URBAN RESPONSE

ALNAP

Systems Thinking Handbook for Humanitarians

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ALNAP is a global network of NGOs, UN agencies, members of the Red Cross/ Crescent Movement, donors, academics and consultants dedicated to learning how to improve response to humanitarian crises.

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About the author
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Introduction

Have you ever tried to open a door by pushing it, only to find that in fact, the door opens towards you? Imagine instead that as you approach the door, you see which side the hinges are on and which direction the door opens. This is systems thinking; 'once you know, a small push (or pull) in the right direction is enough' (O'Connor and McDermott, 1997: xv).

This handbook introduces the 'how' of systems thinking for humanitarians – specifically the particular skills that systems thinkers need to practice and seven basic tools for systems thinking. You can also find a helpful glossary of terms at the end of this handbook (Section 5). If you're new to systems thinking, you may like to take a look at the accompanying ALNAP paper, *Systems thinking for humanitarians: an introduction for the complete beginner*, which provides further background on what systems thinking is and why it is relevant to and useful for the sorts of complex problems that humanitarians face.

1

Why do humanitarians need systems thinking?

1 Why do humanitarians need systems thinking?

Systems thinking emphasises relationships between groups of different interacting or interdependent things that combine to achieve some purpose (parts of a system, unlike a heap) and the value of multiple and diverse perspectives.

Systems thinking is used to address complex problems, where linear (think logframes) and reductionist (think sector siloes) approaches don't work. There are systems thinking tools, some of which are introduced in Section 5. But although these tools can help us to apply concepts, systems thinking is primarily about how we *think*.

Box 1: Clock vs cloud problems

One way to think about the difference between complicated and complex problems is to use the analogy of clocks and clouds, introduced by philosopher Karl Popper (1973).

First, imagine the inner workings of a clock – lots of small parts working in harmony. They take immense skill to take apart and put back together again. Clocks aren't simple; they're intricate and detailed, and fundamentally *complicated*.

Clock problems

Clock problems may have many components and require skilled experts, but ultimately they can be broken down into those little parts. It is possible to see where each piece begins and ends. And if one part breaks, it can be removed and fixed or replaced. When it is put back in again, everything else will have stayed the same.

Think now of a cloud – ethereal, shapeshifting, drifting, constantly re-forming. You can't break a cloud into little pieces. If you tried to take a piece out, the remaining cloud would have changed before you could

try to put it back in. Cloud problems are *complex*. They are hard to define and to get our heads around.

Cloud problems

Clock problems are mechanical. They need clock tools, which can analyse, deduce and understand. Clock tools are important, but they won't work on clouds. Cloud problems need cloud tools, to explore, intuit, weather and find workarounds (Pollard, 2014). Cloud problems – complex problems – need systems thinking.

Though some problems may be complicated, not all problems are complex. In the humanitarian sector, we face a mixture of both. Humanitarians move emergency supplies across the world, organise mass distributions of food and cash, build shelters and wells and other infrastructure. These all require technical skill and competency – and over the past several decades, a great deal of effort has been put into improving our expertise and capacity to tackle these challenges. We have become quite good at dealing with complicated problems.

At the same time, humanitarians also encounter many complex problems: the breakdown of community, food insecurity, conflict and violence, climate change, oppression, and countless more. But, like many other sectors, we have neglected to develop complex solutions; instead, we continue (unsuccessfully) to apply highly skilled technical expertise more suited to complicated problems.

We design and implement projects in siloes, improving our technical capacities in individual sectors while falling short on integrated approaches. We focus on one-off events without recognising the unintended consequences those interventions can have. We conduct analysis which identifies the symptoms of problems and threats, without investigating the reasons behind this, and which entry points are available to remove the threats. We jump straight in to solving a problem without reflecting on the impact we may have on local capacities or long-term plans.

Applying technical skills to complex problems won't get us anywhere, and in fact can do harm. Humanitarians need to develop systems thinking skills alongside their technical skills so we can fully respond to the range of problems and situations we encounter.

2

How to become a systems thinker

2 How to become a systems thinker

Before you set out to become a systems thinker, it's worth remembering why you want to be one: to 'think in a less fragmented, more integrated way' (Meadows et al., 2016: 7).

Some scholars suggest that certain personality traits are associated with systems thinkers – particularly humility, curiosity, courage, persistence and compassion (Ollhoff and Walcheski, 2006; Goodman, 2018; Ho, 2020) – but systems thinking can and should be used by anyone dealing with complex problems. So, the first question is, are systems thinking skills innate or learned?

2.1 Nature versus nurture

The literature is divided on whether systems thinking is a product of nature or of nurture. Some argue that people have an intuitive sense of systems. At a learning exchange workshop, which contributed to the methodology of this handbook, one participant said, 'If you're human, you're a systems thinker,' with another adding, 'Systems thinking comes with a lot of jargon, but … it's something that everyone is doing already, to some extent.'

Some academics agree, noting that people use systems thinking skills all the time in their daily lives without even realising that's what they're doing (Trochim et al., 2006; Emes and Griffiths, 2018). Humanitarians at the learning exchange workshop said, 'We do use the systems thinking, without saying that we're using the systems thinking, in many of our participatory processes.' Several participants felt that crises-affected communities had better systems thinking skills than they did: 'The people who are directly affected by the various crises … systems thinking is not this new fancy concept to them. It's what they do on a day in day out basis.'

Other commentators say that innate systems thinking ability is more like musical talent: 'Easy for some and difficult for others' (Ollhoff and Walcheski, 2006: 11). They suggest that 'most people find it rather awkward and difficult at first' (Open University, n.d.:1). Much of the literature on systems thinking is unnecessarily academic, elitist and jargon heavy; the language of systems thinking can make it seem more difficult than it is. This results in a feeling that systems thinking concepts are 'difficult to illustrate or teach' (Goodwin and Franklin, 1994:7) and that

learning them requires perseverance (Open University, n.d.) and significant practice (Booth Sweeney, 2009).

Some believe that systems thinking is an innate ability that has been underdeveloped or forgotten, requiring us to 'remember wisdom that's already there', as one learning exchange participant explained. Various systems thinking experts criticise the Western education system for not only omitting systems thinking concepts (Booth Sweeney, 2001) but structuring curriculums around linear, reductionist skills. By focusing on 'memorization rather than problem solving' (Valerdi and Rouse, 2010: 4), education systems can shut down a child's innate curiosity and questioning. Instead, traditional thinking dominates, the pervasiveness of which means that 'most people today think in linear, reductionistic and mechanistic terms' (Ollhoff and Walcheski, 2006: 11).

This linear, reductionist structure follows us from school to the workplace – including in the humanitarian sector. Among learning exchange participants and across the literature there are calls to 'unlearn' – to question and reconsider 'things that we as humans have taught ourselves that work against nature's way of systems'. Doing so could help us to re-engage with the innate systems thinking mindset that we once had as children. One learning exchange participant commented:

> **We fundamentally know that the whole is greater than the sum of its parts, that an ounce of prevention is worth a pound of cure. These are adages that have been around for a very long time that are all systems based.**

Those who believe that systems thinking skills are innate are optimistic about our ability to unlearn 'linear and rigid thinking… because, thankfully, humans naturally have a curious and intuitive understanding of complex, dynamic, and interconnected systems that make up the world around us' (Acaroglu, 2019: 6). Whether a natural ability for some or all, the literature is united in agreement that learning and practising systems thinking is something everyone can do, with enough practice. To paraphrase one learning exchange participant: once you cross over the systems thinking paradigm, you'll forget you ever thought another way!

Box 2: Using stories to understand systems

Stories are a well-known learning method and used extensively by educators around the world. Systems thinking is full of visual language and therefore lends itself well to narratives and stories.

There are two main ways to use stories when learning about systems:

1. *Find the system in the story:* Look for systems concepts like feedback, leverage and unintended consequences in existing stories. Linda Booth Sweeney has written several books that highlight existing children's books and fables which contain systems ideas.[1]
2. *Find the story in the system:* Just as systems are easily visualised with diagrams, establishing a narrative that describes relationships and patterns within systems is a highly effective way to explain system behaviour.

Box 3: Using games to understand systems

Games are a great way to practice systems thinking skills and part of an increasing trend in using serious games as a learning tool. Booth Sweeney and Meadows explain, 'Games permit us to learn about complex systems while we are interacting with others. They offer the chance to make mistakes without great consequence. And they are fun' (Booth Sweeney and Meadows, 1995:2).

Games have proven 'to be a consistent and effective means of communicating and illustrating the concepts of systems thinking' (Goodwin and Franklin, 1994:15).

For examples of games designed to teach systems thinking skills, see *The Systems Thinking Playbook* (Booth Sweeney and Meadows, 1995) and *Gamestorming: A Playbook for Innovators, Rulebreakers, and Changemakers* (Gray et al., 2010). See also 'The Beer Distribution Game' (Goodwin and Franklin, 1994) and experiential team-learning game 'Friday Night at the ER' (devised by Breakthrough Learning, Inc., 1992). For more on how to design effective learning games yourself, see Murphy, 2011.

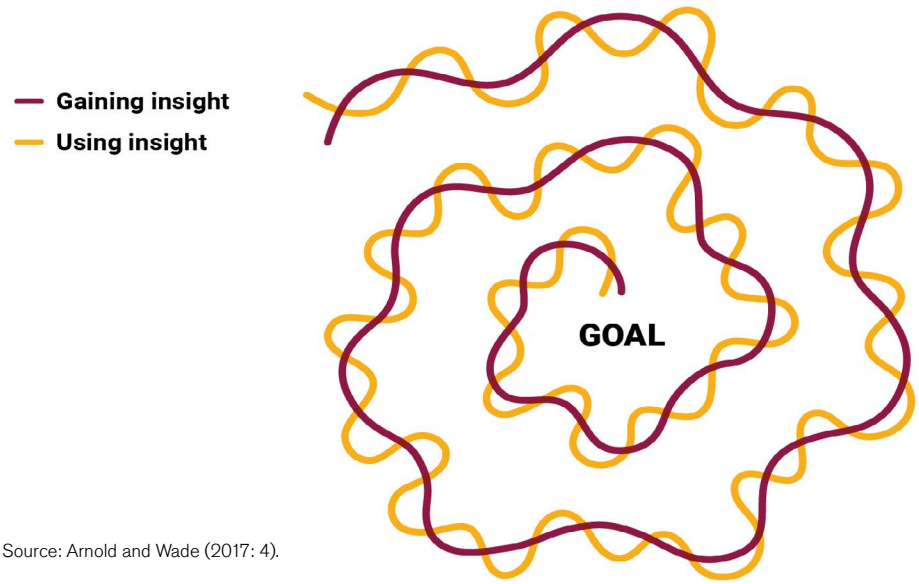
2.2 Learning versus doing

This is an introductory handbook, focused on how you can learn systems thinking and practice activities to develop your own systems thinking competencies. But it's important to note that *learning* systems thinking and developing the requisite skills does not necessarily lead to *action* (Valerdi and Rouse, 2010).

Systems thinking is, first and foremost, a mindset. If you don't want to change how you think and act, no number of exercises or tools can make you. And developing your own competencies won't instantly shift deeply embedded structures and processes in your institution or the broader humanitarian sector. To become a systems thinker, you need to apply the competencies and principles outlined in this handbook and the accompanying paper to complex problems within your own day-to-day work. To turn systems thinking into *systems practice*, you then need to help others to become systems thinkers, to build momentum and support for change within institutions.

