub water will start to fall. But it does not go to zero immediately. Even after the faucet is closed, it will take quite some time until the tub is completely empty.

The atmosphere is like a tub. Emissions of greenhouse gases are the inflow, and the various processes that remove greenhouse gases from the atmosphere are like the drain hole. Except that the average lifetime of greenhouse gas in the atmosphere is much longer than the time water normally remains in a tub – it is decades or centuries or perhaps millennia. There is still enormous controversy about the precise magnitude of the lifetimes of CO_2, methane and other greenhouse gases in the atmosphere. Estimated values for CO_2 half lives vary from 5-15 years to 50-200 years. Each of these estimations is probably partially correct, since greenhouse gases leave the atmosphere in a variety of ways, e.g. absorption into the ocean, chemical combination with minerals in the weathering of rock, in-

corporation into biomass through photosynthesis, and other processes.

Scientists are preoccupied with determining precise figures; most people are not. You do not need to know the precise figures; you only need to realize that you are dealing with a problem that confronts you with very long delays.

CO_2 in the atmosphere at several hundred parts per million is in itself little cause for concern. The problem is that those levels of CO_2 affect the level of heat energy in the atmosphere: CO_2, as well as other greenhouse gases, acts like the glass on a greenhouse where plants are grown. This process, again, is subject to a delay: Even if the worldwide emission of greenhouse gases was reduced right away, it would still take time for the heat level to start sinking.
Differences in heat energy cause a wide variety of phenomena that we collectively label climate, such as rainfall levels, wind velocities and air temperature. But there is more: These phenomena have further effects, from melting glaciers and ice caps to flooding arable land, raising the sea level and causing more damage from wind storms.

These latter effects are adequate cause for great concern. You have no way to influence them directly. Human control does not go very far in this chain of events: Your only real potential for influence is through altering the level of greenhouse gas emissions, the inflow to the “tub”.

Now that you understand a little about bathtub dynamics, you can begin to see their counterparts in the climate system.

Glossary -->

Certain terms from systems thinking appear frequently throughout this book, and particularly in the descriptions of the games. To make them easier to understand, the most important terms are explained here.

Change, incremental

Incremental change is gradual, as opposed to massive or instant change. This type of change can normally be accomplished within the existing institutions using existing policies.

Change, structural

Structural change occurs when you alter the way a system functions. This type of change requires changes in existing policies and institutions.

Flow

A flow controls the rate at which movement occurs in and out of a stock.

Frame

A frame is the context within which you would like your participants to consider the game. "Framing" is the introduction to the exercise that permits participants to bring relevant parts of their own past experience into the activity.

Free rider

A free rider is a player who attempts to gain the long-term benefits of the group's policies without personally paying the short-term price required to implement those policies.

Leverage

A leverage point is a place in the system where a small change can effect a substantial change in the behaviour of the system.

"Limits to Growth" archetype

A system archetype is a simple pattern of structure and behavior that is widely observed in many different settings. The "Limits to Growth" archetype is the set of elements and interrelations that facilitate and then stop growth in a limited environment.

Loop

A loop is a closed set of cause and effect relationships, each element of which can be viewed as having a partial influence on its own behavior.

Stock

An amount of something that increases or decreases over time – trees, fish, people, goods, clutter – is called a stock.

System

A system is a set of elements that interact to achieve some purpose.

how to use this book

First published in 1995, *The Systems Thinking Playbook* has become a favorite of educators and trainers wishing to use systems thinking to support transformational change. For this new version, designed to help promulgate better understanding of climate change, we adapted 18 of the original games in *The Systems Thinking Playbook* and added four new games.

Playing and learning -->

This book aims to help experts, advocates and educators to be more effective in talking with groups about climate change. If they are used well, the games can be relied on to increase the effect of workshops, speeches and conversations. Each game is described for practical delivery. For each of the 22 games, the description begins with some relevant quotes related to climate change and the game dynamics. This is followed by a 'climate link' section with specific information related to climate change, to be used for framing the game and considering the most effective context. Explicit instructions are given for each game in the section 'To run this game', which includes:

- Number of people
- Time
- Space
- Equipment
- Set up
- Instructions
- Debrief

The use of physical interaction and games can greatly enhance the ability of those who are concerned about climate change to help others to understand its key concepts and strategies. In this context, the games are metaphors that provide one way to understand various aspects of climate change. However, there is no learning in the games themselves, only in the discussion of the games. Game administrators should thus be careful not to spend more time playing the games than debriefing!

Choosing a game for your purpose -->

The games can be categorized by their function and by the conceptual errors they help to illustrate.

Function

Each game functions in one of three ways.

1. Mass games --›

These games can be played by a large number of participants. They do not require the participants to interact with each other. Each person in the audience interacts with the speaker. These exercises can be carried out by participants while they remain sitting in their seats. Mass games can involve directly every member of even extremely large audiences, for example in conference settings. A single facilitator can lead thousands of people through a mass game.

2. Demonstration games --›

These games involve a smaller number of people. Participants can play these games while they are observed by the larger group. Games in this category typically involve groups of 4 to 10 people, while very much larger groups can draw lessons by observing the exercise.

3. Participation games --›

These games involve interaction among the participants and physical movement. They cannot be carried out by sitting participants. Participant games may be used for groups as large as 50 people or more. They are best suited for use in seminars or workshops. Participation games could be played in demonstration mode, but it is more effective to involve everyone in the audience directly in the exercise.

System behaviors and conceptual errors

Climate change is characterized by six behaviors that make it very difficult for people to understand and address. These dynamic behaviors are explored in *Climate Change Information for Effective Adaptation*, the GIZ publication on which this Playbook builds. For each behavior there is a corresponding error – a failure to understand the true nature of the climate change process.

1. Habitual behavior --›

Climate change results from actions that have become deeply embedded in the habits of our society. Actions that used to be beneficial now threaten the survival of our species. Thus efforts to reduce climate change will force us to change our habits.

2. Inappropriate frames* --›

The problems caused by climate change, such as a melting icecap in the Arctic or floods in Pakistan, occur in places very far away from the actions that produce them. Thus the efforts to reduce climate change will force us to look in new places for information.

** The term "frames", which you will find repeatedly in this book, is frequently used in systems thinking. It refers to the focus or perspective on a phenomenon.*

3. Consensus under uncertainty --›

Climate change is caused by a complex set of interactions that are not fully understood or accurately measured. Thus efforts to reduce climate change require groups to discuss and reach consensus about novel problems that they do not fully understand.

4. Autonomous behavior --›

The system that causes climate change is not fully under our control. It contains processes that can escalate on their own. Thus efforts to reduce climate change require that we understand how the structure of the system can generate autonomous behavior.

5. Long delays --›

There are very long delays in the system. We are not yet experiencing the full consequences of past emissions. Even after taking strong and effective action, we can expect to see climate-related problems persist for many decades.

6. Magnification --›

The system has the capacity for magnification. A seemingly small change, for example raising CO_2 concentrations in the atmosphere by a few parts per million, can cause major problems such as the permanent loss of species.

To guide you in selecting an exercise best suited to your circumstances and goals, we have developed the Games Matrix (p. 13). In it each exercise is classified and labeled to indicate whether it is a mass game, a demonstration game, or a participation game. And it is labeled to indicate the system behaviors and conceptual errors it may be used to illustrate. Our classification of each exercise is illustrative; we encourage you to find other ways to use each of the games in this book.

Things to consider before getting started --›

Close physical proximity is involved in many of the games. This is usually acceptable to Western participants. Proximity to strangers (especially of a different gender) may be disturbing to people in many societies. Game administrators will need to assess the situation and respond appropriately. If one or two people seem to feel uncomfortable with the exercise, enlist them to help in some way, e.g. by checking for compliance with the rules or by observing. If three or more participants will be uncomfortable with a specific exercise, do not use it. If male-female contact is an issue, consider dividing the participants into a male subgroup and a female subgroup.

Watch to ensure that no exercise places anyone under physical stress at any time, or poses the potential for someone to lose their balance and fall. These exercises have been run hundreds of times with no problems, but it is always wise to be cautious.

During discussion and the debrief, it is best not to call on a specific person. Putting someone on the spot might be embarrassing. Allow the participants to choose to share their thoughts, or not.

Debriefing guidelines -->

Debriefing after each and every game is essential. The groups, goals and circumstances of the games will vary so much that it is impossible to provide precise instructions for each game. However, the seven steps outlined below provide some practical guidance.

Debriefing is essential to realizing the full potential of these games. The debrief may take a few minutes or it may become an extended discussion. But there absolutely must be some general discussion of the game and of its relation to the more general purposes of your session, i.e. promoting understanding and action related to climate change. Summarize the main experiences and insights immediately after each game.

After each game session, the debriefing may follow all seven steps. For any specific game, however, you may choose to skip some of these steps or to condense several of them into one phase of your conversation with the participants.

Seven steps for debriefing

1. -->
Describe the problems and events that occurred during the game.

2. -->
Determine the extent to which those problems and events also occur in the real system.

3. -->
Decide what factors in the game were responsible for those problems and events.

4. -->
Determine the extent to which those factors are also present in the real system.

5. -->
Identify changes in the game that would avoid or solve the most serious problems.

6. -->
Indicate how corresponding changes could be made in the real system.

7. -->
Gain commitment to achieve the necessary changes in the real system.

Ensure that the players feel a sense of responsibility for the behavior that occurred in their game. This is critically important. If they attribute it to some exogenous influence, random variable or a mistake by the facilitator, they will have no incentive to examine the game process and learn from it. Through your careful facilitation, you can help them to become students of their own behavior. But you must do this in a way that avoids embarrassment. The group administrator could employ this kind of language, for example: “When a group of intelligent people like you, who honestly want to do well, behave in this way, there must be an underlying reason.” Do not let participants imagine that you consider their behavior to have come from stupidity, ignorance or ill-will.

The Games Matrix -->

Name	Function			System behaviors and conceptual errors					
	Mass	Demon-stration	Partici-pation	Habitual behavior	Inappro-priate frames	Consensus under un-certainty	Auto-nomous behavior	Long delays	Magnifi-cation
1 Arms Crossed	x			x					
2 Avalanche		x				x	x		
3 Balancing Tubes			x					x	x
4 The Bathtub Game		x						x	x
5 Biodiversity Game	x				x				x
6 Circles in the Air	x			x	x				
7 Frames	x				x				
8 Group Juggle			x			x	x		x
9 Harvest			x	x		x	x		x
10 Hit the Target		x					x	x	x
11 Hands Down	x				x				
12 Living Loops		x					x	x	
13 Paper Fold	x						x		x
14 Paper Tear	x				x	x			
15 Pens	x				x	x			
16 Space for Living			x	x	x	x			
17 Squaring the Circle			x		x	x			
18 Thumb Wrestling	x			x	x	x			
19 Triangles			x				x		x
20 Warped Juggle			x			x			x
21 Web of Life		x				x			x
22 1-2-3- Go!	x			x		x	x		x

1 ARMS CROSSED

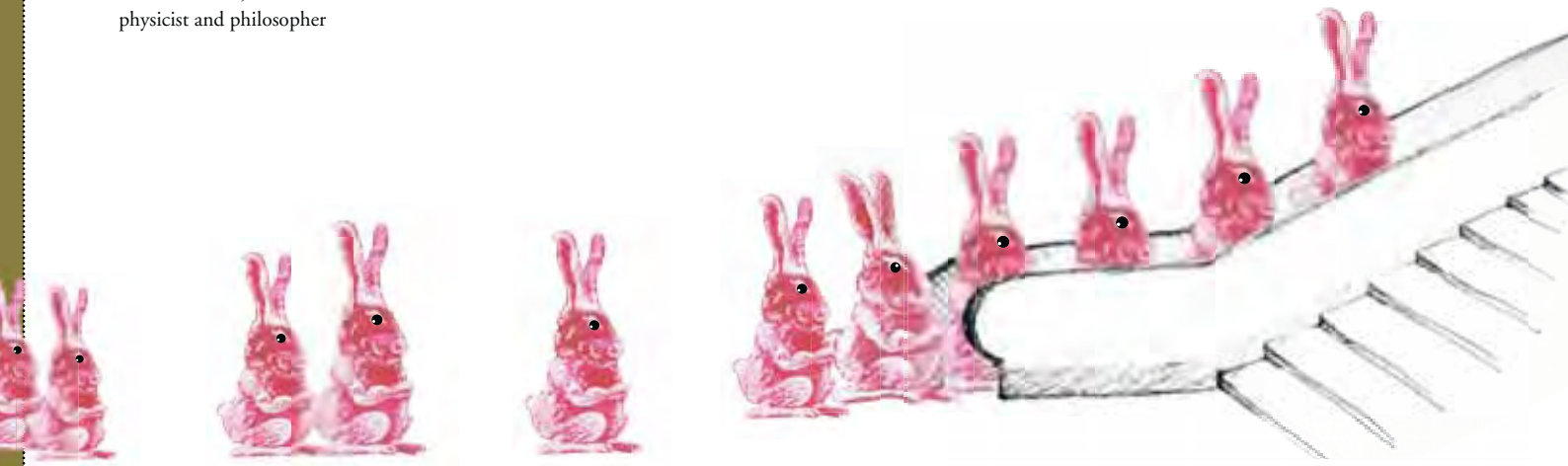
Climate change requires habit change.

"The problems we have created in the world today will not be solved by the level of thinking that created them."

Albert Einstein, theoretical physicist and philosopher

"Bad habits are like a comfortable bed, easy to get into, but hard to get out of."

Unknown



Climate link --> The accumulation of greenhouse gases in the atmosphere continues because human society has developed a set of habits related to economic and demographic growth. Those habits will produce those gases at an ever-increasing rate. In order to reduce the rate of climate change, the habits must be changed. No matter how dangerous or dysfunctional are the current habits, there will be important groups that fight against any effort to change them. Successful efforts to combat climate change will require society to develop new habits of consumption, of location, and of comparison. This exercise alerts us to some of the consequences of trying to change our habits.

About this game --> *Arms Crossed* is useful because it is quick, it requires no special equipment, and it works well with audiences for which English is not their first language. The version described below is very different from the one that first appeared in 1995 in *The Systems Thinking Playbook*. Over the years, the ways it is introduced, conducted and debriefed have all evolved.

To run this game -->

Number of people

This is a mass game. It can be played with audiences ranging from a few people to a thousand or more.

Time

The game takes several minutes. The length of discussion is up to you.

Space

There should be enough space to accommodate participants comfortably. This exercise is suitable for a large audience of people sitting in their seats. It is only necessary that every participant can see and hear you.

Equip-ment

None

Instructions -->

Lead the group through the following process: *"Now I am going to lead you through a brief activity. I need for everyone to participate. So anyone who is holding something, a pencil or pad of paper, for example, should put it down."*

Look around the group and ensure that everyone is ready to follow your instructions. If you see someone who is still holding something, ask them to put it down.

"Everyone fold your arms." As you say this, fold your own arms to illustrate what you have said.

"Now look down and note which wrist is on top, and remember whether it is the left or the right."

"Now drop your arms." Drop your own arms to your sides in order to illustrate what you want them to do.

"Now cross your arms again. Look down and remember which wrist is on top."

Pause long enough for them to accomplish both your instructions.
"Now drop your arms."

"Now we will conduct a little survey. Everyone who had the same wrist up both times, raise your hand." You should raise your own hand to illustrate what you want while saying to the group, *"I had the same wrist up both times."* (Of course you need to make sure that you did actually fold your arms the same way both times.) Normally all but a few people will raise their hands. Look around the group. Remark, *"Almost everyone had the same wrist up both times."*

"But that is desirable. Folding your arms is what you do when you need to focus your attention on something that does not require your arms. Once you find an action that gets your arms comfortably out of the way, you use it whenever it is required. It would be a big waste of time if you had to start from the beginning to find something to do with your arms every time you wanted them out of the way."

"Since almost everyone folds their arms in the same way, time after time, there must be an optimum way to do it. Let us see what it is."

Next see how many people cross their arms the way you do. In these instructions, we will assume you, the facilitator, had the left wrist up both times.

"Everyone who had the left wrist up both times, raise your hand." You raise your hand and remark, *"I did."* Then drop your hand.

"Everyone who had their right wrist up both times, raise your hand."

Look around the group. Ignore the scattered few who folded their arms differently each time and thus did not raise their hand after either of your preceding questions. Normally it will be about 50 percent one way and 50 percent the other.

"That is interesting. About half of you have the habit of doing it one way, and half have the habit of doing it the other way. There is no optimum. You could do it either way. But once you find a habit that works, you just keep using it without question. It may even not occur to you that there is a different way to do it, and that many people around you use that way."

"We create habits because they are effective. As long as they are effective, we can do them automatically. We do not have to think about them. But sometimes, conditions change. Then a habit that was effective is no longer useful. Then the habit must be changed. I am going to give you practice in changing your habit."

"Everyone cross their arms the other way." You do it yourself, making some effort to show that it requires thought and perhaps an initial mistake.

Wait for 30 seconds. Typically there will be some nervous laughter from the group.

"Congratulations, you did it. But notice three things that are always true when we change our habits. First, it is possible. You did all manage to cross your arms differently than normal." Pause and let them consider your statement. *"Second, it requires thought and probably some preliminary mistakes."* Pause and let them consider that statement. *"Third, it is uncomfortable at first. You all felt a little strange doing it differently than normal."*

"For over 250 years, humanity was made better off through actions that brought more and more energy under our control. We developed an extremely effective set of habits for promoting increased energy use, rising food production, more and more use of the forests, and so forth. Now circumstances have changed. To sustain human welfare, we need to reduce our impact on the climate. We need to reduce our use of activities that put more greenhouse gases into the atmosphere. We have to change our habits."

"As we struggle to change the habits that we have adopted over the past several centuries, we will notice the same three facts: (1) We will be able to do it, but (2) it will take careful thought, and (3) it will no doubt entail mistakes. There is no way we can understand the

correct path immediately from the beginning. We will certainly make mistakes. And it will be uncomfortable at first; many people will not like the new habits, at least at first. We are not going to be able to develop effective policies for combating climate change that make everyone happy."

Debrief -->

- *What societal habits seem most influential in producing rising greenhouse gas emissions?*
- *Are those habits necessary, or would it be possible to behave in a different way?*
- *If you accept the three lessons from Arms Crossed, how would you build on them to have the best chance of changing society's habits?*

AVALANCHE 2

This game has been adapted from the original *Systems Thinking Playbook*. Its name derives from the fact that the game was first played using avalanche probes. These have now been replaced by hula hoops.

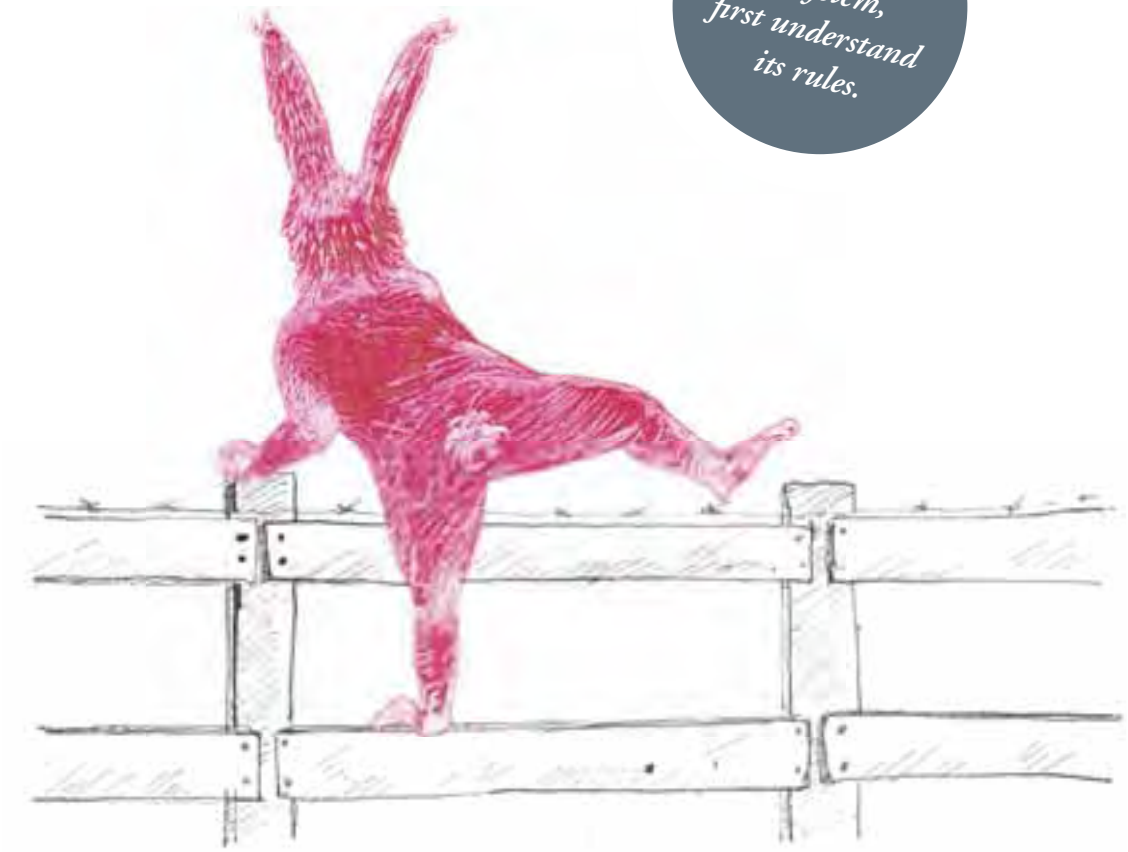
"Learn the rules so you know how to break them properly."

Dalai Lama

"If I'd observed all the rules, I'd never have got anywhere."

Marilyn Monroe

To change a system, first understand its rules.



Climate link --> Governments say they will reduce their nations' greenhouse gas emissions, but the emissions keep going up. People claim they are concerned about the long term, but their actions promote short-term gains, even when they will produce long-term costs. Legislators campaign on the promise to do something about climate change, but when they are in power, they do little.

In each case the rules of the system are producing outcomes different from what many people claim they want. The rules are embedded in laws, administrative custom and cultural norms. The rules that have caused climate change will not let us avoid climate change. We need to change the rules. This exercise shows that when a set of rules produces a problem, merely trying harder will not solve the problem, as long as the effort is enacted within the same rules that caused the problem in the first place.

About this game --> This exercise requires some practice in order for it to produce the desired results. When you know how to conduct it, you will have a powerful object lesson for your participants. Most negotiations are based on the implicit assumption that if everyone agrees on a goal and works hard to achieve it, success will follow. The Kyoto accord is based on this assumption, for example. But success does not always follow. Often the implicit rules of the system produce a result very different from what people want and expect. Using this exercise, the results may be very graphic and VERY surprising. If your colleagues think that they only need to 'educate' people in order to start dealing with climate change, this exercise may jolt them out of that complacent frame of mind.

To run this game -->

Number of people

This is a demonstration game. Conduct one session in front of a large audience. 7 people are required to carry out the game. Pick these people from the front of the audience, in order to minimize the time lost while people move to the game area. You may want to ask for volunteers. Then, after about 5 seconds, if none step forward, simply point to people in the front row and ask them to join you.

Time

10 minutes to conduct the game and 10 to 30 minutes to discuss

Space

You need enough room that you can stand in the middle of a tight circle of 7 people. This group is in front of and in plain view of all the other members of the audience.

Equip-ment

You will need a hula hoop. A plastic hula hoop of 70-90 centimeters or more in diameter works fine.
If you need to carry the hoop in your luggage, it is best to buy one that can be assembled from pieces.
If you assemble a hoop for the exercise, you can make it as large as you like.

