APPENDIX A: CONSENT FORM

Consent Form

Title: Relaxation effects and future design directions of a novel multi-sensory tangible design probe RELAX-CHANGE, a drum to decrease anxiety, for accessible “daily” relaxation support for people with elevated anxiety.

Supervisor: Max Birk, Assistant Professor, Department of Industrial Design, Eindhoven University of Technology, m.v.birk@tue.nl, +49 174 750 52 45.
Researcher(s): Veerle van Wijlen, MSc Student, Industrial Design.

Purpose(s) and Objective(s) of the Research: To increase empowerment and social integration of adolescents and adults with anxiety, I investigate the effects of the probe’s (drum’s) underlying relaxation principle and the users’ user-experience around expressive drum play for relaxation. And in this way, I will inspire specific design directions and improved concepts around accessible multi-sensory expressive tangibles for relaxation. In the research period of 1 week, I aim to leverage experience sampling using diaries, interviews, and questionnaire data at multiple points in time when working with the drum for a fixed number of days.

Procedures:
Phase 1: Initial introduction and short semi-structured interview (30-60 minutes).
The initial introduction and semi-structured interview will focus on installing the research prototype at the participant’s home; re-assuring of study, digital diary booklet, and prototype understanding and profiling the participants on trait anxiety scores, musical preferences, and previous anxiety and relaxation experiences.

Phase 2: The diary study (1 week / 7 days).
The diary study will focus on gathering a variety of data around the effects of the probe’s (drum’s) underlying relaxation principle, the participants’ user-experience around expressive drum play for relaxation, and the participants’ contextual use of the drum for relaxation. This will be asked the participants to do before and after they play the research prototype (drum), with the help of self-report forms and instructions in the digital diary booklet, at self-chosen moments that best fit a state of anxiety or need for relaxation.

Phase 3: Follow-up semi-structured interview and design directions / concept evaluation (30-60 minutes).
The follow-up will focus on evaluating the participants’ experiences of participating in the study; elaboration on responses given in the diary self-report forms; and the evaluation of unsatisfied needs in drum play for relaxation found during play of the design probe, and design directions & concepts satisfying those needs. Furthermore, the research probe will be collected by the researcher and all diary study data is transferred to the researcher.

Funded by: -

Potential Risks and Benefits: During the research, there are minimal known or anticipated risks to you by participating in these interviews, diary study and share of knowledge.

The physical prototype singularly contains CE approved components, and is optimized upfront of the diary studies in terms of multi-sensory interaction and comfort in use, to prevent any form of extra anxiety within the participants.

Furthermore, the diary studies will mainly take place in the participant's home environment. This allows participants to engage from a private, comfortable and safe environment. Within the introduction and follow-up phase, the current COVID-19 situation is highly taken into account, and both the researcher and participants will have to take all hygiene rules into account (such as prototype disinfection practices, and social distancing).

Next to that, data about the participant's level of anxiety from the State-Trait Anxiety Inventory questionnaire (STAI) will be analyzed after the diary studies have been taken place; will
be done anonymously; and only used for the sake of analysis within this design research. Self-reported data from the STAI questionnaire will be coded and allocated a unique identifier. The coded data will be kept on a password protected academic online platform at the Eindhoven University of Technology.

The coded qualitative data of the interview responses, and self-report forms in the diary booklets, will be kept on a password protected academic online platform at the Eindhoven University of Technology. All the personal data collected during the study will be processed confidentially and you, as participant, will never be recognizable in publications, academic material or any other means. Quotes from the diary booklets and semi-structured interviews will be pseudonymized and screened for not being traceable to an individual.

Potential benefits include use of the prototyped novel drum instrument and its potential relaxation effects; reflections on daily relaxation practices; and share of expertise in the fields of design research, music therapy, psychology, and practical tools for relaxation in daily life contexts.

Confidentiality:

- Confidentiality will be maintained throughout the entire research procedure. The entire process and data will be anonymized. Data will only be presented in the aggregate and any individual comments will be anonymized prior to reporting, presentation in class or publication.
- Only the researcher will have access to the data to ensure that your confidentiality is protected.

Data Collection: With your permission, I would like to record audio during the interviews; use anonymized fragments of your self-reported video recordings of your drum play behavior (hand movements singularly); use anonymized touch behavior data of your drum play as logged by the research prototype, in the form of tables or graphs; use anonymized insights from your self-reported STAI questionnaire data; and use pseudonymized quotes from the diary booklets and semi-structured interviews.

The audio, video, touch behavior, STAI, and quotes data would be used to analyse important relaxation effects, interview responses, and diary user-experience self-reports, which can be

used as input for concluding the effects of the probe's underlying relaxation principle and the users' user-experience around expressive drum play for relaxation. And in this way, to provide inspiration for specific design directions and improved concepts around accessible multi-sensory expressive tangibles for relaxation and anxiety.

Please indicate if I am allowed to record audio, and use fragments of your self-reported or logged video recordings, touch behavior, STAI data and interview / diary quotes in reporting; if the material can be presented in class and in case relevant published:

	Be recorded	Presented anonymized	Used for Analysis
Audio:	Yes [ ] No [ ]	| Yes [ ] No [ ]	| Yes [ ]No [ ]
	Used for Publication		
	| Yes [ ] No [ ]		
	Presented anonymized	Used for Analysis	
Video:	| Yes [ ] No [ ]	| Yes [ ] No [ ]	
	Used for Publication		
	| Yes [ ] No [ ]		
	Presented anonymized	Used for Analysis	
Logged touch behavior:	| Yes [ ] No [ ]	| Yes [ ] No [ ]	
	Used for Publication		
	| Yes [ ] No [ ]		
	Presented anonymized	Used for Analysis	
STAI data:	| Yes [ ] No [ ]	| Yes [ ] No [ ]	
	Used for Publication		
	| Yes [ ] No [ ]		
	Presented anonymized	Used for Analysis	
Interview responses & diary quotes:	| Yes [ ] No [ ]	| Yes [ ] No [ ]	
	Used for Publication		
	| Yes [ ] No [ ]		

Storage of Data:

- Data will be stored on a secure password-protected server until 12 months after the end of the research and then destroyed.

Right to Withdraw:

- Your participation is voluntary. You may withdraw from the research project for any reason, at any time without explanation.
- Should you wish to withdraw, you may do so at any point, and we will not use your data; we will destroy all records of your data.
- Your right to withdraw data from the study will apply until the data have been aggregated (one week after study completion). After this date, it is possible that some form of research dissemination will have already occurred and it may not be possible to withdraw your data.

Follow up:
To obtain results from the research, please contact Veerle van Wijlen (v.s.v.wijlen@student.tue.nl).

Questions or Concerns:
- Contact the researcher(s) using the information at the top.
- This research project has been approved on ethical grounds by the Eindhoven University of Technology Research Ethics Board. Any questions regarding your rights as a participant may be addressed to that committee through the Research Ethics Office, ethics@tue.nl, +31 40 - 247 6259.

_____ _____

Date, place Signature

APPENDIX B: INTRODUCTION HAND-OUTS

Diary Study Plan Iteration 1
Veerle van Wijlen - MSc Student Industrial Design.

Reasoning for first person perspective diary study
Diary study really gives me the opportunity to play with different prototype settings (lid, music, context, volume, light) and to play with different types of data gathering, and reflect on that, with regards to learning about anxiety and tension - release patterns and studying "relaxation" behaviors and tension-release play effects.

It gives me the opportunity to get a first set of behavioral, effects, contextual, and use data to get some first insights on:

- insights about **workings and effects of tension-release principle** behind the drum, for relaxation, release of all 3 tensions and state anxiety

  to figure out how to translate this specific tension-release creation, with this design probe, into future improved multi-sensory interactions and novel tangible multi-sensory products for anxiety and relaxation.

- insights about the **supportive function of the multi-sensory feedback** for the tension-release creation, and relaxation effects/expressing emotions

  to figure out how to optimize multi-sensory feedback in this drum, to figure out alternative interactions with this type of multi-sensory feedback, or other types of multi-sensory feedback for novel tangible products for anxiety and relaxation.

- insights about **contextual use** information of drum play

  because this influences various aspects of the relaxation effects and future novel tangible products for anxiety and relaxation.

- insights about **how to gather** tension-release data, tension-release effect data, multi-sensory use data; and **how to study** tension-release behavior, relaxation effects, and emotional/cognitive/bodily release effects for people with anxiety (methodology, data gathering/ux evaluation techniques, data analysis methods, and constructs)

  to base next diary studies / lab studies on, and improve upon this diary study.
  for the implementation of meaningful data gathering in the new multi-sensory tension release products for anxiety and relaxation.

- insights about the **general user experience of relaxation** with the specific design probe;
- insights about the **general user experience of engagement and releasing anxiety responses** with the specific design probe;
- insights about the **general user experience of decreasing state anxiety** with the specific design probe

to find out any missing needs in relaxation/release effects, and general user experience to put into the future novel multi-sensory tension-release tangibles for anxiety and relaxation.

