

Thinking in Loops

Basic Building Blocks of Causal Loop Networks in the 5-Node-Model

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### Abstract

The study of neural networks' dynamic properties that in part show chaotic behavior focuses on two major areas. Cognitive sciences try to understand the mental system acting as a whole, which can be investigated by understanding the brain from a holist point of view.

Neuroscience, on the other hand, attempts to analyze specialized circuits that can be modeled as causal loop networks. These circuits may in part be mapped out by sophisticated investigation of the electric and physiologic activity in the brain, taking on a reductionist perspective. However, their dynamics does not build on sequences of cause and effect. They show emergent *eigen*-behavior. To work with recurrent systems (organizations, brains, societies, groups, cultures, etc.), it is important to understand both causal loop dynamics between individual nodes that produce emergent behavior and subjective experience of individual nodes within a network that cannot be seen from outside. This article discusses an ancient model that can be used to investigate and characterize closed-loop systems, shifting back and forth between holistic and individualistic perspectives to promote integrative thinking.

## Investigating Emergent Properties

When studying recurrent networks, looking for functional relationships of cause and effect is not enough. When examining loops of causation in dynamic systems, to look for patterns conveys more about their behavior than looking for the systems' contents.

### The 5-Node-Model of Traditional Chinese Medicine

Investigation of closed-loop systems dates back to ancient China. Nguyen Van-Nghi and Christine Recours-Nguyen, in their standard on Chinese medicine, provide an insightful explanation of the five phases of transition, commonly also known as the *five elements*. In this treatise, for reasons of consistency, I will call them *five nodes*. When speaking of the five elements, focus nowadays is mostly placed on the contents that are attributed to these nodes, starting with the basic elements water, wood, fire, metal, and earth. Many other attributions have been made accordingly, for example, sense perceptions, colors, tastes, seasons, body organs, and energy vessels in the body called meridians. Working with these contents blurs the view on the original purpose of the instrument and promotes spiritual discussions. But the 5-node-model is essential science. The five phases of transition are nodes in a dynamic, closed causal-loop network. Two forward loops are modeled that pass through all of the five nodes: one forward loop ( $A-B-C-D-E-A$ ) is *productive*, i.e. stimulating the growth and activity in the following node. The other forward loop ( $A:c:E:b:D:a$ ) is *repressive*, inhibiting activity in the following node. Thus, only one dichotomy is modeled by this network: *production-repression*.

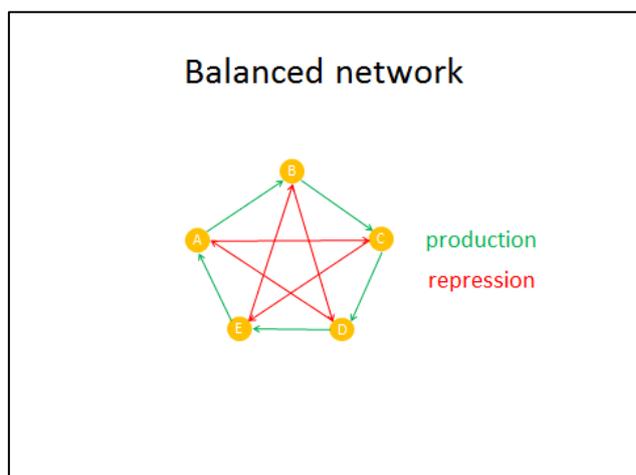


Figure 1 - Balanced network

Therefore, nodes cannot produce and repress their successor at the same time along the same edge. Then, the minimum number of

nodes needed to model two antagonistic circuits that both contain all elements, is *five*. Any *even* number greater than five will also lead to a conflict. Such systems will not be able to maintain a homogeneous equilibrium. Any odd number of nodes greater than five (7, 9, 11, ...) is suitable but will not produce further insights into the fundamental causal dynamics. Thus, a network containing five nodes is the smallest possible primitive to explain the dynamics of complete causal-loop network containing one dichotomy. Within those networks, as a consequence of production or repression, nodes can either be in *balance*, in *excess* or *insufficiency*. If the network is at equilibrium, all nodes are in balance. When there is excess or insufficiency in only one node, the system will reaffirm this extreme and solidify. Thus, the equilibrium of such networks is *fragile* and needs to be continuously regulated. Interesting for this discussion is the power of the nodes (given the contingency to do so) to self-regulate the behavior of the network.

### Early References

The Huangdi Neijing, a classic Chinese medical text usually dated between the fifth and second century B.C., elaborates on this model and identifies two patterns that occur when dynamics in this system are out of balance, dependent on whether the element is in excess or in insufficiency:

- Nodes in *excess* invade what they usually inhibit and revolt against by what they normally are inhibited.
- Nodes in *insufficiency* are defied by what they usually inhibit, and are infringed by what they normally inhibit.

The whole framework of Traditional Chinese Medicine roots in this model. Meridians, its primary, dynamic circuits, are assigned to the nodes of this model to investigate their mutual relationships. Each meridian is then assigned points to either produce or repress itself and other, coupled meridians. Insufficiency and excess form a dichotomy that is symbolized by

*yin* and *yang*. However, their diagnosis within a dynamic system is based on the 5-node-model. (Van Nghi, & Recours-Nguyen, 1997, pp. 21-27)

### **Behavior of Partial Loops within the 5-Node-Model**

Herbert Simon proposes to consider “the organized group as a system in equilibrium.” (1997, p. 140). Magoroh Maruyama transcends this homeostatic model by proposing morphogenesis. In morphogenesis, causal loops within systems continuously stabilize new patterns and act as a driver for change. Karl Weick reflects on Maruyama’s propositions as *deviation-amplifying* or *deviation-counteracting* loops of causation in interaction among its members. Maruyama, 2010, positively calls them *change-creating/change-amplifying* or *change-counteracting*. Whether one wants to maintain equilibrium or promote change, depends on whether the causal loops at hand are thought to keep an organism’s integrity or are concerned with the adaptive, structural coupling between an organism and its environment. (Maruyama, 2010, p. 609; Maturana, 1992, pp. 129-137)

