Software Engineers in China and the US: A Comparison of Cognitive Styles

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Abstract

- The number of software projects developed as a collaboration between China and the US is increasing.
- A good understanding of how culture affects collaborative software development would be useful.
- Software engineers in China, ($n=314$) and the US ($n=158$) completed Allinson and Hayes' (1996) Cognitive Style Index (CSI) online.
- An independent samples t-test of means showed the Chinese software engineers to be significantly more analytical than those in the US.
- Given the lack of face-to-face contact, cross-cultural software collaborators may especially benefit from recognizing and managing cognitive style differences.

Cognitive Style and Software Engineering

- High performers in software development are distinguished by how they organize knowledge, and ways of thinking and solving problems (Clark, Walz, & Wynekoop, 2003).

Organize, Think, Solve ➡ *High Performing Software Engineers*

- Tenant's definition of cognitive style as cited by Allinson and Hayes (2000): "an individual's characteristic and consistent approach to organizing and processing information" (p. 161).

(Organize and Process Information = *Cognitive Style)* ➡ *Software Engineering*

- Conversely, Bishop-Clark (1995) posited that the activity of computer programming might have an effect on cognitive style.

Software Engineering ➡ *Cognitive Style*

Cognitive Style and Culture

- Cognitive style has been the subject of much cross-cultural study. A good number of these studies group subjects by country of origin, and then more broadly categorize countries as either "East" or "West."
- Studies of culture and cognitive style have produced mixed results.
  - Some studies found people in the East to be more intuitive (Nisbett, 2003; Norenzayan, Smith, Kim & Nisbett, 2002; Xing, 1995)
  - Some studies found people in the West to be more intuitive (Allinson & Hayes, 1996).
  - Other studies showed that the geographical location of a country did not determine cognitive style (Allinson & Hayes, 2000; Parikh, Neubauer and Lank, 1994). Allinson and Hayes suggest *stage of industrial development* as a possible differentiating factor.

- Although there does not appear to be agreement on how and why cognitive styles vary, differences between cultures have been found.
- The majority of studies focus on managers and managerial students (possibly because the managerial level was the first where inter-cultural collaboration occurred). Studies of non-managers may produce different results.
- China and the US differ in both geographical category and stage of industrial development indicating a possible difference in cognitive style.

Study Question

Does culture (specifically Chinese and American) have an affect on the cognitive style of software engineers as measured by the Cognitive Style Index?

Table 1. *Work Practices of Individuals with Analytical and Intuitive Cognitive Styles*

Analytical	Intuitive
Compliant	Nonconformist
Prefers structured approaches to decision-making	Prefers rapid, open-ended approaches to decision-making
Thinks using logical sequences and vertical reasoning	Thinks using synthesis and lateral reasoning
Comfortable handling problems step-by-step	Relies on random methods of exploration
Applies systematic methods of investigation	Works best on problems using a holistic approach

Note. Adapted from "The Influence of Individual Cognitive Style on Performance in Management Education," by S. J. Armstrong, 2000, *Educational Psychology*, 20, p. 324.

Method

Participants

Participants were software engineers living in China and the United States. The gender, age, and experience breakdown for each group is shown in Table 2. No attempt was made to balance the gender, age, or experience levels of the two groups.

Table 2. *Demographics*

| Group	*n*	Gender		Age (years)		Experience (years)	
		Female	Male	<= 29	> 29	<= 5	> 5
China	314	4.1%	95.9%	92.4%	7.6%	90.4%	9.6%
US	158	3.8%	96.2%	23.5%	76.5%	27.2%	72.8%

Materials

The CSI consists of 38 self-report items. Scoring moves along a continuum from 0 to 76, from intuitive to analytical cognitive styles. A Chinese-language version was used for Chinese participants.

Participants were recruited using various software programming newsgroups frequented by software engineers in China and the US. The researcher created an online version, which included an orientation page and the survey itself. Participants were asked to identify their country and profession. Timestamp, Email, host, and IP Address information were gathered. Duplicates were identified and removed using this information. A server script was used to score the CSI, and participants were immediately provided with their results and debriefing information.

