Models, Modeling, and Muddles

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Outline

SHERIDAN'S TAXONOMY OF MODEL ATTRIBUTES

	ATTRIBUTE	1 (LEAST)	2 (MODERATE)	3 (MOST)
A	DATA APPLICABILITY	No basis in existing data	Describes existing data	Predicts future data
B	DIMENSIONALITY	Single input, single output	Multi input, single output	Multi input, multi output
C	METRICITY	Limited to nominal relationships	Primarily ordinal relationships	Entirely cardinal relationships
D	ROBUSTNESS	Unique focus on limited objects or events	Moderate focus to a variety of objects or events	Comprehensive of a wide slice of nature
E	SOCIAL PENETRATION	Confined to a mental model	Communicated to the relevant community	Accepted and used by the relevant community

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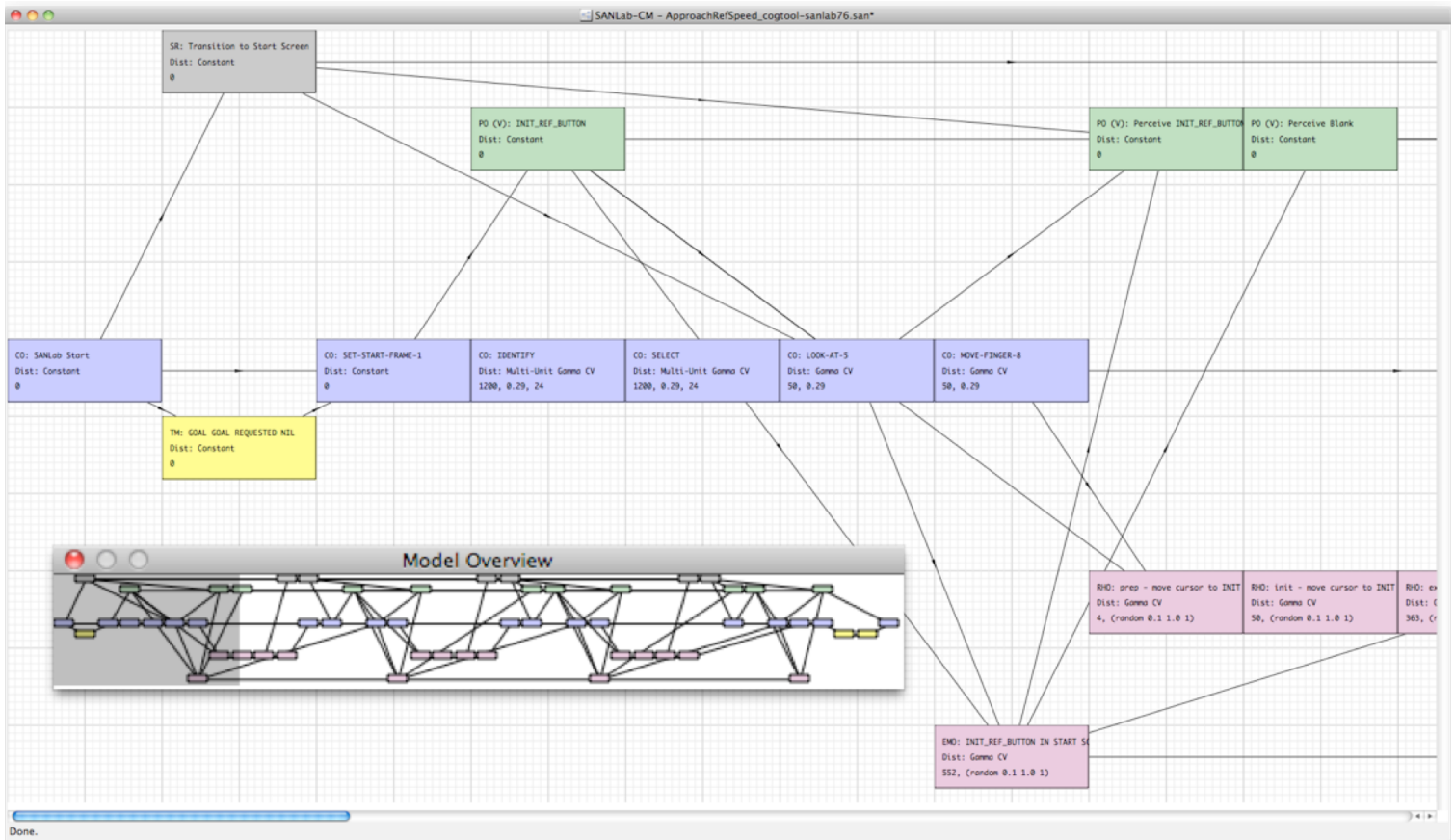
Tools for Predicting the Duration and Variability of Skilled Performance without Skilled Performers - HFES12 - Thur 8:00 HP2

