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Supplementary Information for

Reading on smartphone causes sigh inhibition with brain overactivity and comprehension decline

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This Supplementary Information includes:

Supplementary Text

Supplementary Fig. 1

Explanation of Source Data

1 **Supplementary Text**

2 Questions and answer options for the reading test

3 Novel A (Norwegian Wood (Japanese version), pages 1-6, Haruki Murakami, 1987; 3060 Japanese
4 characters)

5 Q1: How old was the protagonist?

6 A: 35 B: 36 C: 37 D: 38 E: 39

7 Q2: What was the model number of the Boeing of the plane the protagonist was flying in?

8 A: 737 B: 747 C: 757 D: 767 E: 777

9 Q3: What was the name of the airport where the protagonist arrived?

10 A: Hamburg B: Frankfurt C: Munich D: Zurich E: Vienna

11 Q4: In what month did the story take place?

12 A: August B: September C: October D: November E: December

13 Q5: What confused the protagonist?

14 A: Voices of the passengers B: The sound of the air-conditioning C: atmospheric pressure
15 D: background music E: The Captain's Voice

16 Q6: What was the nationality of the cabin attendant?

17 A: French B: American (USA) C: Italian D: English E: German

18 Q7: In what language did the protagonist respond to the cabin attendant?

19 A: English B: German C: French D: Italian E: Japanese

20 Q8: What was the landscape that the protagonist remembered?

21 A: Pasture B: Grassland C: Urban center D: Sea E: Forest

22 Q9: How old did the protagonist remember himself??

23 A: Seventeen B: Eighteen C: Nineteen D: Twenty E: Twenty-one

24 Q10: What was the name of the woman the protagonist remembered?

25 A: Junko B: Misaki C: Yuki D: Takako E: Naoko

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1 Novel B (Colorless Tsukuru Tazaki and His Years of Pilgrimage (Japanese version), pages 1-6, Haruki
2 Murakami, 2013; 3067 Japanese characters)

3 Q1: How old was the protagonist?

4 A: 19 B: 20 C: 21 D: 22 E: 23

5 Q2: What was the protagonist's position?

6 A: High school student B: Unemployed C: Vocational school student D: University student

7 E: Office worker

8 Q3: How long did the protagonist's longing for death last?

9 A: Three months B: Six months C: Nine months D: Twelve months

10 E: Eighteen months

11 Q4: What was the protagonist's routine?

12 A: Walking B: Reading newspaper C: Listening to the radio D: Listening to music E:

13 Watching TV

14 Q5: How many times a week did the protagonist do laundry?

15 A: One B: Two C: Three D: Four E: Five

16 Q6: What type of alcohol did the protagonist drink?

17 A: Beer B: Brandy C: Wine D: Sake E: Whisky

18 Q7: How many best friends did the protagonist have in high school?

19 A: Zero B: One C: Two D: Three E: Four

20 Q8: What city was the protagonist's high school near?

21 A: Yokohama B: Chiba C: Shizuoka D: Nagoya E: Fukuoka

22 Q9: What was the subject of the protagonist's high school assignment?

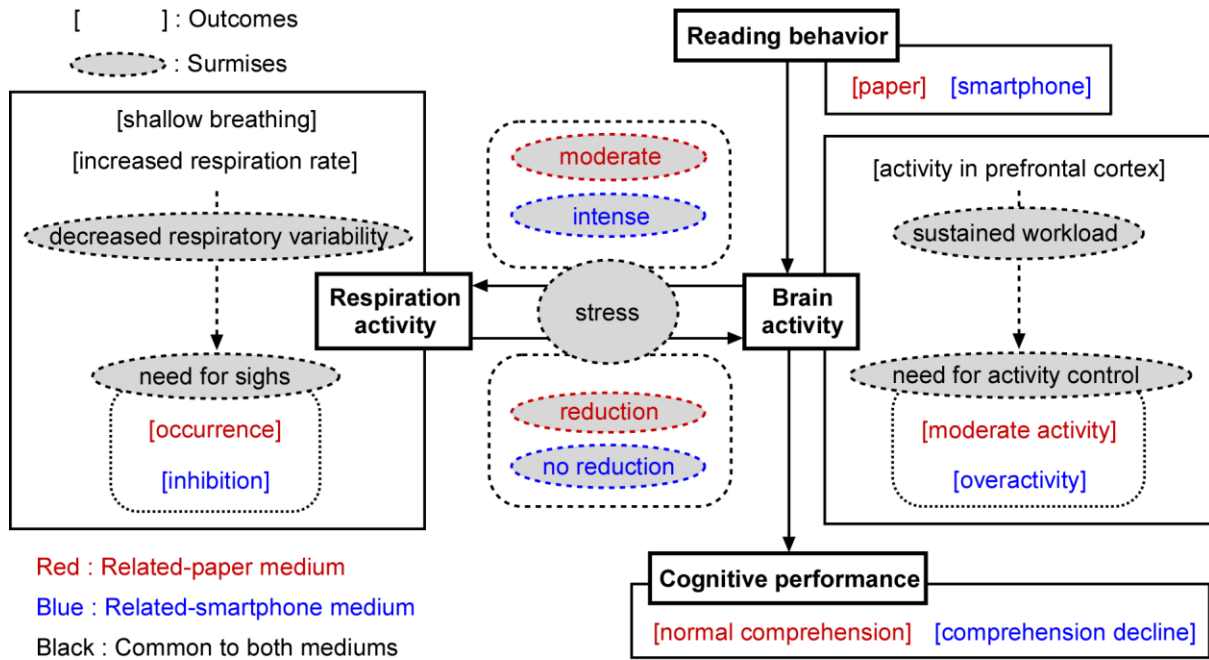
23 A: English B: Math C: Science D: National language E: Social study

24 Q10: How many days did the protagonist attend summer camp?

25 A: One B: Two C: Three D: Four E: Five

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4 **Supplementary Fig. 1 | Possible mechanism of reading processing with interactive relationship**
5 **between respiratory and brain activity.** A relation diagram based on reading behavior, brain activity,
6 respiration activity, and cognitive performance. The terms in parentheses are outcomes from the current
7 experiment. The terms enclosed in a dotted circle are surmises from previous researches. Terms in red
8 text are paper-related, in blue text are smartphone-related, and in black text are matters that are common
9 to both mediums.

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2 **Source Data (separate file)**

3 Data from 34 participants including sex, age, dominant hand, experimental condition, reading score, 6
4 respiratory patterns, 2 metabolism patterns, 2 brain activity patterns. These items divide into 3 sessions;
5 before reading [pre], during reading [read], and after reading [post], except for sex, age, and dominant
6 hand. NS: number of sighs [n], VE: minute ventilation [l], RF: respiratory frequency [n/min], VTE: Tidal
7 volume [ml], Ti: inspiratory time [s], Te: expiratory time [s], VO2: O₂ consumption [ml], ETCO₂: End
8 tidal CO₂ [%], CH1-oxhb: oxygenated hemoglobin concentration in channel 1 [mM], CH2-oxhb:
9 oxygenated hemoglobin concentration in channel 2 [mM].

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