Module Human Side

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Abstract

The module Human Side addresses the psycho-social aspects of systems architecting.

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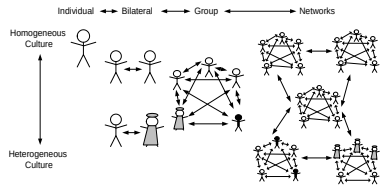
Chapter 1

The Human Side of Systems Architecting



1.1 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.

1.2 Human Aspects

Figure 1.1 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.

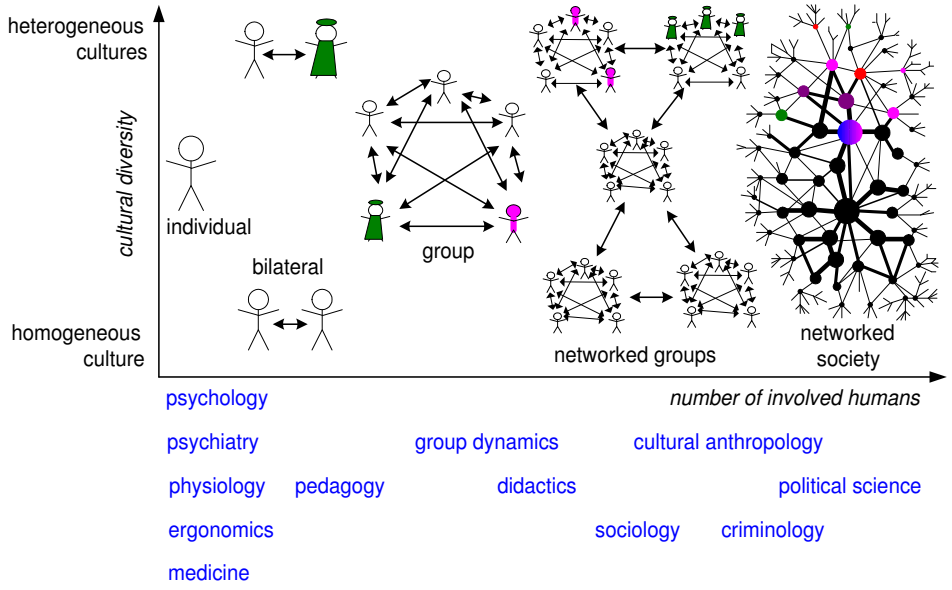


Figure 1.1: Overview of Human Aspects

1.2.1 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.

1.2.2 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.

1.2.3 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.

1.2.4 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.

1.2.5 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.

1.2.6 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 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.

1.3 Human Context

Systems architecting is taking place in a context full of human players. Figure 1.2 shows the value chain where most of the systems architecting takes place in the

[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.

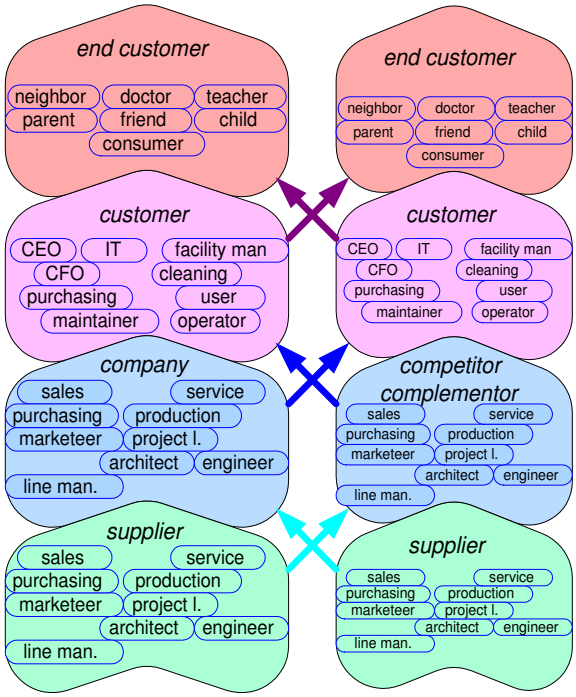


Figure 1.2: The systems architecting context, shown here as value chains, is full of human stakeholders

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.

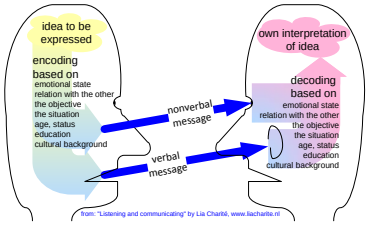
[2] A perfect example is this section itself, where we used several abstractions to discuss humans.

1.4 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.

Chapter 2

Human Side: Interpersonal Skills



2.1 Introduction

We often take for granted that two individuals can cooperate. However, in practice many problems arise at the fundamental level of cooperation between two individuals. We will first discuss the wonder of communication, since communication is the starting point for cooperation. Next we will discuss a set of techniques that can be deployed between two (and often more) individuals:

- investigation and acknowledgement
- constructive feedback
- conflict management
- appraisal
- good practices in a conversation
- searching for ideas

2.2 The Wonder of Communication

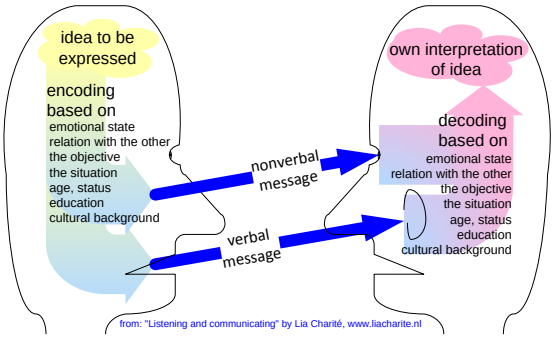


Figure 2.1: Active listening: the art of the receiver to decode the message

If someone wants to transfer an idea to another person, then this idea is encoded in a message. This message is encoded by a variety of means, ranging from the verbal message to the non verbal message such as facial expression(s), gestures and voice modulation. The encoding of this message depends on many personal aspects of the *speaker*, see figure 2.1. The receiver of this message has to decode this message and interprets the message, however, based on many similar personal aspects of the *receiver*.

From technical point of view a pure miracle is happening in communication: sender and receiver use entirely different configured encoders and decoders and nevertheless we, humans, are able to convey messages to others.

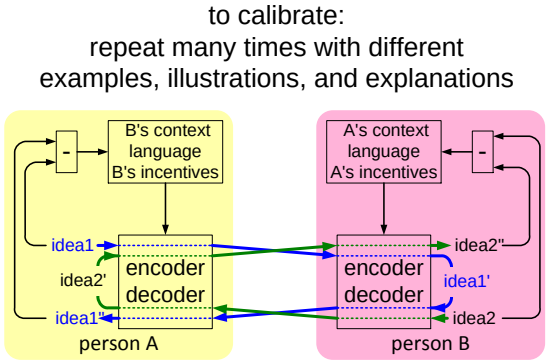


Figure 2.2: Intense interaction needed for mutual understanding

The mechanism behind this miracle can be understood by extending the model of sender and receiver as in figure 2.2. The mutual understanding is built up in an interactive calibration process. By phrasing and rephrasing examples, illustrations

and explanations the coding and decoding information is calibrated.