SANLab Models (Stochastic Analytic Network Laboratory)



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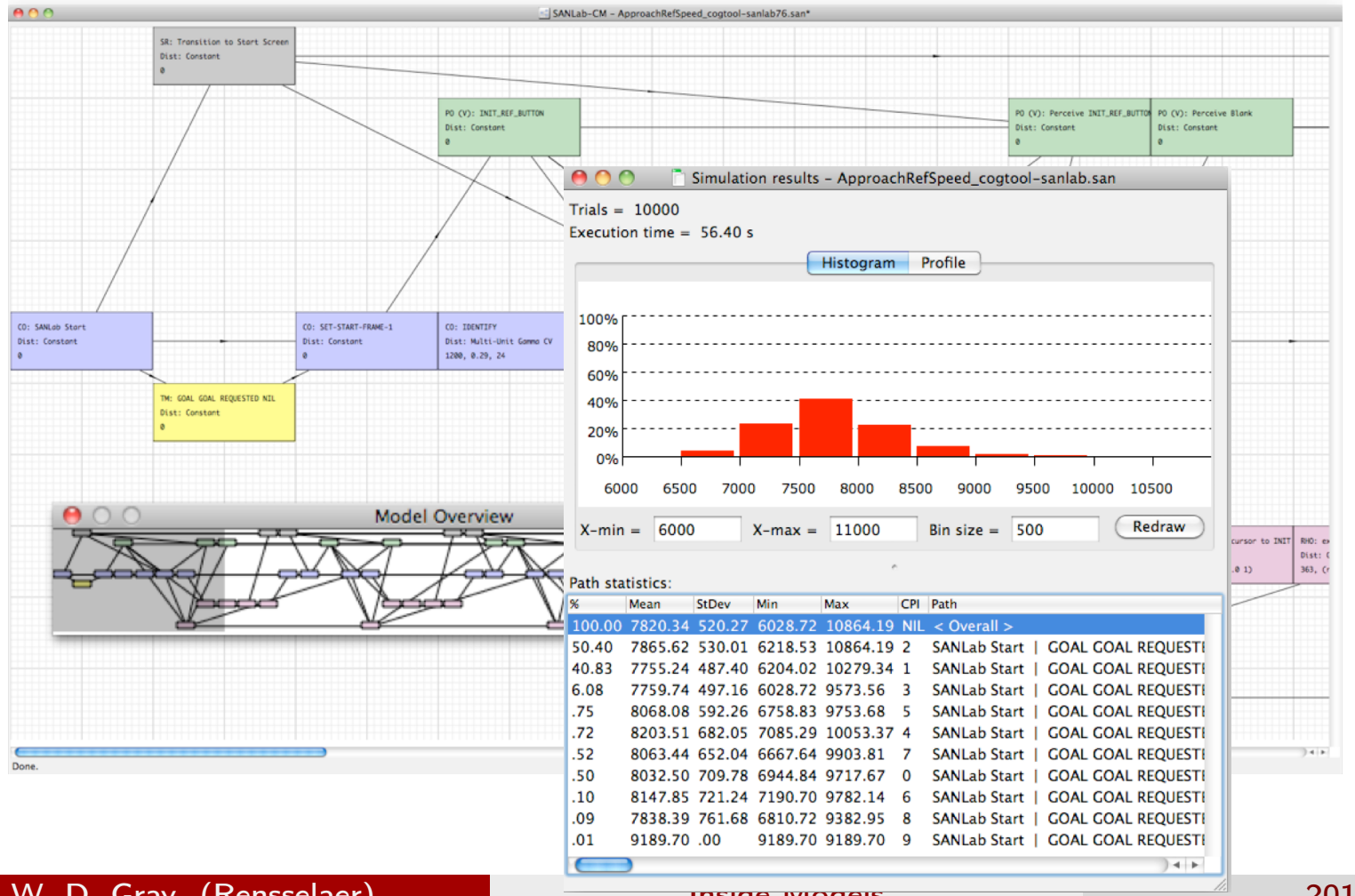


