Improving Personal Practice

Techniques of High Performing Software Developers

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Acknowledgements

- Mojca Konia, MD, PhD, MACM
- SimPORTAL Staff
- Chris Hafner, LAc
- Jesse Corry, MD
- League of Extraordinary Algorithms Meetup
- LambdaConf Speakers
- Abraham Sangha
- relationalAI

What We're Looking For

> "[C]ausal relationships are *ontological*, describing objective physical constraints in our world, whereas probabilistic relationships are *epistemic*, reflecting what we know or believe about the world."

- Judea Pearl, *Causality: Models, Reasoning and Inference* (2nd, 2009)

Working Definition

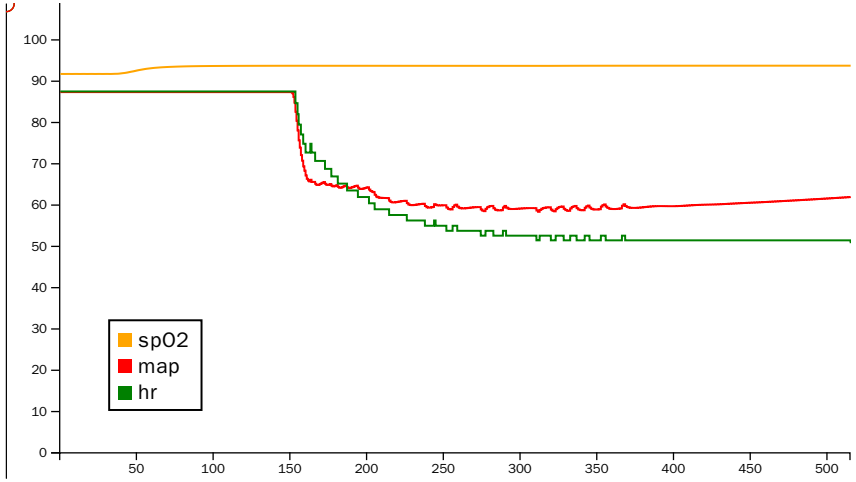
> High performance implies a statistical reliability that within information space (S) future performance (P) will closely resemble ideal performance (I) such that for $I, P \in S$

$$\mu_{I-P} = \mu_I - \mu_P \approx 0.0$$

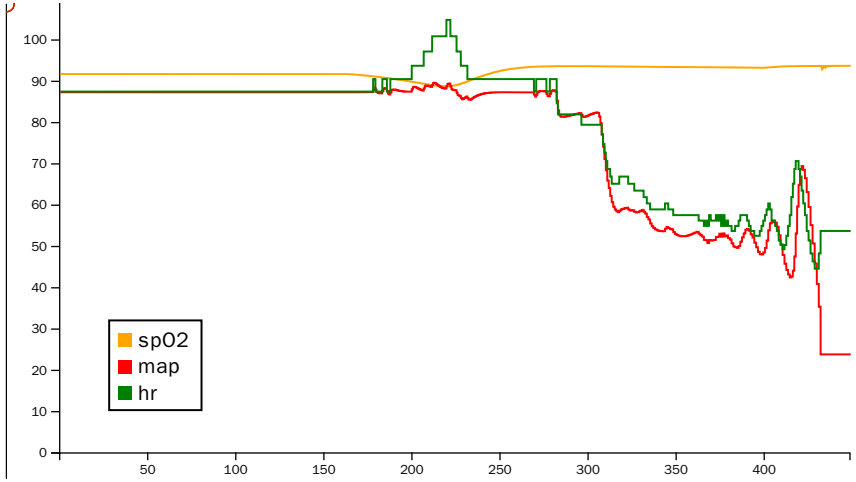
$$\sigma^2_{I-P} = \sigma^2_I - \sigma^2_P \approx 0.0$$

