

White Paper

Architecture Skills: Critical Thinking

WP0153 | June 2014



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Like any other analysis and design activity, architects are often in the role of soliciting requirements from a range of sources and stakeholders. As we have all experienced, this exercise is met with a wide range of opinions and perspectives from stakeholders who think they know what is required, and with a wide range of confusion and vagueness from those who don't know what they want. Given this situation, the architect needs to be able to dig into the issues, collect accurate and relevant information, and question assumptions. Then, the architect has to be able to examine the different opinions, evaluate them in the context of different perspectives, and balance and prioritize them.

The field of study called Critical Thinking is aimed at just these problems. This paper will provide an introduction to critical thinking and draw a parallel between these generic skills and the tasks of an architect.

What is Critical Thinking?

The field of critical thinking has been around for over 100 years. One of the earliest definitions comes from John Deweyⁱ in 1909:

Active, persistent, and careful consideration of a belief or supposed form of knowledge in the light of the grounds which support it and the further conclusions to which it tends.

In this definition, we can see that the focus of Dewey is on examining the validity of someone's beliefs. What, if any, evidence is there to support it?

ⁱ Dewey, John. (1910). How we think. Lexington, MA: D.C. Heath & Co.

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Are the conclusions substantiated by the evidence, or simply based on beliefs with no evidentiary backing? Another good definition supporting this focus comes from Norris and Ennisⁱⁱ in 1989.

Critical thinking is reasonable, reflective thinking that is focused on deciding what to believe or do.

As you can see, being able to evaluate what opinions (or requirements) are based on facts, and apply ‘reasonable thinking’ to decide what to do is certainly applicable to the job of an architect. Perhaps the most detailed definition comes from The National Council for Excellence in Critical Thinkingⁱⁱⁱ

“The intellectually disciplined process of actively and skillfully conceptualizing, applying, analyzing, synthesizing, and/or evaluating information gathered from, or generated by, observation, experience, reflection, reasoning, or communication, as a guide to belief and action”.

Again, as an architect, I’d like to think that I can perform an ‘intellectually disciplined process of conceptualizing, analyzing, and synthesizing information’. So what are the skills required to perform critical thinking?

Critical Thinking Skills

According to Glaser^{iv}, critical thinking requires the ability to:

1. Recognize problems
2. Understand the importance of prioritization and order of precedence in problem solving
3. Gather relevant information
4. Recognize and question unstated assumptions and values
5. Comprehend and use language with accuracy and clarity
6. Interpret data to appraise evidence and evaluate arguments
7. Recognize the existence (or non-existence) of logical relationships between propositions
8. Draw warranted conclusions and generalizations
9. Put to test the conclusions
10. Adjust one’s beliefs on the basis of wider experience

Some of these abilities or tasks are straightforward. Others deserve more discussion. Let’s examine a few of those skills in more detail. The numbers in the headings below correspond to the numbers in the list above.

ⁱⁱ Norris, S.P. and Ennis, R.H.(1989). Evaluating critical thinking. Pacific Grove, CA: Midwest Publications

ⁱⁱⁱ <http://www.criticalthinking.org/pages/defining-critical-thinking/766>

^{iv} Edward M. Glaser (1941). An Experiment in the Development of Critical Thinking. New York, Bureau of Publications, Teachers College, Columbia University.

(4) Question Assumptions – Assumptions are inherent in almost everything we do. Some assumptions are cultural or historical, others come from a perspective or experience. More often than not, we don't even recognize when we are making assumption. But innovative new products, services, and solutions depend on questioning assumptions and removing the unnecessary or unfounded constraints that they impose.

A simple example comes from a project I did recently. The organization involved provides financial business services to a variety of public entities (cities, counties, states). Currently each of this organization's customers has their own set of processes and data for doing essentially the same thing. Unfortunately, this is an expensive and difficult to maintain and enhance solution for the product configuration. And, to make matter's worse, sub-units (e.g. a city resides in a county which resides in a state) all have their own separate processes and data.

The company has an initiative to modernize and reengineer the different business services into a product set that can easily support flexibility for customers. As an architect practicing critical thinking, I asked a few important questions, specifically:

- What are the requirements for flexibility?
- What assumptions should be questioned?

First, we need to dig into the question of what it means to be 'flexible for customers'. What are the specific needs for flexibility, and what needs to be customizable in the product to support that level? It turned out that the user interface needed to be able to be 'branded' for each customer entity, and that a small set of business rules needed to be externalized to support the different governmental entities. The reason each agency had different processes was not that they wanted or needed them, but rather that the product didn't provide a standard solution.

As we examined this question further, a number of assumptions became evident to me that the business analysts couldn't get past. One especially problematic assumption was that every sub-unit needed it's own data set. This assumption was based on the fact that that's how the current product worked. However, the current design had several problems. Data was redundant across sub-units and got out of synch. To address this, a complex mechanism for synchronization was added. In addition, more hardware, licenses, maintenance and operational expenses were required to support the additional (unnecessary) data stores.

I asked the obvious question "Why can't all the related customers share the same data?" There were several explanations offered, all of which proved to be wrong when actually examined. Still, it took a significant effort to convince the business analysts that a single data solution would work, simply because they could not see past the historical perspective of the existing product. Ultimately, a single data store proved to be the right solution.

Often, people who have been working with something for a long time can't get past the current solution to imagine new and better approaches. This is frequently the source of questionable assumptions. And, an important opportunity for a critically thinking architect to provide value.

