

Sense of Place within the Virtuous Circle of Architecture Decision-Making

A tutorial on practical approaches to understanding the current state of an architecture in the context of its history, in order to make decisions about its future evolution

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Abstract—First, we shape our architecture. Then, our architecture shapes us. As architects we bring part of ourselves to the systems we work with. We evolve with our architectures. In this tutorial we consider the metaphor of “*terroir*” to understand architectures and their sense of place. *Terroir* comes from the French word used to describe the set of all environmental factors that affect the observable characteristics of an organism, e.g., the unique set of contextual characteristics of place that influence food crops, coffee, tea, or wine. So too in systems, architectures are uniquely shaped by the culture and context of a place. Factors include people, organization, culture, technology, and tenets shared among the architects and makers. Understanding an architecture is a first step towards evaluating it. The set of concepts and practical tools covered in this tutorial are well suited to being used in conducting architecture analyses and reviews and integrate with any other processes an organization might be using.

Keywords—software architecture, decision making, decision models, complexity, large-scale systems, context, shared understanding

Tutorial Topic

*“We shall not cease from exploration,
and the end of all our exploring
will be to arrive where we started
and know the place for the first time.” – T.S. Eliot [1]*

We can improve our architecture by intentionally working with an understanding of its place and being more intentional about how we work. This includes being more aware of how we make decisions and making conscious choices about when to apply different decision-making approaches. This, in turn, positively influences the future architecture decisions we make. There is a unique set of environmental factors that affect any architecture’s observable characteristics. The “sense of place” of the architecture of a system is different for every architecture. We can’t fairly critique an architecture without knowing where it comes from. People are part of that sense of place. When we visit a new architecture, we like to make an intentional effort to experience its unique *terroir*, to discover what gives that architecture and its community a sense of place. This tutorial brings these concepts together into a usable and useful set of tools that help architects navigate the virtuous circle of decision making in software architecture.

State of the Art in the Topic

Software architects make decisions related to the architecture style of the system, as well as technological and economical decisions [2]. Architecture decision-making is an inherently complex task because the decisions often must satisfy multiple constraints and address multiple stakeholder concerns [2, 3]. Several formal, analytic architecture decision-making approaches have been published [4, 5] but software engineering researchers find few to be used in practice. One explanation for this may be that complex real-world decisions often are not about making tradeoffs, but instead about finding a reasonable decision that satisfies the current situation and allows for action [6].

Early decision-making research focused on decision-making models based on a rational consideration of alternatives. Given a known, limited set of alternatives, a decision-maker should be able to reason about the alternatives. However, Simon [7] proposed that complex situations, limited time, and our limited mental computational capacities constrain our decision-making and that consequently our decision-making is “bounded”. Instead of collecting and processing all possible information, we necessarily construct a simplified model of the relevant factors contributing to the decision, in order to analyze the consequences of each alternative to select the “best” one. Consequently decision-making is bounded by both the structure of the information in the environment and limits of our mental capabilities [7]. In analytic decision-making models the focus is on identifying situations where it is effective or where it fails due to cognitive limitations [8]. In contrast recognitional models of decision-making focus on the conditions where people can effectively make decisions without considering alternatives [5].

Pre-print. To appear as:

Power, K., and Wirfs-Brock, R. (2019). "Sense of Place within the Virtuous Circle of Architecture Decision-Making: A tutorial on practical approaches to understanding the current state of an architecture in the context of its history, in order to make decisions about its future evolution." IEEE International Conference on Software Architecture Companion (ICSA-C 2019)

The field of Naturalistic Decision Making (NDM) has the goal of studying how people actually make decisions in a variety of real-world settings, as opposed to in classroom or in laboratory settings [9]. Settings in which NDM is appropriate are characterized by time pressure, high stakes, experienced decision makers, inadequate information, ill-defined goals, poorly defined procedures, context, dynamic conditions, and team coordination [6]. In this tutorial we explore NDM in the context of software architecture.