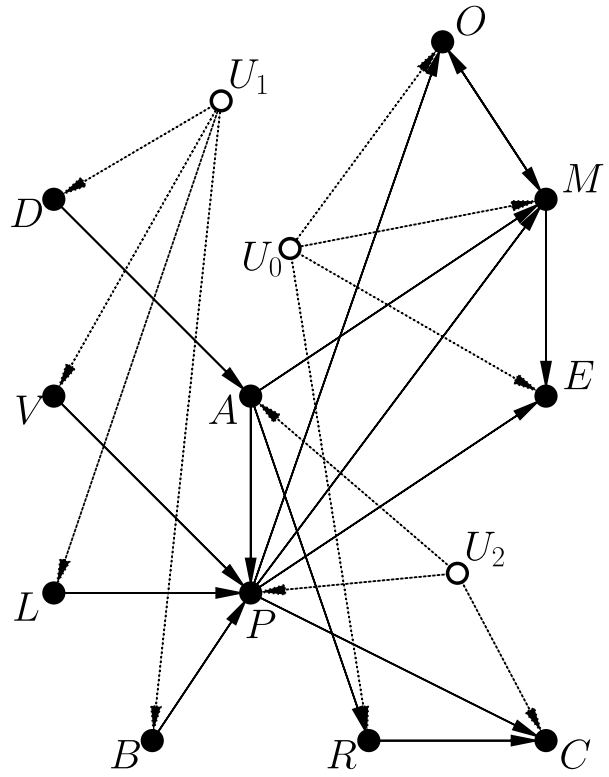
Information Space Model

Provider A

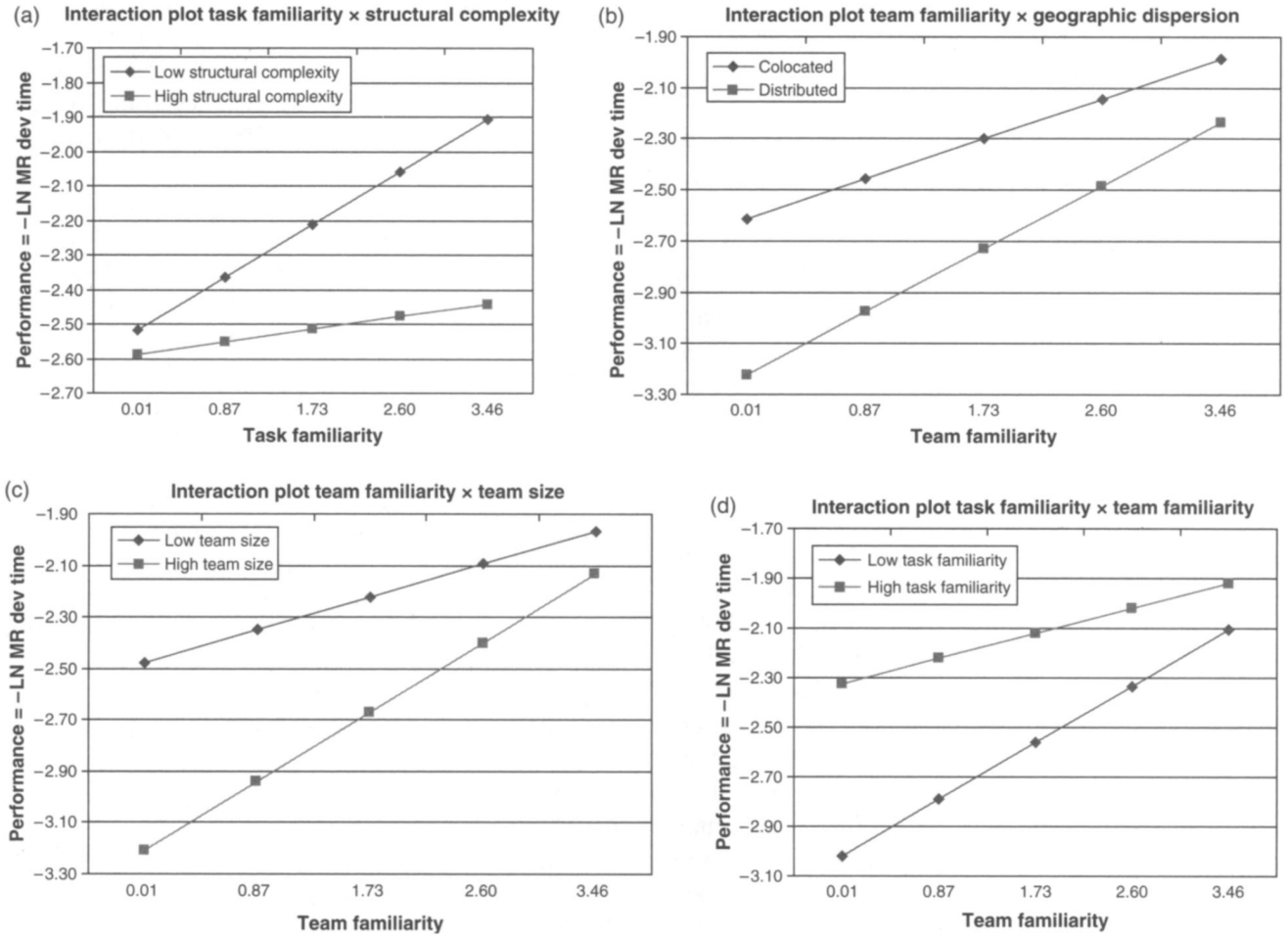


Provider B





Work Context (Espinosa et al, 2007)



Neurophysiology

- Brain physically adapts to *stimuli*