Weick points out that if loops contain an even number of repressive edges, then they are deviation-amplifying, i.e. *change-creating*. With an odd number of negative prefixes, they are *change-counteracting*. (Weick, 1995, pp. 109-112)

**The 5-Node-Model as a whole is Change-Counteracting.** On the top level, the 5-node-model consists of two loops. Its producing loop, cycling through all 5 nodes, is change-creating. However, as a direct antidote, its repressive loop, also containing all nodes, is change-counteracting. So both loops span a dichotomy that has the possibility to be in equilibrium, for example, if the potential and action of nodes and edges are homogeneous.

### 4-Node Loops are Change-

**Counteracting.** There are four possible causal loops containing four nodes within the system (A-B-C-D:A), (A-B:C-D-A), (A-B-C:E-A), and (A:C-D-E-A). All loops contain an odd number of repressive edges (one), here indicated by a *colon* between the respective nodes. Producing edges are indicated by a *dash*. So, all possible

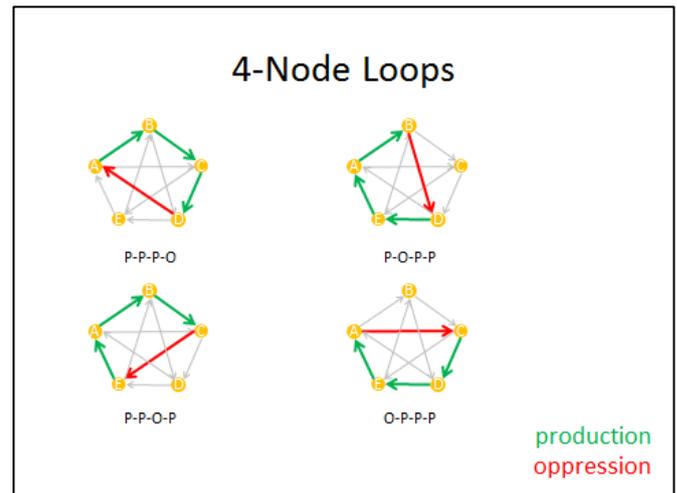


Figure 2 - 4-node loops

4-nodeloops counteract change. These loops help stabilize the system’s overall tendency to maintain its equilibrium as a whole. The dynamics of these loops can be investigated by focusing on the edges between the nodes. For better readability *repression* has been substituted by the more violent *oppression*, although thinking in repression is preferred by the author: P-P-P-O, P-P-O-P, P-O-P-P, and O-P-P-P. It doesn’t matter at which place in the forward loop the repressive relationship resides, as long as it is only one, the loop is change-counteracting, maintaining the equilibrium of the system as a whole.

### 3-Node-Loops Are Change-Creating.

3-node-loops are the fundamental drivers of change in any causal-loop network. Consider this for a minute. Systems with an even number of nodes have been ruled out to gain equilibrium as a whole above. A big, odd number of nodes will create more complex forward loops, which

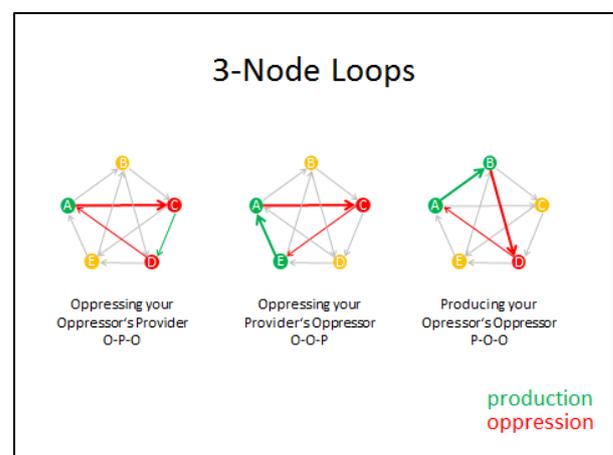


Figure 3- 3-node loops

appear increasingly chaotic because they become incomprehensible. But in any of these models *the smallest forward loops that create change are 3-node-loops*. At the same time, they can exert the strongest influence given their tight, mutual coupling. This fact raises

questions when thinking about the power of oligopolies versus the many players in a whole parliament or society.

*There are only three possible, change-creating loops within any such network: (A-B:D:A), (A:C-D:A), and (A:C:E-A), of which the latter two are identical except for a change in perspective. Their edges are characterized in the following table. Nodes in excess are indicated by upper case letters, nodes in insufficiency by lower case. The last column gives an impression of the characteristic experience, when assuming the point of view of A. As A can either be in a state of excess or insufficiency, 6 states of this network need to be discussed that form stable imbalances away from the equilibrium.*

State of A	Edges	Causal Loop	Characteristic Experience
Excess	P-O-O	(A-B:d:A)	Producing the Oppressor of the Oppressor
	O-O-P	(A:c:E-A)	Oppressing the Oppressor of the Provider
	O-P-O	(A:c-d:A)	Oppressing the Provider of the Oppressor
Insufficiency	p-o-o	(a-b:D:a)	Neglecting the Oppressor of the Oppressor
	o-o-p	(a:C:e-a)	Tolerating the Oppressor of the Provider
	o-p-o	(a:C-D:a)	Tolerating the Provider of the Oppressor

**Table 1 - 3-Node Change-Creating Causal Loops**

To indicate whether the first node in the loop, to which cause is popularly attributed, is in excess or insufficiency, the capitalization of the edge patterns has also been adjusted (p-o-o as opposed to P-O-O). Every change in causal loop systems roots in one of these six 3-node forward loops.

