Ticker Experiment – Participant Information

First, *thank you* for volunteering to participate in our study. Requirements for participation in this study:

1. You have stereo hearing.
2. You are fluent in English (you do not need to be a native speaker).

Purpose: The purpose of the experiment is to assess the efficacy of *Ticker*, an audio text entry method for single-switch, visually impaired users. The assessment will be conducted by asking you to use two interfaces to communicate in multiple sessions, namely *Ticker* and the *Grid2* (the current state-of-the-art method). We will compare the results from testing these two methods, and publish them. **We are not evaluating your individual performance.** *However, it is very important you try to do your best in the experiment. Your results will contribute to the final interface design that will be used by real impaired users*.

Each session will be 1-1.5 hours. There will be 9 sessions in total (4 for the Grid2 and 5 for Ticker). Each session will have a similar schedule.

Experiment Schedule

Ticker (Total time: 5 hours 45 minutes.)

In the tutorial and testing sessions we will ask you to write words by selecting their individual letters from audio files. You can then select a letter when you hear it by pressing the space bar key on the keyboard. Different voices will read different parts of the alphabet at different audio locations. For example, “Pete” will read “a”-“i” in your left ear, while “Susan”, almost simultaneously to “Pete”, will read “v”-“z” in your right ear. The main goal of the experiment is to see if you can communicate with a reasonable accuracy via Ticker, with as little assistance as possible (simulating an impaired user) and as fast as possible. More information about how Ticker works is provided in the instruction manual below.

All progress will be indicated with audio feedback (head phones), so you won't be able to look at anything on the computer screen. However, you will be provided with a “crib sheet” (a piece of paper) to reduce the cognitive load. The crib sheet will contain the phrases that you have to write, and during the initial sessions it will also contain the alphabet layout so that you can remind yourself of it (although you should really try to memorise it as the sessions progress). The information on the sheet will be reduced as the sessions progress. During the last two sessions, you are expected to know the alphabet layout by heart (there will be no alphabet layout on the crib sheet), and you will only be allowed to look at the phrases to be written. It is therefore important to close your eyes at all times, and only look at the phrase sheet and alphabet layout when absolutely necessary.

During all experiments the speed will gradually be increased if you write accurately (about two phrases without errors, and and few repetitions of the alphabet before selecting a letter). However, you can request the speed to be increased at any time.

If you for whatever reason want to withdraw for the study please contact the supervisor immediately. *It is your right to withdraw at any point from the study*. **If you feel any strain or other discomforts** during your participation **contact the supervisor immediately**. *You have a right* to be informed about the results arising from the study. If you are interested in the results, please inform the supervisors.

Session 1: 1 hour 30 mins

1. Tutorial (30-40 min): We will interactively teach you how to use the system we are testing. Start with an overlap speed of about 0.65.
    - Explain how Ticker works (2-8 min).
    - Memorize the alphabet configuration on crib sheet. In this session the crib sheet will contain the full alphabet sequence, and all the phrases that have to be written. It is important that you close your eyes at all times and only look at the crib sheet when absolutely necessary (2-5min).
    - Listen to all the voices separately (3 min).
    - Listen to all the voices together (5min). Adjust the volume of some voices if necessary.
    - Listen to time-out actions (e.g., when waiting for two alphabet-sequence repetitions audio feedback of the current letter index will be given).
    - Pretend to write "yes_" without really clicking (1 min).
    - Write "yes" to calibrate click distribution. (Subsession 1) (1 min)
    - Write "done_.", "for_.", "large_." (all three words in first sub-session of first session and only "done_" in the other sessions). Ask as many questions as possible. (2-7 min).
    - Write "the_quick_brown_fox_jumps_over_the_lazy_dog_." (Subsession 2). Click on any problematic letters in "practise mode". (5-10 min)
2. 2-5 minute break
3. 2x15 min test sessions, with corresponding breaks of 2-5 minutes each in between. (Subsessions 3-onwards).

