Entrapping Landmine Structure in Microworlds Formed with Uncontrollable Positive Feedback Loops

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Abstract

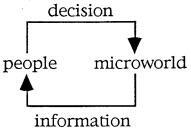
In studying humanbeing's decision-making in microworlds, there are some researches about humanbeing's cognitive issues in decision-making. There are also some interesting issues on the microworld side. When playing microworlds, players might encounter some underlying structures which are very difficult to deal with. Among these structures, there exist what we called "landmine structure"--burried in the microworld there are a certain hidden dangerous structure, nothing happened if not being bothered, but once step on and being triggered will unavoidabbly explode wildly and very difficult to rescue. In this research, we are focused on the issue: why some microworlds have much stronger tendency to induce players almost unavoidably be entrapped into a certain helpless landmine structure than other microworlds? We first classified the feedback loops more delicately according to their variance in the pattern of behaviors so that we can have clearer corresponding relationships between structure and behavior. We then studied two of the most famous microworlds, the Beer Game and People Express Management Flight Simulator, as our samples of research. In the Beer Game, almost all the players will be entrapped into the systemic forces formed by some uncontrollable positive feedback loops and felt very helpless. It seemed that the resulting pattern of behaviors were unavoidable to all humanbeings. When playing People Express Management Flight Simulator, players have some more rooms and chances to avoid the landmine structure. Why they are different? When took the catalogue of the feedback loops to analyze both microworlds, we found that there hid some uncontrollable positive feedback loops. If players unconsciously trigger these loops, the behavior of the system will be dominated by these loops and the decision makers just can not do anything to recover the system. How sensitive this type of landmine structure being triggered mainly depends on the discrepancy or "safety distance" between the current state of the system and a certain critical state. For example, in the Beer Game the initial state of the system is very close to the critical state. If the players can not make the current state of the system far enough away from the critical state of "being entrapped" before the small "jump-up" of the exogenous demand, the landmine structure will be triggered unavoidably. When playing People Express Management Flight Simulator, the initial state of the system is far away from the critical state. Thus, if the players can make some right decisions, the landmine structure may not be triggered. The findings of this research should be very helpful in designing some "surprising effects" into microworlds so that some of the intuitive thoughts of the players can be challenged. Some other implications for management issues will also be discussed in this paper. 597

Introduction

The evolution of S.D.

Policy Lab. → Learning Lab.

human being's decision making in microworld (learning lab.)

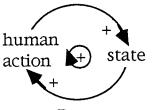


new studying issues

- human cognitive issues
- microworld structure issues

-1-

Uncontrollable positive loops



But

multi-decision makers the control power not in this position rigid mental model

let human action lose control

For example:

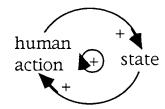
the word of mouth, turnover, panic, debt, escalation, addiction

-3-

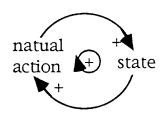
Analysis Tool:

more refine causal loops
The type of positive feedback
loops

Controllable positive loops



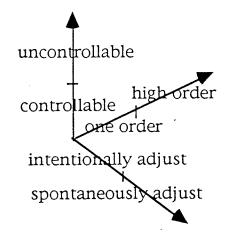
Uncontrollable positive loops



-2-

The type of negative feedback loops

three dimensions



eight catalogs

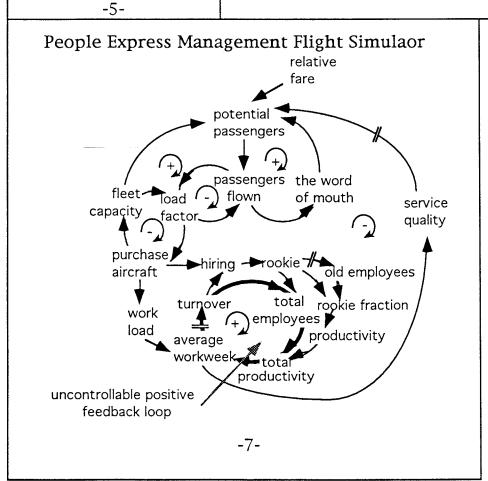
-4-

Landmine Structure
Define: the structure
hid at least one of the
uncontrollable positive
feedback loop which can
make the structure
deteriorate.

Character:

- similar to landmine
- difficulty aware of uncontrollable positive feedback loops
- producing destructive power
- surprising effect, countintuitive
- hepless, hardly rescue
- structure dominate player

Beer Game upstream upstream goal of backlog safe inventory backlog delay downstream / delivery order delay downstream uncontrollable positive panic feedback loop -6-



The difference of two microworld

New concept: safety distance=current statecritical state

critical state: state which landmine structure is just being tirggered

How to measure: "loop by loop simulation algorithm" (Kim, 1995)

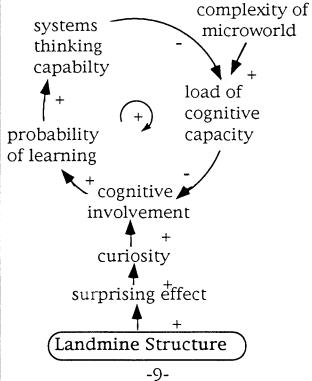
Beer Game:

safety distance short →easily trigger

People Express M.F.S:
safety distance long
→hard trigger
-8-

Application

1. Design microworld



2. Complement S.D.

system problem oriented

Flaw: easily neglect dormant loops during the time frame of the reference mode

How to complement

step1: regular diagonsis focus on landmine find out uncontrollable loop

step2: special issue diagonsis focus on interesting behavior use problem oriented S.D.
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Future Research

What is the forming process What is the entrapping process How to identify

How to deal after exploding before exploding

The nature of landmine structure intensity speech character generic case early warning symptom

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