

Capability Maps

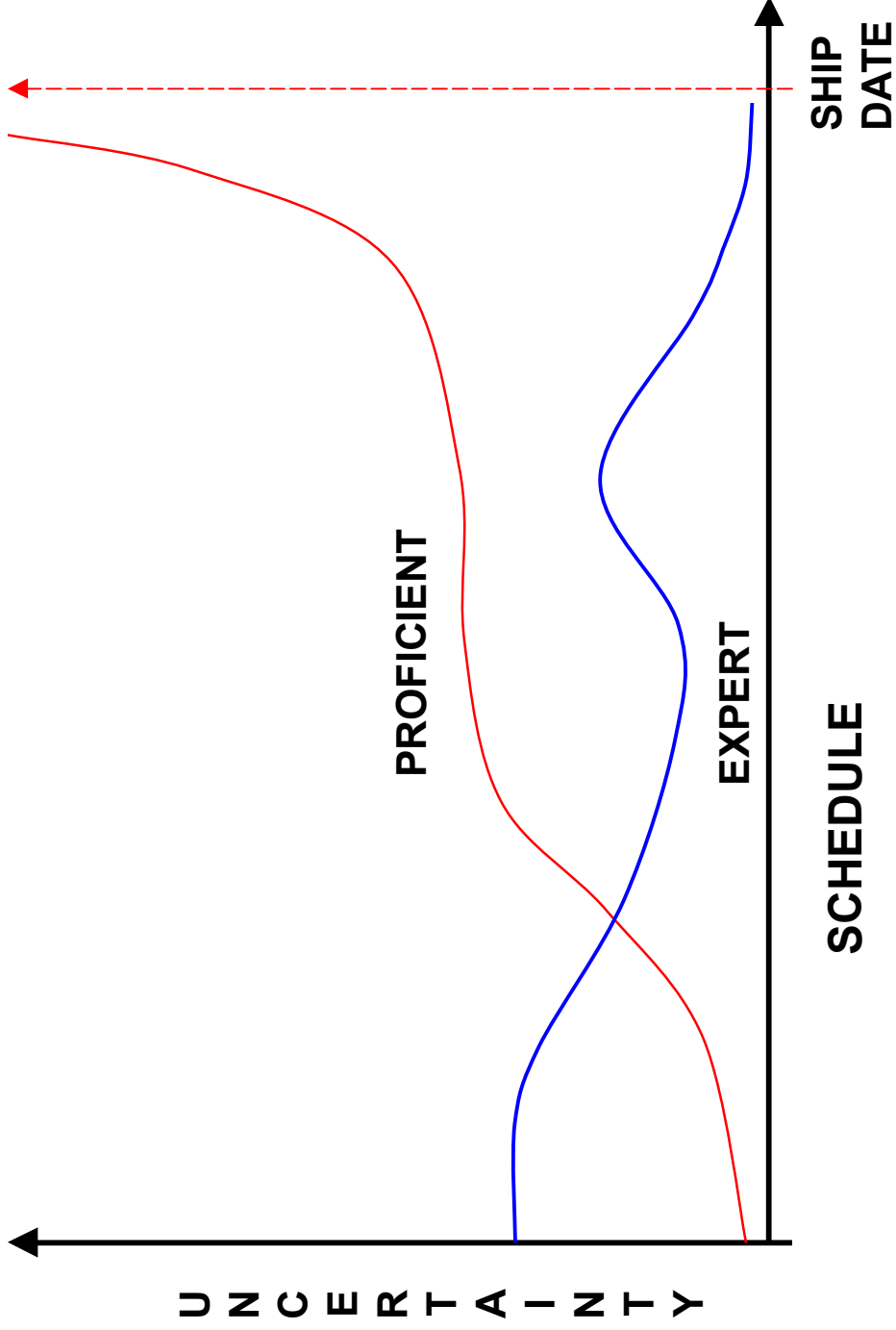
**Demonstrating our expertise using
Behaviorally Anchored
Self-Assessments**

Problem as Posed by Martin Fowler et al

"How do we make it accepted that able people who are expensive end up being better value than cheap, less able developers?"

Performance Signatures

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SCHEDULE

SHIP
DATE

What are the Drivers?

- Liability
- Institutional Consistency
- Recognition of Specialties
- Wage compression
- Underemployment
- Pay for value

Persistent Questions

- “How could pay for performance truly work?”
- “Can people really be paid on merit?”
- “Market value is real value, isn’t it?”
- We claim competency-based compensation using BASA is practical.

Some Current Attempts to Evaluate Merit

- Sun Certification
- Microsoft Certification
- Brainbench
- TopCoder
- “Exams can’t measure key capabilities...”