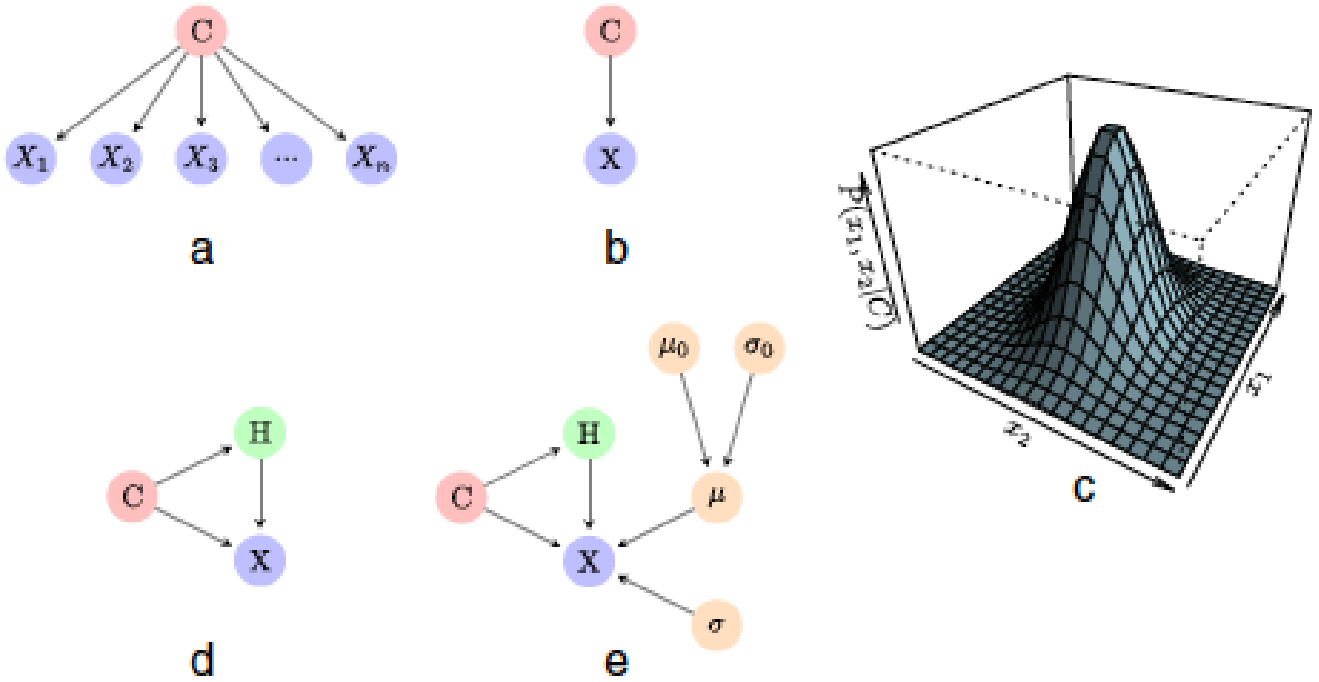
Tools for Predicting the Duration and Variability of Skilled Performance without Skilled Performers

	ATTRIBUTE	CATEGORY (1, 2, or 3)	DISCUSSION
A	DATA APPLICABILITY	3 - Predicts future data	Predicts expert performance times and variability w/o experts
B	DIMENSIONALITY	3 - Multi input/output	Uses *fixed sets of population parameters* and task analysis as input. Predicts time + variability for the average person.
C	METRICITY	3 - Cardinal	Mean times and Standard Deviations
D	ROBUSTNESS	1 - Unique focus (??)	Any one model should focus on one design; however, trivial to make multiple models for same or different device
E	SOCIAL PENETRATION	2-3	CogTool is widely used by the interface design community. SANLab is based on Activity Networks which are the formalism underlying CPM-GOMS models as well as MANPRINT, etc

