

When Brains are Better Than People: Using fMRI to Predict Markets

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Center for Neuropolicy

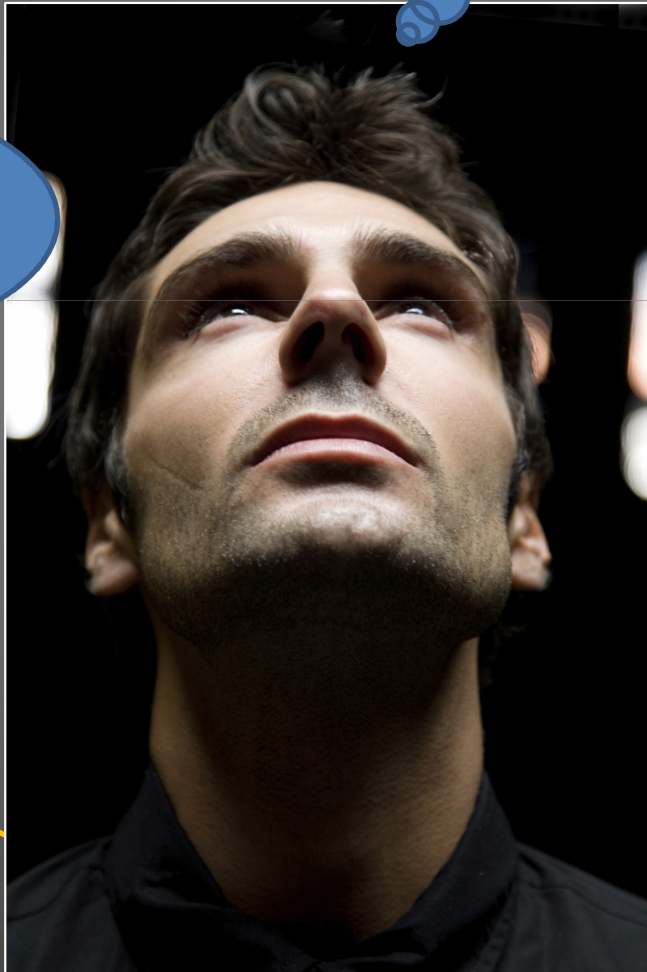
Emory University, Atlanta GA

Outline

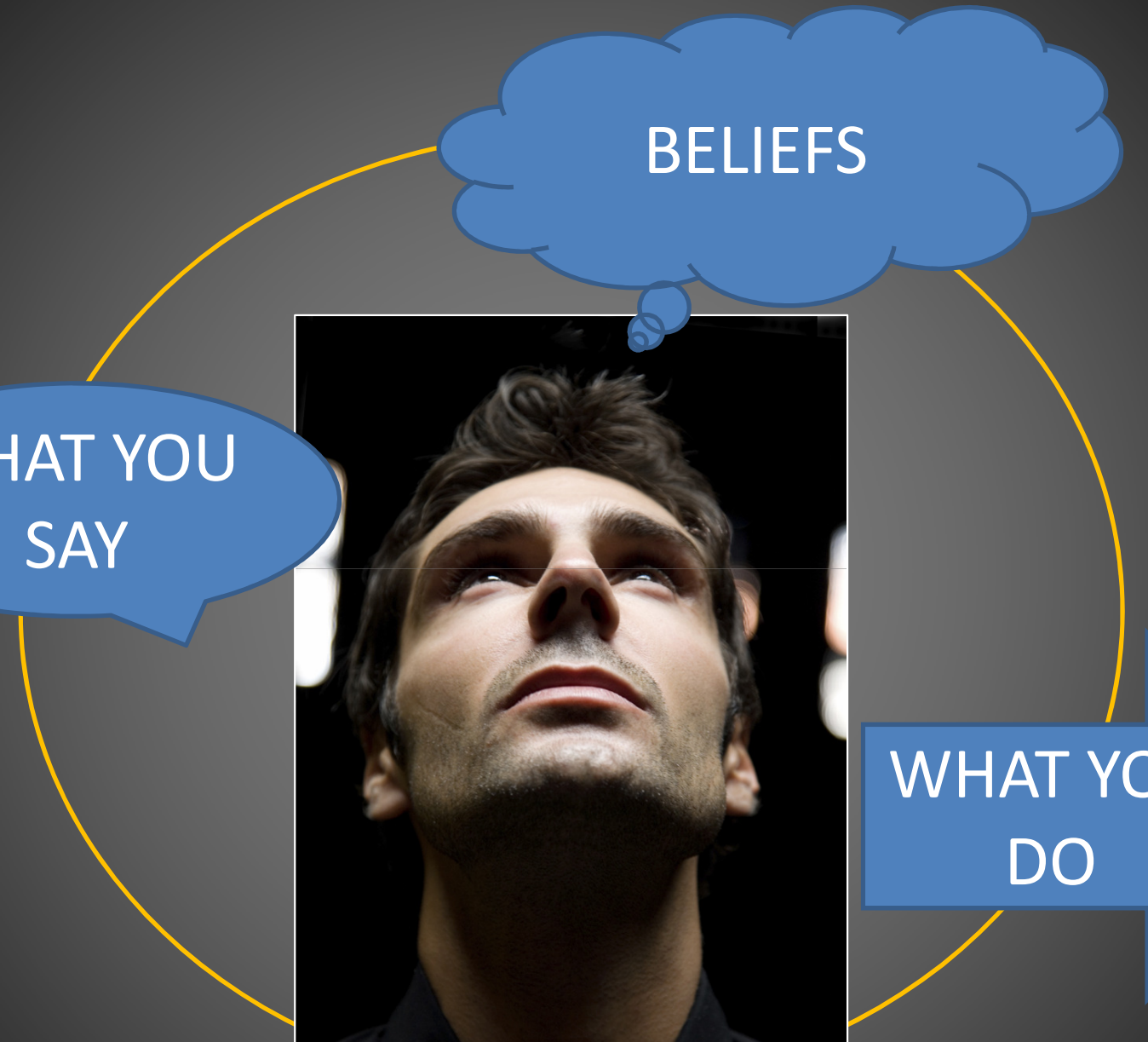
- The reward-prediction error model of dopamine release
- Applications to decision-making (neuroeconomics)
- Applications to forecasting music sales
- Applications to forecasting market reactions

