

CS 428
**“THE FIVE ORDERS OF
IGNORANCE” (ARMOUR)**

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THE TRUE NATURE OF SOFTWARE

- Software is a knowledge-storage medium
- Developing software is a knowledge-acquiring activity
- We seldom have perfect knowledge ahead of time
 - If we do, then why are we doing this? The problem has already been solved.
- Therefore, software development is an inherently inefficient exploration and discovery process
 - We determine what works
 - We determine what does not work (for this particular system)
- Observations and experiences?

WHAT CAN HAPPEN ALONG THE WAY

- The problem of late discovery
 - Blind alleys, significant backtracking
 - Webster: [Do not Defer the Difficult in IT Projects](#) (2013)
- Two kinds of knowledge
 - Again, what doesn't work and what does
 - Sometimes, what doesn't work is just as valuable, but is often discarded
- “Corrupted” knowledge
 - The code often contains artifacts or remnants of our knowledge exploration during development – these may be misleading or obscuring
- Observations/experiences?

WHAT THE DISCOVERY PROCESS LOOKS LIKE



Exhibit 6. A path through the woods.

WHAT THE DISCOVERY PROCESS YIELDS

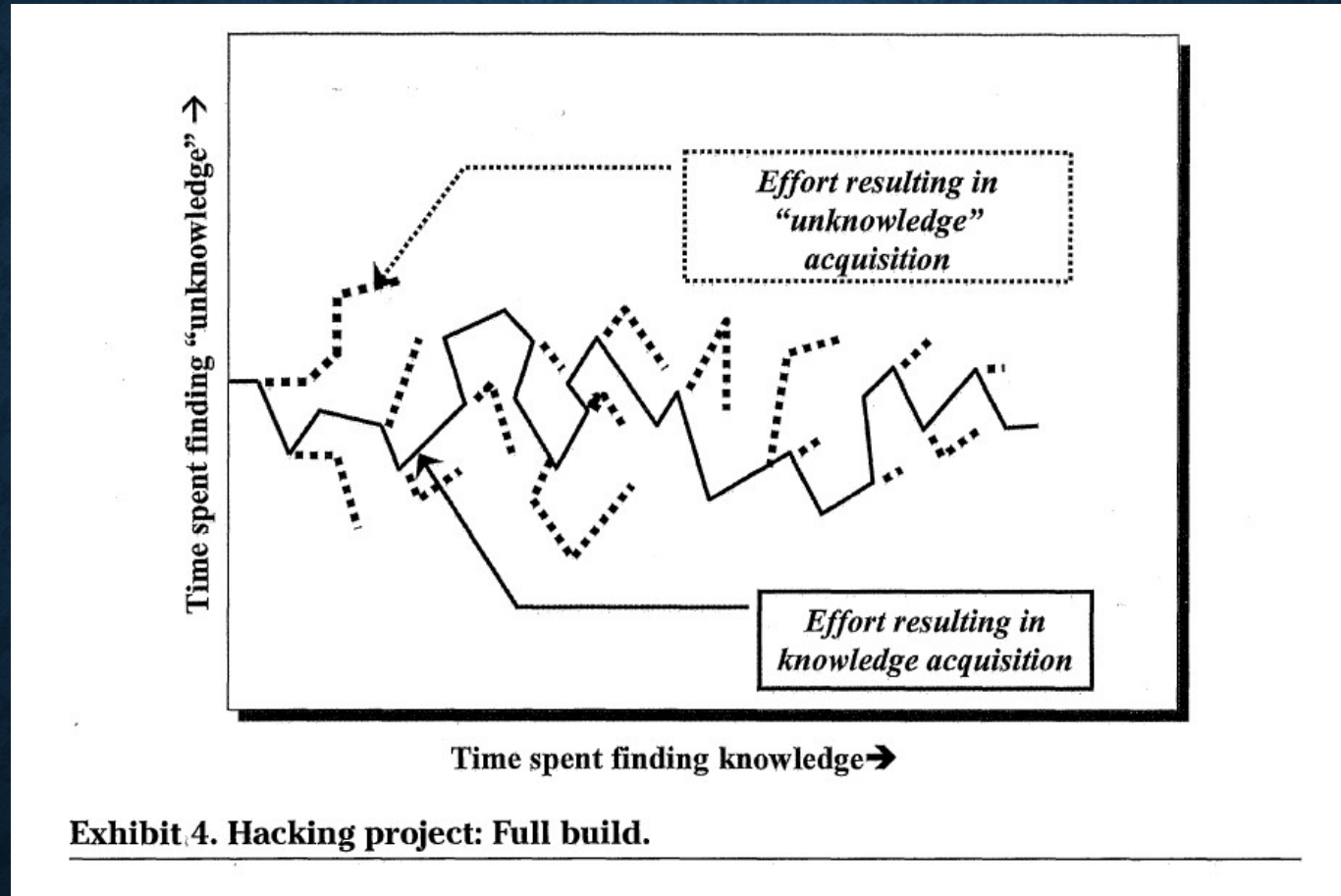


Exhibit 4. Hacking project: Full build.

