Chapter 1
Introduction

If you work with long-term social, commercial or organisational planning – or any type of policy planning that impacts *people* – then you've got *wicked problems*. You may not call them by this name, but you know what they are. They are those complex, ever changing societal and organisational planning problems that are difficult to define and structure properly because they won't keep still. They're messy, ambiguous and *reactive*, i.e. they fight back when you try to do something with them.

The term "wicked problem" was coined by Horst Rittel (Rittel, 1972; Rittel & Webber, 1973), the brilliant design theorist based at the University of Berkley (see Chap. 3). At first glance, it is not self-evident what Rittel meant by this term. Both the words "wicked" and "problem" need to be qualified: Problems are "wicked" not in the sense of being "evil", but in that they are *seriously devious* and are notoriously susceptible to the so-called "law of unintended consequences". Furthermore, as a decision maker, whatever decision you make, a good portion of the stakeholders involved are going to want your head on a block!

Also, wicked problems are not actually "problems" in the sense of having well defined and stable *problem statements*: they haven't come that far yet. This is why they have also been called *social messes* and *unstructured reality* (Ackoff, 1974; Horn 2001).

For 20 years, I worked with *wicked problems* at the Swedish Defence Research Agency (*Totalförsvarets Forskningsinstitut*, FOI) in Stockholm. Generally, these were problems of long-term defence policy, civil preparedness planning and disaster mitigation. More specifically they were about antagonistic threat scenarios, mass murder, political corruption, nuclear sabotage, failed states, uncontrolled migration and any number of distressing things that can happen to a country or population. And all of this was seen as taking place under what is called *genuine uncertainty* – i.e. there is no way to calculate the probability of something happening, and for the most part we are not even sure what might happen.

Our scenario and strategy groups would systematically look for various ways for an "aggressor" to release radioactive material, bomb public places, gas or incinerate thousands of people at a football match, sabotage the electricity grid in the middle of the Swedish winter (it almost happened), or for society to be decimated by the

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release of a super-virulent man-made virus. (Literally as I write this, in May of 2010, the Swedish Evening News reports that Craig Venter and friends have just constructed a synthetic organism – *Mycoplasma mycoides* JVCI-synI.0).

You tend to get callous. We would sit around laughing our heads off at all the weird and evil stuff that we could imagine being perpetrated on society – in order to think about how we might defend ourselves against it. But it was mostly a back-office curiosity: during the cold war period, the people actually running the country were not particularly interested in this sort of thing. At that time, the principle Swedish Defence Establishment concern was being *invaded* – by you know who.

Then everything changed. The Cold War ended (abruptly, in historical terms) and by the middle of the 1990s the project I was running, in order to develop new types of planning methods for what were euphemistically called *extraordinary events*, suddenly began to generate interest. In short, the end of the Cold War literally *caused* the development of computer-aided *General Morphological Analysis*.

What happened?

During the Cold War, one of the main tasks of the Division of Defence Analysis at FOI was to monitor the Soviet Union in an attempt to count, and keep track of, troops, tanks, aircraft and whatnot, in order to determine how long "we" (i.e. Swedish society and the Swedish Total Defence System) could hold out if Sweden were invaded as part of a conventional east-west war. Needless to say, this was not an exact science, and we usually felt that we could, depending on the ferocity of the invasion, make a go at it for a number of days or number of weeks – before we had to ask "somebody" (we were not supposed to use the N-word) to come to our aid. Of course, we were officially "neutral", but the history of Swedish neutrality is full of Jesuit logic. In any event, an *invaded* neutral country is, by definition, not neutral any longer.

This was the general state of affairs within the Swedish Defence establishment during the 1960s, 1970s and 1980s, until the deterioration and final break-up of the Soviet Union in the early 1990s. And at this point, the Swedish military establishment went into a sort of crisis.

In order to understand this, you have to understand that Russia – disguised as the Soviet Union after 1919 – has always been a bogeyman for Sweden. During the past 400 years (with a couple of notable parentheses) we have (rightly or wrongly) feared the Russian Bear above everything else. During the cold war period, practically all of (neutral) Sweden's national defence preparedness pointed in one single direction: east.