BELIEFS

WHAT YOU
SAY



WHAT YOU
DO

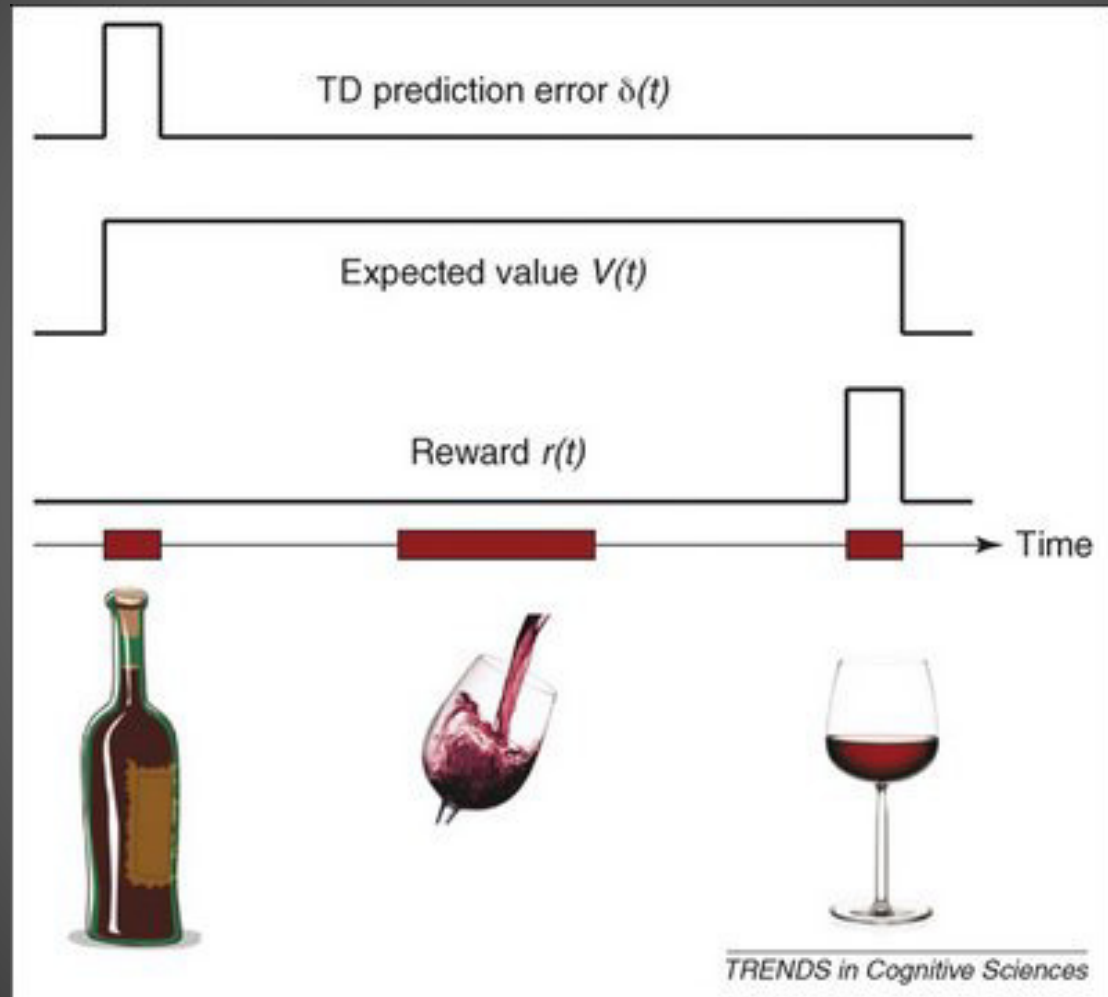


Reward-prediction

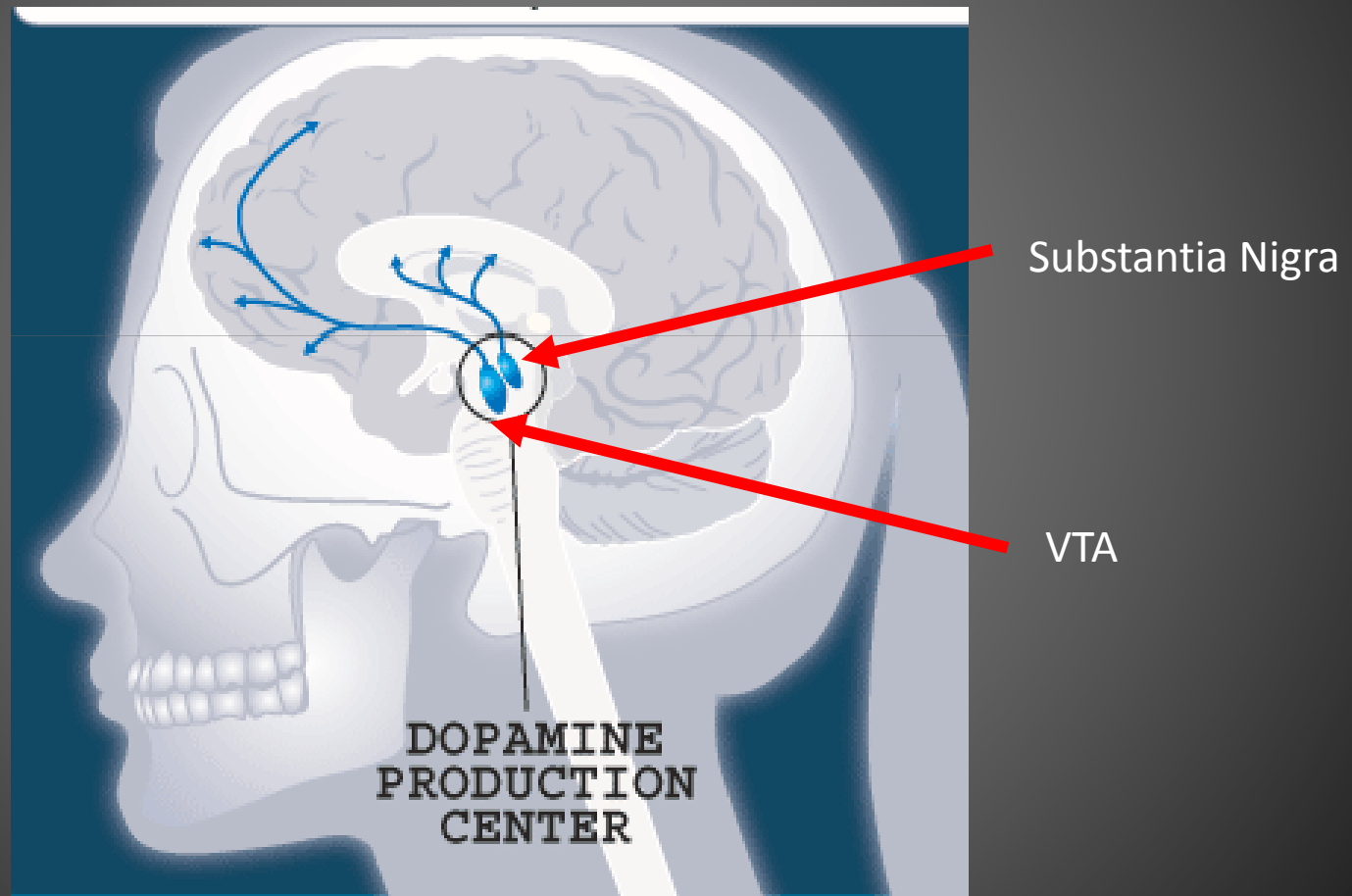


Source: New York Times

Reward Prediction Error (TD)



Dopamine System



Dopamine \neq Pleasure

Dopamine = Δ Anticipation

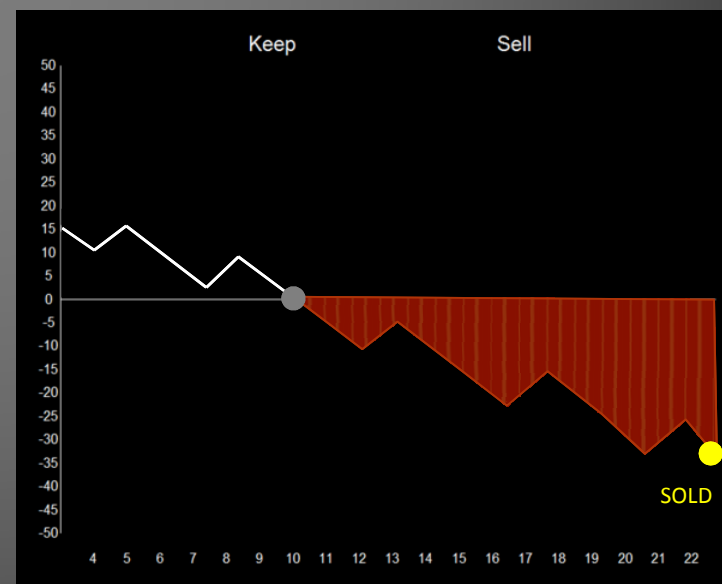
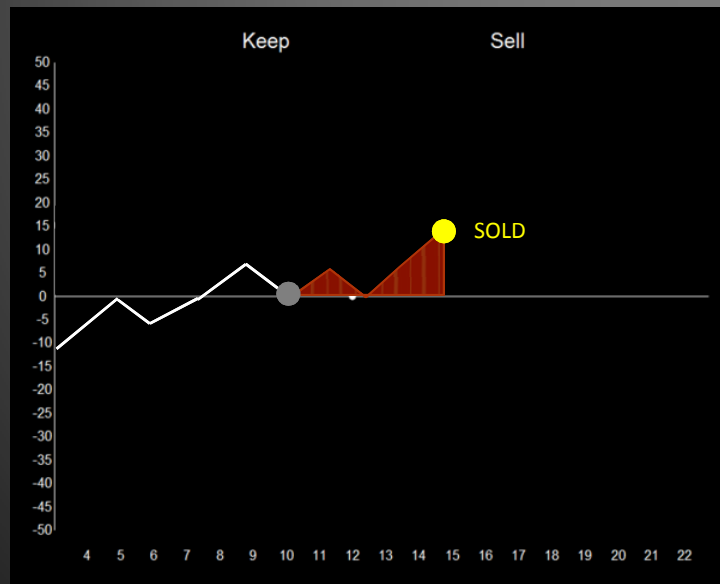