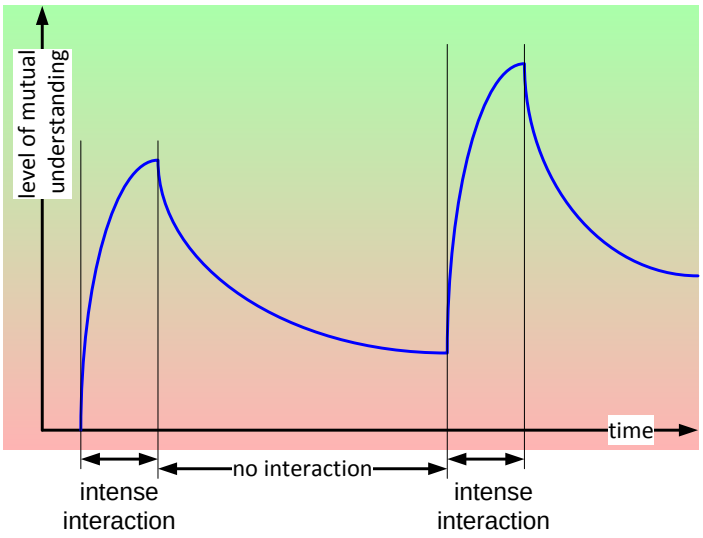


Figure 2.3: Mutual understanding as function of time

The calibration information is very dynamic, part of the coding depends on volatile issues, such as mood, and context. During interaction the mutual understanding improves, since continuous calibration takes place. Without interaction the mutual understanding degrades, due to the dynamics of the interpretation. Figure 2.3 visualizes the mutual understanding as function of time and interaction.

Note that glossaries of terms, unified notations and all these kind of measures do not fundamentally address the communication difficulties explained here. In fact standardized terminology and notations are a minor factor[1] in comparison with the human differences which have to be bridged continuously.

[1] Dogmatic applied unification of terms and notations works often counterproductive. Problems or viewpoints might be more easily expressed in other terms, while the unification drive blocks the search for a mutually understandable expression. Active participation is required to obtain understanding.

2.3 Interpersonal skills

In the previous section we explained that it is rather miraculous that communication between individuals works. In this section we provide a number of fundamental skills to facilitate the cooperation between tow individuals.

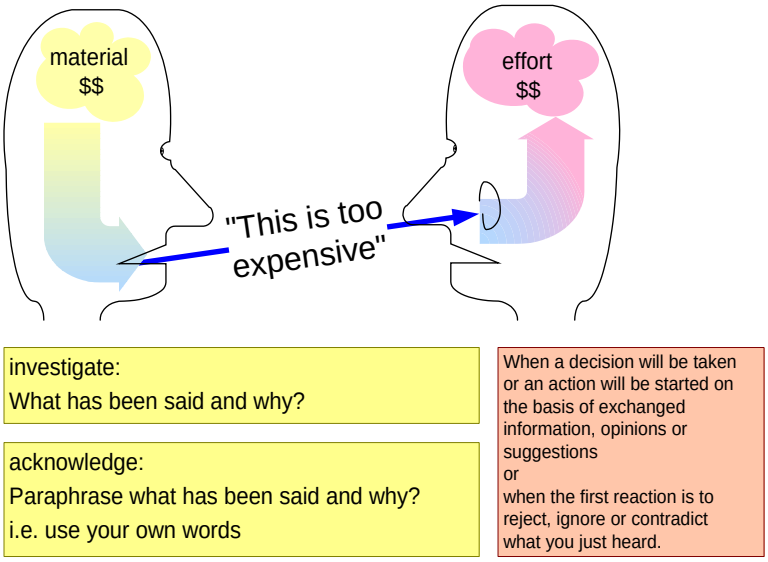


Figure 2.4: Investigate and Acknowledge

Investigate and Acknowledge, see Figure 2.4 is a technique that helps to bridge the differences between individuals. Investigation is the process of asking questions to ensure that you understand what the other person is saying. Acknowledgement is the process to help the other person understand what you have in mind.

In practice people tend to make decisions after a superficial understanding of what someone else has said. The risk is that both persons did not understand each other, with the risk that the decision is faulty. Also tensions between persons can be traced back to a lack of mutual understanding.

Note that application of the investigate and acknowledge technique in first instance slows down the communication. Its application should not be overdone, this may also cause irritation.

The basis for improvement and learning is **feedback**, get observations about the performance and its consequences from someone else. Key for effective feedback is that it is constructive. This means that not only the poor performance issues should be mentioned, but also the strong points, and that the strong points are related to ways to improve the weak points. This is called *constructive feedback*, see Figure 2.5.

Conflicts are part of normal human interaction. Conflicts in itself are not bad.

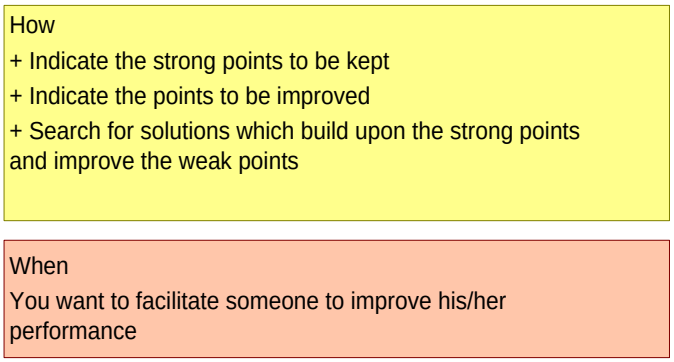


Figure 2.5: Constructive Feedback

However, conflicts that are not handled can grow to unwanted dimensions. **Conflict management** is a technique to explicitly cope with conflicts, see Figure 2.6

The first step in conflict management is to understand the conflict itself. The conflict can be made explicit by formulating what is important for you and why, and by investigation and acknowledgement of what is important for the other and why. A fundamental choice has to be made when the positions are clear:

- If you are willing and able to consider alternatives, then you can jointly search for alternative solutions.
- If you are not willing and able to consider alternatives, or no acceptable solution for both parties can be found, then the conversation must be finished by acknowledging the right to have a different opinion, and by indicating your decision and its rationale.

The main message is that "false" hope should be avoided, rather the conflict should be clearly finished one way or the other. The risk of maintaining false hope is that the conflict will simmer on and it might become a festering disease.

Appraisal can work wonders for the motivation of people. Nevertheless, many people don't know or are hesitant to give appraisal. Figure 2.7 shows when and how to appraise. Essential for appraisal to work is that the appraisal is authentic. In the eyes of the person giving the appraisal the performance of the the appraised person should be so good that appraisal is justified.

The appraisal itself must be specific. Some people appraise simply by stating that "you did a good job". Such generic appraisal does not really help the appraised person. Rather the appraisal should explain:

- what the person did specifically
- what personal qualities were applied that enabled this performance

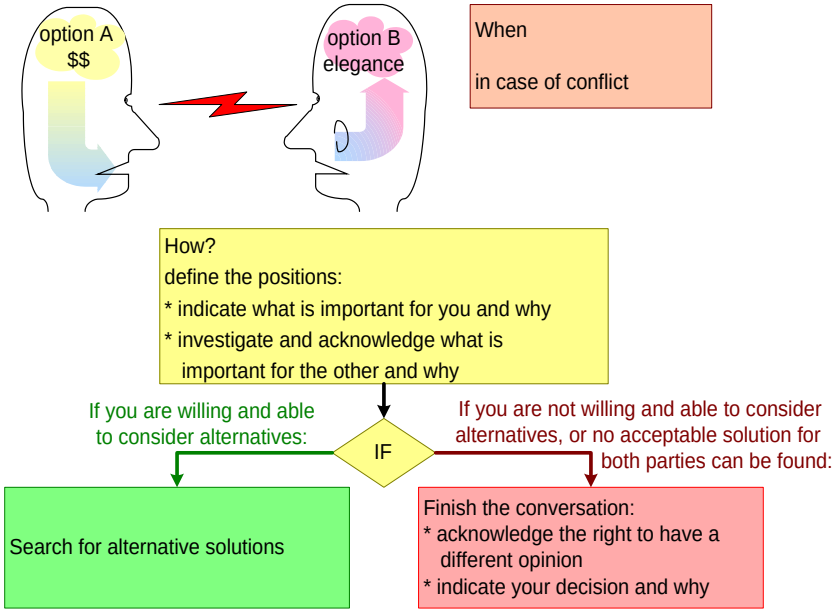


Figure 2.6: Conflict Management

- and what benefits this work had for other people or the organization

Very elementary for effective communication is that **conversations** are opened and closed clearly. Figure 2.8 shows a number of good practices for opening and closing a conversation. At the beginning of a conversation it is good to make explicit what the purpose of the conversation is. At the end it is good to summarize conclusions and agreements, for example in terms of an action plan.