Instructions -->

Assemble one hoop and place it near the podium, so that it is easily available to you when you are ready for the exercise.

As a demonstration game, you may be introducing *Avalanche* within the context of a presentation or broader program. At the appropriate time, explain to your audience that you are going to interrupt the program for a brief exercise, and explain why.

Hold up the hoop. *"I ask you to imagine that this represents the level of CO_2 in the atmosphere. Our goal will be to lower it. Starting here (hold the hoop at your waist height) a team of us will work to lower it, taking it down to the level of the ground. I need a team of seven people."*

Ask for volunteers or simply point to seven people in the first row or two of the audience. Make sure your group does not include anyone who would have physical difficulty bending over or kneeling down on the floor. *"Please come up here." "In just a moment I am going to ask you to work as a team in order to reduce these emissions; that is, to lower the hoop to the level of the ground."*

"There are three rules that you will all need to follow. Please pay attention as I describe them. They are extremely important."

Try not to cause stress among your group members. Reassure them you will be watching carefully to make sure that everyone follows the rules. Explain that if anyone violates a rule, you intend to point them out to the rest of the group.

"First, hang your right arm down, so that the elbow is near your waist. Extend your right hand out in front of you, palm down, make a fist and extend your index finger." Do this yourself to illustrate what you want.

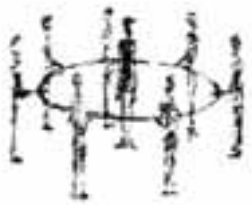
"Please stand around me in a small circle. In a moment I will lower the hoop down until all of you are supporting it, each of you with the top of your index finger touching the hoop."

"There are two rules. The first rule is that each person can only touch the hoop with the top of their finger. The second rule is that no one must ever, ever lose contact with the hoop. This is a team effort. And if any of you loses contact, it means you are not doing your fair share of the work. If I see that any of you loses contact, I will stop the game and start again from the beginning, but without resetting the clock."

"When you are ready, I will let loose of the hoop and say 'Go!' Then someone in the audience will use their watch to see how long it takes you to complete the task of lowering CO_2 emissions. I will stay inside your circle, thus inside the hoop. You should not lift the hoop over my head; just lower it as quickly as you can with me inside."

Now ensure that the seven group members are more or less equally spaced around you. Lower the hoop down to the level of your waist and ensure that everyone is touching it with the top of their finger. You do not need to be grasping the hoop; you can push down on it semi-firmly from the top with one finger of each hand.

"Before we start, I will ask the audience, 'How long do you think it will take for this fabulous team to accomplish their goal?'" Give the audience a chance to ponder your question. Solicit answers from one or two members. Then ask for someone in the audience to use a watch with a second hand to time the effort. Now look around at the members of the seven person team, ensuring that everyone is touching the hoop.



"Remember, each of you, it is EXTREMELY important not to lose contact with the hoop. Are you ready? Go!"

At the moment you say "Go!" raise your fingers up from the top of the hoop and center yourself inside the hoop, to make sure that the hoop does not touch you as the group strives to lower it.

Typically as soon as you quit pressing down on the hoop, it will start to rise up. As soon as it rises to the level of your head, or higher if it is moving fast, grab it.

Sometimes it remains more or less level as the participants struggle to understand what to do and how to coordinate their efforts. Watch the hoop carefully. Almost always you will see someone lower their finger and momentarily loose contact with the hoop. If that happens, point it out. In a humorous way chastise the person who violated the rule and make a big show of bringing the hoop back to the level of your belt and starting again. Eventually the hoop will start to move up. Normally it accelerates as people try to maintain contact with it by pressing up. Eventually you can say, *"Okay. We need to stop now. Thank you all for a terrific effort. Please sit down."*

Almost every time, the group's effort to lower the hoop will have failed. This "failed" effort is the starting point for your debrief. In very rare cases, however, the group succeeds in lowering the hoop to the ground. If that happens, thank them and bring up another group to repeat the exercise. But normally you will have a "failed" effort and move on to the next step.

Wait until they are seated and then begin the debriefing.

Debrief --> *"What happened? The goal of the group was to take the hoop down. What actually happened to the hoop?"* Let someone give you the obvious answer: 'The hoop went up instead of down.'

Now you need to make sure they are not embarrassed by their failure. *"When a group of smart, well-intentioned people like our group here (indicating the seven) fail to do something that they all want to do, there must be a systemic reason. Why did that happen here?"* Give your audience time to reflect and venture opinions.

"It happened because the rules produced a different result from the one we wanted. Those who created the rules may not have intended this to happen, but it did. So, what were those rules?

First, each team member could only touch the hoop with the top of their finger and, second, no one was permitted to lose contact with the hoop. As long as those rules are in effect, success is practically impossible. You could send everyone to an athletic club for exercise but it would make no difference. Even though everyone understood the rules and the rules seemed reasonable, they prevent success. Why? In order to maintain contact, each member needs to press their finger up against the bottom of the hoop. That tends to raise it. When it rises, other members of the team need to raise their finger up to maintain contact. It is a vicious circle, and the hoop goes up instead of down.

It would be easy to change the rules to get the desired result. You could, for example, let people pinch the hoop instead of resting it on the top of their finger. Or say that it is okay for someone to lose contact with the hoop. But you need to make some rule change in order to achieve the stated goal."

Sample debrief questions:

- *What are some of the rules that seem to govern society's response to rising levels of CO_2 and other greenhouse gases in the atmosphere? How are these rules communicated?*
- *Will we be able to avoid climate change while those rules are observed?*
- *How could the rules be changed to give a better chance for reducing greenhouse gas emissions?*

BALANCING TUBES 3

Agree on time horizons to produce effective action.

"The appropriate time horizon for socioeconomic scenarios depends on the use to which they are put. Climate modelers often use scenarios that look forward 100 years or more. Socioeconomic scenarios with similar time horizons may be needed to drive models of climate change, climate impacts, and land-use change. However, policymakers also may wish to use socioeconomic scenarios as decision tools in framing current policies for climate change adaptation. In this context, time horizons on the order of 20 years may be more appropriate, reflecting the immediate needs of decision makers."

Climate Change 2001: Impacts, Adaptation, and Vulnerability. 3rd Assessment Report of the IPCC

"Why do people underestimate the time delays in the response of climate to greenhouse gas emissions? Obviously the average person is not trained in climatology. We hypothesize, however, that widespread underestimation of climate inertia arises from a more fundamental limitation of people's mental models: weak intuitive understanding of stocks and flows – the concept of accumulation in general, including principles of mass and energy balance."

John Sterman and Linda Booth Sweeney, *Understanding Public Complacency About Climate Change* (2007)

"Advocates can try to frame global warming in a way that makes it seem like the kind of 'here and now' crisis we are familiar with, or they can do the much harder work of reframing value systems so that we do something rare for our species: act now to limit risks facing our children and their children."

Andrew Revkin, New York Times journalist

Climate link --> In policy challenges involving an immense number of causes, effects and unintended impacts – such as climate change – our typical approach to decision making fails, in part because we never experience the impact of our decisions.

When considering actions or research related to climate change, it is important for groups to agree on the time horizon of a specific study or action. For instance, over what time frame do we expect high volume emitters of carbon dioxide to change behaviors, particularly when there are no immediate consequences to their actions? Agreeing on time horizons can help groups to avoid the miscommunication, misunderstanding and conflict that arise when group members have implicitly adopted different time horizons for an issue.

About this game --> Using a hand-made tube, this exercise offers a physical experience from which participants can increase their awareness and understanding of appropriate time horizons, particularly as they relate to climate change.

This game does not convey all aspects of the time horizon concept but it does make this important point: When you are trying to understand and control a dynamic system, there will be an appropriate time horizon within which your observations can lead to insight and to effective management. Focusing on changes in the system that occur over shorter or longer periods than the appropriate time horizon will not give you control.

To run this game -->

Number of people

This is a participation game. It can be played by any number of people.

Time

5 minutes for the game, 10 or more minutes for debriefing

Space

1 meter between each person. Have the group standing in a circle so each person can see the performance of the other.

Equipment

1 paper tube for each participant, approximately 3 centimeters in diameter and 1 meter long. Alternatives are sticks or cardboard tubes of similar dimensions.

Prepare enough tubes ahead of time. Using newspaper or newsprint, begin at one corner and roll diagonally around a broom handle. Slide it off and tape it. You might place one tube at each seat prior to the arrival of participants. Or, store the tubes in a paper grocery bag and quickly pass them around just before beginning the exercise.

Instructions -->

Step 1 --> Tell participants, *"Your goal is to balance this tube on your fingertips."* With your palm facing up, demonstrate balancing the tube vertically on your fingers. *"First balance the tube while focusing your eyes on a spot just 3 centimeters above the point where the tube meets your fingers."* Pause to give the group time to try this.

Step 2 --> *"Now, balance the tube while focusing your eyes on a point at the top of the tube."* Pause while the group tries this.

Step 3 --> *"Finally, try to balance the tube while focusing your eyes on the ceiling."* Wait for your group to try. Participants will find it difficult or impossible to balance the tube of newspaper on their fingers when looking at a spot that is either too close to their fingers or too far away.

Debrief -->

Here are a few questions to begin with:

- *Which of the three methods worked best?*
- *Why do you think it was easiest to balance the tube when focusing on the top of the tube?*
- *What was changing when you shifted your perspective?*

The main factor that changes when you shift from one focal point to another is the length of time between the tube starting to fall off balance and your eye detecting the movement, and then providing the information required for your hand to adjust. This is because the tube must move a certain distance before your eye can detect that it has changed position. This is sometimes referred to in psychological experiments as "the Just Noticeable Difference" or JND.

When you focus on the bottom of the tube, the top must move a great distance to provide the JND stimulus you need to counteract the fall. Typically, you will be too late, and the tube will fall. When you focus on the top of the tube, the top needs to move only a little to give you the JND move-

ment you need to cope. So your response is relatively quick and usually effective in maintaining balance. Of course when you focus on the ceiling, the tube can fall almost completely off your finger before you will notice its movement, and there is practically no control at all.

Here is the key lesson to take from *Balancing Tubes*: If you want to control something, the time horizon you choose must be compatible with the dynamics of the systems. If your time perspective is too short or too long, you will not be able to control satisfactorily the behavior of the system.

Ask, *"What long-term climate change policies are currently being made on the basis of short time horizons and short-term considerations?"*

More debriefing suggestions

You can also make the point, as you debrief *Balancing Tubes*, that 'wait-and-see' attitudes are the equivalent of focusing your eyes on the ceiling. Here is one way you may opt to discuss 'wait-and-see' attitudes:

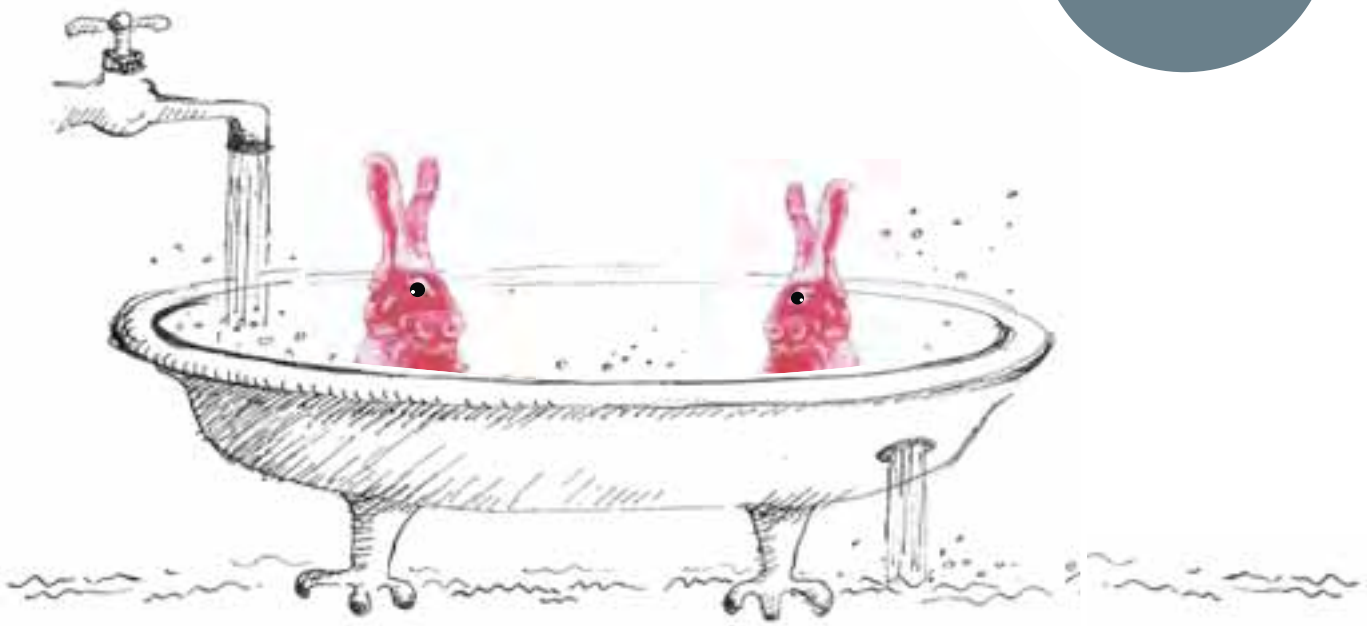
*"Some situations, such as boiling water for tea, have short time delays and very clear time horizons. In boiling water for tea, one can imagine the time horizon to be approximately five minutes. The delay between action (filling the tea kettle and boiling the water) and results (a cup of tea) is very small. Few complex public policy challenges have such short delays and time horizons. Yet surveys show that while people believe that climate change poses serious risks, they also believe it is safe to delay reductions in greenhouse gas emissions to a level sufficient to stabilize atmospheric greenhouse gas concentrations, until there is greater evidence that climate change is harmful. Indeed, many policy makers around the world argue that it is prudent to 'wait and see' whether climate change will cause substantial economic harm before undertaking policies to substantially reduce emissions." **

Such wait-and-see approaches are dangerous because they (1) underestimate the substantial time delays in the climate's response to the consequences of human emissions; and (2) presume that climate change can be reversed quickly when harm becomes evident through, for example, changes in ice cover, sea level, weather patterns and agricultural productivity or changes in the distribution of species, extinction rates and the incidence of diseases.

** For more on public complacency about climate change, see John Sterman and Linda Booth Sweeney's paper: Understanding Public Complacency About Climate Change: Adults' Mental Models of Climate Change Violate Conservation of Matter, Climatic Change 80(3-4): 213-238 (2007).*

4 THE BATHTUB GAME

There are two ways to reduce a stock.



"A fundamental human flaw, says John Sterman, impedes action on global warming. Sterman is not talking about greed, selfishness, or some other vice. He's talking about a cognitive limitation, 'an important and pervasive problem in human reasoning' that he has documented by testing graduate students at the MIT Sloan School of Management. Sterman teaches system dynamics, and he says his students, though very bright and schooled in calculus, lack an intuitive grasp of a simple, crucial system: a bathtub."

National Geographic, December 2009

Climate link --> Wait-and-see attitudes toward climate change assume that the impacts of climate change can be addressed or reversed quickly when harm becomes evident. But this view grossly underestimates the substantial delays in the climate's response to the consequences of human emissions. Such emissions are a result of anthropogenic forcing – that is, emissions generated by, or the result of, human activity.

To understand why these changes can't be made quickly, imagine the Earth as a huge bathtub. In system dynamics terms, the bathtub is called a stock. The concentration of greenhouse gases in the atmosphere is like the water in the bathtub. Flowing from the faucet, or tap, are human-generated greenhouse gas emissions. The drain outflow of the bathtub is the rate at which carbon dioxide is removed from the atmosphere (by biomass, the ocean and other carbon sinks).

Using the metaphor of the bathtub allows us to see that proposals to "slow the rate of growth of carbon dioxide emissions" will continue to increase the stock of carbon dioxide and other greenhouse gases in the atmosphere, if the rate at which carbon dioxide flowing into the atmosphere continues to be greater than the rate at which it is draining out.

About this game --> In this activity, participants have the opportunity to physically experience climate change dynamics. Using a large, marked-off area on the floor, participants enact the inflow and outflow into a stock, and predict the changing level of stock over three rounds of play. They then look at how the same stock/flow structure may help people to make predictions related to CO_2 emission policies.

To run this game -->

Number of people

10 to 16 active participants

Time

15 to 30 minutes

Space

Large enough for 10 to 20 people to stand and walk in and out of a 2.5 x 2.5 meter square, marked off with tape on the floor.

Equip-ment

White board, chalkboard, flip chart or easel pad, over-sized graph pad (or slide on a projector), colored markers, tape to create a space for the activity on the floor (alternatively, use rope or string)

Set up

Mark off a large square on the floor with tape. Create four graphs on a flip chart or white board. Title the graphs Trial 1, Trial 2, Trial 3 and Trial 4 respectively. Label the vertical axis 'people in the stock' and number from 1-15. Label the horizontal axis 'Time' (or the number of rounds) and number from 1 to 5.

Instructions -->

Begin with six people in the stock. Instruct two players to walk into the tub, and have one player leave. Continue that proportion of two IN and one OUT for a total of five rounds.

Pause and ask: *"What is changing here?"*

Explain: *"You have just experienced what system dynamicists call a stock/flow structure. An amount of something that increases or decreases over time – trees, fish, people, goods, clutter – is a stock. Flows control the rate at which a stock changes, by controlling the rate at which movement occurs in and out of the stock. In this activity, we'll have the opportunity to physically experience a structure that enables us to better understand climate change dynamics.*

Let's imagine this square on the floor is a big bathtub representing the amount of CO_2 in the atmosphere.

Let's have six people stand in the square. Right now, we'll represent the level of CO_2 in the atmosphere with six people.

The people entering the tub represent the rate of CO_2 emissions.

The people in the tub represent the accumulation (or stock) of CO_2 in the atmosphere.

The people exiting the tub represent the drain out of CO_2, which could be, for example, through carbon sinks or carbon sequestration.

We'll play this game with four different trials. In the first trial, two players will enter the tub and 1 player will leave. We will repeat this action – two players IN and one player OUT – for a total of five times."

Ask, *"I need one volunteer to graph the results."* Tell this person to keep track of the level of stock, or the total number of people in the tub for each trial. Use a different color marker for each trial. Have the volunteer standing at a flip chart turned away from the group.

"Before we begin, let's each make a prediction. Write this down on a piece of paper and don't discuss your prediction with anyone else."

"What do you think will happen to the level of the stock (or the number of people in the tub), if we have twice as many players going in as going out?"

"OK, let's try it!" Instruct two players to walk into the tub, and have one player leave. Continue that proportion – two in, one out – for a total of five rounds.

Ask a few people to share their predictions.

Ask the person drawing the graph to reveal their graph.

Repeat this same process two more times, but change the proportions to:

--› 1 player in and 2 players out;
--› 2 players in and 2 players out.

Follow the same inquiry process as you did in the first round. Ask them to predict: *"What will happen to the level or amount of players in the stock?"*

Now, have the group test an exponential delay. Tell them that this time as two people enter, a fraction (one third), of the people who are in the stock at the beginning of the round leave it during the round. (Round up or down to avoid the necessity of dealing with fractional people.)

Before running this fourth and final round, ask them to predict: *"What will happen to the level or amount of players in the stock?"*

Explain that what they just experienced was a simple stock/flow structure common to all complex systems.

Debrief --> Ask, *"When is the atmosphere like a bathtub? If you are thinking that the atmosphere accumulates carbon dioxide and other greenhouse gases the way a bathtub accumulates water, you are right.*

Most climatologists agree that humans are putting greenhouse gases into the atmosphere at almost twice the rate that natural processes (such as oceans and other carbon sinks) can remove them. The bathtub is filling twice as fast as it is draining.*

When you are already at twice the acceptable level of greenhouse gases in the atmosphere, slowing the rate of growth is still increasing the overall levels, not decreasing them.

Even if policies to mitigate climate change caused greenhouse gas emissions to fall, atmospheric greenhouse gas concentrations would continue to rise until emissions fell to the removal rate."

Here are some of the actual figures:

By 2008, the level of CO_2 in the tub (the atmosphere) was 385 parts per million (ppm) and rising by 2 or 3 ppm each year. In order to stop it at 450 ppm, a level many scientists consider dangerously high, the world would have to cut emissions by around 80 percent by 2050. Most proposals to cut emissions are not that aggressive. For instance, the Kyoto protocol proposed emission reduction by developed countries by 5.2 percent from 1990 levels by 2012.

Now talk about the exponential delays related to climate change dynamics: *"Greenhouse gas emissions have been growing exponentially since the beginning of the industrial age. As a result, atmospheric concentrations of CO_2 and other greenhouse gases have been growing exponentially. At the same time, fossil fuel consumption has grown exponentially since the industrial revolution, injecting previously sequestered carbon into the atmosphere.*

While some of this carbon is taken up by biomass or dissolved in the ocean, the equilibrium concentration of CO_2 in the atmosphere rises. The rise in atmospheric CO_2 increases net radiative forcing, causing the stock of heat at the surface and in the surface layer of the ocean to rise until the surface is warm enough for radiation of energy back to space to balance the incoming solar energy.

Think back for a moment to the last round of our game, in which we tested an exponential delay. We had two people enter, with a fraction (1/3) of the people who were in the stock at the beginning of the round leaving it during the round.

Ask, *"Where do we see time delays in climate change?"*

Explain, *"The effect of exponential delays is most clear when the input is constant. However, in climate change we are dealing with a process where the input just keeps growing."*

** http://www.cambridge.org/uk/earthsciences/climatechange/scientific.htm*

5 BIODIVERSITY GAME

Small changes can have big consequences.

"Scientists themselves readily admit that they do not fully understand the consequences of our many-faceted assault upon the interwoven fabric of atmosphere, water, land and life in all its biological diversity. But things could also turn out to be worse than the current scientific best guess. In military affairs, policy has long been based on the dictum that we should be prepared for the worst case. Why should it be so different when the security is that of the planet and our long-term future?"

Charles, Prince of Wales

"The latest update of the International Union for Conservation of Nature Red List of Threatened Species shows that 17,291 species out of the 47,677 assessed species are threatened with extinction. The results reveal 21 percent of all know mammals, 30 percent of all amphibians, 12 percent of all known birds, and 28 percent of reptiles, 37 percent of freshwater fishes, 70 percent of plants, 35 percent of invertebrates assessed so far are under threat."

The Reporter, February 2010

Climate link --> Though the science of biodiversity is still quite primitive, we know that species are being extinguished on this planet – apparently at an accelerating rate. And there are several reasons to suppose that rising rates of climate change will increase the speed of the extinctions.

Animals are adapted to specific temperature ranges and precipitation regimes. As these change, the suitability of habitats will shift. Often it will not be possible for a species to migrate quickly enough to reach regions that are still hospitable. One extreme case is when species move gradually up a mountain to higher elevations to reach their desired temperature range. When they get to the top of the mountain there is no place else to go, and they die.

Other connections can be forseen. Shifting cultivation zones will induce migration of human populations into regions that are now sufficiently under-populated to support wild species. Pests and predators will move into regions where they can prey on species that do not have adequate defenses. These and other mechanisms can be expected to pose challenges to biodiversity. This exercise is designed to reinforce the idea that species do not exist in isolation. When one species disappears, it will certainly cause the elimination of others that are interrelated with it.

About this game --> This exercise does not appear in the original Playbook. It is published here for the first time.