- Specialization lowers (metabolic) demand of (stimuli) processing
- Automation trends toward the *mode* (of stimuli)

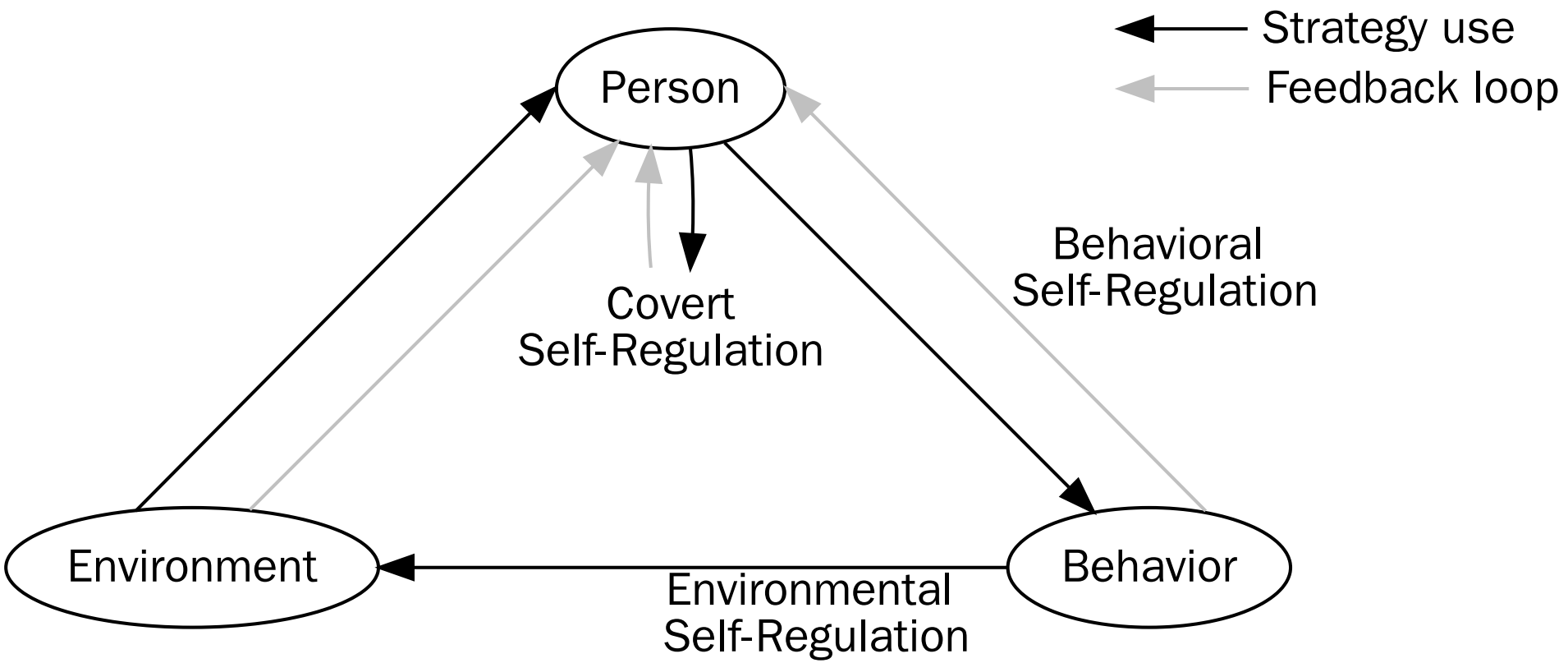
$$f : \mathrm{SocialMedia} \to \mathrm{Garbage}$$