Results

An independent samples t-test showed that Chinese software engineers are significantly more analytical (M=42.84, SD=9.6, n=314) than US software engineers (M=40.45, SD=11.5, n=158), t=2.39, $p < .05$.
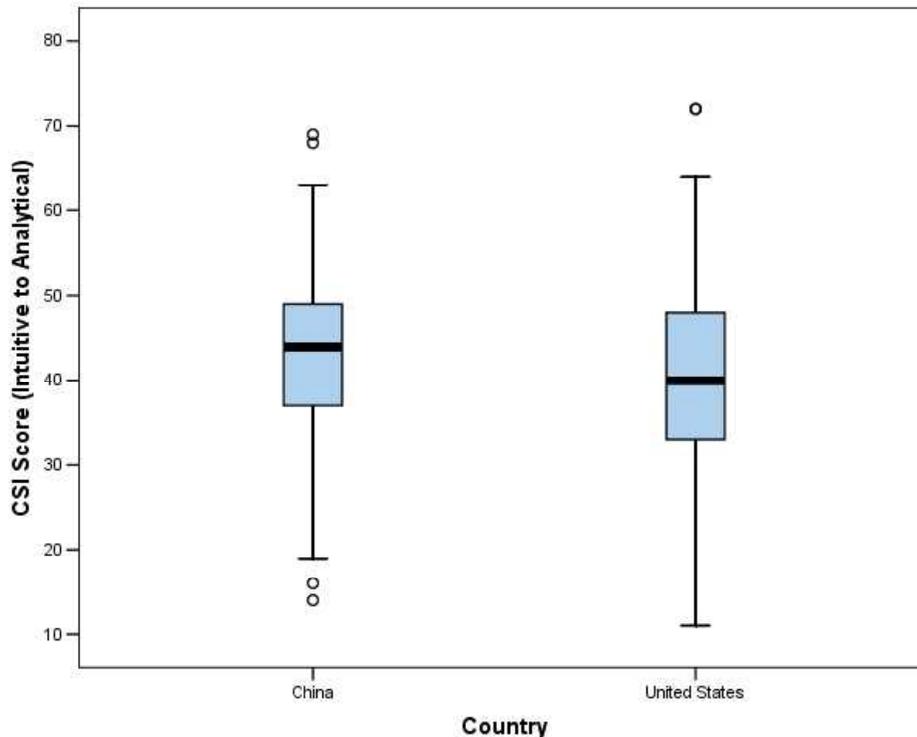
Discussion

Limitations

The Chinese participants were much younger ($M = 20$-29) than the US participants ($M = 40$-49). However, Pearson's correlation showed no relationship between age and CSI score, $r(472) = -.014$, $p > .05$. This factor could be discounted if cognitive style were considered a constant human attribute, which is the view of the designers of the CSI.

The external validity of the study is threatened if the readers of the newsgroups to which the survey was posted are not representative of the software engineering community as a whole.

Conclusion

In my many years of software engineering experience I have noticed that engineers with different problem-solving styles can work together successfully, regardless of their cultural background. However, there are often misunderstandings, missteps, and missed opportunities. The

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Intuitivist's preference for open exploration and open-ended approaches to problem solving may appear disorganized, unfocused, and risky to the Analyst. The Analyst's structured and detailed step-by-step analysis of a problem may seem slow, inefficient, and frustrating to the Intuitivist.

With a better understanding of each team member's problem solving approach, members can be assigned to tasks to which they are best suited. With a better understanding of how others perceive one's own approach, steps can be taken to inform others of its value. With an appreciation of how another's approach benefits the group, acceptance can become easier.

Research exploring the consequences of these perceptions among working groups might uncover ways to increase understanding of how these views affect productivity, quality, and workplace satisfaction. Further, it may suggest ways to integrate these necessary differences, promoting an appreciation for how both styles enrich work results and work experiences. After all, intellect needs intuition to guide it and intuition needs intellect to bring information to it.

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Acknowledgments

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