Feminine Expertise in Architecting Teams

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// Interviews of software architects and a panel of experts revealed seven "flavors" of expertise connected to the feminine role in architecting teams. Much of this expertise relates to the skills required to successfully deal with software architecting's human aspects. //

DESPITE THE VARIANCES in human behavior, most societies tend to assign certain traits to men and women. Assertiveness and competitiveness are considered masculine, whereas cooperativeness and modesty are considered feminine. However, such assignments are relative. Men can behave in a "feminine" way and women in a "masculine" way. This means only that they deviate from certain conventions in their society, and those conventions differ across societies.[1]

The predominance of men in IT[2] has an immediate consequence: fewer people in this profession hold feminine traits and skills. In response to this shortage, many strategies have aimed to increase the number of female professionals, all driven by one assumption: gender diversity brings innovation.[3] For example, we're told that architecting software is a creative process that, in the end, is all about the team's collective skills.[4] Some have heralded the idea that gender diversity in software teams leads to a delicate balance between the traits and skills attributed to the feminine and masculine roles.[5] So, a lack of feminine traits and skills in architecting teams can harm architecting, but what traits and skills attributed to the feminine role contribute to architecting activities?

With this question in mind, we carried out interviews in the Netherlands at four major IT companies: Capgemini, Cisco, IBM, and Oracle. We interviewed technical architects to identify the expertise that brings concrete advantages to technical aspects. We interviewed lead architects to investigate how the companies invested in gender diversity.

As a result, we identified seven "flavors" of feminine expertise—that is, a combination of traits (characteristics and behavior attributed to femininity) and skills (learned abilities in playing the gender roles). Many of them suggest that architects, male or female, who exhibit feminine expertise can successfully deal with software architecting's human aspects. From a management perspective, however, the results show that the surveyed companies aren't exploiting gender diversity in setting up architecting teams, even if they all recognize the importance of gender-balanced teams in successful architecting.

The Study Design

We wanted to determine what expertise the interviewees attributed to the feminine role and how such expertise contributed to Philippe Kruchten's three categories of architecting activities:[4]

- *architecting*—architectural design, prototyping, evaluating, and documenting;

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TABLE 1

An overview of the 11 interviewees.

Interviewee	Company	Role	Gender	Experience (yrs.)	Project context
ORS	Oracle	Lead architect	F	14	Financial services
OSK	Oracle	Technical architect	F	16	A data management system for health insurance
OKO	Oracle	Technical architect	M	20	Modernizing a banking system
CNW	Cisco	Technical architect	F	17	Networking software
CFW	Cisco	Lead architect	M	18	An identity management system
CLZ	Cisco	Technical architect	M	16	Networking software
IJH	IBM	Lead architect	M	18	Embedded systems for document scanners
IAK	IBM	Technical architect	F	16	Cloud migration
CGG	Capgemini	Lead architect	M	19	A public-administration system
CED	Capgemini	Technical architect	F	20	A legal-fraud system
CDR	Capgemini	Technical architect	F	20	A payroll system

- *inward communication*—getting input from the outside world, such as listening to customers and other stakeholders; and
- *outward communication*—providing information about the architecture or help to other stakeholders or organizations.

Moreover, we wanted to understand whether capturing the flavors of feminine expertise would help industry solve crucial problems. In other words, would knowing these flavors bring any benefits? And if so, what benefits? To investigate these questions, we organized a panel of experts, which we discuss in more detail later.

The Participants

We asked each participating company to provide three experienced architects (with at least 10 years' experience) of both genders. One of them had to be a lead architect. Table 1 provides an overview of the 11 interviewees. (At IBM, only two architects were available for the interviews.)

The panel of experts included some of the interviewees and four senior architects (one from each company) who hadn't been part of the interviews.

