TRIZ Forum: Conference Report (22-F)

Personal Report of The Fifth TRIZ Symposium in Japan, 2009

Held by the Japan TRIZ Society, NPO, on Sept. 10-12, 2009, at National Women's Education Center (NWEC), Saitama, Japan

Part F. TRIZ in Education and in Academia

Reviewed by Toru Nakagawa (Osaka Gakuin Univ., Japan), Dec. 20, 2009

[Posted on Dec. 24, 2009]

TRIZ Home Page in Japan

For going back to Japanese pages, press Jap. buttons. Japanese translation of this page is not scheduled.

Editor's Note (Toru Nakagawa, Dec. 20, 2009)

This page is Part E of my Personal Report of Japan TRIZ Symposium 2009. Please see the Parent page for the overall description of the Symposium and the general introduction to the Personal Report. I am thankful to the Authors for their permitting me to quote their slides here for introduction.

Note: (TN, Mar. 11, 2010) Click here for the PDF file of this page of Personal Report.

F1.	Masao Ishihama, Minami Hamada	(Kanagawa Institute of Technology)	Concept Design of a Child-Seat by TRIZ Style Problem Identification	E
F2.	Yutaro Ueda, Hiroki Nabeshima, and Toru Nakagawa	(Osaka Gakuin Univ.)	TRIZ/USIT Case Study: How to Help Recall Passwords	E
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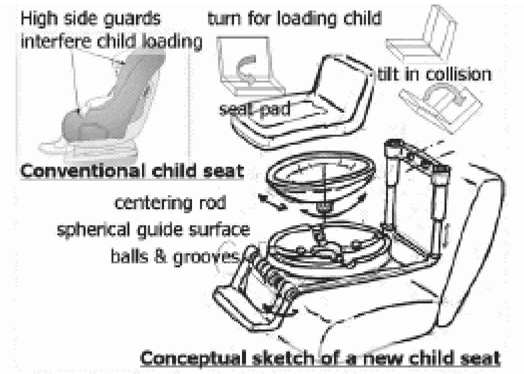
8. Usage of TRIZ in Education and in Academia

Masao Ishihama, Minami Hamada (Kanagawa Institute of Technology) [J28 O-1] gave a nice Oral presentation with the title of **"Concept Design of a Child-Seat by TRIZ Style Problem Identification"**. The Authors' Abstract is quoted here first:

> Child-seats for motor vehicles do not have good reputation in their practical usage in Japanese

> society. In the beginning of this study for improving their design, however, problems to solve were not so clear for the authors to start designing.
> To solve this situation, expected and unexpected functions of child-seats were analyzed using TRIZ method. This analysis identified benefits to be improved as easy loading of a child and ride comfort compatible with collision safety. One of the contradictions was caused by side guards of a child-seat protecting from lateral movement. These side guards interrupt smooth child loading. Second contradiction was between allowing child move and restraining them in collision. Third contradiction was to insulate vehicle vibration and to restrain a child.
> Before proceeding to problem solving stage, resource analysis was conducted. Space surrounding child-seat that is much wider than that around adult passengers was identified as a major resource that has not been properly utilized. Information on CAN (LAN on a car) was picked up as another potential resource.
>
> From these preliminary analyses, several inventive principles and concrete design ideas were drawn. For instance, “segmentation” and “dynamicity” lead to an idea of 90 degree horizontal seat turn. “Spheroidality”, “counter-weight” and “self-service” gave an idea of a swinging motion realized by spherical hollow surface for a seat pad. “Universality” combined these two ideas into one physical design.



On the first day afternoon of the Symposium, this paper was presented by Ms. Minami Hamada, a first year MC graduate student. It was a nice presentation; it obtained the Award by the voting of the participants. In the end of July, after Professor Ishihama made the English translation version, Ms. Hamada further revised the slides in Japanese. Thus the English and Japanese slides in the Proceedings do not match. For writing this Personal Report, I found the Japanese version was much improved. Thus I am now asking the Authors for providing me with new English translation of the revised slides. -- Please wait for a week or two for the introduction of this fine paper.

Yutaro Ueda, Hiroki Nabeshima, and Toru Nakagawa (Osaka Gakuin Univ.) [J22 P-B4] gave a Poster presentation on "TRIZ/USIT Case Study: How to Help Recall Passwords". I will quote the Authors' Abstract first:

> This case study has been achieved by a problem solving exercise with TRIZ/USIT in Nakagawa's Seminar Class of Junior students in Faculty of Informatics of Osaka Gakuin University. Nowadays we often use passwords in computers and social procedures. Some of them were selected by ourselves in relatively simpler forms, but many others were given to us by system sides in randomly-generated lengthy forms. Since there are so many different ones we have to handle, we cannot remember them all. We need some measures which help us recall the appropriate password when required. They should be some auxiliary information ('hints') embodied in some objective form. How, in what form and in what process, should we make the hints? This is the problem of the present study.
>
> We analyzed this problem by using Function Analysis and Attribute Analysis in USIT. If the hints are disclosed and used by a malicious person, we will meet severe danger of the password (s) being broken. Thus the requirements for the hints are to be easy for myself to recall the passwords but extremely difficult for any other person to guess the passwords. In TRIZ terms this is a case of Physical Contradiction which can be separated by the Actor, we understand. Then we used 40 TRIZ Principles (with reference to Mishra's book) to enhance the generation of solution ideas. The desirable solutions, as we understand now, need to be based on several basic principles and use a combination of simple but unique coding (encrypting) methods.