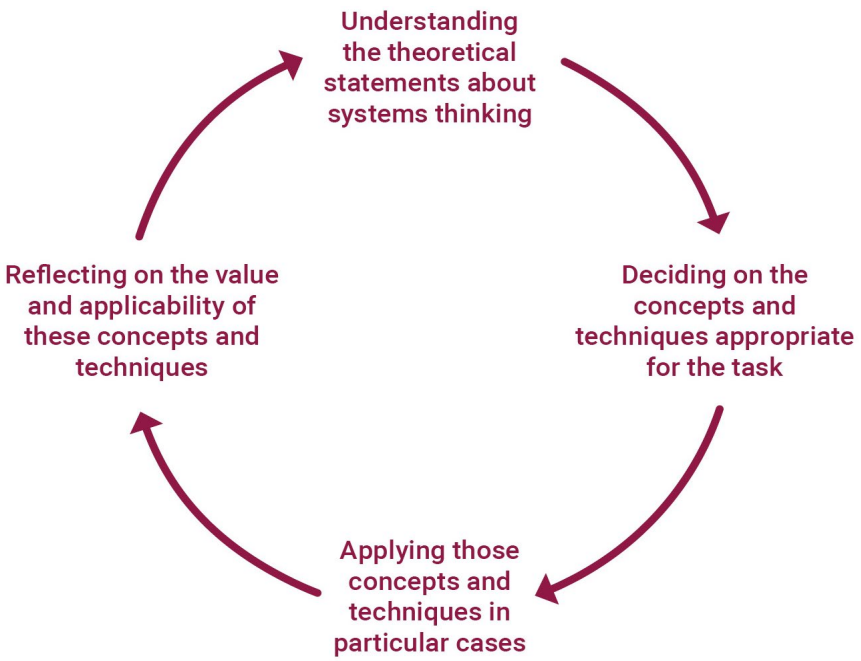
Arnold and Wade (2017) describe this process of turning systems thinking learning into action as a journey, whereby you both gain insight and make use of it, integrating theory and practice (Open University, n.d.). There is no ten-step guide to becoming a systems thinker: you can't just pick up a tool and do what the instructions say. The best way to shift to a systems thinking mindset is to put what you learn into practice (Open University, n.d.; Kay and Foster, 1999; Benson, 2007).

Figure 1: The systems thinking spiral



Source: Arnold and Wade (2017: 4).

Figure 2: The interaction of theory and practice



Source: Open University (n.d.: 1).

2.3 Quick start

In Section 4, we introduce specific systems thinking competencies. This is particularly helpful if you're new to systems thinking or want to understand the detail and develop your skills more methodically. If you want to jump straight in, read on for a 'quick-start'.

The best way to start building your systems thinking skills is to begin asking questions – specifically different questions to the ones you might usually ask (Booth Sweeney, 2009; Goodman, 2018). What you're aiming to do is ask things that:

- get to the underlying patterns or structures of an issue
- bring into focus any delays or unintended consequences
- help you to understand how you and others are perceiving the situation.

Table 1 sets out some examples of questions you might ask in different humanitarian situations. Table 2 also offers some helpful question swaps and prompts that you can try out.

Table 1: Example systems thinking questions for humanitarians

Situation	Purpose of questioning	Example questions
Before designing a project intervention to meet a need or respond in a situation	Ask questions to understand the patterns	Has this same problem occurred in the past? Is it chronic? Is this a one-off event? Does it keep happening? If so, what does the pattern look like?
Before making a decision	Look for additional information that will enhance your perspective	What data are available about this problem?
If faced with an unintended consequence (for example, aid provided is being used differently than intended)	Look at what might be causing the consequence, not just at what is happening	What structures might be causing this behaviour?
When learning about the context, or considering a new working relationship	Power dynamics pervade structure. Think about how power is embedded in the structures that govern the situation	What power dynamics are at play in this situation, context or working relationship?
When making a project plan and identifying expected outcomes	Think about how long, realistically, it will take to make a change and how this lines up with your plans	Over what time period will this system exhibit the full cycle of behaviour that is of interest to us?
When creating an M&E plan	Often humanitarians only capture data during the project lifespan. Consider the reality of time delays	Does the time period we've chosen correspond with the process we're focusing on? When will you use data to make decisions?
When thinking about tracking your impact	Consider how delays will shape impact	What delays might we experience in this system?
Before making assumptions	Consider your own perspective, and ask others for theirs	What makes you see the problem as you do?

Table 2: Asking the right questions – from traditional thinking to systems thinking

Instead of …	Try to …
Blaming someone	Ask, 'What are the influences on that person?'
Saying, 'I know the answer'	Say, 'I have another perspective on the issue'
Thinking you know the answer	Always be looking for evidence to confirm your theory in addition to evidence to disconfirm it
Focusing on one item	Look at all the variables that affect it
Looking at the content of what people say	Look at the process of what they say. How are they saying it? What are they not saying? What are the common themes in the content?
Focusing on negative behaviours	Look at what is motivating these behaviours or if they are masking a deeper problem
Only looking at what individuals are doing	Also look at the dynamics of the system – what forces are pushing individuals towards one thing or another?

Adapted from: Ollhoff and Walcheski (2006: 11)

To develop your systems thinking skills more thoroughly, move on to Section 3.

3

Six key competencies for systems thinking

3 Six key competencies for systems thinking

This section outlines six competencies for systems thinking – perspective awareness, perspective versatility, improving mental models, understanding relationship impact, working the structure and iterative action. It looks at what each competency is, why it's important and how you can develop it in yourself and others. The work of other experts, particularly *Habits of a Systems Thinker* (Benson and Marlin, 2017) and Arnold and Wade's systems thinking skills (2015),[2] has informed this handbook's selection and development of these key competency areas. See Annex A for a full rubric of all of the competencies.

3.1 Perspective awareness

What is perspective awareness about?
Perspective awareness means that a person is aware of their own (and other people's) perspectives and mental models (assumptions and beliefs), and how they influence behaviour.

Perspective relates to the framing you use to understand a problem; it affects how you look at something. You need to be aware of the perspective you have, where it comes from and how it may differ from the perspectives of others (Open University, n.d.; Benson and Marlin, 2017).

Mental models are the deep-rooted assumptions and beliefs that shape how we perceive reality. You need to understand how your mental models shape your perspective, and how both influence behaviour. Once you can recognise this in yourself, you can recognise it in others too.

Perspectives and mental models are shaped by many influences including culture, the perspectives and mental models of other people, social pressure and mores, our past experiences and many more factors (O'Connor and McDermott, 1997; World Bank, 2014).

Table 3: Perspective awareness criteria and indicators

Perspective awareness criteria	Perspective awareness indicators		
	No competency	Basic competency	Advanced competency
Able to recognise perspective and mental models and where they come from	Unable to recognise own perspective or those of others	Recognises own perspective on a situation or issue and where this comes from Understands how own mental models shape this perspective	Acknowledges the perspectives and mental models of others Able to support others to recognise their own perspective and mental models
Able to recognise how perspective and mental models influence behaviour	Believes own perspective is absolute truth/ reality Unaware that there are different ways to view the situation	Can explain how own perspective and mental model are influencing their own feelings, decisions and actions	Locates self and others within the situation/system Can explain how the perspectives and mental models of others are influencing feelings, decisions and actions Offers insights about own perspective and mental models through metacognition

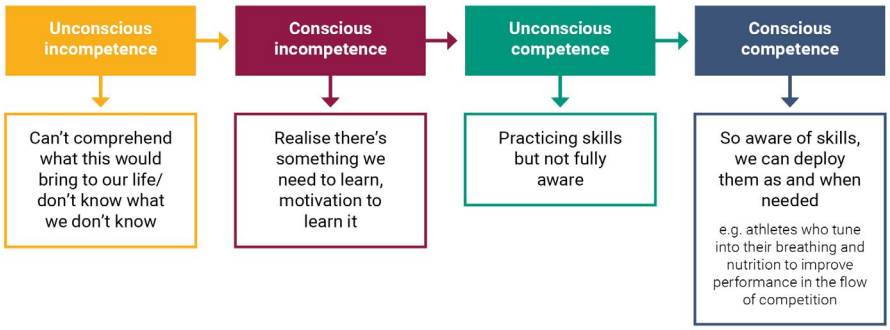
3.1.1 Why is perspective awareness required?

By being aware of how we are framing an issue, we can begin to explore the possibility of *reframing* it; it's difficult to change our perspective if we don't recognise that we have one, even if that perspective is making it difficult to see the solution (Meadows et al., 2016). Making your perspective and mental models clear is an important first step in acknowledging that there are many different ways to view a situation. Without perspective awareness, we risk reality bias – the belief that the way we see reality is the only way to see it (Cabrera Research Lab, 2016). And in recognising your own perspective and mental models, you will in time also be able to recognise those of others.

It is important for systems thinkers to 'recognize the power and influence of mental models' (ibid: 30), which can be far-reaching. The adage goes, 'With a hammer in your hand, all problems look like nails'. That is to say, the perspective you have informs the actions you take. Perspective and mental models influence how we select information to take on board and ignore or discard information that doesn't fit; how we fill in gaps and 'construct' our view; how we amplify some issues and diminish others, 'distorting' a situation from the objective reality; and how we relate one experience to several, 'generalising' across our experiences (O'Connor and McDermott, 1997).

Recognising the influence of our own mental models emphasises our own active role within the issue or system (Meadows et al., 2016) and helps us to see the critical role that the perspectives and mental models

Figure 3: Levels of metacognition (having insights about our own thoughts)



of others are playing. This is particularly the case in development and humanitarian contexts where 'a great deal of policy' is based on decisions shaped by mental models and can 'go wrong when policy designers have a faulty mental model' (World Bank, 2014).

Through awareness of our own thought processes and the impact they can have, we can become so in tune with them that we can adjust them to achieve the most optimal results. If athletes can do this with their breathing and metabolism, can systems thinkers do this with their mental models?

How to develop perspective awareness in yourself and others

Here are three ways in which you can develop your perspective awareness.

Activity 1: Ask yourself…

Identify an experience or issue to focus on. Use the following questions to practice reflecting on your perspective and mental models:

- What thoughts and feelings do I have about this experience/issue?
- How would I describe my current perspective on this experience/issue to someone else?
- What assumptions do I have about this experience/issue? Where have those come from?
- If I shifted my perspective, would I view/perceive the issue in the same way? Is there anyone I could compare perspectives with?
- How might this event/experience shape my mental models in future?

Activity 2: Dive deeper…

Use an iceberg diagram or ladder of inference (see Section 5) to prompt reflection about what lies beneath a surface-level experience.

a. *Iceberg diagram.* Consider an issue you have recently faced or are currently facing. Using the iceberg diagram, reflect on your surface-level experience: how did you think, feel or act? Then look below the surface: have you encountered this situation before or thought, felt or acted in a similar way before? Following the layers of the iceberg, you will eventually reach the mental models that underly your experience. You

can then describe your surface-level experience in the context of those mental models.

b. *Ladder of inference.* Walk yourself through the steps from an action you've taken to uncover the underlying assumptions and view that informed it. You can try thinking through what would have happened if you had taken a different perspective or if your underlying assumptions were different.

Activity 3: Look out for…

Be on the lookout for 'limiting language' (O'Connor and McDermott, 1997), which can reveal underlying mental models. This might include:

- Judgments or authoritative statements
  Ask: Why/why not? Who says? So what?
- 'Ought to', 'should', 'must', 'have to'
  Ask: Why? What happens/would happen if I didn't?
- 'Ought not', 'should not', 'must not', 'cannot'
  Ask: What happens/would happen if I did? What stops me?
- Generalisations – 'all', 'every', 'never', 'no one', 'always'
  Ask: Are there exceptions? What are they?

When you spot limiting language, ask yourself questions to unpack your perspectives.