The Interviews

We chose interviews because they're appropriate when the goal is to identify the experience of individuals or organizations,[6] primarily by asking open-ended questions. Our study is classified as an expert opinion survey.[6] Of course, the interviewees' opinions could be based on wrong assumptions or biases. To mitigate this risk, we followed Roel Wieringa's approach[6] and asked the interviewees to explain their opinion using a concrete experience from a specific project.

We developed an interview guide that would help synchronize the terminology and let the interviewees reflect on their experience before the interviews. (The guide is at http://tinyurl.com/ov6bff8. This study's results are drawn mainly from questions in sections 1 and 3 of the guide.) We piloted the first version of the guide with four practicing architects.

We then sent the interviewees a copy of the guide and background information on the study. We conducted the interviews at the individual companies and recorded them on video (560 minutes total).

In the interviews, the interviewees reconstructed their experience in a certain architecting team collaborating with both male and female architects. They selected one recent project and told us whether female architects worked differently from their male counterparts, and how. Through this question, they recollected and described a range of skills that contributed to architecting. They also told us whether they felt

TABLE 2

An overview of feminine expertise.

Flavor of expertise	No of interviewees who listed the flavor as feminine*					The related architecting activity
	Females	Males	Lead architects	Technical architects	Total	
Eliciting the real needs	6	4	4	6	10	Inward communication
Communication	5	4	4	5	9	Outward communication
Intuition	3	4	3	4	7	Architecting
Exploring the problem and solution spaces	3	4	3	4	7	Architecting
Cherishing relationships	3	3	4	2	6	Outward communication
Questioning	2	3	2	3	5	Inward communication
Embracing ambiguities	1	2	2	1	3	Architecting

** There were 11 interviewees all together.*

those skills were gender-specific or just individual traits.

Data Analysis

To identify the feminine-expertise flavors, we analyzed each interview transcript. Our qualitative-analysis method was transcript coding. We had an initial set of codes called a *start list*, which we refined during the analysis. Our start list stemmed from the three architecting activities (architecting, inward communication, and outward communication) and our study's research questions. We used open coding to categorize the expertise attributed to the feminine role. We used our start list to map those categories to architecting activities, as we show later. Each transcript was independently codified by two researchers and then compared.

The Panel of Experts

After the initial analysis, we organized the panel of experts. They provided feedback on the flavors and reflected on the potential benefits of knowing the available feminine expertise up front.

The Results

Table 2 provides an overview of the seven flavors and their distribution in the 11 interviews. It indicates the number of interviewees who explicitly assigned a given expertise to the feminine role. It also shows the mapping of the flavors to the three categories of architecting activities.

Figure 1 graphically depicts the mapping. As the figure shows, feminine expertise relates mainly to the architect's communication role—both inward and outward. Next, we describe each flavor, discuss our related findings, and list the architecting activities[4] that can benefit from the seven flavors.

Eliciting the Real Needs

Most, if not all, architecting projects include requirements engineering, which involves eliciting the customer's needs and the requirements the solutions should fulfill.[4] A common perception is that customers know what they need, they communicate those requirements, and analysts translate them to the requirements that, when implemented, should lead to fulfilling the customer's need. However, this isn't what happens in practice. What customers communicate as their requirements often aren't what they really need. Overlooking the real needs can result in a brilliant solution architecture that doesn't solve the real problems.

Ten interviewees attributed inquisitiveness about the customers' real needs to the feminine role. OSK said, "My colleagues playing the feminine role are more conscious about what they really need." CLZ said, "In my experience, feminine roles in my team keep asking questions until they know what the customer really wants. For example, they ask many questions of type 'Why are you doing this?' to elicit the unstated needs." CDR said, "What I see is that architects playing the feminine role can better translate customer needs to concrete requirements."

Related architecting activities: All the usual requirements analysis activities associated with design—understanding requirements; extracting architecturally significant requirements; understanding customer and market trends; and capturing customer, organizational, and business requirements in the architecture.

Communication

Architecting projects rely heavily on people and thus on the power of communication.[7] The interviewees emphasized that whatever new processes, techniques, and software tools they come up with, it's still the people who have to communicate and collaborate to analyze and design the architecture solutions.