And the Swedish Defence was formidable. After WW2, Sweden had a *per capita* defence budget that rivalled any nation; during the 1960s and 1970s we are said to have had the world's fourth largest military air force; and (again, *per capita*) developed one of the world's largest defence export industries. We had our own fighter aircraft production, submarine production and world class artillery technology. In case of an invasion, we planned to mobilise one tenth of the population.

However, by the middle of 1990s, every intelligence service in the western world was telling us that Russia didn't have the wherewithal to invade Liechtenstein.

This was serious. We had essentially lost our enemy. For a National Defence Establishment to lose its (only) enemy is a terrible thing. Because if you lose your enemy, you are going to lose your budget!

It didn't take long before one started hearing voices: "We do not believe that the end of the cold war signifies a reduced threat spectrum. The dissolution of the Soviet Union is like taking the lid of some frightful Pandora's Box, and terrible things are going to ooze out of it in the coming 10–20 years. The threat spectrum is not going to decrease – it is going to broaden, and things are going to be more confusing and uncertain than ever before".

A brilliant defence! And, as it has turned out, essentially correct. Furthermore, it resulted in the establishment of a full-time research program: "Develop new, practical, computer based methods and instruments for long-term planning for an increasingly uncertain international situation".

During a series of diagnostic interviews with defence planners, it became clear that the defence planning system needed modelling methods and virtual laboratories that would give them enhanced power to formulate, collate, compare, test and manage hundreds or thousands of (1) possible international developments, (2) flexible strategies for such developments and, (3) flexible organisational structures to facilitate these strategies.

Such a virtual modelling environment should be able to *formulate* and *inter-relate* such diverse issues as threat assessments, technology development, national political directives, organisational structure, educational requirements, public perceptions, ethical issues, and so on and so forth. These are issues that usually cannot be (meaningfully) quantified; they contain irreducible uncertainties; they are strongly stakeholder dependent; and – politically – they are highly sensitive. This is exactly what *wicked problems* are all about.

Suddenly, my being a social anthropologist with a background in mathematics and computer science made some sort of sense. Social anthropology and sociology work with a simple *concept structuring technique* called *typology analysis* (see Chap. 2). Essentially, a typology inter-relates simple terms, ideas and concepts in order to create and explore the more complex concepts which are *compounded* out of these simple concepts. A typology classifies the different *types* of something, according to a set of common characteristics or attributes. This is why typologies or typological models are sometimes called "attribute fields".

However, typologies usually only work with two dimensions – i.e. they relate the attributes of two issues: for instance, Jung's scheme of pitting two personality attributes (introvert-extrovert *vs.* rational-irrational) against each other, giving four possible *personality types*. Even typologies involving three dimensions start to become unwieldy.

What we needed to develop was an expanded form of typology analysis which could treat any number of dimensions. With this in mind, I started to explore different methods of representing multi-dimensional typologies in ways that would make sense – conceptually and visually – and could be exploited by the computer.

When I began working on this in the early 1990s, I actually thought that I might be doing something new. If professional typologists (traditionally sociologists) couldn't find a smart way to exploit computers to represent multi-dimensional typologies, then maybe a mathematically oriented anthropologist could. It didn't take long to "get real". Someone had already done it. But when the answer came, it came from a completely different direction than sociology and anthropology.

Extended typology analysis was invented as early as the 1940s by Fritz Zwicky, professor of astrophysics at the California Institute of Technology – the famous Caltech in Pasadena. These days, most people have never heard of Zwicky, but 50 years ago he was a relatively well-known scientific personality in astronomy. He developed the first galaxy catalogue, coined the term *supernova* and was the first to hypothesize the existence of *neutron stars*. He is also regarded by some as being the father of the modern jet engine (see Chap. 9 for a short biography of Zwicky).

Zwicky developed a general form of non-quantified, dimensional analysis in order (*inter alia)* to categorize and hypothesize new types of astrophysical objects, to develop jet and rocket propulsion systems, and to study the legal aspects of space travel. He called this *morphological research*. Later on, it became *morphological analysis*. However, since there are a number of other scientific disciplines that use this term for specific areas of study (e.g. botany, geology, linguistics,), I started calling it *general* morphological analysis (GMA).

Zwicky, and subsequent practitioners of GMA, did it "by hand", or with only rudimentary computer support. This places severe restrictions on the number and range of the dimensions that can be employed (5–6 dimensions is already pushing it). It is also time consuming and prone to errors. But most important of all, without adequate, dedicated computer support, one cannot properly do morphological modelling in a real-time workshop setting with subject matter specialists (SMS). This is crucial: it is the collective creativity which comes out of facilitated group workshops which is at the heart of developing really useful, innovative morphological models concerning wicked problems.