Dennis Meadows was invited to speak on a panel at the 2009 World Science Forum in Budapest. The panel title was "Science and ecosystem services – sustainability in nature". An important goal was to "encourage new research on the connection between ecosystems and adaptation to and mitigation of climate change." Eight minutes was assigned to the presentation.

What on earth can anyone say in eight minutes about the relation between ecosystems and climate change? Nothing that will remain long in the minds of audience members already overloaded with information and tired from a full day of speeches! Dennis created this game as his contribution to the panel. It is an analogy. While the structure of a triangle gives no scientific proof of potential changes in the number of species, the exercise makes a useful point about species diversity.

To run this game -->

Number of people

This is a mass game. It can be conducted with any number of participants, from one to thousands. If you have a small group and sufficient time, you could give each of them a picture of the master triangle and ask them to use their own pen or pencil to determine what happens to the number of triangles when different lines are eliminated. With a larger group and less time, you can show them the problem and the solution on slides, pausing long enough to let them develop a preliminary answer to each of your questions.

Time

The time required depends on the mode you use for running the game. It would range from a few minutes up to 20 minutes.

Space

No special space is required. Typically, participants continue sitting at their seats in the audience.

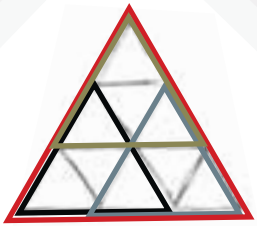
Equipment

Draw, print or otherwise recreate the triangle illustrations.

Instructions --> Conduct the exercise without first explaining its purpose. It is important that you get everyone to participate in the process and that you give them time enough to form an answer to each of the questions you pose.

Put up the large triangle, subdivided into nine equal small triangles, on a flip chart or projection screen. *"Please look at this figure. How many different triangles are formed when nine small triangles are connected?"* Stress that each member of the audience should form their own answer, and give them a minute to respond.

"That form contains 13 different triangles." Show them the answer. *"There are nine small triangles, and four larger ones."* Ask, *"If you erase the lines that form one of the smallest triangles, then how many of the 13 triangles will be left?"* Give them two minutes to decide on their answer.



Explain, *"If you remove one of the smallest triangles from the 13, there will be only seven or nine left, depending on which triangle you remove."*

Debrief --> Because they are connected to each other, you cannot reduce the number of triangles by only one. Taking away one triangle, also eliminates three or five others. Species are more connected to each other than the triangles are.

Here are a few issues you could raise during the debriefing:

- *It is a serious mistake to think that only a single species may be endangered. Whenever we lose one species, we inevitably lose others.*
- *What are the mechanisms through which we could expect that climate change will cause species extinction?*
- *What are some species that are threatened by these mechanisms?*
- *What should we do now to preserve more species during a period of rapid climate change?*

6 CIRCLES IN THE AIR

"Some countries of the world are like people fighting on a large boat. In the middle of their battle over how to catch the biggest fish, they look up and realize that the fine boat is sinking, and everyone is going down. Their next fight will be for basic survival, and they will need to rely on one another, floating far from shore in the angry sea."

Julie A. Barnes, founder of
The SEED Foundation

The same situation may look completely different from different perspectives.

"There now needs to be a change of perspective to take this (climate change) as an opportunity (rather than a burden) ... and that is the key to green growth."

Thomas Heller, Stanford Law School

"The international equity question arises from the costs of climate change itself and mitigation varying greatly across countries. It is affected by the historical responsibility for current greenhouse gas emissions, which countries that were not responsible for what's in the atmosphere now think are very important. Currently rich countries don't think those issues are very important."

Ross Garnaut, Distinguished Professor of Economics at Australia National University

"As I go around and I talk to corporate leaders, managers, and workers at any level, from the most senior to the front-line operators, I find people suffering from this terrible dissonance. On the one hand, they see what's going on in the world, and it's greatly worrying to them. I don't mean they're worried about their retirement plan having collapsed. I mean they see the poverty in the world. They see the resource depletion. They see the political instability. They see the climate change issues. And they're gravely worried that unlike the sweep of history that made it possible for them to live far better than their parents and grandparents, they're leaving a world for their children and grandchildren that could very well be worse."

John Sterman, Professor, M.I.T. Sloan School of Management

Climate link --> When it comes to any particularly complex problem, we all have a propensity to look at our part of the system, or worse, to consider ourselves outside of the system, and to place the blame for the problem on someone else or on some other group. This is particularly true for the issue of climate change.

Circles in the Air is a terrific, experiential means to explore different perspectives related to climate change. For example, scientists say that it is urgent we reduce carbon emissions while the general public may think (erroneously) that no action is necessary because climate change is easily reversible. These are wildly different perspectives. An advocacy group may have a strong opinion about who or what needs to change to address global warming – whether government, business, North or South, one country or another – that is likely to be very different than the opinions expressed by a global corporation.

This exercise illustrates how our perspectives affect the actions we take within and about complex systems. It subtly focuses a group's attention (in a fun and non-threatening way) on thinking about its own thinking.

About this game --> This exercise works on many levels. It exposes our natural tendency to see ourselves or our groups, organizations, or even countries as 'outside the system' and the perceived causes of problems as 'out there'. Through this exercise, you may ask: "How does our identity with a particular opinion or group or organization affect our view of the climate change system?" As people go through the exercise, they quickly discover how one's perspective can vary based on the view you have of the same system. They also discover that by changing their vantage point, either mentally or physically, they can potentially discover new insights and new leverage points.

When used to explore the theme of climate change, this game can help individuals and groups to:

- Develop greater awareness of the 'the enemy is out there' syndrome;
- Identify the different viewpoints related to climate change and explore the possibility that our viewpoint depends upon where we 'sit'; and
- Set the context for discussing the concept of underlying structure.

To run this game -->

Number of people

Any number of people

Time

2 to 10 minutes (depending on length of debrief)

Space

Just enough room to be able to point a finger in the air

Equip-ment

Your thumb

Set up

None. Participants can be either sitting down or standing up.

Instructions -->

Step 1 --> Ask everyone to hold their thumb up in the air and to keep their thumb always pointing up.

Step 2 --> Have them hold their thumb up in the air (you can demonstrate this as you go along), and pretend to draw a circle on the ceiling, in a clockwise direction. Say, *"Your goal is to move your hand clockwise. Always keep your thumb pointing up. Do not stop the rotation, once it starts."* Tell them to continue drawing the circle and looking up at the top of their thumb.

Step 3 --> Say, *"Now slowly continue to draw the circle clockwise, bringing your thumb down a few inches at a time until it is in front of your face. Continue to circle your thumb, and slowly bring it down until you are looking down on top of it. Continue to draw the circle while looking down on it."*

Step 4 --> Ask the group, *"What direction is your thumb moving?"* It will be a counter-clockwise direction at this point. (If someone says *"clockwise"*, you might smile and encourage them to try again.)

Note: You will find that some people lose the integrity of the circle as they bring their thumbs down, swishing their hands back and forth in a straight line. If you notice this, suggest that the person start over and encourage him or her to practice 'drawing' a round circle on the ceiling before moving their thumb down. You may also notice that some people change the direction of the circle as they lower their arm. Simply bring this to their attention, and demonstrate, once again how to continue to draw the circle in the same direction as they lower their forearm.

Debrief -->

To begin, simply ask: *"What happened?"* The initial responses tend to range from the insightful "What changed is my perspective" to the humorous "You tricked me!".

After people have had a chance to try it again, most of them will see that what changed as they brought their thumb down was not the direction of their thumb, but their perspective or vantage point. The debrief can go in any number of directions from here. Acknowledge the looks of astonishment and surprise. Then weave that reaction into a conversation about the potential of changing perspectives to achieve a greater understanding of complex systems, in particular, climate change.

As part of your debrief, here are several **questions you may ask:**

- *What was your initial reaction?*
- *Do you remember the language you used to describe what happened?*
- *Do your immediate reactions provide any insight into your own process of forming assumptions?*
- *What does this have to do with climate change?*
- *In this exercise, how is it that we may all be looking at the climate change system from one perspective? Can you find ways to look at it from multiple perspectives?*

Ask, *"What does it sound like when policy makers and advocates are talking about possible ways of reducing greenhouse gas emissions? And what does it sound like when we hear recommendations about how to deal with the impacts of climate change, such as flooding of coastal areas?"*

Holding your thumb up straight in the air, say: *"The clockwise direction represents countries with heavy emissions and their perspective on climate change."*

Then lowering your thumb, say: *"The counterclockwise direction represents countries contributing to climate change debate with adaptation messages."*

OR:

Holding your thumb up straight in the air, say: *"Scientists have concluded we must reduce carbon emissions immediately!"* Then lowering your thumb, say: *"From this perspective, that of the general public, it looks like no action is necessary. Technology will save the day and reverse the impacts of climate change."*

The structure of the climate change system is the same. What is different is the level of perspective at which we are looking at the systems.

You may also use this quote from system dynamicist Donella Meadows, to spark a conversation about level of perspective as it relates to climate change: *"How is it that one way of seeing the world becomes so widely shared that institutions, technologies, production systems, buildings, cities become shaped around that way of seeing? How do systems create cultures? How do cultures create systems?"* (Donella Meadows, *Thinking in Systems*, 2008)

Optional debrief -->

At Step 3, vary the directions. Tell participants to bring their hands down to the level of their belts, and then ask, *"Whose hand is still moving clockwise, raise your hands. Whose hand is moving counter clockwise, raise your hands."* It is typically about 50-50.

Then say, *"Half of you kept your goal, but you had to break the rule. There is no way to follow all the rules and still have your hand moving clockwise after it has fallen from above your head to the level of your belt. If you follow the rules you have to give up the goal. Your hand will be moving counterclockwise by the time it comes to the level of your belt. But if your goal is important, you will violate one or more of the rules, often unconsciously. Half of you kept the goal, but broke the rules. Half of you kept the rules, but lost your goal. If we wish to achieve our goal of a stable and productive climate, we will have to break many of the rules we have now. If, on the other hand, we decide to keep the rules, then we must give up the goal of combating climate."*

You may want to discuss the kinds of rules that often are automatically assumed as valid, and how these rules ensure that people will keep increasing greenhouse gas emissions.

FRAMES 7

Problem framing can lead to better problem solving.

"Each man should frame life so that at some future hour fact and his dreaming meet."

Victor Hugo,
19th century French
writer

"Great folk wisdom is captured in a body of Iranian folk tales about an itinerant preacher, Nasreddin. In one story, Nasreddin frantically searches for something under the light of a lamp post in the dusty street outside his home. A kind neighbor comes by and asks, 'Mulla, what have you lost?' Nasreddin replies, 'I have lost my keys.' The neighbor, being the good person he is, gets down on his hands and knees and begins to search with Nasreddin through the dust. After a long time, the neighbor says to Nasreddin, 'Mulla, are you certain you lost your keys here in the street?' 'Oh no!' says Nasreddin, 'I lost them in the house.' 'If you lost them in the house,' says the neighbor, 'then why are we looking for them under this lamp post?' 'The light is better here,' Nasreddin replies."

The Systems Thinking Playbook (1995)

Climate link -->

When we have problems, we look for their roots in the data that are most easily accessible to us. In the language of systems thinking, we say that people look for "proximate causes" – that is, causes that are close to the problematic symptoms in both time and space. The causes of difficult behaviors typically lie far away from the physical location where the actual behavior is observed and far back in the past.

Climate change provides ample opportunities to observe both of these facts. We know that the greenhouse gas emissions on one continent can have dramatic effects on the climate patterns in others – which is why the world is closely watching large-scale projects to build coal-fired power stations in places like China, India, Germany and the United States. We also know there are delays in these complex systems, and it is still hard to convince people to act now upon something that will result in changes many decades in the future. As one bold headline in a leading United Kingdom newspaper stated, "Britain must act now to cut carbon emissions or pay the price later". The paper then described measures identified by the Tyndall Centre for Climate Change Research as necessary now to help Britain reach its emissions targets by 2050.

The link from CO_2 emissions to climate change is long and full of delays. Even if tomorrow we totally eliminated all CO_2 emissions from human sources, the average temperature of the globe would continue to increase for decades or centuries, just from all the greenhouse gases that society has already emitted. Therefore actions being promoted, and some of the decisions that need to be taken, are operating with longer timeframes than many people are used to considering or even willing to consider.

When we search for some basis to choose among alternative approaches or policies, we tend to search where the light is better. We look only at what the policies will do for us, here, and soon. But the important consequences of what we do will typically occur far away from where we take the action, and years – or decades – into the future. Debates about the appropriate policy to adopt in relation to CO_2 emissions, or the exploitation of oil reserves, or the protection of endangered species, all illustrate this tendency.

About this game -->

If we hope to understand our predicament and to find more effective solutions, it is often essential for us consciously to reframe our dilemmas, to redefine their boundaries. The challenge is that we are often unaware of how we are framing a problem. Therefore, we find it difficult to change the frame, even if the old perspective is keeping us from understanding and addressing our troubles. When we are under pressure we tend to focus even more on what we're seeing through our frame, and pay less attention to the frame itself.

This game shows us how to **have** our frames as opposed to being **had by them**.

It helps to illustrate the impact of choosing different frames or points of view when defining a problem and seeking solutions. It can encourage participants to try on different perspectives when diagnosing problematic system behavior or when designing ideal systems. It reveals why two different, intelligent people of good will can have opposing views about climate change – one thinking it is a serious problem and the other believing it even does not exist.

This exercise can also help people to develop more openness to experimentation with different time horizons when defining a problem or solution. It can help support more objectivity about our own paradigms and give us more willingness to realize that the way we view something might not necessarily match the way others view it, or might not be the best way to view it.

Most societies have several common frames through which people view reality. These frames include religious thought, economic theory, natural science or political ideology. We can also think of these frames as paradigms-filters that direct our attention to specific forms of data, predispose us to specific theories of causality, and focus us on established kinds of problems and policies. Any paradigm, no matter what it is, has several critical aspects:

- An implicit time horizon; that is, the length of time over which we consider information about the issue;
- Geographical boundary that defines where we look for costs and benefits of alternative policy options;
- Causal links that are presumed to be important. For instance, many economists disregard feedback from the environment in advocating their favorite policies. Many environmentalists, for their part, disregard the impact of the price system when arguing their own viewpoints.

Typically, we start wrestling with problems without first figuring out which frame might be most useful. A research experiment conducted some years ago by NASA offers an apt example.

In 1978, NASA launched the satellite Nimbus 7 into the stratosphere to gather longterm data on significant atmospheric changes high above the Earth. However, the people who designed the experiment were working under an unexamined paradigm. They assumed that they would not have to measure ozone concentrations, because they believed that such concentrations did not change. Consequently, they programmed the computers on board the satellite to ignore

information about ozone levels. Therefore, although the satellite did sense changes in ozone levels, the data were not transmitted back to Earth.

If the experiment designers had operated from a different paradigm, we all would have learned much earlier about the grave damage chlorinated hydrocarbon chemicals were causing to the Earth's ozone layer. Frames become especially important during times of major change in the world around us. If we are not in the habit of changing our frames, we may inadvertently maintain an old one long after it is no longer relevant.

Two kinds of frames or boundaries – temporal and geographical – are particularly interesting to explore within the context of climate change learning.

Geographic or spatial frame --›

This boundary defines the physical area over which we think people, organizations and natural systems will be affected by the actions we take. If we adopt a narrow geographic frame, we may pay less attention to consequences that occur "over there" than we do to events that occur in our own back yard. Some nations oppose climate change initiatives because they believe that climate change will be mainly beneficial within their own boundaries. Those countries are operating from a geographic frame that ignores damaging effects of their actions outside their own borders.

Temporal or time horizon frame --›

This boundary defines the interval of time over which we care about the costs, benefits or results of the actions we are considering, e.g. one hour, one week, one year, 10 years, 100 years.

Almost everyone gives less attention to costs and benefits that will occur in the far future than they do to those that are immediate. Economists have even coined a term, 'discount rate', to designate the extent to which we reduce our concern for future consequences in comparison with current events. If you have a high discount rate, you ignore information about consequences that will manifest themselves more than a few years into the future.

This frame is particularly evident, and damaging, among elected politicians, but we all suffer from it. If people felt the effects immediately and personally of their greenhouse gas emissions, people might choose to undertake less emission-producing activities. But in this case the consequence lies decades in the future, so most people ignore it and opt for the immediate pleasure of their current lifestyles. All the important activities that contribute to climate change give pleasure, prestige or profit to at least some people and organizations in the short term.

So long as they have a short-term frame, they will oppose effective efforts to reduce greenhouse gas emissions. The time-horizon boundary also has a moral dimension. For example, if you are thinking about energy in a one-year time frame, you may focus on price and supply. But if you take a two hundred-year time frame, you cannot afford to ignore issues of climate change and of unequal quality of life among generations.

To run this game -->

Number of people

This is a mass game. It can be played with any number of participants.

Time

Most people use this game as a simple illustration within a longer and more substantive discussion of frames or boundaries. In that case, you can present it in 5 minutes. If you wish to use this exercise as the basis for a more extensive discussion, allow 15 to 30 minutes.

Space

Participants simply sit in place, so no special space is required. The exercise does require everyone to look at you from a distance of at least 2 meters away. The exercise is described as if you are standing in front of the audience, though you could adapt it for use in a circle.

Equip-ment

No equipment is required. You and the participants simply use your hands.

Instructions -->

Ask each participant to make a frame, using their thumb and forefinger touching at the tips to create a ring.

SPATIAL FRAMING

Step 1 -->

Divide the room in two halves down the middle. Ask all participants to hold their frames out at arm's length directly in front of them and to look through the ring at the hand you specify. Ask those to your right to focus on your right hand; ask those on your left to focus on your left hand.

At this point, you are holding both arms outstretched from your sides. Your right hand is thumbs up (as shown) and your left hand is thumbs down.

Ask all participants to look through the frames they have created and focus on the indicated hand.

Step 2 -->

Give the following instructions, pausing for 10-20 seconds after each, so participants have time to ponder their response.

"Everyone who thinks my thumb is pointing up, raise your hand." (Pause) *"Everyone who thinks my thumb is pointing down, raise your hand."* (Pause) Typically those on one side of the room will disagree with those on the other.

Step 3 -->

Now ask the participants to bring their frames as close as they can to their eye while keeping the same hand centered in the ring.

Again instruct them to raise their hand if they think your thumb is pointing up. (Pause) Then ask those who think your thumb is pointing down to raise their hand. (Pause) This time you typically will get everyone in the room to raise their

hand twice. When the frame is close to their eyes, they see much more of reality; they normally can see both of your thumbs. Often people do not disagree because they have a different reality, they disagree because their frames cause them to look at different parts of reality.

TEMPORAL FRAMING

Step 1 -->

Say, *"Now, once again all of you will look through you personal finger rings. Please hold your frame as close to your eye as you can. When I say 'Go!', start looking at my right hand."*

Hold out your right hand with only the thumb extended up, all the other fingers are bunched in a fist (as shown).

Say *"Go!"* and start your timing. After 10 seconds announce, *"Those in the left half of the room may stop observing now."*

After 15 seconds more (elapsed time = 25 seconds) extend all five fingers of your right hand.

Five seconds later, after a total of 30 seconds, tell those in the right half of the room. *"You may stop observing now."*

Debrief -->

Here are some suggested debrief questions:

- *Who thought the number of extended fingers on my hand changed while they were watching? Raise your hand?*
- *Some thought my hand changed; some did not. What is the truth? How can reasonable people disagree on such a simple question?*
- *What is the relation of this exercise to our observations about climate change?*
- *What period of time is implicit in the data we use to think about climate change?*
- *How can we know if we have taken a long enough view of the system to detect important changes?*
- *How could we increase the length of time implicit in people's discussion about climate change?*

8 GROUP JUGGLE

"A lack of appreciation for what exponential increase really means leads society to be disastrously sluggish in acting on critical issues."

Dr. Thomas Lovejoy, Smithsonian Institution

Growth finally overloads any system.

"The climate system contains extremely long delays: It takes time to develop more efficient vehicles and buildings and new carbon-neutral technologies, and still more time to replace existing energy-consuming and energy-producing infrastructure with these new technologies. There are additional delays between emissions reductions and changes in atmospheric greenhouse gas concentrations, between greenhouse gas concentrations and average global temperatures, and between temperatures and harmful impacts such as changes in ice cover, sea level, weather patterns, agricultural productivity, extinction rates, and the incidence of diseases."

John Sterman, Professor, M.I.T. Sloan School of Management

"We are emitting carbon dioxide and several other greenhouse gases in the atmosphere exponentially. We are clearing tropical forest at an exponential rate. The human population is growing exponentially. Human energy use, human production of synthetic chemicals, deserts, and trash are growing exponentially. Our economy is growing exponentially, and we cheer it on, although an economic growth rate of, say, 3.5 percent per year means another whole industrial world plopped down on top of this one in just two decades. We can't keep it up. If we understood the consequences of exponential growth, we wouldn't even want to try."

Donella Meadows, environmental scientist and author

"Global warming, with all of its attendant changes, is the first clear mega-symptom revealing that we are now rapidly approaching many tipping points where overshoot and collapse is occurring ..."

Rev. Dave Steffenson, Acting Director,
Interfaith Climate & Energy Campaign of the Wisconsin

Climate link -->

Deep misconceptions about the dynamics of complex systems persist, even among highly educated adults. Research in dynamic decision making shows that performance is systematically biased and suboptimal when adults are faced with dynamically complex systems containing multiple feedback processes, time delays, nonlinearities and accumulations. Why? Most adults today were not explicitly taught skills related to seeing systems of multiple causes, effects and unintended impacts. These are the skills needed to navigate issues of global impact such as climate change, interdependent financial markets, biodiversity loss and more.

One of the best ways for individuals and groups to gain insight into the systemic nature of the challenges is to illustrate those dynamic behaviors through first-hand experience. *Group Juggle* takes about 10 minutes to play, and one facilitator can lead a large group. Moreover, the three-loop structure underlying the *Group Juggle* dynamics has many interesting applications in the realms of personal relationships and climate change dynamics.

About this game -->

Understanding the systemic nature of challenges such as climate change can be gained through direct participation, and by reflection on personal experience. *Group Juggle* is a valuable tool for this purpose. It is also fun. Using balls or other objects that can be tossed, it propels people up and out of their chairs and gets their blood circulating. This exercise can generate some real laughs; and it almost never fails to reveal profound new insights.

Specifically, you can use this game to:

- Illustrate the way a simple causal structure can produce complex behavior;
- Give participants the experience of being part of a system in which the identity of the dominant loop rapidly shifts;
- Break down the formal, social barriers that exist in a workshop when its members first assemble;
- Develop awareness that different groups can behave in similar ways when they are immersed in the same systemic structure;
- Provide first-hand experience with a systems archetype that explains overload and overshoot.

To run this game -->

Number of people

This is a participation game for 15 to 20 people. If you have more than 20 players, split the group into smaller teams. The teams can do the exercise simultaneously if you have enough supervisors. If not, lead each group through the exercise in sequence.

Time

15 to 60 minutes, depending on the number of lessons you want to convey, the level of participants' sophistication, and the length of the debrief

Space

Enough open space to let team members stand 1 to 2 meters apart in a circle. Objects will be tossed into the air, so the space needs a ceiling height of not less than 2.50 meters.

Equip-ment

An overhead projector, flip chart, or white board; 1 ball or other tossable object per participant (e.g. a tennis ball or softball); and a box, shopping bag, waste basket or other container to hold the balls. Put a chair to your left or right. Put the balls in the container, then put the container on the chair, so it is easy to reach the balls without bending down.