In several circumstances it can be desired to **search for new ideas** or alternatives. Figure 2.9 shows several recommendations for searching ideas. The basic idea is that two persons should build upon each others ideas, when searching for ideas. They should stimulate each other to make suggestions, and to keep going the other person should give a reaction. Credit should be given to the person who originates ideas. The last recommendation to find ideas is a technique from the creativity field: people come up with new solutions if you remove or add constraints. E.g., if cost is not a problem, how would you then solve the problem? Interestingly many solutions found this way can also be used when the constraint is reapplied.

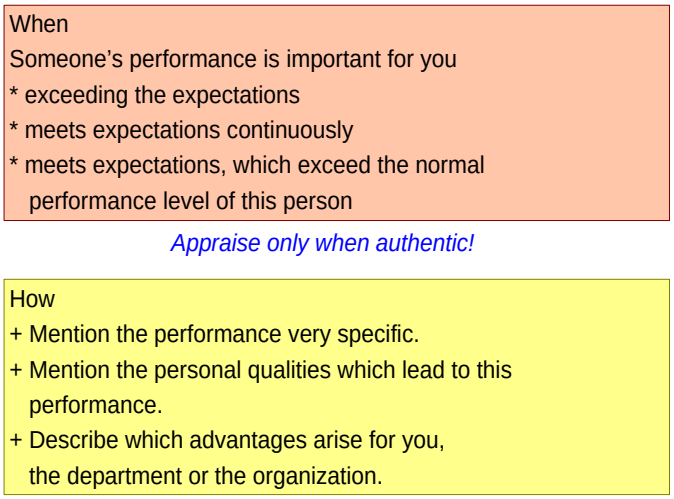


Figure 2.7: Appraisal

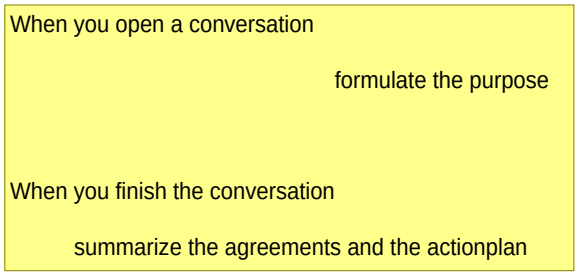


Figure 2.8: Conversation Good Practices

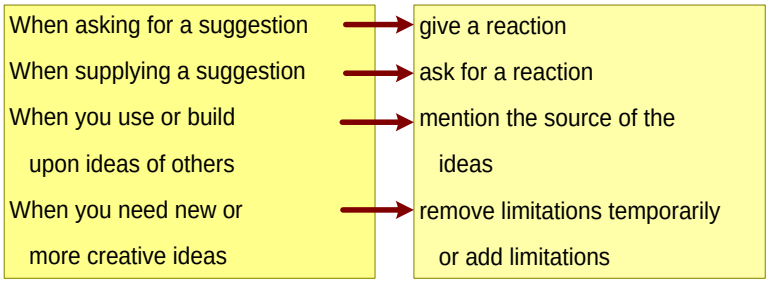


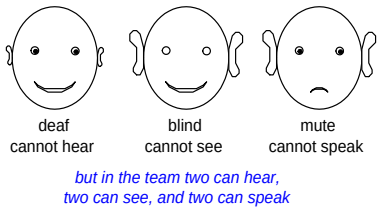
Figure 2.9: Searching for Ideas

2.4 Acknowledgements

The communication section is based on material from Lia Charite (`www.liacharite.nl`). The techniques for interpersonal skills are based on the course “Interpersonal Management Skills” by Hay Management Consultants.

Chapter 3

Human Side: Team Work



3.1 Why Work in Teams?

Today's product creation projects involve so many fields of expertise that we need many different specialists. Teams are a way to organize the project. From management perspective manageability is one of the main reasons to use teams.

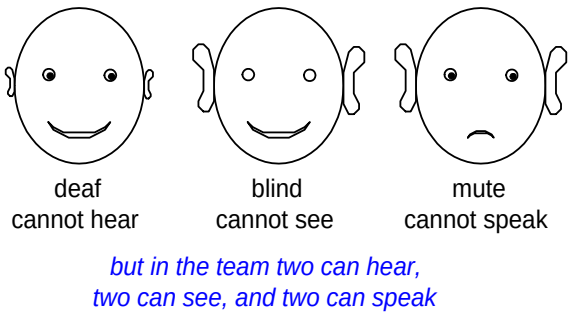


Figure 3.1: Teams consist of peoples with complementary skills and knowledge

Teams can also be an effective way to benefit more from the strengths of individuals within in a group. A well designed team is more than the constituting members. Figure 3.1 shows a schematic version of the figure of the three apes, where one ape cannot see, one ape cannot hear, and one ape cannot talk. If all three

team-up, then we have a team where two apes can see, two can hear, and two can talk. The team members are complementary and jointly they can do much more than every individual alone.

3.2 Team size

Teams can vary from very small (two people) to very large (thousands of people). However, large teams are often further divided in smaller teams, since human interaction gets more difficult with more team members. For example, an entire project is decomposed in subsystems and further decomposed in components, where the team organization follows the same decomposition.

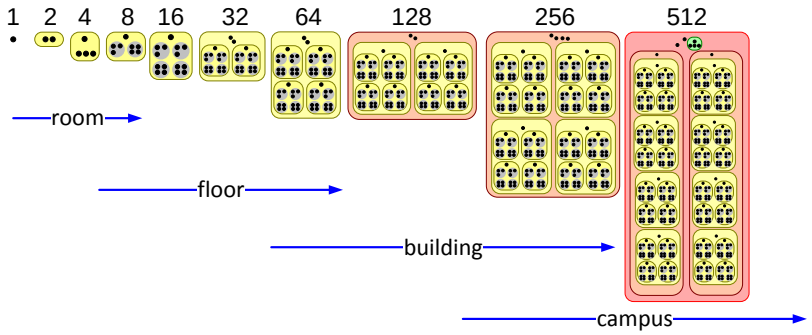


Figure 3.2: The way of working of a team depends on the team size. Every factor 2 in size creates a different paradigm.

In practice only small team, e.g. between 3 and 8 people, show intense interaction. When teams are bigger, the team de facto divides itself further to "human" scale teams. Figure 3.2 shows that large organizations are broken down in smaller units. It also shows that the size impacts the housing and location of teams.

The operation of a team depends strongly on its size. Very small teams of two or three people will interact more intense and informal than larger teams. Larger teams will need more time to communicate, lowering their efficiency. In fact every increase of the organization size with circa 50% triggers changes in the mode of operation.

