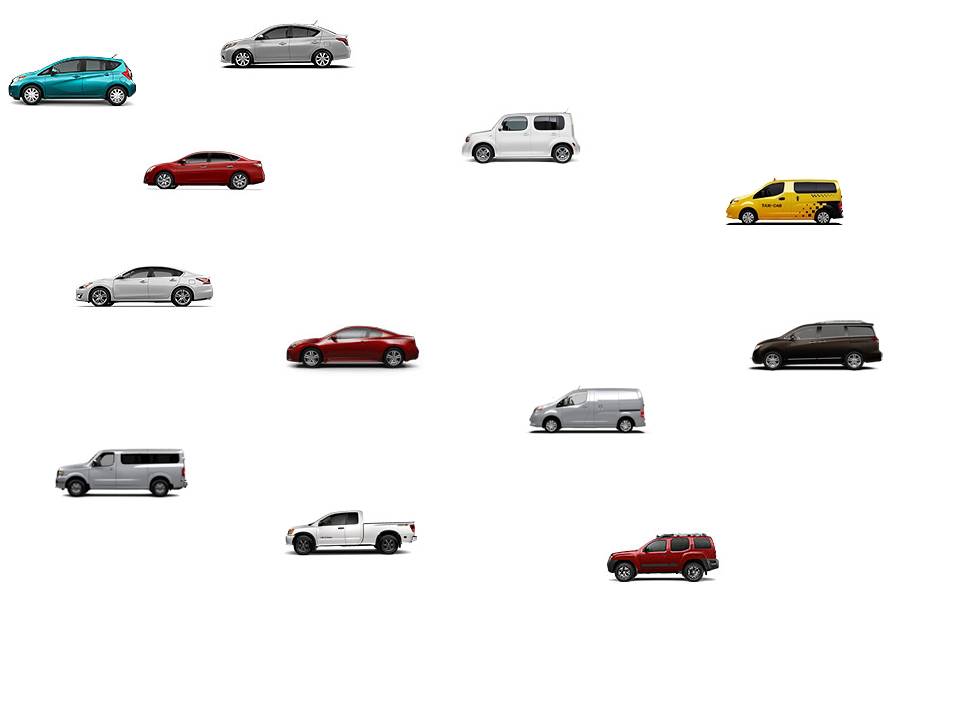
**Chapter 2 – Algorithmic Approach to Building Research Strategies**

**Introduction**

In many areas of modern life, selection of products is based on developing an array of possibilities, considering a number of different measures representing attributes of the products, and developing criteria using those measures. The result is the development of decision-rules leading to a decision. As an example, Figure 1 shows a sampling of the cars produced by a single manufacturer. These cars are presented hoping that the focus of decision will be appearance and price. However, other measures are possible. One such might be the major intended use. If that involved short trips, the seats and attributes of comfort might not be important. If long distance travel was intended, characteristics of the seats would be a priority. Economy of operation could be another consideration.

**Figure 1. Selecting a Car.**

While a large number of measures are possible depending on the objectives to be realized in using the car, typically, individuals will develop favorite sets of measures, criteria, and decision-rules as they construct the desired car (called synthesis), compare various constructions, evaluate the measures and criteria for each construction, develop a decision (called judgment), and buy the chosen car (called application). This use of the cognitive functions often is done almost subconsciously and the performance of each of the cognitive functions merged so that the individual functions appear to be one task.

**Algorithmic Approach:** This chapter considers the possibility that the cognitive functions can be kept separate and that measures, criteria, and decision-rules can be formally developed to facilitate effective use of information of any type. The analysis shows what might be called an algorithmic approach to critical and creative thinking. Critical thinking might be defined as a process leading to selection of an effective solution to a problem. Creative thinking might be defined as a process leading to effective understanding of a situation with expansion of the body of knowledge involved. Making these processes transparent and formalizing the procedures facilitates transfer from the inventor to third parties.

