6th Meeting of the Advisory Council
Max-Wertheimer Minerva Center for Cognitive Processes and Human Performance

Metacognitive regulation of accuracy and informativeness in memory reporting

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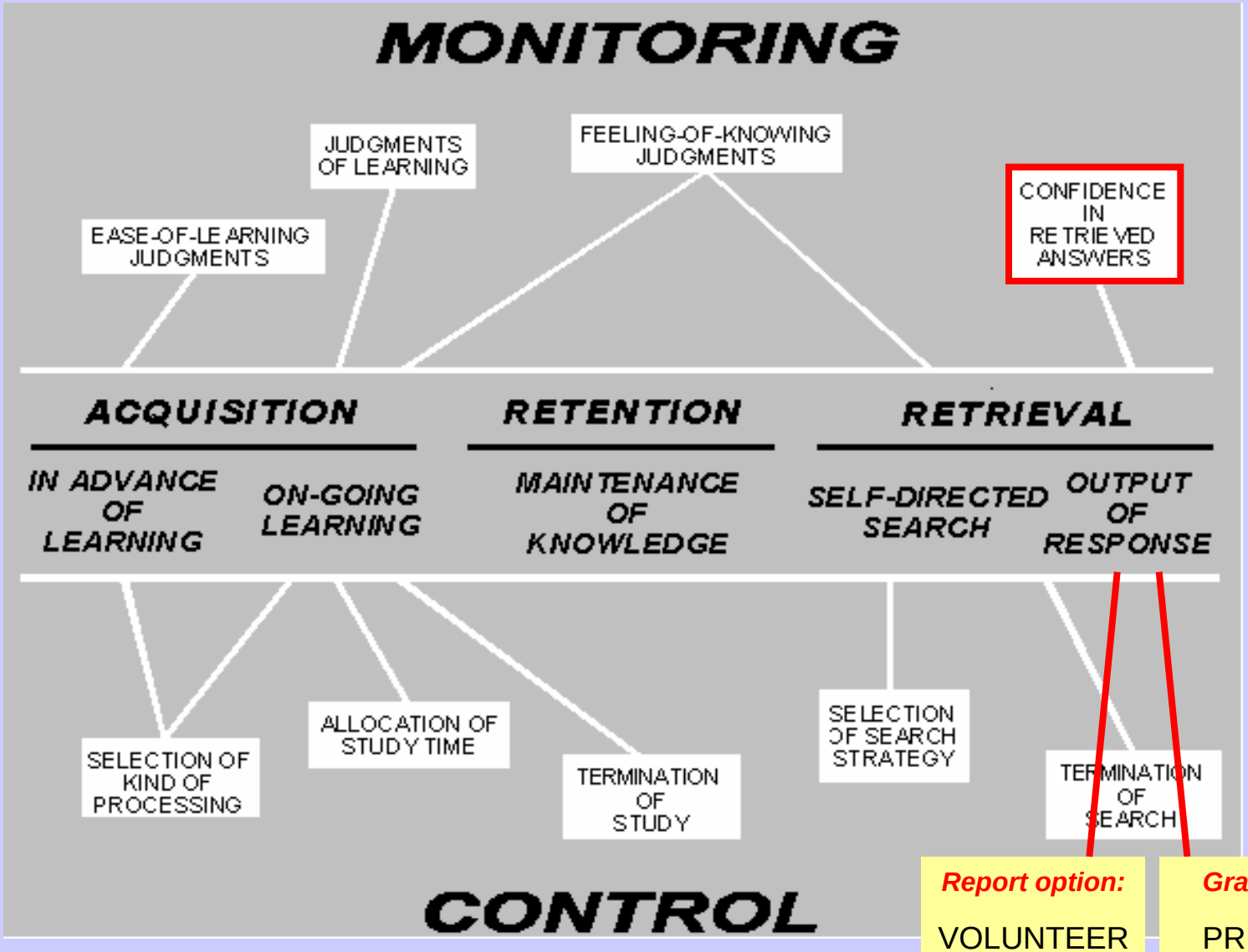


Report option:

VOLUNTEER OR WITHHOLD

Grain size:

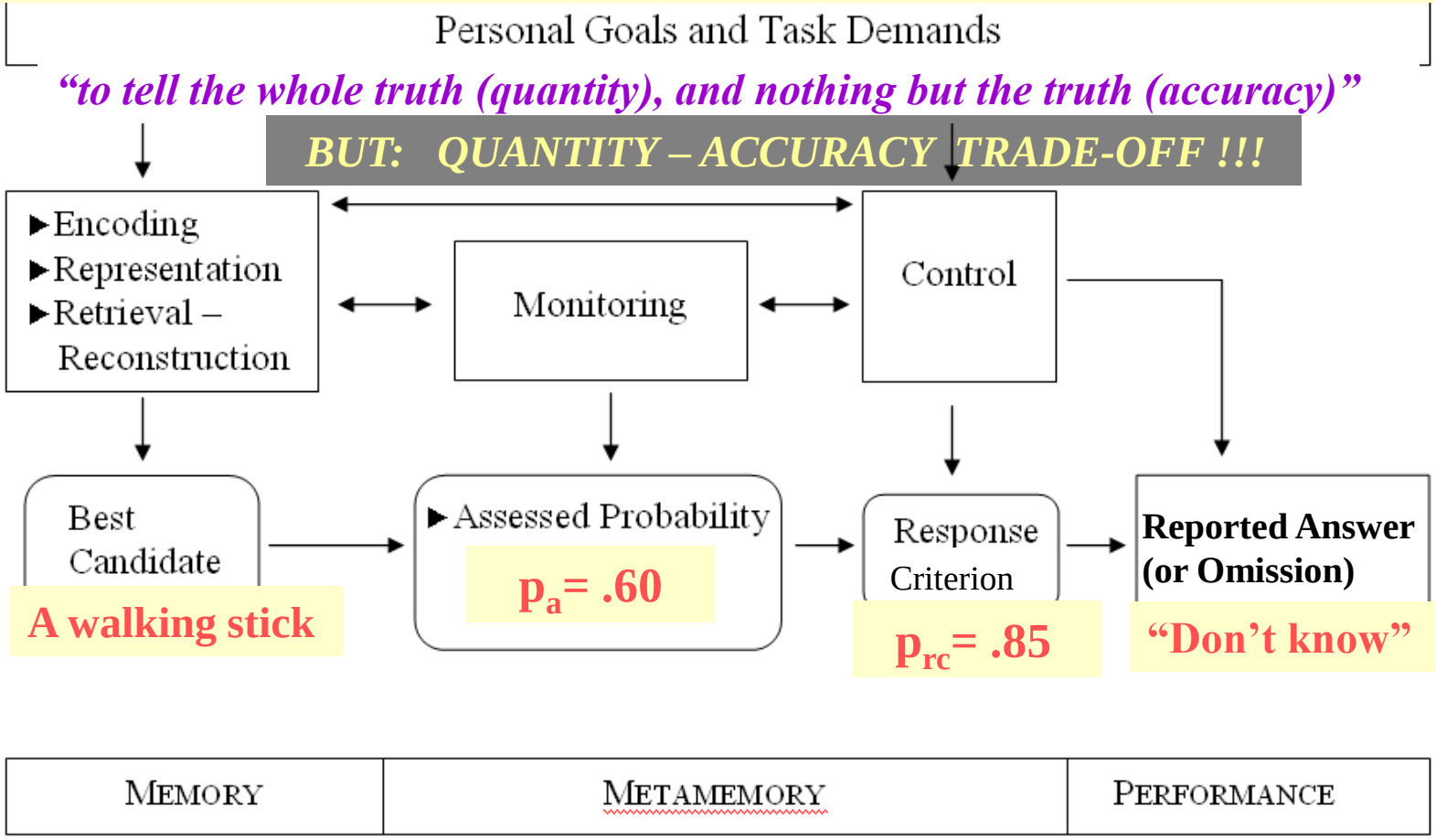
PRECISE OR COARSE

Two Types of Report Control

- **<u>Report Option</u> – Withholding particular items of information (responding "don't know" or "don't remember") in order to screen out wrong answers.**
- **<u>Grain Size</u> – choosing a level of coarseness or generality at which the answer is unlikely to be wrong.**

A GENERAL FRAMEWORK FOR THE CONTROL OF MEMORY REPORTING

What was the defendant holding when he threatened the deceased?