Automation

- You may consider automation a "category view" of adaptive neurophysiologic specialization
- Fairly a "deep learning" process

$$f : \text{effort} > \text{minimum viable} \rightarrow \text{effort} \vee \text{minimum viable}$$

Self Regulation



Barry J. Zimmerman. *A social cognitive view of self-regulated academic learning.* (1989). From Zimmerman *Development and Adaptation of Expertise. . .* (p707, 2006)

Single Consensus Finding

Social Ability $S \ggg$ General Mental Ability G, where $\hat{a}$ represents the effect size of G and λ is total effect

$$\lambda = \hat{a} \cdot G \circ S$$

$$\hat{a}(S) = \begin{cases} > 0, & \text{when} \uparrow S \\ \leq 0, & \text{when} \downarrow S \end{cases}$$

Improving Personal Practice

> "[P]erformance is not a variable that is part of the system that can be directly influenced as with other parts of the system. It emerges when the variables work or interact together in an appropriate way, which entails that it must be reproduced continuously. [...] One cannot intervene into performance. One can intervene into the system, whose parts by working together, make performance emerge."

- Klaus D. Wittkuhn, *Understanding Performance Improvement* (2016)

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Key Points

- Performance patterns are "sticky"
- Self perception of self efficacy is a liability
- $\text{improvement} \perp t \text{ when } t \geq t_{min}$

High performers *(v moderate)*[§]

Category	Trait
Requirements analysis and design	↓ **time on problem comprehension**
	Adequate problem representation early
Program comprehension and programming	**Pursuit of abstract programming goals**
	Cross-reference strategy
Testing and debugging	**Active search for problems**
Knowledge	**Broader and more detailed knowledge base**
Communication and cooperation	**Spend more time on communication and cooperation**

[§] - Sonnentag et al (2006)

Most Frequent (Sub)categories[§]

Skills

- Problem solving
  - Abstraction
  - Decomposition
  - Analytical thinking
  - Logical thinking
- Continuous learning
- Requirements
  - Good listener
  - Understand a customer
  - Effective nontechnical explanations
- Assess trade-offs

Individual Characteristics Expertise, Knowledge, and Performance

- Open-minded
- Team player
- Curious
- Patient
- Self-reflective

- General knowledge
- Task-specific knowledge
- Experience
- Decomposition
- Modularization
- Maintainability
- Clear structure
- Performance

[§] - Baltes and Diehl (2018). Summarized by Jason A. Grafft

Generic Process (Wittkuhn, 2016)

- Define the performance in question
- Identify the variables that influence the performance
- Model the performance system in order to understand how these variables interrelate
- Identify gaps and opportunities in the performance system
- Identify possible interventions to close these gaps
- Look for economic interventions that have leverage and influence other variables beyond the targeted variable and yield a diffusion of effect
- Observe what is happening when you implement the intervention and take corrective action as needed

Generic Process (Wittkuhn, 2016)

G_n

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$G_{\hat{n}}$

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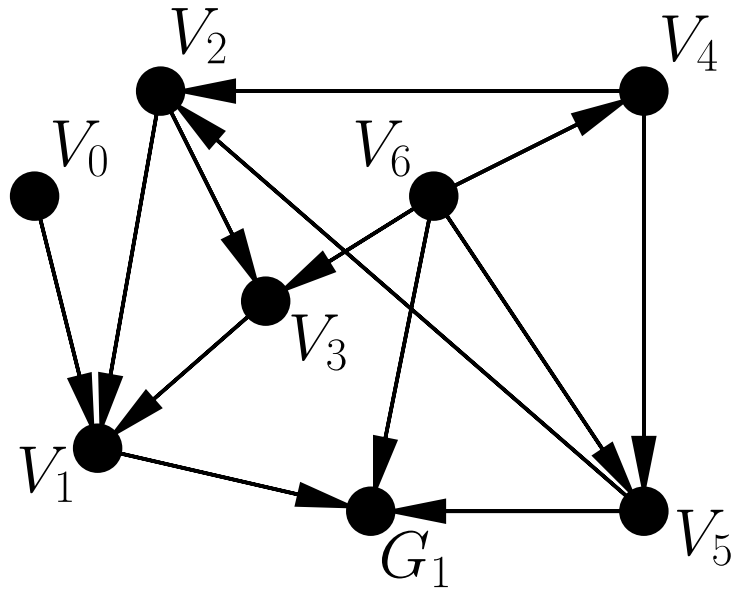
Posterior Predictive Checks