Set up

If a group member is unable to stand, you may try to conduct this exercise with all participants seated in chairs. If a participant is unable to catch or toss a ball or other soft object, you can ask that person to play the role of a "process observer" who provides commentary and feedback to the group during the debrief.

Instructions -->

Step 1 --> Arrange group into teams.

If your group consists of more than 20 people, divide them into smaller teams so no team has more than 20 members. Designate the other team(s) to serve as observers and select one team to begin. Stand with the beginning team in a circle. Ensure that members of the observing team stand far enough away from the circle that they will not impede people who will leave the circle to retrieve dropped balls. However, observers should stand close enough to watch the exercise unfold.

Step 2 --> Establish the throwing order:

The goal during this part of the game is accuracy, not speed. Underhand throws are easier to catch. If anyone drops the ball, ask him or her to retrieve it and resume the sequence of throwing.

Encourage people not to throw the ball to the person standing next to them. Instead, they should try to toss it to someone across the circle who still has her hands raised.

Ask people to remember the identity of their catcher. This person will always be their designated catcher during the game.

During the throwing process, ensure that no one gets the ball thrown to them more than once.

Everyone holds their hands out in front of them at waist level, with elbows bent. You, the facilitator, throw the ball to someone. After that person catches the ball, he throws it to someone else, and then lowers his own hands. The person who just caught the ball throws it to someone else, and then lowers her hands too. Before each person throws the ball to someone else, they look for receivers whose hands are still at waist level. Continue until the ball has been thrown once to everyone, and everyone's hands are lowered. The last person in the initial sequence, when everyone else has now dropped their hands, should throw to the person who initially received the ball from you.

When that person has received the ball for the second time (the first time being from you), stop the action. The person who initially caught the ball from you will be the designated catcher of the last person in the team to get the ball. Thus, once a ball is thrown by you into the circle, it should continue to circulate around the group indefinitely, unless it is dropped.

Get the ball that was in circulation and put it in the container.

Step 3 --› Explain the rules of the game.

Say, *"Your team's goal is to keep as many balls as possible in the air at the same time. Do this by continually catching balls from your designated thrower and then throwing them to your designated catcher."*

And explain what you will do: *"I can throw to anyone I see who is not currently holding a ball. We will start the game slowly. But as I see you successfully keeping more and more balls in the air, I will throw more and more balls in."* Make certain that everyone has heard this statement; it forms the basis for the driving causal loop in the early phase of the game.

If there are observers, ask them to gather data about the number of balls in the air over the course of the exercise.

Step 4 --› Test that everyone remembers who is their designated catcher.

Ask team members to simulate throwing the ball by pointing in sequence to their designated catcher. You start the process by pointing at the person who received the ball from you. They, in turn, point to the person who is their designated catcher. Continue in this way around the circle. If anyone has forgotten the identity of their catcher, have the group figure it out. In rare cases, you may need to throw the ball around again to clarify the sequence or establish a new one.

Step 5 --› Carry out the game.

Throw a ball to the first person you threw to during the sequence-determination round. As team members start passing the ball around according to the established sequence, wait five seconds. Then throw in another ball. Wait three seconds. Then throw in more and more balls. When people start dropping balls, usually after there are 10 to 15 balls in play, loudly urge the players to retrieve them. To provide even more distraction and give the group a few laughs, you can throw in a rubber chicken or some other bizarre but harmless object. As the chaos grows, start throwing balls in rapidly to many different people, even if they are clearly not ready to catch them. Then call out: *"Okay, stop!"*

Step 6 --› Switch teams.

If you divided the group into two teams, go through these steps again with the second team, asking the first team to observe the number of balls in the air. If there is only a single team, move to the flip chart or projector for the debrief.

Debrief --› This exercise is rich in content. The recommended debriefing process is sketched below. Guide your group through this sequence in a leisurely fashion, show them the relevant illustrations (provided below) and give players plenty of opportunities for questions and discussion.

Ask your participants to imagine how the group juggle illustrates behavior related to climate change dynamics. You may ask, for example: *"How might the three dynamics we experienced in* Group Juggle *play out when we think of the consequences of climate change?"* Pause for discussion, then explain: *"Here is one example: if you are confronted with one ball or one problem (e.g. flooding) then you deal with that problem. However, if the number of balls, or the problem, gets bigger (e.g. floods and droughts) then the system may become overwhelmed and collapse. Earlier changes are easier to make."*

Additional debrief --› For a debrief related to climate change dynamics, you can also lead your participants in a useful discussion based on three modes of behavior:

Loop 1 --›

Growth. Prior industrial age, society experienced a period of 'competence' in terms of how people used natural resources. With the onset of the industrial age, the perception of unlimited natural resources has led to unrivaled economic and population growth.

Loop 2 --›

Limits. In the 21st century, the interaction of economic and population growth is causing an overload on natural resources, which are limited. We continue, for instance, to pump CO_2 into the atmosphere at twice the rate it is being drained out or absorbed by carbon sinks and other means of carbon sequestration.

Loop 3 --›

Collapse. We do not feel the immediate impact of this overload, we can not agree on its cause (due to scientific debate), and many people believe that technology will save the day. For these reasons, wait-and-see policies prevail and we continue to use these resources. Natural resources usage is driven by growth at an exponential rate, causing overshoot and, at present, the collapse of environmental systems.

Ask participants to look at this structure in terms of climate, and then in others areas of their lives.

- *Where do you see identical loops with different names?*
- *Where do we see exponential growth in relation to global warming? Is that exponential growth generally understood?*

9 HANDS DOWN

Double check the boundaries of problems.

"I recall a conversation a few years ago Dennis Meadows and I had on a canal boat in southern France with an investment banker friend of his. The banker said he was beginning to realize that climate change is a problem. Dennis said that climate change is not the problem and I said that it is a symptom of the problem. The banker was challenged to see that economic growth itself is a problem – the growing number of people consuming a growing amount of resources without regard for the long term consequences for all life."

David Berry, Sustainable Water Resources Roundtable

Climate link --> Most of the data available to policy makers characterize our economic system and our technology. Thus there is an automatic tendency to look within the spheres of economic actions and technological change for the solutions to problems. The debate about actions to counter climate change focuses on economic initiatives (e.g. carbon taxes, electricity pricing, imposition of levies that reflect external costs) or on technical change (e.g. improved energy efficiency, better ways to remove carbon dioxide from emissions, enhanced solar power devices). There are fewer sources of data about population and lifestyles, so these spheres remain outside the policy debate. This exercise may encourage participants in the climate debate to be more creative in where they look for data to guide their actions.

About this game --> This exercise can help to raise awareness of our unexamined assumptions. It can encourage participants to slow down and examine every assumption, especially the unconscious ones, in order to explore the double-edged nature of those mental models. These models enable us to function in the world, but also often act as blinders.

The most needed and most often underdeveloped skill is peripheral vision. The wider our perspective, the more data we can take in, the more possibilities exist for effective action.

To run this game -->

Number of people

This is a mass game. Any number may play as long as all participants can see what you are doing. About 30 people is comfortable if you are using a flipchart. Very large audiences are suitable if you are using an overhead projector or laptop and beamer for this exercise.

Time

5 minutes or 15 minutes, depending on the size of the group and the extent of the debrief

Space

Enough room so the group can see you drawing on a flipchart or overhead transparency. A seated audience can easily play this game.

Equipment

A flipchart, paper and a thick marker (any color but red, as that is hard to see from a distance). If you are using an overhead projector, you will need a blank transparency sheet and a dark transparency marker. This exercise has not been tested with pre-drawn illustrations on a laptop/ beamer but that might be effective, especially if the illustrations are in the form of photographs.

Instructions -->

Step 1 --> Explain, *"I am going to use a secret code to show you numbers between one and five, only integers. Your goal is to decipher my code and understand each number I show you. Of course you will make mistakes the first few times, until you understand the code."*

Draw a large rectangle in the upper right-hand corner of a flip chart. Be a little fussy as you draw on the first set of three or four simple marks within the rectangle, as if you are arranging them in some particular pattern.

Step 2 --> As you are drawing the symbols inside the rectangle casually place your idle hand flat against the drawing surface with all five fingers outstretched. Ask the group: *"What number am I showing?"* (Pause) *"The number is five. Who guessed five?"*

Normally about one fifth of the people will raise their hands. *"Let us try again."* Casually remove your idle hand and then replace it on the surface, outside the rectangle. But this time only three fingers are outstretched. Ask, *"What number am I showing?"* (Pause) *"The number is three. Who guessed?"* Go through this process one more time with two fingers. When you announce that the answer is two, there will start to be some frustration in the audience.

Step 3 --> Stop drawing the symbols inside the rectangle and proceed quickly. Put your idle hand on the surface with only your thumb outstretched. *"Now I am showing one."* Change your hand to show four fingers. *"Now I am showing four."*

Do this several more times until people understand your code. *"Were you looking for information inside the rectangle? That has nothing to do with the true number. The code is very simple. But as long as you focus inside the rectangle, you will never, ever understand it."*

Debrief --> Without a thoughtful debrief, this game could easily fall into the 'gotcha' category and leave participants feeling frustrated and even manipulated. Be sure that they finally understand that even intelligent careful people will be fooled, if their attention can be focused on the wrong information.

Here are some suggested debrief questions:

- *What frame do we use to define the relevant data for discussions about climate change?*
- *Who determines that we should use that frame?*
- *What would be a more useful boundary for us to use in considering information about climate?*
- *How could we change the boundaries implicit in people's discussion about climate change?*

Optional debrief --> Gross National Product (GNP) statistics play a special role in discussions about climate change, since governments delight in reporting rises in GNP as a sign of progress and growth of an economy. However, as Donella Meadows notes in her book *Thinking in Systems* (2008), the GNP calculations lump together goods and bads. (If there are more car accidents and medical bills and repair bills, the GNP goes up.) It counts only marketed goods and services. It does not reflect distributional equity. It measures effort rather than achievement; gross production and consumption rather than efficiency. New light bulbs that cost the same to manufacture and give the same light yet consume one-eighth the electricity and last ten times as long make the GNP go down.

- *Where are our opportunities to look outside of our own frames, or the frames that we are being encouraged to use, to include more data that might be helpful in making decisions that can affect change?*

HARVEST 10

You can't keep taking more than nature gives.

"They hang the man and flog the woman
That steal the goose from off the common,
But let the greater villain loose
That steals the common from the goose."

18th century English folk poem

"By the law of nature these things are common to mankind – the air, running water, the sea, and consequently the shore of the sea."

Justinian I, Byzantine Emperor, 6th century A. D.

"One reason it is so hard to slash carbon emissions is that climate change occurs globally. The countries that produce the most greenhouse gas all need to take action to fix the problem. That raises a classic economic dilemma called the tragedy of the commons."

David Kestenbaum, National Public Radio, United States

Climate link --> Our 'commons' are those resources such as air, water, land, highways, fisheries, energy and minerals upon which we all depend and for which we are all responsible. When it comes to our commons, we may find ourselves acting in surprisingly selfish ways. In 1968, Garret Harding coined a phrase for this strange behavior. He called it "tragedy of the commons".

Here's how it goes:

We use a common resource – whether it is air, water, or a fish – to promote our own well-being. Without some collective agreement about how that common resource will be managed, the commons become overloaded or over-used, often resulting in a collapse of the very resource on which our well-being depends. When countries act in their own interests and emit high levels of CO_2, they feel the immediate gain (greater economic growth, for instance), but not the losses related to global warming. If just one country emitted high levels of CO_2, there may be little to no negative consequences. But when many countries emit high levels of CO_2, everyone suffers.

Harvest allows participants to try out a particular kind of solution, one that is urgently needed in the realm of climate change policy making. This special kind of solution requires people **to collectively make a decision to alter the behavior of everyone, including themselves.** Using an imaginary fishery, participants have the opportunity to practice cooperation and partnership in the face of tragedy of the commons scenarios.

About this game --> *Harvest* provides a means for participants to experience the consequences of self-optimization in the face of limited resources. This game also reveals what can happen when a select few players (e.g. individuals, organizations, countries) dominate a system to the detriment of the collective good. This exercise can be used to explore the 'tragedy of the commons' archetype and the related phenomenon of 'worse before better'. In worse-before-better scenarios, the actions required to produce fundamental, long-term solutions often make the situation seem worse in the short run. The long-term results can prove tragic when politicians or economists persist in looking at only the short-term indicators of success as they select policies. This fact has been graphically illustrated in many sectors of society, but especially in the flagrant overuse of natural resources such as fishing grounds. In some areas, over-fishing has destroyed fish populations' ability to regenerate.

To keep using a resource in the long term, we often have to accept a short-term reduction in what we harvest from that resource. And to implement sustainable-use policies, we must understand the system's long-term dynamics, value our long-term (not just our short-term) welfare, and trust each other to observe short-term constraints. *Harvest* gives groups the opportunity to practice all of these principles.

To run this game -->

This is a participation game. You can play it in 2 to 6 teams, each comprised of 2 to 6 individuals

15 to 30 minutes

You will need to select a space that accommodates two kinds of activity. First, you will introduce and facilitate the game to the whole group of participants. Second, you will lead participants through a debriefing conversation. It is most convenient to conduct both of these activities using a flip chart placed in front of a sufficient number of chairs to seat your entire audience.

Also, you will need a room that allows people to break into teams of 2 to 6 people. These small teams will need to sit or stand far enough apart so that they do not overhear one another's conversations.

Equip-ment

1 large coffee can or some other opaque container that can hold 50 coins.
The container must be large enough that you can reach into it to retrieve a small number of coins.

5 rolls of medium-sized coins (i.e. 250 coins) of identical value. You may also use plastic money.

1 paper coffee cup, a small basket or some equivalent small container per team, numbered on both sides sequentially with prominent, easily visible numerals (1, 2, 3, and so forth, according to the number of teams)

10 slips of paper or index cards per team

1 large flip-chart sheet showing the following four charts (in this order):

CHART 1: Game title

Harvest

CHART 2: Rules of the game

You are part of a team of people who fish for a living. Your team's goal is to maximize its assets by the end of the game. Each fish you catch is worth one coin.

The ocean can support a maximum of 50 fish. We start the game with between 25 and 50 fish in the ocean.

We will play for 6 to 10 years, making one round of decisions per year.

The maximum order is between 0 and 8 fish per fleet, per round.

With each decision round, your team decides how many fish it will try to harvest that year. You indicate your desired harvest by writing the number on a slip of paper, putting the slip in your ship, and taking your ship to the game operator. The operator will fill orders randomly. The fish you catch are returned to you in your ship. If your order exceeds the number of fish remaining in the ocean, you receive no fish that year.

After all orders are processed, and your team's ship is returned, the fish in the ocean will regenerate according to the curve shown on Chart 3.

CHART 3: Fish Regeneration

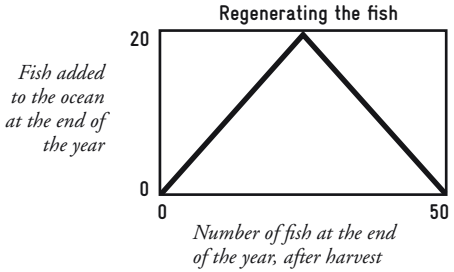


CHART 4: Steps of play

1. Decide on your team's long-term strategy.

2. With each decision round, select the number of fish you wish to harvest this year.

3. Record the number on a slip of paper, insert the paper in your ship, and take the ship to the game operator.

4. Harvest requests will be filled in random order, if your order is less than the number of fish in the sea.

5. Receive back your ship, remove the fish, and start again with Step 1.

Set up

Put 40 coins in the ocean (the coffee can). Put the remainder of the coins in a nearby container that is not accessible to participants. Put 10 slips of paper in each team's ship (paper cup or comparative container). Divide players into roughly equal teams. Try for 2 to 6 teams, each comprising 2 to 6 members. Assign each team a number. Teams can sit or stand anywhere in the room. (They should be far enough from one another that no team overhears another's strategy. They should also be close enough to the front of the room that they can see the charts and follow your instructions.) If time allows, you may also encourage teams to give a name to their ships.

Instructions -->

Step 1 -->

Compose the teams that will play the game. Ask the members of each team to stand near their fellow members. Introduce the exercise with something like this: *"Congratulations! Each of you has just become a member of a fishing company. We start with a bountiful ocean."* Hold up the coffee can and shake the coins in it loudly.

"Your team's goal is to maximize its assets by the end of the game. For this purpose, each team has a state-of-the-art fishing ship." Hold up one of the paper cups.

Now read aloud slowly through the rules on Chart 2. Answer any questions.

Explain the curve in Chart 3. *"The curve means that if there are no fish left in the ocean after all orders have been filled, then no new fish will be added to the ocean. But if, for example, there are 25 fish left after all orders had been filled, then 25 new fish will be added, to reach the ocean's carrying capacity of 50. If there are 38 fish remaining, 12 will be added."*

"We will play 6 to 10 rounds. Each round represents one year."

The number of rounds you play will depend on the time you have available. Each round lasts approximately five minutes.

Step 2 -->

Display Chart 4, *Steps of play*. Leave this where it can be seen by all teams during the game. Give the teams a few minutes to discuss their long-term strategy and to submit their first fish request.

Step 3 -->

Fill requests in random order. After gathering all the ships (paper cups), place them on the table in front of you, close your eyes, and mix the ships up. Open your eyes and arrange the ships in a straight line – left to right – visible to all participants. You do this mixing, because it is important that you fill orders in random order. The first ship should not necessarily be the first one to have its orders considered. Nor is the first team to hand in its ship guaranteed that they will have first call on the remaining fish.

Step 4 --›

Pull the paper from the left-most ship. Do not reveal the size of the request. If there are enough coins in the ocean (coffee can) to fill the request, remove the requested number of coins from the can and put them in the ship. Then fill the orders from the next ship in the line, and so forth. If one order is larger than the number of fish remaining in the ocean, return that paper to the ship with no coins and go to the next ship. When you have processed all the orders, return the ships to their respective teams.

Step 5 --›

Ask the teams to decide on their next order. While they are doing that, count the number of coins in the ocean and consult the Regeneration Curve to decide on the number of new fish to add to the ocean. This is quite simple. For any number of fish in the ocean between 25 and 50, you simply add enough coins to bring the total back up to 50. Below 25 coins, you add a number equal to the number remaining in the ocean after processing all the orders. For example, if there are 12 fish (coins) left in the ocean, you would then add 12 more coins. You may either count the coins physically in the can or keep track, using a piece of paper, of the initial number minus the total of what you put in the ships.

Step 6 --›

Collect the ships for Year 2, process the orders, and continue. If the teams quickly catch all the fish, let them go through one or two more yearly cycles experiencing the consequences of their mistake – no catch. Then stop the game. If you can see that the entire group has adopted a strategy that will keep the fish population sustained around the point of maximum regeneration, you can also stop the game. But with most groups, you will have to go through at least 6 to 8 cycles before participants experience the consequences of their decisions.

Debrief --> Typically one or two teams will pursue an aggressive strategy and place large orders early in the game. That causes the fish population to decline, pulling down the possible harvest for everyone. Sometimes there will be a serious effort to coordinate all the teams' decisions and produce a total harvest that can be sustained over the entire period of the game. But that effort usually fails. Either it is ignored by one or two teams or it is based on a false estimate of the maximum number of fish that can be harvested annually.

Discuss the regeneration curve, Chart 3, with your participants. The regeneration curve shows that 25 is the maximum number of fish which can be added to the ocean each year. Therefore 25 fish per year is the maximum number that can be harvested sustainably. Over 10 years, 250 fish could theoretically be harvested without reducing the fertility of the ocean. Divide that number by the number of teams, multiply by the value of each fish, and you have the maximum average wealth possible per team. If any team fails to reach that level of assets, it is the consequence of overharvesting early in the game.

Have each team report its wealth on the flip chart in front of the room. Then, lead the participants through a discussion about their experience.

- *What happened in this game?*
- *Who was responsible for this result?* Actually, in *Harvest*, the structure of the game bears more responsibility for the collapse in the fishery than any individual does.
- *What would have been the maximum possible wealth available to all the teams in this exercise?*
- *What wealth did teams actually achieve?*
- *Was there a winner in the game?*
- *What policies would you have to follow to achieve maximum wealth for all the teams? Why might these policies not be followed?*
- *Where do you see examples in real life of the behavior we witnessed in this game?*
- *What policies could be followed in real life to produce a more sustainable result?*

As you ask this question, ask participants to think of real life policies related to 'commons' such as fisheries, but also commons such as our climate and atmosphere.

- *Where do we see free riders in climate change scenarios?* A free rider is a player who attempts to gain the long-term benefits of the group's policies without personally paying the short-term price required to implement those policies. Free riders can derail compromises a group may be trying to negotiate to serve collective, long-term goals.

In this game, participants experience how quickly and unexpectedly a commons can collapse.

- *How can you effectively communicate the potential for quick, sudden changes in climate? What are examples of free riders in climate change scenarios?*

- *What insights did you gain about how groups can improve discussions when they are attempting to define and solve problems involving complex natural/social systems?*

- *What if climate were thought of as a commons, in the same way we think of fish as a common resource. What methods do we have for overseeing and caring for common resources?*
  In the *Harvest* game, overfishing produces an immediate and clear gain, at first, while the consequences of fishing beyond the regeneration rate was, for several years, unclear and delayed. How can climate-related policies and actions overcome that time delay and have immediate, positive results? We can see immediate cost savings, for instance, by using energy more efficiently and by increasing the use of alternative energy sources that do not produce CO_2. In some countries, tax policies make it economically advantageous to capture and store CO_2 rather than release it into the atmosphere.

Resources -->

A more elaborate version of this game is available for those who have the time and the goals that warrant its use. *FishBanks, Ltd.* is a computer-assisted role-playing game for groups up to 50. It takes two hours to play and it is rich in learning. Contact: Dennis Meadows (lataillede@aol.com).

For an excellent discussion of the *Tragedy of the Commons* archetype, see *Systems Archetypes II: Using Systems Archetypes to Take Effective Action*, by Daniel H. Kim. Pegasus Communications: 1994.

11 HIT THE TARGET

When there are delays between action and consequence, expect overshoot.

"To overshoot means to go too far, to go beyond limits accidentally – without intention. People experience overshoots every day. When you rise too quickly from a chair, you may momentarily lose your balance. If you turn on the hot-water faucet too far in the shower, you may be scalded.

The three causes of overshoot are always the same, at any scale from personal to planetary. First, there is ... rapid change. Second, there is some form of limit or barrier ... Third, there is a delay or mistake in the perceptions and the responses that strive to keep the system within its limits. These three are necessary and sufficient to produce an overshoot."

Donella Meadows et al., *Limits to Growth: The 30-Year Update* (2004)

Climate link --> One essential and widely ignored fact about climate change is that our actions take place far away in space and time from their ultimate consequences. Emitting CO_2 is, in itself, relatively benign. The amount of carbon dioxide in the atmosphere is very small, some hundreds of parts per billion. This small concentration of CO_2 has few direct physiological effects on our species. But a rising CO_2 level in the atmosphere reduces the rate at which heat is radiated back out of the Earth's atmosphere, making the atmosphere warmer. Some people consider this result to be attractive. Some places would welcome warmer weather, and they might not be much affected by the rising sea levels, stronger winds and more sporadic precipitation that, with other effects, will also accompany rising heat levels in the atmosphere. But all of these effects alter the habitat and they cause damage. Concern about CO_2 levels is a result of the ecological damage we perceive and anticipate.

There is a fairly widespread impression that when the damage is finally recognized as starting to become serious, we will be able to prevent it from growing really serious through rapid action to reduce greenhouse gas emissions. This ignores the dynamic consequences of several delays strung together – the delay from emissions to concentration, from concentration to atmospheric heat, and from heat to ecological damage. *Hit the Target* is designed to illustrate the overshoot that comes inevitably when there is a series of delays between action and ultimate consequence.

