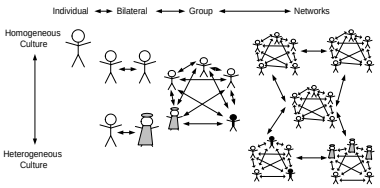
The Human Side of Systems Architecting

-



Gerrit Muller
University of South-Eastern Norway-NISE
Hasbergsvei 36 P.O. Box 235, NO-3603 Kongsberg Norway
gaudisite@gmail.com

This paper has been integrated in the book "Systems Architecting: A Business Perspective", http://www.gaudisite.nl/SABP.html, published by CRC Press in 2011.

Abstract

Systems architects interact quite often with many humans, and create products that must satisfy human needs. Insight in human aspects is crucial. However, human aspects span a very broad field, the human sciences, that differs quite significantly from the technical background of most architects.

version: 1.0 status: draft September 9, 2018

1 Introduction

Systems architecting involves much more than understanding technology and using technologies to create systems. Systems architect are working for and are working with humans. Architects are continuously confronted with human aspects. These human aspects might get lost in the hectic world of technology oriented Product Creation. The technical origin of most of the design and implementation work lures designers into a technology only viewpoint.

Human aspects cover a broad field that in the academic world is covered by the human sciences. Human sciences approach knowledge significantly different than engineering sciences: it is a much "softer" world than the "hard" engineering world.

We will discuss the breadth of the human sciences and their relevance for systems architecting. The goal is to make (potential) systems architects aware of the importance of human aspects and to stimulate systems architect to invest time in studying human sciences.

We focus on the relevance of human aspects for systems architects, but most information and insights are also applicable to engineers, designers, and managers.

2 Human Aspects

Figure 1 shows an overview of human aspects as a two-dimensional space. One axis is the cultural diversity (vertical). The other axis is the amount of humans involved, starting with one individual and ranging to the entire society. The space of human aspects is covered by a range of human sciences, such as psychology and sociology, shown at the bottom.

2.1 Individual

Examples of attributes related to an individual are: identity, self-perception, attitudes, physical condition, and health. *Psychology* focuses on the psyche of the individual, related to psychological aspects. *Psychiatry* copes with pathological psychological characteristics, such as personality and learning disorders. *Physiology* captures the knowledge of the physical aspects of humans. *Ergonomics* combines physical and mental human aspects. *Medicine* copes with pathological physical characteristics.

Traditionally, ergonomics is the main expertise area that is seen as relevant for systems architects. However, systems architects will meet all of these aspects both in the company while cooperating with others as well as with external stakeholders.

For example, in security straightforward biometrics can play a role. The biometrics might be disturbed by illnesses or physical handicaps. Security measures might not work well, because the measures do not fit with psychological needs. Security design, finally, has to take mental disorders into account too.