3.2 Perspective versatility

3.2.1 What is perspective versatility about?

Perspective versatility is about improving one's understanding by using multiple perspectives consistently and intentionally (Benson and Marlin, 2017).

The ability to change your perspective is key to systems thinking (Meadows et al., 2016; Stalter et al., 2016). But stepping back and acknowledging that there are different perspectives on an issue can be difficult, particularly for people who have viewed things through the same perspective for a long time (Valerdi and Rouse, 2010). Systems thinkers should challenge themselves to consider perspectives that are unfamiliar, non-obvious and which may conflict with their original perspective (Arnold and Wade, 2015).

Boundaries describe what's in and what's out. Systems thinkers can use boundaries to change their perspective by changing the size/shape of the frame. They can also think about shifting between different scales; systems thinking emphasises holism and understanding the bigger picture (Meadows et al., 2016). The 'whole', however, includes individuals. Systems thinkers therefore need to 'balance the big picture view with attention to detail; [to] hold both views' (Benson and Marlin, 2017: 18; see also Arnold and Wade, 2015).

It may help to think of perspectives as different lenses (some are

Table 4: Perspective versatility criteria and indicators

Perspective versatility criteria	Perspective versatility indicators		
	No competency	Basic competency	Advanced competency
Sees situations through different perspectives	Unable to change one's perspective	Sometimes able to shift perspective	Able to shift perspectives consistently and intentionally
Uses boundaries to frame a problem in different ways	Only seeing a problem in one way	Recognises the boundary of the problem	Able to change boundaries appropriately
Shifts between micro and macro perspectives	Unable to change one's perspective on a situation	Able to look at a situation at a micro or macro level	Building a comprehensive understanding by using micro and macro perspectives simultaneously

specialised to see things far away or up close), such as the difference between a telescope – macro view – and a microscope – micro view. (Acaroglu, 2017a). Others describe this competency as 'forest thinking' (Richmond, 2010): zooming out to see the entire forest, zooming in to see the details among individual trees (Plate and Monroe, 2014; Arnold and Wade, 2015), shifting back and forth between these views to 'build a three-dimensional worldview' (Acaroglu, 2017a: 5).

3.2.2 Why is perspective versatility required?

Systems thinkers understand the limitations of seeing from only one perspective (Valerdi and Rouse, 2010) and the value of triangulating multiple views (Clarke et al., 2017). Looking at a situation through a perspective different to our own provides us with an opportunity to rethink (Cabrera Research Lab, 2016) and makes our understanding of an issue more thorough. Of course, 'the system that everyone sees is different, the connections they see are different, the vision they have of different parts of the system is different, their interpretation of what is important is different' (Burns and Worsley, 2015: 60). Seeing things through multiple perspectives is also one way to expand our mental models (Sherwood, 2002).

This competency is particularly crucial for humanitarian systems thinkers because moments of crises tend to make us hold onto existing perspectives. Sherwood explains:

> **Systems thinking is seeing situations and experience as a whole. You will not see them as a whole unless you either take a longer view; a step back to see the pattern, or you build up that whole from many different angles.**
>
> (Sherwood, 2002: 141)

Acknowledging the validity of multiple perspectives can also contribute

to better communication and relationships when working with others, particularly in consensus building and problem solving (Cabrera Research Lab, 2016).

System thinkers use boundaries to make complex problems manageable. Boundaries can be thought of as temporary framings that can help systems thinkers to look at the most relevant issues at a given time (Richmond, 2010). In this way, they are a type of perspective. Boundaries are subjective and often change as new information emerges or new questions arise. It is therefore important to be intentional about the boundaries being used and to 'consider how your thinking and/or actions might change if you expanded the boundary of inquiry' (Peterson, 2010: 42).

As you begin to develop your perspective versatility, it can be helpful to think of boundaries as a swimming pool and broader systems thinking as an ocean.

> **When you first learn to swim, starting off in a pool that has clearly defined edges to grip and a shallow end gives you the confidence to explore and learn. The ocean, on the other hand, can be overwhelming and perceived as dangerous… As you build your systems mindset, start with a defined system boundary: a pool where you can determine the edges and know what you are dealing with before you jump into the ocean.**
>
> (Acaroglu, 2017a: 5)

It is important to consider issues of power when it comes to boundaries – who is setting them and who is left out or marginalised by the boundaries used? (Hummelbrunner, 2011). Whoever sets them, these boundaries should be explicit and reviewed regularly.

How to develop perspective versatility in yourself and others

Try developing your perspective versatility in one of the following three ways:

Activity 1: Ask yourself…

Think of a situation or problem you're currently faced with. Identify what your current perspective is, and then try to shift this by asking yourself the following questions:

Have I considered:

- perspectives beyond the obvious
- perspectives that conflict with my original view
- how my perspective is influencing my behaviour
- the broader context
- balancing between big picture and detail?

What might change my perspective?

- Approaching someone else – if so, who?
- Gathering information – if so, what?
- Noticing things outside my day-to-day – if so, how?
- Taking multiple views – micro/macro

Am I using the right boundaries?

- What is the boundary I'm using to consider this issue?
- Who set this boundary and why?
- Is this boundary still relevant?
- How would my thinking change if the boundary changed?
- Is anything critical missing that should be included in the boundary?
- What expertise is included/excluded using this boundary?
- Who benefits from this boundary?
- Who is disadvantaged/marginalised by it?

Activity 2: See it differently

Practice seeing through different perspectives by intentionally taking the view of someone else, making 'a serious effort to see the system through the eyes of others' (Open University, n.d.: 7). Think about a time when you shared an experience with someone, but your perspectives on the experience differed (for example, different views about a film you both watched).

How did your varying viewpoints affect your understanding of the experience? For this to be effective, you will need to suspend judgement and focus on understanding what someone else would be seeing (Benson and Marlin, 2017).

Activity 3: A thought experiment

Consider a familiar story or fable. What if you retold that story from a different perspective? How might the story be different? What insights did you glean from changing the perspective of the story?

Practice shifting perspectives with this thought experiment, writing down your thoughts or discussing them with another person.

3.3 Improving mental models

3.3.1 What is improving mental models about?

The third systems thinking competency is about improving your mental models. Everything you know or think you know is a model (Meadows, n.d.). Your understanding of a problem is not objective reality, but rather a model. We can improve our mental models by learning (Richmond, 2010). But to learn, we need to exercise humility, surfacing and testing our assumptions – and admitting when they have been wrong (Benson and Marlin, 2017). 'The thing to do, when you don't know, is not to bluff and not to freeze, but to learn' (Meadows, n.d.: 3).

Table 5: Improving mental models criteria and indicators

Improving mental models criteria	Improving mental models indicators		
	No competency	Basic competency	Advanced competency
Seeks out information to expand mental model	Does not recognise the need to improve mental models	Gathers information to improve mental models	Routinely applies relevant learning to improve mental models
Surfaces and tests assumptions	Does not recognise assumptions	Able to surface and test assumptions if prompted	Regularly surfaces and tests assumptions
Communicates about mental models to generate shared understanding	Is not able to communicate about mental models	Able to share own mental models with others	Understands and communicates about mental models of self and others With others, generates a shared understanding

This competency is about reflection: 'observing oneself, being aware of… mental models… and how they affect what we see or hear…, checking whether… assumptions are still valid' (Hummelbrunner, 2011). This requires the ability to articulate a belief, look for evidence and information and listen to others (Benson and Marlin, 2017).

3.3.2 Why is improving mental models required?

Mental models have deep roots and can be difficult to change, even when reality does (Kim, 1999). However, systems thinkers can expand their mental models, and those of other people, by using new information and surfacing and testing their assumptions. Changing mental models is often one of the things that has the greatest impact when trying to make change within a complex problem (O'Connor and McDermott, 1997).

When accurate, mental models can save us time and energy. Unfortunately, they are often inaccurate and 'out of sync with the real world' (World Bank, 2014: 63). Flawed mental models cause us to miss critical information, and act on incorrect assumptions (ibid). By exposing 'your mental models to the open air' (Meadows, n.d.: 1) you can improve them.

Mental models can be shared by a group; they're not only individual. As well as taking action to improve your own mental models, you can try to improve the mental models of others. Sharing information expands everyone's understanding of the problem, which improves individual and collective mental models. During the COVID-19 pandemic, the virus 'spread like wildfire around the world whilst we interpreted, argued and prevaricated' (Reynolds, 2020: 5) and ultimately, 'an effective solution required all of us to reach a common understanding of the problem' (ibid: 5). By sharing information and perspectives with others, the collective mental model is strengthened.

Table 6: Sustaining vs changing mental models

How *not* to change mental models	How to change mental models
Insist your ideas are how reality really is	Admit mental models are a best guess, look for better ones
Have a narrow set of interests, ignore a lot of experiences	Have wide interests, pay attention
Don't tolerate ambiguity, jump to conclusions quickly and generalise	Be comfortable with ambiguity, take time to think and contextualise
Base evidence on one-sided, unfocused experiences	When faced with problem, examine own assumptions as well as situation itself
Think in straight lines of cause and effect	Look for loops and circles, how effect of one cause can be the cause of another effect
Blame failure on individuals, including yourself	Have wide time horizon to look for feedback
Never update your beliefs in light of experience	Be curious about experiences that contradict your mental models
Use 'all', 'never', 'nobody' and 'must', 'should', 'cannot'	Look at how relationships, events fit together

This competency requires humility. There is always information we do not have, always more to learn. To truly take in information, you need to be 'more committed to solving the problem than to being… correct' (Meadows, n.d.: 6).

How to improve mental models in yourself and others

You can work on this competency by trying one of the following four ideas:

Activity 1: Familiar behaviour?

Reflect by yourself or with others on Table 6, adapted from O'Connor and McDermott (1997: 111–112). How many of the things in the 'How *not* to change' column do you find yourself doing? Refer back to this table periodically to think about how you could change your thinking to *improve* your mental models rather than *sustain* them.

Activity 2: Challenge your understanding

Think of an issue or belief that you have an opinion about. Take a few minutes to note down as many possible explanations for your chosen issue or belief as you can think of – whether they are your own explanations or not.

Now, step back from your initial assumptions and view each explanation as plausible *until you find evidence that rules it out* (Meadows, n.d.).

Activity 3: Beyond the obvious

Identify a belief you hold about a community you belong to. 'Walk up' the ladder of inference (Section 5), asking yourself:

- What do you notice about the current state of this community?
- What else could you choose to pay attention to?

- What in your own background/experience influences your viewpoint?
- How do your beliefs influence what you notice?
- How are your actions influenced by your beliefs?
- Reflect: what evidence do you now have that your assumptions are correct? (Benson and Marlin, 2017)

Activity 4: Make the known unknown

Think of an issue that you know a lot about. Put yourself in someone else's position and consider how you, as this other person, might observe and describe your assumptions and beliefs about this issue (Williams and Hummelbrunner, 2011). Now seek out relevant information from a totally different perspective, looking for information from other disciplines or experiences beyond your own (Meadows, n.d.; Valerdia and Rouise, 2010). For example, look at practices from the business sector or government programmes in countries other than those that you are familiar with or are working in.

3.4 Understanding relationship impact

3.4.1 What is understanding relationship impact about?

In a complex problem 'nothing lives alone' (Hughes, 2016: 59); from a systems thinking perspective, complex problems are a 'series of connected issues' (Stalter et al., 2016: 328) that cannot be successfully addressed in isolation. Interconnectedness is like a spiderweb: 'pulling on any one strand … will affect, directly or indirectly, every other strand in the web' (Ricigliano, 2012: 22). Systems thinkers need to understand and be able to describe how different elements within a system relate to and influence one another and can result in a range of potential consequences. This relational approach (Morgan, 2005) emphasises 'patterns of relationships and the structures that might facilitate them' over 'conventional categories of tasks, functions and hierarchies' (ibid: 13).