Figure 3.3 shows a very simplistic model of the communication and the productivity of a team member. Every team member is modeled as being able to spend time on 4 tasks each 25% of the time. Every task is either producing something or communication with someone. This simple model shows that working with more people gets quickly less efficient due to communication overhead.

This simple model can be transformed in a hierarchical team model, see 3.4. The hierarchy reduces the communication overhead, and hence improves efficiency.

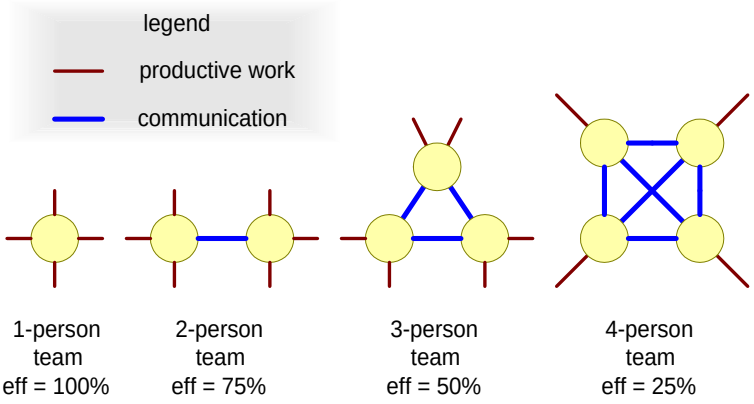


Figure 3.3: Very simplistic model of team communication and productivity

Note that the hierarchy increases length of the communication paths. Longer communication paths suffer from more latency and more deformation. Efficient organizations tend to combine a hierarchical structure with more direct communications between individuals, creating a network organization.

3.3 Team composition

A good team consists of complementary members, where the members can cooperate well. The team "chemistry" must be good. In the literature many role models are given that can be used to "design" a team.

Figure 3.5 show the roles described by Meredith Belbin [2] See for a summary of these roles [1]. People tend to have preferred role patterns that they follow. This is not black and white, people can be mostly plant and somewhat of a chairman at the same time. The idea is that a good team needs all different roles.

Another role model is provided by Edward de Bono [3], the so-called *Six Thinking Hats*. These colored hats symbolize the natural attitude that persons bring into the team. Figure 3.6 shows the six different colors and their main characteristics. Again the idea is that these different kinds of people are complementary, a team needs positive and negative oriented members, creative and process oriented members, and neutral and feeling oriented members. Also note that some members can take on all colors: chameleons.

A famous ontology is provided by the Myers-Briggs type indicators [6]. Four characteristics with their two extremes are used as parameters to classify people, following Jung's ideas with similar characteristics. In Figure 3.7 these four characteristics are shown: *Extraversion* and *Introversion*, *Sensing* and *iNtuition*, *Thinking* and *Feeling*, and *Judging* and *Perceiving*. Someone's personality type can be captured by concatenating the 4 letters of these characteristics. For example, it

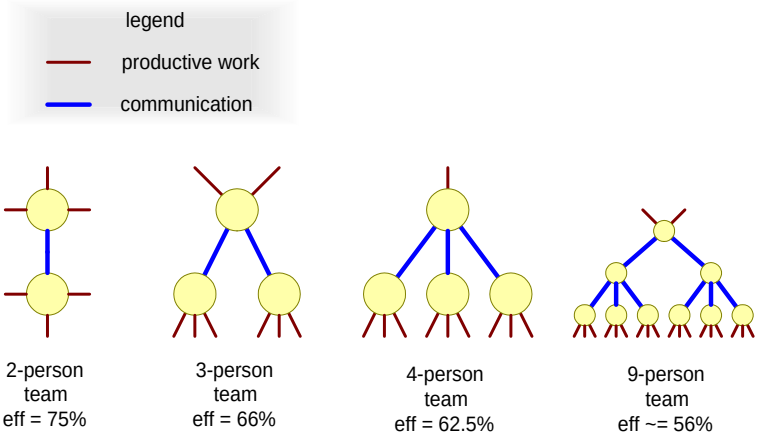


Figure 3.4: Very simplistic model of team communication and productivity with hierarchy

plant creative	*team worker* cooperative, averts friction	*implementer* disciplined, conservative, doer
resource investigator enthusiastic communicator	*shaper* driver, dynamic	*completer finisher* conscientious, painstaking
coordinator mature, chairman	*monitor evaluator* sober, analytical	*specialist* single-minded, rare skills

Belbin's team roles

Figure 3.5: Belbin team roles

is often observed that systems architects have INTP as personality, see for instance `http://www.e-mbti.com/intp.php`.

To design a team the roles/personalities of its intended participants have to be taken into account. However, we also have to design the team to get:

- a multitude of opinions
- coverage of the involved stakeholders
- coverage of knowledge and skills

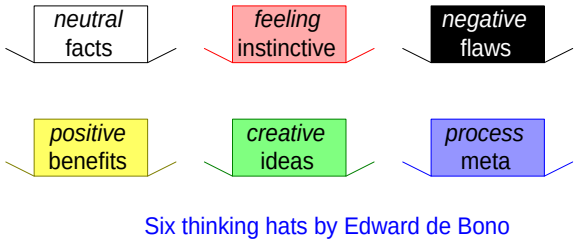


Figure 3.6: Six thinking hats by Edward de Bono

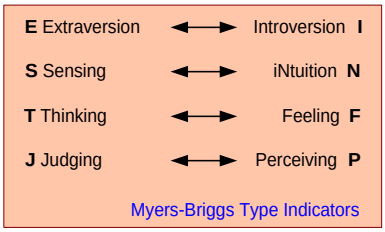


Figure 3.7: Myers-Briggs type indicators

3.4 The Process of Creating and Employing a Team

Let us assume that someone in the organization, for example the business manager or project leader, has the need for a team. We will call this person the team owner, meaning that this person feels responsible for a good functioning team and has a need for its results. Figure 3.8 shows this team owner at the top of the figure.

This team owner will compose the team as described in 3.3, will arrange facilities, such as housing as described in 3.5, and will have to provide a charter for the team. A charter provides the scoping for the team: *what* has to be done*why*, *how* to achieve this, *whom to involve*, and *when* and *where*. This charter gives direction for the team. However, the team should be able to determine its own way-of-working within the charter. Micro-management of the team by its owner or others outside the team will greatly reduce the team's productivity. In other words the team has to be empowered by the owner.

The team will produce results while working. These results have to be respected by the receivers, such as the owner. If the results are not respected, then this will discourage this team and also the successive teams: *Why engaging in team activity, if the results are not taken seriously?* The owner should consider this aspect before initiating a team. Teams might reach conclusions that are undesired by the initiators. Sometimes, teams are initiated as decoy rather than a real goal; this works once, after that employees are frustrated and it takes a long time to repair trust and motivation.