- insights about specific **prototype improvements** for
    - tension-release creation
    - use of multi-sensory feedback (support tr/relaxation in itself)
    - release of the three tensions and relaxation (in general)
    - smooth and responsive interaction
    - offering variability to get all people with anxiety engaged in play (zoned in) → knobs / lids / tones etc.

    to improve the prototype for further data gathering/t-r and anxiety learning, and to find out take-aways for the future design directions.

- **unexpected insights** (ux-related, use-related, regards tension-release pattern creation, important behavioral constructs, regards effects etc.)

    to learn for next studies, future design directions, prototype itself and so on.

This will result into:

- a first attempt to visualize the creation of tension-release with the drum, and actual effects on relaxation, state anxiety and release of all 3 tensions to anxiety.
- a first iteration on future design directions and improved concepts.
- creation of a new study protocol and ERB form, to hand over the prototype to other people who experience anxiety.

<u>Data gathered</u>

- Contextual information, around drum play, relaxation, state of anxiety and cognitive, emotional and bodily tensions (qualitative contextual data)
- STAI data (quantitative state anxiety data, and one-time trait anxiety data)
- User experience reflections (qualitative ux data)
- Tension release creation reflections (qualitative tension release data)
- Proto improvements reflections (qualitative prototype data)
- Quantitative touch/use data (quantitative tension release pattern, and use data over time of play)
- Use videos (observational data: tension release patterns, breathing, relaxation effects in hand movements etc.)

In general, data analysis will focus on:

- observation of overall tension-release creation during 1 week usage, through analyzing the use videos.
  (patterns, hand usage, bodily expressivity, effects) and relate to touch data in csv's (times hold/groups/speed etc.); and specific remarkable use.
  → video snips (Illustrator? / Miro?)

- quantitative analysis of the touch data over 1 week usage, especially focusing on the musical tension-release created.
  (build up of the tension and release tones: which used mostly and when in the play session, times tone hold, combinations of tones, alternations of tones, and repetitions of tones and combos/alternations in play).
  → excel document

- quantitative STAI data analysis around the general trait anxiety of the researcher, and the effects on “decrease” of state anxiety after each play session.
  → comparison state anxiety before and after play (state anxiety / relaxation effect);
  → comparison of the effects on state anxiety, with tension-release patterns created, and musical tones used.
  → excel document

Introduction Hand-Out (iteration 2)
Veerle van Wijlen - MSc Student Industrial Design

1.Sign consent form (printed).

2. Goal of the research and playing the prototype (playful “workout” for relaxation).

- The goal of this research is **to investigate the relaxation effects** of drum play on this prototype and the user-experience around "expressive" drum play for relaxation.

- In the end to create a **data visualization of the effects** and potential hypothesis behind it.

- And to design a set of **improved concepts for multi-sensory tangibles** with the same underlying relaxation principle, but satisfying “unsatisfied” needs in interaction/engagement/relaxation.

Therefore, if you feel the need for relaxation or you find yourself in an increased state of anxiety you are advised to play the drum prototype, and fill in this diary booklet before you start playing, leave it open while playing, and finishing off the form after drum play. Advised to play around **2 times a day**, for data purposes, doesn’t matter on what time of the day, that is up to you as participant!

- **No right or wrong in playing the drum**, play it as long as you need it and according to what feels satisfying. If playing the drum doesn't have the expected or required effects, do not worry about that, this is all valuable information for the research.

- When playing the drum, try to **reach relaxation and potentially build up towards peaks in play intensity to release later on**. It’s not a musical instrument, it’s more a multi-sensory workout tool so to say.

3. Installing prototype & explaining diary procedure.

a. Provide with the research prototype (drum) and digital diary booklet and RELAX-CHANGE booklet (send link via whatsapp or mail).

b. Install research prototype (drum).

- Ask with wifi or ethernet cable?

- Explain the most important commands, password and limitations, and that this is also explained in the diary booklet (give form with all commands).
  Go through play mode; change music / light / volume; go back and forth (ctrl+c and ctrl+y etc.); save data mode.

- **Common issues** as: delay in connection, just wait a while or plug in ethernet cable again (NOT power cable!); cannot connect over wifi (reboot ssh); don't overwrite event-data.csv, give them other names; light delays; sudo shutdown now is the whole sentence; musical settings using / and don't remove the " " in the edit mode; don't plug out the power cable before you've stated sudo shutdown now.

c. Explain diary booklet and video logging of the play.
https://forms.office.com/Pages/ResponsePage.aspx?id=R_J9zM5gD0qddXBM9g78ZE9luQGSKLlEmJYkqaFsRZZUMzE4MklBRk9SVDFTTDJYSjUwS1BaVlg0Sy4u

d. Try to set-up the prototype themself, change tones, and save data (with the diary booklet).

e. Contact details: me!

4.Checking their understanding of the prototype and study.

- Let them try out various musical tones, and ask them to report on their preferred tones so far. Which tone settings do you expect yourself to use most? And why? (while using diary booklet, third page).

- Any questions left?

5.Profiling the participant's on trait anxiety scores, musical preferences, and previous state anxiety and relaxation experiences.

a. State-Trait Anxiety Inventory (STAI) self-evaluative "anxiety questionnaire", and then only the trait anxiety (T) items (on my laptop).
https://forms.office.com/Pages/ResponsePage.aspx?id=R_J9zM5gD0qddXBM9g78ZE9luQGSKLlEmJYkqaFsRZZUM0cwN1JFRVRXNUtEV0ozR1I2WUw1TlVPUC4u

START AUDIO RECORDING.
Previous experiences with anxiety
Relaxation practices

Musical preferences for relaxation.

STOP AUDIO RECORDING.

6.Plan follow-up.

7. Any final questions? + thank you so much + have fun!!

Checklist

- Printed version of this hand-out
- Printed version of the Relax-Change booklet
- Printed version of the consent form
- Research prototype (drum)
- Ethernet cable (multiple)
- Video tripod
- Charged phone
- Phone charger
- Notebook
- Pen
- Digital diary booklet (link in this document)
- Contact details ready
- T-Anxiety questionnaire (link in this document)
- Calendar on phone (plan follow-up)

Prototype Instructions Summary Document (iteration 2)

When using the ethernet cable.

Turn the drum on

1. Connect the drum to power (plug in the power cable in a socket).
2. Plug in ethernet cable of the drum into your laptop.
3. Type in the search bar of your laptop: command prompt, and open the command prompt panel.
4. Type in the command prompt panel: ssh pi@raspberrypi
   (!!! note this has to be a shared ethernet connection. You can check if the ethernet cable is “shared” in the “View Network Connections” panel of laptop where you can check the “sharing” properties of the ethernet cable → you can look for this in your laptop’s search bar)
5. Type in the password of the drum: not mentioned in this Appendix.
   Click on the ENTER key on your laptop to confirm the password.
6. Type in the command prompt panel: cd relax-change
   This to go to the directory of the drum, and to be able to turn it on or change musical tone settings.
7. Type in the command prompt panel: make
   To make the drum work, it will now give musical and light feedback when touching the “touch pads”.

Play the drum

As mentioned above, make sure you are in the directory of the drum, cd relax-change
Being in there, the command: make

This will make sure you can play the drum.

Stop playing the drum
If you want to STOP playing the drum, to turn it off or maybe change some musical tone settings, then type: ctrl+c

If you want to play again, type: make

Turn the drum off

1. If you are in “make” mode, make sure the drum is not playing anymore, by typing: ctrl+c
2. To turn it off, type: sudo shutdown now
3. Wait 5 seconds before you get the power cable out of the socket.
4. Get the power cable out of the socket.
5. Get the ethernet cable out of your laptop, but leave it plugged in the raspberry pi within the drum.

Change musical tone settings

1. If you are in “make” mode, make sure the drum is not playing anymore, by typing: ctrl+c
2. To change musical tones, type in the command prompt panel: make edit
   In order to go to "edit" mode and change the musical tones that the drum will play.
3. Look for the line in the upper part of the code that says MUSIC_PATH.
4. Type in the command for the tones you want to set, after MUSIC_PATH=:

D-Major/Guitar/D45/
D-Major/Guitar/D56/
A-Major/Guitar/
A-Major/Piano/
A-Minor/Guitar/
C-Major/Guitar/
E-Major/Guitar/E34/
E-Major/Guitar/E45/
E-Minor/Guitar/Em3-Em4/
E-Minor/Guitar/Em4-Em5/
G-Major/Guitar/
G-Major/Piano/
G-Major/Celestial Voices/
Drum/

Don't forget the / in the end of the line!
And make sure the command for the tone settings is always in between “ and “

As example, if you want to play pre-set tones within C-Major, type in MUSIC_PATH= "C-Major/Guitar/"

5. Save your filled in tones by typing: ctrl+x, after that type y, and after that press the ENTER key on your laptop's keyboard.

