# Response-related patterns in discrimination of FM narrowband noise

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# Introduction

- Theories accounting for mechanisms of frequency change detection

  - Pitch-sampling theory (Hartmann and Klein, 1980; Demany and Semal, 1989)

  - Dynamic channel theory (Green and Kay, 1973; Regan and Tansley, 1979; Dooley and Moore, 1988)

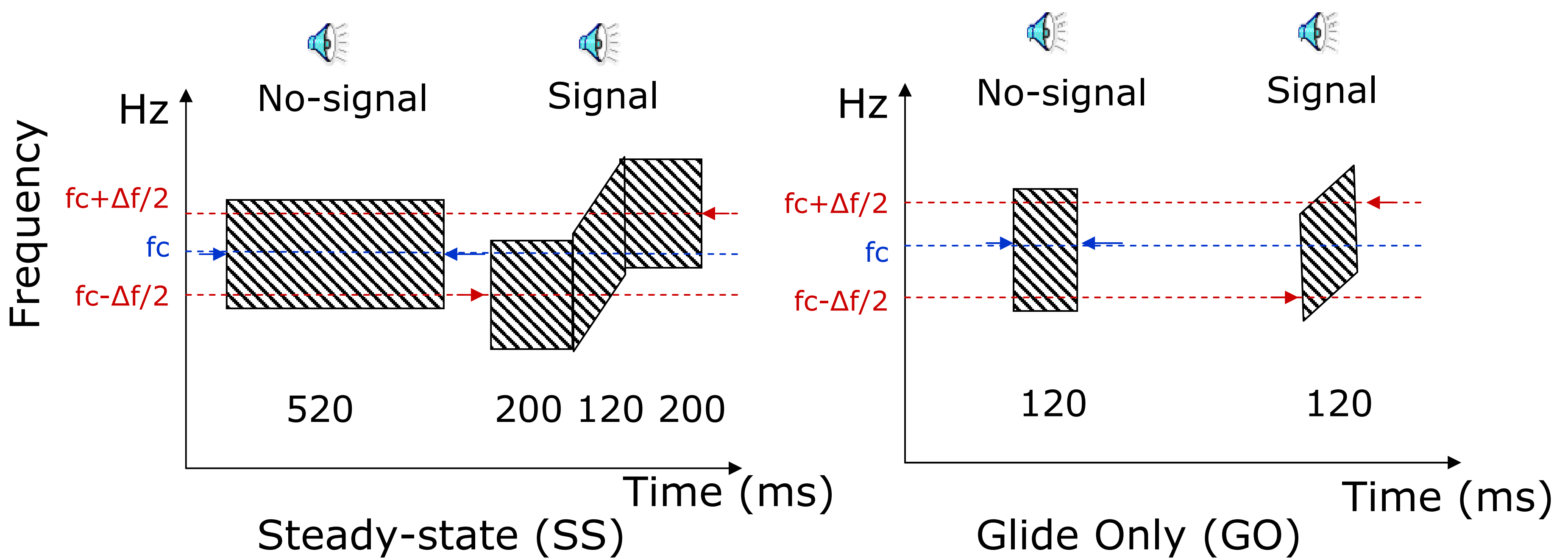
  - Combination of pitch-sampling and dynamic channel theories (Sek and Moore, 1999; Lyzenga *et al.*, 2004)

# Current study

- Investigate the auditory mechanism for frequency glide detection
- Derive temporal weights using a linear classification model (Ahumada, 2002)
- Stimuli: 50-Hz BW
  - Fixed: fc = 1000 Hz
  - Random: 800 Hz<fc<1200 Hz