About this game --> This game was created to provide a simple illustration of the mistakes that inevitably occur when there is a sequence of delays and errors in perception between taking an action and achieving a goal.

To run this game -->

Number of people

This is a demonstration game. You will use 3 members of your audience for the demonstration. Their efforts can inform every member of a very large audience.

Time

20 minutes to run and discuss

Space

You need only room enough in front of the audience to conduct an exercise that involves up to 3 participants and a large white board or flip chart.

Equip-ment

A marking pen, which should be erasable, if you use a white board. A surface for drawing that will be visible to the entire audience. Normally a white board or large flip chart will suffice.

2 pieces of cloth (e.g. napkins or scarfs) that can be used as blindfolds.

Instructions -->

On a large surface that will face the audience, draw a rectangle comprised of nine circles separated as widely as is permitted by the surface you are using. It is best if you can manage to have at least 30 centimeters between any two adjoining circles. The circles should be arrayed as shown below:

o o o
o o o
o o o

Say, *"I need one volunteer, one member of the audience who will come up."* If no one is preparing to help you, simply point to someone in the front row and ask them to join you. Give this first volunteer a marker to hold in their right hand.

"Please hold this pen in contact with the surface in the middle of the central circle. Remain in contact with the surface during each of the three steps in the exercise, so that all of us will eventually be able to see the three paths through which your marker has moved. In each step, I will point to one of the circles around the edge of the square. When I say 'Go!', your goal is to move the point of the marker from where it is now, the central circle, to the circle I designate, stopping when the point of the marker is in the center of the target and is not touching the edge of the circle. Do this as quickly as possible; a member of the audience will time you."

Identify someone in the audience who has a watch with a second hand. Prepare them for their timing assignment. Point to one of the outside circles, then say, *"Go!"* Your volunteer should be

able to move the pen easily and quickly to the center of the designated circle, and they should create a more or less straight line from the starting point to the center of the target. Ask for the length of time it took. Label the line "1", and write down next to it the time that was required.

Now guide your first volunteer to place their marker again in the central circle.

Ask a second member of the audience to come up. Have them face the surface. Put a blindfold on the first person, the one who is holding the marker. Place the blindfolded person's left hand on the right index finger of the new person, who is standing to their left. The second person can still see the circles, but is not permitted to speak.

"Again we have the same goal, hit the target. After I say 'Go!' the person holding the marker will as quickly as they can move the marker from its present location, the central circle, to the center of the circle I designate, stopping when the pen is inside the target circle and is not touching any edge."

The person drawing now is blindfolded and cannot see, so they will have to find the circle using only information they get from movements of the person on their left, who can see the circle but is not permitted to speak. The sighted person will move their right index finger to guide the first person. The blindfolded person does their best with their right hand, holding the marker and making a line on the surface all along, to copy exactly the movements of the right index finger of the sighted person. In this way the sighted person will guide the blindfolded person to put their marker exactly inside the center of the target.

Our timer in the audience will again measure how long it takes. Point to a new circle on the edge of the rectangle you have drawn. Then say, *"Ready? Go!"*

Make sure the person drawing the line retains contact with the surface, so that you and the audience will later be able to see the line that marks his or her progress to the target. Success should still be possible, though it will take longer. And now you should see a line on the surface that has more wiggles and perhaps overshoots the target before coming to a rest in its center. Label the new line "2" and write down next to the second line the time required to complete the second task.

Now ask a third member of the audience to come up.

Leave the blindfold on the person holding the marker, and put a new blindfold on the second person. Guide the left hand of the second person onto the right index finger of the third person, the newest volunteer. Guide the right hand of the first person, the hand holding the marker, back into the center of the central circle. Now the third person has their eyes uncovered; the first and the second person are blindfolded and must rely on their touch.

Again the goal is the same. After you designate a new target circle and say *"Go!"*, the first person should move their marker as quickly as possible from the starting point to the center of the target. But this time guidance will come from further away. The result should be a line that is much more crooked and slow. After the target has been reached, label the line "3" and mark down the time required to create it.

Thank your three volunteers and ask them to return to their seats.

Debrief -->

Some questions to ask in debriefing:

- *What general trends did you notice when looking at the three lines?*
- *What caused the third effort to be so much slower and less precise?*
- *What does this exercise tell us about the process of controlling greenhouse gas emissions?*

In the first step, the sighted person's behavior is analogous to controlling CO_2 emissions to reach a target for CO_2 in the atmosphere. In the second step, the sighted person's behavior is analogous to controlling CO_2 emissions to reach a target for heat in the atmosphere. In the third step, the sighted person's behavior is analogous to controlling CO_2 emissions to reach a target for ecological damage.

12 LIVING LOOPS

Make the system work for you.

"We must always be on the lookout for perverse dynamic processes which carry even good things to excess. It is precisely these excesses which become the most evil things ... The devil, after all, is a fallen angel."

Kenneth Boulding, US Economist

"Everything an Indian does is in a circle, and that is because the power of the world always works in circles, and everything tries to be round. Even the seasons form a great circle in their changing, and always come back again to where they were. The life of a man is a circle from childhood to childhood and so it is in everything where power moves."

Hehaka Sapa ("Black Elk"), Holy Man of the Oglala Lakota (Sioux) tribe in Northern America

"Bear with me now: a positive feedback loop occurs when a small change leads to an even larger change of the same type. For example, a modest amount of warming melts ice in northern climates. But the bare ground absorbs three times as much heat as ground covered by snow or ice, so the change amplifies the original warming. Even more ice melts, more heat is absorbed, and the spiral grows."

Nicholas Kristof, *New York Times*, "Warm, Warmer, Warmest", 5 March 2006

Climate link --> What causes the Earth's climate to change? To answer this question, you have to understand feedback. Feedback entails the circular processes that create stability by counteracting or lessening change (e.g. balancing feedback) or growth or decay by amplifying or reinforcing change (e.g. reinforcing feedback). By feedback, we don't mean giving praise or criticism, as in "my teacher gave me feedback on my homework".

Feedback loops, particularly positive or reinforcing feedback loops, play a significant role in trends towards warming global temperatures. Here is one example of a positive feedback loop from the Arctic:

As average temperatures rise, warming melts ice in the northern climates. More ice melts in the summer and less ice forms in the winter. When the sun reaches the Earth, some is reflected back to space and some is absorbed. With less ice and more open water, less reflection happens and so more heat from the sun is absorbed by the open water. As a result, the water temperature rises further. This causes more ice to melt, which results in more open water, which absorbs more of the sun's energy, which causes the water temperature to rise further, which causes more ice to melt, and so on.

About this game --> *Living Loops* helps participants to understand, through first-hand experience, the structure and behaviors inherent in simple feedback loops, and more complex feedback loops related to climate change. The exercise also illustrates how individuals and groups can utilize feedback loops to achieve desired goals.

Living Loops can be used as a quick and simple way to boost understanding of how systems function, demonstrating that the quality of a system depends on the quality of the relationships in that system, and that one element in the system can alter the entire outcome of that system. Participants are encouraged to hypothesize about the impact of a simple change in the sign of a link or loop, and then to test their hypotheses. Often participants walk away with the realization that one part or one person can make a difference in even the most complex systems.

You may use *Living Loops* to:

- Experience and discuss the profound difference between open and closed loops;
- Illustrate through participants' own physical movements the behavior of balancing and reinforcing feedback loops;
- Link physical experience with intellectual analysis of behavior in closed chains of cause and effect;
- Demonstrate the principle that balancing loops have an odd number of negative (-) links and reinforcing loops have an even number of negative links;
- Develop a more intuitive understanding of the basic dynamics in simple feedback systems;
- Investigate the 12 to 15 reinforcing loops or 'tipping points' (e.g. tundra melt, ice cover, CO_2 emissions, etc.) that are currently driving climate change;
- Develop a fuller appreciation for the profound impact that adding a loop or changing the polarity of one or more links in the loop can have; that is, converting a "-" link to a "+" link, or vice versa.

All learners – but particularly those who learn best through physical experience – can benefit from *Living Loops*.

To run this game -->

Number of people

This is a demonstration game. It can be played by 5 to 12 participants, while any number of people can act as observers. This exercise involves gentle movement.

Time

About 20 minutes

Space

A room free of obstacles, in which a group of 5 to 12 people can stand shoulder to shoulder in a single line, or in a circle holding hands. There should be enough room for observers to watch the action and hear you, the facilitator. With groups of 50 or more, a raised platform or stage is very helpful. Move chairs and tables to the sides of the room if necessary, to give people enough space to play and observe.

Equip-ment

1 ball or other colorful object that can be held easily in a player's hand

Loudspeaker and microphone, if observers number several hundred

An index card and a piece of string per player (not per observer), long enough to fit generously over one's head. Attach both ends of each string to a card (e.g. with a stapler or clear tape). Using a marker, label each card with a big "+" on one side, and a big "–" on the other side.

If you are running this activity for participants from a culture in which strangers, or men and women, do not comfortably hold hands, give each person a short length of rope, about 30 centimeters in length.

A chalkboard, white board, or flip chart

Instructions -->

The instructions for *Living Loops* are detail-intensive. We encourage you to read them several times before conducting the activity. Consider, for example, if participants will be comfortable holding hands or if you need to plan ahead to modify the exercise.

Note: In this game, it is particularly helpful to debrief as you go along.

Step 1 --> Establish a one-way, open loop.

Invite 5 to 12 volunteers to come up and serve as players. Have players stand in a line, shoulder to shoulder, facing the observers.

1. Take one of the string loops with cards, put it over your head and flip the card so that the "+" faces out. Ask the players to do the same.

2. Give the ball or other visible object to the person standing at the far right end of the line, when viewed from the audience. They hold the object in their left hand. Walk to the other end of the line and get in line yourself, facing the audience on their left.

3. Explain that every player's left hand is going to be "active". Ask players to clench their left hand into a fist and hold it out at waist height. Do that yourself.

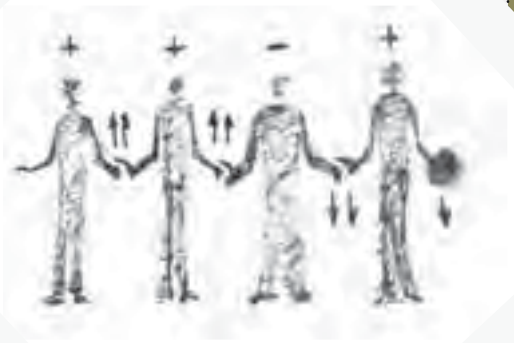
4. Explain that players' right hands are "passive". Ask them to rest their right hand lightly on the fist of the person to their right.

5. Explain that the signs on the cards indicate the nature of the response to the incoming signal by each player's left hand. If a person is wearing a "+" sign, their left hand must move in the same direction

(up or down) and distance (number of centimeters) as their right hand, after a one-second delay. For those wearing a "-" sign, their left hand must move in the opposite direction and same distance as the right hand, after a one-second delay.

6. Demonstrate. Point out that everyone is wearing a "+" sign, so their left hands must move in the same direction as their right. Send a practice "signal" or pulse to the person on your left by raising your right hand 5 centimeters above waist level and then, one second later, raising your left fist 5 centimeters. Point out that the person on your left, having felt their right hand rise 5 centimeters, must now move their left fist up by the same distance.

7. Invite everyone in line to lower their hands and shake out their arms to relax. Ask if they have any questions.



8. Now explain that you're going to lower your right hand by 5 centimeters. Lower your right hand, then your left hand, and ask the rest of the players to follow suit. Ask observers to note the positions of everyone's hands and the ball at the end of the line over the time period of the exercise.

9. Now change the sign of one person in the line by flipping their label card from "+" to "-" (see illustration).

10. Repeat the definition of "active" and "passive" hands and of "+" and "-" links. Announce that you are going to raise your right hand just once by 5 centimeters and then your left hand will simply respond as indicated by your "+" sign. Ask what the ball will do. Give participants and observers time to make their predictions. Then move your hands up by 5 centimeters. Check to make sure that each successive person, starting with the player on your left, moves their fist in the proper way. Do not let people anticipate the motion; they should move their left fist only one second after they have actually felt their right hand move.

Step 2 - - › Closing the loop

1. When the signal comes to the end of the line, observe: *"In order to move the ball at the end of the line, we need continual inputs from the other end of the line. Now, let's see what happens if we close the loop."*

2. Make sure all cards are showing "+" signs. Now, ask the participants to help you form a circle. The player holding the ball will be standing next to you.

3. Raise your left hand 5 centimeters and watch that impulse move around the circle until it reaches you. You will naturally move your left hand 5 centimeters higher. Let the signal travel all the way around the circle several times; eventually, a player will reach the limit of their ability to reach higher, and the signal will have no option but to stop.

4. Ask the players to release their hands. Invite them to describe what happened.

5. Ask, *"Why was the behavior of the ball so much different this time?"* The answer, of course, is because you closed the loop for the first time, creating feedback. Since all the links were "+", the group created a reinforcing loop.

6. Ask, *"When have you felt as if you were in a reinforcing structure in an everyday life situation?"*

7. Point out that all reinforcing structures have limits that determine how far they can grow in one direction. By closing the loop, the structure of the system has taken over. It does not require continual input from the outside.

8. Test this idea by running the exercise again. Announce that the initial motion will be 5 centimeters down. Give people an opportunity to predict what will happen. Most of them will correctly guess that the ball will move progressively down until someone's hands reach the floor. Then operate the loop by starting the signal yourself with your left fist. People will physically experience the idea that limits are inherent in reinforcing loops.

Step 3 --› Create a closed balancing loop.

1. Explain that the group will run another experiment. Say, *"This time we will introduce a single '-' link into our system. Most of you will still be representing a '+' link. You must still move your left fist in the same direction and distance as your right hand. One of you will represent a '-' link; you will move your left fist in the opposite direction and same distance as your right hand."* Tell that person to switch their sign from "+" to "-" (they will need to reverse the card).

2. Announce that the input will be 5 centimeters down. Ask players to figure out how their own fist will move as the signal travels around the circle. Let players think about this silently for about 30 seconds. Then invite a few volunteers to demonstrate what they think their fist will do over the time period of the exercise.

3. Ask everyone to arrange their hands as before. Move your left hand down 5 centimeters. Watch to make sure that the "-" link behaves correctly and that the others are also correctly following the movement. This switch from "+" to "-" in one link causes people to move their hands down until the signal reaches the "-" link and then up afterwards, then down, and then up, as the signal passes around the circle and through the "-" link. **Stop the group after several rounds, as soon as everyone sees that the loop is oscillating indefinitely.**

4. Make the following observation, saying *"Simply by changing one sign, we changed this from a reinforcing loop, which amplifies the initial input, to a balancing loop, which tries to offset or correct it. If we compare the open loop to the closed loops, we see that the open loop needed continual input. Whereas the closed loops, whether balancing or reinforcing the process, progressed with very little input."*

5. Invite the group to drop their hands and shake their arms to relax. Ask the following questions:

- *"What happened? What was the difference between the open and closed loops? And between the balancing and reinforcing loops?"*
- *"How long do you think this system could continue?"* (The answer is "forever".)
- *"What did it feel like to be in this balancing loop, compared to how it felt being in the reinforcing loop?"* Explain that the normal behavior of a balancing loop is oscillation; that is, the "motion" of the system continuously moves back and forth around a fixed point, just as people's hands were oscillating during the exercise.

"When have you felt as if you were in a balancing structure in an everyday life situation?" If participants are having trouble coming up with examples, offer the example of hunger & eating, savings accounts & spending, exercise & stress. Then ask players to try to generate more of their own examples.

Climate change debrief -->

To draw the connection to climate change, give the participants labels that refer to important feedback loops that have been identified for climate change.

For instance: Ice melting (+), ice cover (-), reflection (-), heat in atmosphere (+), temperature (+), average precipitation (+). Have participants enact the changes in each variable, as they did in the *Living Loops* activity.

There are at least 12 to 15 reinforcing loops that have been identified, for example: Ice cover (-) -> heat reflection (-) -> temperature of the atmosphere (+) -> ice melting (+) -> ice cover (-).

Another reinforcing feedback loop could be: temperature of the atmosphere (+) -> tundra melting (+) -> methane emissions (+) -> methane in atmosphere (+) -> heat trapping (+) -> evaporation (+) -> water vapor in atmosphere (+) -> heat trapping (+) -> temperature of the air (+) -> evaporation (+) -> temperature of the air (+) -> degree of plant stress (+) -> methane emissions from plants (+) -> methane in atmosphere (+) -> heat trapping (+) -> temperature of the air (+).

If you are working with a group of climate change agents, you can link reinforcing and balancing structures to the group's desire to foster self-sustaining change.

Reinforcing loops -->

Ask, *"What reinforcing loops might be unleashed or unblocked? Are there ways for targeted efforts to trigger reactions in the wider system that sustain the positive effects of our actions?"*

For example, what set of interrelationships underlies the growth (reinforcing loop) of a climate change effort, or decline (another reinforcing loop) in a community's emission rates? One strategy may be to slow the growth of reinforcing loops to allow self-correcting or balancing loops to function (carbon emitted – carbon sequestered).

Leveraging balancing (self-regulating) loops -->

Ask, *"How can you strengthen balancing loops' ability to self-correct?"* Examples: choosing draught-resistant crops to cope better with increasing temperatures; planting mangroves in coastal zones to avoid erosion; developing early-warning systems for floods, etc.

Invite participants to anticipate resistance: *"In what ways could climate change efforts cause reactions in the wider system that could reduce or weaken your desired results? Should you avoid this resistance? If so, how? Does your understanding of the possible resistance to one action lead you to choose a different action?"*

PAPER FOLD 13

This game has been adapted from the original *Systems Thinking Playbook*. For easier recognition, its title has been left unchanged even though no paper is used in the currenct version of the game.

"The most powerful force in the universe is compound interest."

Albert Einstein, theoretical physicist and philosopher

"... bacteria multiply geometrically: one becomes two, two become four, four become eight, and so on. In this way it can be shown that in a single day, one cell of E. coli could produce a super-colony equal in size and weight to the entire planet Earth."

Michael Crichton. *The Andromeda Strain* (1969)

Climate link --> One dilemma for climate change activists is that they must argue against policies that seek apparently very small percentage increases in activities that people value, such as energy use. The problem is that many of these activities exhibit exponential growth. And even small exponential growth rates quickly lead to extremely large numbers. The exercise helps people to understand the dynamics of exponential growth. And it can be used to illustrate the concept of doubling time. The latter concept is intuitively easier than growth rate for most people to grasp. A growth rate of 4 percent, for example, seems innocuous. Yet a growth rate of 4 percent per year corresponds to a doubling time of about 18 years. Thus a factor growing at 4 percent per year will increase more than 50 times over a century. That does seem appropriately threatening.

About this game --> *Paper Fold* graphically illustrates the power of exponential growth, which is always present when some factor's growth depends on how large the factor is already – think population or the economy. Most nations aspire to an annual growth rate of 4 percent in their use of energy and materials. The result is accelerating expansion in many physical factors, especially greenhouse gas emissions.

To run this game -->

Number of people

This is a mass game. It can be played with any number of people.

Time

5 to 15 minutes

Space

This game is often carried out while participants are sitting in their seats.

Equip-ment

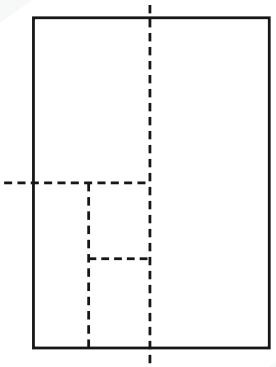
1 bed sheet or large table cloth for use by the facilitator. In spite of the game's title, do not use a large piece of paper, such as a sheet from a flip chart, since it is too thin.

Instructions -->

Provide some justification for the exercise you are about to conduct. Say, for example, *"We have been talking about an issue that involves behavior over the long term. Let me show you now an exercise that illustrates some important points about long-term behavior."*

Pick up the item you will fold. *"Here I have a bed sheet (or table cloth). It is very thin."* Show them the edge of the item, so they can see it is very thin.

"Now I fold the sheet in half once. A second time. A third time. And a fourth time." Actually perform the four foldings as you talk about the process.



"Each fold doubles the previous thickness. After four folds, the sheet is about one centimeter thick." Hold it up edgewise, so that participants can see the thickness. Hold it up loosely, if necessary, in order to avoid pinching it down to a thinner cross section. The numbers that appear in the following script depend on the fact that the item is plausibly one centimeter thick after four folds.

"Of course, you could not physically fold this sheet in half 29 more times. But imagine that you could. How thick would it be then? After four folds it is one centimeter. How thick will it be after 29 more folds?"

Invite answers from the group. *"All those who think the sheet will reach from the floor to below my waist, raise your hand."* Pause, look around the audience. You should see a few hands, if people are indicating their honest opinion. *"All those who think the sheet will reach from the floor to below the ceiling, raise your hand."* Pause again and look around the audience. Someone might say something like, *"To the moon."* If you hear this claim, state emphatically, *"No, not to the moon. Not even close!"*

Then tell them the answer. *"If four doublings take the sheet to one centimeter thick, 29 more doublings would make the sheet more than 5,000 kilometers thick. That is approximately the distance from the city of Boston in the United States to Frankfurt, Germany."*

Debrief --> Most participants consider the correct answer preposterous and assume there is a trick behind it. Therefore, in debriefing the exercise, you may want to first try demonstrating the math behind the answer. Use slides or a white board to show the dramatic outcome of starting with 1 and doubling it 29 times: 1, 2, 4, 8, 16, ... 536,870,912. Doubling something 29 times increases it by a factor of about 540 million. After four folds, the cloth is about one centimeter thick. Doubling it 29 more times would produce a thickness of 540 million centimeters. One kilometer is 100,000 centimeters, so the folded cloth would be nearly 5,400 kilometers thick.

You can quit at this point, having demonstrated that the process of doubling quickly produces unexpectedly enormous numbers. There can be a tendency to believe that any process which involves doubling, a 100 percent growth rate per fold, cannot be relevant to a process that involves "only" a few percent growth per year. Point out that an expansion of 4 percent per year will increase something by more than 50 times over a century.

We often ask people to draw a "behavior over time" graph for the increasing thickness of the sheet, assuming that they could accomplish one fold every second for 33 seconds, assuming that at the sheet initially has a thickness of 1. Point out that it seems like nothing much is happening during the first 80 percent of the process. That is our problem with climate change. The small annual increments do not seem significant. But they imply massive changes later.

Ask where else they have seen this sort of behavior. Population growth and growth of energy are both examples.

If you wish to continue, tell them the riddle of the water lily.

"A traditional French riddle also illustrates the surprising nature of exponential growth."

"Suppose a water lily is growing on a pond in your backyard. The lily plant doubles in size each day. You are told that if the lily were allowed to grow unchecked, it would completely cover the pond in 30 days, choking out all other forms of life in the water. For a long time, the plant seems small, so you decide not to worry about cutting it back until it covers half the pond. How much time will you have to avert disaster, once the lily crosses your threshold for action?"

"The answer is: One day. The water lily will cover half the pond on the 29th day; on the 30th day, it doubles again and covers the entire pond. If you wait to act until the pond is half covered, you have only 24 hours before it chokes out the life in your pond."

