

# Beyond Self-Report: Direct Detection of Depressive Symptoms from Neural Activity

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## Background

- Depression is assessed through clinical interviews and self-report questionnaires, which are vulnerable to self-presentation bias, cognitive load, and limited access to implicit schemas.
- This Study:** Developed 160 self-relevant vignettes targeting major domains of depression, including emotional (e.g., mood, guilt), cognitive (e.g., concentration, memory), behavioral (e.g., motivation, withdrawal), and physiological (e.g., energy, appetite) experiences.
- Each vignette ended with a first-person statement which was either depression-consistent or depression-inconsistent.
- Created a matched set of 160 non-self-relevant vignettes describing another person's depression-consistent or depression-inconsistent experiences, with expected and unexpected versions.
- Examined how overall depression severity influences multiple stages of processing, from early stages of access to meaning (N400: 300-500ms) [1] to later, sustained attention to emotionally salient stimuli (LPP: 500-1000ms) [2].

**Can we detect depressive symptoms directly from neural activity during natural reading of self-relevant depression-consistent vs. depression-inconsistent probes?**

## Stimuli & Design

### Self-relevant vignettes

### Other-relevant vignettes

**Broad context:** People's responses to stress can differ a lot. At times one might feel pretty resilient, and able to quickly recover when facing difficulties. At other times, one might feel quite fragile, and easily overwhelmed by stressors.

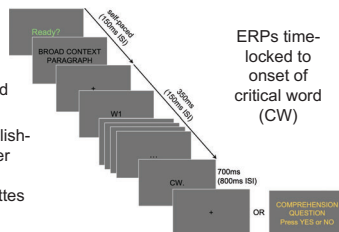
**Broad context:** Some people are resilient and able to recover after challenges, while others are fragile and easily overwhelmed. Colin never lets anything get him down. He's always recovered quickly after setbacks.

Self-Experience	Final sentence <sup>1</sup>
Depression-Inconsistent	Thinking about my recent emotional state, I've been feeling quite <u>resilient</u> .
Depression-Inconsistent	Thinking about my recent emotional state, I haven't been feeling very <u>fragile</u> .
Depression-Consistent	Thinking about my recent emotional state, I've been feeling quite <u>fragile</u> .
	Thinking about my recent emotional state, I haven't been feeling very <u>resilient</u> .

Other-Experience	Final sentence <sup>1</sup>
Depression-Inconsistent	Everyone who knows him can see that he is really <u>resilient</u> . [Expected]
Depression-Inconsistent	No one who truly knows him would describe him as <u>fragile</u> . [Expected]
Depression-Consistent	Everyone who knows him can see that he is really <u>fragile</u> . [Unexpected]
Depression-Consistent	No one who truly knows him would describe him as <u>resilient</u> . [Unexpected]

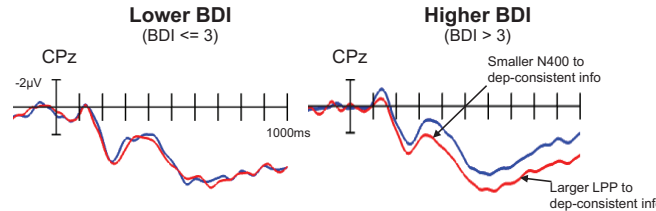
<sup>1</sup>Critical words are underlined in the table but were not underlined in the experiment itself. Each critical word appeared in both affirmative and negated versions to disentangle valence from depression-consistency.