DECISIONS

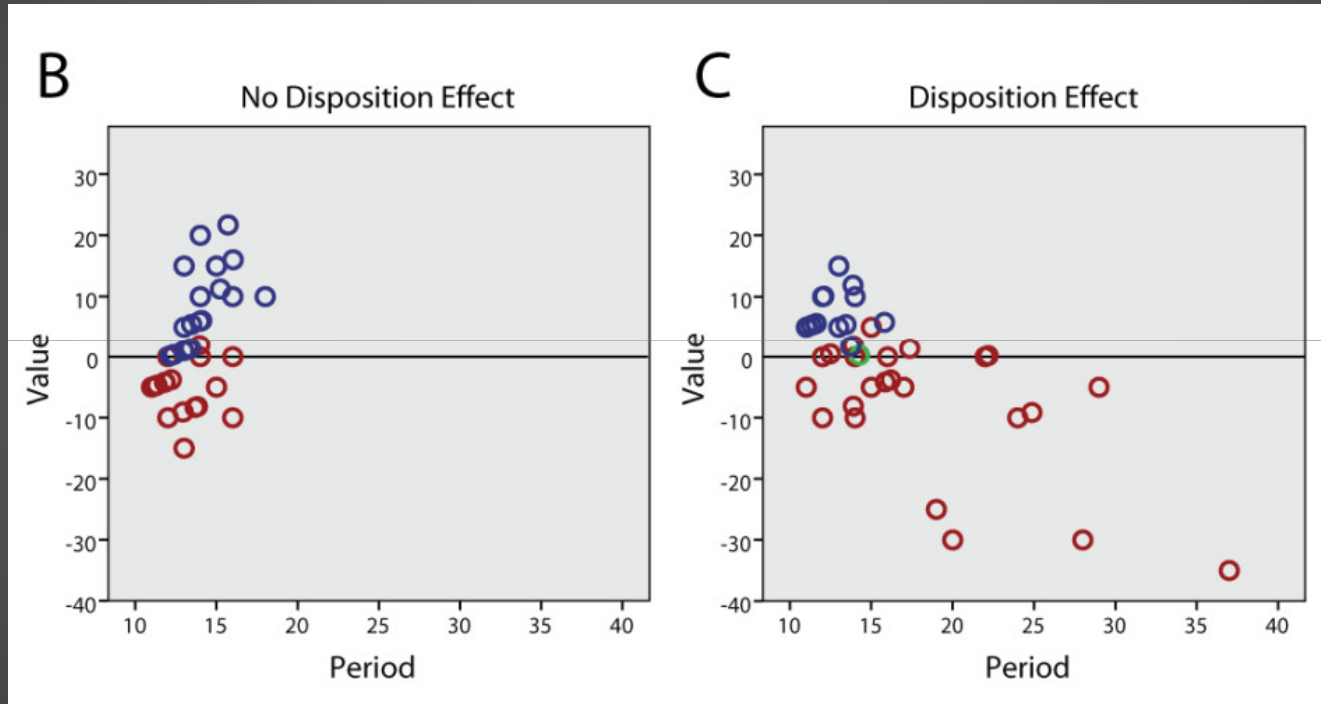
Example from Neuroeconomics

Disposition Effect (with Andrew Brooks)

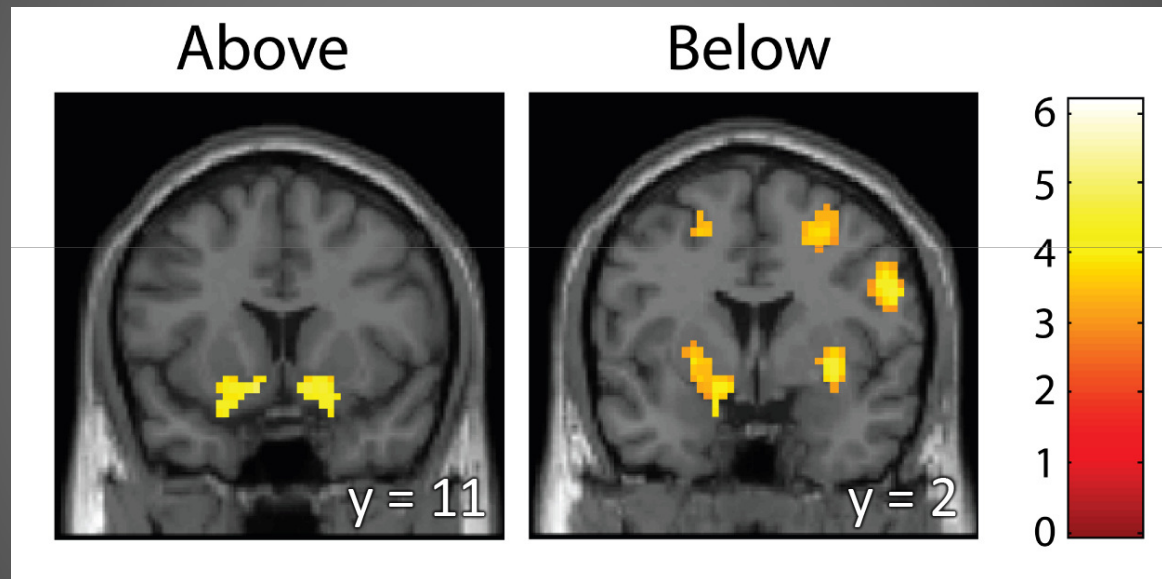
- People hold onto losses longer than gains
 - Risk-preference
 - Realization Utility
 - Mean Reversion



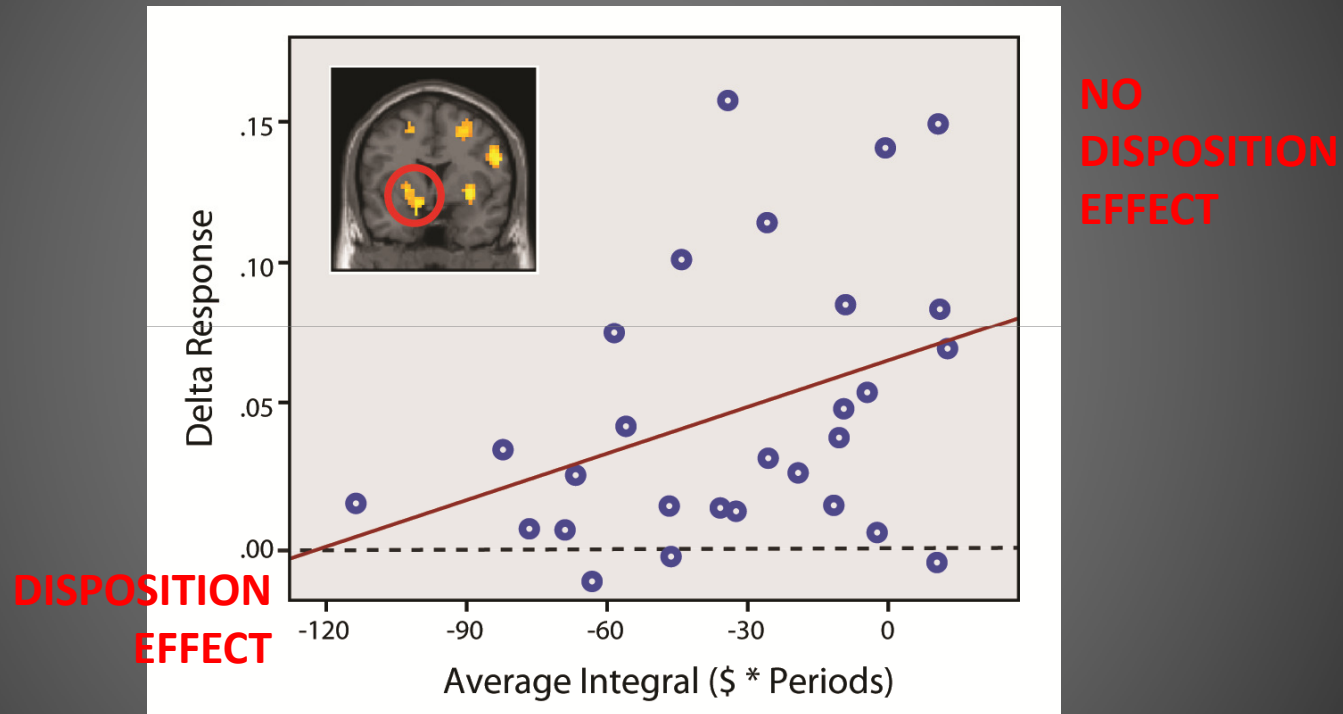
Disposition Effect



Disposition Effect



Disposition Effect Blunted Response to Upticks



Disposition Effect Conclusions

- Consistent with mean reversion hypothesis
 - Belief that the asset will revert to mean
 - Those who show DE have expectations met when below the purchase price (blunted response)

Predicting Culture Trends (Music Sales)



Source: Bruce Ely, The Oregonian



New! Google Trends and Google Insights for Search have been redesigned and merged into a single powerful tool. [Learn more](#)

Trends

Web Search Interest: **adele**. Worldwide, Jan 2008 - Jan 2012.