Relationships between elements within a system are often dynamic (happen and change over time), non-linear (the scale of the cause may not determine the scale of the effect), context sensitive and entangled or messy (Hummelbrunner, 2011). When describing the relationships between parts of a system, systems thinking emphasises *circular causality*, whereby if one thing influences another, it is in turn affected by it. Causality is often delayed: unlike a row of dominoes, which fall down in rapid succession, the outcome or impact of action in a system may not be visible for days, months or even years. Linear thinking has ingrained the idea that 'the relative consequences of an action will appear near in time and space to the action itself. Yet actions are often destructive elsewhere and later' (Meadows et al., 2016: ix). Circular, delayed causality can lead to short-term, long-term and unanticipated consequences. Systems thinkers keep all three in mind, 'giving voice to' the consequences (Meadows et al., 2016).

Table 7: Understanding relationship impact criteria and indicators

Understanding relationship impact criteria	Indicators		
	No competency	Basic competency	Advanced competency
Describes circular relationships between different issues or elements	Focuses exclusively on linear relationships	Recognises circular relationships when prompted	Unconsciously aware of circular relationships
Anticipates time delays in relationships	Doesn't recognise or take account of any time delays	Aware that there may be time delays	Able to make decisions and take actions that account for potential time delays
Recognises short-term, long-term and unanticipated consequences	Only recognises immediate consequences	Aware that there may be short-term, long-term and unanticipated consequences	Able to make plans and monitor short-term, long-term and unanticipated consequences

3.4.2 Why is understanding relationship impact required?

When we can see cause and effect as a circular, interdependent process, we can better anticipate the dynamics of these connections (Benson and Marlin, 2017). By recognising that causes are multiple and complex (Boulton et al., 2015), systems thinkers know there isn't one solution to complex problems (de Coning, 2016). Rather than focusing on finding 'the' solution, systems thinkers instead devise a series of ongoing processes that will shape the situation over time (Peterson, 2010). Seeing circular causality can help you to find the unexpected (Ho, 2020).

The humanitarian sector is keen on immediate results, but the delays that often characterise relationships within a complex system mean that these aren't always achievable and make it harder to see causality, blocking our view at any given moment of a consequence that hasn't yet happened. Expecting an immediate improvement can stifle innovation. When we don't get immediate results, we may adjust what we're doing too quickly, having misinterpreted 'the impacts, outcomes, or causes of a phenomenon' (Acaroglu, 2017b: 7); 'great ideas are lost because decisions are made without allowing for a time delay between the innovation and the assessment of results' (Benson and Marlin, 2017: 74).

Linear thinking can also make this misattribute an impact where there hasn't been one: if we expect A to lead to B, if B happens, even years later, we take it as proof of a connection to A even if this is coincidental (O'Connor and McDermott, 1997).

Being able to consider the short-term, long-term and unintended consequences of actions is a core systems thinking skill (Meadows et al., 2016; Benson and Marlin, 2017) that 'helps minimize the chances of decisions backfiring and producing ill effects' (Benson and Marlin, 2017: 77). The reality is that 'good intentions don't always lead to good outcomes' (Acaroglu, 2017b). Think about all the well-meaning government policies that have gone on to have contrary effects (Open University, n.d.). In a

system, every action has multiple consequences: 'It is impossible to do just one thing" (Benson and Marlin, 2017: 82).

It may be challenging to apply circular causality to humanitarian work. Humanitarian and development organisations predominantly use logframes in their planning whereby interventions are 'structured in a linear manner into objectives, inputs and a sequence of expected effects' (Hummelbrunner, 2011). You can start to add circular logic to linear models by adding elements which connect back to one another, such as how the context influences implementation (ibid).

This competency goes hand-in-hand with the competencies around expanding perspectives. Bringing in new perspectives expands your understanding and helps you to recognise all potential outcomes and consequences of an action (Benson and Marlin, 2017).

3.4.3 How to develop understanding relationship impact in yourself and others

Try one of the following six activities to practise this competency:

Activity 1: Ask yourself…

Practice looking for trends and patterns, and using the example of the spread of a rumour amongst crises-affected people, ask yourself:

- Why are connections important in this context?
- How is the spread of a rumour similar to the spread of a disease?
- What would you focus on to address this situation?

Activity 2: Map it out

Visual tools like causal loop diagrams and systems maps (Section 5) can be helpful ways to bring circular relationships to life. Systems tell great stories (Box 2) and you can use these to enhance your practice. Linda Booth Sweeney recommends drawing one feedback loop per day each morning, finding new stories that describe circular causality (Booth Sweeney, 2009).

Activity 3: Stop and reflect

Take a look at the examples of problematic thinking in Table 8. If you find yourself thinking things from the first column, take a moment to reflect.

Activity 4: Patterns of behaviour

Practice characterising issues as patterns of behaviour over time by thinking through how the situation has reached its current point and what might happen from here (Peterson, 2010). Behaviour-over-time graphs (Section 4.3) can help you to visualise the patterns that emerge.

Table 8: Examples of problematic linear thinking

If you find yourself thinking…	Take a moment to reflect
We've got to fix it, quick!	Sometimes we see a problem and try to dive straight into fixing it before we really understand. Quick, assertive action can be important, particularly in humanitarian contexts. But applying a solution that doesn't fit the problem can do more harm than good. So, before trying to fix a problem, we should make sure we understand what it is.
Oh, let's just put a 'bandage' on it.	Bandages are an important temporary measure, but they're not a solution in themselves. Sometimes we use superficial fixes like bandages as an attempt to solve a problem. But applying a bandage can 'cover up the worst of the symptoms while allowing the problem to continue to fester'.
We must balance the budget by the end of the fiscal year!	Budgets reinforce linear thinking. They can lead us to make decisions based on money rather than whether something is a good idea. Deciding to apply a fix just so we spend money by a certain (arbitrary) deadline is problematic. Last-minute efforts to reach a monetary target are likely to represent 'the antithesis of systemic thinking. Short-term quick fixes almost always harm long-term sustainability'.
We need to respond immediately!	Humanitarians tend to foster a sense of urgency even when it's not warranted (Campbell and Knox Clarke, 2019). Panic and anxiety lead to knee-jerk reactions and linear solutions. Systems thinking doesn't mean acting slowly – but it does call for calm, reasoned thinking. It means take a moment to consider the situation before diving in.
We need more information.	Information is powerful, and often underutilised. There is nothing wrong with seeking more information, when there is a clear use for it. But information doesn't solve the problem for us: 'We – not information have the power to act. And we – not information – must have the courage to do so.'
To hell with the rest of the organisation/sector; we must get our own needs met!	Humanitarians are highly siloed. Within and between organisations there is a 'fortress mentality': "we live in bunkers, protecting our own needs and the resources of our unit". This is classic linear thinking, emphasising win-lose, us-them dynamics. It leads to strategising about how to get more for ourselves, viewing colleagues as competition.
You will do it this way, and you will enjoy it!	Forcing your own perspective and opinion on others, leading through authoritarianism, is also linear thinking. Wisdom and knowledge are collaborative. Domineering undermines innovation, problem solving and creativity.

Source: Adapted from Ollhoff and Walcheski (2006: 10–11); material quoted is taken directly from this source.

Think of a potential intervention or policy and ask:

- What time horizon are we working with? Is this appropriate given the problem's impact?
- What was happening a year ago? What is happening now?
- What actions, beliefs, circumstances and behaviours led to this point?
- What are attitudes, actions and behaviours are likely to happen from this point forward?
- How might a time delay affect the implementation of a potential intervention or policy? How might delays affect the outcomes or impact we expect to see?
- What are the likely reactions of my: allies, enemies, competitors, neutral third parties and other actors in the environment?
- What might we do to mitigate the effects of time delays?
- Will the change we are proposing show immediate results or will we need to wait to see improvements? If so, how long?
- What effect will anticipated delays have on our resources?

Sources: Anderson and Johnson (1997); Booth Sweeney (2009); Monat et al. (2015); Waters Foundation (2017).

Activity 5: What's the purpose?

For this activity, you'll need to think about a system (i.e. a team meeting). Then think about a result or consequence of that system (i.e. making a small room heat up). How does it change your thinking to think of that consequence as the purpose of that system?

The system	A team meeting
Consequence	Heats up a small room
System and purpose	Using collective body heat to warm a room

Thinking of the system in this way can bring up lots of ideas about unintended consequences, which are relevant for the complex problems we try to solve. Once an unintended consequence is identified, circular thinking must be applied: consider carefully before making any rash changes.

Activity 6: Fixes that fail

You can also practise thinking through potential interventions, especially if they feel like 'quick fixes'. It might be helpful to look at the systems archetype 'fixes that fail', wherein something meant to address a problem in fact makes things worse (see also Section 4.7; Benson and Marlin, 2017). Ask yourself:

- What are possible unintended consequences of your decision? They might involve reactions, attitudes, results or new challenges.
- Is the need to respond quickly greater than the importance of investigating potential unintended consequences?
- Who will the quick fix impact? What will this look like in the short-term and the long-term?

- What would happen if you got what you wanted? What would happen if you got the opposite?
- What are the benefits and trade-offs of your decision? What structures will you put in place or how will you minimise the impact of trade-offs (e.g. communication, safeguards, modified practices)?
- Is there an alternative solution to minimise the chances of negative unintended consequences, but which may take longer to implement?
- Will your decision involve short-term hardship to achieve long-term success? If so, how do you plan to minimise the short-term challenges? If not, describe the road to long-term success.
- Would unintended consequences create new problems that would then need fixing?

Source: Anderson and Johnson (1997); Waters Foundation (2017: 81).

3.5 Working the structure

3.5.1 What is working the structure about?

The structure of a system determines its behaviour (Meadows, n.d.; Meadows et al, 2016; Benson and Marlin, 2017). By understanding a system's structure, you can take action that influences the system to perform in different ways (Arnold and Wade, 2015). By accepting that the structure is responsible for system behaviour, using appropriate boundaries, supporting self-organisation, identifying patterns and finding the best leverage points, you can learn to use the structure to achieve the greatest impact.

As explored in Section 4.2, a boundary is a temporary framing that we can use to make understanding a system manageable. By identifying which elements are/are not in the system, you define its boundary (Arnold and Wade, 2017). The key is knowing how broad to draw the boundary, so that nothing important is missed while nothing irrelevant is included (ibid). Boundaries are not a one-off. Boundaries require maintaining over time, so this competency includes knowing when your boundaries need to shift (ibid). This competency will take some trial and error. Think of a system and imagine different conceptions of it. Think through the implications, and what you might be missing if the boundary is too narrow, or wasting time on if the boundary is too wide.

Because a system's structure determines its behaviour, it is vital to know what the behavioural patterns and trends in the system are. This competency therefore goes alongside the need to recognise circular relationships and time delays, as explored in Section 4.4.

Systems are self-organising: they change on their own, usually in the direction of stabilisation or maintenance of the status quo. Systems do of course behave unpredictably sometimes, due to their connections to the surrounding context (Hummelbrunner, 2011) and the interventions that actors like us bring to them. By supporting the natural self-organisation of a system, you listen to the wisdom of the system (Meadows, n.d.).