# Stimuli

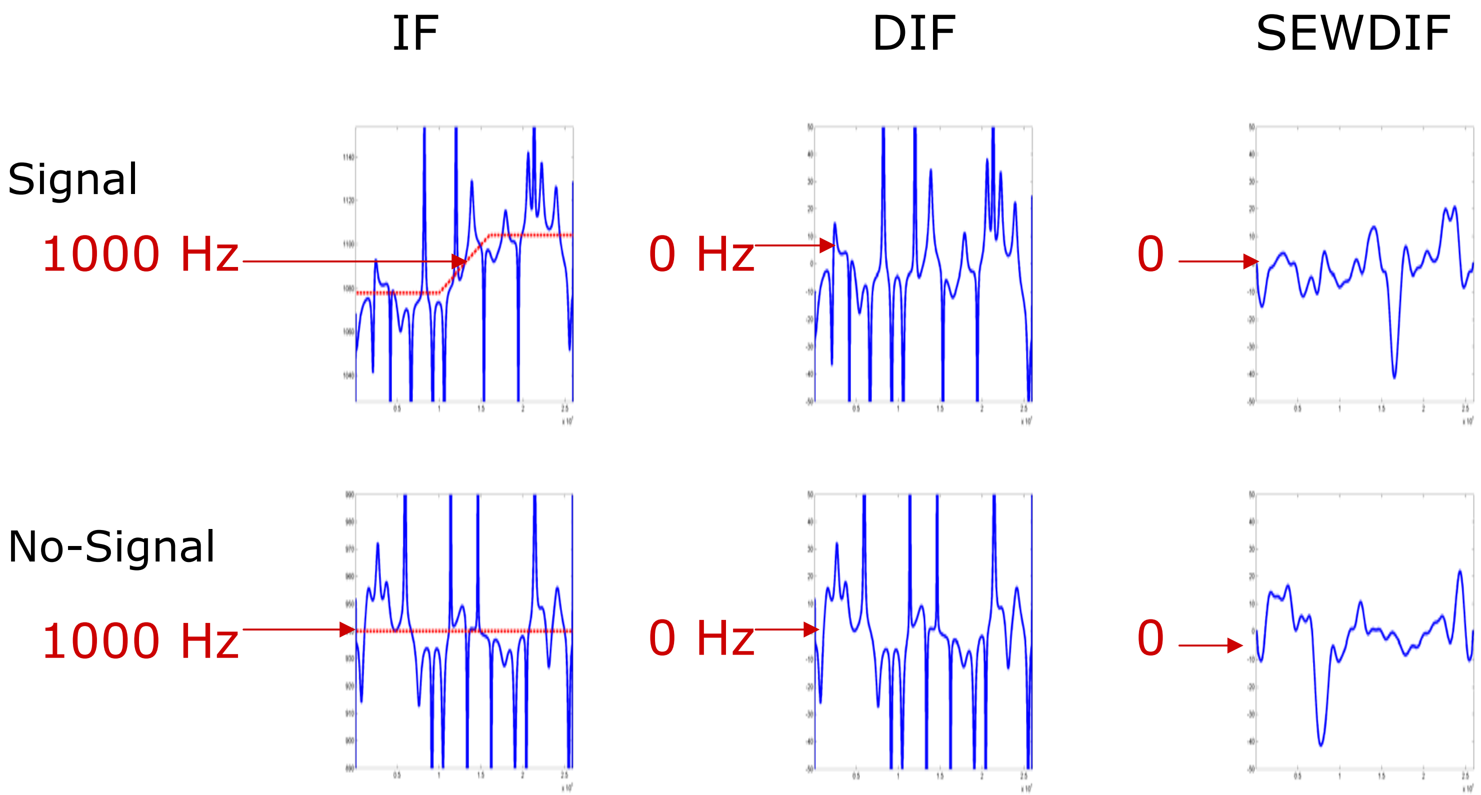
- 50-Hz narrow bands of noise
  - Fixed: fc = 1000 Hz
  - Random: 800 Hz<fc<1200 Hz