**Different Perspectives.** The *characteristics* column in Table 2 give an impression how the dynamics of these causal loops might unfold from A’s personal perspective. These perspectives do not yet take causal loops into account. They are causal (!) observations that A can make when being a part of the system, without understanding the closed-loop dynamics of the system as a whole. One will see phrases that are typically termed as excuses, when behavioral change is desired, or explanations, when scientific contexts are investigated. However, all of them do not actually grasp the whole picture. They sequence a small portion

of the whole into a chain of cause and action, falling short of seeing the loop. The blind spots have been indicated by an *x* in the causal loop symbol. To signal lacking understanding for the causal closure the parentheses have been omitted.

Perspective	State of A	Edges	Causal Chain	Characteristic Experience
1 <sup>st</sup> order	Excess	P-O-O	x-x:d:A	I am strong <i>because of</i> my weak Oppressor
		O-O-P	x:x:E-A	I am strong <i>because of</i> my strong Provider
		O-P-O	x:x:d:A	I am strong <i>because of</i> my weak Oppressor
	Insufficiency	p-o-o	x-x:D:a	I am weak <i>because of</i> my strong Oppressor
		o-o-p	x:x:e-a	I am weak <i>because of</i> my weak Provider
2 <sup>nd</sup> order	Excess	P-O-O	x-B:d:A	I am strong, <i>because of</i> the strong oppressor of my oppressor
		O-O-P	x:c:E-A	I am strong, <i>because of</i> the weak oppressor of my provider
		O-P-O	x:c-d:A	I am strong <i>because of</i> the weak provider of my oppressor
	Insufficiency	p-o-o	x-b:D:a	I am weak <i>because of</i> the weak oppressor of my oppressor
		o-o-p	x:C:e-a	I am weak <i>because of</i> the strong oppressor of my provider
		o-p-o	x:C-D:a	I am weak <i>because of</i> the strong provider of my oppressor
3 <sup>rd</sup> order	Excess	P-O-O	A-B:d:A	I am strong, because <i>I produce</i> the oppressor of my oppressor
		O-O-P	A:c:E-A	I am strong, because <i>I oppress</i> the oppressor of my provider
		O-P-O	A:c-d:A	I am strong because <i>I oppress</i> the provider of my oppressor
	Insufficiency	p-o-o	a-b:D:a	I am weak because <i>I neglect</i> the oppressor of my oppressor
		o-o-p	a:C:e-a	I am weak because <i>I tolerate</i> the oppressor of my provider
		o-p-o	a:C-D:a	I am weak because <i>I tolerate</i> the provider of my oppressor

Table 2 - First Person Perspectives on Imbalances

So in the 1<sup>st</sup> order, only considering its direct environment, A experiences four influences on A's current state: strong or weak Providers and strong or weak Oppressors. For A to transcend these limits, its field of view has to widen to include an influence on these directly experienced "causes". To transcend

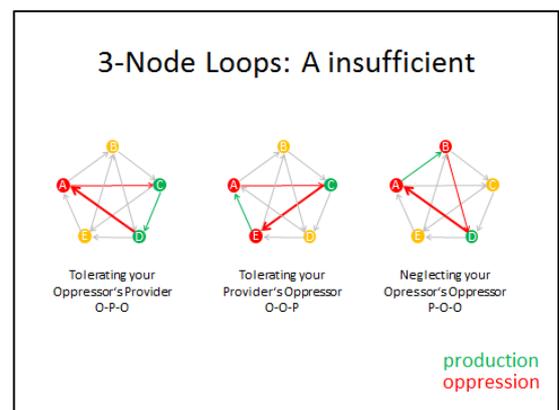


Figure 4 - 3-node loops: A insufficient

from 2<sup>nd</sup> to 3<sup>rd</sup> order it is not enough to find more influences on the 2<sup>nd</sup> in one's environment. A real progress in understanding will only be made when acknowledging the involvement of A itself in the causal relationship. Typical phrases at this stage of the discussions include, "It's not only the others; it is also you. You are responsible for your own fate. Take control."

However, this perspective is far from truth and will not lead out of misery. It is cheating oneself by acting as being part of a causal chain that exerts influence on oneself, where the two instances of self (the acting and experiencing end) are disconnected from each other. Because their identity is not recognized, they can assume two different values at the same time in mental experiments: One, still being factually low; two, having artificially been increased by some individual magic. Upon failure when applying this causal theory in practice, fate is thought to bounce back. This view is widespread and the basis upon which emotions like guilt and shame arise. Instead, all three actors are equally responsible (or not responsible) in this network. So there are 12 more views on these illusionary cause and effect relationships when changing the perspective that are equally valid. The reader may recognize some of these characteristic phrases from own experience.

Perspective	State of A	Edges	Causal Loop	Characteristics
2 <sup>nd</sup> node	Excess	P-O-O	A-B:d:A	If A would not agitate me as much, I could be easier on D. <i>A, cut down, I overwhelm D!</i>
		O-O-P	A:c:E-A	If A would not repress me as much, I could exert more control on E. <i>A, leave me alone, I cannot control (repress) E!</i>
		O-P-O	A:c-d:A	If A would not repress me as much, I could produce more D. <i>A, leave me alone, I cannot produce D!</i>
	Insufficiency	p-o-o	a-b:D:a	If A would help me more, I could control D. <i>A, give more support, I cannot control(repress) D.</i>
		o-o-p	a:C:e-a	If A would help me control my excess, I would not repress E as much. <i>A, please control me so I don't repress E so much!</i>
		o-p-o	a:C-D:a	If A would help me control my excess, I wouldn't produce D so much. <i>A, please control me so I don't produce as much D!</i>
3 <sup>rd</sup> node	Excess	P-O-O	A-B:d:A	If A wouldn't help my oppressor as much, I could control A more. <i>A, don't help on my Oppressor!</i>
		O-O-P	A:c:E-A	If A wouldn't control my Oppressor as much, I could help him more. <i>A, please go easy on my Oppressor!</i>
		O-P-O	A:c-d:A	If A wouldn't control my Producer as much, I could control him more. <i>A, please go easy on my Producer!</i>
	Insufficiency	p-o-o	a-b:D:a	If A would help my Oppressor more, I wouldn't oppress A as much. <i>A, please help my Oppressor, so I don't oppress you as much.</i>
		o-o-p	a:C:e-a	If A would control my Oppressor more, I could help A better. <i>A, please control my Oppressor, so I can help you more!</i>