Ten interviewees identified communication as a feminine expertise. CGG said, "Feminine roles are much more natural in communication, both with colleagues and with the customers." IAK said, "Feminine roles, usually, are skilled in making a common ground in communication, they can effectively communicate despite cultural barriers or differences, and they have good skills to bring the right message to the table."

Related architecting activities: Consulting with design, implementation, and integration teams; understanding what the developers want and need from the architecture; and helping developers see the architecture's value and understand how to use it successfully.

Intuition

Psychologists have traditionally identified intuition as a trait, according to the Myers-Briggs Type Indicator,[8] of people who pay attention to complex interaction patterns, theoretical implications, and new possibilities. This is in contrast with those people who are attuned to the practical, hands-on view of events. In the ever-changing environment of architecting projects, architects must often make decisions based on incomplete information. This is when intuition—holistic thinking, immediate insight, or seeing the answer without knowing how it was reached—can be important.[9,10] Interestingly, Luiz Capretz and Faheem Ahmed indicated intuition as a key personality trait that software engineers usually lack.[5]

The interviewees repeatedly mentioned that architects playing the feminine role tend to be more comfortable with intuitive decision making. They can use tacit or incomplete knowledge—knowledge that you can't explain, like how to ride a bike—to choose among alternatives or draw conclusions. IJH said, "Feminine roles in my team are more comfortable to decide based on incomplete data. This type of decision making is absolutely a necessity because customers never give you the whole data and then you need to make decisions." CLZ said, "Feminine roles can generalize concepts from a somewhat unrelated set of information."

Related architecting activities: Isolating relevant items from large quantities of fuzzy and imprecise data, which require the intuition to recognize patterns; imaginative and innovative designing; and forming insights into what's feasible, doable, or too far-fetched.

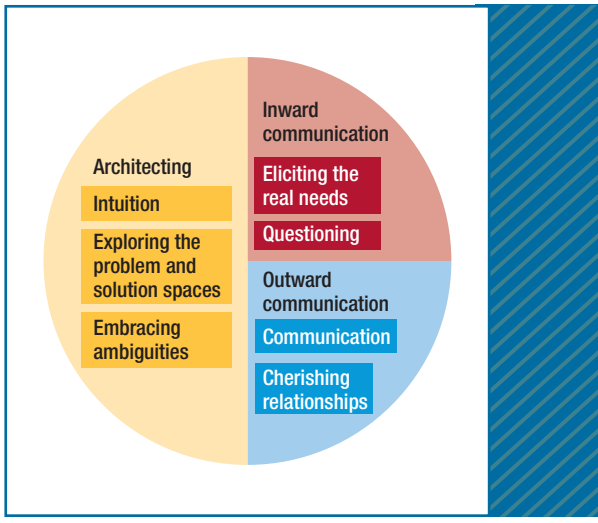

FIGURE 1. Mapping the seven flavors of feminine expertise to the three architecting activities. Feminine expertise relates mainly to the architect's communication role—both inward (for example, listening to customers) and outward (for example, describing the architecture to the customers).

Exploring the Problem and Solution Space

Studies of design techniques indicate two important activity types:

- exploration—scoping and identifying the problems and possible solutions, and
- problem solving—dealing with a certain problem in depth.

Architects use these two activities in combination. However, according to Antony Tang and Hans van Vliet, how they do this can influence a project's success or failure.[11] For example, when architects don't fully explore the problem space, the design decisions based on the related assumptions or requirements can be faulty.

The interviewees emphasized that architects playing the feminine role tend to explore the problem more broadly; they're skilled in capturing an adequate picture of the issues and

alternative solutions. IJH said, "In my experience, teams that work the best are the teams that have people who are versatile. They are usually the ones that tend to take different perspectives on a subject manner. … They usually look for possible problems, unstated requirements, and different solutions, and they are quite often people who play the feminine role." CNW said, "What I see is that feminine roles tend to take a step back and look at the end goal; they look for alternative solutions, more so than men."