6. In order to be able to play with your chosen musical tones in the drum, type in the command prompt panel: make

Change volume settings

1. If you are in "make" mode, make sure the drum is not playing anymore, by typing: ctrl+c
2. Type in the command prompt panel: alsamixer
3. With the "up" and "down" arrow keys on your laptop you can set the volume you want.
4. Press the escape key on your laptop's keyboard to get out of the volume settings panel, and to confirm your new settings.
5. In order to be able to play with your chosen musical tones in the drum, type in the command prompt panel: make

Password

Not provided in this Appendix.

Press ENTER, when you have filled it in.
Note: when you fill in the password in the command prompt panel, it won't show what you type.

Copy a command from the diary booklet (MS Forms) into the command prompt panel

1. Copy a command from the microsoft forms page (ctrl+c).
2. Go to your command prompt panel.
3. Click the right mouse button.
4. Now the line is copied into the command prompt panel.

When using wifi connection.

Turn the drum on

1. Connect the drum to power (plug in the power cable in a socket).
2. You DON'T need the ethernet cable if it's connected via wifi.
3. Type in the search bar of your laptop: command prompt, and open the command prompt panel.
4. Type in the command prompt panel: ssh pi@192.168.1.100
5. Type in the password of the drum: not mentioned in this Appendix.
   Click on the ENTER key on your laptop to confirm the password.
6. Type in the command prompt panel: cd relax-change
   This to go to the directory of the drum, and to be able to turn it on or change musical tone settings.
7. Type in the command prompt panel: make
   To make the drum work, it will now give musical and light feedback when touching the "touch pads".

Play the drum

As mentioned above, make sure you are in the directory of the drum, cd relax-change
Being in there, the command: make

This will make sure you can play the drum.

Stop playing the drum

If you want to STOP playing the drum, to turn it off or maybe change some musical tone settings, then type: ctrl+c

If you want to play again, type: make

Turn the drum off

1. If you are in “make” mode, make sure the drum is not playing anymore, by typing: ctrl+c
2. To turn it off, type: sudo shutdown now
3. Wait 5 seconds before you get the power cable out of the socket.
4. Get the power cable out of the socket.

Change musical tone settings

1. If you are in “make” mode, make sure the drum is not playing anymore, by typing: ctrl+c
2. To change musical tones, type in the command prompt panel: make edit
   In order to go to "edit" mode and change the musical tones that the drum will play.
3. Look for the line in the upper part of the code that says MUSIC_PATH.
4. Type in the command for the tones you want to set, after MUSIC_PATH=:

D-Major/Guitar/D45/
D-Major/Guitar/D56/
A-Major/Guitar/
A-Major/Piano/
A-Minor/Guitar/
C-Major/Guitar/
E-Major/Guitar/E34/
E-Major/Guitar/E45/
E-Minor/Guitar/Em3-Em4/
E-Minor/Guitar/Em4-Em5/
G-Major/Guitar/
G-Major/Piano/
G-Major/Celestial Voices/
Drum/

Don't forget the / in the end of the line!
And make sure the command for the tone settings is always in between “ and “

As example, if you want to play pre-set tones within C-Major, type in MUSIC_PATH= "C-Major/Guitar/"

5. Save your filled in tones by typing: ctrl+x, after that type y, and after that press the ENTER key on your laptop's keyboard.

6. In order to be able to play with your chosen musical tones in the drum, type in the command prompt panel: make

Change volume settings

1. If you are in "make" mode, make sure the drum is not playing anymore, by typing: ctrl+c
2. Type in the command prompt panel: alsamixer
3. With the "up" and "down" arrow keys on your laptop you can set the volume you want.
4. Press the escape key on your laptop's keyboard to get out of the volume settings panel, and to confirm your new settings.
5. In order to be able to play with your chosen musical tones in the drum, type in the command prompt panel: make

Password

Not mentioned in this Appendix.

Press ENTER, when you have filled it in.
Note: when you fill in the password in the command prompt panel, it won't show what you type.

Copy a command from the diary booklet (MS Forms) into the command prompt panel

1. Copy a command from the microsoft forms page (ctrl+c).
2. Go to your command prompt panel.
3. Click the right mouse button.
4. Now the line is copied into the command prompt panel.

Diary Booklet important remarks.

If you play the drum, always make sure to fill in the diary booklet! There are questions and items to fill in before and after you play the drum. When filled in the questions and items before play, leave the MS forms open on your laptop / tablet (don't submit yet); and after playing the drum complete the MS forms and submit.

Participant number: you are P1/P2! So you can fill in P1/P2. (This number was adapted in the hand-out for the particular participant).

For video recording, you can use your phone, the tripod to put your phone in or the camera of your laptop. If the videos take too much space on your phone / laptop, you can send them right after you made them to me (researcher), to download, so you can remove them from your phone / laptop afterwards.

You can ignore the sections about saving your data. For Q19, you can fill in yes/no, that doesn't matter. As long as you have saved your video recording, and submitted the Microsoft Forms after playing the drum and completing it, it's all fine!

APPENDIX C: DIARY BOOKLET

This Appendix contains snapshots from the Microsoft Forms diary booklet that the participants filled out in every drum play session. Personal information, such as phone numbers to contact the design researcher have been left out for privacy purposes in this Appendix.

Digital Diary Booklet - Drum Play Using RELAX-CHANGE - final version

This digital diary booklet is a way to get started every time you play the drum; report your relaxation and play experiences before and after playing the drum; and save gathered data.

The goal of this research is to investigate the relaxation effects of drum play on this prototype and the user-experience around "expressive" drum play for relaxation.

Therefore, if you feel the need for relaxation or you find yourself in an increased state of anxiety you are advised to play the drum prototype, and fill in this diary booklet before you start playing, leave it open while playing, and finishing off the form after drum play.

As a reminder: there is no right or wrong in playing the drum, play it as long as you need it and according to what feels satisfying. If playing the drum doesn't have the expected or required effects, do not worry about that, this is all valuable information for the research.

I hope you really enjoy being part of this research, and playing the drum prototype!!

Best,

Veerle

Sectie 1

1: Contextual Information

1. Participant number *

Please fill in a unique number containing your initials, date of participation, and time of participation in one number, in the order as mentioned (e.g. AB-220421-1648).

Voer uw antwoord in

Sectie 2

2: Setting up the research prototype for drum play

1. Connect the raspberry pi to power: plug power cable of the prototyped drum into the socket.

2. Open the command prompt panel on your laptop, by typing cmd in your laptop's search bar.
In this panel you will be able to connect the prototype to your laptop over wifi / ethernet; send commands and save drum play data.

3. Type in the command prompt panel: ssh pi@192.168.1.100
To connect to the raspberry pi over wifi.

If this doesn't work, please plug in the ethernet cable from your laptop into the raspberry pi.

Instead of ssh pi@192.168.1.100, type: ssh pi@raspberrypi
This to connect to the raspberry pi over the ethernet cable.

4. Type in the password of the drum prototype: Relax-Change

5. Type in the command prompt panel: cd relax-change
To navigate to the relax-change directory.

6. Decide if you want to put the light illumination cover on top of the drum or not, to filter the lights while playing the drum.

7. Decide if you want to play the drum with the current musical tones set, or with different ones.

If you decide to change the musical tones, go to the next section (section 3), otherwise read what's below -->

If you decide NOT to change the current musical tones, then you can type: make

This runs the program and makes the drum ready to be played.

If you want to go out the "make" settings to still change some musical tones, then press ctrl+c, and follow the instructions to change the musical tones (section 3, next section).

If you need more information, full instructions can be found in the following link:
https://docs.google.com/document/d/1A5ENkAlHdhOlyZLknWFYrJawSIJ67r3CAsLIZXFhtJE/edit?usp=sharing

If for some reason, you cannot get the prototype to work, that is NO problem! Please contact me (Veerle van Wijlen) on

Sectie 3

3: Change musical tones

1. To change musical tones, you have to go to "edit" mode in the command prompt panel,
therefore type: make edit

2. Look for the line in the upper part of the code that contains the musical tones settings, that says MUSIC_PATH.

3. Type in the command for the tones you want to set.

List of tones (and their commands) to choose from:
D-Major/Guitar/D45/
D-Major/Guitar/D56/
A-Major/Guitar/
A-Major/Piano/
A-Minor/Guitar/
C-Major/Guitar/
E-Major/Guitar/E34/
E-Major/Guitar/E45/
E-Minor/Guitar/Em3-Em4/
E-Minor/Guitar/Em4-Em5/
G-Major/Guitar/
G-Major/Piano/
G-Major/Celestial Voices/

Or:
Drum/
(That is the command if you want to try to reach relaxation, using drum tones).

(That is the command if you want to try to reach relaxation, using drum tones).

Don't forget the / in the end of the line!

As example: if you want to play pre-set tones within C-Major, type in MUSIC_PATH= "C-Major/Guitar/"

4. Are these the ones you want?

5. Great!, now save them, by pressing ctrl+x, after that press y, and after that press the key ENTER.

6. You have now saved your musical preferences.

7. In order to be able to play with your chosen musical tones in the drum, press: make

This runs the program and makes the drum ready to be played.