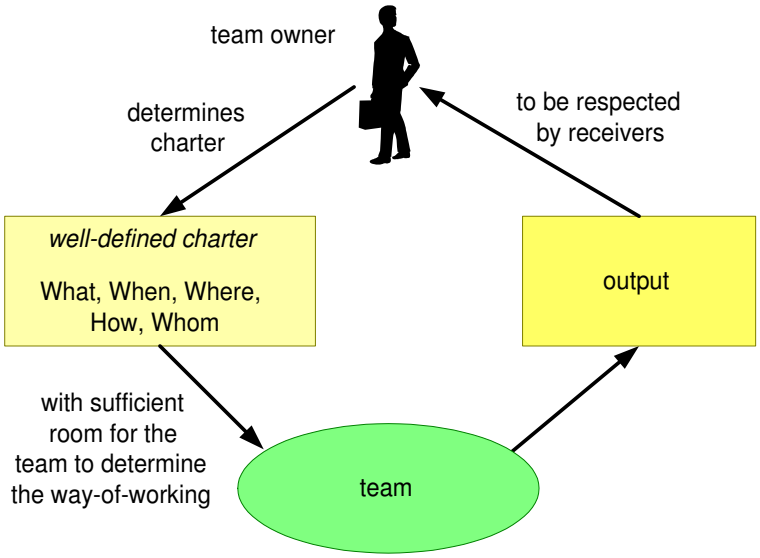


Figure 3.8: Process of creating and employing a team

3.5 Housing and Location

Housing can be used as instrument to boost team productivity and cohesion. When team members sit in one and the same room, then they will communicate more frequently and more natural.

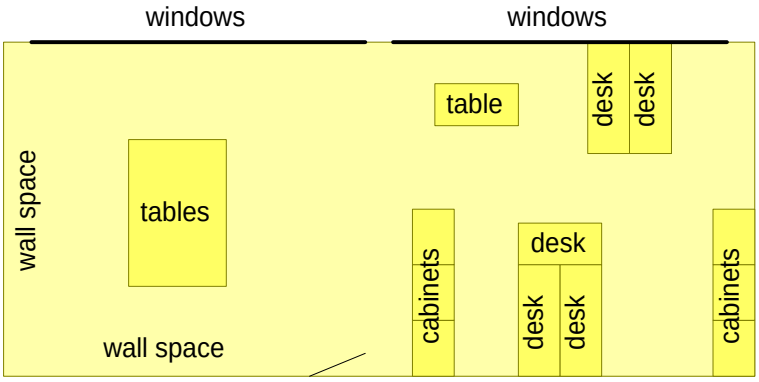


Figure 3.9: “War Room” is very effective

Figure 3.8 shows an example of a room used by the systems engineering team that designed the next generation wafer steppers at ASML. This large room had space for the normal desks with PC’s, and a meeting space with plenty of wall space. The wall space can be used for white-boards, flip-overs, and large format

print-outs of diagrams. This type of war room is very effective.

Housing is an effective means to improve team efficiency. There should not be any obstacles, such as distance, to let team members communicate. The room described above also supports communication by providing wall space and simple means to share visualizations. In LEAN product development also the physical system or the components are shared in the same location, supporting tactile and visual discussions. In a Concurrent Design Facility the room facilitates sharing of computer based models by using multiple large screens for projection.

3.6 Concurrency

Organizations seem to increase the number of activities continuously. Individual employees get more and more activities they have to do, often more or less concurrently. These activities tend to fragment the time of individuals, working a little on the first activity, do something on the second activity, continue with the next, et cetera. Figure 3.10 shows this fragmentation. It also shows that working in burst mode, e.g. working focused for one day, one week or one month on a single activity can be more efficient, because less context switches are required.

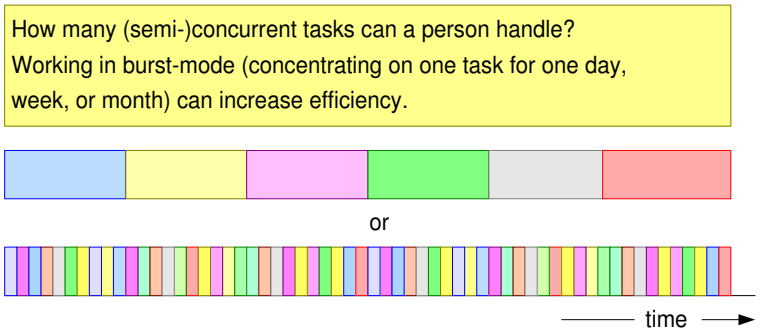


Figure 3.10: Many engineers have to divide their attention over a multitude of activities

Figure 3.11 takes this line of reasoning further. It shows six activities that are being executed in parallel and the same activities, but now executed sequentially. When the activities are done in parallel, then the results of all activities become available when all work is finished. When the activities are performed sequentially, then the first result gets available after one sixth of the time of the parallel approach. This means that the result itself, and feedback on this results becomes available much earlier. In other words, when working in parallel all results are late.

Figure 3.11 is a simplification of reality. It might be that some activities need to be parallel, for example because of the inherent elapsed time of the activities.

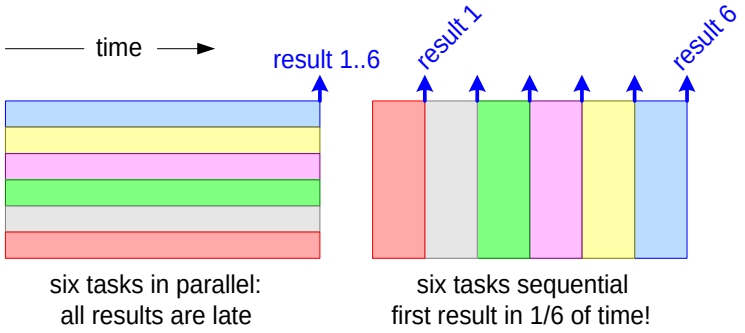


Figure 3.11: It can be more efficient to do activities sequential rather than parallel

Nine mothers cannot deliver one baby in one month, although nine mothers can deliver nine babies in nine months.

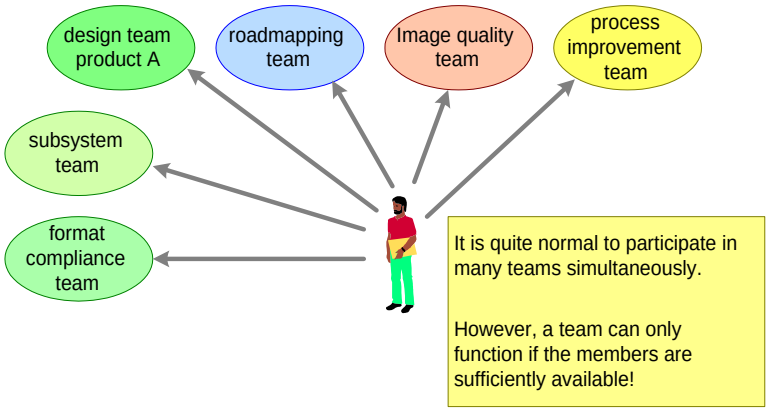


Figure 3.12: One person will be member of multiple teams

If we map these consideration on teams, then we should realize that in practice people, and certainly systems architects, participate in multiple teams at the same time. An example is shown in Figure 3.12.

The systems architect in Figure 3.12 works on the creation of a product, and is part of the *design team* of that product. At the same time the architect participates in more specific teams of that product creation, such as one of the *subsystems* and some specific aspects such as *format compliance*. However, the system architects will also participate in broader concerns of the organization, such as *image quality*, *roadmapping*, and *process improvement*.

If all these activities run concurrently, then some of them might suffer. For example, it might be better to focus for four weeks entirely on roadmapping together with the other roadmapping team members, and after that time continue with the

day-to-day architecting concerns of the product creation.

3.7 Critical success factors

Figure 3.13 shows a summary of the critical success factors that we have discussed.