Programmer Testing Services Get Wary Reception From IT

Some CIOs say exams can't measure key capabilities beyond coding skills

BY THOMAS HOFFMAN

INFORMATION technology executives last week had mixed reactions to the emergence of so-called programmer testing services that can be used to measure and rank the accuracy and technical know-how of both offshore and domestic soft-

tract with Wipro Ltd. to provide tests to programmers at the Bangalore, India-based software services firm. Brainbench has about 100,000 results for each of the major programming languages for which it offers tests, said Mike Russiello, the company's president and CEO.

Testing Techies

	TopCoder	Brainbench
WHAT THEY OFFER	500-plus problem-solving tests for Java, C++ and C# developers	220 IT-related tests, about 20 of which are specific to application programming
WHAT IT COSTS	\$12,500 for a six-month license that lets companies test up to 50 programmers	Starts at \$200 per seat for an annual license that provides unlimited access to tests

Untangling Words

- Learning, understanding
- Knowledge, behavior
- Inferred data, snapshot data
- Test scores, authentic performance

Certification et al: Evaluation alternatives

- **Certification**
- **Resumes**
- **Portfolios**
- **Personal recommendation/project reputation**
- **Professional licensure**
- **Authorship, recognized trade leadership**
- **Professional assessment services**
- **Educational credentials, transcripts**

Practical Problems

- Credibility is uncertain, untraceable
- Knowledge vs. Behavior confusion
- Don't show authentic performance
- Predictability vague, retained knowledge nil
- Scalability unlikely
- Having to rewrite often is tedious
- Often expensive and delayed

History of BASA:

Behaviorally Anchored Self-Assessment

- Originated as way to measure effectiveness of educational system
- Used in competence-based performance reviews
- Used in K-12 education
- Used in college elearning
- HR theory cites it as best practice
- Often described as time consuming

What is a BASA?

- Usually a one page document
- Organized by Developmental Stages of Expertise
- Lists behavioral anchors (strongly inferential statements depicting a capability)
- ~Quarterly the operator/trainee indicates T/F of each anchor item
- An expert corroborates each item for accuracy

The Working Principles

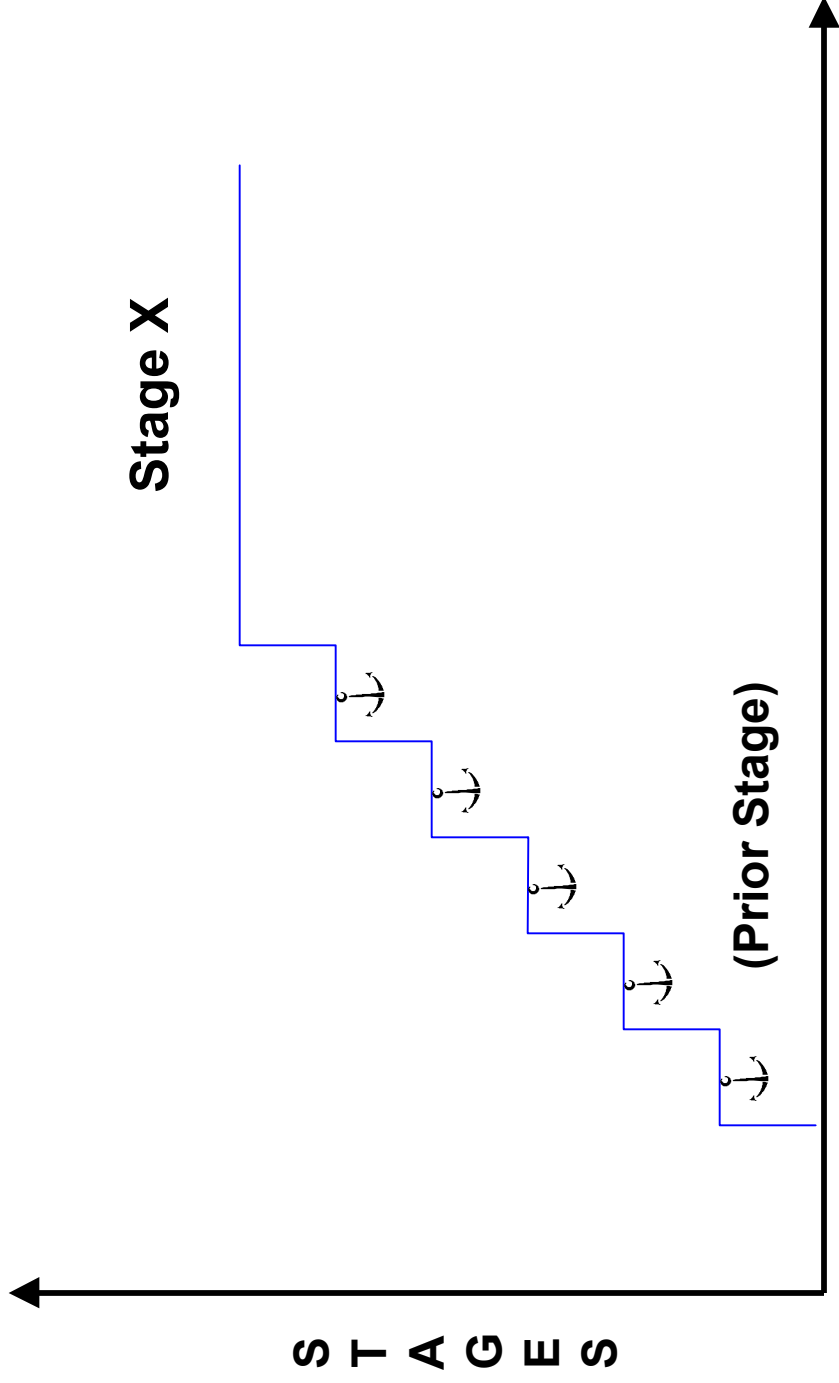
- Dev. stages as emergent view of expertise
- Self-awareness of capability yields accurate data
- ‘Anchors’ are compelling evidence
- Strong inference from anchors
- Expert corroboration
- Simplicity in context and format
- Compactness via interpolation between anchors
- Highly reusable & chartable over time