If you want to go out the "make" settings to still change some musical tones, then press ctrl+c, and follow the instructions to change the musical tones as written above.

If you need more information, full instructions can be found in the following link:
https://docs.google.com/document/d/1A5ENkAIHdhOlyZLknWFYrJawSIJ67r3CAsLIZXFhtJE/edit?usp=sharing

If for some reason, you cannot get the prototype to work, that is NO problem! Please contact me (Veerle van Wijlen) on

Sectie 4

4: Instructions to start video recording

1. Grab the phone tripod and put your phone in the tripod, in horizontal direction.

2. Make sure the camera of your phone is focused on your hands that play the drum.
(You can put some books underneath the tripod if needed).

3. Don't turn the video on yet!
You will be instructed to do that later on in this diary booklet.

If anything is unclear in the video recording process, don't hesitate to contact me (Veerle van Wijlen) on the following

Sectie 5 ...

5: Pre-reporting Section A
Context of play & State Anxiety

In this section, I would like you to report some contextual drum play information, around certain topics as setting of use or motivation for drum play. Next to that, I would like you to fill in the items of the state-anxiety questionnaire, to understand your level of "anxiety" before you start playing the drum.

You can be as elaborate in the answers as you want.

For the state-anxiety questionnaire items, please don't think too long about each item, and try to fill out what suits your situation best at this moment in time.

2. What is the current time? (XX.XX AM / PM)

Voer uw antwoord in

3. This is the ...time I play the drum

Voer uw antwoord in

4. What is your setting of using the drum? (where are you? do you sit or stand? etc.)

Voer uw antwoord in

5. Are you surrounded by others or on your own?

Voer uw antwoord in

6. What are your prototype settings? (musical tones used; light settings; volume settings; light illumination cover on/off?)

Voer uw antwoord in

7. What is your motivation for drum play?

Voer uw antwoord in

8. Explain your expectations of this drum play session...

Voer uw antwoord in

9. State Anxiety Before Drum Play: rate the following items as presented underneath *

A number of statements which people have used to describe themselves are given below.

Read each statement and then, using the scale below, indicate how you feel right now, that is, at this moment.

There are no right or wrong answers. Do not spend too much time on any one statement but give the answer which seems to describe your present feelings best.

	Strongly disagree	Disagree	Agree	Strongly agree
1. I feel calm	○	○	○	○
2. I feel secure	○	○	○	○
3. I am tense	○	○	○	○
4. I feel strained	○	○	○	○
5. I feel at ease	○	○	○	○
6. I feel upset	○	○	○	○
7. I am presently worrying over possible misfortunes	○	○	○	○

8. I am satisfied	○	○	○	○
9. I feel frightened	○	○	○	○
10. I feel comfortable	○	○	○	○
11. I feel self-confident	○	○	○	○
12. I feel nervous	○	○	○	○
13. I am jittery	○	○	○	○
14. I feel indecisive	○	○	○	○
15. I am relaxed	○	○	○	○
16. I feel content	○	○	○	○
17. I am worried	○	○	○	○
18. I feel confused	○	○	○	○
19. I feel steady	○	○	○	○
20. I feel pleasant	○	○	○	○

6: Pre-reporting Section B
Perceptions before play

In this section I would like you to report some of your perceptual information around your current relaxation state, cognitive/emotional/bodily state and tiredness before drum play.

You can be as elaborate in the answers as you want.

10. How are you feeling at the moment? (in general)

Voer uw antwoord in

11. Relaxed? (report on your current relaxation state)

Voer uw antwoord in

12. Negative thinking? (report on your current state of negative thinking)

Voer uw antwoord in

13. Emotions above/under the surface? (report on your current emotional state)

Voer uw antwoord in

14. Bodily feelings or tensions? (report on your current bodily relaxation state)

Voer uw antwoord in

15. Tiredness? (report on your current state of tiredness)

Voer uw antwoord in

7: Time to play!

Well done! It is time to play the drum now!

Don't close this Microsoft forms tab please, you will be asked to fill in some questions and items after you have played the drum to complete the diary booklet around this drum play session.

1. Make sure the video recording is on! You may now press the video recording button!

2. Make sure you've typed: make
In the command prompt panel.
If you not already did that ;)

3. Don't close this form, you still need to fill in some items and questions after you have played.

4. Play as long as you need or feel comfortable to do. There are NO time restrictions, you cannot fail in playing this drum, and drum play is pure for relaxation purposes and is supposed to be enjoyable.

5. If you are finished playing the drum, go to the next section, section 8, of this diary booklet by pressing "volgende".

Have fun!

8: Do you feel like you are done playing?
Save your "play" data!

Well done and thank you for taking the time to play the drum!

1. Stop your video recording and save the recording on your phone.

2. Press in the command panel of your laptop (that is still open): ctrl+c
This to get the prototyped drum out of running the musical tones and light settings, and to be able to save your "play" data.

3. Save your "play" data that the prototype has logged during your play session. You can do this in the following way:

a. Leave your current command prompt panel OPEN. So DON'T close it yet!

b. While your current command prompt panel is still open, open a second command prompt panel.

c. Download the "play" data from the raspberry pi to your laptop in the following way:

Type in the new command panel (if you have connected the prototype via wifi):
scp pi@192.168.1.100:relax-change/event-data.csv C:\Users\sxxxxxx\Downloads\

Or if you have connected the prototype via the ethernet cable:
scp pi@raspberrypi:relax-change/event-data.csv C:\Users\sxxxxxx\Downloads\

d. Still leave both command prompt panels open!

e. You can now go to your Downloads folder on your laptop and check if the event-data.csv file is located there.

f. Move this event-data.csv file to a folder where you know you can find it back!

g. Now you can close the command prompt panel where you have typed in the "play" data downloading commands as described in c.

h. Still leave the other command prompt panel open! (the one in which you have put in the all commands as instructed before).

4. Yes! You have now saved your "play" data!!

If you need more information, full instructions can be found in the following link:
https://docs.google.com/document/d/1A5ENkAlHdhOlyZLknWFYrJawSIJ67r3CAsLIZXFhtJE/edit?usp=sharing

If for some reason, you cannot get the prototype to work, that is NO problem! Please contact me (Veerle van Wijlen) on

This 8th part in the diary booklet has been advised to leave out due to the complexity of saving logged play behavior data by the participant him/herself and because this play behavior data had already been captured through video logging.

9: After-reporting Section A
State Anxiety & Data Uploading

In this section I would like you to fill in the items of the state-anxiety questionnaire, to understand your level of "anxiety" before you start playing the drum. Next to that you will be asked to upload your video recording and downloaded "play" data (the event-data.csv file).

For the state-anxiety questionnaire items, please don't think too long about each item, and try to fill out what suits your situation best at this moment in time.

16. What is the current time? (XX.XX AM / PM)

Voer uw antwoord in

17. State Anxiety After Drum Play: rate the following items as presented underneath *

A number of statements which people have used to describe themselves are given below.

Read each statement and then, using the scale below, indicate how you feel right now, that is, at this moment.

There are no right or wrong answers. Do not spend too much time on any one statement but give the answer which seems to describe your present feelings best.

	Strongly disagree	Disagree	Agree	Strongly agree
1. I feel calm	○	○	○	○
2. I feel secure	○	○	○	○
3. I am tense	○	○	○	○
4. I feel strained	○	○	○	○
5. I feel at ease	○	○	○	○
6. I feel upset	○	○	○	○
7. I am presently worrying over possible misfortunes	○	○	○	○
8. I am satisfied	○	○	○	○
9. I feel frightened	○	○	○	○
10. I feel comfortable	○	○	○	○
11. I feel self-confident	○	○	○	○
12. I feel nervous	○	○	○	○

13. I am jittery	○	○	○	○
14. I feel indecisive	○	○	○	○
15. I am relaxed	○	○	○	○
16. I feel content	○	○	○	○
17. I am worried	○	○	○	○
18. I feel confused	○	○	○	○
19. I feel steady	○	○	○	○
20. I feel pleasant	○	○	○	○

18. How long did you play the drum? (# minutes)

Voer uw antwoord in

19. Have you saved the play data (.csv file) and your play video?

You can choose to send both via e-mail to me already, or in the end of the diary study. In the latter case, this is just a reminder to save all your "play" data.

- ○ Yes
- ○ No

In question 19 the participants could indicate to the design researcher whether they had already saved all the data around the use of the RELAX-CHANGE prototype. So I, as design researcher, knew, before the follow-up interview, whether I should check this again with the participant or not.

10: After-reporting Section B
Perceptions of play & User experience

In this section I would like you to report on some perceptual information around your current relaxation state, cognitive/emotional/bodily state and tiredness after drum play; and your user experience around "expressive drum play" for relaxation after drum play.

You can be as elaborate in the answers as you want.