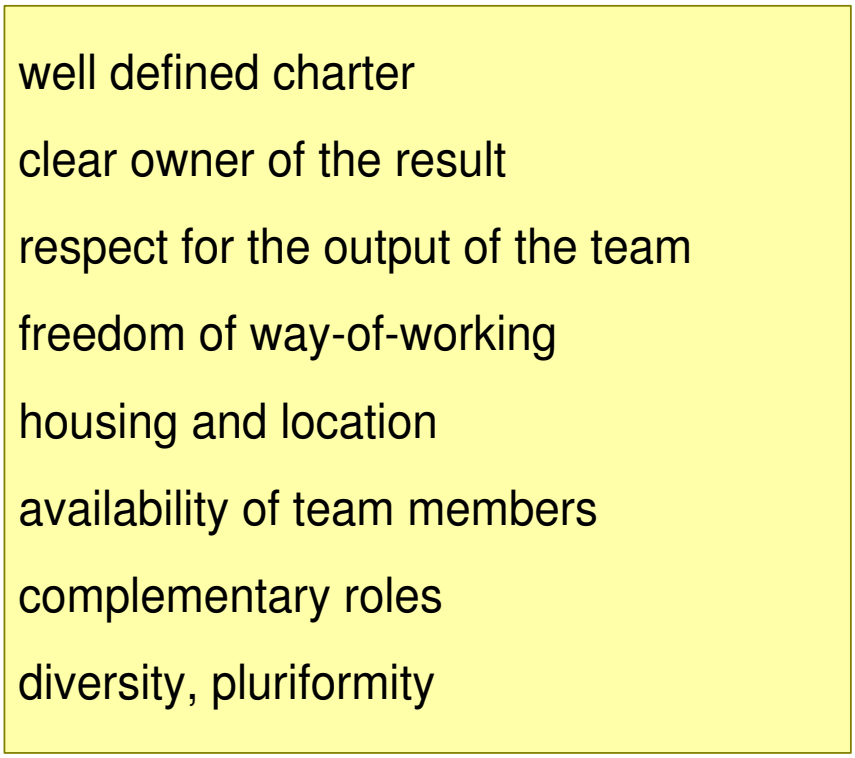


Figure 3.13: Critical Success Factors for teams

well defined charter for the team: *what*, *where*, *when*, *how*, *whom*

clear owner of the result Who needs the team, who ensures appropriate support and facilities, who is worried when the team hits obstacles?

respect for the output of the team The team with all its expertise might draw unwanted, undesired conclusions. The output of the team has to be respected, otherwise follow-up teams will not be motivated.

freedom of way-of-working The owner has to empower the team, micro-management will stifle the teams effectiveness.

housing and location are instruments to forge a team, co-location in a war room is recommended.

availability of the team members is a prerequisite to work as a team. The availability can be arranged by careful preparation and clear allocation of team members.

complementary roles so that the team is more than the sum of the individual participants.

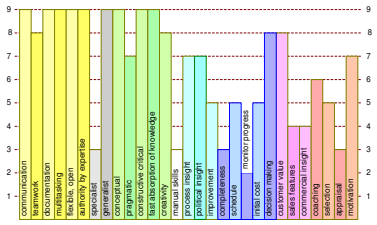
diversity, multitude of opinions Some controversy or tension in the team is healthy to prevent inbreeding and blind spots.

3.8 Acknowledgements

Ben Spierenburg showed me very long ago the simplistic model of team communication and productivity. The sequential versus concurrent tasks diagram was shown to me by Philips Organization and Efficiency department.

Chapter 4

Function Profiles; The Sheep with Seven Legs



4.1 Introduction

Many human resource and line managers struggle with the questions:

- What people have the potential to become good system architects?
- How to select (potential) system architects?

Employees thinking about their careers might similarly wonder if they have the capabilities to become a good systems architect.

We list a number of characteristics of individual humans. We map the these characteristics on different jobs, such as system architect, developer, and line manager, indicating the relative importance of this characteristic for that job. We first discuss the different jobs and their typical characteristics in 4.2 to 4.7. Then we elaborate the characteristics in 4.8.

The attention for this subject is increasing. Recent research is being carried out by Keith Frampton, see amongst others [4].

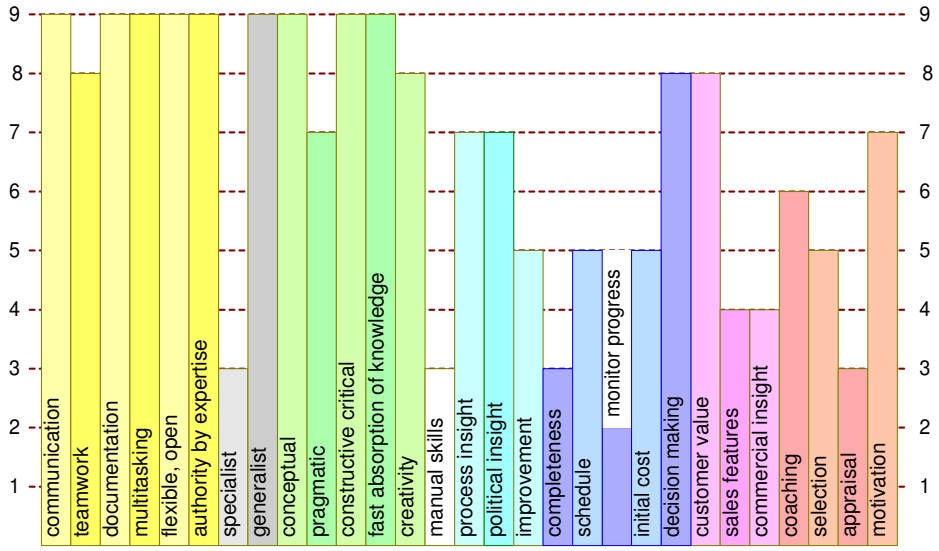


Figure 4.1: The function profile of the systems architect

4.2 Systems Architect Profile

The profile of the "ideal" system architect shows a broad spectrum of required skills. Quite some emphasis in the skill set is on *interpersonal skills*, *know-how*, and *reasoning power*.

This profile is strongly based upon an architecting style of technical leadership, where the architect provides direction *(know-how* and *reasoning power*) as well as moderates the integration (*interpersonal skills*).

The required profile is so requiring that not many people fit into it, it is a so-called **sheep with seven legs**. In real life we are quite happy if we have people available with a reasonable approximation of this profile. The combination of complementary approximations of such ideal architect allows for the formation of architecture teams. Such a team of architects can come close to this profile.

4.2.1 Most discriminating characteristics

In practice the following characteristics are quite discriminating when selecting (potential) systems architects:

- Generalist
- Multi-tasking
- Authority by expertise

- Balance between conceptual and pragmatic

Generalist The first reduction step is to select the *generalists only*, reducing the input stream with one order of magnitude. The majority of people feels more comfortable in the specialist role.

Multi-tasking The next step is to detect those people that need undisturbed time and concentration to make progress. These people become unnerved in the job of the systems architect, where frequent interrupts (meetings, telephone calls, people walking in) occur all the time. Ignoring these interrupts is not recommendable, this would block the progress of many other people. Whenever the people with poor multi-tasking capabilities become systems architect, then they are in severe danger of stress and burn out. Hence it is also the benefit to the person self to assess the multi-tasking characteristic fairly.

Authority by expertise The attitude of the (potential) architect is important for the long term effectiveness. Architects who work on the basis of delegated *power* instead of *authority by expertise* are often successful on the short term, creating a single focus in the beginning. However in the long run the inbreeding of ideas takes its toll. Architecting based on know-how and contribution (e.g. *authority by expertise*) costs a lot of energy, but it pays back in the long term.

Conceptual thinking and pragmatic The balance between conceptual thinking and being pragmatic is also rather discriminating. Conceptual thinking is a must for an architect. However the capability to translate these concepts in real world activities or implementations is crucial. This requires a pragmatic approach. Conceptual-only people dream up academic solutions.