Ueda and Nabeshima are 4th-year undergraduate students of Nakagawa's Seminar Class in Faculty of Informatics of Osaka Gakuin University. Ueda gave this Poster presentation. The way of group practices in the Seminar Class is shown in the slide (below-left). Even though the teacher (i.e., Nakagawa) facilitated the practices, advised from time to time, and brushed up the presentation slides, the students are the main authors of this presentation. The problem 'How to help recall passwords' is defined as shown in the slide (below-right).

Outline of Presentation

- **Nakagawa's Seminar Class: "Creative Thinking for Problem Solving"**
  Small number of students (5 to 1 depending on the year)
- **"How to Help Recall Passwords"**
- **Group practices in the seminar class (2 or 3 students only)**
  - Teacher facilitated the group practice.
  - Students' discussions and remarks were recorded on the white board.
  - The white board records were taken in photos.
- **TRIZ and USIT were used in a flexible manner.**
  - **USIT led the solution procedure:**
    Problem definition, Analysis of the present system (Function & Attribute analysis), Image of the Ideal system, Idea generation,
  - **TRIZ helped the idea generation:**
    Physical Contradiction, Idea generation with 40 Inventive Principles
  - **A system of solutions is built up with TRIZ and USIT**

Problem Definition: "How to Help Recall Passwords"

(1) ID/PWs may be decided for ourselves in some cases,
while they are given by the system in some other cases.

(2) When we may decide, how should we decide the PWs?
How can we help ourselves recall them?

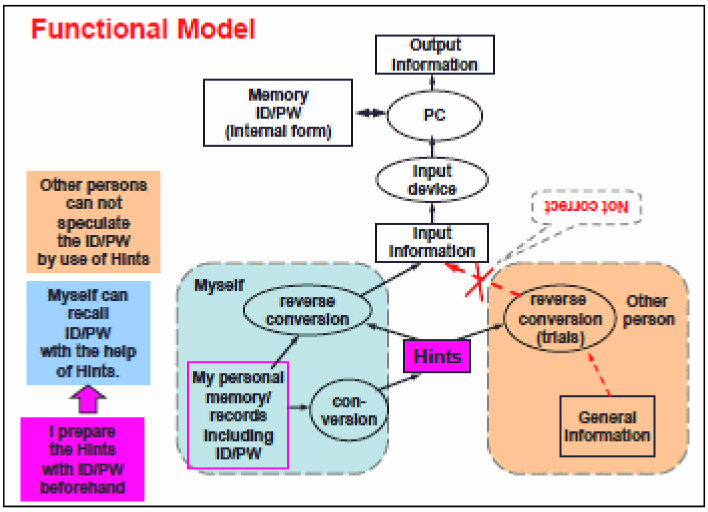
(3) When the PWs were given to us (often in complex forms),
how can we help ourselves recall them?

(4) Even if the Hints are stolen, they must not tell the PWs to others.
How should we make the Hints and manage them safely?

(5) The media of the Hints are sheets of paper, primarily.
Methods of storing them in PCs/cell phones will be considered later.

(6) If one cannot recall the PW by any means, a new PW will be issued.
The process of PW re-issuing is already established.
-- It's outside of our problem.

The Functional Model of the problem situation was built as shown in the slide (below-left) and was used throughout the work as a reference model. Since we cannot remember so many (different and complex) passwords by heart, we need some 'Hints'. But there is always a risk of the Hints being read by others, especially malicious people. Thus, the focus goes on to the Attribute Analysis (in slide below-right) to consider 'What kind of properties should have the Passwords and Hints?'. The Authors found the attributes as information (or symbols) are more important than those as a concrete medium (or objects).



Attribute Analysis

What kind of properties should have the PWs and Hints?

Attributes of PWs and Hints:

(a) Attributes of PW/Hints, as a concrete medium

Recorded medium, way of recording, way of carrying, etc.

⇨ (Mostly) related to the degrees of risks of passing to or being read by other persons

(b) Attributes of PW/Hints, as information (or signals)

Number of characters, character set, regularity, meaning, etc.

⇨ (Mostly) related to the degrees of risks of being the PW speculated by other persons after having been passed to or read by them.

How easy to recall/speculate the original PW by use of the Hints?

==> The most critical issue of the present problem

The following slide (below-left) tabulated various attributes of Password/Hints as the information. Easiness to understand is noted in 3 different phases, i.e. for myself to remember the PW, for myself to recall PW with the Hint, and for some other (malicious) person to speculate the PW with the Hints. The table continues to the next slide (omitted in this review), which considers the properties as word, meaning, relation with other PWs, and hierarchy of PWs. Thus making the Hints easy to understand or difficult to understand is not a solution either. The requirements of this problem is to make easy to understand for myself and at the same time difficult to understand for others (slide below-right). Thus the problem is clearly stated as a Physical Contradiction which need to be separated between myself and others, i.e. by the Subject of the action. (This type of Physical Contradiction is not so familiar in technological fields, but may often appear in human-related areas.)