Table 9: Working the structure criteria and indicators

Working the structure criteria	Working the structure indicators		
	No competency	Basic competency	Advanced competency
Places responsibility with the structure	Blame actors and events for the system's behaviour	Identify how the system's structure drives its behaviour	Use understanding of the system's structure to achieve the results you desire
Uses appropriate boundaries	Doesn't consider the boundaries in use at all	Aware of boundaries being used, attempts to draw them appropriately	Uses boundaries that are not too wide or too narrow Updates the system's boundaries iteratively
Identifies patterns and trends	Identifies patterns and trends	Looks for patterns and trends	Uses understanding of trends to focus on low cost, high reward leverage points
Finds the most impactful leverage points, helping the system to help itself	Takes action without any awareness of intractability or potential impact	Uses understanding of the system to identify leverage points	Identifies the most appropriate leverage points, avoids wasting time on high cost, low reward issues.

Trust and respect are important aspects of this competency.[3] Humanitarians need to trust a system's ability to change and to respect the emergent properties that make systems special (Hummelbrunner, 2011). As Meadows writes, 'before you charge in to make things better, pay attention to the value of what's already there'. Humanitarians have a lot to learn here.

3.5.2 Why is working the structure required?

One of the most helpful things you can do to intervene in a complex issue is to understand it. Meadows called this 'getting the beat' and explains that:

> **Starting with the behavior of the system forces you to focus on facts, not theories. It keeps you from falling too quickly into your own beliefs or misconceptions, or those of others [and] discourages the common and distracting tendency we all have to define a problem not by the system's actual behavior, but by the lack of our favorite solution.**
>
> (Meadows, n.d.: 2)

When you accept the centrality of the system's structure, you can change the structure to achieve the outcomes you desire (Benson and Marlin, 2017: 54). This is more effective than blaming individual elements or actors, which instead 'blinds one to the easier task of increasing responsibility within the system' (Meadows, n.d.: 4).

One of the biggest selling points for systems thinking is that it can help you to do more for less, by identifying where in the system a small intervention can have a big impact (Stalter et al., 2016). It also helps to identify where time may be wasted – intractable issues where endless effort could be spent trying to shift something that, even if you ever do succeed in making a change, the self-organisation of the system might stabilise away. O'Connor and McDermott (1997) describe this as a strong elastic, which springs back to where it was before. Leverage on the other hand is 'like undoing a crucial knot in a ball of string' (ibid: 15).

Humanitarians, take note: the first step to finding the best leverage points is to start the process without any preconceived ideas of what you intend to do (Allen, 2016). More importantly, 'the way solutions are visioned and delivered locally must reflect the values, contexts and cultures of each different community of stakeholders' (ibid: 4). Often, the greatest potential leverage lies in the issues that are most difficult to change – for example, mindsets, values and beliefs (Morgan, 2005).

3.5.3 How to develop working the structure in yourself and others

There are various ways to develop this competency. Try one of the following three ideas:

Activity 1: Structures that help or hinder

Think of a system that you are part of, such as a class work team, family, etc.

- Describe the current reality of the system. What are the structures? What behaviours are they currently producing?
- Envision your desired results. What behaviours would you like to see produced?
- What can you do to effect change? What existing structures are helping/hindering that effort?
- Recognising that it is a system's structure that generates its behaviour, ask yourself: 'When things go wrong, how can I focus on internal causes rather than dwell on external blame?'

Activity 2: Part of a pattern?

Think about something that has changed in your life. Was this a one-time occurrence or has it happened before? What exactly was the change? Which elements changed? How did they change?

You may find it useful to use a behaviour-over-time graph (Section 4.3) or other visualisations to draw out patterns. The iceberg diagram (Section 4.1) can also help to prompt a shift in focus from one individual event to the broader trends and dynamics at play.

Activity 3: Leverage in the system

By visualising a system, you can get an 'interdependent picture' of it (Benson and Marlin, 2017). Drawing a systems map can help to identify leverage points (Acaroglu, 2017b; Benson and Marlin, 2017). Kennedy et al., 2018 use distinguish between:

- **Weights:** the biggest problems
- **Fulcrums:** key points where a shift or interruption can create change
- **Levers:** the potential interventions that could achieve the shift

For this activity, take a look at Section 4.6. Pick an issue, and draw a rough systems map. Once you've made a start, you can use the map to help identify leverage points.

You can develop your ability to look for leverage by asking:

- Who or what is missing from the map?
- Friends and foes – which relationships between elements do you want to maintain, change or remove?
- Where are the greatest number of connections to other system elements?
- How could you strengthen, weaken or break a causal link between elements?
- Is there a way to add an element/relationship to the system to positively impact the whole?

(Benson and Marlin, 2017)

3.6 Iterative action

3.6.1 What is iterative action about?

Iterative action means monitoring the situation over time, making changes based on what is appropriate, being proactive and not becoming paralysed by uncertainty. 'A systems thinker needs to have the ability to move forward… despite the uncertainty inherent in any complex system… without simply stopping work, becoming stuck or making inappropriate decisions' (Arnold and Wade, 2015). In this way, systems thinkers 'hold the tension of paradox and controversy without trying to resolve it quickly' (Meadows et al., 2016: 8).

Systems thinkers pay attention to the rate, pace and scale of the relationships between different elements. In systems thinking, the term 'accumulation' or 'stock' is used to refer to any part of the system that might increase, stabilise or decrease over time, e.g. more or less money; more or less satisfaction; more or less pain. 'Flow' refers to the rate of change within these elements. For example, a decreased rate of flow in productivity (an element). Sometimes flows and accumulations can be harder to see or more abstract – such as freedom, truth or justice (Benson and Marlin, 2017) but it is important not to forget these things just because they are difficult to measure (Meadows, n.d.).

Table 10: Iterative action criteria and indicators

Iterative action criteria	Iterative action indicators		
	No competency	Basic competency	Advanced competency
Monitors flows and accumulations in the system	Doesn't monitor changes in the system	Takes note of changes in the system	Tracks relevant changes in the system
Embeds iteration in own behaviour	Refuses to deviate from plans	Iterates when plans fail	Plans to iterate from the start
Pre-empts reactionary behaviour	Completely reactive	Considers possible iterations in advance	Keeps eye on the horizon, makes changes before problems happen

The terminology here isn't particularly important. What *is* important is being able to see the pattern: whether something has built up or diminished over time (Benson and Marlin, 2017). Some people find it helpful to visualise these patterns in behaviour-over-time graphs or system maps (Section 5). Monitoring these sorts of patterns can help identify time delays or whether there is inertia or something blocking relationships within the system (Meadows et al., 2016). Systems thinkers can use what they know about flows and accumulations to make reasonable inferences about how the system will behave (Plate and Monroe, 2014).

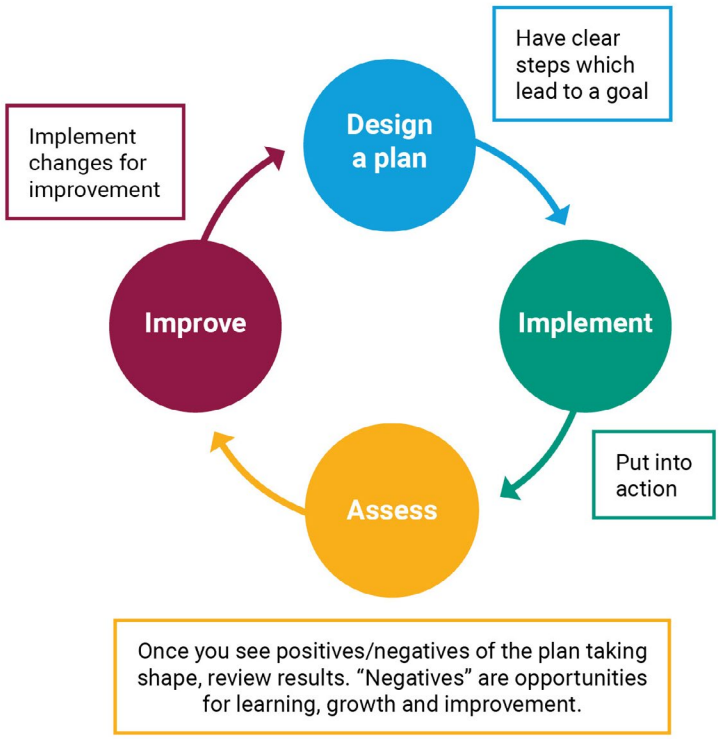
3.6.2 Why is iterative action required?

Systems are dynamic, in constant change (Stalter et al., 2016). Systems thinkers therefore aim to create adaptive organisations (Cabrera and Cabrera, 2015), recognising that it will take time to understand the situation and that this understanding will also change over time (Open University, n.d.). This competency is about shedding the reductionist idea that there is 'one and only one right approach and right answer' (ibid: 11) and instead embracing the idea that a good plan is a malleable plan that is continually altered in order to achieve the desired outcome (Benson and Marlin, 2017).

Systems thinkers use their understanding of the way systems change over time to inform their own actions (Arnold and Wade, 2015). A systems thinker needs to continuously evaluate whether a given strategy is still valid, or whether system behaviour has become fundamentally different due to changes that have occurred over time (ibid). Part of this competency involves being willing to reflect and learn from experience, recognising failure as a necessary part of achieving an outcome (Benson and Marlin, 2017).

Interventions should be planned to account for change, containing built-in benchmarks and opportunities to consider and iterate (Bowman et al., 2015; Benson and Marlin, 2017) and to test many approaches (Open University, n.d.). In a complex and dynamic situation, context matters (Clarke et al., 2017). Adaptations should be informed by the

Figure 4: Iterative action in practice



Sourc

local circumstances (Bolton, 2015), with decisions made as close to the situation as possible (Bowman et al., 2015).

The humanitarian system is plagued by reactive decision-making (Campbell and Knox Clarke, 2019). While it is a reality that in crisis situations quick decisions will sometimes be required, broadly speaking the sector has a bad habit of leaving things to the last minute and artificially creating conditions of urgency. The iterative action competency is about pre-empting reactionary decision-making and action by promoting proactive behaviour and not freezing when confronted with uncertainty.

Being proactive allows systems thinkers to take time to consider situations before jumping to conclusions or making hasty, last-minute decisions (Benson and Marlin, 2017). This means 'absorbing' the complexity of a situation and figuring out what's appropriate (Arnold and Wade, 2015). Of course, being proactive isn't always possible, but this competency aims to help you put your understanding of the system's behaviour to work, so that you can be proactive as often as possible. Systems thinkers can demonstrate this competency through the questions they ask, the perspectives they consider and the consequences of the actions they foresee (ibid).

3.6.3 How can you develop iterative action in yourself and others?

To develop skills in this competency, try one of the following three exercises.

Activity 1: Considering everyday accumulations

Think of an accumulation you encounter in your day-to-day life, such as the amount of fuel in your car's tank, or the stress you experience throughout the week. Think about all of the factors that may cause this accumulation to increase or accelerate and all of the factors that may cause it to decrease. Finally, consider how this accumulation affects other parts of your life.

Activity 2: Making progress

Identify a challenge in your life that you would like to address (to improve, desire or learn).

1. What one element of this could you track over time? What range will you use? (high/medium/low; hard/medium/easy; many/some/few, etc.)
2. What indicators of progress would you expect to see? Or what will progress look like?
3. Have you scheduled time to pause, assess the effects of your current plan and take necessary action, which may include modifying your approach?
4. What other systems thinking competencies might you use to help achieve this change?

(Benson and Marlin, 2017)

Activity 3: Ask yourself…

Take time to answer the following questions (Benson and Marlin, 2017):

- Can you think of a time when you made a snap decision you later regretted? What practices would help you in the future when schedules are busy and there is little time to think about decisions?
- How do you know when you have taken the right amount of time to make a decision?
- Think of an important decision that you need to make. What is the timeline? Is it reasonable? What are the potential consequences of acting too quickly or delaying?
- How can you help yourself and others be patient while living with an unresolved decision?