These objectives are dependent on the information processing tools used. Traditionally, paper-oriented procedures were used. This process, with its permanence of storage, slows the tasks of managing information and forces the individual to perform major amounts of the organization and utilization internally. As a result, decisions appear to be mystical with little conscious awareness of the steps in information processing actually performed.

With the advent of computing, many of these personal functions (i.e., sorting, copying, etc.) could be accomplished using specific algorithms. The result was that separation of the information management tasks could be realized. The challenge changed from developing a single solution to constructing an effective information processing system. With that in place, previously unknown information could be more rapidly and easily transformed into concepts, issues, and topics. Concepts are organizations of ideas. Issues are organization of concepts. Topics are organization of issues. The emphasis could be changed to dealing with a constellation of possible solutions and developing measures, criteria, and decision-rules accordingly. This process could be considered to be an algorithmic approach to accomplishing the acts of critical and creative thinking.

The essential ingredients making this algorithmic approach feasible are:

1. The idea database providing access to a subset of ideas.
2. Tools designed to process ideas.
3. Transparency based on measures, criteria, and decision-rules.

**Measures to Represent Importance:** Traditionally, declarations of importance of ideas came from individuals possessing considerable experience and knowledge of the subject. The determination of importance involved identifying these authorities and letting them be the guide. This use of subject specialist expertise also is employed in the determination of importance in the idea analysis approach. The difference is reliance on a consensus of author-specialists rather than on a single expert.

Consensus involves different measures. One is the **frequency of use** of a specific idea by the world’s authors. A second is the **consistency of use** across different situations by the authors. A third is the **specificity of use** and the fourth is the **dimension used.** Specificity of use is determined by the number of times the authors linked a particular related term to a common primary. Larger values suggest more specific meaning of the idea while smaller values imply more general or less specific meaning.

The classification of ideas into dimensions or categories making up segments of the topic is helpful in organizing the ideas into concepts and issues. While ideas may be included in different dimensions depending on the authors’ intentions, these ideas tend to have a commonly used or frequent classification. Those general categories are:

1. Personal factors – describing attributes of the individuals studied.
2. Environmental factors – describing attributes of the physical, social, and cultural setting of the study individuals.
3. Subject factors – describing measures and procedures making up the subject matter representing the discipline.
4. Intervention factors – describing actions and procedures used to alter existing relationships.
5. Outcome factors – describing measures of the change in relationships as a result of the interventions.
6. Methods – describing procedures used in studying ideas used in the other dimensions.

These primary classifications are arbitrary and authors can change the dimensions depending on how they use the related term in the idea.

**Building a Research Strategy**

What if building research strategies could be performed using a process comparable to that involved in building cars or comparing refrigerators? That is, what if topics were less important than the procedures used in working with them? This section explores the possibility that effective analysis must begin with information processing tools and these must be applied to the particular text.

To illustrate, consider ideas from the disaster-related literature. Begin with ideas involving disaster. From the disaster vocabulary, select terms representing the different dimensions in the research template. Populate the template with those terms. These terms were used to populate the research template shown in Figure 2. These terms and relationships can be used to develop statements describing the links shown in the template. For example, statements might be:

***Children and patients are two at risk groups in the population. What steps in the earthquake preparedness plan provide for favorable response and reduction of stress in these groups? Are these steps based on data from research studies?***

**Figure 2. Research Template With Disaster Related Terms Inserted**

**Preparedness Management**

**Intervention Outcome**

**Personal Subject**

**Child Patient** **Earthquake** **Provide** **Response Stress**

**Environment**

**Population**

**Methods**

**Plan Research**

These terms, relationships and resulting statements are based on ideas involving the central term – disaster. They represent a limited perspective based on that idea structure. For example, the groups in the personal factors dimension were each linked with the term – disaster. As such, given the relationships, these groups could be considered to be at risk because of the particular status. New research designs could elect to include samples from these groups in order to develop more effective protective programs.

A more expanded description of the concepts and related issues could be accomplished by adding the ideas involving the central term – earthquake.