Developmental Stages of Expertise

- Novice
- Advanced Beginner
- Competent
- Proficient
- Expert
- Master

Anchoring Each Stage (Inferentially)

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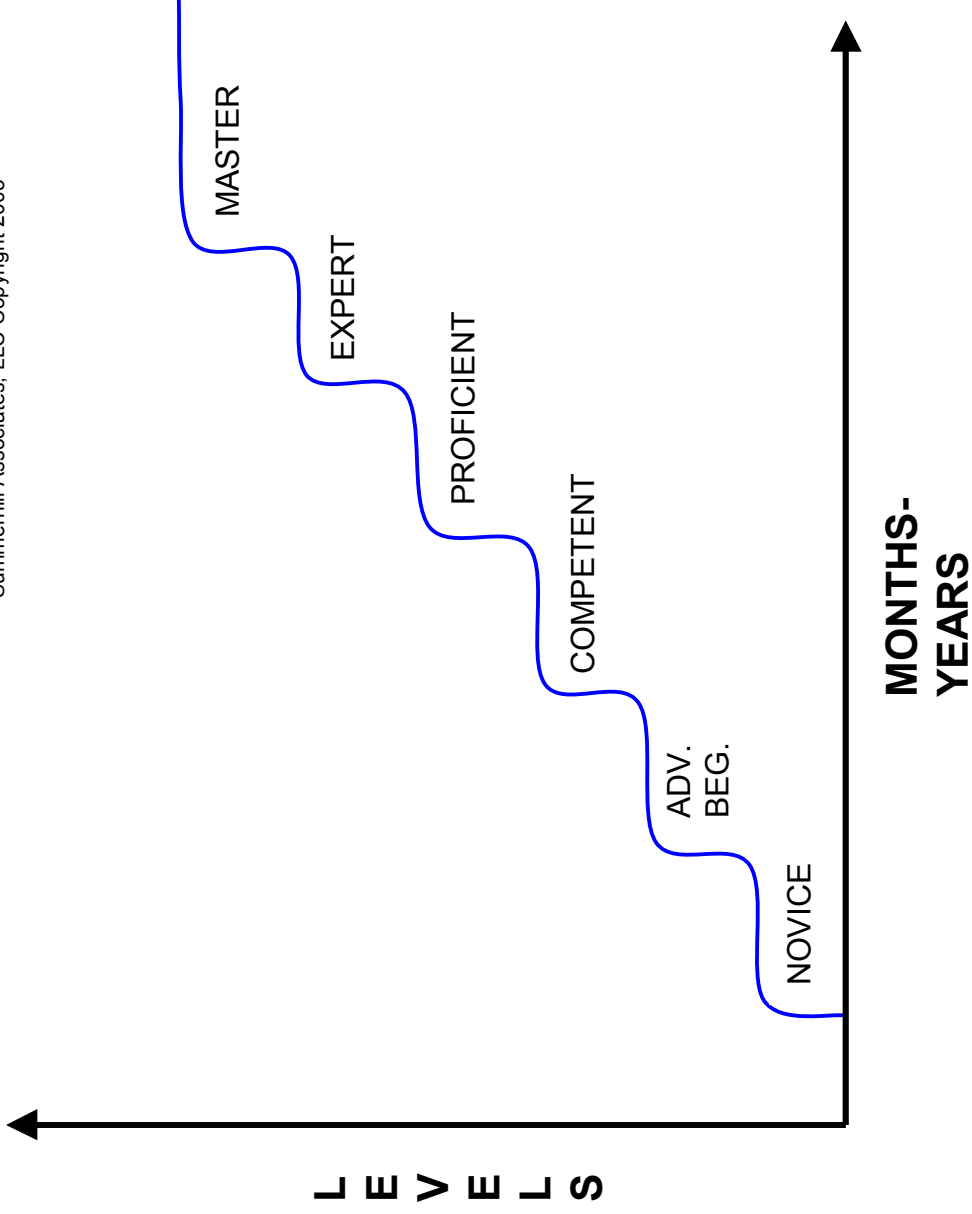