(Benson and Marlin, 2017)

4

Introducing systems thinking tools

4 Introducing systems thinking tools

In this section we briefly introduce a select number of the variety of tools that are available within the broader systems world.[4] This introduction is not designed to be comprehensive nor is it a toolkit. Moreover, many of the tools already familiar to humanitarians can be used to practice systems thinking, if you apply systems thinking principles to them. These include brainstorming tools like mind maps and Ishikawa fishbone diagrams, mapping tools such as stakeholder analysis and social network analysis, management tools like Gantt charts, evaluation tools like outcome mapping and conversational or workshop formats such as a world café.

New systems thinkers are sometimes drawn to systems thinking tools (Goodman, 2018), hoping that they will provide a set of clearly laid-out steps to follow – and therefore an easy way to make big changes. For some, the idea of using a new tool feels more acceptable than adopting a new way of thinking[5], but as explained at the outset of this handbook, systems thinking is primarily a mindset; the tools are there to complement this shift in thinking but they won't work without it.

Other people may feel, as one learning exchange participant did, that 'the humanitarian world has probably got too many tools already' and the thought of another toolkit 'makes your brain hurt'. If that's you, feel free to skip this section; you do not need new tools to practice systems thinking.

If, however, you have room in your own personal toolbox for a few more, you may find this section useful. The highly visual language of systems thinking had led to some helpful ways to unpack difficult problems. Systems thinking tools are largely diagram-based and can help to paint the big picture, capture different perspectives, reveal hidden patterns and expose structure by depicting real-world situations (Burge, 2018).

None of the tools introduced in this section require extensive training or software to use. The point of this section is not to teach you a slew of new processes, but to provide a friendly introduction to some tools which can help you practice systems thinking, if you want to.

The tools outlined in this section are:

Tool	Use it to
Iceberg diagrams	Understand underlying structure
Ladder of inference	Surface mental models
Behaviour-over-time graphs	See patterns and think dynamically
Rich pictures	Reveal structure and identify problems collaboratively
Causal loop diagrams	Visualise relationships and explore perspectives
System maps	See structure and find leverage
System archetypes	Identify patterns

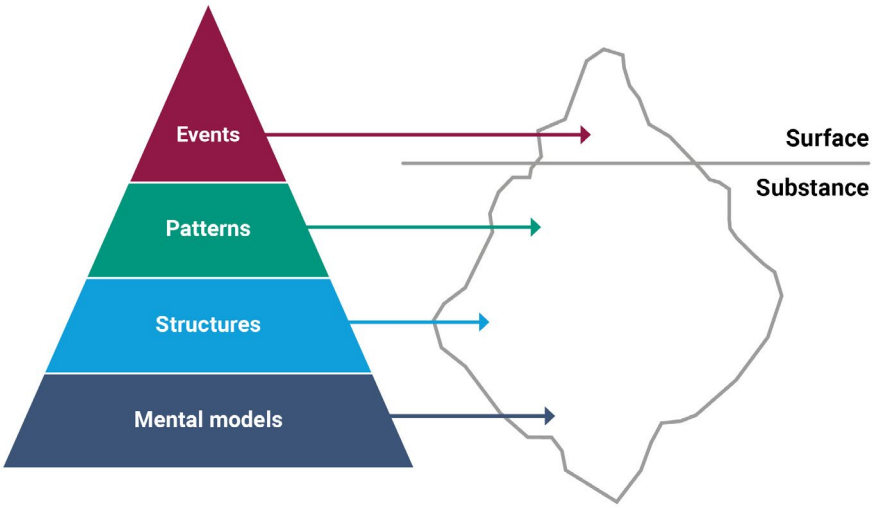
4.1 Iceberg diagram

The iceberg diagram depicts four levels of thinking as a pyramid, with events at the top (the tip of the iceberg), with patterns, structures and mental models below. It helps the user to comprehend that visible events are only a fraction of what's going on and hide a lot that's happening below the surface (Kennedy et al., 2018; Kim, 1999; Monat and Gannon, 2015).

The iceberg diagram highlights:

- **Events**: Situations that are visible above the surface, occurring due to things happening underneath (Kennedy et al., 2018)
- **Patterns:** Trends based on multiple events or situations (Kim, 1999; Booth Sweeney, 2001), which can reveal repeating behaviours (Kennedy et al., 2018)
- **Structures:** Relationships between parts of a system. The structure determines how a system behaves and what events happen (Kim, 1999; Booth Sweeney, 2001)
- **Mental models:** Deep-rooted beliefs and assumptions (Booth Sweeney, 2001)

Figure 5: The iceberg diagram



It is difficult to pinpoint the exact origins of the iceberg diagram. The earliest reference identified by this research is Kim (1999). Maani and Cavana are credited for developing 'the "four levels of thinking" model' (Kennedy et al., 2018: 10), which illustrates the hierarchy of interconnected factors represented in the iceberg. It has been used widely by systems thinkers in different formats.

Iceberg diagrams help us to dig below the surface and address root causes, not just symptoms. Rather than focusing on a series of one-off instances or events (Kennedy et al., 2018; Ribesse et al., 2015; Stroh 2015), iceberg diagrams support the systems thinking approach, emphasising patterns, fundamental structures and the power of mental models (Kim, 1999; Waters Foundation 2017). If you want to read more about iceberg diagrams, see Kennedy et al. (2018) and Kim (1999).

4.2 Ladder of inference

The ladder of inference is a diagrammatic tool developed by Argyris that aims to surface untested beliefs that shape our mental models.

The theory behind the ladder is that our mental models are often based on self-generating, untested beliefs, which we create from conclusions we draw, are inferred from what we observe and are shaped by our past experiences and beliefs (Senge et al., 1994; Benson and Marlin, 2017).

Often, we assume that 'our beliefs are the truth, the truth is obvious, our beliefs are based on real data, and the data we select are the real data' (Senge et al., 1994: 242). In doing so, we ignore the impact that our perspective is having on these beliefs.

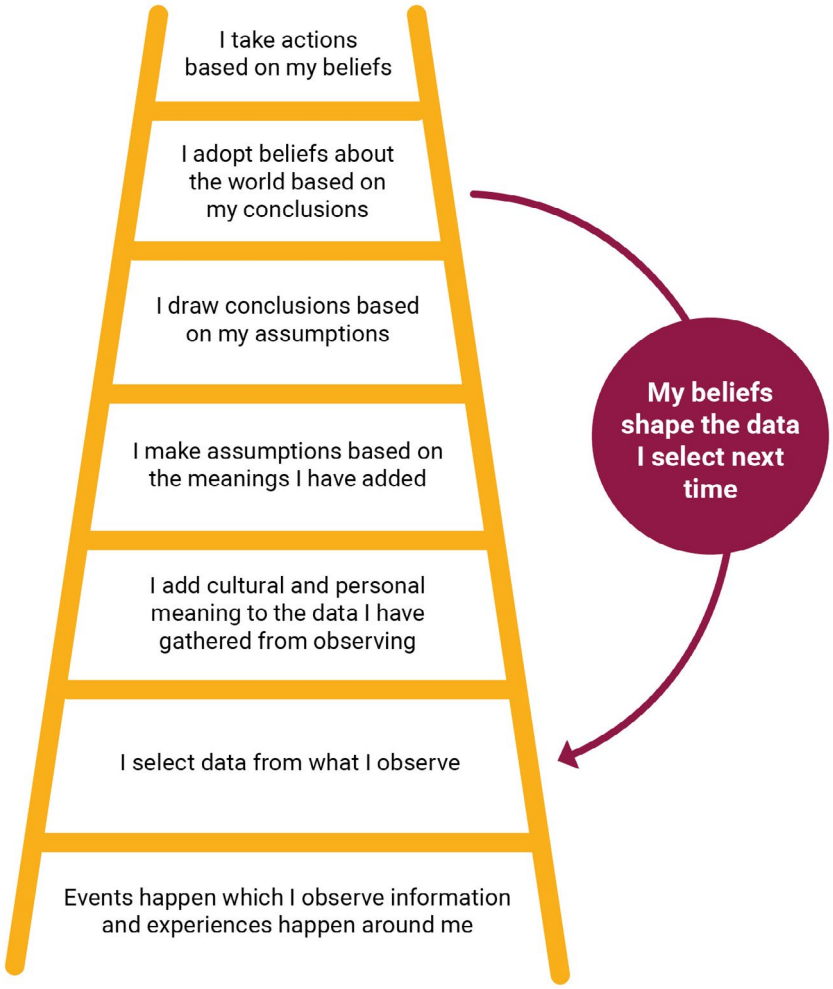
The ladder of inference offers a visual guide to identifying one's mental model, or to compare mental models the perspectives of different actors:

> **The real power of this tool is in recognizing that our beliefs lead to our actions and what we choose to notice in the future. Unexamined, highly filtered beliefs can lead to potentially embarrassing or even detrimental actions.**
>
> (Benson and Marlin, 2017: 47)

The ladder of inference has three purposes:

- **Reflection:** We can use it to suspend judgment and become more aware of our own thinking and reasoning.
- **Advocacy:** We can use it to make our thinking and reasoning clearer to others by describing what influences our beliefs and actions.
- **Inquiry:** We can use it to understand others' thinking and reasoning by asking questions and soliciting additional perspectives.

Figure 6: The ladder of inference



Using the steps outlined in the ladder, we can unpack how our actions are driven by our beliefs, which are shaped by what we choose to pay attention to, which is in turn shaped by our experiences. This shows that if we want to change our perspective, we need to consciously expand the data we observe. We can do this by seeking out the experiences and perspectives of others (Benson and Marlin, 2017).

As you climb the rungs of the ladder, ask yourself (ibid):

1. What am I noticing about the current situation?
2. What else could I choose to pay attention to that might enhance my understanding?
3. What in my personal background or experience is influencing my current viewpoint?
4. How do my current beliefs influence what I notice?
5. How are my actions influenced by my beliefs?

Once we become familiar with the steps on the ladder, we can use it as a reminder of the need to gather further information and perspectives, asking:

- 'What is the observable data behind that statement?'
- 'Does everyone agree on what the data is?'
- 'Can you run me through your reasoning?'
- 'How did we get from that data to these abstract assumptions?'

(Senge et al., 1994: 242)

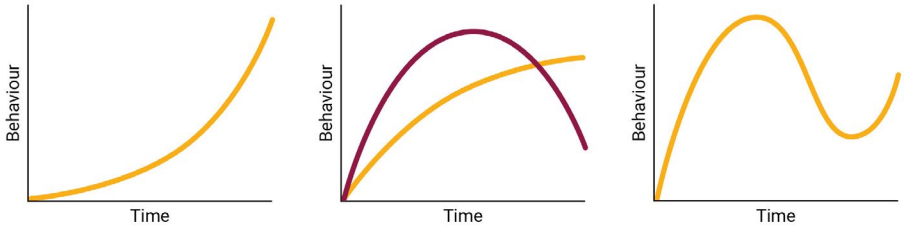
4.3 Behaviour-over-time graphs

Behaviour-over-time graphs are used to visualise change, helping the user to see patterns and reflect on what has happened and why (Ribesse et al., 2015). They are a helpful first step towards observing and understanding a system's behaviour (Monat and Gannon, 2015).[6]

By allowing us to visualise or plot multiple phenomena to reveal patterns beyond our own perspective, behaviour-over-time graphs are particularly helpful in applying the systems thinking principle: understanding recurring patterns in a system's structure, rather than focusing on individual events (see Section 4.1 of *Systems thinking for humanitarians: an introduction for the complete beginner*). We can use them to explain an issue from our own point of view, improving shared understanding, and can help to surface and test assumptions and mental models by comparing how different people may graphically plot the same thing (Benson and Marlin, 2017).