Session 2-3: 1 hour 15 minutes each

1. The tutorial will be shorter than in session 1 (15 minutes, sub-session 1):
    - Go through crib sheet, and memorize alphabet (1-5 minutes). The crib sheet in session 2 will contain less information than the crib sheet in session 1 – only the figure indicating which voice is responsible for reading which letter in the alphabet, not the full alphabet sequence, will be provided. In session 3 all crib sheets will be removed, except for the one containing the phrases to be written in the session.
    - Listen to voices combined and calibrate on "yes_" (1-2 minutes)
    - Write "the_quick_brown_fox..." until tutorial time is over.
2. 2-5 minute break
3. 3 x 15 minutes of testing, with corresponding breaks of 2-5 minutes each in between. (Subsessions 2-4).

Session 4: 30-45 minutes

- This session will test how fast you can write “the quick brown fox jumps over the lazy dog”.
- Calibrate on “yes_”. Practice “the quick brown” in tutorial mode (5 mins).
- 2x15 minutes sessions at six speeds (starting from a speed the previous session was ended with, sub-session 1).
- Increase the speeds in increments of 0.02 and write “the_quick_brown_fox....”
- Each speed setting lasts for 5 minutes.
- 2 minute breaks will be given after each 10 minutes of writing.
- The breaking point is usually clear, so the experiment will probably terminate after 30 minutes.

Session 5: 1 hour

- This session will test the effect of typical switch noise on Ticker.
- Tutorial and calibration (10 minutes), in tutorial mode.
- 2 x 15 minutes of testing with 2-5 minute breaks in between, at a speed of 0.65, simulating a comfortable speed for a “typical user” (typically slower than what you're used to). Start in sub-session 1.
- Calibrate on “yes_” at the beginning of each sessions, and disable learning of false positive rate (set to the default 0.25) and false negative rate (set to the default of 0.1).
- Ticker: The delay of the will be increased by the corresponding noise delay (the click-time model is saved), and then set to a Gaussian distribution. A waiting time of 3*std + delay seconds will be added after the alphabet sequence has been read to be able to process all clicks in time.
- Setting 1: Gauss noise: delay=0.8s, sigma=0.05s, fp_rate=0 per minute, fr=0
- Setting 2: Gauss noise: delay=1.5s, sigma=0.05s, fp_rate=1/3 per minute, fr=0.1

Results to use in paper: *New phrases, reaching expert level:* Sessions 2 & 3 (sub-sessios 2,3,4), *Speed-saturation experiment:* Session 4 (sub-sessions 1-end), *Noisy experiment:* Session 5 (sub-sessions 1 & 2).

Ticker Instruction Manual

1. Click to start program.
2. Each phrase to be written will be read to you. You're allowed to look at the phrases on a piece of paper (your crib sheet) at any given time, to help you keep track of where you are. Before any three consecutive phrases, the supervisor will pause, so that you can read through them and think them through before proceeding to write them.
3. The alphabet will be played to you in sequence.
4. Direct your attention to the voice that says the letter you want to write.
5. Click twice for each letter selection (when you hear the letter that you want to write).
6. The program will move on to next letter (saying *next)* if you clicked once or more. Note that even though one click is enough to proceed to the next letter, this is not optimal as it might slow down your overall text-entry rate. Always try to click twice. You're only meant to click once *occasionally* (by accident). If you

struggle initially to hear a voice, rather wait for one or two sequences more so that you can click twice.