In 1995, I began to develop software support for GMA with this goal in mind: to be able to develop non-quantified, interactive ("what-if") inference models in a real-time workshop setting with subject-matter-specialist and stakeholder groups.

However, there is a lovely Catch 22 situation involved. On the one hand, you will not really understand what types of functionalities and flexibilities you will need in your workshop oriented GMA software until you start running GMA workshops. But, on the other hand, you will find it really difficult to run proper GMA workshops without dedicated (well-thought-out) GMA software.

This is a classical *bootstrapping* problem, and anyone who has started his or her own business from scratch knows exactly what this is about.

Let's say that you work for a commercial organisation that, naturally, has to make a profit and wants satisfied customers; or, alternatively, you work in a bureaucratic organisation that practices extreme risk avoidance (which most bureaucratic organisations do). In either case, if you go out and "burn" five clients in a row in trying to introduce, understand and develop a new method or product – then you are either going to stop doing this on your own accord, or someone else is going to pull the plug on you.

Nobody pulled my plug. I turned out to be the proverbial “right person in the right place at the right time”. Above all, I had the “right” colonel supporting the whole effort (it always seems to be a *colonel!*). For 2 years I was allowed to engage dozens of defence study groups in the bootstrapping process of learning how to conduct GMA workshops, and learning what software requirements should go along with this. Thus the GMA software was developed *in parallel* and *in interaction* with the development of the facilitation and modelling techniques required for GMA workshops.

It was an authentic “theory and practice” bootstrapping process. There have been several attempts to develop GMA software “back-office”, as purely intellectual products. The ones I have tested are strangely inflexible and practically useless in a real-time workshop setting.

So what’s the bottom line here? What is it that *General Morphological Analysis* is actually good for?

GMA is good for the process of stakeholders learning to understand the complex issues and interrelations of the *wicked problems* they are confronted with, and for helping these stakeholders to better understand each other’s positions and rationales concerning these issues. The single take-home message is this: never begin any project involving complex policy and planning issues, and complex stakeholder positions, without first engaging the stakeholders (and related subject specialists) in *at least* a 2-day morphological analysis workshop. You will be very glad that you did so!

Almost all of the clients that I have worked for during the past 15 years have ended up saying more or less the same thing: “Boy, are we glad we did a morphological analysis of this problem area before we started spending time and money on it. We didn’t really have an adequate understanding of the actual problem space”.

As far as I know, this is the first book to more or less comprehensively treat computer aided General Morphological Analysis. It has this distinction by default: the discipline is only 15 years old, and I and my colleagues are the only ones to have amassed enough client based projects employing GMA (more than 100) to be able to draw any general conclusions about the method. Still, it is only a first, tentative attempt to put together some sort of systematic picture of the work that has been done. It is my sincere hope that it will help to generate further interest in General Morphology, and result in more and better research papers, and books, on the subject.

We are not many practitioners in the world at this point – maybe a couple of dozen. These are spread out over the globe in e.g. England, France, Holland, Australia, New Zealand, Korea, the U.S.A. and (of course) Sweden. I have personally introduced and trained facilitators in GMA in Holland, England, Singapore, the Republic of South Africa and the U.S.

Concerning the composition of this book, some of the text is based upon earlier articles and presentations of GMA. To avoid accusations of *self-plagiarism* (i.e. reusing one's own old texts without informing the reader), these earlier sources are footnoted for each section.

The reason for using these earlier texts is simple: I have been writing about and presenting GMA for 15 years and I cannot substantially improve upon some of these descriptions and explanations. It would be silly for me to attempt to completely reformulate everything again. Also, I do not think that "self plagiarism" is all that much of an issue. As the composer G. F. Händel said to someone who accused him of using the same musical theme in several different works: "How many good ideas do you think you get in a lifetime, sonny"?

Likewise, some of the case studies presented have been reported in earlier conference papers. These are also noted in the "Case Studies" section.

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Finally, I am honored to have this book published by Springer, not the least because it was Springer that published Fritz Zwicky's first book on Morphological Research some 44 years ago (Zwicky & Wilson, 1967). I think that Fritz would have appreciated this also.