Various Attributes of PW/Hints, as the information (or signals)

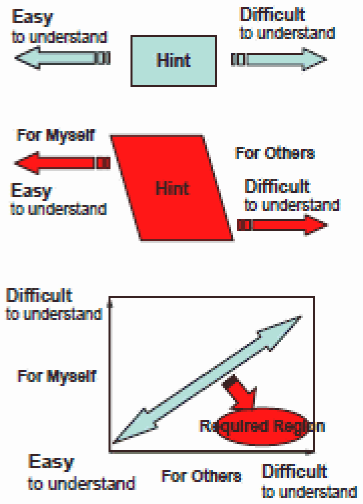
	"Easy to Understand"	"Difficult to Understand"
Easiness of under-standing the PW	Easy to remember the PW, Easy to recall PWs with the Hints, Easy to speculate PWs with the Hints	Difficult to remember the PW, Difficult to recall PWs with the Hints, Difficult to speculate PWs with the Hints
Simplicity	Simple	Complex
number of digits/ characters	4 up to 7±2	8 16 (credit card number) 24 (software key number)
character set	numbers (10 characters) English alphabets (26 characters) alpha-numerical (36)	alphanumerical + special symbols (46) alphanumerical + upper case letters (62 characters)
regularity	Some regularity involved: e.g. 1111..., 123..., ...321, 121212..., abcdef..., abcd 1234 efgh 5678	Without apparent regularity: (remove any regularity) Irregular in the order, mixed randomly, at random by using random numbers

Making the hints
Easy to understand or
Difficult to understand
is not a solution either.

The requirement of this problem is: ==>

This is a case of
Physical Contradiction
in the TRIZ terms.

The contradiction
need to be solved with
the Separation by
the Subject of the Action.



On the basis of these analysis, the Authors generated solution ideas by using the 40 Inventive Principles (with reference to Umakant Mishra's draft book Engl). Many concrete ideas thus obtained were reorganized to form a system of solution principles as shown in the slide (below-left). The solution principle (1) is to handle the two types of PWs (i.e., PW chosen by myself and PW given to me independent of my preference) differently (slide below-right).

On the basis of these analysis, we tried to generate solution ideas by using the 40 Inventive Principles in TRIZ. Then, we reorganized them to obtain the following solution principles:

Principal Solution Directions:

(1) Handle the PWs we set ourselves separately/differently from those given to us, concerning to how to make and carry the hints.

(2) Insert dummy information intently and frequently in the Hints.

(3) Make a unique, non-universal, non-uniform conversion method and use it for generating the Hints.

(4) Apply relatively simple unique conversion methods in two steps for making the Hints from the PWs.

(5) Keep the information for the reverse-conversion method separately in a secret way.

(6) Use these solution directions together in combination.

(1) Handle the PWs we set ourselves separately/differently from those given to us.

PWs we set ourselves	PWs given to us
How to make the PW itself is the main issue in this case. Choose the PW easy to remember for myself, but difficult to speculate for others. PWs can be remembered by heart, in most cases. --> Hints should be much simplified, mostly with the association in meaning.	PW is given by the system independent of our preference Often randomized, complex. No relation among the characters. Impossible to remember these PWs. Necessary to reproduce all the characters individually. --> Cannot omit the PW information in the Hints. No use of meaning association.

The solution principles (2) and (3) are shown in the following two slides (below). Those of (4)(5)(6) are skipped in this review for the sake of space.

(2) Insert dummy information intently and frequently in the Hints.

PWs we set ourselves	PWs given to us
For myself: Hints may be short and simple. Insert short Hints into abundant dummy information. For others: Difficult / impossible to distinguish the Hints from dummy information.	Comparison with PW information: , ・Hints with reduced information: → Not enough to recall the PW for myself. No good. ・Hints with corresponding information: → Easy to understand for myself and easy to speculate PWs for others. No good. ・**Hints with extra information:** **→ Removing dummy is easy for myself, but difficult for others.** **→ Good policy.**

(3) Make a unique, non-universal, non-uniform conversion method and use it for generating the Hints.