Weeks to Months

Developmental Stages of Expertise

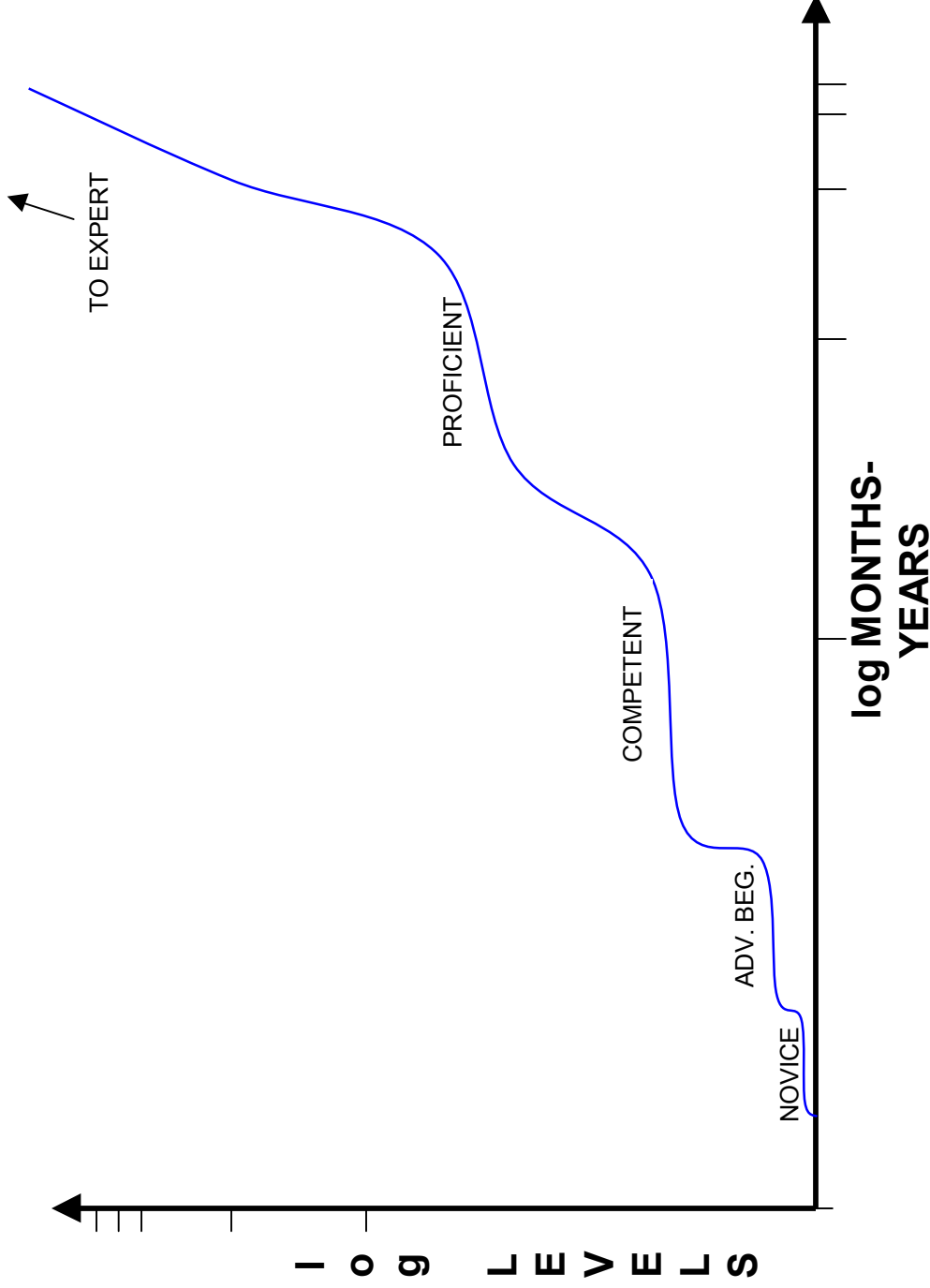
Popular View

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Logging Expertise in Real Time

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BASA used extensively, by other names

- Post-graduate oral exam
- Medical profession
- High Risk equipment operator licensure
- Military: Classical and BASA embedded in simulations
- Driver's license
- K-12
- College elearning
- Some business examples in mfg., hotel, others.