20. How are you feeling at the moment? (in general)

Voer uw antwoord in

21. Changes in relaxation? (report on changes in your relaxation state)

Voer uw antwoord in

22. Changes in negative thinking? (report on changes in your negative thinking)

Voer uw antwoord in

23. Changes in emotions above/under the surface? (report on changes in your emotional state)

Voer uw antwoord in

24. Changes in bodily feelings or tensions? (report on changes in your bodily relaxation state)

Voer uw antwoord in

25. Changes in tiredness? (report on changes in your state of tiredness)

Voer uw antwoord in

26. What was your general experience of playing the drum for relaxation this time?

Voer uw antwoord in

27. How did you try to build up your play intensity over the course of your play session? And how did you release it?

Voer uw antwoord in

28. How would you describe your absorption while playing the drum this time? (immersive experience)

Voer uw antwoord in

29. How did you make use of the multi-sensory feedback? (e.g. for relaxation, absorption in play, building up/releasing play intensity)

Voer uw antwoord in

30. Did you use the light illumination cover? What was your experience with or without it?

Voer uw antwoord in

31. What are any unsatisfied needs you experienced during drum play?

Voer uw antwoord in

32. Any prototype improvements that you can reflect on?

Voer uw antwoord in

33. Any additional comments you would like to share?

Voer uw antwoord in

Thanks for playing!

And you can now submit the form! :)

If you have any questions or remarks you would like to share with me, at this moment, don't hesitate to contact me
Best,

Veerle

APPENDIX D: FOLLOW UP HAND-OUT

Follow Up Hand-Out
Veerle van Wijlen - MSc Student Industrial Design

1. Gather research prototype; gather all video recording material; gather papers left there.
2. Everything worked fine with the prototype and diary booklet (MS forms)?

Semi-structured Interview:

TURN ON AUDIO RECORDING

1. How did you experience using the drum prototype for one week at your home for relaxation? What was your general experience of doing the diary study around this drum prototype for relaxation? How could I for example improve my diary study procedure?

2. How did you in general experience the drum play? Did you play it for relaxation, more as a musical instrument or as a work-out? And did this differ over the course of the diary study? And how come?

3. How did you experience the relaxation after playing the drum prototype? Did you have the idea that playing the drum helped you in relaxing or did it make you more irritated / stressed / frustrated? And how come?

4. How did you experience any other effects after playing the drum prototype? emo/cog/body/tiredness

5. Did you have moments during the week that you could for example relax better with the drum than during other moments of usage? And how come? e.g. evening, morning, afternoon?

6. Did you experience moments in which playing the drum didn't work for relaxation, or less than in other play sessions? And how come?

7. Did you have the idea you experienced a kind of learning curve over the course of the diary study? In that you improved your understanding of play? optimal interaction? insights in musical scales you liked for play / relaxation? improvements in relaxation effects over time, when gained more experience?

8. How did you experience release from worries, emotions or bodily tensions over the course of the diary study after and during playing the drum instrument?

9. How did you experience the multi-sensory feedback in the drum, with regards to relaxation, with regards to absorption, with regards to releasing worries, emotions or bodily tensions?

10. How did you experience the engagement/ absorption in drum play? And did you have any experience of playing it like a work-out instead of a “musical instrument”?

11. What was your favorite musical tone scale(s) you liked to use for relaxation? And why? Or what was the reason behind the chosen musical scale(s) at certain moments in the diary study?

12. Which touch pads do you think you have used the most during play? And why? (bigger pads / smaller pads / combinations?)

Diary booklet remarks:
In this section, participants will be asked about specific mentionings in their diary reports (checked upfront by the design researcher in MS Forms).

In this Appendix an example is given of the questions asked to P1 based on her diary reports.

a. Did you play all the time in A-Major Piano? Why? Did you try others, how did you experience those?

b. Saw you also played in the drum settings, how was that?

c. I saw in the diary booklets you filled in and the videos that you sat down in all the play sessions, what was the reason for that? How did you experience that?
d. Why did you choose for this specific contextual play setting?

e. You have played the drum in between 5 and 10 minutes, with an exception of the first play session, how come you played about that long? Was there a reason behind this duration? Did you have the feeling you were relaxed afterwards, or maybe more irritated, or distracted? How did you feel you wanted to end the play?

f. Used the light cover over it, why was that? :)

g. How did you experience the idea of not being able to fail while playing this drum? (as part of reaching relaxation, the importance of this to reach relaxation)

h. Can you imagine you would use this drum in daily life to improve your relaxation or support you in relieving from states of anxiety?
i. For whom could you imagine the benefits of using this drum in daily life? (in the way you did in the diary study)
j. Would you recommend playing the drum instrument for relaxation to other people you know?

Unsatisfied needs / Future design directions / Improved interaction concepts evaluation:

1. I know you have mentioned this in the diary booklet too, but would you mind describing some unsatisfied needs while playing the drum to reach optimal relaxation state for you?

2. If I would make a re-design of this drum instrument, and you look at the way it gives you relaxation effects (through multi-sensory feedback interaction, absorption in play, playful workout, musical tension & release tones), how could I improve it? Or make it different? What if it wouldn't be a drum, how could another type of design improve the relaxation effects for you, what kind of design would suit better relaxation for you? And how could I improve the interaction with the drum instrument to improve the relaxation effects for you? (not taking the sound and light delays into account, if that worked fine)

3. Do you have any tips to improve the formgiving to increase relaxation effects?
4. Do you have any tips to improve the drum's quality of not being able to "fail" while playing?
5. Do you have any tips to improve the multi-sensory interaction to increase relaxation effects?
6. Do you have any tips on how to improve the bodily expressiveness in playing this drum? And would this help you in increasing your relaxation effects while playing the drum?
7. Do you have any tips to improve the guidance in the drum instrument to increase relaxation effects? Imagine there would be more guidance incorporated in the drum prototype (on how to play this drum for relaxation), what would help you to reach improved relaxation effects / engagement / release of worries, emotions, body tensions? Or reach a better understanding of playing this drum for relaxation?

I have also made some suggestions of concepts addressing unsatisfied needs to reach relaxation with this prototype that I would like to discuss with you, on if it could improve relaxation effects **for you**.

1. Improved bodily expressiveness (show concepts within)
a. What do you think of the direction of improving bodily expressiveness, could this improve relaxation effects for you?
b. What is your opinion around the concepts to improve this? Do you have a favorite and a least favorite or a new suggestion?
2. Improved light guidance (show concepts within)
a. What do you think of the direction of improving light guidance, could this improve relaxation effects for you?
b. What is your opinion around the concepts to improve this? Do you have a favorite and a least favorite or a new suggestion?
3. Improved playful tension-release guidance (show concepts within)
a. What do you think of the direction of improving playful guidance, could this improve relaxation effects for you?
b. What is your opinion around the concepts to improve this? Do you have a favorite and a least favorite or a new suggestion?
4. Additional concept ideas?
5. Pick favorite concepts (top-3)

Any final remarks or questions?

If there is **time left,** do you mind playing it one more time while I ask you to do something for me?

- show me how you “started playing”
- how would you play it to really reach relaxation?
- how would you play it as a work-out? to reach a playful peak? and calm down after that?

Thank you so much!!

TURN OFF AUDIO RECORDING.

<u>Checklist</u>

- Printed version of this hand-out
- Printed version of the Relax-Change booklet
- Research prototype (drum)
- Ethernet cable (multiple)
- Video tripod
- Charged phone (audio recordings)
- Phone charger
- Notebook (interview & evaluation)
- Pen
- Chosen digital diary booklet answers for discussion
- Printed design direction mappings (visuals)
- Printed improved concepts (visuals)

APPENDIX E: DATA ANALYSIS PROCEDURE

Data Analysis Procedure

Veerle van Wijlen - MSc Student Industrial Design.

The research questions of this thesis are:

1. What is the effect of the design probe's novel relaxation principle on relaxation and decrease in state anxiety, amongst people with elevated trait anxiety?

2. What are the unsatisfied needs for playful tension-release creation, relaxation, and release of responses to anxiety to be found during play of the design probe? which therefore limit the benefits for relaxation and release of cognitive, emotional and bodily tensions to anxiety.

3. How can these relaxation/state-anxiety effects and user experience insights around expressive drum play for relaxation, making use of the design probe's novel relaxation principle, inspire specific design directions and improved concepts around accessible multi-sensory expressive tangibles for relaxation and anxiety?

Data analysis should provide answers to these three RQ's.

Based on the design researcher's amount of play sessions in the first iteration, it is expected that around 3*6 = 18 drum play sessions have to be analyzed on 1) effects of drum play on the participants' state anxiety and relaxation; 2) participant characteristics and the role of these in the effects; 3) participants' drum play contexts and its influence of the effects; 4) participants' UX around drum play for relaxation and its role in the effects; 5) participants' drum play behavior that caused both "top" and "flop" relaxation / state anxiety effects; 6) participants' unsatisfied needs for relaxation through use of the design probe; and 7) participants' suggested future design directions and improved interaction concepts.