	o-p-o	a:C-D:a	If A would control my Producer more, I wouldn't repress A as much. <i>A, please control my Producer, so I don't repress you as much!</i>
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**Table 3 - 2nd and 3rd Node Perspectives**

It is striking that some of the characteristics, when considered alone, are counter-intuitive: In one case it appears reasonable for *E* to ask *A* to not exert as much control on *E*'s Oppressor. However, this is only reasonable when *E* is strong, *E*'s Oppressor weak, and *E* needs this oppressor to keep balance. The 3<sup>rd</sup> node can assume all perspectives of the 1<sup>st</sup> and 2<sup>nd</sup> node in respect to direct neighbors, but can also develop a unique passive perspective containing all three nodes as indicated in Table 3.

**All Of These Perspectives Are Equally (In-)Valid.** However, there is a big difference when it comes to social acceptance or discussing the resolution of the problem. This difference becomes evident when considering all possible perspectives to one causal loop next to each other:

State of A	Edges	Node	Characteristics
Excess	P-O-O (A-B:d:A)	1 <sup>st</sup>	(a) I am strong <i>because of</i> my weak Oppressor (b) I am strong, <i>because of</i> the strong oppressor of my oppressor (c) I am strong, because <i>I produce</i> the oppressor of my oppressor
		2 <sup>nd</sup>	If A would not agitate me as much, I could be easier on D. <i>A, cut down, I overwhelm D!</i>
		3 <sup>rd</sup>	If A wouldn't help my oppressor as much, I could control A more. <i>A, don't help on my Oppressor!</i>
	O-O-P (A:c:E-A)	1 <sup>st</sup>	(a) I am strong <i>because of</i> my strong Provider (b) I am strong, <i>because of</i> the weak oppressor of my provider (c) I am strong, because <i>I oppress</i> the oppressor of my provider
		2 <sup>nd</sup>	If A would not repress me as much, I could exert more control on E. <i>A, leave me alone, I cannot control (repress) E!</i>
		3 <sup>rd</sup>	If A wouldn't control my Oppressor as much, I could help him more. <i>A, please go easy on my Oppressor!</i>
	O-P-O (A:c-d:A)	1 <sup>st</sup>	(a) I am strong <i>because of</i> my weak Oppressor (b) I am strong <i>because of</i> the weak provider of my oppressor (c) I am strong because <i>I oppress</i> the provider of my oppressor
		2 <sup>nd</sup>	If A would not repress me as much, I could produce more D. <i>A, leave me alone, I cannot produce D!</i>
		3 <sup>rd</sup>	If A wouldn't control my Producer as much, I could control him more. <i>A, please go easy on my Producer!</i>
Insufficiency	p-o-o (a-b:D:a)	1 <sup>st</sup>	(a) I am weak <i>because of</i> my strong Oppressor (b) I am weak <i>because of</i> the weak oppressor of my oppressor (c) I am weak because <i>I neglect</i> the oppressor of my oppressor
		2 <sup>nd</sup>	If A would help me more, I could control D. <i>A, give more support, I cannot control(repress) D.</i>
		3 <sup>rd</sup>	If A would help my Oppressor more, I wouldn't oppress A as much. <i>A, please help my Oppressor, so I don't oppress you as much.</i>
	o-o-p (a:C:e-a)	1 <sup>st</sup>	(a) I am weak <i>because of</i> my weak Provider (b) I am weak <i>because of</i> the strong oppressor of my provider (c) I am weak because <i>I tolerate</i> the oppressor of my provider
		2 <sup>nd</sup>	If A would help me control my excess, I would not repress E as much. <i>A, please control me so I don't repress E so much!</i>
		3 <sup>rd</sup>	If A would control my Oppressor more, I could help A better. <i>A, please control my Oppressor, so I can help you more!</i>
	o-p-o (a:C-D:a)	1 <sup>st</sup>	(a) I am weak <i>because of</i> my strong Oppressor (b) I am weak <i>because of</i> the strong provider of my oppressor (c) I am weak because <i>I tolerate</i> the provider of my oppressor
		2 <sup>nd</sup>	If A would help me control my excess, I wouldn't produce D so much. <i>A, please control me so I don't produce as much D!</i>
		3 <sup>rd</sup>	If A would control my Producer more, I wouldn't repress A as much. <i>A, please control my Producer, so I don't repress you as much!</i>

Table 4 - Summary of contrary positions

Interestingly, whatever perspective (a), (b), or (c) A takes, A always faces two opposing views that seem to form a coalition, in that they ask the same from A. As long as A thinks in terms of (a) or (b), there is direct opposition that A can hardly win against a coalition of two opposing players. When widening the perspective from (b) to (c), A primarily accepts guilt. However, that does not help to change the dynamics of the system. It just puts the blame on A.