# Procedure

- 3 young adults with normal hearing
- Fixed Δf Y/N task, 57 dB SPL
- Proper stimulus level (Δf) to ensure 75~80% correct responses
- 1250 trials for each of the four conditions
  - 1) SS-fixed , 2)SS-random
  - 3) GO-fixed  and 4)GO-random

# Data Analysis




IF: Instantaneous Freq

DIF: Deviation of Instantaneous Freq

SEWDIF: Squared- Envelop-Weighted- Deviation-of-Instantaneous-Freq

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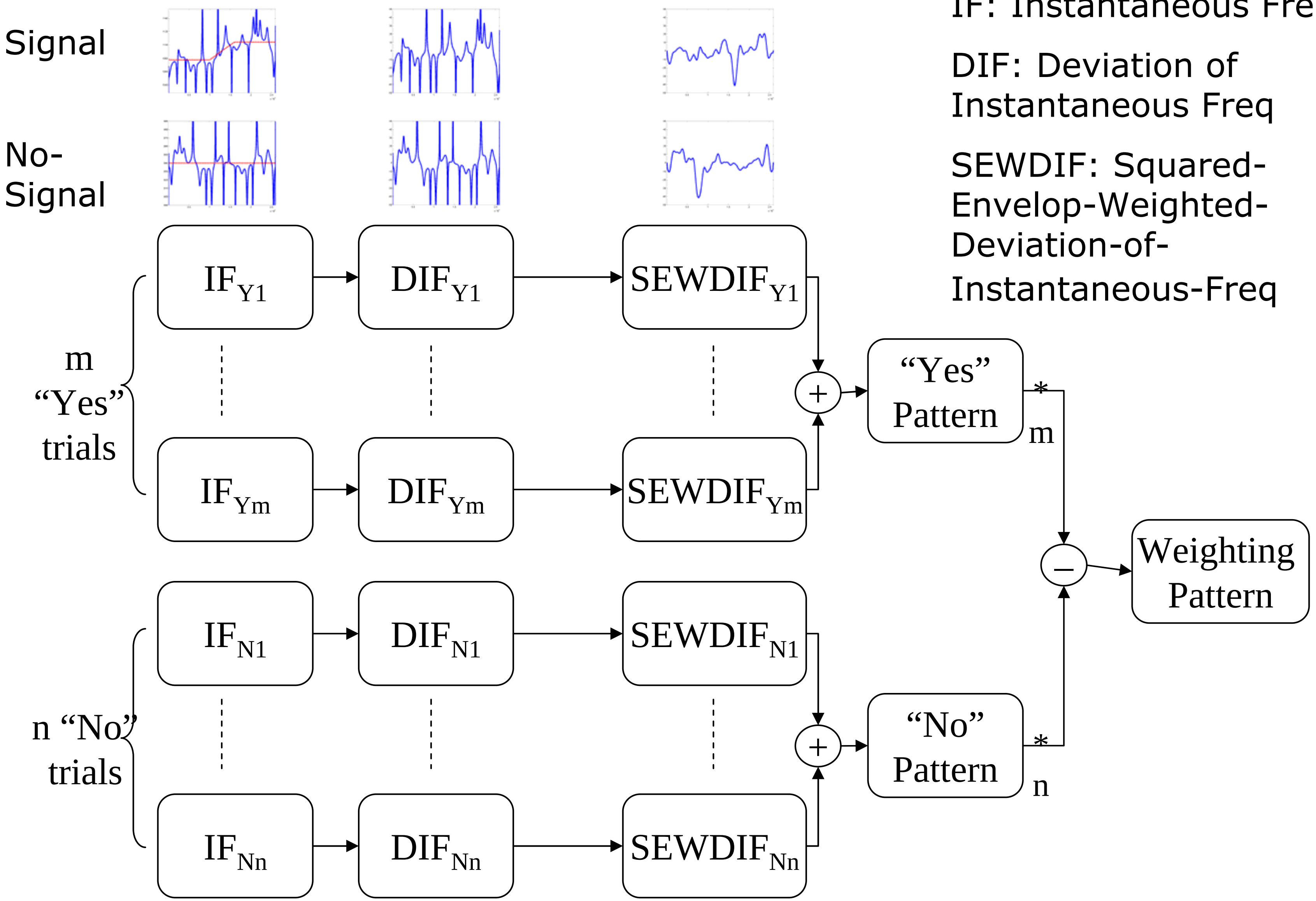
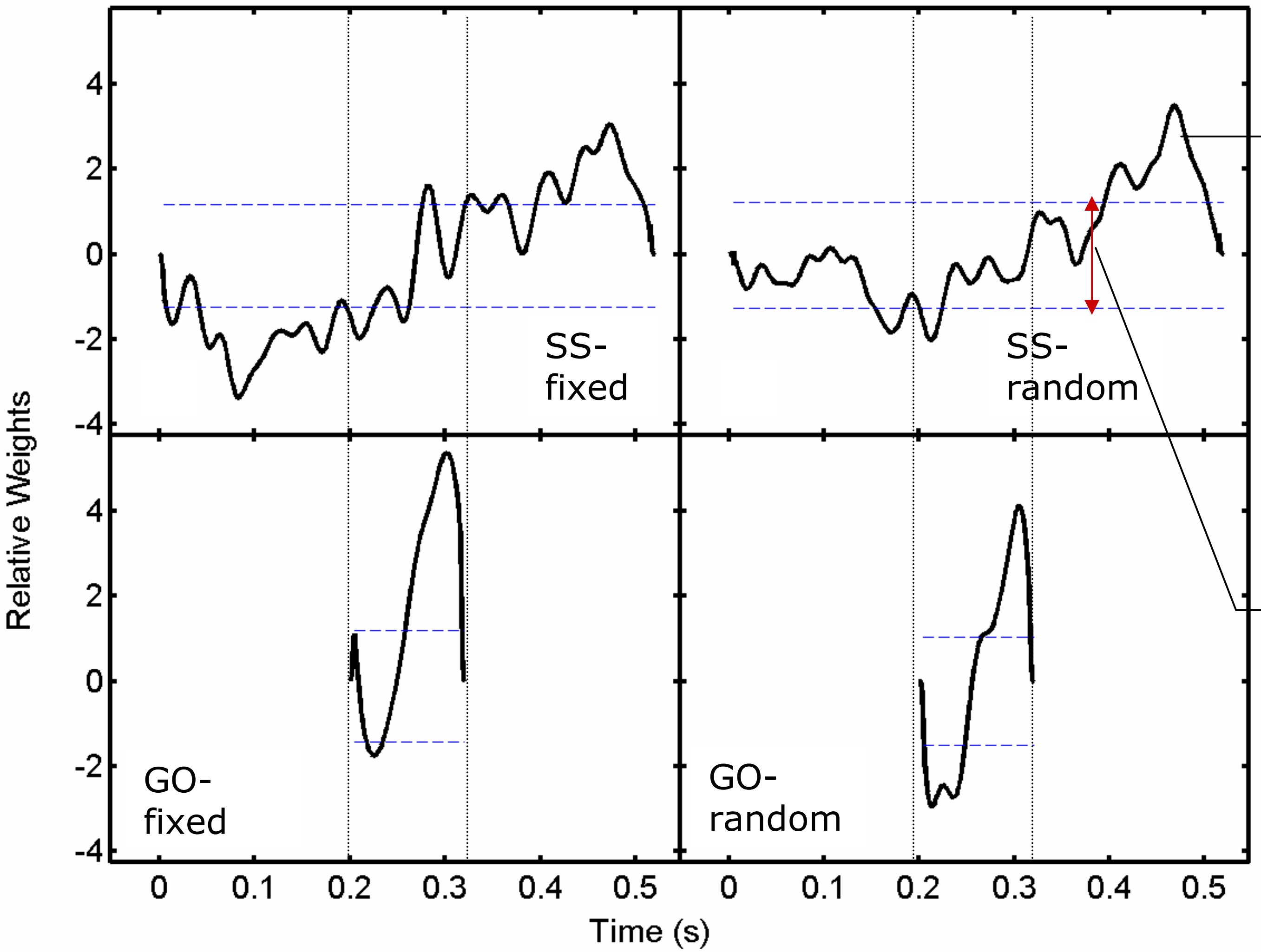