John, B. E., Gray, W. D., & Patton, E. W. (2012). Tools for predicting the duration and variability of skilled performance without skilled performers. In *56th Annual Conference of the Human Factors & Ergonomics Society*. Santa Monica, CA: HFES

Outline

Cross-subject workload classification with a Hierarchical Bayes Model - HFES11



Wang, Z., Hope, R. M., Wang, Z., Ji, Q., & Gray, W. D. (2012). Cross-subject workload classification with a Hierarchical Bayes Model. *NeuroImage*, *59*(1), 64–69

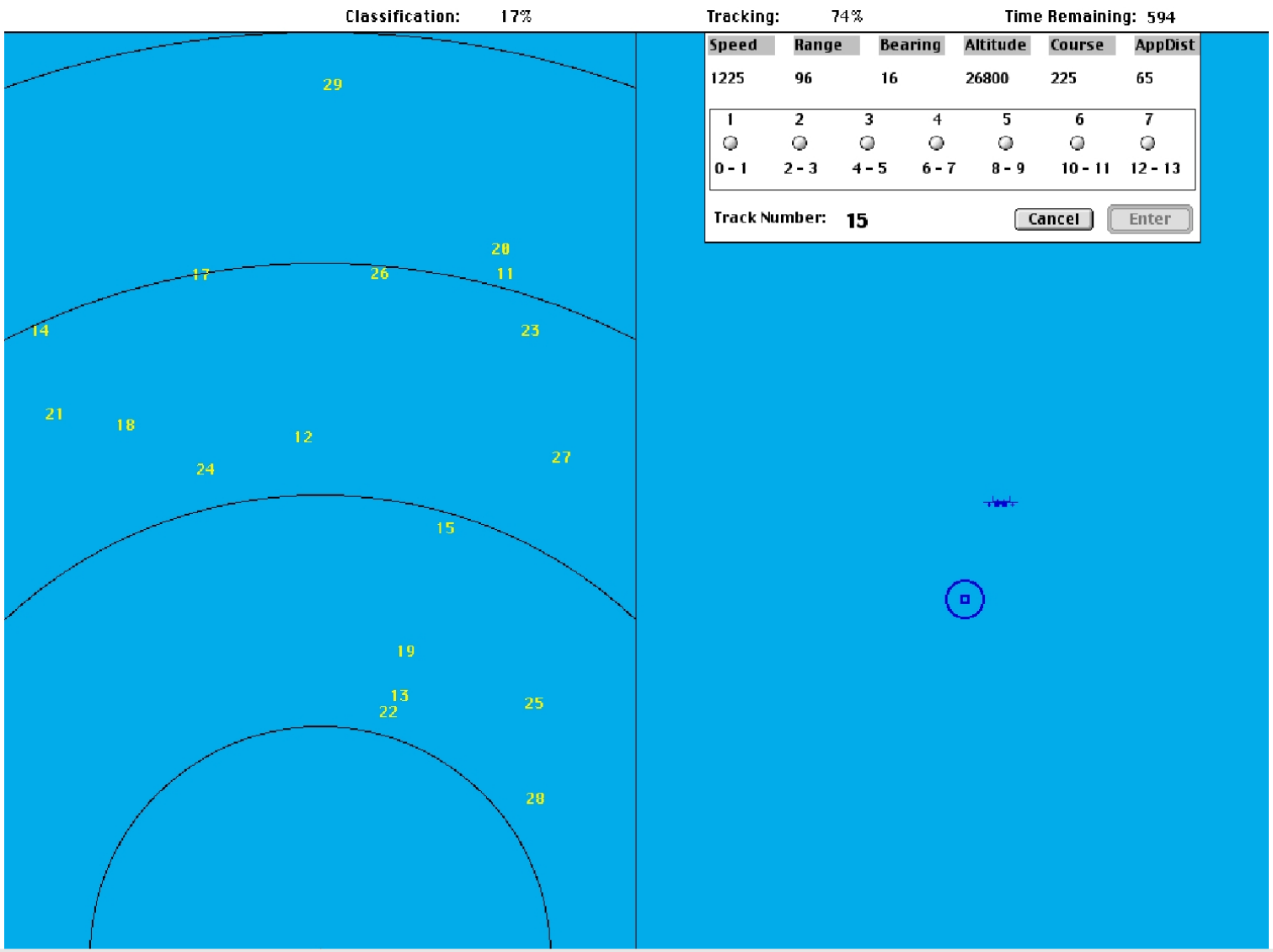
Cross-subject workload classification

Using a non-cognitive, Hierarchical Bayes Model

	ATTRIBUTE	CATEGORY (1, 2, or 3)	DISCUSSION
A	DATA APPLICABILITY	3 - Predicts future data	Uses a training set of multiple people to derive parameters that can read each of their EEG data to recognize their current workload state (caution - this gloss may make the model sound better than it actually is)
B	DIMENSIONALITY	2 - Multi input/ single output	Takes 64 channel EEG data and predicts one CWL measure
C	METRICITY	2 - Ordinal	High, medium, or low workload
D	ROBUSTNESS	1 - Unique focus (??)	Workload!!!
E	SOCIAL PENETRATION	1-3	Hierarchical Bayes Analyses are well-accepted in the academic engineering community, apparently new to Human Factors

Outline

Strategy Evaluation via Cognitive Modeling - HFES02



Gray, W. D., Schoelles, M. J., & Myers, C. W. (2002). Computational cognitive models ISO ecologically optimal strategies. In *46th Annual Conference of the Human Factors & Ergonomics Society* (pp. 492–496). Santa Monica, CA: Human Factors & Ergonomics Society

Strategy Evaluation via Cognitive Modeling

Using a cognitively valid, ACT-R model locked into one of 3 search strategies – asking a variant of the *optimality* question - how useful are the strategies that the researchers *think* they have identified in actually doing the task in question????

	ATTRIBUTE	CATEGORY (1, 2, or 3)	DISCUSSION
A	DATA APPLICABILITY	??? none of these categories really fit	Eliminates possible interpretations, does not necessarily describe the data
B	DIMENSIONALITY	2 - Multi input/ single output	Takes hours of observation and data analyses to derive 3 candidate strategies, then tries to find the one that matches human achievement
C	METRICITY	??? not sure this is the right metric for this research question	Issue is whether performance using any of the candidate strategies come close to matching human performance