THE FIVE ORDERS OF IGNORANCE

- **Zeroth Order: Lack of Ignorance**
 - I know something, I know that I know it, and I can demonstrate I know it
- **First Order: Lack of Knowledge**
 - I don't know something, and I know I don't know it
- **Second Order: Lack of Awareness**
 - I don't know something, and I don't know that I don't know it
- **Third Order: Lack of Process**
 - I lack a process by which I can discover that I don't know that I don't know something
- **Fourth Order: Meta Ignorance**
 - I don't know about the Five Orders of Ignorance

APPLIED TO SOFTWARE DEVELOPMENT

- 0th Order: I know how to complete the system
- 1st Order: I know what I need to know to complete the system
- 2nd Order: I don't know yet what I will need to know to complete the system
- 3rd Order: I don't know how to discover what I need to know to complete the system
- 4th Order: I have no clue about any of the issues above

ORDER OF IGNORANCE CYCLES

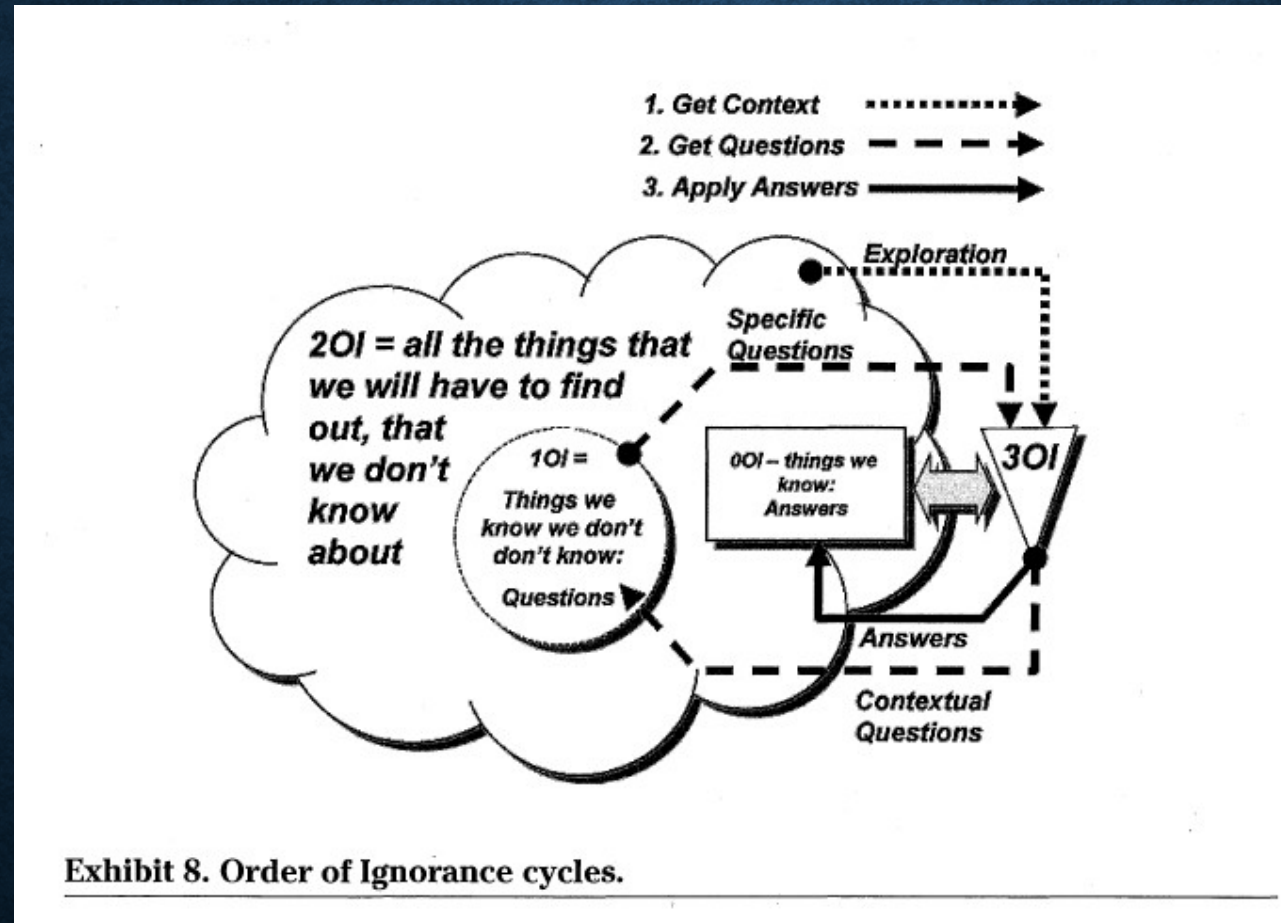


Exhibit 8. Order of Ignorance cycles.

HOW IT ACTUALLY IS



NATURE OF THE PROCESS

- To identify whether there are areas where we have ignorance (need to acquire knowledge)
- To identify what questions we would need to ask to resolve ignorance in these areas
- To obtain the answers to these questions in a form that we can usefully integrate into the system
- Key problems
 - Acquiring knowledge also illuminates more areas of lack of knowledge
 - Humans have not found a way to empirically measure knowledge
 - The critical measure of knowledge in software is that of the knowledge *not* in the software
- Observations/thoughts?