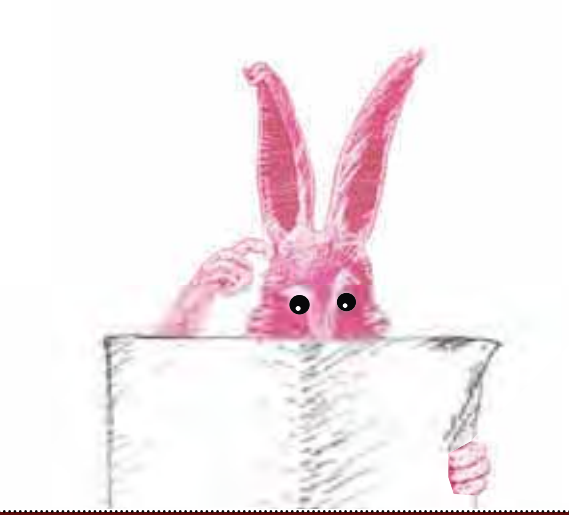
The behavior in all of these instances seems counter-intuitive. We generally expect things to follow linear patterns of growth. For example the height of a pile of paper grows linearly, when new sheets are added to the top of the pile at a constant rate. With linear growth, the initial change is the same as the change later in the process. But positive feedback causes a process that starts slowly. In folding the cloth, no significant change is noticeable for many doublings. Then, although the underlying growth process hasn't changed at all, an explosion seems to occur. The 34th doubling would actually add another 5,400 kilometers to the cloth's thickness.

PAPER TEAR 14

We can't agree, if we can't communicate.

"By improving their communication, politicians could build stronger support for policies and reduce the likelihood of a public backlash."

Green Alliance, *From Hot Air to Happy Endings* (2010)



"The single biggest problem in communication is the illusion that it has taken place."

George Bernard Shaw, Irish playwright

Climate link --> The demand for long-term action to avoid serious climate disturbance on a worldwide scale must be the most complex challenge society has ever faced. Both urgency and the need for transformational change are a part of any effort to limit climate change.

However, scientists' and politicians' efforts to communicate the basis for their concern about climate change have often failed. Climate change poses a particularly challenging set of concepts to convey – not only is its effect invisible for many people, but

there are significant time delays between action and consequence. People inevitably draw on their experiences of weather in their efforts to understand climate, and the two are fundamentally different. Causal links extend across disciplinary boundaries, so that parties to the discussion often do not understand each other's vocabulary. And a well-funded set of organizations are exploiting every disagreement and controversy to confuse the issue and to block change. Understanding the threat of climate change requires scientific knowledge outside the cognizance of most citizens, and it poses moral challenges that are outside the experience, even the concern, of most people.

But these obstacles must be overcome, if global society is to deal proactively with climate change. Never before have effective communication and education been so necessary than around the climate change issue.

About this game --> This exercise illustrates that efforts to communicate even simple ideas can fail. It helps people to understand the reasons for poor communication, as well as to practice some of the skills around effective communication. When stakeholders come together in a group, they frequently discover they have different perceptions of what is going on. This is especially true when the group comes together to understand and intervene in a complex system. As divergent perspectives become evident, there is a tendency to increase the frequency or the volume with which we express our own thoughts. We should try to empathize with the listener and discern what they understand and anticipate what might be the sources of misunderstanding.

We often assume that if we do an eloquent job of describing our thoughts, the hearers will end up with the same images in their minds. This simple exercise shows quickly how unfounded this assumption really is, even when the hearer shares your goals and has a strong incentive to understand your meaning. How much more challenging is communication, when the opposite is the case, as it typically is with matters related to climate change?

This game can heighten listening and communication skills and increase awareness of the multiple interpretations of the same message. This game is useful for people working in an area as complex as climate change to reflect on how others hear their words and call to action, both with and without two-way communication and feedback.

This game is useful at the start of a meeting to remind participants that communication requires constant care and the involvement of everyone.

To run this game -->

Number of people

This game requires a comparison of people's final results. So it does not work very well with just 1 or 2 players. A minimum of 5 players is suggested. The maximum number is unlimited.

Time

10 to 15 minutes (depending on length of debrief)

Space

No special space is required. This exercise is often carried out with an audience of people who remain sitting in their chairs.

Equip-ment

1 sheet of paper for each person. Please use recycled or waste paper, if at all possible, to reduce waste. It is only necessary that the sheets are all the same size. Differences in printing or color on the sheets do not matter. Often your host will have a box of used sheets from the copy machine, printed on one side. Those work well for this game.

Setup

Pass the pile of paper around the room, and ask each participant to take a sheet. Keep a sheet for yourself. Or, if you are in a hurry, distribute the paper ahead of time, putting a piece either on the chair seat or underneath the chair. When people come in you can tell them the paper is for use later.

Instructions -->

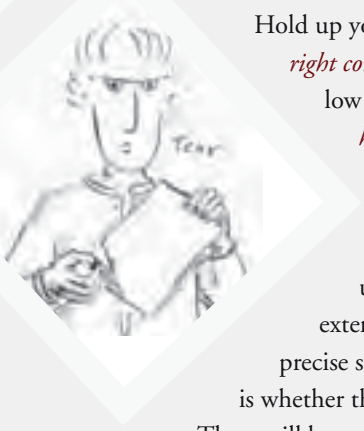
Step 1 -->

Ask everyone to pick up the piece of paper. Ensure that all participants are sitting someplace in the room where they can see and hear you.

Step 2 -->

Explain the exercise. *"This piece of paper is a metaphor for our policy options vis-à-vis climate change. I have an extremely important message to give you about a new climate policy that we all need to follow. It is a critical message and I ask you to listen carefully and please do not interrupt me or talk while I share with you my important message. Do not ask questions. Just do precisely as I ask you to do. Tearing the paper is a metaphor for the policy steps. Our goal is for everyone to produce identical patterns with their pieces of paper."*

Step 3 -->



Hold up your paper for everyone to see. *"Fold your paper in half and tear off the bottom right corner of the paper."* Do that to your paper and pause for a moment and allow the group to do this. *"Fold the paper in half again and tear off the upper right hand corner."* Do that to your paper and pause briefly again. *"Fold the paper in half again and tear off the lower left hand corner."* Do that to your paper and pause briefly again. *"OK, you are all intelligent people, eager to follow instructions. Let us see how you did."* You unfold your paper and hold it up. *"Please unfold your paper and hold it up for the group to see."* Pause for an extended period until everyone has had a chance to look around. Of course the precise shape of the torn holes will differ. But that is not important. The key question is whether the pattern of holes is the same from one paper to the next. Normally it is not. There will be a variety of different patterns. Some will be identical to yours; most will not.

Step 4 -->

Ask participants for their reflections on what happened and what set of behaviors on both your and their parts produced this result. Once they have shared their opinions about "what went wrong", ask participants for their advice on how to have a better outcome that more closely reflects the goal for everyone to have the same result at the end of the game.

Debrief --> Most often each participant creates one of four or five different shapes out of their paper. Participants are likely to be surprised by the different interpretations of the same, simple message and set of instructions.

"When intelligent people fail, the problem is normally in the structure of the process. What was there about this communication process that gave us so little success?"

Give the participants a chance to reflect on this question and respond. The key failures in the communication process were:

- One-way communication; you did not permit questions;
- Ambiguous vocabulary. "Fold in half" and "Upper right hand corner" and other phrases can be interpreted differently. For example, upper right for the speaker, who is facing the audience, is upper left for people who are observing;
- No common understanding of the final goal. You did not show them the final result you wanted; you only focused on the process.

Make sure that each of these failures is identified, preferably by the participants. Then you can ask questions:

- *Is it important that people share a vision of the causes and consequences of climate change?*
- *Is it important for people to have the same understanding about policy options?*
- *Where do these failures also exist in discussions about climate change?*
- *How could we make the communication more effective?*

End with drawing out some communication lessons learnt in the debrief that participants can keep in mind when they are communicating about their climate change work.

"Which opportunities do you see to adopt these lessons and practice these skills in the near future?"

15 PENS

Sustainability is in the relationship, not in the thing.

"Geoengineering, the intentional large-scale manipulation of the Earth's systems to modify the climate, is one of the most serious issues the international community will face in the decades ahead."

160 organisations in an open letter to the Inter-governmental Panel on Climate Change (IPCC), June 2011

"Critics counter that no quick-fix solution to climate change exists and may never exist. Meddling further with the environment, they say, will have manifold unforeseen, far-reaching and possibly catastrophic effects. The geoengineering cure, in short, may end up killing the patient."

Eifion Rees in *The Ecologist*, 25th July, 2011

Climate link --> Among those who acknowledge the threat of climate change, the dominant response is to promote changes in technology, for example shifting from use of fossil fuels to reliance on various non-carbon based sources such as wind, solar, and wave power. But the inconvenient truth is that new technologies in the service of a society that tolerates population growth, pursues economic growth, and uses per capita GNP as an indicator of success will still lead to climate change.

About this game --> This exercise was first created for use in Japan where the authors had little time and faced great cultural barriers in trying to communicate with several thousand Japanese corporate and government leaders who had assembled for a several day conference on technology policy. The meeting was called "Technology for Sustainable Development". But technology mainly serves the values and goals of those who develop and use it. If their values and goals promote growth, the technology they develop will produce growth, not sustainable development. Real solutions to climate change and other symptoms of physical growth on a finite planet will require changes in the values and norms of society. This game helps to make the point that sustainability is inherently a matter of social norms, cultural practices and psychological attitudes.

To run this game -->

Number of people

This is a mass game. Any number can play.

Time

About 5 minutes

Space

No special space is required. This exercise is often carried out while participants are sitting in the seats.

Equip-ment

You will need 2 pens, which you will show the audience: a noticeably expensive one and a cheap one. This works well if you use a widely-recognized premium brand pen, in contrast to a "green" pen made of cardboard and wood. Instead of real pens, you may also use slides showing photos of the pens.

Instructions -->

The following instructions and script are written as if you actually have an expensive pen and a cheap pen to show the audience.

"We are meeting in part because we all share a concern about sustainable development. I am now going to conduct a simple exercise to see if we all agree on what that term actually means."

"I have two pens." Hold them up, so that everyone in the audience can see the two pens.

"The first pen has been made by a very renowned manufacturer. It is used for writing. It is made from platinum and precious resin. It costs about 200 euro."

"The second pen is used for writing. It is made from wood, plastic, and recycled cardboard. It costs about one Euro."

"Which pen is more sustainable?" Here you need to get every member of your audience to develop a personal answer to your question and actually make a choice. You can make it easy for them to do that. *"Refer to the expensive pen as number 1 and the cardboard pen as number 2. Decide which pen you think is more sustainable and show either one or two fingers silently to the person sitting next to you."* Pause long enough for them to ponder the issue and indicate their decision to their neighbor. It would also be possible to ask all those who think the expensive pen is more sustainable to raise their hand, and then to do the same for those who think the cardboard pen is more sustainable. We ask instead for a silent communication with each participant's neighbor, because in some cultures people are embarrassed to raise their hands in a situation where they may be "wrong".

"Now I will provide you with more information. The expensive pen is never taken out of my home office where I use it, so I will use it the rest of my life and then give it to a friend. The cardboard pen is lost almost every time it is taken out of the house. Thus I must buy many dozens of them each year.

When the expensive pen's ink cartridge becomes empty, I buy a refill. If I still have the cardboard pen when its ink cartridge becomes empty, I will throw the pen away and get a new one. It costs more to buy the replacement cartridge than to buy a complete new pen.

Now I will ask you again. Which pen do you think is more sustainable? To indicate your decision show one or two fingers to your neighbor, showing one finger for number 1, the expensive pen, and two fingers for number 2, the cardboard pen."

"Note that many people changed their votes." You do not actually have any good way to know this, and it might not be true. But the statement is didactically useful, and no one will challenge it. So say it regardless of what you infer from the raised hands.

"However the new information did not describe the pens' physical technology; it described my relationship, habits and attitudes toward the pens. That indicates that property of sustainability is not mainly inherent the physical technology of the tool. Sustainability is in a person's relationship to the tool. Achieving sustainability does require new technologies, but more important will be the development of new relationships and attitudes to the technologies we already have."

Debrief -->

Here are some sample questions for debriefing:

- *What are some technical measures to reduce emissions of greenhouse gases into the atmosphere? What are some social measures to reduce emissions of greenhouse gases into the atmosphere? Which of these is more widely mentioned?*

- *Will purely technical measures stabilize emissions while social norms promote indefinite growth?*
- *What could you do to promote changes in the social and cultural factors that promote growth?*

- *If you were successful, how would those changes affect greenhouse gas emissions?*

SPACE FOR LIVING 16

"The blunt truth about the politics of climate change is that no country will want to sacrifice its economy in order to meet this challenge, but all economies know that the only sensible long term way of developing is to do it on a sustainable basis."

Tony Blair, former British Prime Minister

"Sharing what you have is more important than what you have."

Albert M. Wells, American author

"The financial crisis is a result of our living beyond our financial means. The climate crisis is a result of our living beyond our planet's means."

Yvo de Boer, former Executive Secretary of the United Nations Framework Convention on Climate Change

Climate link --> Vanishing natural resources are a commonly shared concern of our climate crisis. There are many examples, from diminishing forest carbon sinks to declining habitable spaces in islands and coastal nations, to shrinking Arctic ice fields for polar bears. Man and other species face mounting challenges related to sharing essential but diminishing resources.

The Food and Agriculture Organization of the United Nations estimates that, globally, around 13 million hectares of forests were converted to other uses or lost through natural causes each year between 2000 and 2010. This represents a slight decrease in world deforestation, which nevertheless continues at an alarmingly high rate in many countries.

According to NASA aerial surveys (November 2009), the East Antarctic sheet is shedding 57 billion tons of ice a year and contributing to sea level rise. We know these things are happening, but until it affects us personally, it is hard to change our behaviors

Many well-intentioned efforts to adapt to declining resources founder on three deeply ingrained ways of thinking. First, people tend to avoid thinking and talking about better sharing of resources. They believe that "If he gets more, then I'll have less."

Second, many people prefer to ignore a problem until it is widely perceived. They think that "When I see it, I'll do something about it." Third, people often rely on tried-and-true methods. They believe that "If it worked before, it will work again."

This game can lead a group through a shared experience in which they confront the consequences of these three conceptual habits.

About this game --> This exercise is useful to help people experience their own behavior and those of their group when confronted with mounting resource problems related to limits and scarcity. It is a powerful way to introduce a discussion about society's responses to competition for resources. It can set the stage for discussions about adopting innovations that can lead to collaboration. Its use is not recommended at the beginning of a workshop. Rather, it is best to wait until participants have gotten to know each other a bit before asking to put themselves in close physical proximity.

This exercise can help people to experience their own and others' reactions in the face of declining resources. It can demonstrate the need to be open to new plans or policies even while current ones seem successful. It helps to illustrate some basic principles governing innovation and opinion change in groups; and it can provide a metaphor that is relevant to situations that arise when resources become inadequate to support the habitual way of doing business.

To run this game -->

This is a participation game for a minimum of 10 to 15 participants; ideally, 25 people. With groups larger than 30, split into subgroups of 15 to 20 participants.

15 to 30 minutes

Space

Outdoors is best if the surroundings and climate are not too distracting. If you use a space indoors, make certain there is an open floor area, clear of any objects, that will comfortably fit your group standing at arms length apart.

Equip-ment

In total, allocate 2 meters of rope per participant, but at least 25 meters. (For example, if you're working with 25 people you will need 50 meters of rope.) The first time you play the game, you will cut the rope up into pieces of different length and tie each piece into a loop. In subsequent sessions of the game, with other groups, you can reuse the rope by tying several pieces together to get the required number of loops of the proper size.

Setup

Take 50 percent of the rope and cut it into 1 meter pieces. Tie the two ends of each 1 meter piece together to make a loop. This loop will be large enough to encircle one pair of feet that are placed together flat on the floor, with no part of the shoes touching the rope. In our example, take half the 50 meter rope (25 meters), cut into 25 lengths of 1 meter each and knot.

Use 20 percent of the rope's length (in our example: 10 meters) to make loops large enough to encircle the feet of 2 to 3 participants. Each of these loops will require a piece of rope about 2.5 meters long.

Make one loop big enough for about two-thirds of the participants to stand within it very closely together. For 10 people, you need about 4 meters, for 25 people about 6 meters.

Use the remaining rope to make loops big enough to encircle the feet of 5 participants, about 3.5 meters each.

Put all the loops on the ground so that they are at least 30 centimeters away from each other. Pull each loop into the shape of a circle. Leave clear ground where everyone can stand while you are introducing the game.

Instructions -->

Step 1 -->

Gather your group near the rope loops. If you have more than one group you will need at least one supervisor for each subgroup. Ask all participants to go and stand inside a loop so that both of their feet are on the floor and do not touch the rope.

Step 2 -->

Explain the game's rules: *"Imagine that the space you're standing in represents an important resource (you can choose one that is appropriate: a carbon sink that is important for fixing enough carbon for your survival, habitable land on your island, arable land on Earth, enough rangeland for your cattle, etc.). For you to 'survive' to the end of the game, each of you needs to keep finding space within a loop. It is essential, in each round, that you find a place where your feet touch the ground inside a loop without touching the rope. Anyone who has not found their own space within two minutes after I have said 'Switch!' will be asked to move to the side-line of the game."*

"When I see that all of you have 'space for living,' or have moved to the sidelines, I will say 'Switch!' Then, if possible, you must leave the loop where you are standing and find space for your feet within a different loop. Again I will wait until everyone has either found the space they need, with their feet not touching the rope or the ground outside the rope or have moved out of the game. Then I'll say 'Switch!' again."

Step 3 -->

Look around to ensure that everyone is standing inside a loop with no illegal touches. Then say *"Switch!"* Wait for all participants to move to a different loop and position themselves inside it, without any foot touching the ground outside a loop.

Step 4 --›

Repeat the exercise. However, just as you say *"Switch!"* pick up several smaller loops as soon as they're empty, so that the number of the remaining loops is smaller than the number of participants. It helps to have a colleague assist you with this. (If someone refuses to vacate the loop you wish to pick up, just untie the knot and remove it from around him or her.)

There may be brief panic, until participants realize that more than one person can stand within the larger loops. Observe how this realization first occurs to an individual, and then moves through the group.

You might choose to make the analogy stronger, and increase drama by announcing towards the end of the game, when you take away a loop or loops, *"We've just lost another 32,000 hectares of forest from deforestation"*, or *"The East Antarctic sheet just shed another 57 billion tons of ice"*, depending on the metaphor you have chosen.

Step 5 --›

Continue with several more rounds, each time removing several smaller loops. Whenever you observe that someone is not accommodated within a loop two minutes after you have said *"Switch!"*, ask them to step away from the active zone of the exercise. Reassure them that their observations will be useful at the end of the game, to help them stay engaged in the play.

Step 6 --›

When only 1 or 2 loops remain, it will be impossible for all the remaining participants to stand completely within the space the loops provide. At this point, some participants may start creating human pyramids – for example, by trying to carry colleagues on their shoulders. Don't permit this strategy; it is dangerous.

If people start creating human pyramids, simple say that everyone must have their feet touching the ground, and everyone must be self-supporting.

At some point, people may ask whether their feet must be flat on the ground, or whether they can stand on tiptoe or position their feet in some other way and still follow the rules. A good reply is: *"Everything that is not*

forbidden is permitted." Eventually, someone will realize that it is therefore legal for participants to sit or lie on the ground outside the circle with just, for example, their heels touching the ground inside the circle.

Notice how and with whom this idea originates and whether others in the group promote or resist it.

If a high-status participant, such as a senior manager, initiates the idea, often other group members will support it. The same idea coming initially from another participant will often be ignored. Make a note of this, to bring back to the debriefing around power asymmetries and communication.

Step 7 --›

When all remaining group members have successfully managed to have their feet touching the ground inside the last remaining rope circle, the exercise is complete.

Then lead a brief round of group applause. Help up those who are on the floor, and segue into the debrief.

Cautions

Normally, the close physical proximity that this game requires is not an issue for Western participants. However, if you believe that one or two people may feel uncomfortable with it, enlist them to pick up the ropes and to check for compliance with the rules. If you think more than just a few participants will be uncomfortable, do not use this game. You may possibly finesse this issue, when working with a non-Western group, by dividing the participants into a male and a female subgroup, so that there is no close proximity among those of the opposite sex.

Watch to ensure that no one creates a solution to the crowding that puts anyone under physical stress or poses the potential for someone to lose their balance and fall over. *Space for Living* has been run hundreds of times with no problem, but it is always wise to be cautious.

During the discussions and the debrief, it is best not to call on a specific person. Let the participants choose to share their thoughts, or not.

Debrief -->

In order to get the most learning from this game, make sure you have enough time to debrief it. You can ask a variety of questions to prompt insightful discussions on three levels:

First: What happened in the game? -->

Give participants time to express their own views, feelings, and conclusions about the game. You can do this by asking, *"Who has some view or feeling about the game that they would like to share?"*

Second: What caused the events and outcomes? -->

Then move to this set of related questions about underlying assumptions, paradigm change, control, and the ethics of equity and inclusion:

- *Did you assume at the beginning of the game that each person had to have their own loop? If so, why?*
- *Is it acceptable to develop a strategy that depends on some people dropping out?*
- *Did you take the time during the game to discuss longer-term strategy? If not, why not?* The typical response is that players felt the facilitator was pushing them from one round to the next by announcing *"Switch!"*. If you hear this reply, ask the next question.
- *How did those of you inside the circle feel about those who were not able to find a space? Who was responsible for outsiders' failure to find space?*
- *When the perception of diminishing resources was reached, how did you feel? Often there is a sense of giving up. What behavior does that transform into? Do we tend to see more innovation and creative problem solving or less?*
- *How did those of you outside the circle feel about those inside? Who was responsible for the fact that no one offered to help you find a place? Ask those who were removed from the game how they felt.*
- *Who controlled the progress of the game from one round to the next?* Participants generally assume that the facilitator has this authority. But you can point out that players had the final power. By simply standing on the rope, any one of them could have stopped the progress of the game long enough to hold any useful conversation within the group.
- *To succeed in this game, you need to experience two paradigm changes, or strategy shifts. First, you have to recognize that each person does not need to have their own loop. Second, you must figure out that your entire foot does not need to be touching the ground. In this exercise, how did these shifts occur? Who first had these ideas? Was it someone who already had a space? Someone who was excluded? What other characteristics did the initiators of these ideas have? How did other group members respond to these shifts? Did they support them? Resist them? If the group supported these changes, what was it about the initiators that caused others to support their ideas? Can you generalize from these conclusions to predict the most likely sources of new ideas in your organization?*

- *It was obvious early on that there would not be enough loops for everyone to find their own space using the policies with which you started the game. When the limits became obvious, did group members change immediately or wait to innovate until they had no alternative? If they waited, why? What are the costs of dealing with limits only after they are pressing hard on the system? How could you change the system to make it anticipate limits and innovate in advance of absolute necessity?*

Third: How does our game behaviour relate to real world events? - - ›

- *Do the causes of our game results also exist in the real world?*

- *The group processes you experienced in this exercise are quite common; we talked about vanishing carbon sinks, habitable land, low-lying islands, arable land, and polar ice caps. How else is climate change creating the dynamic of ever diminishing resources? Are resources declining in the organizations that are dealing with the climate change issue? What might you learn from this game that you could use in our work on climate change to facilitate the spread of constructive new ideas?*

You might comment, if you did indeed observe this, that in the end the game produces encouraging results that people can creatively find a way to share and cooperate, even with reduced resources.

"A blind man can make art if what is in his mind can be passed to another mind in some tangible form."

Sol LeWitt, American conceptual artist

What it takes to be a successful, self-organizing system

"New organs of perception come into being as a result of necessity. Therefore, O, man, increase your necessity so that you may increase your perception."