In this thesis, the "mixed data" set will be analyzed per participant in the following four steps:

1. Participant profiling: analysis of their baseline anxiety scores (t-anxiety), and previous relaxation/musical experiences and preferences.
   This will be turned into visualized participant profiles containing all those aspects.

2. Analysis of (contextual/ UX) effect data: the effects of drum play with the prototype on the participant state anxiety levels and relaxation, and the role of the reported contextual and UX factors in the effects.
   The effects on the participant's state anxiety levels will be calculated for every drum play session: state anxiety level after play - state anxiety before play. A negative score means a decrease in state anxiety, so a positive effect of drum play. A positive score means an increase in state anxiety, so a negative effect of drum play.

   Diary reports and mentionings in the followup interview around relaxation effects will be analyzed and compared with the calculated state anxiety effects of every drum play session of the participants.

   This will be turned into visualized graphs of the effects on decreasing or increasing

state anxiety levels due to drum play with the prototype over the course of the diary study for every participant.

Contextual drum play factors will be analyzed based on the participants' diary reports in every drum play session and remarkable answers will be marked. In the end, these can be combined and compared to state the role of these contextual factors on the overall state anxiety and relaxation effects of all participants. Which again will be turned into visualized graphs to show the relationship between contextual factors and state anxiety / relaxation effects.

3. Analysis of drum play behavior characteristics within “top” effect and “flop” effect drum play sessions and the role of those in the effects created.
   Within the coding software MAXQDA the drum play videos that correspond to the best state anxiety / relaxation effects and to the worst state anxiety / relaxation effects will be annotated. This will be done with the help of a video coder guide.

   From the annotated videos, visuals will be created that show the top and flop effect play behavior characteristics of every participant. Later on the annotated top videos can be analyzed all together on the overall top effect play behavior characteristics of all participants. The same for the annotated flop videos.

4. Analysis of design related insights: selection of most outstanding unsatisfied needs for relaxation through drum play with the prototype, suggested future design directions and suggested improved interaction concepts.

   Unsatisfied needs will be analyzed from the diary reports of every participant together with mentionings in the followup interviews of each participant. Together with the unsatisfied needs gathered from a first person perspective in iteration 1, these will be combined and concluded into a final set of unsatisfied needs around expressive drum play for relaxation.

   Suggested future design directions mainly will be analyzed from the followup interview transcripts. Together with the suggestions from the first person perspective diary study qualitative results in the first iteration, these will be combined and concluded into a final set of suggested future design directions to optimize expressive drum play for relaxation and so the relaxation support the probe offers.

   Suggested improved interaction concepts mainly will be analyzed from the top-3 improved interaction concept evaluation from the followup interview transcripts and pictures made of the selected “concept cards”. Together with additional comments and suggestions by the diary participants in the second iteration, a final set or choice around the direction for future improved concepts for RELAX-CHANGE will be concluded.

APPENDIX F: VIDEO CODER GUIDE

Video annotation coder guide
Veerle van Wijlen - MSc Student Industrial Design.

Based on the paper: Hailpern, J., Karahalios, K., Halle, J., Dethorne, L., & Coletto, M. K. (2009). A3: Hci coding guideline for research using video annotation to assess behavior of nonverbal subjects with computer-based intervention. ACM Transactions on Accessible Computing (TACCESS), 2(2), 1-29.

Via MAXQDA software: https://www.maxqda.com/blogpost/how-to-analyze-videos

Each video will be analyzed in 4 takes (4 passes).

Pass 1: Time indicators and phases in drum play.
Use interval playback mode (slower playback, stop when needed, repeat when needed).

Play phase X: type of phase in playful tension-release build up (in play intensity).
A: start of play.
B: exploration, a phase in which the user gets used to the musical tones and starts drum play.
C: peak build up.
D: peak play.
E: big peak play.
F: playful release play.
G: “after peak” play.
H: small peak play.
I: break.
J: “end” play.
K: finish of play.

Pass 2: Hand movements and play characteristics in drum play.
Drag position in the playing video for fast skim.

Double hand use / One hand use: the use of both hands or the use of one hand in a particular drum play phase.

Slider movement: the movement of fingertips or a hand sliding over one or multiple touch pads in a particular moment during a drum play phase.

Fast / slow play: user plays either fast or slow according to the perception of the researcher.

Hard / light / loose play: user plays the drum touchpads either hard (with lots of body weight involved), light (with not a lot of body weight involved) or loose (in a more flowy way).

Clawed hand: user plays with tensed, spread, clawed hands.

Finger tips: user makes use of finger tips during play.

Finger spreads: user spreads fingers during play. For example, like playing a chord on a piano.

Full / half flat hand: user makes use of flat hand movements, either a full flat hand or a part of the hand flattened on the drum's surface.

Tensed / flowy play: user plays either with tensed hand movements or flowy hand movements.

Combo play: user plays multiple touch pads simultaneously.

Interchange combo play: user interchanges combinations of touch pads. Plays multiple combinations after each other and keeps changing between them.

Singular play (taps or claps): user plays singular touch pads, after each other. Either taps or claps, depending on the use of finger tips or flat hands.

Long / short hold: user holds touch pads for a "long" time (longer than 1 second) or for a "short time" (<= 1 second), according to the perception of the researcher.

Tap-hold play: user plays the touch pads by interchanging taps and holds during drum play. Either involves tap(s) and hold(s) after each other or simultaneously (when both hands or multiple fingers are used in play).

Repetitive play: user repeats drum play pattern.

Melodic play: user tries to make rhythms or melodies during drum play.

Chaotic play (without musical intention): user plays unintentionally and chaotic, doesn't try to "be musical".

Gentle movements: user plays with caring, gentle, soft (hand) movements.

Pass 3: Multi-sensory settings and use.
Standard playback mode.

Tension tones in favor: musical tension tones are played most or longest within a play phase.

Release tones in favor: musical release tones are played most or longest within a play phase.

Tension tones incorporated: user starts to incorporate musical tension tones in play.

Release tones incorporated: user starts to incorporate musical release tones in play.

Pass 4: Play engagement and “breathing”.
Standard playback mode.

Singing along: participant makes vocal sounds while playing the drum or sings a song/melody during play.

Bodily moving along: participant’s body is moving expressively during drum play.

Distracted: moment of distraction during play.

No audible breathing: can’t hear breathing on the audio of the “play” video.

Light breathing: breathing is light and rather normal.

Heavy breathing: breathing is intense, like the user is engaged in an intense work-out.

Increase breathing: depth of breathing increases (gets more intense).

Decrease breathing: depth of breathing decreases (gets less intense).

APPENDIX G: DATA ANALYSIS RESULTS ITERATION 1

Qualitative Analysis Diary Study Iteration 1 (First Person Perspective)

The written diary reports can be obtained on request.

Relaxation effects

Often very relaxed and calm afterwards. And could concentrate / focus better on my work afterwards, if I played the drum as a “break” in between my university work. A friend of mine also felt more relaxed after playing the drum for the first time.

Tiredness

It even helped me and a friend of mine to let go of tired feelings, she was really surprised by that, had not expected any of that! It had helped her out of her afternoon “dip”. Especially nice during lunch breaks or in the morning to clear your mind! Sometimes after play I felt a little bit more tired, but more cognitive/emotionally tired, but this feeling was gone very fast afterwards, and I often felt way more clear after working again for a while afterwards. An example, is the last time I played for this diary study:
“I felt a bit tired afterwards, like I had done some huge emotional heavy workout, but this is already disappearing. Felt very satisfied, comfortable and secure afterwards.”

Choice of musical tones for emotional release, emotional inducement and relaxation

Emotional release is very nice with the tension tones, also in the end to release the last bits, and really feel your emotions “blow away”.
Musical tones are very important to choose right to not leave you with a more frustrated, irritated or sad feeling.
Sometimes after play, even when I used the D45 tones, I felt quite emotionally aroused afterwards because I came “close to my emotions” that were under the surface and were now more noticeable at the surface.

D45 works best for relaxation, and happy feeling inducement. G45 works quite well as well, but the sounds are quite high, which makes the highest tones sound maybe a bit too crunchy in my ears, which was a bit frustrating and distracting during play. Some tones were really soothing and relaxing, resonated deeply, but others were really scratchy such as the 8th tone. However, I did use these scratchy tones in the end to resolve some last bits of tension. E major, E34, does not work that well, at least not in the evening before going to sleep, it made me more emotionally aroused!

The sounds in themself are really relaxing too! Even though I noticed the tension when pressing the tension tones, I still found them to have a relaxing effect. Especially the soundscape that keeps on clinging in your ear really helps relaxing in itself too. A friend of mine also found the sounds to be really nice: “lekker geluid wel!”

Once I tried A-major in the morning to see if it could help me clear my mind, create less bodily tension and create a happier emotional state. However the sounds were a bit too dark for the morning, however relaxing though. I felt like those A-Major sounds were more for the evening, so I chose D45 in the end.