Koriat & Goldsmith (1996, Psych. Rev.)

Retrieval ==> Monitoring ==> Control ==> Performance

- **Retention ("memory"):**

  the amount and quality of the information that can be retrieved.

- **Response criterion setting:**

  the confidence threshold set in accordance with competing demands for quantity and accuracy.

- **Monitoring effectiveness:** **(confidence ⇔ correctness)**

  the extent to which the assessed probabilities successfully differentiate correct from incorrect candidate answers.

- **Control sensitivity:** **(confidence ⇔ volunteering)**

  the extent to which the volunteering or withholding of answers is in fact based on the monitoring output.

Koriat and Goldsmith (1996 Psych. Rev.)

Empirical Evidence for Report Option

- **Free vs. forced report**
  - **Accuracy increases substantially ⇔ Quantity decreases slightly**
- **Manipulation of accuracy incentive**
  - **Accuracy increases further ⇔ Quantity decreases further**
- **Cut-off control mechanism on monitoring output**
  - **Confidence ⇔Volunteering - Mean gamma ~ .95 !**
  - **Report criterion accounts for over 90% of report decisions.**
  - **Estimated criterion level is sensitive to accuracy incentives.**
- **Free report performance depends on monitoring effectiveness**
  - **Poor monitoring + matched quantity = poor accuracy**

Koriat and Goldsmith (1996 Psych. Rev.)

Applications of Report Option

- Children's memory *(Koriat et al., 2001; Roebers & Schneider, 2002)*
- Ageing *(Kelley & Sahakyan, 2003; Pansky et al., 2002; Rhodes & Kelley, 2005)*
- Clinical populations *(Danion et al., 2001; Koren et al., 2004, in press)*
- Psychometric testing *(Notea-Koren, in progress)*
- Social cognition *(Payne et al., 2001; DIP project)*
- Changes in accuracy over time *(Koriat & Goldsmith, in progress)*
- Encoding specificity *(Higham, 2002; Higham & Tam, 2005)*

Control over Grain Size

What was the defendant holding when he threatened the deceased?

		conf	cumulative
A walking stick	**not sure**	**60%**	**60%**
A metal rod	**not sure**	**25%**	**85%**
A baseball bat	**not sure**	**10%**	**95%**

"I think it was a stick or club or something like that, yes—

some kind of club-like object **…"**

almost certain

Control over Grain Size

What time did the incident occur?

6:20	**best guess**
6:15 – 6:30	**probably**
6:00 – 6:30	**highly likely**
"Sometime in the early evening ..."	**definitely**

ACCURACY - INFORMATIVENESS TRADE-OFF !!!

Yaniv & Foster (1995, 1997)

Experimental Design *(Goldsmith et al., 2002, JEP:General)*

- **PHASE 1 -- <u>Forced grain size at two grain levels</u>**
  - **EXAMPLE: When did Neil Armstrong walk on the moon?**
    A) Specify a 3-year interval: From _____ - _____
    B) Specify a 10-year interval: From _____ - _____
  - **EXAMPLE: How many chromosomes are there in the nucleus of a human cell?**
    A) Give a specific number: _____
    B) Specify a 20-chromosome interval: _____ - _____
- **PHASE 2 -- <u>Free choice of grain size</u>**
  - **For each item, choose the answer that you would prefer to provide if you were "an expert witness testifying before a government committee."**

Results

- **Exps. 1, 2, & 3**
  - **Chose fine 40%; chose coarse 60%**
  - **Achieved accuracy = .60**
    [p(fine correct) = .32; p(coarse correct) = .75]
  - **Control: fine confidence ⇔ grain choice: Gamma = .82**
  - **Fine-confidence report criterion accounts for 88% of actual choices**
  - **Criterion estimates sensitive to informativeness incentive manipulation: .58 (high incentive) vs. .74 (low incentive)**

A "satisficing model" (cf. Simon, 1956)

Goldsmith et al. (2002)