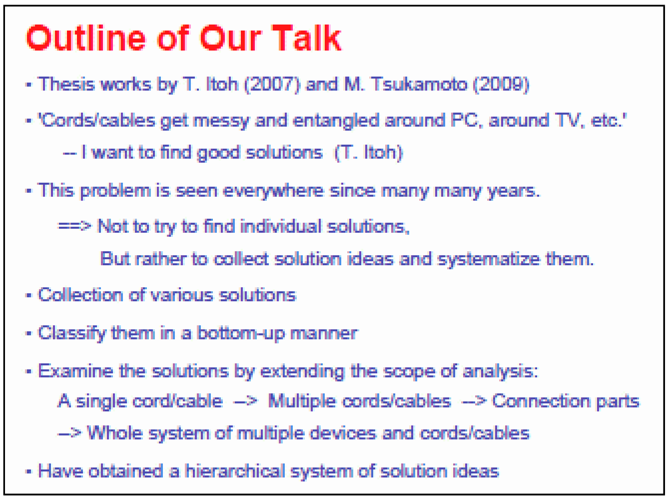
PWs we set ourselves	PWs given to us
In setting the PW, do not use ordinary (universal) words, nor regular (uniform) patterns. Create a new (unique) word. Generate PWs randomly, and select one easy to remember with some association. Generate the Hints by use of association (conversion) of meaning. Not ordinary (universal) association, but case-by -case (non-uniform) association for each PW.	Conversion from PW to Hints is the principal issue in this type of PWs. Ordinary (universal) conversion makes the reverse conversion (Hints -> PW) easy, thud dangerous. Applying conversion partially makes non-uniform (localized) conversion. (Inserting dummy gives non-uniform effects.) Non-universal and non-uniform conversion makes a unique one. Thus, difficult for others to speculate PW.

*** This work was started in October 2008 with the stimulation by the former Password Working Group of MPUF USIT/TRIZ Study Group, but was carried out independently. The processes of problem definition, functional and attribute analysis, solution generation and solution generalization are well guided by USIT (even though not in its formal way). I am going to post the full set of presentation slides of this work in due course in this Web site.

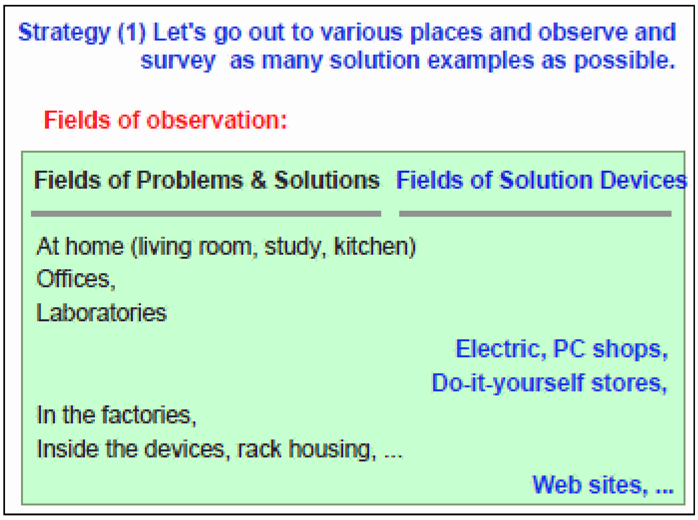
Toru Nakagawa, Tomoyuki Itoh, and Masanobu Tsukamoto (Osaka Gakuin Univ.) [J09 O-16] gave an Oral presentation with the title of "How to Prevent Cords and Cables from Getting Entangled: A Study of Systematic Classification of Various Solutions". I will quote the Abstract first:

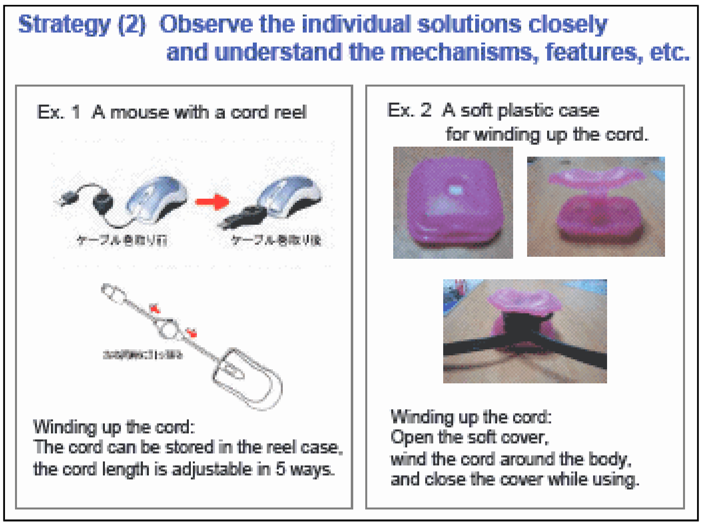
> Cords and cables often cause troubles by getting complex and entangled, around appliances at home, around PCs at offices, around equipments in labs, etc. The present study started to think of methods of preventing cords and cables from getting entangled. Since the problem lasts so long and spreads so widely, there must be a lot of different solutions known and used in the world, we thought. Thus we first searched for various methods, tools, devices, equipments, etc. which are used for such a purpose, at home, at offices, at hardware stores, at PC shops, etc. Then we classified all these cases, in a bottom-up manner, into a hierarchical system of methods expressed in the functional terms.
>
> Then we reorganized the system of solutions by introducing step-wise expanding scopes of the target system. A system of solutions has been found, namely: (A) As for a cord or cable, to adjust its length so as not to get entangled. (B) As for multiple cords or cables, to bundle them, to combine and unite them. (C) As for the connecting parts between devices and cords/cables, to standardize them for easy connection and disconnection and to use simple connection modules. (D) As for the system containing devices and cords and cables, to reorganize the devices in their functions, structures, methods, and arrangements, and to set and store cords and cables in appropriate places. Significance of this sort of study of classifying solutions is discussed.