Dschalal ad-Din ar-Rumi, 13th century Persian mystic

"The ability to self-organize is the strongest form of resilience. A system that can evolve can survive almost any change, by changing itself."

Donella Meadows, *Thinking in Systems* (2008)

Climate link --> To avert the most serious effects of climate change, we are faced with the intense need to make significant changes in the fundamental structures on which our lives, political institutions, economies and lifestyles depend. Climate change, however, is characterized by future surprises and unknowable risks. This creates the need for building resilience and social learning into our own systems, so that society can self-organize and create a shared vision for working within, while fighting to change the drivers for, our fast-changing environment.

About this game --> During *Squaring the Circle,* a team engages in a process that may feel a lot like real life-trying to develop a totally shared view of their problem, and shared vision of the solution, without any individual having a complete overview of the situation (here, literally in the dark).

In this exercise, the group members are blindfolded or told to close their eyes. Then they are asked to solve a problem that can only be solved with the assistance of all team members. Success hinges on members of the group calling on their visioning and visualization skills, and understanding the importance of their contribution to the solution, both individually and collectively.

In nature and society, successful systems are those that possess a self-organizing capability – those that have capabilities to act autonomously, to view themselves in relation to their environment, and to adapt accordingly. *Squaring the Circle* challenges a group to become its own self-organizing unit, and to find its own order (which is achieved when they "square the circle") through team work, shared visioning and visualization, and systemic thinking.

The purpose of this exercise is to explore experientially the meaning of group or social learning, and to introduce the concept of self-organization, especially when a complete overview of the situation is not available. Learning around some of the challenges of communication, the process of creating a shared vision, and joint problem-solving will also surface in the process.

Deprived of sight and thus of a wide array of non-verbal communications (e.g. gestures and facial expressions), the group is challenged to adapt to their new environment, which is a challenge faced by all self-organizing groups. The group also is challenged through the skills of social learning to create new methods of communication and problem solving.

To run this game -->

Number of people

This is a participation game. The minimum is 8 people and the maximum is 30. If you have more than 30 participants, you can run this game in multiple groups as long as you have sufficient ropes and monitors to ensure the safety of each group.

Time

20 to 30 minutes (depending on group)

Space

Outdoors or in a room large enough for participants to form a loose circle, and not be too close to stationary objects, walls, or other items that could pose safety issues as the group members move blindfolded.

Equipment

1 long rope, about 9 meters or longer

1 piece of cloth per participant (e.g. a napkin or a scarf) that can be used as a blindfold

Setup

Have the rope nearby and make sure it can be easily uncoiled without having to unravel tangles and snarls. Ideally it should already be uncoiled and ready on the floor.

Instructions -->

Step 1 -->

Have everyone line up, shoulder-to-shoulder, in a straight line, all facing in the same direction. Ask the participants to put their hands out in front of them, palms up. Place one end of the rope in the hands of a person at the end of the line and walk down the line having each person take hold of the rope with both hands. At the end of the line, turn around and walk back up to the original end, but this time just laying out the rope on the floor. Then tie the two ends of the rope together. Now all people are bunched on half of the loop.

Step 2 -->

Tell participants the rules: *"Close your eyes, and keep them closed during the rest of the task."* (Or put the blindfolds on at this point.) *"The entire rope needs to be used. You may slide along the rope, but you cannot change positions with anyone else on the rope. When you personally think that the group has finished its task, raise your hand and I will ask for a vote. If a majority of the group thinks you are finished, I will ask you to stop and open your eyes. If only a minority join you in raising their hands, I will tell you to keep going."*

If a participant doesn't want to close his eyes, or accidentally opens them during the exercise, ask him to let loose of the rope and step back silently. He will serve as an observer who can later help the group understand the strengths and weaknesses of their problem-solving approach. You can also ask one or two people to volunteer to act as observers, prior to the start of the exercise.

Step 3 -->

Finally say, *"Your goal is to create a square while everyone maintains their hold on the rope."*

Step 4 -->

As the facilitator, you should see that no member of the group wanders into anything, such as a wall, a tree or a hole. As the group attempts to solve the problem, you should remain silent. When a participant raises a hand to signal the process is complete, the facilitator asks the group to vote on whether they are finished. If fewer than half the people think the task is finished, tell them to keep their eyes closed and continue working to achieve the goal. If the majority believes the task is accomplished, ask everyone to open their eyes. Have them place the rope on the ground, being careful to maintain the shape.

Step 5 -->

Give the group a chance to look at the shape of the rope and then move to a comfortable place to sit and debrief. Leave the rope on the ground so that the group can refer to it during the debrief.

Debrief --> Some groups create a perfect square, some a triangle and others a shape that looks like an amoeba. Whatever the shape, you and the group can be assured that there is learning to be had. If you had any observers, allow them to comment on what they observed.

Then ask participants to describe their experience:

- *How were features of this task similar to the challenge society faces in preventing and adapting to climate change?*
- *How easy was it to complete the task and solve the problem together (to square the circle?) What if the problem we were solving was climate change?*
- *What were some of the features of the process that helped you to accomplish this together? Or features of the process that hindered this?*
- *What was your strategy?*
- *Was the strategy effectively communicated?*

Their strategies will vary. Some group members will figure out that they can make the process easier if they count off and try to align the group so that there is an equal number of participants on each side of the square (all sides are equal). Other groups will figure out that the process can be improved if the people who make up the corners are chosen. Very rarely a small group will make a square out of the rope they control, while simply ignoring the others.

Social learning --›

Squaring the Circle provides a good opportunity to explore how the group may have learned over the duration of the game.

Revisit what happened in the first few minutes of the activity: *"How does this compare to what was happening toward the end? How did the group improve? How are we seeing learning occur in the climate change field? What examples can we identify?"*

Self-organizing groups --›

To explore the concept of self-organizing groups, you might consider these questions:

- *Did a leader emerge? Is it hard to lead when you don't have a "solution"? What can leaders in this situation provide (e.g. process leadership)?*
- *How did the leader or lack thereof affect the group dynamics?*
- *How did "not being able to see" affect the ability to communicate?*

Group administrators have often witnessed this somewhat ironic occurrence: after moving almost immediately and effortlessly into a good square, members of the group start to analyze and intellectualize the process and their satisfactory solution deteriorates. In the end, the square becomes more misshapen than the group's original solution.

Link this game with the breadth of the change that needs to happen across society, for example to make progress on averting the worst damages from climate change. You may also wish to explore the analogy to communicating about a goal without necessarily being able to see one another. How are the dynamics similar for organizations, sectors, or communities working on climate change projects who only communicate virtually with one another?

Link this game to society's need, at many levels, to solve shared problems and define collective strategies around climate change. What reflections does the group have on how their process relates to the social change needed within the climate change context? What lessons can they draw?

THUMB WRESTLING 18

"Focus on competition has always been a formula for mediocrity."

Daniel Burrus, technology forecaster

Competition vs. Cooperation: You don't have to beat the other person to win!

"The only thing that will redeem mankind is co-operation."

Bertrand Russell, British philosopher

"If we do not hang together, we will all hang separately."

Benjamin Franklin, American inventor and statesman

Climate link --> Most members of the global community have finally come to recognize that it is necessary to reduce the amounts of greenhouse gases emitted into the atmosphere. But most polluters assume that they can get someone else to make the short-term sacrifices associated with reduced emissions. The rationalizations differ. Poor countries claim the problem was caused by the rich; therefore the industrialized nations should make the biggest reductions. Populous nations ask for a quota to be defined per person; sparsely populated nations prefer that the quota be allocated to each country. Developing nations claim that the rich should give them the technologies they need to develop energy from non-carbon sources. Rich countries feel that they need more time to make big changes.

And so it goes. There is a fantasy that someone else can solve the problem; that co-operation and shared sacrifice will not be necessary; that each of us will be better off, if we can get others to make the necessary reductions. The total fiasco in the 2009 Copenhagen climate change conference illustrates that each country considers it is in a competitive situation with the others. This game creates an opportunity to examine assumptions about the potential of co-operation versus competition.

About this game --> It is one thing to talk about our mental models and another to see them in action. *Thumb Wrestling* gently and humorously shows the consequences of our implicit assumption that life is a zero sum game. People like this exercise, because it is fun. But it can lay the foundation for serious discussion.

To run this game -->

Number of people

This is a mass game that is played in pairs. If there is an odd number of people in one group, for example, an odd number of people in one row of the audience, it is possible for one person to engage in a thumb wrestling competition with two people at the same time.

Time

10 to 20 minutes (depending on the length of your debrief)

Space

This game can be played by audience members sitting in their seats, with or without a table.

Equipment

None

Instructions -->

Ask participants to find a partner, preferably by turning to the person sitting or standing next to them. If there is an uneven number, the leader may participate or one person can "wrestle" with both the right and the left hand simultaneously. It may go faster if you explicitly tell people how to find a partner, or if you assign partners. But one way or another you need to start by having each participant identify the person with whom they will play the game.

"Now we are all going to engage in a simple competition, called Thumb Wrestling. *Over the next few minutes your goal is to get for yourself as many points as you can. It is socially acceptable, during this exercise, for you to be completely selfish."*

Call up someone to help you demonstrate. It is best to pick someone who has been warned ahead of time and asked to help you demonstrate an aggressive style of play. When your demonstration partner is up in front of the audience, lock the fingers of your right hand with the fingers of their right hand.

"During the game each of you will have the goal of getting as many points for yourself as you can. To get a point, one partner pins the thumb of the other partner." Now engage in a few seconds of elaborate feinting and struggling with your partner to illustrate the process. Make sure that at some point you pinch the other person's thumb between your thumb and the middle of your index finger. Referring to the pinned thumb, *"That would give me one point. But since I want many points, I will immediately let loose and try for more success in pinching my opponent's thumb."*

"When I say 'Go!' you will play the game for 15 seconds. Each of you count your own points as you earn them. Be honest! Go!"

Now let 15 seconds elapse. The precise length is not crucial. You can either count to approximately estimate the time, or you can use a stop watch. After the time has elapsed, say *"Stop!"*

Debrief -->

"Now we will see how you did. Everyone who got 3 or more points for themselves, raise your hand." Pause until people have had a chance to respond. Probably about half the audience will raise their hand. *"Thank you. Put down your hands. Now everyone who got 6 or more raise your hands."* Pause. *"Ten or more raise your hands."* Pause again. *"Fifteen or more. Twenty or more."* When only one couple is still raising their hands as you increase the limit, ask them, *"How many points did you get?"* It will be a fairly large number, perhaps 20 to 30. Repeat their answer loudly and with emphasis, so that the entire audience hears it. *"Please stand up and demonstrate your technique."* Almost certainly they will demonstrate a cooperative approach in which first one and then the other lowers their thumb, so that the other can pin it. *"Thank you, please sit down."*

Obviously the cooperative approach let both participants in the game get many more points for themselves than the competitive approach. Yet almost everyone here automatically assumed that they had to compete. They adopted a zero-sum attitude – if you get more, I will get less. In fact the situation was win-win: either we both get many points, or we both get only a few.

- *What similarities do you see between this exercise and climate change negotiations?*
- *How can we change the nature of climate change discussions, so that nations are prompted to collaborate rather than compete?*

TRIANGLES 19

Don't put 80% of your effort into policies that make 20% of the difference!

"[Organizational] challenges are predictable. They arise as natural counter pressures to generating change, just as the need for soil, sunlight, and water arise as natural limits when plants start to grow. Though they often appear as seemingly independent events, they are interconnected and interdependent. There are high-leverage strategies that can help teams and individuals deal with each challenge separately. But the greatest leverage comes from understanding them as an ensemble of forces."

Peter Senge, director of the Center for Organizational Learning, M.I.T.

"It would be difficult to exaggerate the degree to which we are influenced by those we influence."

Eric Hoffer, American social philosopher

Climate link --> Climate change is being caused principally by direct and indirect consequences of the rising levels of greenhouse gases in the atmosphere. But any effort to change some behavior that leads to greenhouse gas emissions has many other consequences. Most of the indirect consequences lead the system to resist change. If we are to be effective in our change efforts, we need to become skilled at anticipating the indirect effects and at identifying the few policy options among many that might actually lead to sustained change.

About this game --> In his best-selling book, *The Fifth Discipline: The Art & Practice of the Learning Organization*, Peter Senge offered this simple, yet profound axiom: "Small changes can produce big results – but the areas of highest leverage are often the least obvious." Here, he refers to what systems thinkers call "leverage points" – well-timed, well-placed actions that can produce significant, lasting improvements. Most people immediately grasp the concept of leverage points, but to spot them in an actual system is often more difficult. This exercise quickly illustrates the concept of leverage points through concrete changes made to the group's structure.

To run this game -->

Number of people

This is a participation game for 10 to 40 people. If your group exceeds 50, split it into two groups with less than 50 people in each.

Time

20 to 30 minutes

Space

A square or rectangular area about 10 meters long on each side or larger, free of obstacles, and large enough for all participants to move around freely

Equip-ment

No special equipment is required.

Setup

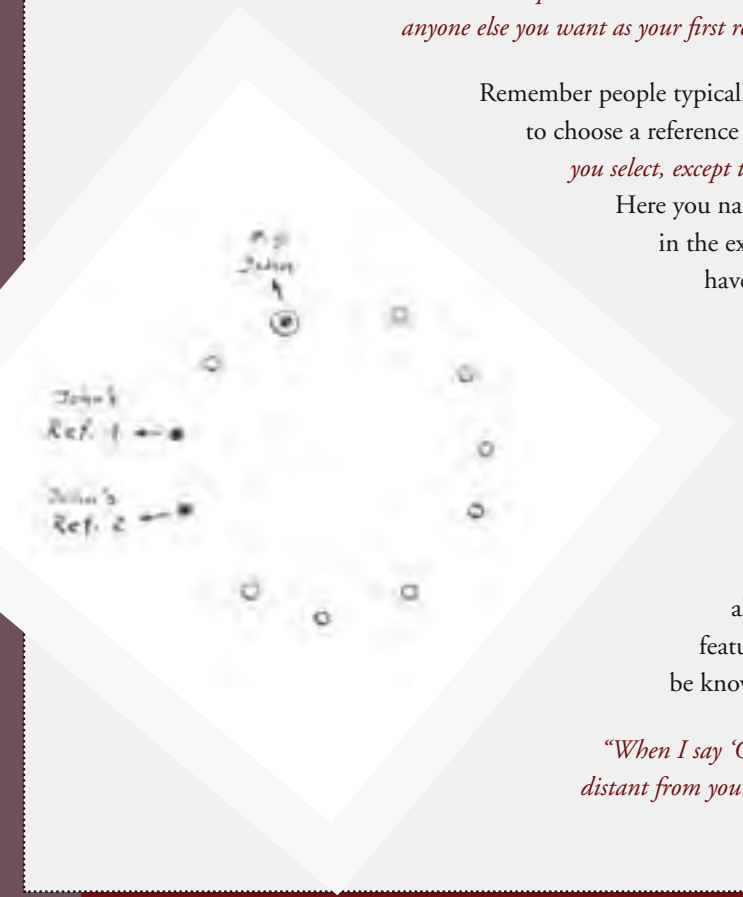
Ask the participants to stand in a circle within the space you will be using for the exercise. It should be possible for each person to see all the others. You should stand inside the circle.

Instructions -->

Optional introduction, if you have sufficient time: Ask participants to think of some effort to address climate change that produced no result or a very different outcome than the one intended. Ask one or two people to share their stories briefly.

Then say, *"Through this exercise, we can gain insight into how systems are able to produce very different results than we expected."*

"I ask each of you to choose two other people around the circle who will be your references during this exercise. The first of your references should be someone who is ..." Here you should indicate a feature that is unique to one person in the room. For example who has blue eyeglasses, or who is wearing a yellow dress, or whose shirt is hanging outside his belt. *"No one can pick themselves as a reference. Thus if you yourself have (describe the feature), you should pick anyone else you want as your first reference."*



Remember people typically will not know the names of everyone else. So you cannot ask them to choose a reference on the basis of names. *"The second of your references can be anyone else you select, except that no one should choose themselves as a reference nor a person who is ..."* Here you name some characteristic that is exhibited by at least one other person in the exercise. If you have done this correctly, everyone in the group will have chosen one specific person as one of their references (except that person, who cannot be his or her own reference). In the remainder of these instructions we will call this person the "**Universal Reference**". And there will be one or more people in the room that have not been picked as a reference by anyone. We will call the people in this group the "**Null Reference**".

Be careful to find some basis for exclusion that is not likely to embarrass the person who exhibits it. Items of clothing are generally acceptable. Physical features are better avoided. Psychological features (always happy) are unacceptable, since they would typically not be known by everyone.

"When I say 'Go!' your goal is to move around the room SLOWLY until you are equally distant from your two references. You can be very near or far from each of them; that

makes no difference. But you have to be the same distance from each. When you are equidistant from your references, you should stop moving. But of course, if one or both of your two references move further, you may need to move again in order once more to place yourself equidistant from the two of them."

"I may intervene at some point and steer or stop one of you gently by placing my hands on your shoulders. Please don't resist me. If I say 'All stop!' then everyone should halt immediately and remain standing in place. Any questions?"

To show what you mean, invite two participants to join you in the middle of the circle. Tell them to stand in two specific locations and then illustrate how you would have to move to make yourself equidistant from them. Illustrate being both close and equidistant and far away and equidistant. When you are equally distant from both of them, ask one person to move several feet and then show how you would have to move to regain equidistance. Again, ask if there are any questions.

Return your two demonstrators to their original positions, and move yourself out of the circle.

"In a minute, I am going to ask everyone to get equidistant from their references. What will happen?" (Pause for replies. You should not agree or disagree with the replies. But make sure everyone understands what is said.) *"Will the group keep moving forever, or will it come to a stop?"* (Pause for replies.) *"How long will it take for the group to stop?"* (Pause for replies.)

These questions are important, because it is essential to get the participants to ponder and decide what they think the behavior of the system will be. That will maximize their learning from what actually does occur.

After you have given the participants a few minutes to speculate say, *"Go!"*

Watch what happens. Most often, people will mill around the room for a minute or two, before everyone slowly comes to a stop. Be patient. It may take longer to reach equilibrium, but eventually the participants will come to rest.

Now you can conduct a set of experiments that illustrate the concepts of high and low leverage and that show the extent to which a change in one part of the system can have impacts in a very different part.

Ask everyone to return to their original positions. Now point to the person who is the Universal Reference. Announce that in the next phase of the exercise you will use your hands to stop his or her movement. When you do that you will expect that everyone else should continue to follow the original rules. Ask what will happen. Give them time to reflect and respond. Do not evaluate the responses. When people are finished with their comments, you can say, *"Let's do an experiment and see."* Then say, *"Go!"* After three seconds, use your hands gently to stop the motion of the Universal Reference. The rest of the group typically will also stop very quickly.

Return to the original circle and discuss what happened.

Point to someone in the Null Reference group. Explain that in the next part of the exercise you will intervene by placing your hands on the shoulders of that person, causing them to stop moving. All others will continue to follow the rules. In other words, they will move until they are equidistant from their references. Ask the participants how your intervention will change the behavior of the system. Give them time to reflect and respond. Do not evaluate the responses. When people are finished with their comments, you can say, *"Let's do an experiment and see."* Tell the group to *"Go!"* After three seconds in which every-one moves around trying to get equidistant from their references, gently stop the movement of the person you have previously indicated. Halting this person will not have any influence on the remainder of the group. It will still take some time for the rest of the group to come to a halt.

Return to the original circle. Ask what happened and why.

In the first of the two exercises you used a "high leverage" policy. You changed something that had influence on every other part of the system. In the second of the two exercises you used a "low leverage" policy, you changed something that had no influence on any other part of the system.

Debrief --> Ask group members to take their seats and share their general impressions, feelings, and observations about the exercise. Many insights should already have emerged during the conversations after each experiment Now it is time to summarize.

Here are some possible questions to ask:

- *In this exercise the indicator of impact is the length of time required for people to stop moving. What is the corresponding indicator of impact in the climate system?*
- *What are some of the low leverage policies people are using in response to climate change?*
- *What are some of the high leverage policies people are using in response to climate change?*
- *What can we do to shift political activities more towards the high leverage policies?*

WARPED JUGGLE 20

Incremental change or structural change? Know the difference!

"After almost two years of fraught negotiations, the European Council agreed on a climate-change package in mid-December 2008, which was subsequently approved by the European Parliament. The headline goals are for a reduction in EU greenhouse gas emissions by 20% on 1990 levels by 2020 – or 30% if other industrial nations sign up to a successor to the Kyoto Protocol – and an increase in the share of renewable energy sources to 20% of overall EU energy consumption. However, with a group of member states pushing hard to limit the potential impact on the industrial sector, the EU has arguably weakened the means of achieving its goals."

Economist Intelligence Unit,
Countdown to Copenhagen (2009)

"In 1972, global population and consumption were still below the planet's long-term carrying capacity. It was only necessary to slow down and then stop. Now, they are far above, about 35% above according to Wackernagel's Global Ecological Footprint analysis, and the problem is to figure out how we can get back down below the sustainable limits."

Dennis Meadows

Climate link --> In our attempts to understand and solve the climate change crisis, we may find ourselves pushing on various levels (or actions that are perceived to have high impact) such as greenhouse gas emissions, food production, aerosols in the atmosphere, habitat loss and population. Many of these interventions can be characterized as incremental change (for example, policies focused on slowing the rate of growth of CO_2 emissions), and others as structural change (for example, alternative energy sources that require no fossil fuels and result in no CO_2 emissions).

As examples, incremental change in transportation is getting better fuel efficiency for a car; structural change is moving to a house that permits you to sell your car and commute by walking or by bicycle. Incremental change in industry is substituting solar energy for oil-fired electricity plants; structural change is shifting the composition of products, so that you produce materials that are fully recyclable.

This exercise provides participants an opportunity to experience the difference between incremental and structural change as it relates to climate change. The exercise may also be used to explore the "Limits to Success" archetype as it relates to climate change consequences, policies and interventions.

About this game --> This game provides participants an experiential opportunity to:

- Experience the difference between incremental and structural change;
- Look at the behavioral aspects of climate change through a systems archetype known as "Limits to Growth" or "Limits to Success";
- Become students of their own behavior, as they observe their own habitual ways of forming assumptions;
- Work with the "Limits to Success" archetype;
- Use and examine the creative process for alternate solutions;
- Draw a loop diagram to map the group's process;
- Extrapolate to other situations such as climate change in which exploring assumptions and looking for alternative models are useful or critical;
- Surface one or more assumptions about team learning and problem-solving.

To run this game -->

Number of people

This is a participation game for a minimum of 6 people. Maximum of 20. This exercise works best with 8 to 12 participants.

Time

20 to 45 minutes (depending on length of debrief)

Space

Clear away all furniture to create a space large enough for the group to stand shoulder-to-shoulder in a circle. This exercise can be conducted almost anywhere: in a boardroom, on a lawn, in a corridor.

Equipment

3 tossable objects (e.g. soft balls, oranges, stuffed animals, etc.).
Note: tennis balls can be difficult to catch.

Have the 3 tossable objects on hand. If possible show only one object at first, hiding the other two in your pocket or a bag.

Instructions -->

Step 1 -->

Gather the group into a circle, with you as a participating facilitator. Show one of the objects and tell the group that your first step is to set up a pattern for tossing the object. Ask everyone to hold their hands out in front of them until after they have received the ball. *"So, when someone is looking to throw the ball in order to establish the order the first time, you should only consider throwing it to someone whose hands are still stretched out."*

"You need only remember who threw the object to you and to whom you threw it." Begin by tossing it to another member of the circle (but not to the person standing next to you). It is important to use a gentle underhanded toss. This is not an exercise that should require expert catching skills. Slow the pace of the toss if necessary so everyone is comfortable with tossing and catching the objects.