Explore trends

Hot searches

Search terms

adele

+ Add term

▸ Other comparisons

Limit to

Web Search ▾

Worldwide ▾

Interest over time

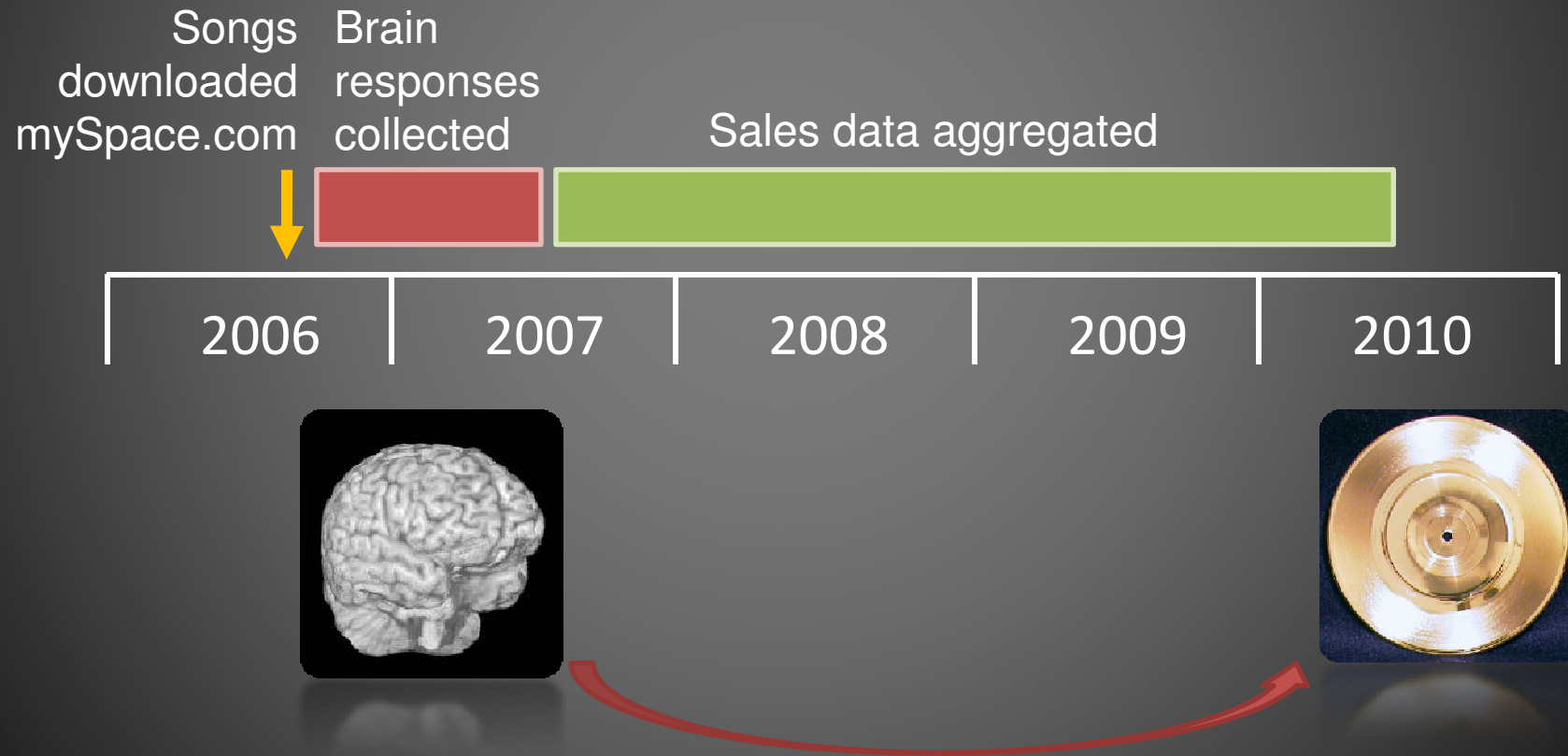
The number 100 represents the peak search volume

News headlines Forecast

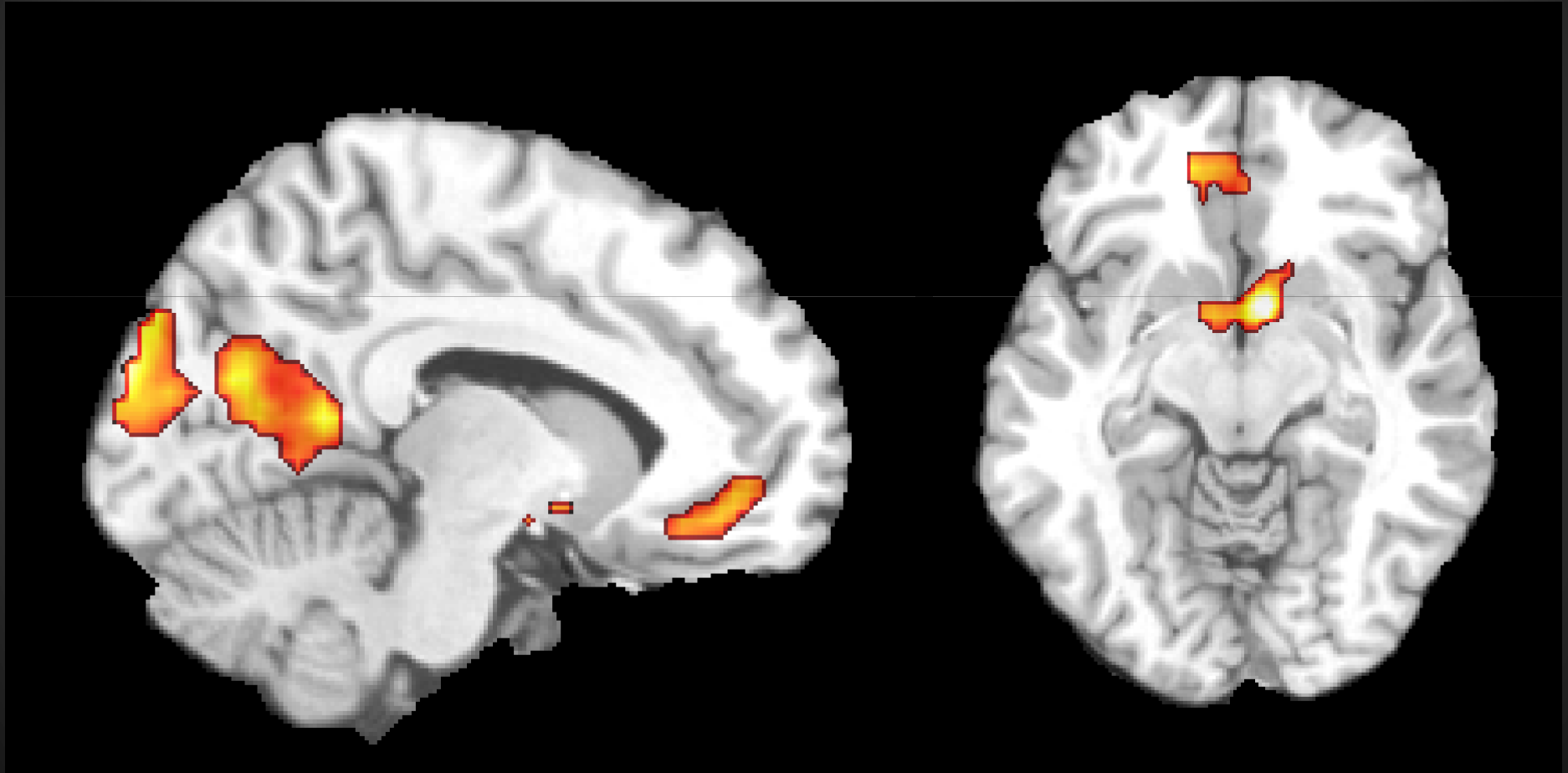


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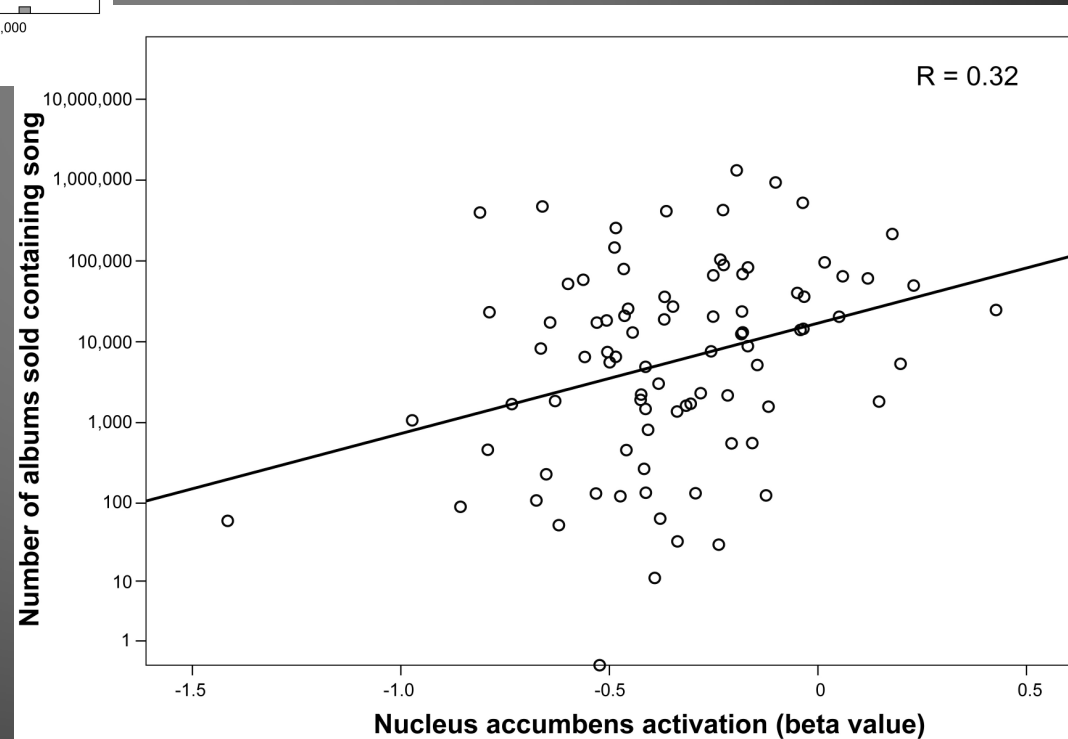
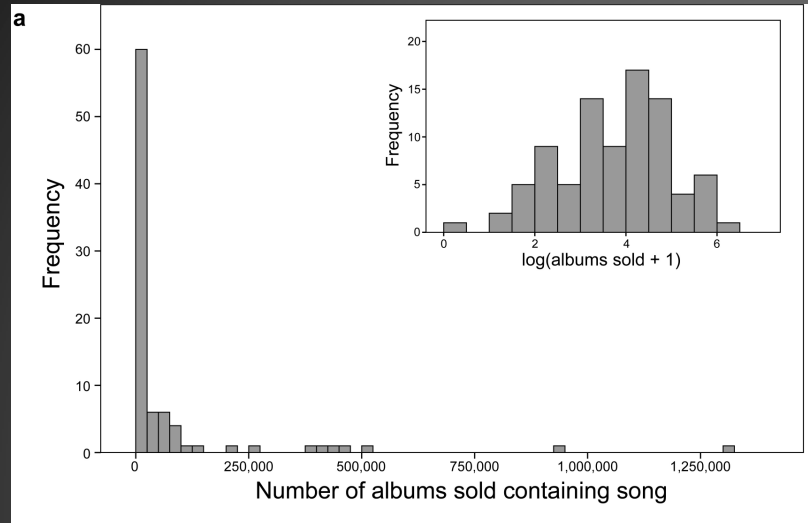
Timeline