Members of the panel of experts emphasized that architects playing the feminine role tend to explore the context, problem, and solution at hand broadly and consider possible solution options. In contrast, architects playing the male role explore a particular design area in depth.

Tang and van Vliet suggested that architects combine breadth-first and depth-first thinking—exploring and scoping the design areas broadly versus going deep into a certain area's problem and solution spaces.[11] Architects often switch between. This flavor might suggest that breadth-first reasoning comes more natural to the feminine role.

Related to breadth- and depth-first thinking, IAK said, "When the project is very new, new technology or new domain, a lot of understanding should happen up front; you cannot just dive into the solution. But, when the technology and domain are familiar, you can just dive in. For the first case, you would better have feminine roles in your team; for the second case, a male-only team might be even better."

Related architecting activities: Synthesizing a solution, exploring alternatives, validating, assessing technical risks, and working out risk mitigation strategies or approaches.

Cherishing Relationships

We often need to remind ourselves that, in the end, architecting projects are really all about people. These projects' success depends heavily on the social relationships of the people involved.[12]

Six interviewees emphasized that, generally, team members playing the feminine role are skilled in building relationships with both customers and team members. ORS said, "Feminine roles are skilled in linking people together." CED emphasized that "feminine roles have more empathy with the customer, and they can solve problems before they escalate." IAK said, "Colleagues playing the feminine role have a different style in building relationships with customers; they tend to make a common ground, sometimes beyond the work and problems. This is very valuable for the success of the project."

Related architecting activities: Recruiting prospective customers, helping other teams that are experiencing a difficult technical issue, and assisting product marketing.

> Embracing ambiguity can lead to discovering new problems and innovative solutions.

Questioning

Architects need to ask their stakeholders the right type of questions. Unfortunately, the traditional, prevalent, approach is to ask a lot of technology-related "How?" and "What would you like?" questions. However, curiosity-related questions such as "Why?" or "What if?" can be a powerful tool for architects to widen the boundaries, elicit unstated goals, or reflect on decision making.[13]

The interviewees stated that team members playing the feminine role use questioning more often and more comprehensively. IAK said, "Feminine roles are less reluctant to ask questions for help or direction, and they use their network much more effectively. This can save us considerable time and effort." OSK said, "Feminine roles in my team tend to ask more questions—sometimes just for clarification, but also to bring up their ideas." CED said, "Feminine roles in my team always ask 'What if?,' and this sometimes reveals problems that the customer is not aware of."

Related architecting activities: Reflecting on the problems and constraints, identifying risks, triggering reflection in junior team members, identifying unknown assumptions, and challenging solution options and decisions.

Embracing Ambiguities

Ambiguity is intrinsic to any architecting project. Sometimes architects overcome it, removing it and making everything precise. Sometimes architects embrace ambiguity, accepting the possibility of not understanding exactly how the pieces

fit together. Embracing ambiguity can lead to discovering new problems and innovative solutions.[14] So, tolerating, exploiting, and removing ambiguities at the right times can lead to greater innovations.

Three interviewees attributed this skill to the female role. IJH said, "There are architects who avoid ambiguity and the ones who are comfortable with it. Female architects usually cope well with ambiguity, and that is how they fill the gap in knowledge." OSK said, "Usually feminine roles are very skilled in highlighting issues and problems, but they are also comfortable not having an answer for them."

Related architecting activities: Discovering new opportunities by eliciting answers to the questions that ambiguities trigger, and avoiding premature commitment to a solution.

Incorporating Feminine Expertise into Architecting Teams

When building architecting teams, we ask ourselves whether we have the right collective expertise for the architecting activities. Kruchten suggests that a well-focused, balanced team spends 50 percent of its time and effort on communication and the other 50 percent on technical architecting activities (for example, architectural design, prototyping, evaluating, and documenting). Four of the flavors contribute directly to the architect's communication role, whereas the other three capture the soft skills needed for architecting.