**Table 1. Expanded Research Design Template Combining Disaster and Earthquake Related Ideas.**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Personal** | **Environment** | **Subject** | **Intervention** | **Outcome** | **Methods** |
| Adolescent | Electricity | Disaster | Coping | Contamination | Assess |
| Child | Housing | Earthquake | Evacuation | Damage | Interview |
| Patient | Landslide |  | Management | Depression | Plan |
|  | Population |  | Mitigation | Drowning | Questionnaire |
|  | Sewage |  | Nutrition | Infect | Research |
|  |  |  | Preparedness | Injuries | Simulation |
|  |  |  | Provide | Response | Survey |
|  |  |  | Rehabilitation | Stress |  |
|  |  |  | Rescue | Violence |  |

The terms linked with either disaster or earthquake were arranged within dimensions and are shown in Table 1. An additional risk group was identified – adolescents. Interventions were expanded but dealt with the immediate and aftermath of dealing with an earthquake. The environmental factors were expanded to include breakdowns in conditions following the earthquake. One possible exception was housing. It could be linked with earthquake in describing prevention of damage and injury or as a condition following the natural event.

There were four references dealing with earthquake and housing in the 2010-2013 literature. Exhibit 1 shows these sources and involved sentences. In each publication, the emphasis was on some condition involving temporary housing following an earthquake.

**Exhibit 1. How Authors used the Idea – Housing and Earthquake.**

**Source:** [**El-Anwar O**](http://www.ncbi.nlm.nih.gov/pubmed?term=El-Anwar%20O%5BAuthor%5D&cauthor=true&cauthor_uid=20345460)**,** [**El-Rayes K**](http://www.ncbi.nlm.nih.gov/pubmed?term=El-Rayes%20K%5BAuthor%5D&cauthor=true&cauthor_uid=20345460)**,** [**Elnashai A**](http://www.ncbi.nlm.nih.gov/pubmed?term=Elnashai%20A%5BAuthor%5D&cauthor=true&cauthor_uid=20345460)**. Minimization of socioeconomic disruption for displaced populations following disasters.** [**Disasters.**](http://www.ncbi.nlm.nih.gov/pubmed/?term=20345460) **201**0 Jul;34(3):865-83. doi: 10.1111/j.1467-7717.2010.01173.x. Epub 2010 Mar 23.

**Sentence 1: *In the aftermath of catastrophic natural disasters such as hurricanes, tsunamis and earthquakes, emergency management agencies come under intense pressure to provide temporary housing to address the large-scale displacement of the vulnerable population.***

**Source:** [**Chang Y**](http://www.ncbi.nlm.nih.gov/pubmed?term=Chang%20Y%5BAuthor%5D&cauthor=true&cauthor_uid=21913934)**,** [**Wilkinson S**](http://www.ncbi.nlm.nih.gov/pubmed?term=Wilkinson%20S%5BAuthor%5D&cauthor=true&cauthor_uid=21913934)**,** [**Brunsdon D**](http://www.ncbi.nlm.nih.gov/pubmed?term=Brunsdon%20D%5BAuthor%5D&cauthor=true&cauthor_uid=21913934)**,** [**Seville E**](http://www.ncbi.nlm.nih.gov/pubmed?term=Seville%20E%5BAuthor%5D&cauthor=true&cauthor_uid=21913934)**,** [**Potangaroa R**](http://www.ncbi.nlm.nih.gov/pubmed?term=Potangaroa%20R%5BAuthor%5D&cauthor=true&cauthor_uid=21913934)**. An integrated approach: managing resources for post-disaster reconstruction.** [**Disasters.**](http://www.ncbi.nlm.nih.gov/pubmed/?term=21913934) **2011 Oct;35(4):739-65. doi: 10.1111/j.1467-7717.2010.01240.x.**

**Sentence 2: *Following the earthquake in Wenchuan, China, in May 2008, housing reconstruction was not immune to resource shortages and price inflation.***