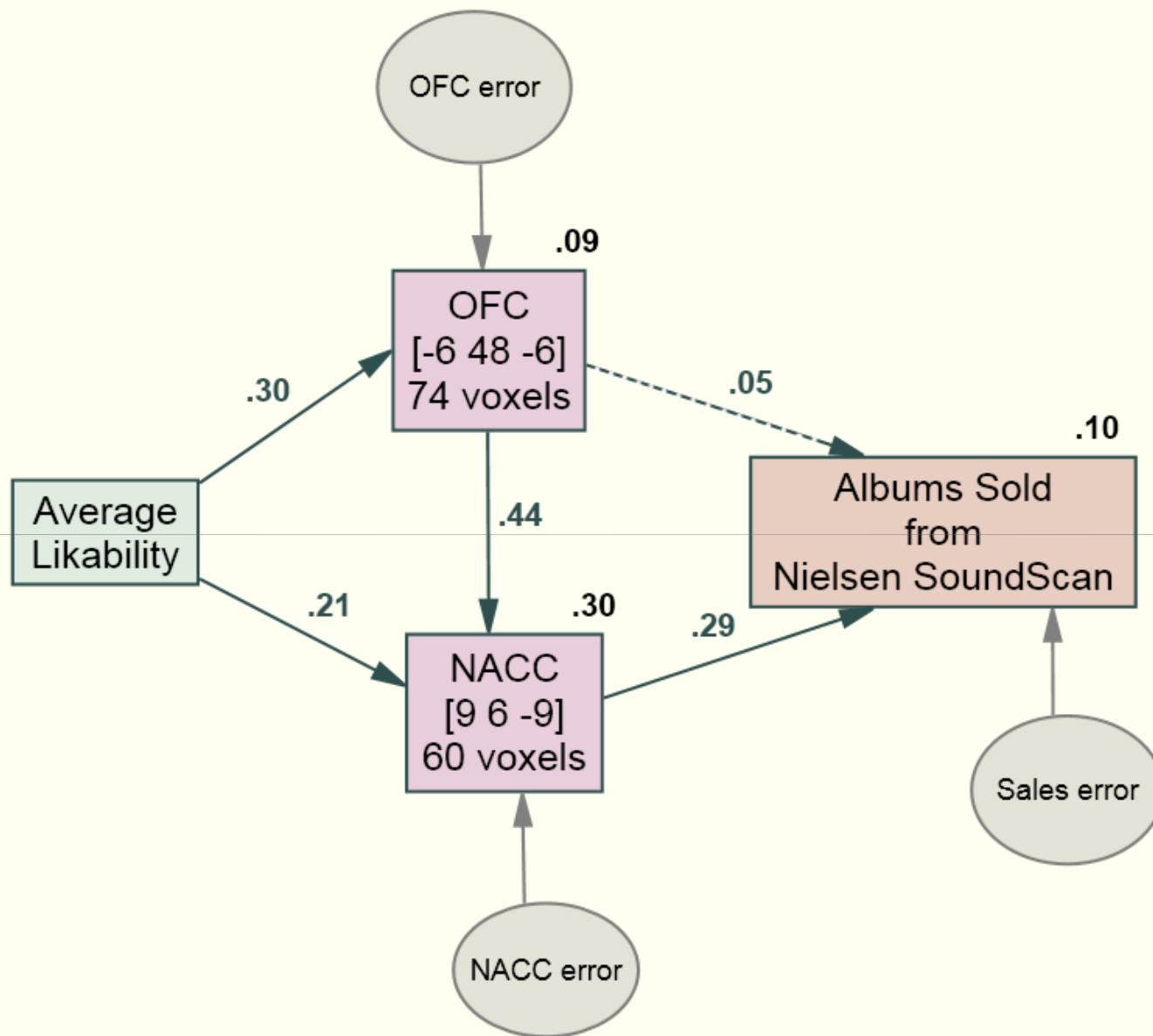


Regions that correlate with song likability

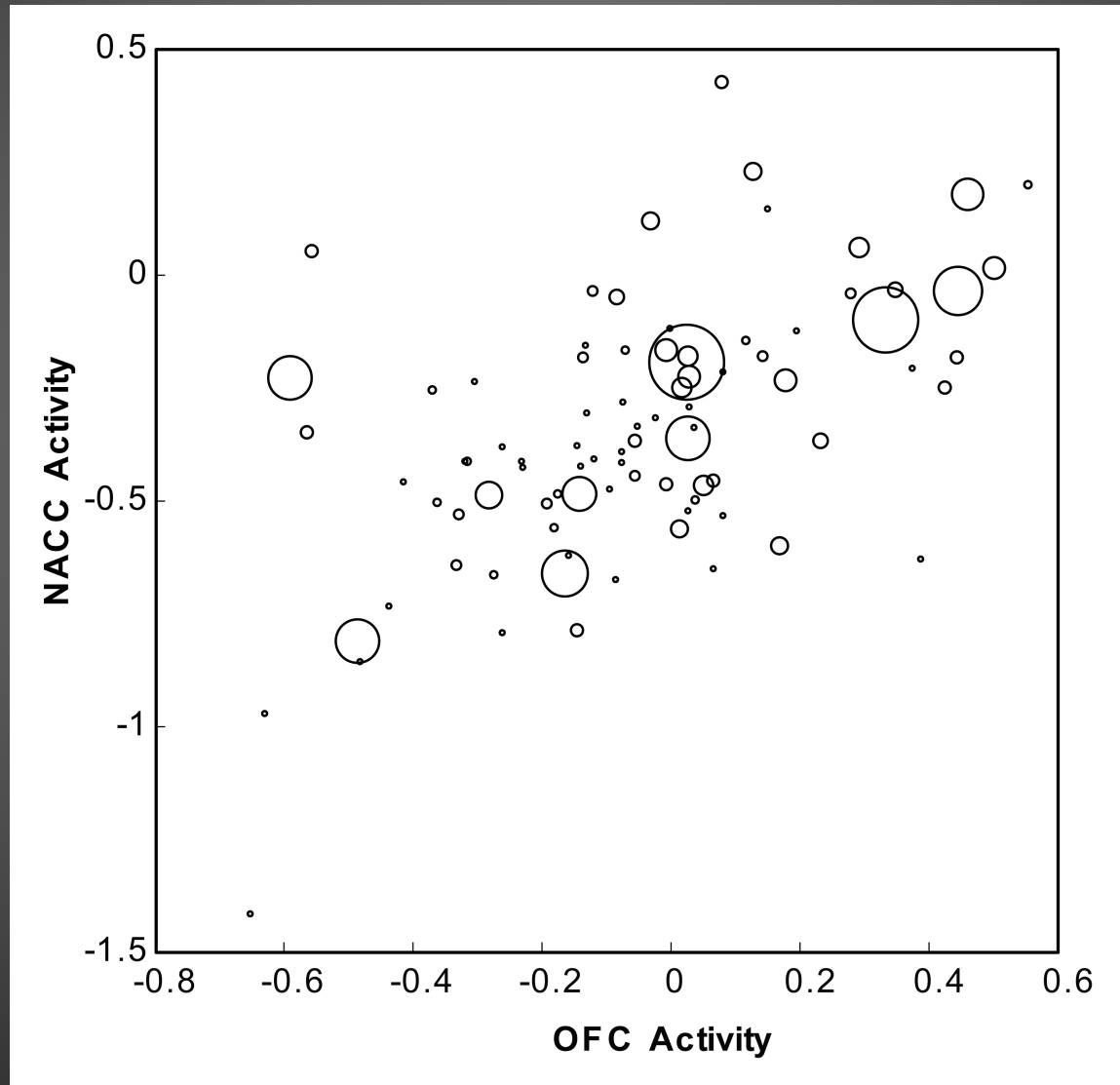


Ventral Striatum Correlates with Future Album Sales

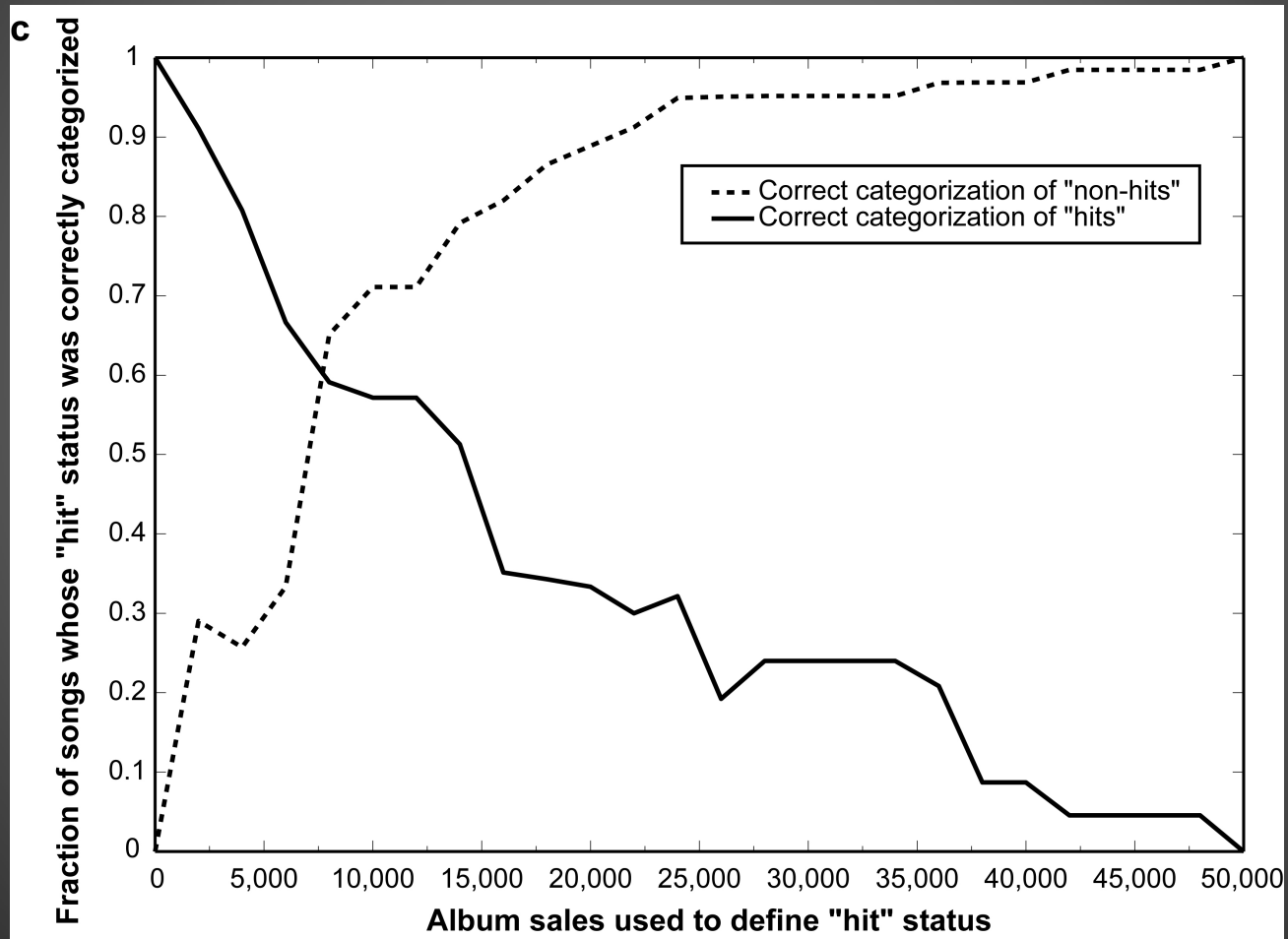




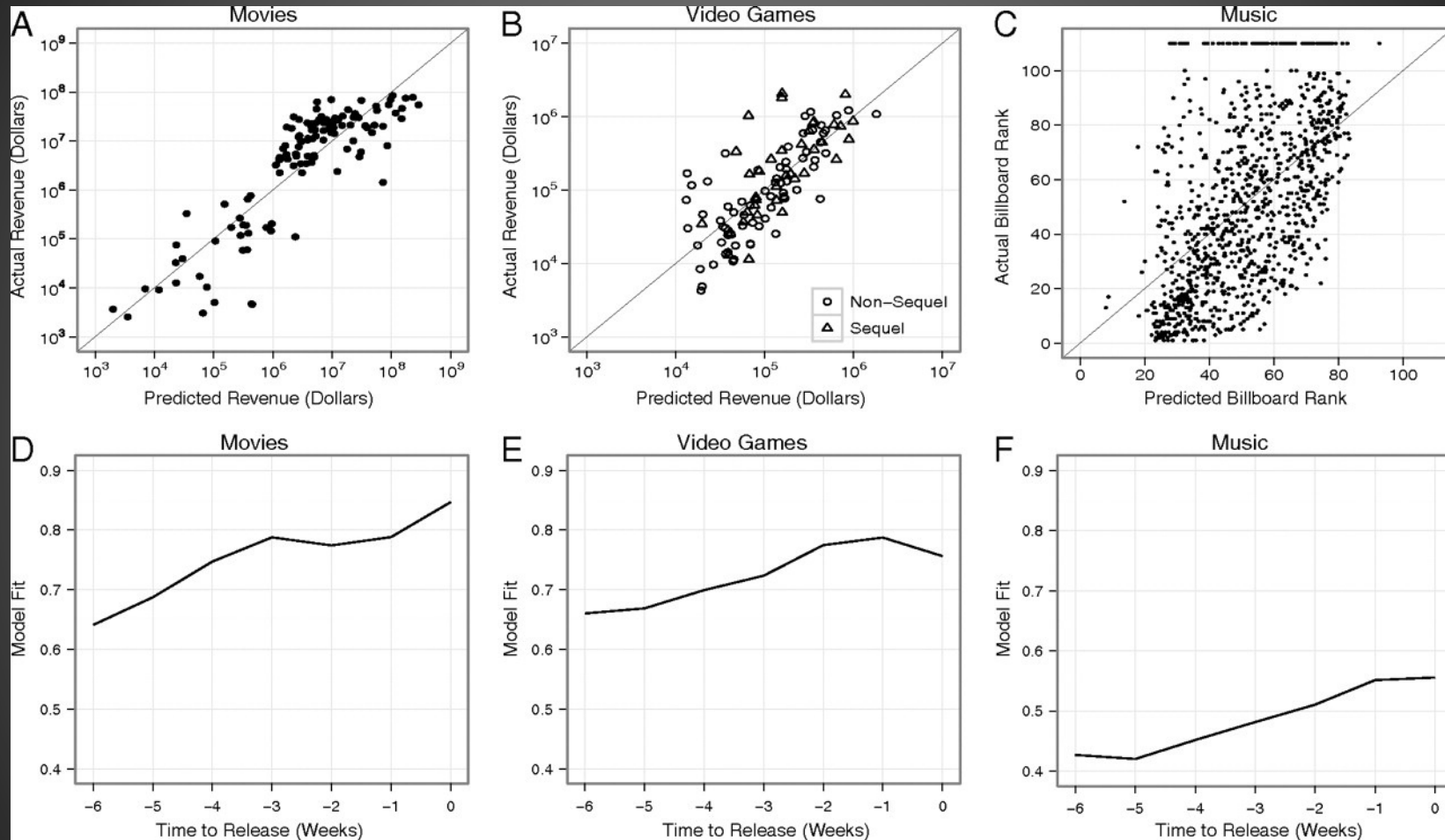
Predicting Hits from Brain Activity



Predicting Hits



Web-based hit prediction



Goel S et al. PNAS 2010;107:17486-17490

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What Does It Mean?

- NACC and OFC activation markers for both likable songs and future sales
- SEM suggests final common pathway through NACC linking likability to sales
- Possibility of neural focus groups
- Limitations to “hit prediction”

Neuroaccounting

**The neuroscience behind
the stock market's reaction to
corporate earnings news**

work with

Jan Barton and Andrew Brooks

Three questions

- How does the brain react to earnings surprises?
- Is brain reaction associated with stock market reaction?
- How does market aggregate individual brain reactions?