Semantic Hierarchy

Capability Maps based on

Assessments based on

Rubrics based on

Behavioral anchors based on

Understanding/automatic skill based on
Self-awareness

Example with Mathematics

- Capability map for a student's current skills in math: algebra, geometry, stat, calc
- Assessment for 8th grade mathematics
- Specific skill matrices (called 'rubrics')
 - {Add, Subt, Mult, Div} for whole numbers
 - Fractions
 - Etc.
- Example behavioral anchor item would be 'two place integer multiplication tables'

QAL Success Story

- **Case Study**
- **Quality Assured Label, Inc.**
- **Overview**
 - Self-Assessment Using Developmental Stages of Expertise*
 - Performance Review Format
 - Observations of 7 Years BASA Experience
 - Salary Structures/Compensation Plan
 - Capacity Planning
 - Benefits to Employee and Supervisor of BASA
 - Benefits to the Company

*Based on *Developmental Staging in the Learning Process*, Gary L. Jedynak, copyright, 1991.

Self-Assessment using Developmental Stages of Expertise

- **Positions used—Press Operator, Finishing Operator/Inspector, General Production Worker**
- **Assessment is done in 6 month or 1 year intervals**
- **Performance expectations & predictions are based on level of expertise**
- **Self-assessment provides data to supervisor and resulting feedback to employee**

Performance Review Format

- Review Format is based on Developmental Stages of Expertise
- Self-Assessment & Supervisor Assessment
- A structured review format was developed for production jobs
- Review form can be completed on computer
- Performance is expected to match level of expertise. If not, why not?
 - ✓ Assessment too high or too low?
 - ✓ Employee not working to capability?
 - ✓ Employee not following procedures?
 - ✓ Employee needs to learn new skills due to equipment or process changes?

Observations of 7 Years BASA Experience

- Supervisor and employee agree on ratings or discuss why they don't agree.
- Behaviorally anchored descriptions result in “show me” statements. If the employees can't do what they claim, it is obvious.
- Assessment is based on major skill/knowledge categories—employees learn in some areas more easily than in other areas.

Salary Structures/Compensation Plan

- Salary levels link directly to Developmental Stages of Expertise
- Brings objectivity to the system
- Takes away the “arguing” about money
- Can justify larger & faster increases for higher performers and/or learners
- Can start “trainees” at a lower rate if company puts them on a faster review cycle

Capacity Planning

- The number of employees at each level in each position creates a mathematical “score” of production capacity
- Can help make or justify decisions regarding whether to improve equipment, train employees or both
- Capacity changes over time with additional learning

Benefits to the Employee & Supervisor

- Based on the employee's current level of expertise, together they create future development plans.
- BASA can be used to address performance problems. If employees claim they are capable of performing at a certain level, they can be held accountable.

Benefits to the Company

- Developmental Stages can help a company understand total production capability and capacity based on number of employees at each stage.
- An individual's compensation can be tied directly to level of expertise and performance so company is not over-paying or under-paying.
- BASA and Developmental Stages take the subjectivity out of compensation so the “argument” goes away.

Press Operator Dev Stage Cklist

PRESS OPERATOR DEVELOPMENTAL SKILLS CHECKLIST

Supr. Date Supr. Date Supr. Date

4/1/00 12-11 12-11 12-11 12-11 12-11

Date Date Date Date Date Date

Employee Name

Novice/Advanced Beginner:

May be familiar with similar skills or techniques from a related job.
 Can sometimes do simple tasks, (but does not understand the tasks).
 Becoming familiar with procedures and techniques.
 Requires close supervision.

Competent:

Can run specific jobs confidently.
 Knows how to run a specific press.
 Skills becoming automatic.
 Terminology beginning to fall into place.
 Beginning to understand some methods.
 Requires some supervision.

Proficient:

Can run specific jobs confidently.
 Knows how to run a specific press.
 Skills becoming automatic.
 Terminology beginning to fall into place.
 Beginning to understand some methods.
 Requires some supervision.

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Press Operator cont'd

Proficient:
 Works independently from job start to job finish when all materials are supplied.
 Able to set up and run any repeat job with consistent color and quality.
 Run any similar press efficiently (letterpress, screen, or flexographic).
 Executes many procedures and techniques with automaticity.
 Can describe how work is done and how decisions are made.
 Fluent in job terminology and may assist in writing procedures.
 Knows press well enough to recognize mechanical problems.
 Can troubleshoot and solve problems in general press area.
 Tutors novices and beginners effectively.

	Some		X						
	some	some	X	X					
			X	X					
		some	X	X					
		some	X	X					
			X	X					
			X	X					