# Results: Psychophysical Data

Frequency extents ($\Delta$f in Hz) and *d*'s in four conditions

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Conditions | | | GO | | | | SS | |
| | | CK | RK | MD | | CK | RK | MD |
| Fixed-center-frequency | $\Delta$f | 46 | 44 | 42 | | 16 | 18 | 20 |
| | *d'* | 1.52 | 1.38 | 1.51 | | 1.76 | 1.72 | 1.62 |
| Random-center-frequency | $\Delta$f | 46 | 64 | 60 | | 24 | 18 | 26 |
| | *d'* | 1.60 | 1.42 | 1.72 | | 1.76 | 1.49 | 1.52 |

# Results: Temporal weighting patterns




**Patterns derived based on *subjects*' responses**

96% confidence interval of null hypothesis

# d′ based on relative weights

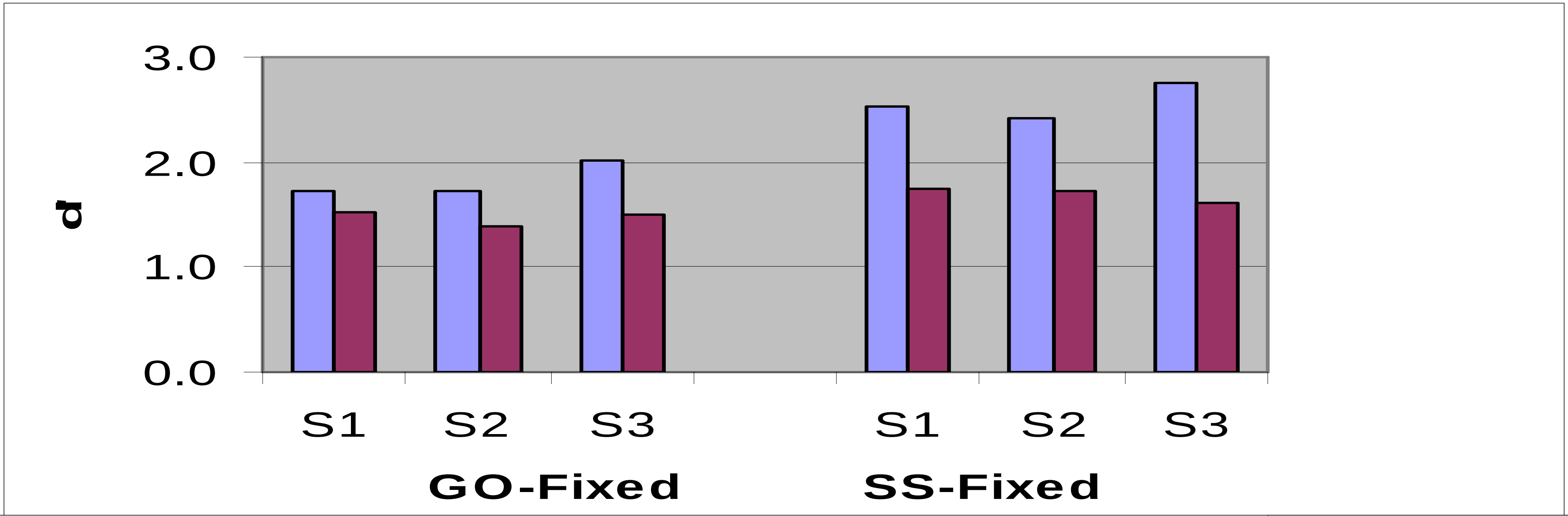
- Evaluate the degree to which derived weight pattern captures a subject's decision process.
- Compare d′ based on weights ($d'_{wgt}$) and d′ based on subjects' performance ($d'_{obs}$).
- Estimate $d'_{wgt}$