Results

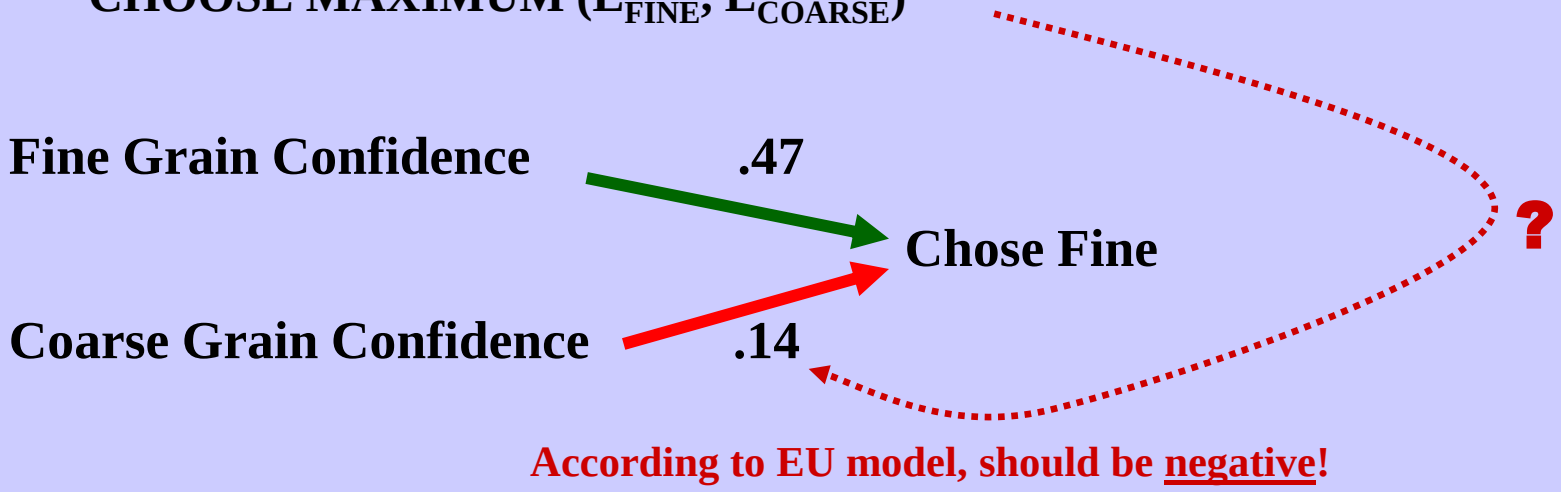
REJECTED:

Relative Subjective Expected-Utility model:

$E_{FINE} = (P_{FINE} * BONUS_{FINE}) - ((1 - P_{FINE}) * PENALTY)$

$E_{COARSE} = (P_{COARSE} * BONUS_{COARSE}) - ((1 - P_{COARSE}) * PENALTY)$

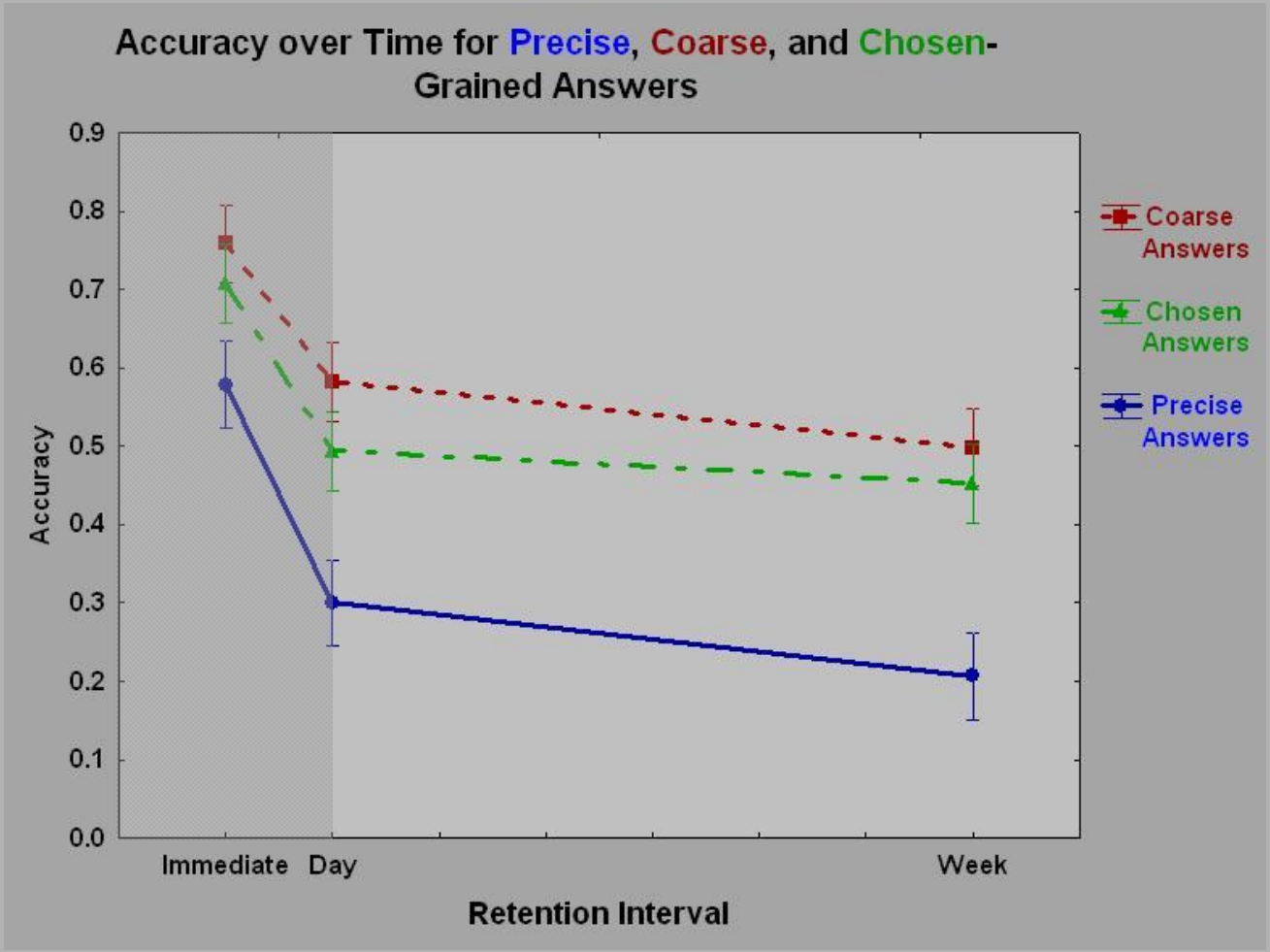
CHOOSE MAXIMUM (E_{FINE}, E_{COARSE})



According to EU model, should be negative!

Goldsmith et al. (2002)