This work was started in Nakagawa's Seminar Class by Tomoyuki Itoh for his thesis of graduation of Faculty of Informatics. The process of the work is summarized in the slide (right). Itoh posed the problem of messy and entangled cords/cables around PCs, around TVs, etc. and wanted to find some good preventive solutions. The problem is very common and familiar all around us, and there are various kinds of products for possible (but partial) solutions. Thus, instead of trying to find new specific solutions, we thought it more fruitful to collect many known solutions and to find a system of such preventive solutions.

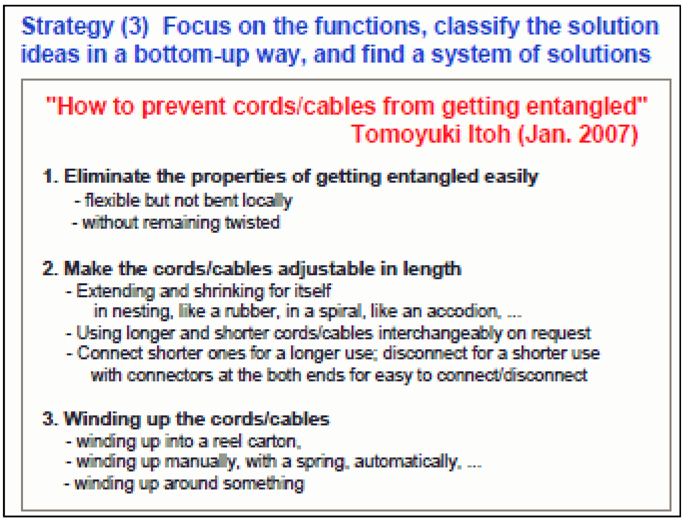


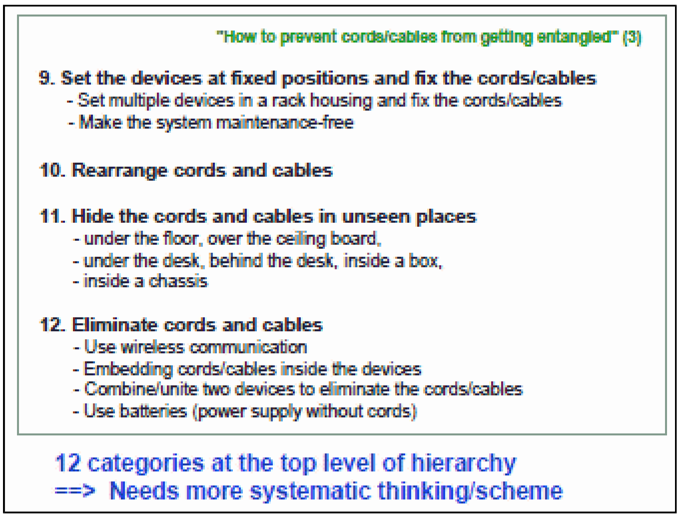
The following two slides (below) illustrate our basic strategies in the initial stage. First, we went out to various places (see slide below-left) to observe and survey as many solution examples as possible. Then, secondly, we observed the individual solutions closely to understand their mechanisms, features, limitations, etc. Observing the solutions closely is the basis of our understanding the essence of them and classifying them properly.





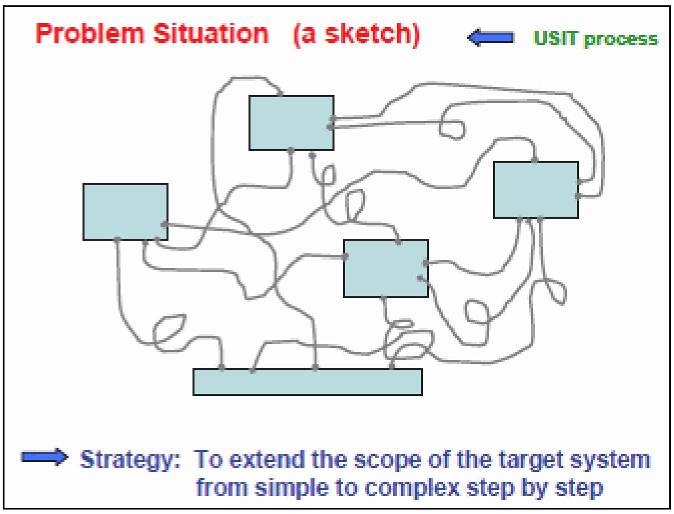
Then, thirdly, we tried to classify the solution ideas in a bottom-up manner using their functions as the keys. The following two slides (below) show the results obtained by Itoh (2007). We obtained 12 categories at the top level of hierarchy of solution ideas (note: A slide showing Categories 4 to 8 is skipped in this review for the sake of the space). The system of solution ideas thus obtained, however, was somewhat not convincing. We were not sure whether the 12 top level categories cover the whole space of possible solutions and whether the arrangement of the 12 categories is logically systematic.