**Source:** [**Saito K**](http://www.ncbi.nlm.nih.gov/pubmed?term=Saito%20K%5BAuthor%5D&cauthor=true&cauthor_uid=22623222)**,** [**Aoki H**](http://www.ncbi.nlm.nih.gov/pubmed?term=Aoki%20H%5BAuthor%5D&cauthor=true&cauthor_uid=22623222)**,** [**Fujiwara N**](http://www.ncbi.nlm.nih.gov/pubmed?term=Fujiwara%20N%5BAuthor%5D&cauthor=true&cauthor_uid=22623222)**,** [**Goto M**](http://www.ncbi.nlm.nih.gov/pubmed?term=Goto%20M%5BAuthor%5D&cauthor=true&cauthor_uid=22623222)**,** [**Tomiyama C**](http://www.ncbi.nlm.nih.gov/pubmed?term=Tomiyama%20C%5BAuthor%5D&cauthor=true&cauthor_uid=22623222)**,** [**Iwasa Y**](http://www.ncbi.nlm.nih.gov/pubmed?term=Iwasa%20Y%5BAuthor%5D&cauthor=true&cauthor_uid=22623222)**. Association of urinary 8-OHdG with lifestyle and body composition in elderly natural disaster victims living in emergency temporary housing.** [**Environ Health Prev Med.**](http://www.ncbi.nlm.nih.gov/pubmed/?term=22623222) **2013 Jan;18(1):72-7. doi: 10.1007/s12199-012-0284-8. Epub 2012 May 24.**

**Sentence 1: *Residents who lost land and houses due to disasterous heavy rainfall-related events on July 13, 2004 and the Chuetsu Earthquake on October 23, 2004 were moved to emergency temporary housing.***

**Source:** [**Zubizarreta JR**](http://www.ncbi.nlm.nih.gov/pubmed?term=Zubizarreta%20JR%5BAuthor%5D&cauthor=true&cauthor_uid=23222557)**,** [**Cerdá M**](http://www.ncbi.nlm.nih.gov/pubmed?term=Cerd%C3%A1%20M%5BAuthor%5D&cauthor=true&cauthor_uid=23222557)**,** [**Rosenbaum PR**](http://www.ncbi.nlm.nih.gov/pubmed?term=Rosenbaum%20PR%5BAuthor%5D&cauthor=true&cauthor_uid=23222557)**. Effect of the 2010 Chilean earthquake on posttraumatic stress: reducing sensitivity to unmeasured bias through study design.** [**Epidemiology.**](http://www.ncbi.nlm.nih.gov/pubmed/?term=23222557) **2013 Jan;24(1):79-87. doi: 10.1097/EDE.0b013e318277367e.**

**Sentence 9: *In particular, we use new and recent methods for multivariate matching to control 46 covariates that describe demographic variables, housing quality, wealth, health, and health insurance before the earthquake.***

**Revised Research Strategy**

Three at risk groups have been identified – adolescents, children, and patients – when considering links with disasters and/or earthquakes. The damages to the environment include contamination with infectious agents, failures in delivery of electricity, flawed housing, landslides, and sewage removal disruptions. Interventions have been focused on actions such as evacuation, mitigation, rehabilitation, and rescue. Outcomes studied have focused on existence of depression, injury, stress, and violence control. The study methods included interview, questionnaire, survey and simulation.

**Exhibit 2. Abstracts Involving Housing Intervention – 1990-2009.**

**Source:** [**Johnson C**](http://www.ncbi.nlm.nih.gov/pubmed?term=Johnson%20C%5BAuthor%5D&cauthor=true&cauthor_uid=18028163)**. Strategic planning for post-disaster temporary housing.** [**Disasters.**](http://www.ncbi.nlm.nih.gov/pubmed/?term=18028163) **2007 Dec;31(4):435-58. PMID: 18028163**