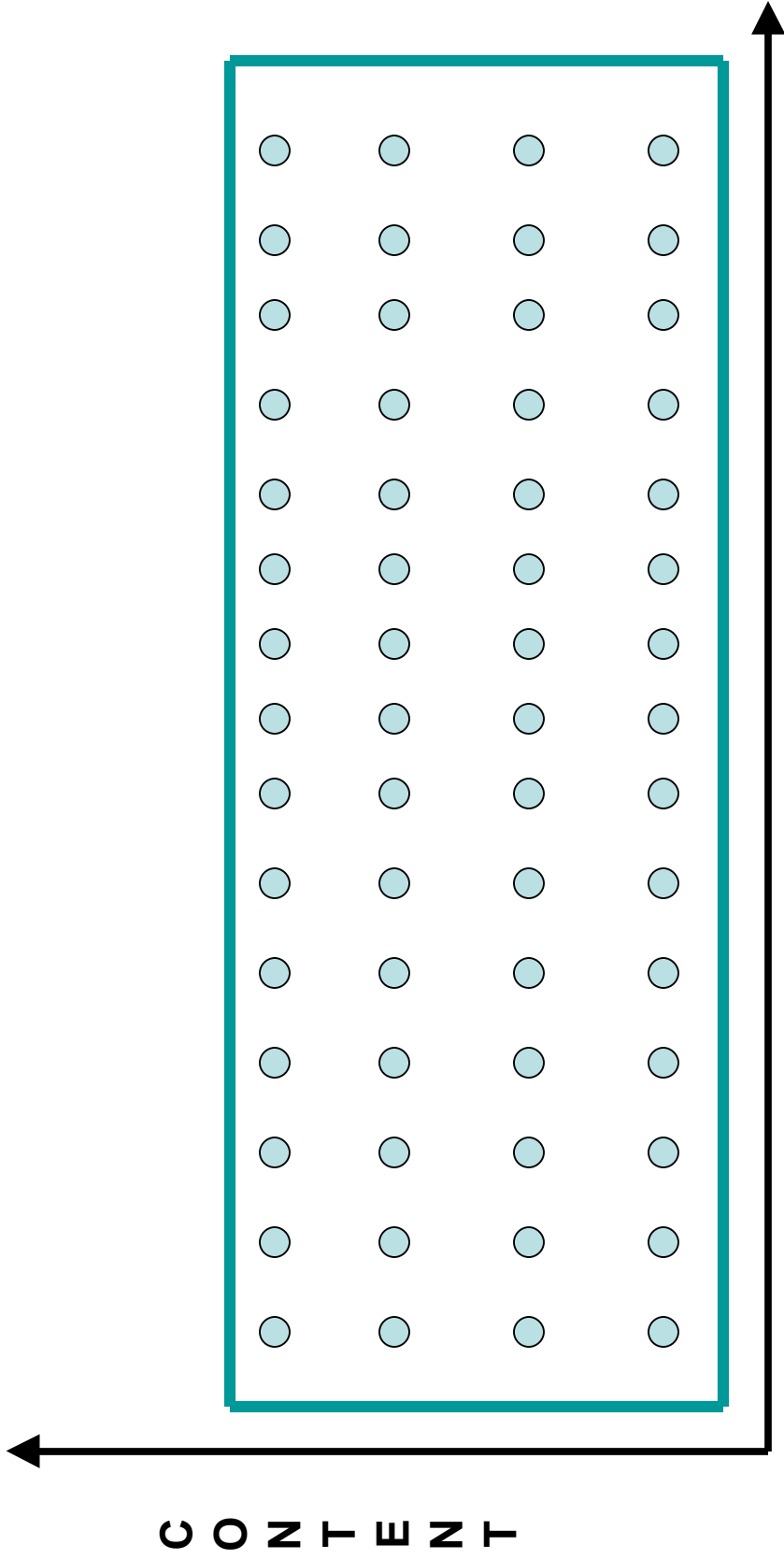
Expert:
 Highly productive on any press running any job due to exceptional automaticity.
 Adapts to any QAL press quickly and easily (letterpress, screen, or flexographic).
 Reliable application of skills and knowledge.
 Knows what to do and what not to do.
 Excellent understanding of methodology.
 May coach others.
 Lay out job for product fit for press.
 Mechanically maintain and fix press for routine production.
 Exceptional troubleshooting skills - can solve most difficult problems.
 Able to suggest improvements to equipment and procedures.
 Excellent estimating and predictive abilities.

Questions on the way to BASA

- Won't people cheat?
- Don't one page assessments leave a lot out?
- How I have an advantage in using BASA?
- If it's so easy then how can it be believable?
(Empirical ways do work: Navy dolphins and police dogs.)
- Your questions?

'The Learning Model'