Strategic Regulation of Memory Grain Size over Time



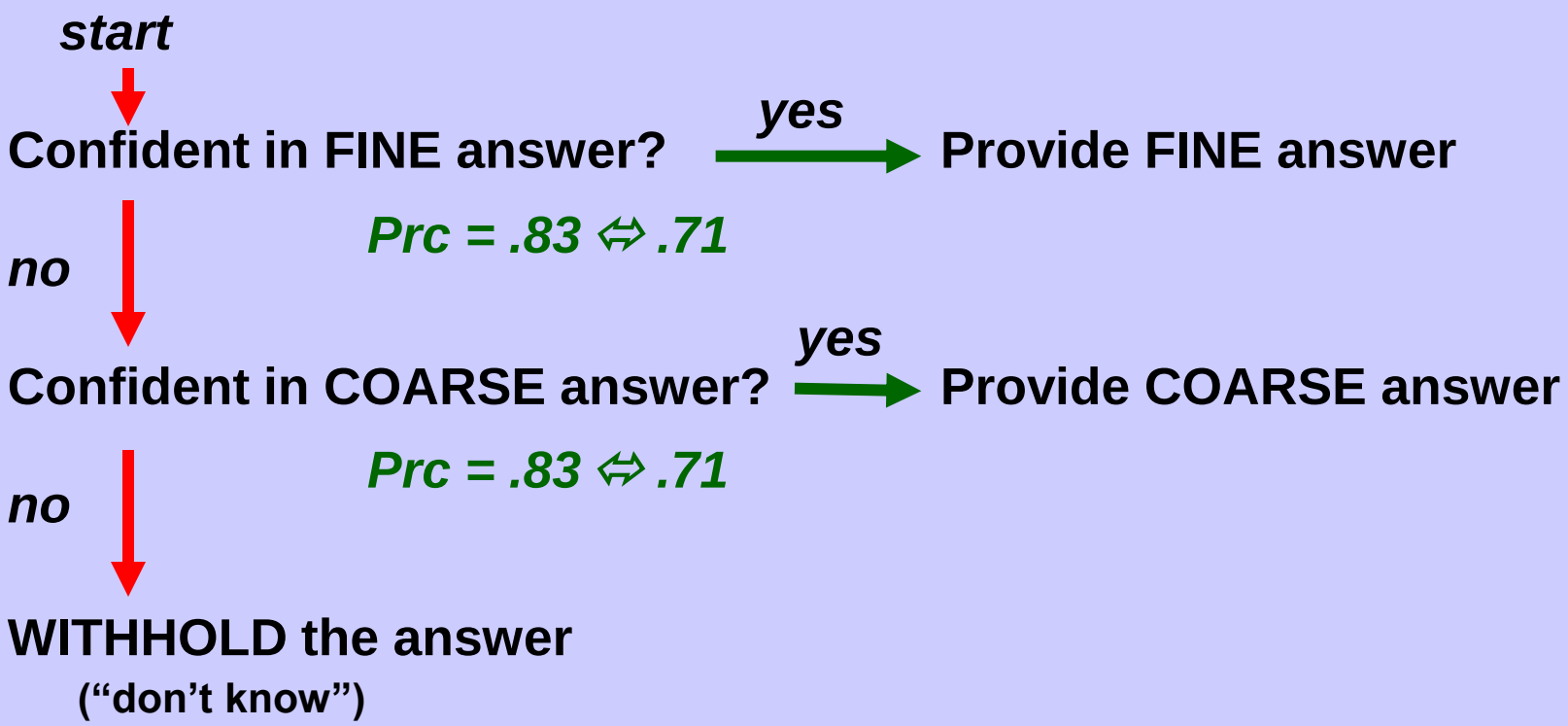
Goldsmith et al. (2005, JML special issue)

Control of Grain Size and Report Option

- **Both involve an accuracy – informativeness trade-off.**
- **Both involve monitoring the correctness of candidate answers.**
- **Both involve setting a report criterion (accuracy satisficing) per competing incentives for accuracy and informativeness.**

➢ **A single integrated model?**

Control of Grain Size and Report Option



Accounts for 90% of grain choices

Goldsmith et al. (in progress)

A Complication – Continuous grain control

- **PHASE 1 -- <u>Forced grain size at two grain levels</u>**
  - **EXAMPLE: When did Neil Armstrong walk on the moon?**
    A) Specify a 3-year interval: *1948-1951* (conf = *0*)
    B) Specify a 10-year interval: *1945-1955* (conf = *10%*)
- **But, what if:**
  - **Specify a 20-year interval: *1940-1960* (conf = *40%*)**
  - **Specify a 50-year interval: *1930-1980* (conf = *70%*)**
  - **Specify a 150-year interval: *1850-2000* (conf = *100%*)**

Goldsmith et al. (in progress)

Evidence for Informativeness Criterion

Retention Interval (% DK)

Immediate (13%)

One day (17%)

One week (24%)

Goldsmith et al. (in progress)

Evidence for Informativeness Criterion

Retention Interval (% DK)	Normalized Width
Immediate (13%)	.74
One day (17%)	.71
One week (24%)	.85
Control	1.48*

Normalized width = (actual width) / midpoint

**Significantly different from experimental conditions*

Goldsmith et al. (in progress)