Hypotheses

Ventral Striatum Activity (VS)

Assume: $VS = \text{reward-prediction error}$

$$(1) VS_{\text{BEAT}} > VS_{\text{MEET}} > VS_{\text{MISS}}$$

$$(2) \text{RETURN} = f(VS)$$

	Y1	Y2	Y3	You	Analysts
Actual	1.65	2.34	2.73		?
Expected	1.50	2.24	2.55	<u> </u>	2.62
Difference	0.15	0.10	0.18		

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Would you like to go:

1. Long 2. Short

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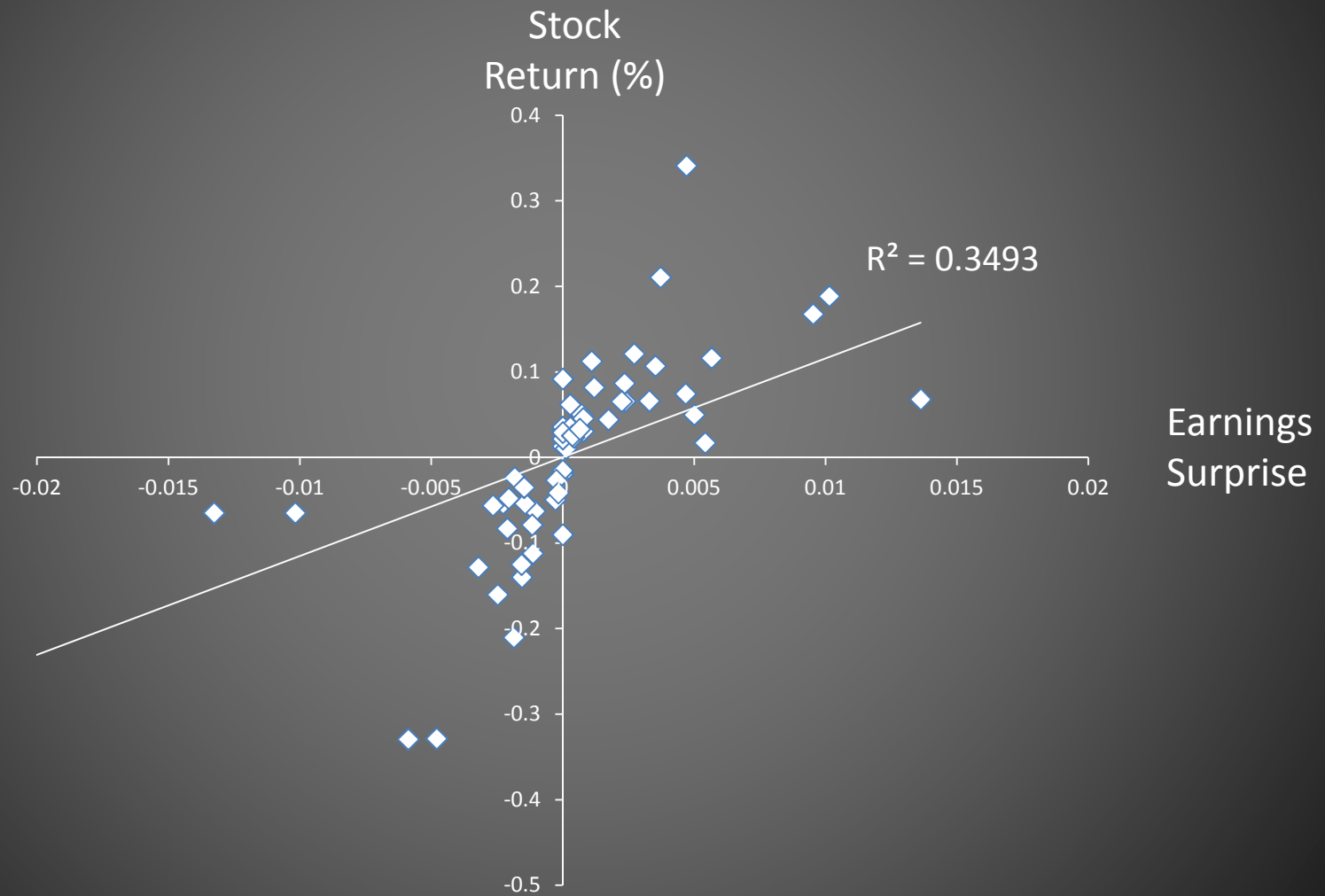
	Y1	Y2	Y3	You	Analysts
Actual	1.65	2.34	2.73		2.76
Expected	1.50	2.24	2.55	2.63	2.62
Difference	0.15	0.10	0.18	0.13	0.14

You are long.

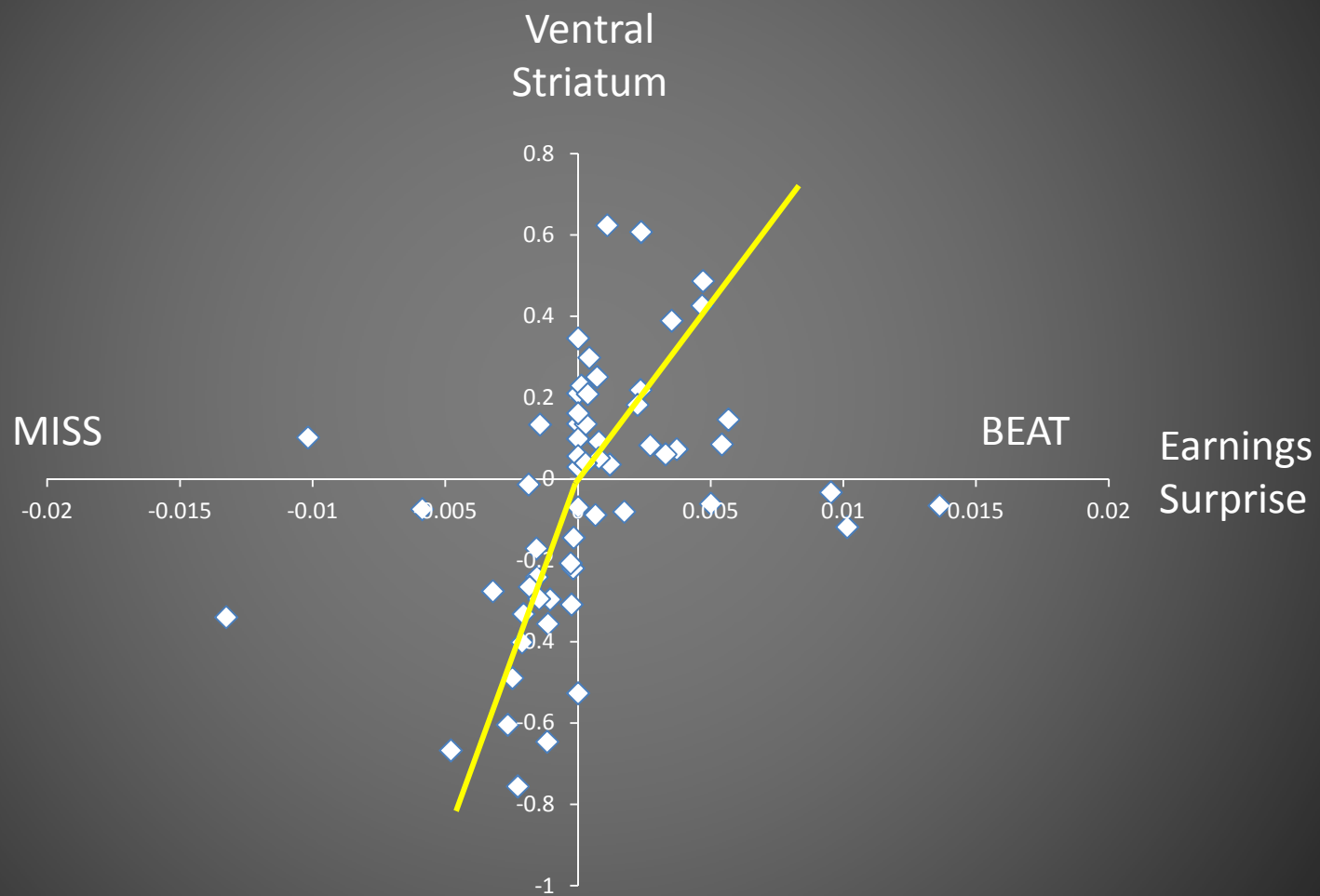
The stock price went
up by 6.5%.

You **won** money.