D	ROBUSTNESS	1 - Unique focus (??)	What the heck are our subjects doing????
E	SOCIAL PENETRATION	1-3	Do any of the strategies suggested by *observation* come anywhere close to explaining the data??

Outline

OTHER VISIONS OF MODELS: *McClelland, 2009*

"The essential purpose of cognitive modeling is to allow investigation of the implications of ideas, beyond the limits of human thinking.

- Models allow the exploration of the implications of ideas that cannot be fully explored by thought alone.
- As such, they are vehicles for scientific discovery, in much the same way as experiments on human (or other) participants.
- But the discoveries take a particular form: A system with a particular set of specified properties has another set of properties that arise from those in the specified set as consequences.
- From observations of this type, we then attempt to draw implications for the nature of human cognition" (McClelland, 2009)

McClelland, J. L. (2009). The place of modeling in cognitive science. *Topics in Cognitive Science*, *1*(1), 11–38

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IMPORTANCE OF SIMPLIFICATION – from McClelland, 2009

- "Borges (1998) describes a town where there are mapmakers who are obsessed with verisimilitude in their mapmaking
  - Each strives to outdo the others in making his maps more detailed and realistic. Some mapmakers are criticized because their maps are too small–their scale prevents recording of many details. Others are criticized for schematic rendering of roads and intersections.
  - The consequence is the construction of huge, life-size maps, which, of course, are completely useless because use of such a map is no easier than direct exploration of the real space that the map represents.
- When it comes to mapmaking, simplification is evidently crucial–the point of the map is to offer a guide, rather than a replication, of reality."

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MORE MCCLELLAND

The point is simply this:

- Simplification is essential, but it comes at a cost, and real understanding depends in part on understanding the effects of the simplification.
- Unfortunately, this can mean that further exploration becomes more technical and complex as a result.
- Trying hard to add just enough additional complexity can help. Learning what simplification is the best one to use is also a part of the process. Some simplifications do a better job retaining essential properties of a process than others.


Thank You!!