Evidence for Informativeness Criterion

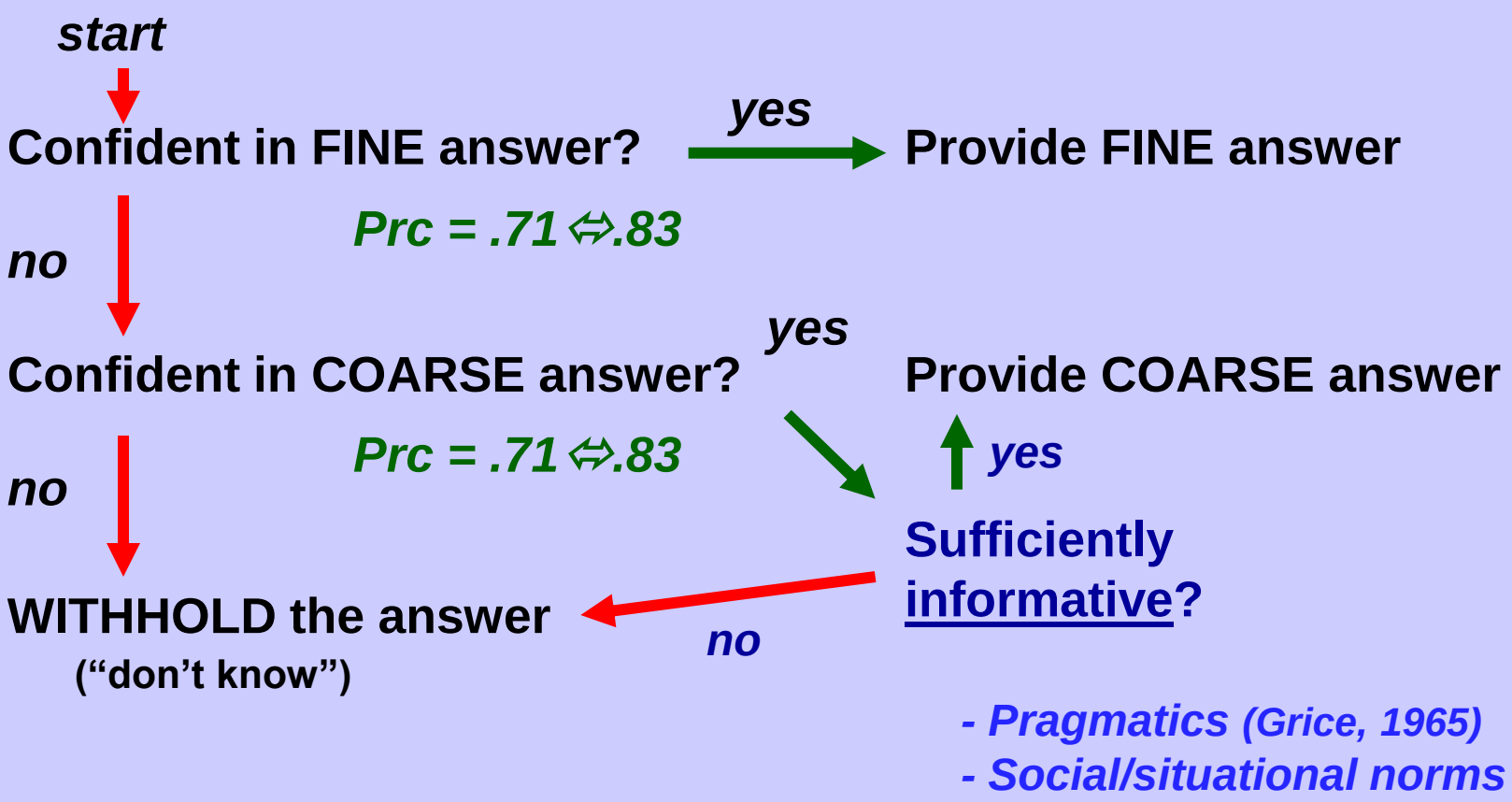
Retention Interval (% DK)	Normalized Width	Accuracy Difference
Immediate (13%)	.74	+.19*
One day (17%)	.71	+.07*
One week (24%)	.85	.00
Control	1.48*	

Normalized width = (actual width) / midpoint

**Significantly different from experimental conditions*

Goldsmith et al. (in progress)

Control of Grain Size and Report Option



Goldsmith et al. (in progress)

Conclusions

- Report option and grain size are both important means of regulating accuracy and informativeness of memory reports.
- We must understand such regulation in order to understand the factors underlying memory performance in real-life settings.
- Doing so requires examination of cognitive, metacognitive, and social-pragmatic contributions to memory performance.
- More work remains to be done.