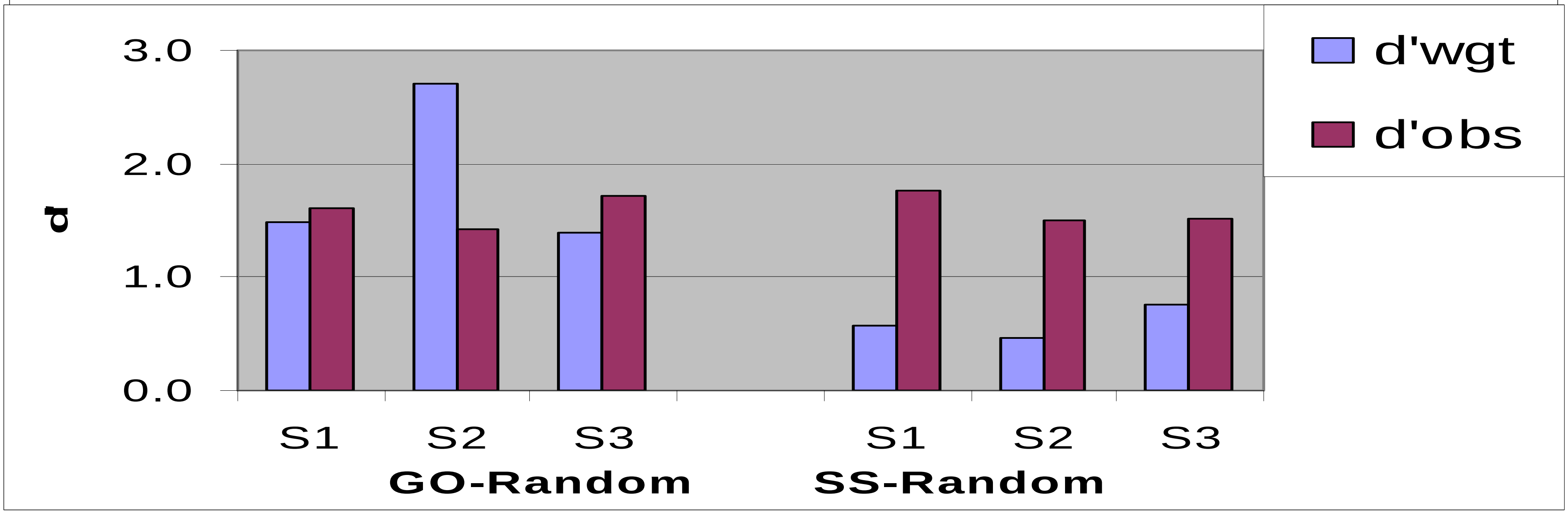
1. Decision variable: $\beta(i)=W\bullet S(i)$

   $\beta$: decision variable, i:ith trial, W: temporal weighting pattern vector, S(i): ith squared-envelop-weighted-instantaneous carrier (SEWIC), also a vector.

2. $d'_{wgt}$ based on $\beta_{sig}$ and $\beta_{nos}$

# d′$_{wgt}$ and d′$_{obs}$



# Conclusions

- Linear model successfully accounted for the decision process in 3 out of 4 conditions
- Larger magnitude of weights in the second half of TWPs than in the first half suggest more attention at the end of the stimulus
- d' analysis in the SS-fixed condition supports the idea that both static and dynamic frequency information is integrated into decision process
- Differences of TWPs in GO and SS conditions suggest different decision process in these conditions

# Acknowledgements

Work supported byNIH RO1 DC02012

Thanks to:

Rong Huang

Zhongzhou Tang

Xiang Cao