- Observe what is happening when you implement the intervention and take corrective action as needed

$\text{Goal}_1 : \downarrow t \rightarrow$ Problem Comprehension

G Goal
V_0 Good Listener
V_1 Understand a customer
V_2 Effective nontechnical explanations
V_3 Assess trade-offs
V_4 General knowledge
V_5 Task specific knowledge
V_6 Analytical thinking



$G_{\hat{1}} : \downarrow t \rightarrow$ Problem Comprehension

Λ	$\uparrow$ time at code reviews, meetings, ...
E_0	"Listening strategies" resource
E_1	Solicit reviews from coworkers
E_2	Track number of communications to consensus understanding
G	Goal
V_0	Good Listener
V_1	Understand a customer
V_2	Effective nontechnical explanations
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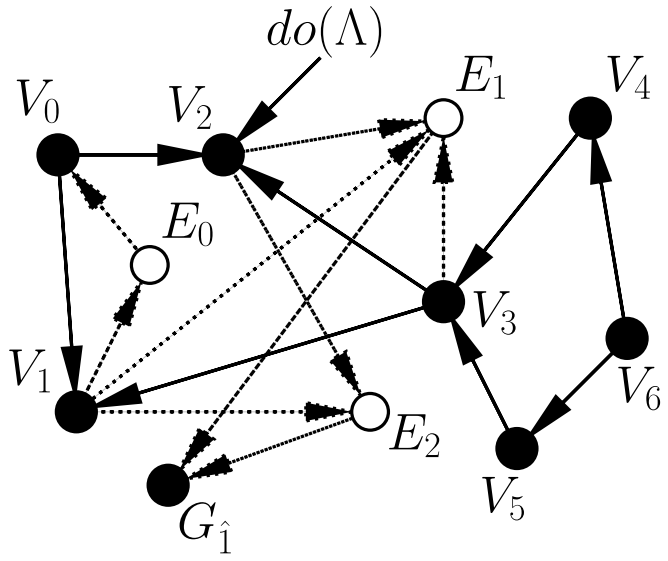

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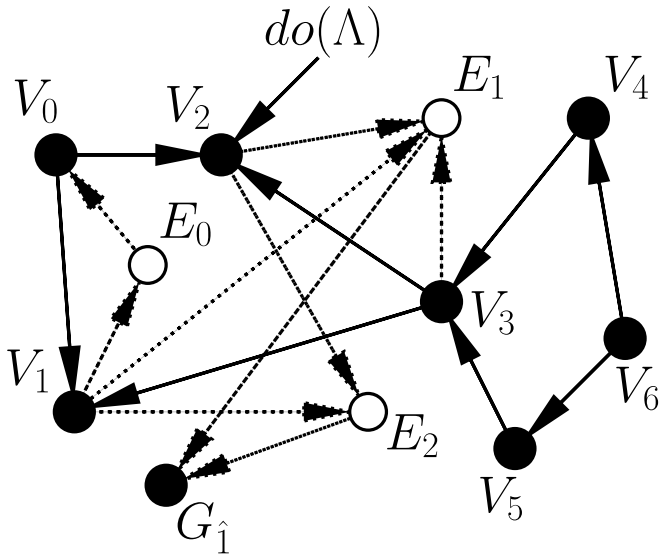

Posterior Predictive Checks

- $\downarrow$ in recommunications to mutual understanding
- $\downarrow$ in "downstream" refactors