Behaviour-over-time graphs can also help us to predict future change: 'By incorporating the future into observations about patterns and trends of essential system elements, system thinkers can together envision a wide range of anticipated results' (ibid: 33).

Figure 7: Behaviour over time



Source: Adapted from Senge et al. (1994) and Waters Foundation (2017).

To create a behaviour-over-time graph, you simply plot time (in minutes, days, years, etc. as appropriate) along the x-axis and the variable for your chosen issue on the y-axis. You can do this with a pen and paper, in a spreadsheet, or using more advanced visualisation software. You can plot more than one variable on the same graph, to understand the relationship between multiple issues. Once you have plotted the variables and you can see a pattern emerging, ask yourself:

- What is changing?
- How is it changing?
- Why is it changing?
- What is the significance?

You may find a rapidly rising or falling pattern, which suggests a reinforcing process, or an oscillating pattern, which suggests a balancing process (Kim, 1999).

4.4 Rich pictures

The rich pictures tool is often used for problem diagnosis. It encourages people to create visual representations of their perceptions of a situation (Bell and Morse, 2013; Burge, 2015b; Ribesse et al., 2015). The concept of using pictures to develop understanding and support analysis can be traced far back in human history, but it is thought that the concept of 'rich pictures' originates from Checkland's publications about 'Soft Systems' from 1975 (Bell and Morse, 2013) and is commonly used within soft systems methodology (Emes and Griffiths, 2018).

Users of the rich pictures tool express their perception of ideas and concepts (for example, relationships, connections, causes and prejudices) through a process of free drawing. Images allow users to explore and examine issues in a more holistic way as they are less restricted by mental filters or the challenge of putting concepts into words (Bell and Morse, 2013). This tool can thus provide a rich insight into the complexities and perceptions of a situation and help users to understand the system (Burge, 2015b).

Rich pictures are often created in small groups and can help the collective to reach a consensus and move an issue forward (ibid). Users are tasked with representing a situation visually in a way that would enable them to explain it to others at a later time (ibid). There are no set rules though some people choose to use 'standard' symbols to represent some elements for example 'Role' and 'Viewpoint' (ibid). For more detail on rich pictures see Bell and Morse (2013) and Burge (2015b).

4.5 Causal loops

Systems thinkers use simple diagrams, called causal loops or feedback loops, to illustrate the circular relationships between parts of a system. Causal loops emerged in the 1970s (Williams and Hummelbrunner, 2011) and are used in various systems disciplines.

- **Causality:** How one thing influences another. Systems thinkers see causality as circular feedback loops, rather than linear.
- **Feedback:** Circular causality relationships whereby one thing affects something else and is in turn affected by it; opposite to a linear, one-directional cause-and-effect relationships (Kim, 1999). Feedback is either balancing or reinforcing. Looking for circular, feedback relationships gives systems thinkers a better understanding of all of the forces influencing behaviours within the system (ibid).

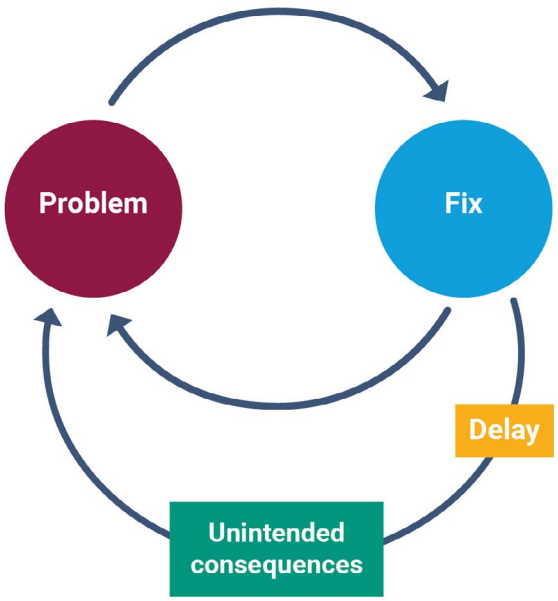
It may help to think of causal loops as shorthand descriptions that help to visualise relationships (Goodman, 2018). They can be useful in situations where it is difficult to explain verbally the influence of multiple interrelated factors (Williams and Hummelbrunner, 2011). Visualising the causal relationships within a system can help to tell the story about a situation, allowing you to identify the best way to intervene (Sherwood, 2002). As with behaviour-over-time graphs, asking different people to draw their understanding of causal relationships can also identify differences in perspective (Kim, n.d.a). Causal loops can also be the first step to drawing a system map (Section 4.5).

There are two main types of causal loops:

- **Balancing or negative loop:** A relationship that maintains the status quo, creating stability by limiting or constraining change.
- **Reinforcing or positive loop:** A relationship whereby change in one direction compounds or amplifies even more change in the same direction.

Causal loop diagrams can also visualise delays, and the loops may include more than two issues. For example, a balancing loop between A and B might be impacted by a reinforcing loop related to C.

Figure 8: Causal loop



4.6 Systems mapping

Systems maps build on the idea of causal loop diagrams but allow us to build a more comprehensive visual representation of a complex problem. Looking at a completed map, systems maps may initially appear confusing; in fact, systems maps are a fairly intuitive way to visualise complex relationships (Burge, 2015b).

There are many different ways to draw a systems map,[7] but the essential idea is to visualise the things (elements) within a system and the relationships between them. Doing so lays the groundwork for 'unique insights and discoveries… to develop interventions, shifts or policy decisions [in order to] change the system in the most effective way' (Acaroglu, 2017b: 7).

Systems maps are often people's first introduction to systems thinking but, while a useful tool for some, systems maps are not the main point of systems thinking (Egan, 2019). If you've come straight to this section and haven't read the rest of the handbook or *Systems thinking for humanitarians: an introduction for the complete beginner*, it might be helpful for you to look there first.

A systems map can communicate 'the essence of a problem' while also providing rich 'implications and insights' (Goodman in Kim, 1994: 6). Informed by our mental models, humanitarians often assume that we know what the impact of our actions will be – after all, we wrote it all down in our logframe! In reality, complex problems make this impossible to predict.

By visualising the system, we can better understand its behaviour and appreciate that any intervention could have broad consequences. Mapping can also help us to be humble, acknowledging the reality of the complex situation rather than pretending a simple fix will work.

Box 4: Identifying your 'guiding star' and near-term goals

Having a map can help you describe the current behaviours of the system and formulate a problem statement (Omidyar Group, n.d.).

In creating your systems map, it can be particularly helpful to identify your core, long-term objective or aspiration, which you can think of as your 'guiding star' (ibid). Once you have this, you can then look for nearer-term outcomes – 'near stars' (ibid) – which are achievable goals or benchmarks that align towards the guiding star.

The purpose of systems mapping is not to create a one-off, stand-alone map (USAID, 2014). Complex problems are dynamic, but a map will only capture a snapshot in time. Maps will always be limited by the information and perspectives used to or involved in creating it; they will always have boundaries and we should, in the words of one learning exchange participant, always 'assume you've got the boundaries wrong'.

Systems thinking practitioners who joined ALNAP's learning exchange workshop stressed that the value of systems mapping is largely in the process of creating the map, not in creating something that 'gets locked in a drawer somewhere and no one ever looks at it again'. This map-making process is particularly valuable where it is collaborative as it 'taps into local knowledge, promotes a common understanding of a system and its dynamics, and establishes a common ground for coordinating multiple interventions' (USAID, 2014: 9). It is important to ensure that diverse perspectives are part of any mapping exercise, to get 'a fuller picture of reality' (Kim, 1999: 12).

Burge (2015b) outlines basic steps you can take to draw a systems map, and Omidyar Foundation and Acumen have a free e-learning course that focuses on creating a collaborative systems map. You don't need any particular formats or software to create a systems map, particularly when you're getting started. However, there are several systems mapping software programmes you can use, notably Kumu, which has a free plan, and Cauzality, a new tool that emphasises the collaborative process and includes features that make it easier for new systems thinkers to recognise archetypes, patterns and leverage points (see Box 5). Using software, or drawing the map on a computer, may make it easier to update the map and use it over time, something that participants at the learning exchange emphasised. This is particularly helpful where new information is emerging.

Box 5: Finding leverage

Once you have identified relationships between various elements of the mapped system, you can begin to look for leverage points. These are likely to be:

- influential elements (those which have a relationship with many other elements)
- disproportional relationships (where there a large impact from a small action)
- relationships that bolster negative reinforcing loops (where a lack of action is likely to perpetuate a problem unless interrupted)
- opportunities to bolster a positive reinforcing loops (what is already making a difference, that could be amplified)

Once you've identified leverage points, consider which actions might affect these, considering not only the potential impact of these actions on the leverage point itself but also on the broader system (Kennedy et al., 2018). In response to a question from a fellow participant, one individual at ALNAP's learning exchange explained that focusing on 'paths of influence' can help to show the 'bridge from understanding to action'. However, it is important to note that the map itself is not the answer to the complex problem.

4.7 System archetypes

System archetypes are patterns of behaviour that cause common effects to a system and can occur in similar ways across different settings (Booth Sweeney, 2001; Jones, 2020). By identifying archetypes and representing these common patterns and their effects visually (Kim, 2000), systems thinkers gain insight into different system scenarios, much like the narrative of a story (Acaroglu, 2017c). Archetypes provide a template of analysis that can be applied to different contexts (Kim and Lannon, 1997; Peters 2014) and help the user to view their own situation in a new way or to forecast potential outcomes (Kim and Lannon, 1997).

Donella and Dennis Meadows first explored the idea of archetypes in the 1970s with their work on limited growth using feedback loops (Acaroglu, 2017c). The concept was then developed by Daniel Kim and brought into more common use by Peter Senge (Williams and Hummelbrunner, 2011).

Looking for archetypes in a system can help to identify how best to break vicious cycles by detecting a weak link or identifying targeted areas to trigger change (Stroh, 2015). They can also be used to track the causes and effects of changes in the system, supporting the user to question assumptions about actions taken and instead focusing on identifying the effects that are caused by change (Kim, 2000). Archetypes may also reduce the risk of defensive attitudes hindering analysis by taking a view of the issue within the structure of the system (Kim and Lannon, 1997).

Kim identified eight common archetypes (Williams and Hummelbrunner, 2011) and others have been proposed over time. Table 11 provides an overview of the archetypes identified in this research.

Archetypes can be used in many ways at different points – for example, in the initial design stage of a project to enable a new perspective to provide insight into potential issues by challenging the discussion and stimulating analysis (Kim and Lannon, 1997) or once a project is established to identify reoccurring issues that need to be addressed (ibid).

Archetypes have been used to identify common patterns of behaviour in distributing resources and how exploitation, greed and competition can harm the success of a food supply chain system (Acaroglu, 2017c) and to highlight the positive reinforcing behaviour of a community which pulled together as the result of a shared experience following the 2017 Mexico City Earthquake (ibid). For more information on archetypes see Kim and Lannon (1997); Kim (200a); and Acaroglu (2017c).