(5) Accurate and clear language – As part of the investigation into requirements, or analysis of solutions the meaning of terms needs to be questioned. Everyone has experienced the case where different people mean different things but are using the same term (such as customer, account, product). Or, where people mean the same thing, but are using different terms. To be able to evaluate information, we need to understand the meaning of terms, and the semantic context within which it's used.

(6) Interpret data – All data and assumptions need to be evaluated for accuracy and context. Critical thinking should question:

- *Goals, purpose, objectives* – to make sure that discussions are relevant to meeting them
- *The way in which questions are framed, problems posed, issues expressed* – to expose underlying beliefs
- *Information and sources of information* – to ascertain accuracy, providence, and impartiality
- *Assumptions being made* – as above
- *Concepts being used* – to determine acceptability and applicability
- *Perspectives or points of view* – to understand semantics and biases
- *Implications of assumptions, concepts, and perspectives* – to identify dependencies and priorities
- *Interpretations and conclusions* – to validate against the evidence

(10) Adjust one's own beliefs – A key aspect of critical thinking is to draw conclusions based on the evidence. It turns out that these conclusions and beliefs are based on the evidence available at the time. However, as new evidence is discovered, or a wider experience or broader context is applied, or as previous assumptions and beliefs are challenged, we have to be able to adjust our own preconceived notions. After all, this is what we are asking of our stakeholders when we perform critical thinking, so we better be able to do it for ourselves.

Incidentally, I consider this one of the key characteristics of a good architect. Someone who is not open to different conclusions or new ideas in the face of the evidence is not who I want on my team. It takes a combination of open mindedness, fact based reasoning, and self-confidence to evolve one's belief systems, a combination I don't see all that often.

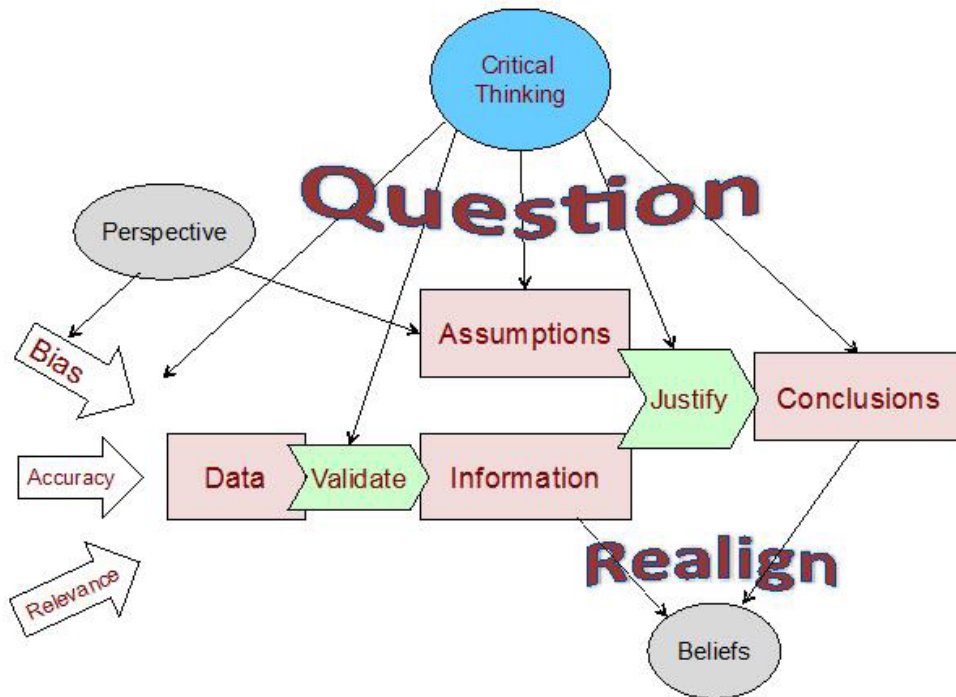


Figure 1 – Perspectives of Critical Thinking

The Critical Thinking Architect

When thinking about the skilled architects I do know I came up with a list of actions that characterizes the well skilled architect:

- Raises important questions and problems formulating them clearly and precisely. Questions assumptions.
- Gathers and assesses relevant information using abstraction to consolidate and interpret it
- Comes to well-reasoned conclusions and solutions testing them against relevant criteria, requirements, standards, and best practices
- Thinks open-mindedly recognizing and assessing their assumptions, implications, and consequences
- Communicates effectively with others in arriving at solutions to complex problems without being unduly influenced by preconceived notions or other's opinions

Of course, there are many other skills that a good architect has but let's just focus on this set for the context of this paper. I'll leave you with two important questions:

1. Do the above actions describe how you'd like to be described? Your aspirations for performance?
2. Can you see where the concepts discussed here and in Glaser's list of 10 skills would be a useful foundation for the above actions?

Conclusion

Architects need to collect information in order to understand requirements and environment and put them into context of best practices to establish solutions. But not all information is created equally. It must be examined in terms of accuracy and applicability as well as perspective, bias, and assumptions. To get to a good solution, first, those assumptions need to be questioned. Then the conclusions drawn from the data needs to be examined in terms of whether they are justified in face of the facts or are drawn from bias or preconceived notions. Critical thinking provides an architect with a set of skills to accomplish these important architectural tasks.

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