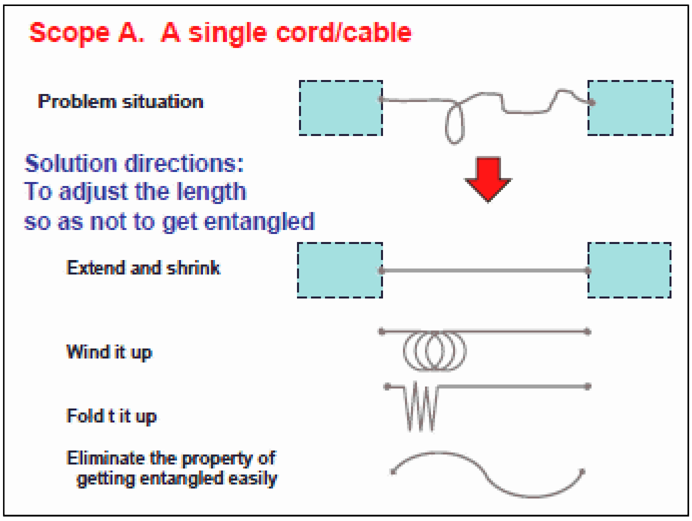


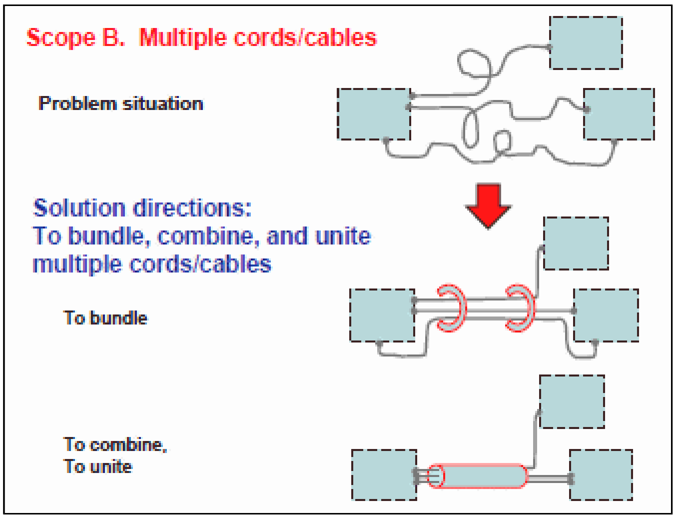
Thus in July 2009, I restarted this work by using the USIT procedure more explicitly. (At this stage, Itoh and Tsukamoto already left the university.) USIT requests us to define the problem in a well-defined form by answering: 'What is the unwanted effect?', 'What is your task?', 'What are the plausible root causes?', 'Draw a sketch of the problem situation', and 'What are the minimal set of relevant objects?'.

The slide (right) shows a sketch of the problem situation. There are a number of devices and many cords/cables laid in a complex and entangled manner. The cords/cables are usually connected to the devices with some connecting parts (i.e., connectors). [*** This kind of schematic sketch is more suggestive than photos, I realized.]

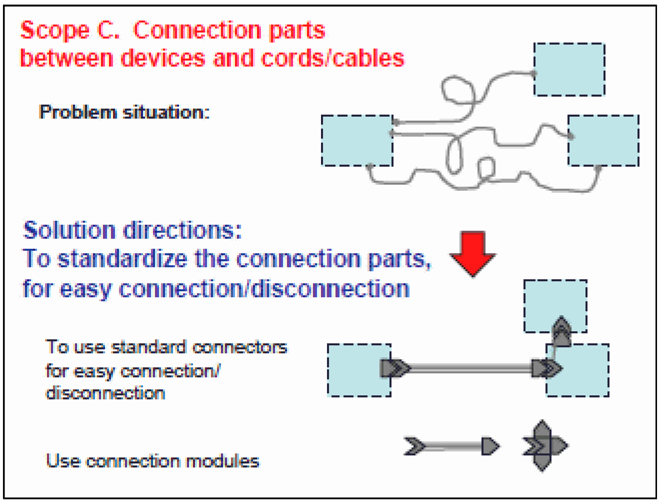


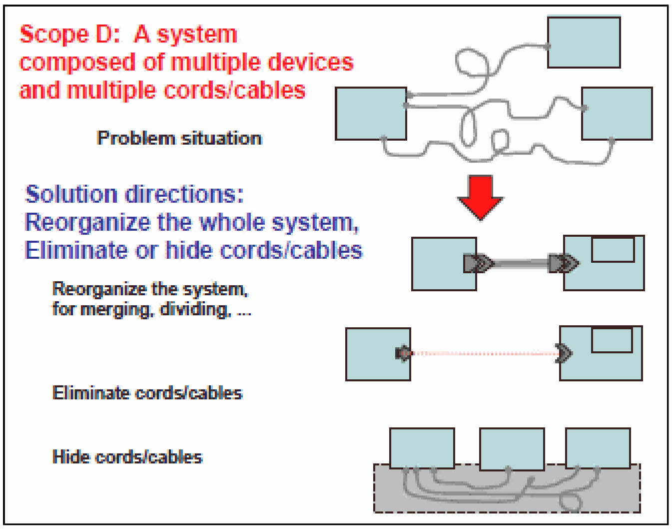
The USIT question 'what are the minimal set of relevant objects?' inspired me a new strategy of handling the present problem. Namely, to extend the scope of the target system from simple to complex step by step. The new strategy guided me first to the smallest scope, i.e., Scope A: A single cord/cable (slide below-left). The sketch of problem situation in this slide shows a cord/cable, which connects two devices by use of some connectors. We should note that we focus only on the cord/cable and neglect the devices and connectors in this Scope A. On the basis of the previous collection of solution ideas, the solutions applicable to this scope of problem are easily selected as shown in the slide (below-left). Extending and shrinking the cord/cable is not so easy, and hence winding up or folding up the extraneous length of cord/cable are the solution direction often used. Next level of scope is Scope B: Multiple cords/cables, where devices and connectors are still neglected. The solution directions in this scope is to bundle the multiple cords/cables at one or more positions, to combine them for some distance, and further to unite them from the start (i.e., use united cords/cables).