- 80 vignettes per condition
- Task: read vignettes silently and naturally
- Comprehension question followed ~ 1/3 of trials
- Recorded EEG as 39 native English-speaking participants (none under psychiatric treatment for Major Depressive Disorder) read vignettes word-by-word



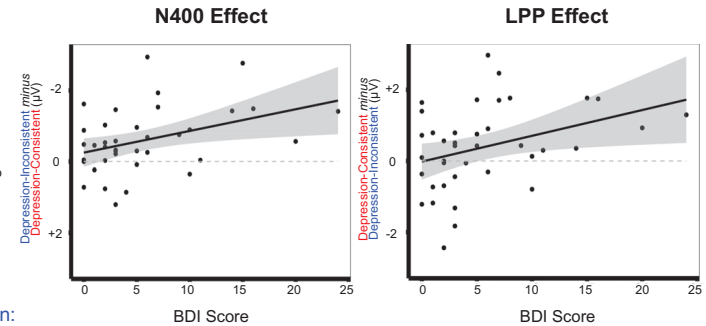
## Results

### Selective Effect of Depression Consistency in Self-Relevant Vignettes in Lower and Higher BDI Participants

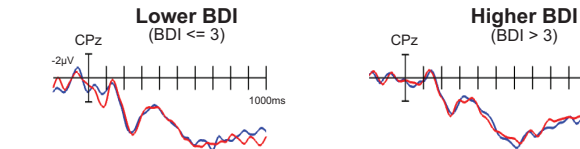


Peoples' responses to stress can differ a lot. At times one might feel pretty resilient, and able to quickly recover when facing difficulties. At other times, one might feel quite fragile, and easily overwhelmed by stressors. Thinking about my recent emotional state...

**Depression-Consistent Completion:** ... I've been feeling quite **fragile**.  
**Depression-Inconsistent Completion:** ... I've been feeling quite **resilient**.  
 ... I haven't been feeling very **resilient**. ... I haven't been feeling very **fragile**.



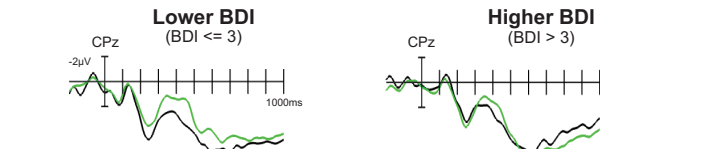
### No effect of Depression Consistency in Non-Self-Relevant Vignettes in Lower and Higher BDI Participants



**Depression-Consistent Experience:** Some people typically feel energetic but others feel tired. Lionel has severe insomnia. It's really difficult for him to get restful sleep. When he wakes up...  
 ... he feels really **tired**.  
 ... he hardly ever feels **energetic**.

**Depression-Inconsistent Experience:** Sometimes peoples' minds feel clear while at other times they feel foggy. James has been very focused and on the ball lately. His mind...  
 ... has felt really **clear**.  
 ... hasn't felt at all **foggy**.

### Classic Effect of Expectancy in Non-Self-Relevant Vignettes in Lower and Higher BDI Participants



**Depression-Consistent Experience:** Some people typically feel energetic but others feel tired. Lionel has severe insomnia. It's really difficult for him to get restful sleep. When he wakes up...  
 Expected: ... he feels really tired.  
 ... he hardly ever feels energetic.  
**Unexpected:** ... he feels really **energetic**.  
 ... he hardly ever feels **tired**.

**Depression-Inconsistent Experience:** Sometimes peoples' minds feel clear while at other times they feel foggy. James has been very focused and on the ball lately. His mind...  
 Expected: ... has felt really clear.  
 ... hasn't felt at all foggy.  
**Unexpected:** ... has felt really **foggy**.  
 ... hasn't felt at all **clear**.

## Discussion

Even at subclinical levels, we can directly and selectively detect depressive symptoms from neural activity during natural reading...  
 ... from the earliest stages of access to meaning (300-500ms) to later implicit evaluative processing (500ms onward)

This study therefore lays the groundwork for implicitly evaluating depressive symptoms, without the need for overt responses or conscious deliberation.

## References

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## ACKNOWLEDGMENTS

This material is based upon work supported by the Defense Advanced Research Projects Agency (DARPA) and Naval Information Warfare Center Pacific, (NIWC Pacific) under Contract No. N6600123C4002. Any opinions, findings and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the Defense Advanced Research Projects Agency (DARPA) and Naval Information Warfare Center Pacific, (NIWC Pacific).

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