**Gravitational Shift.** Gravity shifts because whenever *A* is in excess or insufficiency, a gravitational shift occurs within the system. This gravitational shift is directly experienced by *A*'s opposites. In equilibrium with five nodes, *A* has two direct opposites, *C* and *D*. Nodes *B* and *E* are not as affected by this gravitational shift. The balance on their mutual axis even seems entirely unaffected. *B* and *E* are drawn insignificantly closer toward *A* in cases of *A*'s excess, and drawn insignificantly closer toward *D* and *C* in cases of *A*'s insufficiency. So although there is a massive imbalance between *A*, *C*, and *D*, nodes *B* and *E*, in their mutual relationship, may take little notice of it. (Compare the gravitational shift in Game Theory, especially versions thereof based on Fuzzy Logic.)

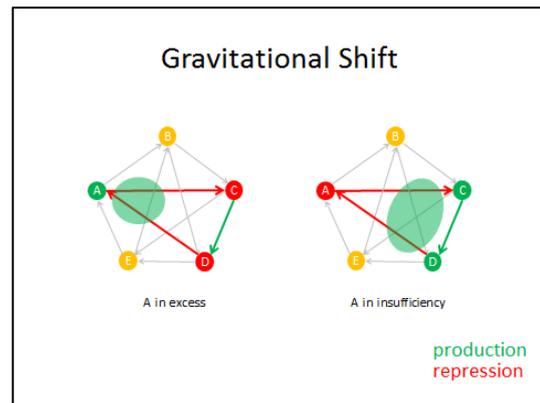


Figure 5 - Gravitational shift

**The 4<sup>th</sup> Perspective: Recognizing the Loop.** To start this investigation, the 5-node-system at some point must have been at equilibrium. It can only be out of balance because *A* (for example) received a drift toward excess or insufficiency in the first place. This influence does no longer have to be part of the system. It may have been mediated by an earlier change in the environment. However, *A* is not to blame. The change-creating loop is only possible if all other nodes behave accordingly. As long as *A* is in insufficiency, mere continuous effort will not lead *A* out of the insufficient state as *A* will be kept in its state of insufficiency by the eigen-behavior within the causal loop. If *A*, by any means, is brought to a state of excess, it will immediately turn into an oppressor by the very same dynamics. Also, *A* has no guilt in this situation, despite being in opposition to *C* and *D*, *A* may accept the blame. *The causal loop between A, C, and D containing an even number of repressive influences is responsible*

*for the loss of equilibrium.* This situation requires joint effort for the system to regain equilibrium in most cases.

On a side note: It may not be necessary for the system to regain equilibrium. The self-stabilizing situation of excess or insufficiency in one node may fulfill the purpose of being the foundation for something new, with its change-creating property. However, if equilibrium must be regained, for example, to maintain the integrity of a living organism or social system, several interventions are possible.

### **Karl Weick's Remedies**

Karl Weick, following Maruyama, models organizational dynamics using deviation-amplifying or deviation-counteracting loops of causation in interaction among its members. Here, an unspecified number of variables (nodes) are used. Between nodes, directed edges of positive or negative influences are inserted. Object of investigation are loops that can be found in these networks. If loops contain an even number of negative prefixes, then they are deviation-amplifying. With an odd number of negative prefixes, they are deviation-counteracting. The 5-node-model, on the top level, contains a closed loop of five repressive influences stabilizing its equilibrium. Imbalances happen in partial 3-node loops that are discussed above. The deviation-amplifying loops contain two repressive and one productive influence, i.e. an even number of negative edges. These loops, therefore, are deviation-amplifying. (Weick, 1995, pp. 102-112; Maruyama, 1963, p.164)

The following table discusses the proposed remedies and gives examples in terms of behavior and way of thinking.

Remedy	Behavior	Way of Thinking
<b>Reverse causality</b>	When you go to bed does no longer influence when you get up, if you introduce a rule to go to bed sooner or later, dependent on when you got up.	Instead of functional units, think in constraints.
<b>Swap polarity</b>	Enduring stimuli that are linked with negative emotions makes you feel bad. However, if you make a higher virtue out of enduring these, enduring them may actually make you feel better.	Reframing an experience from negative into positive context
<b>Remove coupling</b>	Exposition therapy.	By knowledge and understanding. Once you know how thoughts and feelings are connected, they will feel less threatening to you.
<b>Remove direction from edge</b>	A reprimand may cause a change in behavior, but the direction of the change cannot be predicted.	Develop equal-mindedness toward certain stimuli.
<b>Remove variable</b>	Leave problematic organizations or bad relationships. Get rid of a problematic player.	Don't actively support a certain way of thinking. Drop a mental habit.
<b>Tighten coupling</b>	Attending to a problem may help resolve it. Write journals. Measure daily what you want to change. Increase your awareness.	Make a practice out of observing a phenomenon you want to change. Attend to it and practice noticing it.
<b>Loosen coupling</b>	Getting away from detrimental influences can help you regain balance. Just be friends, not sexual partners. Put the chocolates out of sight, for as soon as you're lost in thought, your body will react on them.	Willingly create an imaginary space between yourself and a certain way of thinking that your mind is used to.
<b>Insert a new edge</b>	Starting physical exercise can change the equilibrium of your system. Getting a dog or visiting a therapist will change your behavior.	Become an observer and bracket the situation to be able to move outside of the context.

Table 5 - Causal-loop remedies

### Remedies for the 5-Node-Model

When trying to regain balance within the 5-node model, some of the remedies Weick proposed are of little use. They help if one is willing and able to change the layout of the system as a whole. However, reversing the causality of an edge, swapping the polarity, removing a coupling or direction from an edge or inserting new nodes or edges are not an option, as they fundamentally change the layout of the system. In the following paragraphs, *minimal interventions* are discussed that help the system regain equilibrium. They neither require new nodes or edges (no consultant heroes required) nor do they promote a constant compensating effort (so no burn-outs). Instead, only two operations are used: the *channeling of attention* and the *non-reacting*. They can be thought of as temporarily tightening and loosening the coupling between two nodes. If the participating nodes in systems do not learn

how to execute these remedies, the system will not be able to maintain its equilibrium, once it has been set off by temporary, external stressor.