Relevance for ICSA

Decision making is an essential element of software architecture. Some of the topics we cover, particularly Naturalistic Decision Making and different decision models, are under-explored in the context of software architecture. All topics covered in this tutorial contribute to approaches for understanding and evaluating architectures and taking action to evolve architectures. The tutorial provides some practical tools for architects to work collaboratively to quickly gain sufficient insight into the parts of an architecture they are interested in, at the level of abstraction they choose, with due consideration to its context.

Key Take-Away Messages

- How to gain a deep understanding of an architecture and its sense of place in a relatively short time
- Understand the decision models and be more intentional about the kinds of decisions that we are making that influence the architecture
- How to structure action in conditions of uncertainty in a way that is appropriate to the context of the decision
- Understanding of the cultural aspects that influence architecture decision making in organizations

Tutorial Implementation

Tutorial Duration

This tutorial is designed as a full-day interactive session.

Structure and schedule

- **Part 1: Making sense of system architectures.** The tutorial begins by introducing some concepts that help people to make sense of a system architecture. The outcome includes insight not just into the architecture itself, but also the wider context, including culture, decision-making processes, attitudes, constraints, and assumptions that contribute to the architecture. We will demonstrate how to see and interpret patterns to understand architecture context and understand the decision-making landscape of which architects are part.
- **Part 2: Decision models for architects.** Having established a sense of place for the architecture, we will move into discussing decision models. Different kinds of decision are necessary to evolve our architectures. Sometimes we need to make high-stakes decisions under conditions of uncertainty, with insufficient information, and too little time. Other times we need to balance deep thought, collaboration, and trade-offs among different architecture qualities.
- **Part 3: Taking action to evolve our architectures in conditions of uncertainty.** Once we have a sense of place, and we have decided how we will make decisions, we will move into action. In this tutorial we focus on making decisions and acting in conditions of volatility, uncertainty, complexity, and ambiguity. We explore the roles of heuristics and experimentation for making decisions under such conditions, and how this influences the evolution and evolve-ability of our architectures.
- **Part 4: Practical considerations for the dimension of time in architecture decisions.** In this section we will look at the temporal dimensions of architecture decisions. We will look at the time factors that affect our architectures. These include when decisions are made, the cadence of decision making, the impact of decisions over time, and challenges around ensuring follow-through and consistency of decisions over time.
- **Part 5: Summary and closing activities.** Summary of concepts, decision models and tools; Q&A. In this section we spend time to ensure participants have at least one or two practical things they are ready to try when they get back to the office.

Presenters' Backgrounds

Ken Power has held multiple positions in large technology organizations, including principal engineer, engineering director, and chief architect. His current responsibilities include leading global, large-scale engineering organization transformations with a focus on software and systems architecture, and engineering organization culture. He holds patents in virtualization and network management. He coaches and mentors architects, engineers, and engineering leaders to achieve their goals. His focus includes complex adaptive systems, sensemaking, flow-based development, software architecture, distributed systems, artificial intelligence, machine learning, strategy, technical debt, engineering management, and leadership. He has published widely on these topics, including winning IEEE Software Best Paper award for work on decision making in teams.

Rebecca Wirfs-Brock is an object design pioneer who invented the set of design practices known as Responsibility-Driven Design (RDD) and by accident started the x-Driven Design meme. She is author of two popular object design books and has served as design columnist for IEEE Software. Rebecca helps teams hone their design and architecture skills, manage and reduce technical debt, and address architecture risks. In addition to coaching and personal mentoring, she teaches and conducts workshops on architecture and design. Rebecca is program director of the Agile Alliance's Experience Report Initiative [10] and

serves on the Board of the Hillside Group. Recently she has written essays about the relationship between patterns and heuristics, and patterns about how to create and manage magic backlogs, sustainable architecture, agile QA, and adaptive systems architectures.

Both Ken and Rebecca have led many sessions, workshops, and tutorials at conferences (including ECSA, SATURN, OOP, DDD, Agile, XP, Lean Kanban) as well as in-company workshops and teaching on these topics.

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