G_2: ↑ FP Skills

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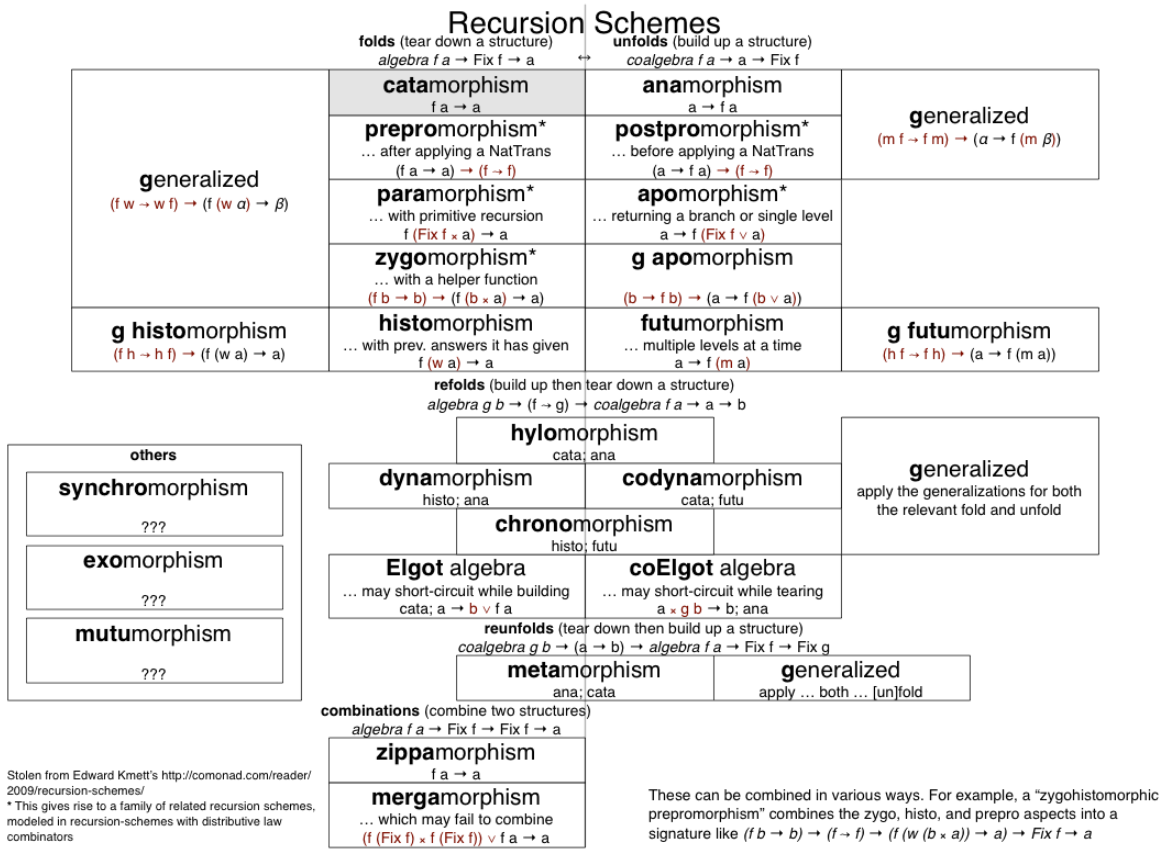
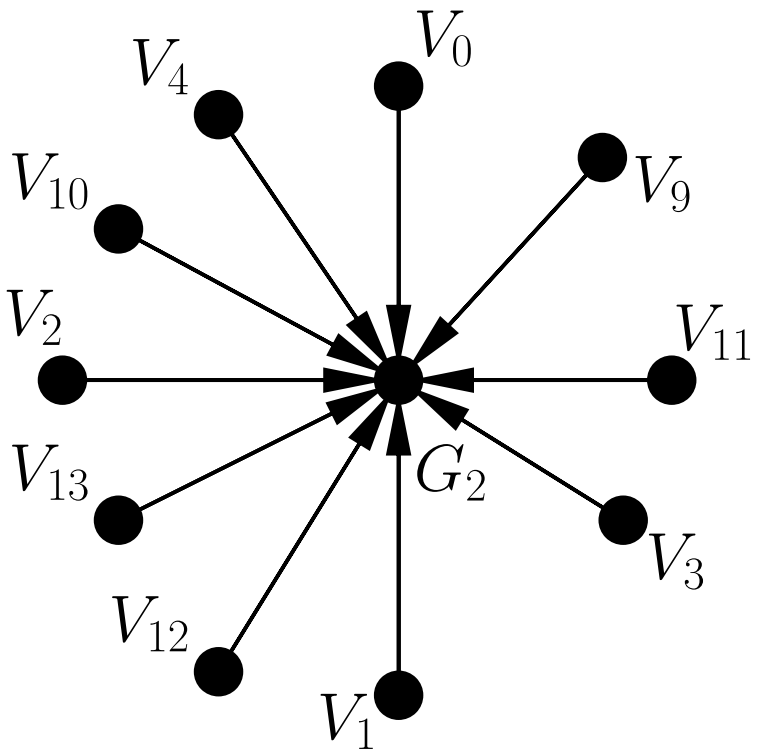


from https://github.com/slamdata/matryoshka

Refinement$_2$: Data61 `..., Applicative.hs, ...`

G_2 Goal (Refinement)
V_0 `ExactlyOne`
V_1 `List`
V_2 `Optional`
V_3 `((->) t)`
V_4 `lift{2,3,4,0,1}`
V_9 `*>`
V_{10} `<*`
V_{11} `sequence`
V_{12} `replicateA`
V_{13} `filtering`