From all major and minor scales I had chosen to implement in the prototype, I found D-Major (D45 and D56) and G-Major good for happy relaxation and flowy play; A-Major for harder and darker sounds, more melancholic play; E-Major (E34) for melancholic relaxation and E-Major (E45) for happy tones; and I was not really convinced of E-Minor, Em3-Em4 was relaxing in a “hard”/dark way and Em4-Em5 was really melancholic, maybe good to reflect inner pains.

Release of cognitions
No cognitions afterwards, or very little, had a very clear head always afterwards. Sometimes you feel quite like you’ve done some cognitive or emotional workout, like you’ve cried, but it feels very satisfied!
However, these cognitions were often gone after drum play, during drum play they were sometimes back quite fast. Or I needed to turn up the play tension quite a lot during play to get rid of every bit of cognitions left in my mind.
For example, the final time playing for this diary study, my cognitions were back very fast during play when I had tried to release them with intense play, fast combos and hard combo taps (whole body weight on the drum). Somehow, they came back, so I had to release them over and over again, which was okay, but it was also annoying because after a while I kind of wanted to stop playing, felt like it was long enough but I still had emotions and cognitions left, so I needed to turn up the play tension again to release them over and over again.

Also during slow play, release play actually, I was often more triggered to start thinking again, however changes in light colors and the intense musical sounds in the headphones got me zoned in again quite soon often, which got me out of thinking again. Or I used specific t-tones to remove last bits of thinking!

Release of bodily tensions
Bodily release was quite hard to create because the drum doesn’t invite that well for big bodily expressiveness. However, that being zoned in supports you in taking big breaths helps releasing bodily tension. Furthermore, I noticed when I played the drum more than 3 times a day, I got into “flow” way easier and also started to move my body along way more, like I was actively playing the piano, I started moving my shoulders and arms flowy along with the expressive flowy movements of my fingertips on the touch pads.
On the other hand, hand tension really releases, and lots of different hand movements are used, also to stretch. And you really notice on the hand tension and movements if people are building up play tension, are in the flow or have released some of their tensions.
Although it was hard to release e.g. shoulder tension or arm tension, what was super relaxed afterwards almost every time I played, was my face. Facial tension releases really well through playing the drum. I also noticed that often before play, I had a very tensed face, I often frowned my forehead (“frons”), and during play, when building up the play tension I even increased the tension in my face to really let go off during the release drum play parts.

Bodily tension only really released in intense expressive play, when playing up tempo, using a lot of combos and creating bodily flow, moving along with the musical play.

Or in the explorative first phase I already got rid of some bodily tension, but mostly I started to release some bodily tension after some very expressive phases (play tension phases). Furthermore, when I released some bodily tension, this was the tension that came back the

fastest afterwards or during play! It's a really difficult tension to "blow away" with this type of drum play, because actually only body movements really help for it, not the music or light in itself!

Facial expressions and talking as indicator for emotional and bodily release or effects
For next studies, it would therefore be a good idea to video record changes in facial expressions to see the effect of drum play on engagement in play, somebody's emotional state and especially facial relaxation (bodily release). For example, I let a friend of mine play the drum, and I observed her during play. In the beginning I noticed her secretly looking at me while she was playing, after a while I saw her jaw releasing and she started to stare at the drum while playing, and smiled way more. After play, when reflecting with her on that she indeed mentioned she later on forgot about me while playing the drum.

Furthermore, I also noticed my face was very relaxed afterwards when I recorded myself reflecting on the drum play afterwards. I really talked very lousy, with almost no tension in my jaws. Funny enough, on these videos you can really see low facial tension, because of my "resting bitch face" in the shots.

Play indicators for changes in state anxiety
Furthermore, another interesting indicator for change in state anxiety over the course of playing the drum, could be a reflection on the play decision making over the course of drum play of a person with anxiety.
I namely noticed that when I was in a high anxious state, I often had lots of worrying and emotions coming back during the course of play, and noticed this influenced the amount of times I tried to increase my playing tension.
Furthermore, I noticed when I was in a high anxious state, I was more restless, and had more difficulties in decision-making around which musical pads to touch, especially during "release play". Or I noticed I did not know if I should focus on the light feedback, or just focus more on the musical feedback to release my cognitions and emotions through play. I noticed in such a state, my cognitions were really in the way of conscious play (when I wasn't zoned in anymore), maybe also because this state made it harder for me to get "zoned in" play?

Same holds for hand movements and tension noticed in the hands, and the change of tension and movements over the course of time. This is a good indicator for building up play tension or release of play tension; and for bodily tension changes.
Especially to look at flat hand use, back flat hand use, finger tips, clawed hands, tensed finger combinations, stretched fingers on lots of pads etc, or flowy hand movements vs. very direct touches, quick taps, long taps for contact etc.

Indicators for relaxation effects, tension releases, play, and play context

- cognitive release: "clear head feeling", "decision-making", "indecisive", "confused", "worried", "overview", "head is very empty", "like I have cried or yelled", "removed last bits of thinking", "worrying", "cognitions gone", "less thoughts", "thoughts back soon", "free of worrying", "no worries", "worrying during sequence", "blew away my thoughts", "resolving", "no blocking", "head full of thoughts", "tired of thinking", "questioning myself", "light made me think", "doubts", "cognitive clashing".

- emotional release: “aroused”, “irritated”, “frustrated”, “emotional workout”, “close to emotions”, “emotionally touched”, “emotionally empty”, “happy”, “emotionally tensed”, “stressed”, “sad”, “like I have cried or yelled”, “heightened emotions”, “closed my eyes to really feel”, “blow away emotional tension”, “annoyed”, “fun”, “emotional impact”, “nothing specific on the surface”, “nervous feelings”, “feel emotionally worked out”, “close to surface”, “experience the effects of the music”, “deep”, “pure”, “pleasant feeling”, “nerves”, “slight panic”, “indecisive feeling”, “returning feelings while playing”, “manageable emotions”, “sad emotions under the surface”, “extra frustrated by prototype”.

- bodily release: “bodily tensed”, “shoulder tensed”, “facial tension”, “facial release”, “shoulder release”, “jaws”, “belly”, “not thought about how to use hands or how that changed”, “breathing”, “stomach tension”, “use arms more freely”, “bodily relaxed”, “heavy breaths”, “let go of shoulder and facial tension”, “quickly returned”, “bodily expressive”, “face relaxes”, “very relaxed face”, “eyes look very satisfied”, “tired eyes”, “facial tension changed”, “loose face”, “loose talking”, “stroking hand”, “stretching hand”.

- relaxation: “feel relaxed”, “really relaxed”, “calmth”, “satisfaction”, “secure”, “comfortable”, “I have done something good for myself / cared for myself”, “relaxed feeling in itself (light)”, “release of tiredness”, “tiredness”, “nice sounds”, “feel close to myself / connected”, “come to senses”, “feel good”, “certainty”, “sleepy eyes”, “feel very zen”, “content”, “remaining absent feeling”.

- process of relaxation: “exploration phase”, “exploring touch pads and tones”, “tension building”, “expressiveness”, “release play”, “started to play music / making music”, “making melodies (intentional)”, “go crazy (flow)”, “I went loose with combos”, “repetitive melodies”, “repetitive tapping”, “intense play”, “body weight”, “up tempo”, “big combos”, “slow, long combos”, “lots of different hand gestures”, “tense play”, “intense soundscape creation”, “incorporate t-tones”, “switched”, “faster”, “slow harmonic soundscape”, “ending play”, “close my eyes”, “zoned in”, “did a lot of things”, “combos after each other”, “tension tone combined with r-tone”, “no introduction period”, “immediately expressive play”, “played lots of t-tones”, “listening closely to musical tones and what they made me feel”.

- engagement: “zoned in”, “staring”, “flow”, “immersed”, “soundscape”, “conscious/intentional play”, “(no) eye for environment”, “related / connected to drum”, “loved/caring for drum”, “lost in play”, “forgot”, “musical heart was triggered”, “started to see blurry”, “only felt music”, “closed my eyes”, “grabbed my attention (light)”, “forgot about rest of environment”, “zoned in and out”, “distracted”, “no clear idea of what I am playing”, “light to stay zoned in”, “soundscape in headphones”, “indirect or direct light”, “noticed”, “light areas”, “indecisive (because of light areas)”, “confused (because of light color change)”, “attention to pair of lights”, “focus”, “payed attention on environment”, “feeling watched/window shopping effect”, “anonymity”, “like I was playing a product instead of doing research”, “being into play”, “hard to reflect on play (non-mindful play)”, “went for it!”, “in and out of engagement in play”, “other activity done during play (e.g. touch computer mouse to prevent standby mode)”.