All remedies below can be carried out by a mutual consent between two contributing players, or even be initiated by one player alone. It is, however, not always the one who got the blame. The solution always involves shifting the perspective from a 3-node to one of the 4-node causal loops by non-reacting on one of the oppressing edges and diverting attention to one of the nodes that did not participate in the 3-node loop. As a general rule, nodes in excess need to divert their attention outside the triangle, and nodes in insufficiency need to non-react on their strongest, detrimental influences.

State of A	Edges	Causal Loop	Target Loop	Actions
Excess	O-P-O	(A-B:d:A)	(A-B-C-D:a)	A diverts attention to B C non-reacts on detrimental influence from A
		(A:c:E-A)	(A-B-C-D:a)	A diverts attention to B C non-reacts on detrimental influence from A
	P-O-O	(A:c:E:b:D:a)	(A-B-C-D:a)	E non-reacts on weak oppression from C E diverts attention to B (A non-reacts on production from E)
			(A:c:E:b:D:a)	E non-reacts on weak oppression from C E diverts attention to B (A non-reacts on production from E)
		(A:c-d:A)	(A-B-C-D:a)	B diverts attention to C. A diverts attention to C. (B non-reacts on production from A)
Insufficiency	p-o-o	(a-b:D:a)	(a:C-D-E-A)	D diverts attention to E
			(a:C:e:B:d:A)	C diverts Attention to E.
	o-o-p	(a:C:e-a)	(a:C-D-E-A)	C diverts attention to D
	o-p-o	(a:C-D:a)	(a-b:D-E-A)	D diverts attention to E

Table 6- 5-node model remedies

Most noteworthy, A is in no case part of the remedy when A is in a state of insufficiency.

However, in popular settings, that's when A is being encouraged most to *spend more effort* or *try harder*. Spending more effort will only work if that energy can be applied in one batch.

However, A will thereafter likely become a node in excess and active oppressor via the very same loop.

Similarly, when A is in excess, the remedy lies in A diverting attention to an outside supporter of C (in this case B), that until then hasn't been part of the argument. A is best off when leaving the argument and investing the energies that have been set free in a different

affair within the same context. It is only in case O-P-O – when *A* is acting as primary oppressor on both counterparts – that the action of *A* is actively required for the elimination of the imbalance.

**Discussion in Detail**

**O-P-O:** *D* could try to divert attention to *D*, while *C* ignores *A*'s oppressing influence. However, that would not channel *A*'s energy excess back into the system to lead *C* and *D* out of their insufficiency. *D*'s influence on *A* was weakened to begin with, so diverting the attention away from *A* does not do very much.

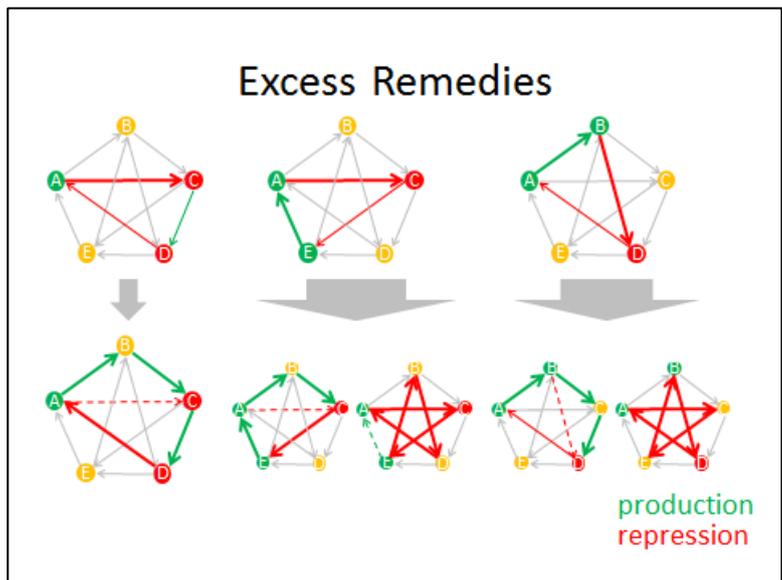


Figure 6- Remedies for excess

The strong oppressing axis *A:c* remains unresolved. *C* and *D* are not in a position to resolve this situation.

**O-O-P:** This causal loop can be addressed by the same strategy as P-O-O above. However, in this case, with *E* being in excess, *E* can also alleviate the situation by channeling attention to *B*, reaffirming the oppressing 5-node loop (*A:c:E:b:D:a*). In addition, *A* can non-react on production from *E*, but that would not be a solution on its own, as *E* has to channel the excess somewhere. So *E* has to become active for this remedy to work.

**P-O-O:** *D* has to non-react on the oppressing influence from *B*, and *B* must divert attention to *C*. As again there are two nodes in excess, *A* can resolve this situation alone by diverting his attention to *C*, opening the 5-node loop (*A:c:E:b:D:a*). As you might have guessed, O-O-P and P-O-O are the same, with a shift in perspective

**o-p-o:** In this situation, *D* has to channel attention back to *E*. *A* can help by non-reacting on *D*'s harmful impact. So *A*'s egocentric view in this case isn't as wrong as it may appear. If *D* is not willing to cooperate, *C*, who is also in excess, can remedy this situation alone by diverting attention to *E*, activating the 5-node oppressing loop.

**o-o-p:** *C* can resolve this imbalance in cooperation with *E*. *E* must non-react on *C*'s oppressing influence, and at the same time *C* channel excess towards *D*. *C* may attempt this situation alone by diverting attention to *D*. *A* is not in a position to resolve this situation.

