Entrapping Landmine Structure in Microworlds Formed with Uncontrollable Positive Feedback Loops

Showing H. Young, Associate Professor
Chia Ping Chen, Doctoral Student
Department of Business Management
National Sun Yat-Sen University, Kaohsiung, Taiwan, R.O.C.

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 unavoidably 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.
Introduction
The evolution of S.D.

Policy Lab. → Learning Lab.

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

decision
people microworld

information
new studying issues
- human cognitive issues
- microworld structure issues

-1-

Uncontrollable positive loops

human action + state +

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

human action + state +

Uncontrollable positive loops

natural action + state +

-2-

The type of negative feedback loops

three dimensions

uncontrollable
controllable
intentionally adjust
spontaneously adjust

high order
one order
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
- helpless, hardly rescue
- structure dominate player

People Express Management Flight Simulaor
The difference of two microworlds

New concept:
safety distance = current state - critical state

critical state: state which landmine structure is just being triggered

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

<table>
<thead>
<tr>
<th>2. Complement S.D.</th>
</tr>
</thead>
<tbody>
<tr>
<td>S.D.</td>
</tr>
<tr>
<td>system oriented</td>
</tr>
<tr>
<td>problem oriented</td>
</tr>
</tbody>
</table>

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

How to complement
step 1: regular diagnosis
focus on landmine
find out uncontrollable loop

step 2: special issue diagnosis
focus on interesting behavior
use problem oriented S.D.

---

Application

1. Design microworld

systems thinking capability
+ complexity of microworld
+ load of cognitive capacity
+ probability of learning
+ cognitive involvement
+ curiosity
+ surprising effect

Landmine Structure

---

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

---