4.3 Test Engineer Profile

The *test engineer* function at system level requires someone who *feels* and *understands* the system. Test engineers are capable of operating the system fluently and know its quirks inside out.

The main difference between an architect and a test engineer is the different balance between **conceptual thinking** and **practical doing**. Test engineers often have an excellent intuitive understanding of the system, however they lack the conceptual expression power and the communication skills to use this understanding pro-active, for instance to lead the design team.

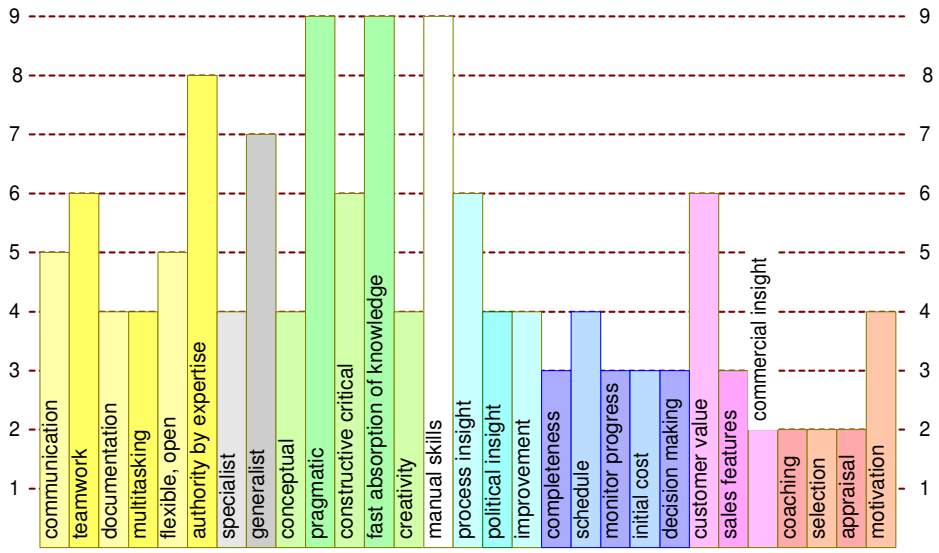


Figure 4.2: The function profile of the test engineer

4.4 Developer Profile

The core value of developers is their specific discipline know-how. Good developers excel in a limited set of specialties, knowing all tricks of the trade. On top of this they should be able to deploy this know-how in a creative way. In today's large development teams a reasonable amount of *interpersonal skills* are required as well as *reasoning power* and *project management* skills.

4.5 Operational Leader Profile

The *operational leader*, for instance a project leader, is totally focused on the result. This requires *project management* skills, the core discipline for operational leaders.

The *multi-tasking* capability is an important prerequisite for the operational leader too. If this capability is missing the person runs a severe risk of getting a burn out.

Note also that the operational leader functions as kind of gatekeeper, where the *completeness* is important.

4.6 Line Manager Profile

The *line manager* manages the intangible assets of an organization: the people, the technology and the processes. Technology and process know-how are tightly

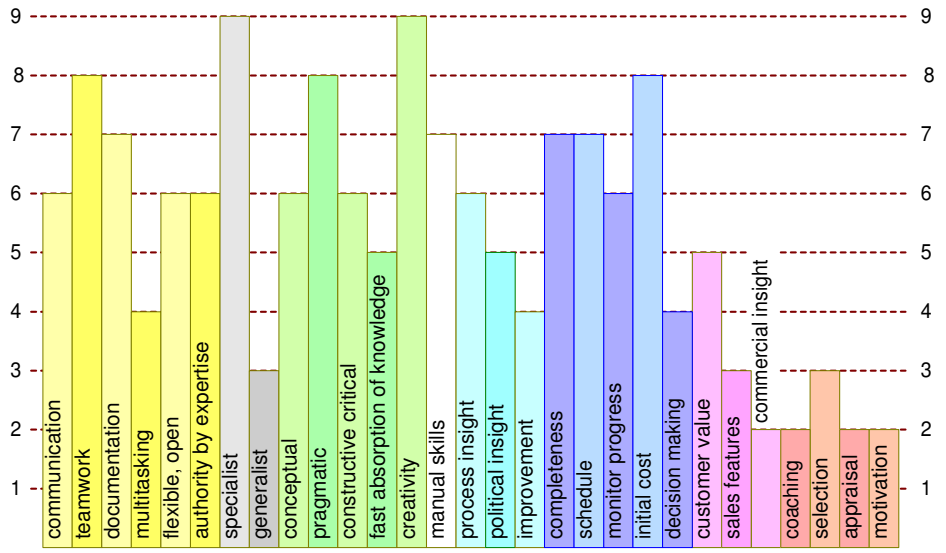


Figure 4.3: The function profile of the developer

coupled with people, this know-how largely resides in people and is deployed by people. *Human resource management* skills and *process* skills are the core discipline for line managers, which need to be supported with sufficient *specialist* know-how.

4.7 Commercial Manager Profile

The *commercial manager* needs a commercial way of observing and thinking. This way of thinking appears to be fuzzy and not logical for technology oriented people. From technology oriented perspective a strange *mind warp* is required to perform a commercial manager function.

The commercial manager is a valuable complement to the other functions, responsible for aspects such as salability and value proposition.

4.8 Definition of Characteristics

4.8.1 Interpersonal skills

communication The ability to communicate effectively. Communication is a two-way activity, presenting information as well as receiving information is important.

teamwork The ability to work as member of a team, in such a way that the team is more than the collection of individuals.

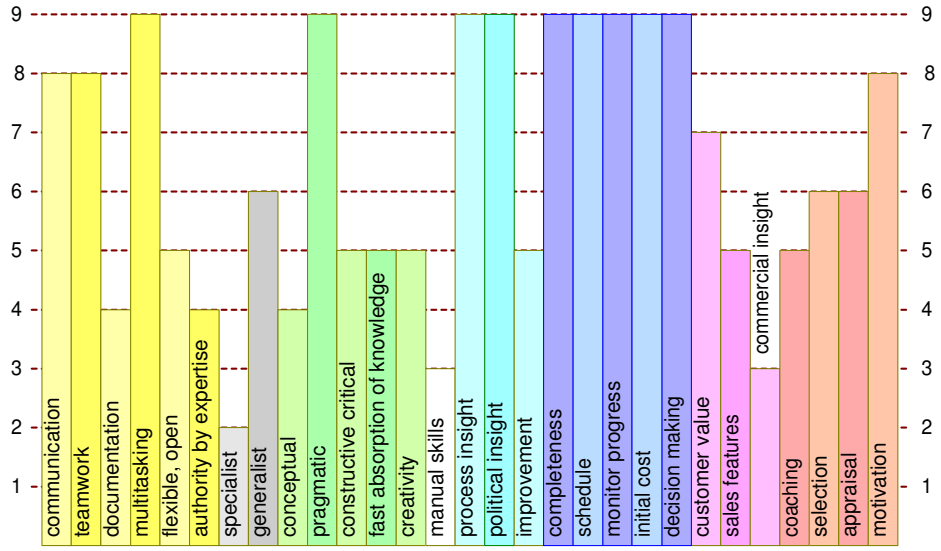


Figure 4.4: The function profile of the operational leader

documentation The ability to create clear, accessible and maintainable documentation in a reasonable amount of time.

multi-tasking The ability to work on many subjects concurrently, where (frequent) external events determine the task switching moments.

flexible, open The attitude to respect contributions of others, the willingness to show all personal considerations, even if these are very uncertain, the willingness to adopt solutions of others, even in case of strong personal opinions.