7. Always try to click right after you've heard the letter that you want to write, and not in anticipation. This will enable you to write faster in the long run, as your speed is directly linked to how *consistently* you click.
8. If a word was written successfully it will say “you have written...”. The program works similar to the T9 mobile interface: you keep on going from one letter to the next. If the probability of a word is larger than a predetermined threshold, that word will be selected. Ticker therefore never selects a letter, it just moves on to the next letter after it received some clicks. This allows for some automatic error correcting, and is more effective the longer the word is (as it becomes more clear what you want to write). The word can therefore be selected after any number of letter selections, but in most cases you'll have to select all the letters of a particular word once.
9. The “new word” voice prompt will always tell you which word to write next.
10. If you've completed your word, but the program couldn't figure out what you were trying to write, you have to repeat your word. For example, if you've selected all the letters in “do_” but the program didn't select it, you have to select “d” again, and then “o”, etc. *Only* start a new word when you've heard the “new word” voice prompt. Because we're evaluating the interface, the program does in fact know which word you're supposed to write (but it won't help you in any way to get to it). It specifically won't allow any word to be repeated more than twice (this is seen as an unacceptable condition). In this case, the word you're trying to write will be seen as a “user error” and you will be prompted to move onto the next word (the program will say “time out …” and then “new word...”. This typically happens if you're trying to write at a speed that is too fast for you. If this happens frequently in the first three sessions, the supervisor will reduce the speed.
11. You can say “pause” at any time to ask a question, e.g., if you're confused, uncomfortable or if you want to increase the speed. The supervisor will then pause the program and adhere to your question. Please try to ask as many questions as possible during the tutorial session to prevent any during the test sessions. The supervisor will increase your speed very gradually if your performance is accurate, but you can also ask to increase the speed at any time. Note that it is more important to write **accurately** rather than trying to go as fast as possible in the first three sessions.
12. Click 4 or more times to undo the last letter (if you know you made a mistake). You can only undo the last letter selection once. The voice prompt will say “undo, repeat” if you've successfully completed this undo action. It is generally only necessary to undo when writing a short word such as “is_”, and even if you don't you'll typically get the word when repeating it for the second time. The idea is to undo immediately after you've realised that you've made a mistake.
13. Wait for two alphabet-sequence repetitions for the program to read your current status (current letter number). For example, it will say “second letter” if you're busy with the second letter of any word. If you've already selected all the letters of “do_” and you're at “d” again, it will say “fourth”. If you're unsure at all where you are, wait a bit for this voice prompt.

14. Wait for 6 alphabet repetitions to restart the word. This can happen if you're completely lost, or need to undo more than once. It will say “undo, restart word ..”
15. A summary of all the Ticker manual is provided on the crib sheet.

Grid2

The Grid2 experiment is very similar to Ticker (see the Grid2 crib sheet for an instruction manual). Total time: 4 hours

Session 1: 1 hour 30 minutes

1. Tutorial (15-30 minutes): We will interactively teach you how to use the system we are testing.
    - Explain how Grid works and memorize alphabet (5 minutes)
    - Write “the_quick_brown_fox_jumps_over_the_lazy_dog_.” (Subsession 2). Click on any problematic letters in “practise mode”. (10 min)
    - 5 minute break
2. 3 x 15 minutes of testing, with corresponding breaks of 2-5 minutes each in between. (Subsessions 2-4).
3. At the end of this session the speed should be at a scan delay of about 400ms.

Session 2: 1 hour

1. Tutorial (5 minutes), sub-session 1.
2. 3 x 15 minutes of testing, with corresponding breaks of 2-5 minutes each in between. (Subsessions 2-4).
3. At the end of this session the user should be very familiar with the interface and the scan delay should be at about 300ms.

Session 3: 30 minutes

- This session will test how fast you can write “the quick brown fox jumps over the lazy dog”.
- 1 Practice run at 400ms of “the quick brown...”, tutorial mode (5 min).
- 1x15 minutes session (starting from a scan delay of 400ms and increasing the speed to a scan delay of 200ms in increments of 100ms). 5 minutes will be spent on each of the three speed settings.
- 2 minute breaks will be given after each 10 minutes of writing.
- Immediately proceed to session 4

Session 4: 1 hour

- Follow the same schedule as session 5 in the Ticker experiment.
- The scan delay will be adjusted to be 3*std + delay seconds longer than the speed you ended session 3 with (typically around 300-400ms).

Results to use in paper: *New phrases, reaching expert level:* Sessions 1 & 2 (sub-sessios 2,3,4), *Speed-saturation experiment:* Session 4 (sub-sessions 1-end), *Noisy experiment:* Session 5 (sub-sessions 1 & 2).

Grid2 Instruction Manual

See the Grid2 crib sheet.