Step 2 -->

The person receiving the object tosses it to someone else that has yet to touch it. When all members of the group have touched the object, it is tossed back to the facilitator. **After they have thrown the ball around the first time to establish the order, simulate the order once by having people point, one after the other in the same order that the ball will go, to the person to whom they will throw the ball.**

Allow the group to throw the first object using the established pattern, until you are sure that they remember the sequence well. Once that pattern is well established you can then stop and show the group the further two objects.

Step 3 -->

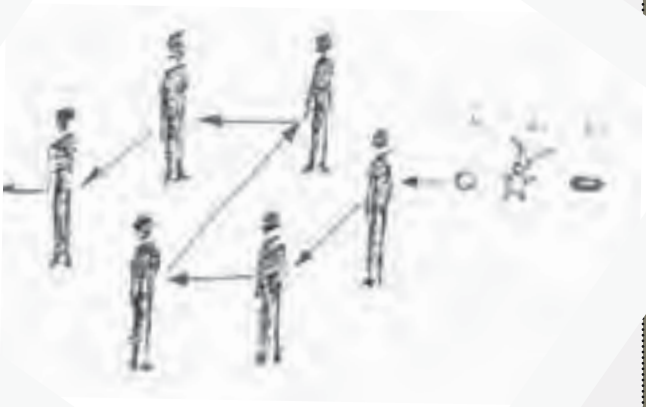
The facilitator asks the group: *"How long do you think it will take to toss all three objects in the sequence your group has established?"* Before coming to a consensus on the time, you should state that there are only two rules:

1. Everyone must touch all the objects once.
2. They must be touched in the same sequence.

When participants ask for clarification on the rules, it is important that you state there are only two rules (as outlined above). When participants ask how they might "bend" the rules, the two rules should be your standard response. Also, ask if anyone has done this exercise before. If they have, ask them to participate, but not to offer the solution.

Step 4 --›

Come to a consensus on the time and then, with one of the participants acting as a timer (a digital watch is preferred), try the sequence again. When all three objects are returned to the facilitator, he or she calls *"Stop!"* and asks the person with the watch what the time was. Whatever time they end up with (typically the first effort is 20 to 40 seconds), you then challenge them to cut that time in half. (To have some fun, we sometimes spur groups on by saying their major competitor has done it in X seconds less). The exercise is complete when the participants feel they have done it in the fastest time possible, usually in a second or two.



Note: If group members are new to each other, ask each person to call out their name before throwing the object. The person to whom the object is thrown, receives it, saying, for example, "Thank you, Anna,"and then tosses it to the next person, saying their own name. You may offer a member or members of the group the role of observer. Ask the observer to share observations of the group's process: What happened when someone had a contrary idea? How did the group solve the problem? What patterns of behavior did you observe?

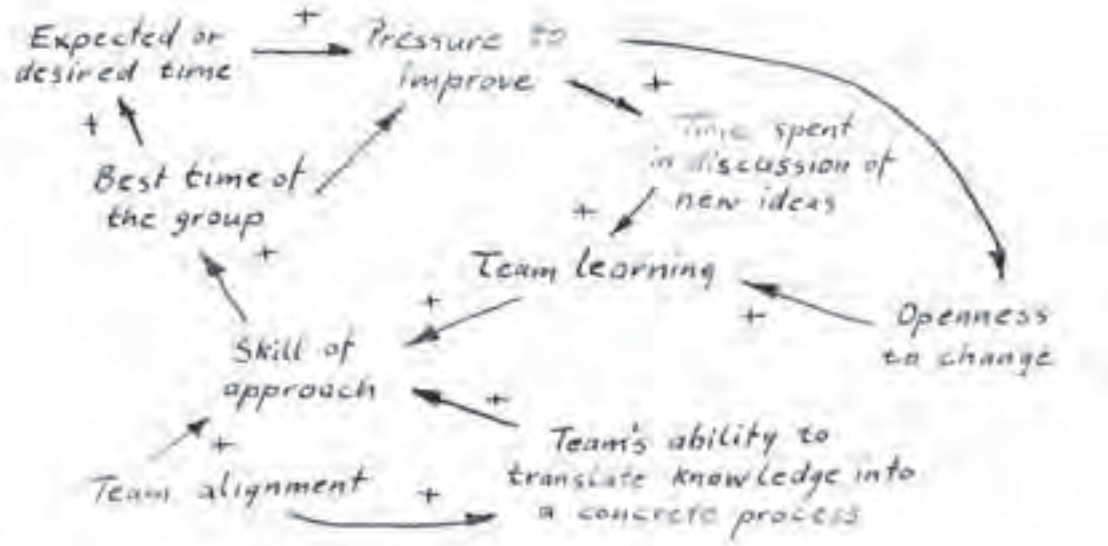
Possible solution

Group members will figure out that they should stand next to the person to whom they are tossing the object, rather than across the circle, to cut down their tossing time and minimize drops and misses. A shuffling then ensues until each is able to pass the object to the person next to them, rather than tossing it across the room.

Debrief --> What typically happens is that initial efforts with all three objects lead to improved performance. Over time (usually within the first 5 to 10 minutes), the group cuts the time down from 40 seconds to 10 or 12 seconds but then they encounter a limit. This limit often causes the performance to slow down or even stop, even though efforts to solve the problem may be increasing. An example of "increasing efforts" might be that the group decides to squeeze in tighter together or to throw the objects faster (which actually causes more errors and more delays).

At this juncture, the opportunities are rich for gaining insights into individual and group behavior patterns within complex systems. One way to do this is through the use of causal loop diagramming. Ask the group to identify the key variables in their experience (e.g., teamwork, time pressure, improvements, etc.) and begin, using a flip chart or overhead, to map the relationships between the variables.

Following is a sample diagram.



You can also use a behavior-over-time graph to plot the trials (number of seconds per attempt) against the time of the activity (like 10 minutes) that would show the initial improvement, and then a potential upswing as people try different things or stabilize with little improvement.

Now, introduce the group to the "Limits to Growth" archetype and ask if the group sees the archetype at play in their own problem-solving process. Observe that this archetype typically involves a constraint.

Ask, *"What do you think the constraint or constraints were in this exercise?"*

In *Warped Juggle*, the constraint is very often the group's assumption that there are more "rules" than those stated by the facilitator. What is the limiting action? The limiting action here can be that participants hammer away at the same approach, without stopping to reflect on their assumptions, hear other ideas, or consider other options.

Climate change debrief -->

The group experienced how immediate success can produce subtle constraints, particularly in the thinking of individuals and groups.

- This game is about setting targets. What were the different targets that were set for this game? If we consider targets related to climate change, leaders may choose to set very low targets (such as slowing the rate of growth of CO_2 emission). However, as we saw in this game, if leaders encourage people to get only a little better, they will achieve that and be satisfied. But when a very challenging target is set, it more often encourages people to seek revolutionary solutions (as they did in *Warped Juggle*). In what other ways is this discussion regarding targets parallel in the climate change discussion?

- *What kinds of inherent pressures and constraints may accumulate in your organization or more broadly as a result of successes related to climate change?* Possible constraints: Financial resources? Capacity to respond to inquiries? Number of staff?

- As a facilitator, you can also point out that the way in which we receive information affects the assumptions we make about that information. In this exercise, the facilitator begins by tossing the ball across the circle. Participants assume that they too have to toss the ball, even though there are no requirements in the rules to do so. The fastest times are actually achieved by not tossing the objects. *"How is the way in which we receive information about climate change affecting the assumptions we (or the general public, or some other group) make about that information?"*

21. WEB OF LIFE

Everything is connected to everything else.

"We did not create the web of life, we are merely strands in it."

Hehaka Sapa ("Black Elk"), Holy Man of the Oglala Lakota (Sioux) tribe in Northern America

"When we try to pick out anything by itself, we find it hitched to everything else in the Universe."

John Muir, naturalist

"All persons are caught in an inescapable network of mutuality, tied to a single garment of destiny. What affects one directly, affects all indirectly."

Martin Luther King, Jr., civil rights leader

"We're trying to deal with a whole array of integrated problems – climate change, energy, biodiversity loss, poverty alleviation and the need to grow enough food to feed the planet – separately ... 'We need to stop thinking about these issues in isolation – each with its own champion, constituency and agenda – and deal with them in an integrated way, the way they actually occur on the ground,' argued Glenn Prickett, senior vice president with Conservation International. 'We tend to think about climate change as just an energy issue, but it's also about land use: one-third of greenhouse gas emissions come from tropical deforestation and agriculture. So we need to preserve forests and other ecosystems to solve climate change, not only to save species.'"

Thomas Friedman, *New York Times*, August 22, 2009

Climate link --> It is easy to think that our actions exist in isolation. Grow more food if you need to feed a growing population, right? What though, is the impact of that decision on forest lands that must be cleared to grow more food? What of the loss of wetlands and forests' ability to store carbon and dampen the impact of climate change? Ultimately, climate change is an issue marked by high behavioral and dynamic complexity,* yet solutions offered are often fragmented, focusing on fragments and not on the intricate web of interrelationships that make up the "whole" of the climate change system.

Given the web-like nature of climate change, where do you start? Do you develop climate change policy and regulations? Develop communications strategies to motivate the general public or specific groups to change behaviors? Create a set of indicators to help communities monitor and make community-wide changes? Work with businesses to develop pro-climate investment strategies?

You can use this exercise to physically trace the interconnections and dynamics of any one of these social, economic and policy-level actions. You can also use *Web of Life* to explore the physical science of climate change.

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* *In situations of high dynamic complexity, cause and effect are distant in time and space and causes of problems are not easily recognized through first-hand experience. Behavioral complexity is the extent to which there is diversity in the mental models, aspiration and values of decision makers related to a particular challenge.*

About this game --> At its simplest, *Web of Life* allows a group to observe how the parts of a system of interest are interconnected. As they participate in this exercise, they see that the system at hand, whether it be the physical climate system, or the behavioral system related to a specific climate change intervention or policy, is typically not made up of straight lines of causality. Instead it is made up of patterns of connection and interaction that better resemble loops, webs, and networks. In most situations, we can't see these interconnections, we have to imagine them. *Web of Life* gives participants an opportunity to begin to appreciate and "make visible" the often complex patterns of interconnection that comprise some of the more perplexing challenges associated with global warming.

In addition, this exercise can help intact teams "see" and better understand the interdependencies and the connections that exist among themselves and within the larger system (such as their organization and their community).

To run this game -->

Number of people

This is a demonstration game. 8 people works well. You may want to experiment with larger numbers. If you use larger numbers, make visible signs with the names and/or pictures of the variable to put around people's necks, like name tags.

Time

Approximately 15 to 30 minutes, depending on the number of people and the length of the debrief

Space

Enough space so your group can stand, nearly shoulder-to-shoulder, in a circle

Equip-ment

2 balls of yarn (or string or surveyor's tape), of different colors. Make sure it will unravel easily. A flip chart, index cards, sticky tape and colored markers.

Set up

Organize the group into a circle. Give someone in the group the large ball of colorful yarn.

Instructions -->

Step 1 -->

While standing in a circle, ask group members to pick a complex issue they wish to make visible (i.e. show, using yarn, the interconnections and dynamics). For example, let's imagine you use this game with local stakeholders who are challenged to understand the necessary agricultural adaptations in a specific region as a result of changing climate conditions.

How might this exercise be used to surface and communicate (to the appropriate research or decision making groups) their existing knowledge about the interconnections and dynamics inherent in agricultural adaptations?

Step 2 -->

After you have picked your complex system or issue, begin to brainstorm some of the variables related to that system. Write out the variables on a flip chart as people say them. Then note each variable on an index card and attach one card to each participant, using the sticky tape. Using the example of "adaptations of agriculture to climate change" the group may brainstorm the following variables:

- (rising) global temperatures
- extreme weather conditions
- water shortages
- food supply
- increasing heat
- crop and livestock yields
- (less) exports
- global shortages of food

Step 3 --›

Start by having the person holding the yard name their variable. For instance, the person may pick "rising global temperatures."

Step 4 --›

Someone else in the circle then names their own variable, tells how it is related to the person who is holding the yarn now, and takes over the ball of yarn. For instance, *"Rising global temperature drives extreme weather conditions."*

Now another person, not yet holding the yarn, explains how their variable is related to variable of the person holding the yarn. For example, the sequence might look like this:

Maja begins with the yarn and picks the variable higher temperatures. John then takes the ball of yarn saying, *"When we experience higher temperatures, we also experience extreme weather conditions."* Eric takes the ball from John, saying, *"Extreme weather conditions often result in poor crop yields"* and so on.

Step 5 --›

The group continues identifying as many connections as possible while the "web" grows in complexity. Once the group is sufficiently entwined, ask, *"Have you captured most of the important variables?"* Then have them place the web, intact, on the floor where they are standing and return to their seats.

Debrief --> Listen carefully to the group's comments as the web becomes more intertwined and complicated. Remember or write down a few of their comments. After they've finished, ask the group for their reactions.

Ask the group to consider the nature of complex systems (comprised of tightly coupled causal relationships, time delays, feedback structures, nonlinear relationships, etc.) as they look at a particular strategy or design:

- *Which variables have the most connections? What does that tell you? Where might there be a significant disconnect between actions and consequences?*
- *Over what time horizon are we talking? Looking at the web, where do you see significant time delays between cause and effect (or between actions and the consequence of those actions)? If so, how long are those delays?*
- *Where are there feedback loops between variables? Where do you see multiple "feedback loops"? How might these multiple feedback loops influence your groups' ability to take action?*
- *Where do you see significant "non-linearities" between actions and consequences (such as when small deviations from a norm produce no response but a slightly larger deviation produces a dramatic one)?*

Optional debrief -->

Ask, *"Is climate change really the problem? What if we think of climate change as a symptom of another problem (economic growth)?"*

Work with the group to brainstorm eight or more variables related to economic growth: number of people, amount of resources consumed, amount of waste generated, amount of greenhouse gases, land use, habitat loss, etc. Now using the ball of yarn, explore how the interaction of these factors may produce symptoms such as climate change. *"Looking at the web you have created, where do you see leverage for fundamental change?"*

Alternatively, you might go through the following steps.

Step 1 -->

Ask group members to brainstorm a set of interrelationships that are driving the growing trend towards increasing global temperatures.

Step 2 -->

Start by identifying key variables and assigning an individual to represent each variable. Here is an example of key variables, which are drawn from the work of Drew Jones and the Climate Interactive group: such as global temperature, solar heat, reflectivity of the Earth, ice at poles, polar ice melting, soil and ocean release of CO_2, greenhouse gases in the atmosphere.

For example, Maja represents "global temperature," John represents "solar heat," Stephanie represents "polar ice melting," etc. (One person may represent two variables if necessary.)

Step 3 -->

Now, the person holding the yarn names their variable. Someone else in the circle then names their own variable

and then tells how it is related to the person who is holding the yarn now and then they ask for the ball of yarn.

Have participants explain the connection:

"As global temperatures increase (ball passes to person who represents polar ice)*, polar ice melts* (ball passes)*, ice at the poles decreases* (ball passes)*, reflectivity of the Earth decreases* (ball passes)*, solar heat absorbed increases and* (ball passes) *global temperatures continue to increase."*

If the group has little familiarity with the dynamics of global warming, talk them through the connections. After they make the connections using the yarn, walk through the connections again using a causal loop diagram.

Now, introduce a new color yarn, and look at a possible, social/behavioral dynamic (or tipping point) related to rising global temperatures:

Assign these key variables to individuals in the group: *global temperature* (same person)*, concern about global warming, mitigation efforts fossil fuel emissions, CO_2 in the atmosphere and greenhouse gases in the atmosphere.*

Say, *"As global temperature rises, concern about global warming increases, mitigation efforts increase, fossil fuel emissions decrease, CO_2 in the atmosphere decreases and greenhouse gases in the atmosphere decrease and over time, global temperatures will decline."*

This reinforcing loop can, of course, operate in the other direction: *"When concerns about global warming declines, mitigation efforts decline, and fossil fuel emissions increase, increasing CO_2 in the atmosphere, and eventually, greenhouse gases in the atmosphere."*

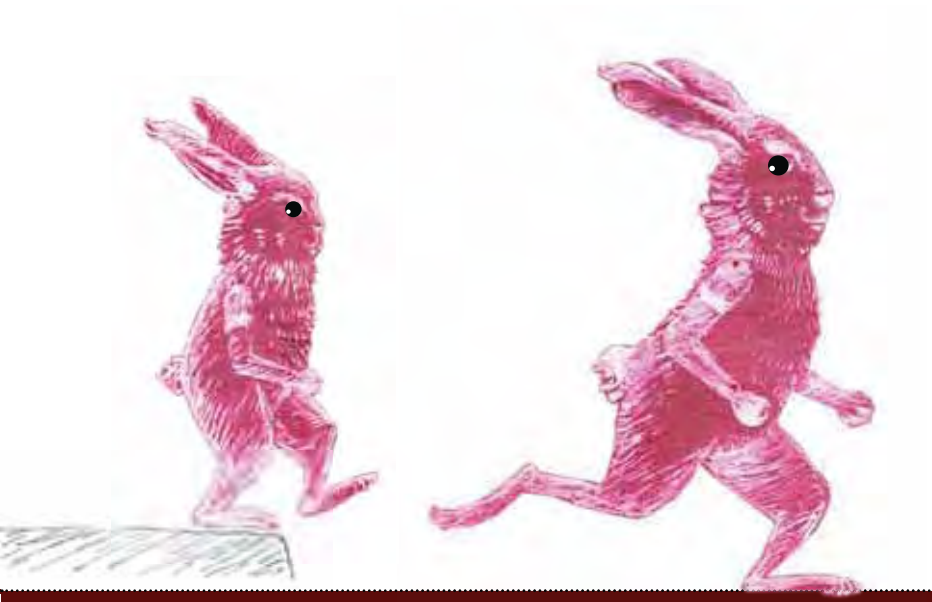
Step 4: - - ›

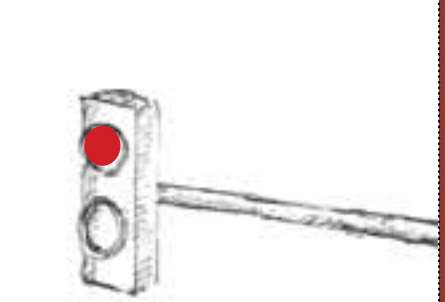
The group continues to identify as many connections as possible while the "web" grows in complexity. Once the group is sufficiently entwined in a seemingly impossible tangle ask: *"What are the other important variables to add?"* You may then add in additional causal connections. When finished, have them place the web, intact, on the floor where they are standing and return to their seats. In his blog, Climate Interactive (http://climateinteractive.com), system dynamicist Andrew Jones points readers to the urgent need to strengthen the upper loop (the social climate change-related feedback loop) in order to prevent the biogeochemical feedback loops from creating catastrophic, runaway climate change.

Actions speak louder than words.

"Do as I say and not as I do"

(Unknown)





"Mixed messages are highly damaging to public understanding, trust and sense of personal capacity to act."

Green Alliance, *From Hot Air to Happy Endings* (2010)

Climate link --> As our climate changes, climate activists and advocates are calling for us all to make behavior changes – changes in consumption patterns, information management, political processes – that signal significant effort on the part of all the Earth's stakeholders.

For example, WWF advocates for reduction of greenhouse gas emissions by at least 80 percent by 2050 (compared to 1990 levels).

The Kyoto Protocol is an international agreement that sets binding targets for 37 industrialized countries and the European community for reducing greenhouse gas emissions by an average of 5 per cent against 1990 levels over the period 2008-2012. Developing countries are being encouraged to "leapfrog" conventional technologies and adopt low-emissions methods and processes, instead of opting for cheaper, and in some cases easier to access, higher-pollution technologies. Everyone needs to contribute to this change.

As advocates and activists in this complex and critical field, how congruent are we with our messages? What extra power do we add to our efforts when we work as hard as we can to model the changes we advocate?

About this game --> This exercise helps to make the point that when you are talking about deep change, leading by example provides more power to your words and messages. In many ways, it supports the popular saying that many have heard since childhood: "Actions speak louder than words."

This exercise is relatively brief so it works effectively as an introduction to a workshop or as a wrap-up activity. It makes the point that whatever we learn and whatever we promise to do, our constituencies, our organizations and our social networks will notice the congruence of our behavior, or potentially the lack thereof, with our words.

As an example of how this game is used, Professor Chirapol Sintunawa from Mahidol University in Thailand often tells his participants in the wrap-up discussion of his sustainability workshops that he does not want them to go home and tell anyone about what they learned during the day. He then introduces *1-2-3 Go!*, and at the end of the exercise, he asks them instead to demonstrate their learning, through their actions, as that will have much more impact and will encourage more change around them in the long term.

When using *1-2-3 Go!* as a wrap-up exercise, it is important to do it quickly and use it "lightly" in the facilitation sense so that it does not appear heavy handed or like a "trick" that the facilitator played on the group. For this reason, you might want to play it twice, and give people ample warning the second time and laugh along with the group if someone forgets and does it again the second time. With caution and a light touch on the part of the facilitator, this simple exercise can help participants focus more attentively on congruence of their words and actions in our field.

To run this exercise -->

Number of people

This is a mass game. The minimum is 2 people and there is no maximum, as any number can play.

Time

3 to 10 minutes (depending on length of debrief, and this should not be long)

Space

No requirements other than enough space so everyone can see the facilitator

Instructions -->

Step 1 -->

Ask everyone to stand where they can see you, with enough space between them so they can raise their hands in front of their bodies to clap.

Step 2 -->

While you demonstrate holding out your hands as if you were going to clap, ask participants to hold their arms out in front of them. Say, *"Now I am going to count slowly to three and then say 'Go!' When I say 'Go!', everyone should clap their hands together."* You might want to repeat these instructions twice to make sure that everyone hears and is paying attention to you.

You can add, *"Our goal here is for everyone to clap at the same time, so that it sounds like one pair of hands clapping loudly. After all, we are all doing the same thing and doing it together will amplify our individual impact."* Repeat the instructions at this point, say, *"Now I am going to count to three, and say 'Go!'"*.

Step 3 -->

Slowly count *"1-2-3"*, then clap your hands together loudly, pause for one second, then say *"Go!"*

When you clap your hands together almost everyone will clap their hands together, not waiting until you say *"Go!"* as they were instructed. Pause a moment, and let everyone realize what happened. At this point, have your debriefing discussion as below.

Step 4 -->

Repeat your instructions and then try the exercise again. Don't concentrate attention on those individuals who still clap prematurely, for they are usually quite embarrassed.

Debrief -->

Keeping in mind that *1-2-3 Go!* can be a quick introduction to a wrap-up session, and is primarily an awareness-generating exercise, the debrief tends to be light and quick.

Different points can be made and it is interesting to ask the group at the end of the first trial, what lessons they can take away from the exercise. After their points, you can make the following observation:

"The exercise points out the importance of nonverbal communication in determining what happens when you are trying to make impact or catalyze change. People will not only attend to what you say, they will look at what you do. As a climate policy maker or an advocate, if you want your words to have the most impact, it is crucially important that your actions be consistent with what you are telling people."

Here is a question to explore:

- *What are the ways your behavior might send confusing signals to your constituencies, partners or community?*

This question does not necessarily need an answer; however, if your wrap-up discussion is focused on personal action in people's climate change work, you might get more thoughtful and personalized answers.

about the authors

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