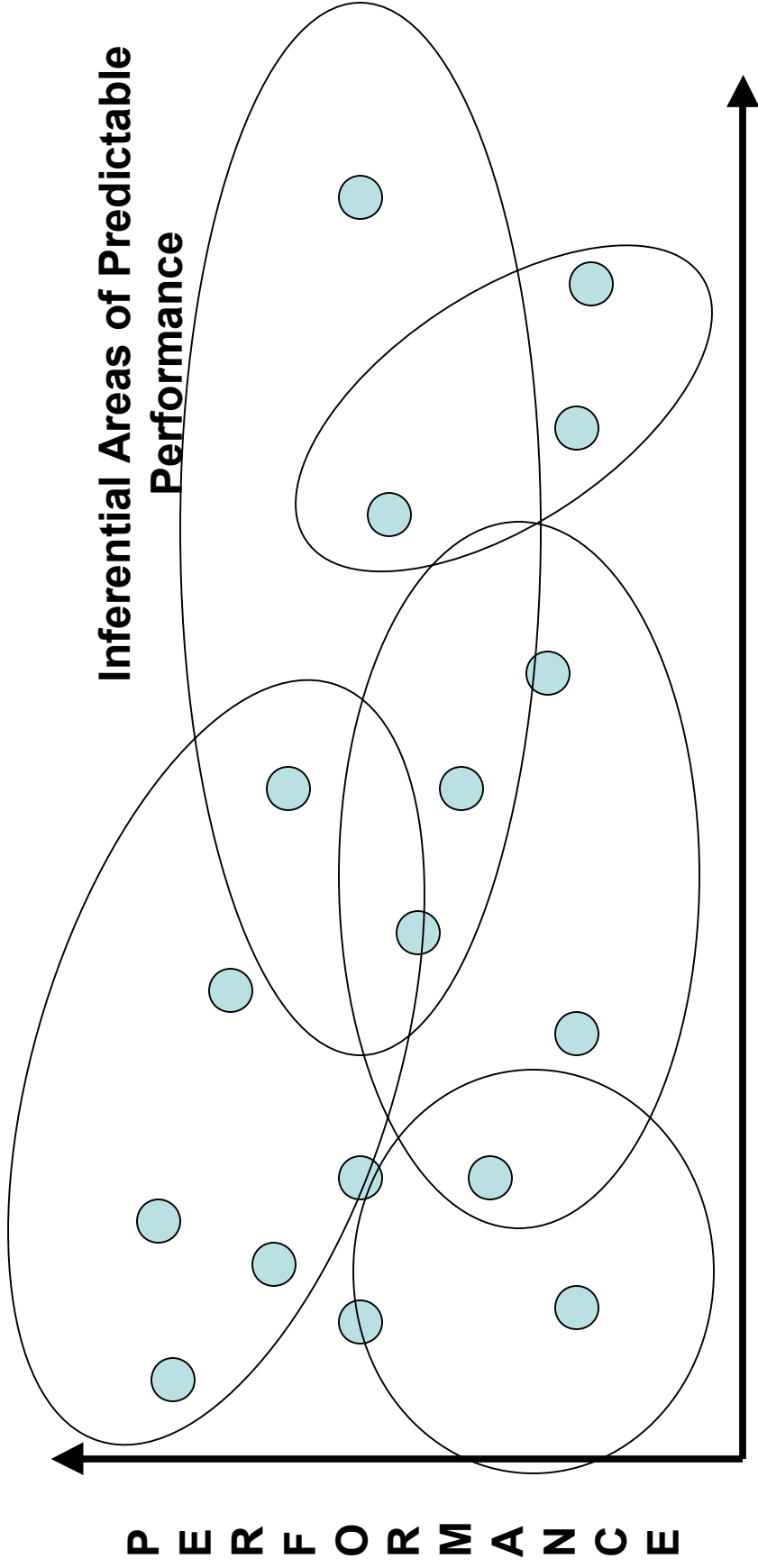
(Dots represent tested items/'points')



Time in Weeks or Months

The Understanding-Consolidation- Expertise Model

(Dots represent anchored behaviors)



TIME in MONTHS or YEARS

Creating Assessments

- First draft must be done by Expert in field
- Dev Stages of Expertise as template/guide
- Have BASA advisor present initially
- First draft can be done in a hour or two
- Should be fun creating this 'seed' document
- Give to other experts for their review and additions
- Discuss and resolve different views
- Document quickly converges and becomes robust

Experience of doing a BASA

- It has self-apparent structure
- It uses terms familiar to the field
- People know themselves--should be easy
- Effective even in rapidly changing technology, because BASA focuses on stable aspects

Creating an Assessment: Object Oriented Design/Programming

- First draft done by Expert in the field:
- Expert knows/decides: What are the key capabilities and understandings?
- For OOD/OOP:
 - *Improve development of highly complex systems*
 - *Divide-and-conquer through small-grained class, object and method solutions*
 - *Highly maintainable and reusable code*
 - *High cohesion and low coupling*

Creating an Assessment:

Rubric Areas for OOD/OOP

- Expert selects subject areas for Rubrics:
- For OOD/OOP:
 - *OO understanding*
 - *Coding practices and standards*
 - *Language and IDE familiarity*
 - *Refactoring expertise and code reuse*
 - *Debugging / inspecting skills*
 - *Design Patterns*
 - *Unified Modeling Language*

Creating an Assessment:

Use Dev. Stages of Expertise as Guide

- Novice
 - *Not familiar with terminology or procedures*
- Advanced Beginner
 - *Can sometimes do simple tasks but unpredictably*
- Competent
 - *Effectively uses basic techniques and procedures*
- Proficient
 - *Productive, does many techniques and procedures with automaticity*
- Expert
 - *Highly productive due to experience and automaticity*
- Master
 - *High degree of expertise and recognition, extends the discipline*