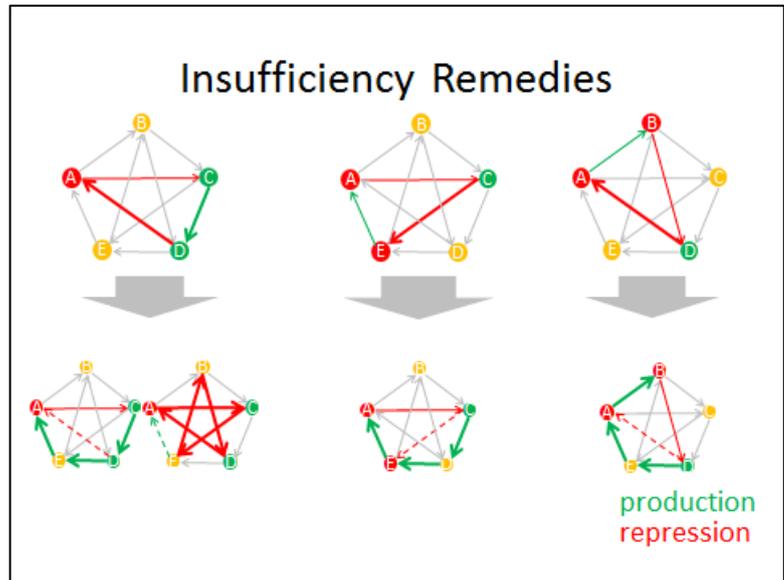


Figure 7 - Remedies for insufficiency

**p-o-o:** To resolve the

detrimental influence in this situation, *D* must channel attention back to *E*. In support, *A* can non-react on *D*'s detrimental influence. However, this is not a remedy in its own. *B* is not in a position to resolve this situation.

### Some Conclusions

**Nodes in Insufficiency:** If you are in insufficiency, and you get no support, you cannot remedy any imbalances within the system. If you are insufficient and under active oppression, ignoring the oppressing influence alone is not enough. As a long term solution, the abundant oppressing influence has to be eliminated. From an insufficient position, searching for new alliances seems to be the best way to go, particularly for ones that help remedy the existing, detrimental influence. If you are in insufficiency, then the whole system is out of balance. It's not "your problem".

**Nodes in Excess:** If you are in excess and not under intense oppression, you can remedy situations alone by directing your attention from oppression towards production, no matter whether you have direct support or not. You should do that because there is a high chance that you are actively oppressing somebody. Otherwise you would not be in excess. If you are in excess, then the whole system is out of balance. Invest your energies in something else within the same system.

### The Phenomenon of Invasion

There is one more, interesting phenomenon that occurs within closed-loop networks that may be easier to understand, because it gives you a touch of cause and effect. It has been called invasion in the classic texts. Invasion happens when A invades C via a different route, which it normally represses. A can only do that with the help of B.

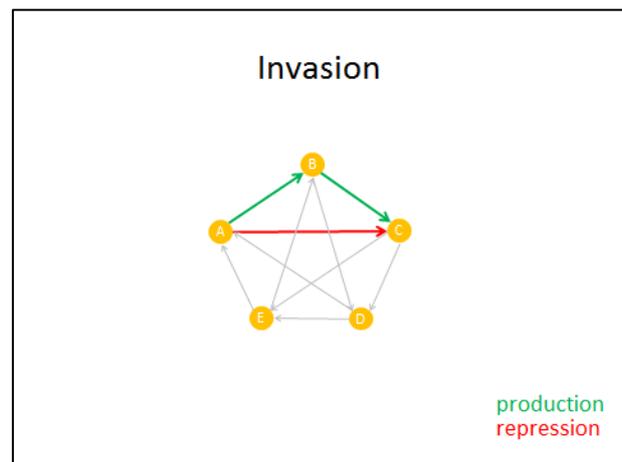


Figure 8 - Invasion

Invasion happens when A invades C via a different route, which it normally represses. A can only do that with the help of B.

**Example - Invasion and Exercise:** Consider *A* to be *exercising*, either in one's favorite gym, running, mountain biking, or whatever suits best. Exercising then exerts two influences:

1. Exercise (*A*) positively influences good physique (*B*) which positively affects well-being (*C*).
2. Exercise (*A*) negatively impacts well-being (*C*) directly by exhaustion, wear and tear, etc.

Any person considering their well-being may, after having exercised, may come to the conclusion that exercise has a negative influence on their well-being (which, in fact, it has). Unfortunately, people will not be able to directly experience the positive effects of their better physique. They cannot willfully alter their physique with the same contingency that they can exercise (which leads to exhaustion). To make things worse, they have to exercise to achieve that, what negatively influences well-being. So to them it is not obvious that exercising is the choice to do. Lacking a natural stimulus that automatically makes them work out, an imbalance can arise.

However, not every form of exercise will remedy this imbalance. There are several requirements that exercise has to fulfill, which the model reveals:

1. That exercise must be able to exert substantial positive influence on the person's physique (and not only move it).
2. A substantial increase in physique of that person must be possible.
3. When looping many cycles, the benefits from improvements in physique must outdo the adverse effects of the training on the well-being.

*It is obvious that not every form of training will fulfill this requirement.* If, for example, you go jog, the wear and tear on your joints might outdo the positive effects on your physique, dependent on your physique. The same happens if you over-train. Also, your exercise must be capable of substantially increasing your physique. Biking might not be able to produce stimuli that are high enough. Super-slow heavy weight training that builds your muscles may be superior to other forms of exercises in a couple of ways:

- It maximizes the effect on your physique
- It minimizes wear and tear on your joints and periods of exhaustion

So it meets the requirements that we have found with this model.

**Example - Invasion and Nutrition.** I want to conclude with one other example that is not limited to the 5-node-model, but will widen the perspective to other causal-loop systems.