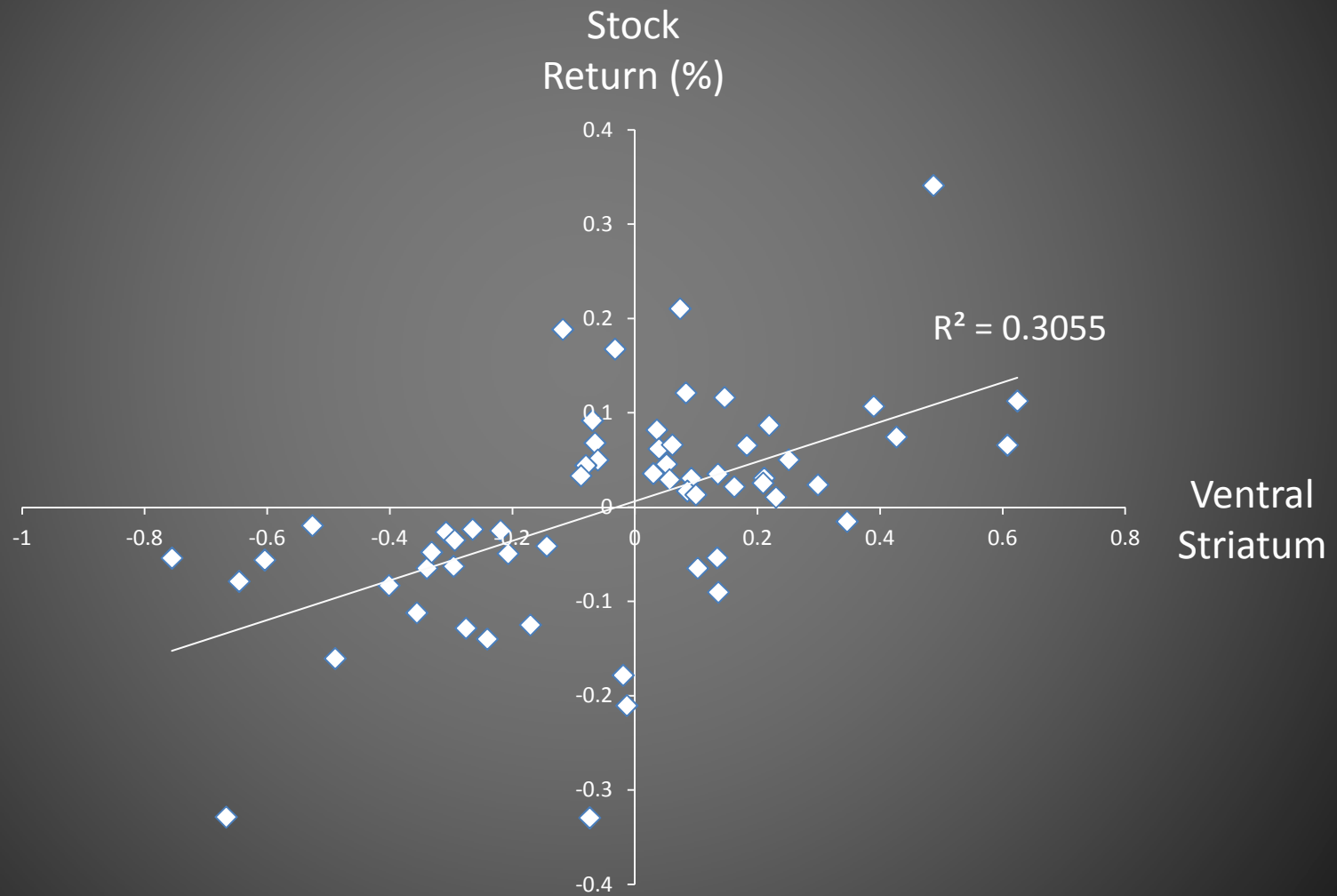
Stock Return



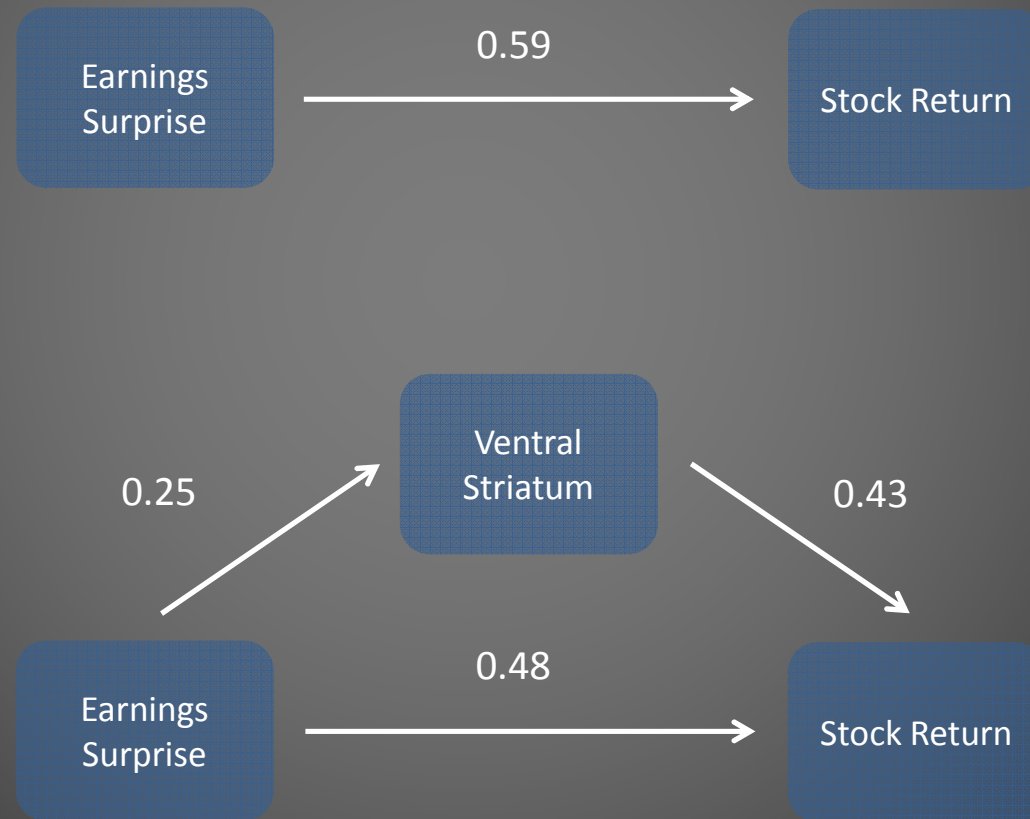
$$VS_{\text{BEAT}} > VS_{\text{MEET}} > VS_{\text{MISS}}$$



Stock Return vs. Striatum



Path Diagram for Total and Mediated Effects

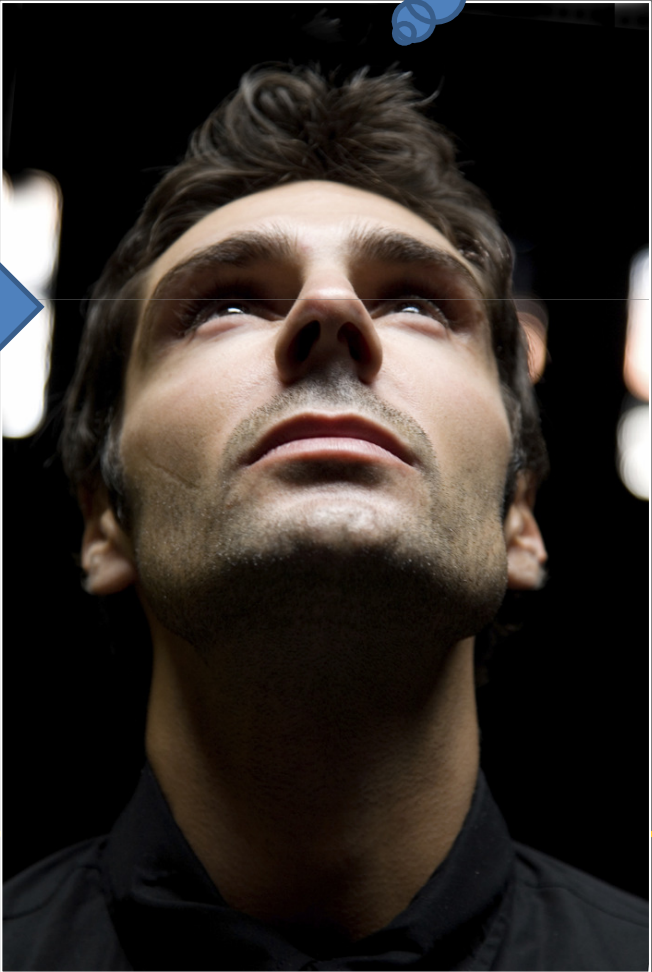


Conclusions

- Disposition Effect
 - Belief that the asset will revert to mean
 - Those who show DE have blunted striatum response to upticks (when below purchase price)
- Music Sales
 - Average ventral striatum response to music correlated with future sales
- Neuroaccounting
 - Striatum mediates link between earnings surprise and market reaction
 - Better measure of information?

DECISION
PROCESS

INFORMATION



ACTION