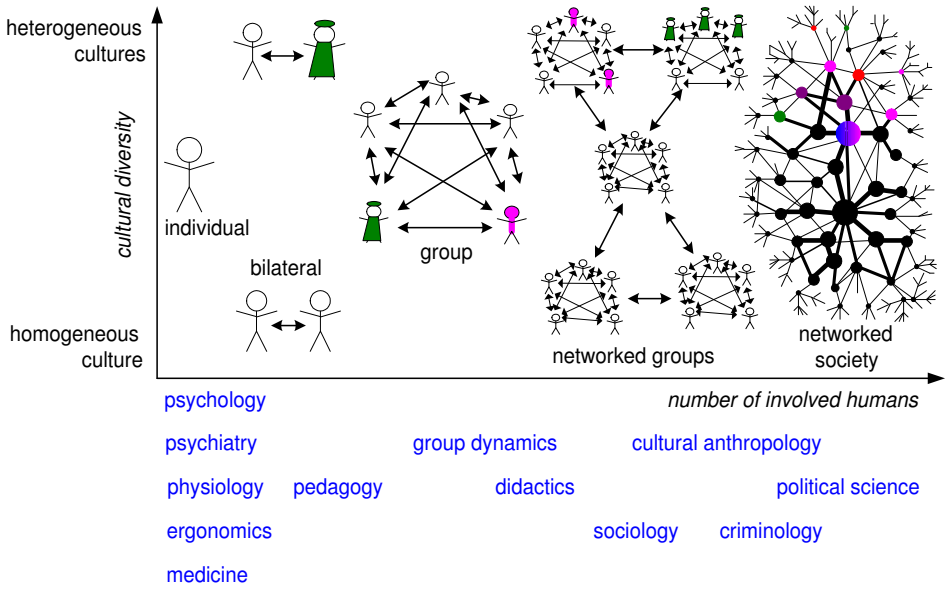


Figure 1: Overview of Human Aspects

2.2 Bilateral

When two individuals meet, then they need to be able to understand each other, to communicate, and to behave such that both feel well and respected. Typical bilateral skills that are required whenever two individuals meet are: active listening, empathy (the ability to feel or assess the emotions of the other), capabilities to express ideas, to give feedback, and to provide direction.

Most of these skills are fundamental in group interactions as well. Bilateral skills are the foundation for successful interaction in broader groups and networks.

An example of the value of bilateral skills is a situation where a designer has a conflict with the partner at home. The design discussion between architect and designer does not work well, despite good ideas and suggestions from the architect. In this case the architect has to discover that the current problem is not in the design and the discussion about the design. The actual problem is outside the immediate context: the conflict at home. By combining bilateral skills the discussion might be postponed to a more suitable moment.

A specific subset of bilateral interaction is covered by *pedagogy*, how to educate children. Understanding of pedagogy can help to understand bilateral relations.

2.3 Groups

System architects spend a significant amount of time in groups, for instance in design and specification meetings, ad hoc task forces, strategy work shops, or

reviews. Interaction between group participants is described by "Group Dynamics".

Architects can function better in groups or teams when they understand behavior of individuals. There are many role models that can help to understand roles that are required in teams and roles that fit specific individuals.

2.4 Networked Groups

When more and more individuals are involved then there are many interpersonal relations. We can view that as networks or networked groups. *Sociology* studies how larger groups of humans live, behave, and cooperate. *Didactics* focuses on teaching to larger groups.

In the example of security we can also see the need to understand social aspects. Many security problems originate from social behavior. For instance, malware makers apply social engineering to penetrate secure systems. Social engineering uses expected social behavior to harvest confidential information.

2.5 Networked Society

Today's society contains globally about 10 billion individuals. The global society can be viewed as a huge network. In larger populations humans start to show political behavior: using power and coalition strategies to achieve personal other other local goals.

Most systems architects dislike politics intensely. Politics operates opposite of the natural architecting style: trying to find a solution that maximally satisfies stakeholders, based on facts and figures. The system architect is the catalyst to be fact and task driven in groups, to discuss the content, rationales and solutions instead of compromising and polluting the whole by personal interests[1].

Another phenomenon that pops up in larger populations is crime: people who have chosen to operate outside the social system and ignoring the legal rules.

2.6 Heterogeneous Cultures

The vertical axis shows cultural diversity. Culture consists of unwritten rules that very slowly emerge in a population. These rules are ingrained in all individuals of the population. In due time the rationale of the rules is lost, but the population continues to live according to these rules. Changing culture is a tedious and slow process.

Cultural anthropology studies cultural aspects of populations. The cultural background of individuals plays from individuals to the entire society. The cultural

[1] Note that personal interests need to be acknowledged and taken into account, as described in the bilateral skills. However acknowledging and taking into account is not the same as fulfilling.

background of an individual shapes believes and behavior of an individual. Interaction between individuals with different backgrounds may have unexpected side effects.

For example, Dutch people are quite blunt and not hierarchical oriented. In the Dutch culture an employee may contradict the boss. When such Dutch employee contradicts an American manager higher in the hierarchy, then the American manager may be offended by the contradiction.