Refinement$_{\hat{2}}$: Data61 `..., Applicative.hs, ...`

Λ	`recurse`
E_0	`foldRight`
E_1	`map`
V_{4^*}	`lift`$_n$
G_2	Goal (Refinement)
V_0	`ExactlyOne`
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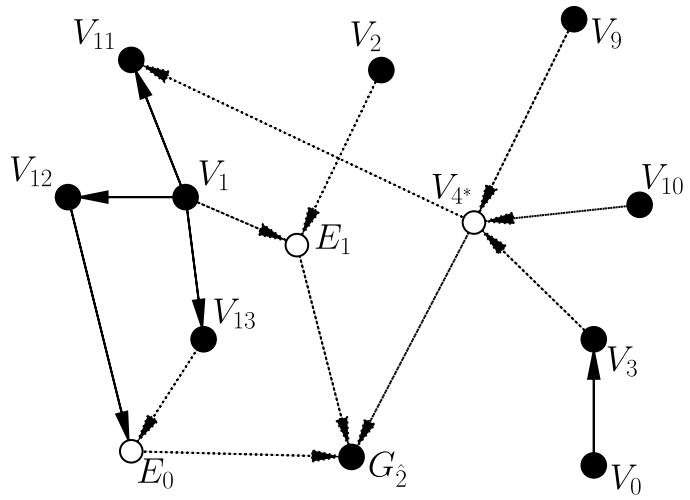

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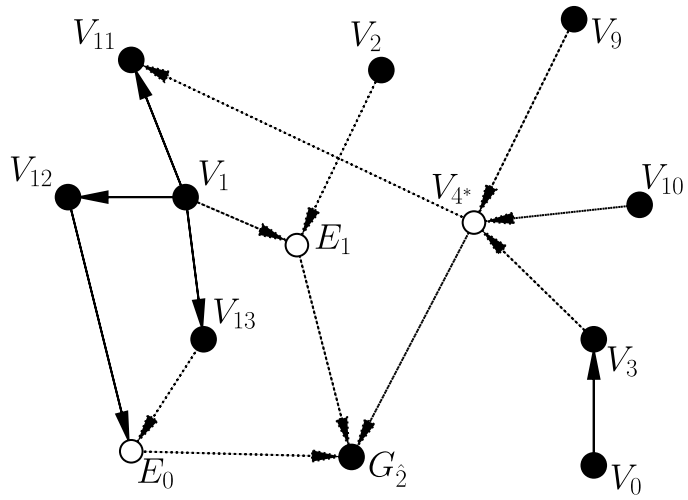