Consider weight gain. Eating food has an opposing effect on your optimal weight when you go on eating. So eating food makes you gain weight. From the perspective of weight gain, exercise seems like the way to go, as exercise appears to counteract weight gain. However, widening the perspective, there are some not-so-obvious dynamics.

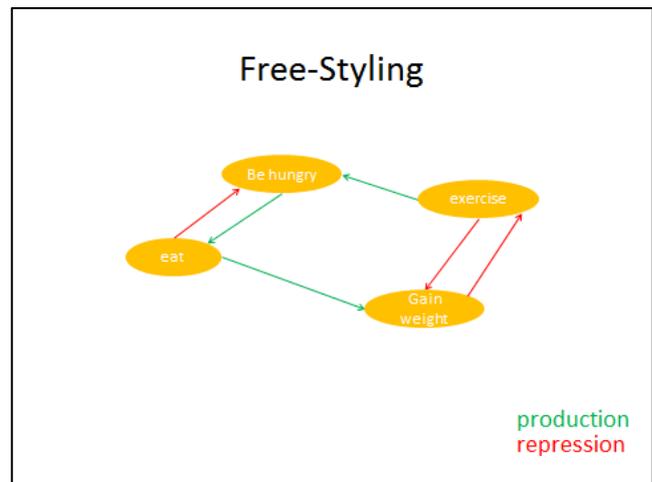


Figure 9 - Free-styling

Consider eating. Eating much makes you gain weight. However, eating also makes you less hungry. Being less hungry makes you eat less, as you usually eat when you're hungry (if things are going well). From this we can deduct that you will only gain weight if you regularly eat food that makes you gain weight faster than it satiates you. If you mostly eat food that satiates you before you gain weight, it simply will not happen. What kind of food meets this demand depends in part on your physiology. But there are scientific cues.

Now consider exercise. Exercise makes you hungry, and that in turn makes you eat. So exercise only counteracts your weight gain if its effect is stronger than the hunger-loop that makes you eat. The balance point again depends on many factors, e.g. physiology, type, time, intensity and duration of exercise, etc. So exercise indirectly invades your weight gain by making you hungry and eat, although, directly observed, it makes you lose weight (water, at least). Additionally, gaining weight makes you less likely to exercise, because it then creates more wear and tear. So if you gain weight, you need to select exercise with as little wear and tear as is possible, i.e. adapt your regimen. What works for one will probably not

work for another one. So exercise may play a major role in the health loop, but it might not be the best remedy to lose weight, unless we can factor other circuits in.

From the perspective of hunger, things are pretty obvious. The only thing that makes you less hungry is to eat things that satiate you. From the point of view of eating, you can observe what satiates you quicker than you gain weight. The problems are: the dynamics are slow, food that tastes good is abundant in western societies, and what tastes good does not necessarily satiate. So, one might want to take a look at science to find a short cut. Studying monkeys, scientists have found that the constant in their daily food intake seems to be the amount of protein consumed. After reaching a fix amount of daily protein intake, they stop to eat. An explanation may be that some proteins are essential, i.e. the body cannot produce them, and that the body has no store for protein. It may be worth a shot.

If you choose to eat food that doesn't satiate you before you put on weight, then your only alternative is to be always hungry. Unless you find a way of exercising that will not make you eat more than you burn. For some people, this may be a difficult task, as exercise creates wear and tear, which increases their protein requirements. So for super-small people who get little wear and tear when exercising, this circuit may work. The more wear and tear you get, the fewer alternatives for training there are. However, if the protein balance in your nutritional mix is wrong to begin with, exercise will only make things worse as it will make you hungry.

### **Conclusion**

When reflecting on his mindscapes, Maruyama contemplates that there are two types of thinking in loops. What he calls S-types, are people who think in loops of interactive, homeostatic models. They tend to be searching for equilibria, thus counteracting change. This

type should find a rich toolbox in the above-discussed 3-node loops and their remedies. What he considers to be G-types are people who think in interactive, morphogenetic networks. The trick lies in abolishing the notion of *good* and *bad* when thinking in production and oppression. Not every imbalance of excess and insufficiency is necessarily wrong, not every deviation from equilibrium needs a remedy. Gauss is not the solution to questions of human evolution. Maintaining equilibria is a fragile thing that organisms have to master. Configurations need to change to progress to the next level. One motivation for change is to seek remedies when equilibria cannot be found in any other way. A system that is in permanent balance does no longer advance. Reverting to the mean does not create progress. One may dwell in a yogic peace of mind. But when transcending the current configuration, integrating new nodes into an existing network, new configurations and contingencies can be found.

Maruyama (2010) sums up, “we still do not know which parts of the mindscapes are inborn and which parts are learned. Therefore, there remains a possibility that some persons cannot think in causal loops.” (p. 610). The 5-node-nodel has been invented more than 2500 years ago. So there is hope – with proper consideration – that contemporary people are able to deal with it.

## References

- Van Nghi, N., Recours-Nguyen, C. (1997). *Traditionelle Chinesische Medizin: Pathogenese und Pathologie der Energetik in der chinesischen Medizin* [Traditional Chinese medicine: Pathogenesis and pathology of energetics in traditional Chinese medicine]. Uelzen, DE: ML Verlag.
- Maruyama, M. (2010). Causal Loops, Interaction, and Creativity. *International Review of Sociology: Revue Internationale de Sociologie*, 13(3), 607-628, doi: 10.1080/0390670032000139557.
- Maturana, H. R., & Varela, F. J. (1992). *The tree of knowledge: The biological roots of human understanding*. Boston, MA: Shambhala.
- Simon, H. A. (1997). *Administrative Behavior: A study of decision-making processes in administrative organizations*. New York, NY: Free Press.
- Weick, K. E. (1995). *Der Prozess des Organisierens* [The social psychology of organizing]. Frankfurt am Main, DE: Suhrkamp.