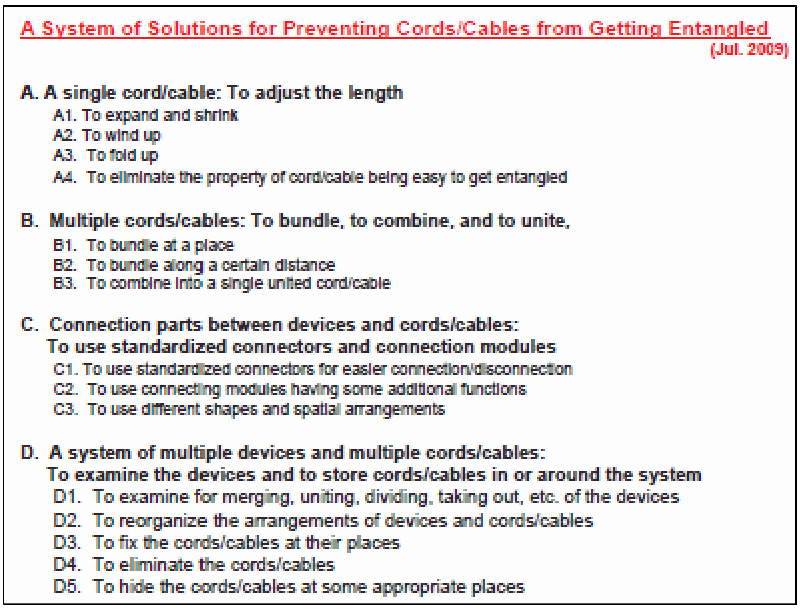


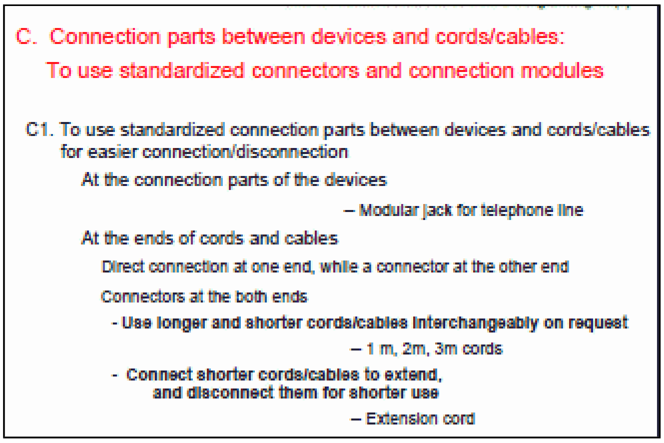
Then Scope C puts focus on the connection parts between devices and cords/cables (slide below-left). Using standardized connectors for easy connection/disconnection is certainly the solution direction. Connection modules having various shapes and additional functions also appear as useful solutions in this scope. Finally in Scope D, we handle the whole system composed of multiple devices and multiple cords/cables (slide below-right). In this scope, reorganizing the devices themselves (before considering about the entangled cords/cables) is the most important solution direction. Merging, uniting, dividing, taking out, eliminating, etc. of devices need to be considered. Rearranging the positions of devices and of cords/cables (together with various solution directions in the smaller scopes A, B, C) is certainly useful. Fixing the cords/cables at their (proper/appropriate) positions is often used. Eliminating cords/cables is a drastic solution direction, which can be applicable by use of wireless technologies, batteries, etc. Hiding cords/cables at some appropriate places inside devices, on some devices, around the system, in the environment (e.g. under the free-access floor) is also very common and useful.



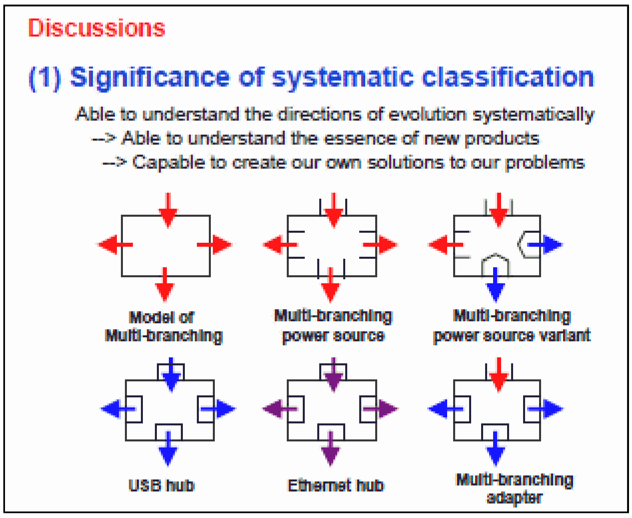


In this manner, a system of solutions to this problem was finally obtained as shown in the slide (below-left). The slide (below-right) shows the portion of C1 for demonstrating its detail.