Creating an Assessment:

Rubric 1: OO understanding

- Novice
 - *Limited familiarity with OO terminology and concepts*
- Advanced Beginner
 - *Basic understanding of classes, inheritance, instances and methods*
- Competent
 - *Conversant in OO terminology*
- Proficient
 - *Thorough understanding of OO terminology and all elements of their OO language*
- Expert
 - *Able to evaluate pros & cons of different OO coding techniques (e.g. instance composition and delegation vs. class inheritance for behavior specialization)*

Creating an Assessment:

Rubric 2: Coding practices and standards

- Advanced Beginner
 - *Can edit class and method definitions, with unpredictable results*
- Competent
 - *Can successfully but unevenly edit class and method definitions*
 - *Codes with a focus on algorithms and logic*
- Proficient
 - *Uses language idioms, best practices, and local standards*
 - *Aware of impedance mismatches between OO and non-OO I/O sources*
 - *Familiar with their local frameworks and architectural layering*
 - *Codes with a focus on efficiency and “cleverness”*

Creating an Assessment:

Rubric 2: Coding practices and standards cont'd

- **Expert**
 - ***Codes with a focus on maintainability; creates literate, readable code***
 - ***Designs frameworks and architectures, solves impedance mismatches***
 - ***Knows the Law of Demeter – don't reach through private implementations***

Creating an Assessment:

Rubric 3: Language and IDE familiarity

- Novice
 - *Limited familiarity with OO terminology and concepts*
- Advanced Beginner
 - *Knows syntax of one OO language*
 - *Comfortable with browsing classes and methods in their language's IDE*
- Competent
 - *Comfortable with the most frequently used classes in their OO language*
- Proficient
 - *Comfortable with main path of their software configuration management (SCM) tools*

Creating an Assessment:

Rubric 3: Language and IDE familiarity cont'd

- Expert
 - ***Full awareness of SCM life-cycle, alternatives, policies and procedures***
- Master: ***Extends language, modifies IDE***

Creating an Assessment:

Rubric 4: Refactoring expertise, code reuse

- Advanced Beginner
 - *Uses cut and paste technique to reuse code*
- Competent
 - *Reuses existing code if it is visible and convenient to do so*
- Proficient
 - *Looks for existing code to reuse, refactors it if convenient*
- Expert
 - *Refactors regularly as a standard coding practice*
 - *Looks for application improvement through refactoring*
 - *Always looks for existing code to reuse, refactors it if necessary, and eliminates other duplicate code*
- Master
 - *Discovers and documents new refactorings, automates existing ones*

Creating an Assessment:

Rubric 5: Debugging / inspecting skills

- Advanced Beginner
 - *Can use debuggers and inspectors to observe snapshots of execution*
- Competent
 - *Can observe execution behavior and values while stepping through*
- Proficient
 - *Can use debugger breakpoints and inspector value editing to control and change runtime behavior*
- Expert
 - *Regularly uses debuggers and inspectors to find and eliminate bugs by controlling and changing runtime behavior*
- Master
 - *Extends and modifies debuggers / inspectors*

Creating an Assessment:

Rubric 6: Design Patterns

- Advanced Beginner
 - *Has basic understanding of the idea of patterns*
- Competent
 - *Knows the commonly used patterns in their language/local environment*
- Proficient
 - *Conversant in most common patterns, including those not currently used in their local language and environment*
 - *Basic awareness of industry trends in patterns, methodologies, etc.*
- Expert
 - *Uses patterns exactly when appropriate, able to evaluate pros & cons of one pattern over another in a given context for “goodness of fit”*
- Master
 - *Discovers and documents new patterns*

Creating an Assessment:

Rubric 7: Unified Modeling Language

- Advanced Beginner
 - *Can follow explanations of some UML diagrams*
- Competent
 - *Understands the most common UML diagrams*
 - *Can create some UML diagrams without assistance*
- Proficient
 - *Can create the most common UML diagrams, understands all UML diagrams*
- Expert
 - *Effectively understands and creates all UML diagrams*
- Master
 - *Authors UML or methodology practices*

Why not wider usage of BASA?

- HR performance reviews are not a popular brainstorming area (totem poling legacy)
- Originated in academia, not in business
- BASA started with assessing learning, but assessing understanding is easier
- Requires long-term commitment for best results
- Leads to no more old boys' clubs
- Intriguingly usage is growing!

What is the future of BASA?

- Emergent, distributed, online community growth
- Increased competition will require it
- Increasing need for predictability
- Online community can promote expert corroboration
- Online document mgt. will simplify assessment archival and authentication
- Real-time, embedded self-assessment likely in tutorials

Summary

- QAL provides a long duration example
- Practices becoming more common
- Approach has promise in software
- Long standing wage-expertise problem getting more attention

Capability Map