Cultural differences are not limited to geographical boundaries or ethnological backgrounds. Companies (IBM, Google, Apple, Microsoft) do have specific cultures, disciplines can have specific cultures. Any group of people gradually develops an own culture.

3 Human Context

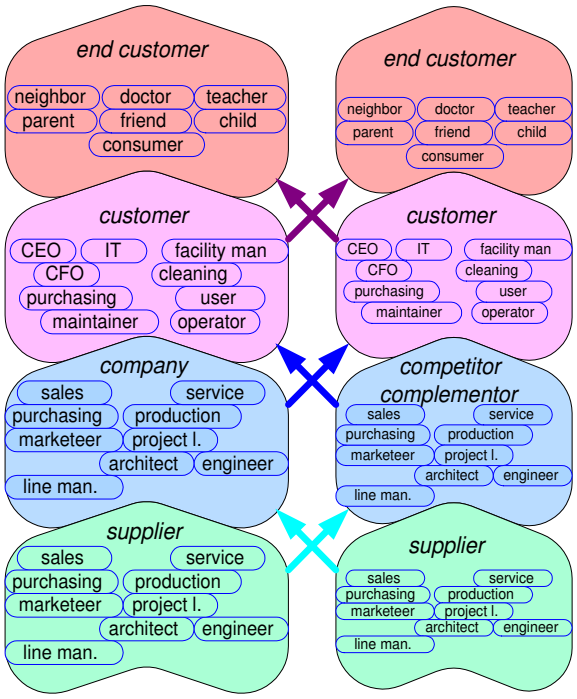


Figure 2: The systems architecting context, shown here as value chains, is full of human stakeholders

Systems architecting is taking place in a context full of human players. Figure 2 shows the value chain where most of the systems architecting takes place in the *company* part. In the company itself there are many human stakeholders. But also the suppliers, customers, and end customers consist of many human stakeholders.

Note that in most processes[2] an abstraction of the stakeholder is used, such as *customer*, *consumer*, *user*, *employee* et cetera. The needs of these abstracted stakeholders are captured in other abstractions, such as requirements and specifications. Architects need to be aware of the rich variations in humans hidden behind these abstractions.

For instance, a specification might indicate that a product is targeted at elderly citizens. "Elderly citizens" is much more abstract than "85 year old mister Smith who cannot find his remote control that is so small that it always disappears".

Systems architects interact with external and internal stakeholders. Quite often it is impossible to know all of them personally, forcing architects to work more indirect and to apply abstractions. For instance, Sales and Marketing Managers meet much more customers and often represent them during the requirement capturing. The systems architect should at least meet a few "life" customers. Systems architects need to balance the degree of abstraction and the amount of attention for internal and external stakeholders.

4 Acknowledgements

The trigger to write this article is the work of a work-group consisting of: Dieter Hammer (Technical University Eindhoven), Jaap van Rees (Van Rees adviesbureau), Jeroen van Hoven (Erasmus University Rotterdam), Kees van Overveld (Philips Research/TUE), Daan Rijsenbrij (Cap Gemini), Nathalie Masseus (Cap Gemini), and myself from Philips Research. The contributions of the members stimulated me to write this article.

References

[1] Gerrit Muller. The system architecture homepage. `http://www.gaudisite.nl/index.html`, 1999.

History
Version: 1.0, date: August 31, 2010 changed by: Gerrit Muller

- rewrite of abstract and introduction
- changed title: system architecture -> systems architecting
- removed section PCP perspective
- many textual updates

[2] A perfect example is this section itself, where we used several abstractions to discuss humans.

- changed status to draft

Version: 0.5, date: February 16, 2009 changed by: Gerrit Muller
- moved section *The wonder of communication* to HSinterpersonalSkills

Version: 0.4, date: June 24, 2005 changed by: Gerrit Muller
- added section *The wonder of communication*

Version: 0.1, date: September 21, 2001 changed by: Gerrit Muller
- abstract added
- changed offensive part of figure 1

Version: 0, date: April 11, 2000 changed by: Gerrit Muller
- Created, no changelog yet