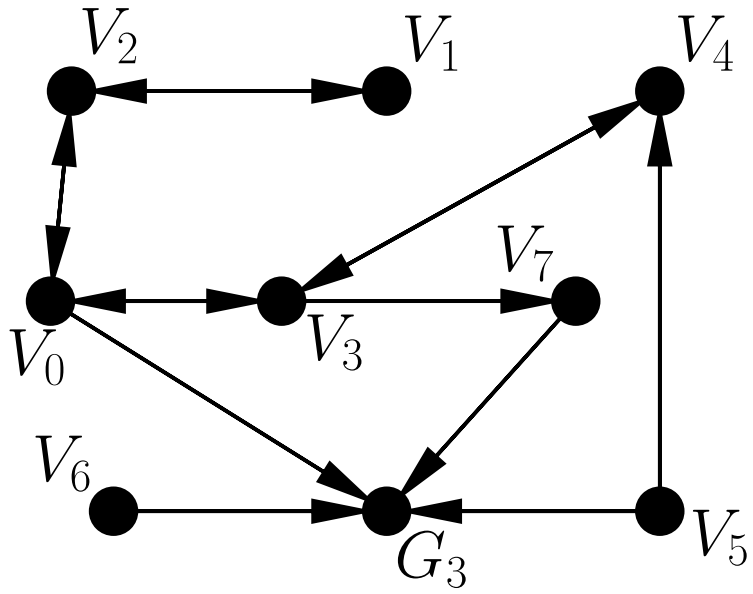
Posterior Predictive Checks

↓ per attempt, to stability

- Time spent per function
- Number of external resources used per function

G_3: $\uparrow t \rightarrow$ Communication $\wedge$ Cooperation

- G_3 Goal
- V_0 Open-minded
- V_1 Broader and more detailed knowledge base
- V_2 Curious
- V_3 Patient
- V_4 Self-reflective
- V_5 Experience
- V_6 Team player
- V_7 Good listener



$\mathsf{G}_{\hat{3}}$: $\uparrow t \rightarrow$ Communication $\wedge$ Cooperation

Λ	2×month $\rightarrow$ Coach/Counselor/Mentor
E_0	Journal
E_1	4 hours of in-person, structured socializing per month
G_3	Goal
V_0	Open-minded
V_1	Broader and more detailed knowledge base
V_2	Curious
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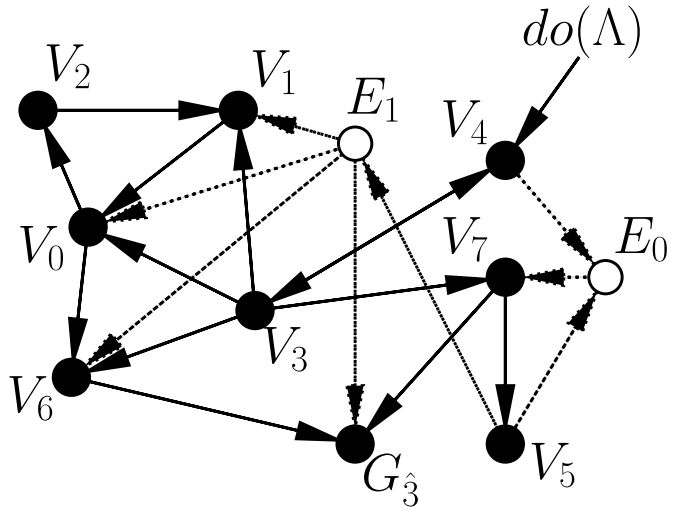

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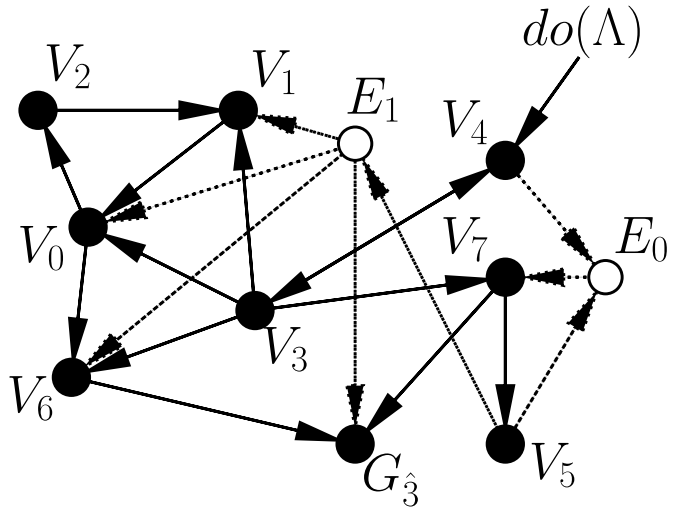

Posterior Predictive Checks

- $\downarrow$ in anxiety/distraction/... round related activities
- $\downarrow$ in dissonant behaviors

Summary

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High Performers

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- Are characterized by statistical regularity of *outcome* in a particular environment
- Model their practice as one of social efficacy *reinforced* by knowledge and technical ability

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High Performance

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- Model their practice as one of social efficacy *reinforced* by knowledge and technical ability

High Performance

- Is bound to a domain because it is well-attenuated to the needs of that environment
- Is "sticky"
- May be automated, and social reinforcement is especially helpful

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- Is the result of automation behaviors
- Is modifiable of our own effort

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Performance Improvement

Summary

Personal Practice

- Is the result of automation behaviors
- Is modifiable of our own effort

Performance Improvement

- Is the side effect of a dynamic process
- Depends on mutable combinations and interactions *we may influence*

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Thank You!

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