Note that this overall attitude does not mean that a flexible and open person always adopts the ideas of others (chameleon behavior). The true strength of this characteristic is to apply it when necessary, so adopt an alternative solution if it is better.

authority by expertise The personality which convinces people by providing data, instead of citing formal responsibilities. Hard work is required before authority by expertise is obtained; a good track record and trust have to be build up. Authority is earned rather than being enforced.

4.8.2 Know-how

In terms of characteristics the know-how is qualified in 2 categories, generalist and specialist.

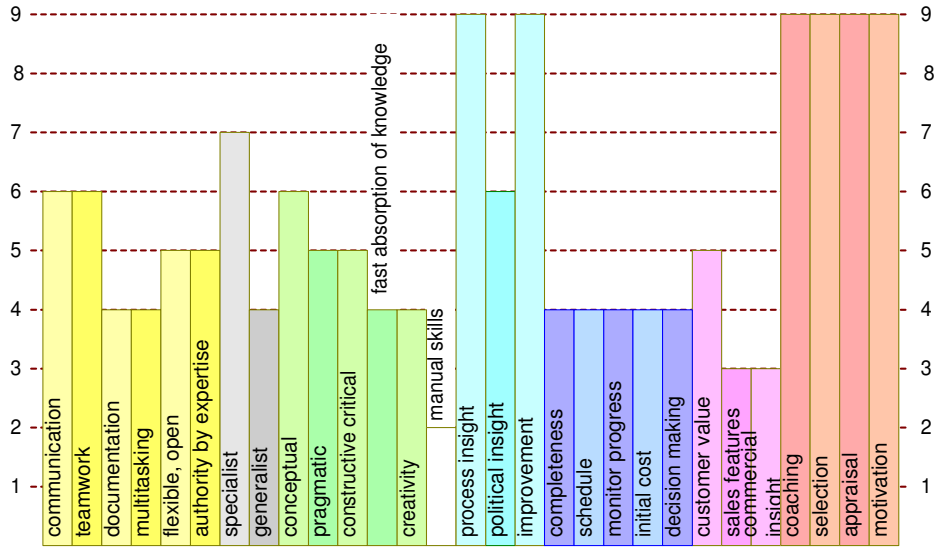


Figure 4.5: The function profile of the line manager

Generalist The persons which are always interested in the neighboring areas, how does it fit in the context? How does the "whole" work.

Specialist The persons which are always interested in knowing more detail.

4.8.3 Reasoning Power

conceptual The ability to create the overview, to abstract the concepts from detailed data. The ability to reason in terms of concepts.

pragmatic The ability to accept non-ideal solutions, to go after the 80% solution. The ability to connect "fuzzy" concepts to real world implementations.

constructive critical The ability to identify problems, formulate the problems and to trigger solutions. The term *critical thinking* is also used. Note that critics serves a constructive goal: to achieve better results.

fast absorption of know-how The ability to jump into a new discipline and to absorb the required know-how in a short time. Systems architect are never able to know all about the technologies used in the systems. This capability helps them to get the right knowledge when needed.

creativity The ability to come with new, original ideas. A specific subclass of this ability is lateral thinking: applying know-how from entirely different areas on the problem at hand.

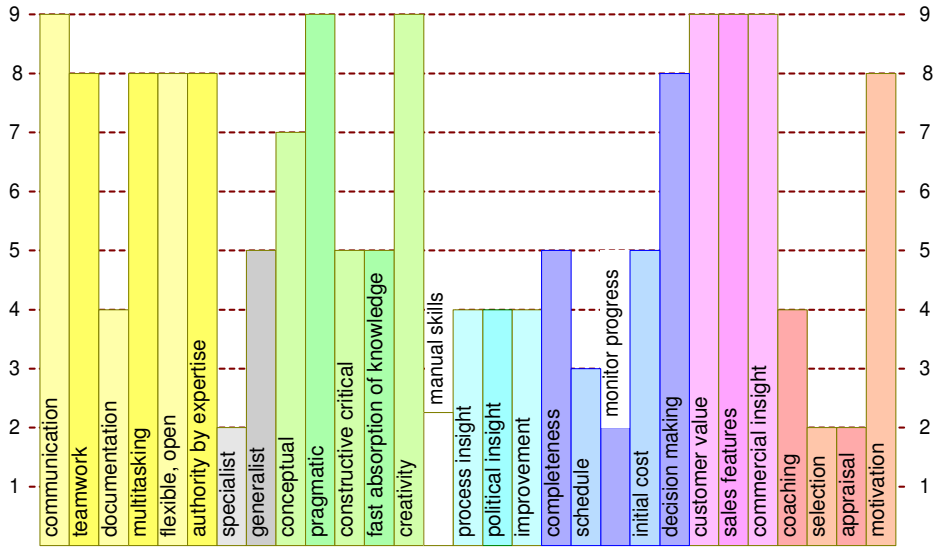


Figure 4.6: The function profile of the commercial manager

4.8.4 Executing Skills

Manual Skills The ability to **do** things, for instance build or test something. This ability is complementary to the many ”mental” skills in this list of characteristics.

4.8.5 Process Skills

process insight The ability to understand specific processes, the ability to recognize the de facto processes, the ability to asses formal and de facto processes, both the strong points as well as the weak points.

politics insight The ability to recognize the political factors: persons, organizations, motivations, power. The ability to use this information as neutralizing force “depoliticizing”: facts and objectives based decision making instead of power based decision making.

improvement drive The ever present drive to improve the current situation, never getting complacent.

4.8.6 Project Management Skills

Completeness The ability to pursue **all** information. This is often done by means of spreadsheets or databases. Large collections of issues are maintained and processed.

This ability is often complementary to, or even conflicting with, the ability to create understanding and overview: the parts view versus the holistic view.

schedule The ability to create schedules: activities and resources with their relationships, scheduled in time.

monitor progress The ability to monitor progress, the ability to chase people, and the ability to find and resolve the causes of delays.

initial cost The ability to create initial cost estimates and to refine these into budgets. The ability to understand and reason in terms of initial costs. Initial costs are the one time investments needed to develop new products and or businesses.

decision making The ability to make choices and to handle the consequences of these choices.

4.8.7 Commercial Skills

customer value The ability to see and understand the value of a product or service for a customer. The ability to asses the value for the customer.

sales feature The ability to recognize features needed to sell the product. The ability to characterize the relevant characteristics of these features ("tick-mark only", "competitive edge", "show-off", et cetera).

commercial insight The ability to think in commercial terms and concepts, ranging from "branding" to "business models".

4.8.8 Human Resource Management Skills

coaching The ability to coach other people; help other people by reflection, by stimulating independent thinking and acting.

selection The ability to select individuals for specific jobs. The ability to interview people and to asses them.

appraisal The ability to asses employees and to communicate this assessment in a fair and balanced way.

motivation The ability to make people enthusiastic, to motivate them beyond normal performance.

4.9 Acknowledgements

Pierre America applied fine tuning of translations, spelling and capitols. Lennart Hofland suggested an improvement for the description of the commercial manager. Sjir van Loo suggested an increase of coaching and selection skills of the architect. Keith Frampton pointed me to recent research about this subject.

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History

Version: 1.6, date: Jnauary 18, 2015 changed by: Gerrit Muller

- added summary

Version: 1.5, date: February 16, 2009 changed by: Gerrit Muller

- added interpersonal skills

Version: 1.4, date: March 25, 2004 changed by: Gerrit Muller

- created reader