**Abstract: Temporary housing programmes suffer from excessively high cost, late delivery, poor location, improper unit designs and other inherent issues. These issues can be attributed in part to a prevalence of ad hoc tactical planning, rather than pre-disaster strategic planning, for reconstruction undertaken by governments and non-governmental organisations (NGOs) in the chaotic post-disaster environment. An analysis of the process and outcomes from six case studies of temporary housing programmes after disasters in Turkey and Colombia in 1999, Japan in 1995, Greece in 1986, Mexico in 1985, and Italy in 1976 yields information about the extent to which strategic planning is employed in temporary housing programmes, as well as common issues in temporary housing. Based on an understanding of these common issues, this paper proposes a framework for strategic planning for temporary housing that identifies organisational designs and available resources for temporary housing before the disaster, but allows modifications to fit the specific post-disaster situation.**

**Source:** [**Ozcevik O**](http://www.ncbi.nlm.nih.gov/pubmed?term=Ozcevik%20O%5BAuthor%5D&cauthor=true&cauthor_uid=18699858)**,** [**Turk S**](http://www.ncbi.nlm.nih.gov/pubmed?term=Turk%20S%5BAuthor%5D&cauthor=true&cauthor_uid=18699858)**,** [**Tas E**](http://www.ncbi.nlm.nih.gov/pubmed?term=Tas%20E%5BAuthor%5D&cauthor=true&cauthor_uid=18699858)**,** [**Yaman H**](http://www.ncbi.nlm.nih.gov/pubmed?term=Yaman%20H%5BAuthor%5D&cauthor=true&cauthor_uid=18699858)**,** [**Beygo C**](http://www.ncbi.nlm.nih.gov/pubmed?term=Beygo%20C%5BAuthor%5D&cauthor=true&cauthor_uid=18699858)**. Flagship regeneration project as a tool for post-disaster recovery planning: the Zeytinburnu case.** [**Disasters.**](http://www.ncbi.nlm.nih.gov/pubmed/?term=18699858) **2009 Apr;33(2):180-202. doi: 10.1111/j.1467-7717.2008.01069.x. Epub 2008 Aug 9. PMID: 18699858**

**Abstract: Sustainable redevelopment following disasters has been a main policy objective of post-disaster recovery efforts over the past few decades. Yet, nine years after the 1999 Marmara earthquake in Turkey, the redevelopment of risky housing areas is still a point of debate on the urban planning and disaster mitigation agenda. However, planning studies on mildly and moderately damaged areas located in the centre of Istanbul are ongoing. This article presents the evidence of a pilot project undertaken by Zeytinburnu Municipality, Istanbul, four years after the Marmara earthquake.(2) The aim is to generate a debate on the preconditions required for a sustainable urban regeneration approach in the post-disaster recovery phase. The results of the pilot project underline the importance of capacity building in sustaining social capital, strengthening the legal framework, restructuring planning regulations, and managing the housing redevelopment process by taking advantage of a window of opportunity afforded by the disaster recovery period.**

Suppose that the investigator wished to study changes in the environmental factors. Those would involve prevention of failures in electricity delivery, protection of housing, prevention of landslides, improved awareness on the part of the population, and effective disposal of sewage. Of these, suppose that the investigator is most interested in housing related considerations. There were two abstracts describing attempts to introduce interventions associated with housing (see Exhibit 2). The two describe attempts to introduce preventive influences. In both, the timeframe involved in planning the interventions was long. One problem with the political approach suggested in Exhibit 2 is the lack of data demonstrating the efficacy of changing the legislation and regulations. Several solutions have been introduced to deal with safe housing during earthquakes. (<http://ngm.nationalgeographic.com/big-idea/10/earthquakes>) Should new buildings and houses in Los Angeles be made of straw? Should houses in Haiti be reinforced using steel rods? The appropriate construction to match the physical, social and economic conditions requires data-driven solutions. Simulation studies could be of value in developing realistic examples leading to such solutions.

**Summary**

Ideas are subject-independent building blocks that can be used to effectively construct new idea structures. Likes parts of an engineered machine, the ideas fit together either through a common term or through a series of terms, each acting as a center of a swarm of ideas. This network of ideas facilitates effective description and enables consideration of new strategies in expanding knowledge. The merger of a research orientation with ideas, as essential data, offers a form of learning that is experiential as well as transparent. That combination of process and content aids in developing long term memory.