So, to keep a team well focused and balanced, we suggest using gender-aware team-building practices. This would mean assigning holders of feminine expertise to activities to which they can directly contribute (see the lists of architecting activities in the previous section). For example, for requirements analysis, team members who can elicit the customers' real needs will be extremely valuable. Therefore, making team members who play feminine roles responsible for the related activities will increase the probability of providing a solution that addresses the real needs.

This study laid the foundations of such practices—understanding the types of traits and skills linked to feminine roles and relating them to relevant architecting activities. Future research is needed to elicit gender-aware practices for various types of architecting projects and various settings. Such practices should also produce ways to train software architects to acquire both technical competences and feminine (and masculine) expertise.

Discussion

The traits and skills we describe here have been reported as making a real difference in terms of the ability to tackle hard problems[3] as well as technical and sociotechnical results in software projects.[5]

The expertise we found is in line with the typical traits of femininity in societal cultures[1]—that is, a focus on relationships, people, flexibility, and intuition. Geert Hofstede and his colleagues famously labeled various societies according to their gender role patterns:[1]

- masculine societies in which feminine and masculine behaviors are clearly distinct, and
- feminine societies in which male and female behaviors overlap.

They considered the Netherlands to be a feminine society. In such societies, the risk of a shortage of feminine expertise in a primarily male team is lower. Conversely, a primarily male team in a masculine society should cause project managers to examine the team's blend of skills and expertise and possibly use gender-aware team-building practices.

> To attract and retain women, promotion policies should consider feminine expertise.

Unfortunately, even the companies that address gender diversity in their hiring policies don't effectively use such gender-aware practices when building teams. Hiring more IT women professionals doesn't necessarily mean becoming better. Only if role and activity assignment considers feminine expertise will it make a difference, eventually increasing the probability of successful projects.

The members of the panel of experts emphasized that career paths in organizations currently don't reward feminine expertise. To attract and retain women, promotion policies should consider feminine expertise. In this way, employees playing feminine roles will be able to find or create a rewarding niche for themselves in the profession. They'll do this by aligning their expertise with their job duties and thus achieve satisfaction in a job in which they can respect their preferences and feel

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comfortable with themselves and their roles.

Although we surveyed only four companies, they provided a relevant representation because they're multinational and influential in the IT industry. In addition, we presented our results to various boards and networks representing other IT companies, including VHTO (www.vhto.nl), the National Platform on Women and ICT (www.platformvrouwenict.nl), and PyLadies (www.meetup.com/PyLadiesAMS). They gave us positive, confirmatory feedback.

As is often the case in studies focusing on software engineering's human aspects, we have only opinion-based evidence of how each expertise exactly contributes to architecting. Moreover, because the interviewees kept confidential the identity of the architects playing the feminine role, we couldn't control confounding factors related to their background such as training. Although this study focused on software architecting, many expertise flavors fall into the soft-skills category and can thus benefit software engineering in general.

A possible limitation of the generalizability of the results is that the survey was relatively small and the companies were in the Netherlands. As such, the social culture of the Netherlands might have influenced the results. To mitigate this threat, we chose the interviewees from international companies that were geographically distributed. Nevertheless, we plan to geographically extend the survey to further investigate the results' generalizability. Moreover, we plan to cover small and medium enterprises and other types of companies specializing in Internet-related services and products. Although our exploratory analysis suggests that feminine expertise and architecting activities are related, further research is needed to determine exactly how those expertise flavors benefit architecting.

We hope this article inspires IT companies to revisit how they set up project teams and assign responsibilities. As with teaching technical skills, corporate training programs and on-the-job coaching should address feminine and masculine expertise.

Acknowledgments

This research received funding from ECP and Digivaardig & Digiveilig. Special thanks to the architects who participated in the interviews, as well as Astrid Zuurbier and Cocky Booij for their support.

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