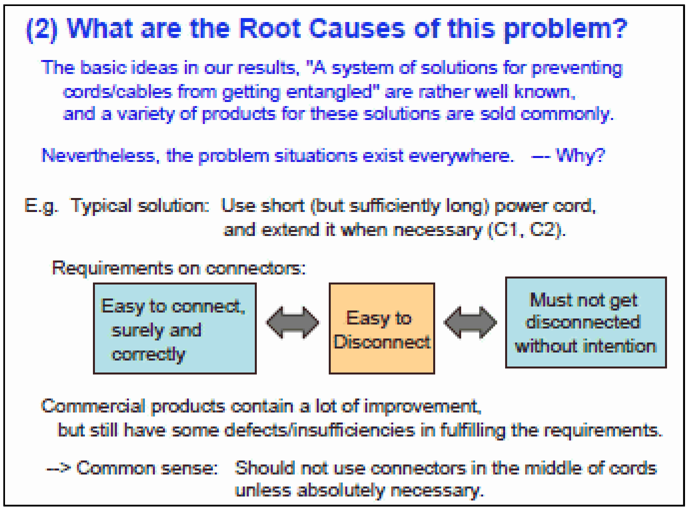


In the slide (right), the significance of this kind of systematic classification is discussed. The problem is common and widely spread and hence there are so many different solutions to it in the forms of solution concepts, knowhows, devices, processes, etc. The solution space was initially vague and chaotic. Systematic classification of collected known solutions make the solution space structured and clear to some extent. This makes us capable to understand the directions of evolution, and to understand the essence of new and possible future products. For example, the slide (right) shows a model of multi-branching as a form of connecting modules (Solution class C2). Once we know such a model, we can find many different devices as examples of implementing the model, and will be able to think of more novel implementation examples.



The slide (right) reconsiders the root causes of this problem. As you see so far, the basic solution concepts obtained in our system of solutions are rather well known and a variety of products are sold commonly. Nevertheless, the problem situations exist everywhere. We should think of the root causes more deeply.

A typical solution is to use a shorter power cord and to extend it when necessary (C1 and C2). This implies the usage of standardized connectors. However the requirements on connectors contain two basic contradictions: namely 'Easy to connect' vs 'Easy to disconnect', and 'Easy to disconnect' vs 'Must not get disconnected without intention'. Looking at various connector products, we can find a lot of improving ideas, but can still find various defects/insufficiencies in fulfill the requirements. [*** This implies a rich source of work to be done.]



The slide (right) discusses further about the typical length (2 - 3 m) of power cords. In most cases, ordinary use requires 1 - 2 m, leaving 1 - 2 as slack (or extra length), which is the main cause of entangling. Even though knowing this fact, however, we need the slack in various cases, as shown in the slide (right). If we use a shorter cord usually, we sometimes need an extension cord. But we can not have a guarantee that an extension cord is available. Thus, people commonly choose to use the cords longer than the usually-sufficient length, for the consideration of future possibility of needs. Such choices result in the extraneous length of cords, which provide the root causes of the present problem.

> Power cords of most devices are 2 - 3 m long. (in sales)
> In most cases, ordinary use requires 1- 2 m of power cords.
> ==> Thus, 1 - 2 m of power cords are slack (extra length).
> ==> This causes the cords get entangled.
>
> "We need the slack": when we give the device maintenance,
> when we rearrange the devices,
> when the power source is far than usual,
> when we use it at other places,
> when we think of different situations of many customers, ...
>
> If we use a shorter cord usually, we sometimes need an extension cord.
> But we can not have a guarantee that an extension cord is available.
>
> After all, people have chosen to use the cords/cables longer than the usually-sufficient length, for the consideration of future possibility of needs. Such choices result in the extraneous lengths, which provide the root causes of many cords/cables getting entangled everywhere.

*** I suppose that there are a wide variety of solution concepts and solution devices concerning to this cord/cable entangling problem and that many engineers (and ordinary people) are involved and have experiences of solving the problem either beforehand during the designing or afterward under messy problematic situations. The present work started as a thesis work by an undergraduate student and has become a nice case study of building up a hierarchically classified system of solution concepts for the vague and open-ended problem. There should be much more professional compilations of solution concepts and solution devices, etc. [I have not made surveys of references of this problem. If there are any systematic approaches to this problem, please let me know and please excuse me for not referring to them.]

*** This work has been presented also at ETRIA "TRIZ Future 2009" Conference held at Timisoara, Romania, on Nov. 4-6, 2009. This work is already posted in this Web site "TRIZ Home Page in Japan" both in English Engl. and in Japanese Jap., containing a full set of presentation slides and a full paper.]

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