Table 11: Overview of system archetypes

System archetype	Description
Drifting/eroding goals	Goals that are reduced time and time again as a result of targets not being met, closing a gap by reducing the goals further.
Escalation	The escalation of a situation when actors compete for limited resources, seeing each other as a threat and seeking to increase their hold of the situation.
Fixes that fail	The process of taking a shortcut may have unintended consequences resulting in a situation that takes longer to fix than the original issue would have.
Growth and underinvestment	The process of compensating a stretched system by reducing standards and performance that leads to justifying underinvestment.
Limits to success	Over a period of time, despite continued effort, improved performance turns into a reduction when it reaches the limits of the system.
Addiction	When the system relies too heavily on an external force and thus becomes addicted to what the external force is providing.
Shifting the burden	Burdening another part of a system while trying to solve an issue as a result of a lack of knowledge about the workings of the system.
Tragedy of the commons	A reinforcing feedback loop formed when common resources lead to exploitation as a result of competitive and greed-based extraction beyond a sustainable level.
Seeking the wrong goal	The goal chosen is not based on tackling the root cause of an issue, instead the goal is based on superficial action.
Success to the successful/ exponential success	Renewed action based on the perceived reward of success from a behaviour, perpetuating a winning streak for one actor whilst preventing others from succeeding.
Race to the bottom	Actors spiral down as a result of competing to be lowest price, for example, within a sector.
Rule breaking	Actors altering their approach to avoid a rule effecting their success.
Fixes that fix back	Attempting to address an issue and only succeeding in tackling the symptom of a problem.
Intensity to action	The push to collective action as a result of the intensity of an event.
Growth paradox	When one area grows this will lead to the decline in another part of the system.
Status quo disruption	The 'new normal' formed due to a disruption to the current status quo.
Regenerative relationships	A positive reinforcing feedback loop that is formed when a culture of collaboration and support is created within a system.

Sources: Kim (n.d.b; 2000); Anderson and Johnson (1997); Kim and Lannon (1997); Booth Sweeney (2001); Acaroglu (2017c); Waters Foundation (2017).

5

Systems thinking glossary

5 Systems thinking glossary

This section provides an easy reference for the systems thinking concepts and terminology introduced in this handbook and *Systems thinking for humanitarians: An introduction for the complete beginner*.

Archetypes: Patterns of behaviour which result in common effects to a system and can occur in similar ways across different settings.

Balancing loop: A relationship which maintains the status quo, creating stability by limiting or constraining change.

Boundary: A framing for what's in/what's out when looking at a particular system. Boundaries are subjective, not absolute and thus systems thinkers should remember that relationships and leverage points will persist beyond the defined boundary.

Causality: How one thing influences another. Systems thinkers see causality as circular feedback loops, rather than linear.

Complexity: Situations that are 'messy, unpredictable and hard (or impossible) to replicate' (Egan, 2019: 8). Complexity and systems thinking go hand in hand, both recognising interconnectedness, patterns, dynamism and so on.

Dynamic: Where something is recognised as experiencing constant change; the opposite of static.

Emergence/synergy: The idea that there are characteristics of a system that emerge only when the parts of a system interact with one another – characteristics that are not found in any of the individual parts on their own and cannot be predicted by analysing the parts individually (O'Connor and McDermott, 1997). Examples of emergence include the schooling of fish, traffic jam patterns (Monat and Gannon, 2015) or the sound made by a piano (O'Connor and McDermott, 1997). Emergence is unpredictable and not easily controlled or manipulated (Morgan, 2005). Emergence requires that systems thinkers look beyond the individual parts of the system, focus on relationships and be flexible when planning (Hughes, 2016).

Feedback: Circular causality relationships whereby one thing affects something else and is in turn affected by it; opposite to a linear, one-directional cause-and-effect relationships (Kim, 1999). Feedback is either balancing or reinforcing. Looking for circular feedback relationships gives systems thinkers a better understanding of all of the forces influencing behaviours within the system (ibid).

Holistic: An approach which focuses on looking at the whole of something (the parts and their relationships).

Leverage: The idea that, in a system, where you try to have influence matters. Using leverage, you can identify where a small change can have a big impact, and this will be more effective than a scattered, untargeted approach. Effective leverage happens where you find the right place (leverage point), understand what it is you want to change and how to go about it (Kennedy et al., 2018).

Linear: The idea that one thing causes another thing to happen, where the causality is easily traced from A to B.

Mental models: The deep-rooted assumptions, stories and beliefs that shape what we perceive as reality; a way to frame information based on our perspective and worldview (Senge et al., 1994; Cabrera Research Lab, 2016). First coined by psychologist Kenneth Craik, mental models influence what we perceive, filter the information we absorb and shape how we interpret it (World Bank, 2014). In other words, they are how we create meaning from experience (Richmond, 2010).

Perspective: Simply put, perspective (or framing) is how you look at something (Williams and Hummelbrunner, 2011). Systems thinkers recognise that each situation can be viewed in different ways, through multiple lenses or framings. Perspective (how things look from your current position) is different from worldview (how you see the world, regardless of your current position), which is harder to set aside as it represents your most fundamental beliefs and assumptions (Open University, n.d.).

Reductionist: An approach which takes things apart to find out how it works.

Reinforcing loop: A relationship whereby change in one direction compounds or amplifies even more change in the same direction.

Self-organisation: The idea that the system changes on its own, developing patterns and structures, regardless of any external intervention or action.

Structure: The way that parts of the system are connected to one another; the links, patterns, flows, reactions, incentives, interactions, feedback loops and relationships within a system.

System: A group of 'interacting, interrelated or interdependent' (Monat and Gannon, 2015: 21) things that combine to achieve some purpose.

Systems thinking: A set of principles that aims to address complex problems in practical, tangible ways by examining the relationships between different parts of a system and making use of multiple and diverse perspectives.

Unintended consequences: Recognising that, due to interconnectedness across the system, any action or intervention will impact other parts of the system and that these relationships are often hidden and unanticipated, leading to outcomes that are not intended or forseen.

Annex A
Competencies rubric

Competency	Criteria	Iterative action indicators			How to develop this competency
		No competency	Basic competency	Advanced competency	
Perspective awareness	Able to recognise perspective and mental models and where they come from	Unable to recognise own perspective or those of others	Recognises own perspective on a situation or issue and where this comes from Understands how own mental models shape this perspective	Acknowledges perspectives and mental models of others Able to support others to recognise their own perspective and mental models	1. Use questions to practice reflecting on your perspective and mental models 2. Use the iceberg diagram and/or ladder of inference to consider how perspectives and mental models shape actions in particular examples 3. Be aware of language that reveals underlying mental models and use this awareness as a point of reflection/challenge
	Able to recognise how perspective and mental model influence behaviour	Believes own perspective is absolute truth reality Unaware that there are different ways to view the situation	Can explain their how own perspective and mental model are influencing their own feelings, decisions and actions	Locates self and others within the situation/system Can explain how the perspectives and mental models of others are influencing feelings, decisions and actions Offers insights about own perspective and mental models through metacognition	
Perspective versatility	Sees situations through different perspectives	Unable to change one's perspective	Sometimes able to shift perspective	Able to shift perspectives consistently and intentionally	1. Reflect on your thinking using probing questions 2. Practise seeing through someone else's view 3. Conduct a thought experiment to re-tell a familiar story from another perspective
	Uses boundaries to frame a problem in different ways	Only sees a problem in one way	Recognises the boundary of the problem	Able to change boundaries appropriately	
	Shifts between micro and macro perspectives	Unable to change one's perspective on a situation	Able to look at a situation at a micro or macro level	Building a comprehensive understanding by using micro and macro perspectives simultaneously	

Annex A: continued

Competency	Criteria	Iterative action indicators			How to develop this competency
		No competency	Basic competency	Advanced competency	
Improving mental models	Seeks out information to expand mental model	Does not recognise the need to improve mental models	Gathers information to improve mental models	Continuously and flexibly applies relevant learning to improve mental models	1. Change thinking patterns to support the improvement of mental models 2. Look for evidence before discounting other explanations 3. Reflect on how actions are influenced by beliefs
	Surfaces and tests assumptions	Does not recognise assumptions	Able to surface and test assumptions if prompted	Regularly surfaces and tests assumptions	
	Communicates about mental models to generate shared understanding	Is not able to communicate about mental models	Able to share own mental models with others	Understands and communicates about mental models of self and others With others, generates a shared understanding	
Understanding relationship impact	Describes circular relationships between different issues/ elements	Focus exclusively on linear relationships	Recognises circular relationships when prompted	Unconsciously aware of circular relationships	1. Think about how rumours spread 2. Use maps to visualise circular relationships 3. Call out your own problematic thinking 4. Question the time horizon 5. Imagine negative consequences as the system's purpose 6. Think about whether an intervention might be a 'fix that fails'
	Anticipates time delays in relationships	Doesn't recognise or take account of any time delays	Aware there may be time delays	Able to make decisions and take action which take account of potential time delays	
	Recognises short-term, long-term and unanticipated consequences	Only recognise immediate consequences	Aware there may be short-term, long-term and unanticipated consequences	Able to make plans and monitor short-term, long-term and unanticipated consequences	

Annex A: continued

Competency	Criteria	Iterative action indicators			How to develop this competency
		No competency	Basic competency	Advanced competency	
Working the structure	Places responsibility with the structure	Blames actors and events for the system's behaviour	Can identify how the system's structure drives its behaviour	Use understanding of the system's structure to achieve desired results	1. Take a closer look at a system's structure 2. Look for patterns 3. Draw maps to identify leverage points
	Uses appropriate boundaries	Doesn't consider the boundaries in use at all	Aware of boundaries being used, attempts to draw them appropriately	Uses boundaries that are not too wide or too narrow Updates the system's boundaries iteratively	
	Identifies patterns and trends	Focuses on one-of events and interventions	Looks for patterns and trends	Uses understanding of trends to focus on low cost, high reward leverage points	
	Finds the most impactful leverage points, helping the system to help itself	Takes action without any awareness of intractability or potential impact	Uses understanding of the system to identify leverage points	Identifies the most appropriate leverage points, avoids wasting time on high cost, low reward issues.	
Iterative action	Monitors flows and accumulations in the system	Monitors flows and accumulations in the system	Doesn't monitor changes in the system	Takes note of changes in the system	1. Consider everyday accumulations 2. Set reflection points 3. Consider the consequences
	Embeds iteration in own behaviour	Embeds iteration in own behaviour	Refuses to deviate from plans	Iterates when plans fail	
	Pre-empts reactionary behaviour	Pre-empts reactionary behaviour	Completely reactive	Considers possible iterations in advance	

End notes

1. See When a Butterfly Sneezes (2001) and Connected Wisdom (2008) by Linda Booth Sweeney.

2. See Meadows, n.d.; Plate and Monroe, 2014; Arnold and Wade, 2015; Meadows et al., 2016; Benson and Marlin, 2017; Valerdi and Rouse, 2010.

3. Writing in particular about evaluators, Hummelbrunner (2011) suggests the following ways to practice this competency: 'Having trust in self-organization is about paying attention for emerging patterns, responding to them – and resist the temptation to control or exert direct influence. Differences from original plans need not be conceived of a priori as negative leading to corrective actions to put an intervention back "on track". For evaluations to work this way they should not be limited to observing intended effects or routes, but instead look at the entire range of processes triggered, irrespective of whether they are in line with original intentions; and to value differences, because exceptions, discontinuities, contradictions and puzzles are important sources of information that can provide useful clues for improving implementation.'

4. For a more advanced exploration of systems tools, see Kim (2000), Williams and Hummelbrunner (2011) and Emes and Griffiths (2018).

5. One learning exchange participant said: 'I think the main reason people want toolkits is in order to not have to change the way they think. It's the exact opposite of what the tool is supposed to do. It's like "Please give me something that I can go through a set of exercises that doesn't require me to think any differently from the way I'm thinking, but it gives me the activities I have to do and that's what I'm going to do".'

6. For a short visual introduction, see CLExchange (2016) 'Introduction to behavior-over-time graphs (BOTGs)'.

7. See Acaroglu (2017d) for an introduction to different types of systems maps.

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