- motivation to play: “excited”, “curious”, “ready for work”, “clear my head/mind”, “release bodily tensions”, “notice emotional change”, “to feel happy”, “release tiredness”, “thoughts slowly increasing”, “looking forward to playing it!”, “looking forward to coming into flow”, “in need for a break”, “want to go into the end of the day joyfully”, “make ready for the day”, “releave from initial day worrying”, “get head in ready mode”, “wanna calm down before work”, “need to calm down”, “don’t really feel satisfied with myself today and my work”.

- context: “alone”, “home”, “living room”, “bed room”, “expecting someone to come home”, “morning”, “evening”, “before bed”, “coffee”, “as a break”, “too late in bed”, “standing play”, “sitting play”, “have been behind laptop for a while”, “TV room”, “mom in living room”, “don’t want to bother mom closeby”, “seated on couch”, “drum on lower table”, “drum on high table”, “mom calling”, “light cover on”, “dark outside”, “didn’t feel like doing homework”, “tired”, “feel done for today”, “sister making tea in kitchen closeby”.

Use and effects of musical tension-release function
I noticed the musical tension release very well during play and also used it unconsciously to release emotional tension, get engaged into play, build up the tension in play, and build off the tension in play. I am wondering if I noticed it so clearly because I designed the principle behind the touch pads, or because I am quite musically skilled, or just because it works.

This musical tension release principle really helped me to zone into play, or to help me in the beginning of play to get into it. I noticed I often started with slow play in the beginning, really exploring which pads to touch to calm me down or to already release from some cognitions or emotions. This exploration phase sometimes was really needed to calm me down,or relax me already a little bit before I could build up the play tension. Sometimes I was just too frustrated, or emotionally aroused, or full of thinking, before I could really build up the play tension. I guess I needed to “zone in” first. Except for one time, where I was so frustrated by the big musical delay in the first moments of play with the prototype, that I immediately went for it and played very very intense from the beginning on, and only started to calm down during release play after this intense drumming. In this intense drumming I really tapped very hard (lots of force) on the drum, tapped om-en-om quite fast, and did not use lots of combo play I remember.

A funny notice was that I could find the musical touch pads without even looking at the top of the drum, when my eyes were closed and I really wanted to deeply feel the effect of the musical tones.

Playful tension-release creation
I noticed there is a paradox in play tension-release, and anxiety tension-release. Because I have built up the tension to especially release my cognitions and emotions, and a bit of bodily tensions. And then I used “release of play tension” to also release tensions because of anxiety, but more little tension that was left.

It was very interesting that almost every time I played, I guess except for one time, I had a kind of “exploration phase” in which I started to play slowly, touched pads one by one or

combinations from 2 or 3 pads maximum, to explore touch pads and the musical tones that I wanted to use, and already released some cognitions and emotional tensions. I often needed this phase in play to calm me down before building up the tension in play or to get me “zoned in”. Often, quite fast after this explorative calming and slow period, I started to really get into play, and started to play music / making music and making intentional melodies (intentional) or slow rhythms, to flow from there into absorption and increased play tension.

In short what characterized building up play tension:
“go crazy (flow)”, “I went loose with combos”, “repetitive melodies”, “repetitive tapping”, “intense play”, “body weight”, “up tempo”, “big combos”, “pressing lots of pads together”, “lots of different hand gestures/movements”, “exploring different types of play”, “tense play”, “intense soundscape creation”, “incorporate t-tones”, “switched”, “om en om”, “faster”, “tap tap tap”, “zoned in and out”, “engaged in and out a lot”, “no introduction period”, “immediately expressive play”, “did a lot of things”, “big combos after each other”, “combo of singular (lots of) t-pads”, “expressive middle part”, “play tension tones intensely”, “cross hand combos”, “hard”, “ready for building up play tension”, “flow”, “used light to build up combo play”, “tr-tr-tr-tr repetitions”, “when started to zone in”, “slowly adding t-tones to r-tone combo(s)”, “interchanging rapidly”, “combo-tap patterns: e.g. 3 r’s and 1 or 2 t’s as combo after each other rapidly”, “fast fingertips / flowy finger tips”.

In short what characterized release of play tension:
“explorative”, “repetitive slower melodies, rhythms, slow tapping”, “slow harmonic soundscape”, “ending play”, “close my eyes”, “zoned in”, “mindful play”, “distraction”, “smaller combos after each other”, “tension tone combined with r-tone”, “listening closely to musical tones and what they made me feel”, “played lots of t-tones”, “slow, long combos”, “not fully released from tension sometimes”, “releasing is harder than building up”, “slowly tapping r-pads after each other”, “long hold tr-combos”, “slow after each other play”, “combos of only r-tones”, “tone by tone to calm down”, “gentle touches”, “whole hands, flat hands”, “flowy / wavy flat hand movements”, “flat hands touching multiple pads at same time”, “connect-focused / caring touches”, “no play, quiet for a while”, “cross hand combos”, “final ending tone or combo”, “used light for flowy play or to slow down”, “big pads with finger tips”, “”finger tips”, stroking pads”, “close contact with drum”, “t-tones to release last bits of tensions (not really singular t-combos)”.

Building up tension is very easy. I noticed to build up the tension, I only maybe 2-4 times played very fast. I mostly build it up by using more tension tones in play, making bigger combos (so using more touch pads in play), speeding up the big combos (repeating press, or repeating alternating combos), or playing lots of different tones quickly after each other (sometimes also in melodies). I rarely touched just 1 or 2 pads very fast or as a combo after each other or combined when building up play tension. Almost every time more than 3 pads were involved when building up the play tension. And often I also did not really think in detail about how to build up the tension, I just let it happen, just let myself be expressive.
It was interesting that I kind of saw the same tension build up pattern happen over play time, when I got a friend of mine playing the drum. She also built up with bigger combos, and alternating different big combos, or pressing several combos quite quickly after each other, and alternating combo play with quick tap tap play (quick interchanges with less pads). She

also reported that she didn't think about what exactly she played! (#non-mindful tension building, #engaged).
I was also surprised that when I built up my play tension with "big combos" in play, I often used a lot of body weight in play and expressed some emotional frustration that way. I really pressed those combos very "hard", using my vertical body weight to get rid of my frustrations, emotional tensions and bodily tensions.
When building up the tension, I perceived that I normally had quite short periods of playful tension build up. Except for one time (last time of the diary study), where I played for a longer period, very expressive, longer than I have experienced in previous sessions. I think it was needed, because it helped me quite well to get rid of some emotional tensions and cognitions.
I also flowed into these periods of "tension play" very naturally, didn't think about, "okay now I need to build up my play tension or so". And flowed into release play very naturally afterwards as well. However, I did reflect sometimes during play like "okay do I need to release more cognitive tensions or emotions?" and then explored what type of play (release/tension) fitted my needs.

Releasing play tension is sometimes harder. Then sometimes I started to think again about what I was playing, because I played slower and therefore had more time to notice the light which confused me sometimes in what I wanted to play, or I started to overthink which tones I wanted to play. However, this disappeared as soon as I was zoned in in play again.
To release play tension, I especially liked to play repeating melodies, interchange r-tones slowly, or play r-tone combos slow and long. Sometimes I touched a singular t-tone in between to release some last cognitions or emotions.
Funny enough, when I wasn't zoned in anymore at that time I sometimes closed my eyes to really feel the musical tones blow away my last bits of worrying or emotional tensions, during "release play".
Also to determine when you are really done playing, when you feel done playing, there is no real way to "stop" playing. Also because sometimes there were tensions left and I couldn't really release from all of them it was hard to determine it was time to stop. But also because the musical tones kept on inviting me to explore other musical combos and got other emotions triggered, I could keep on playing.
Furthermore, sometimes I felt in myself I had played for a long enough time, started to feel a bit restless, felt like I needed to move on with my work (when I played as a "break"), but I had not released all my emotions or cognitions yet, which created some extra cognitive tension in my head and some confusion, like "do I need to stop now? or move on to release some more?".

Over time I have used lots of different play patterns, and what was more surprising is that I also used lots of different types of hand movements.
I noticed I used my flat hand in the end of my play sessions quite some times, to get more close contact to the drum, kind of connect more with it, feel it more, kind of care for it more gently to release some play tension and last bits of bodily tension, cognitions and emotions.
When I used flat hands I kind of rolled them over the bigger r-pads, to release some hand tension as well and really get in contact with my feels.
One time I also used the back of my hands to stroke the r-pads, which was nice, it felt like I was really more in contact and in play.

When I was in the flow, I touched the pads quickly, loosely, with fingertips and made more flowy movements. This also invited me to be more “bodily active” in play.
When I wanted to build up play tension,or when I was emotionally aroused and wanted to get rid of it in intense play I noticed more tension in my hands, kind of tensed my fingers together or clawed my hands to be able to harder touch the musical pads.

Use and effects of the light feedback mechanism
Light feedback has to change. Color change is nice, works relaxing, works engaging, and that it shows the direct effect of touch is very satisfying, but the function of the light in supporting the creation of tension release isn’t clear at all. And also sometimes it made me even more confused in play and making play decisions. I mostly forgot about the light feedback when I was “zoned in” into play. However, I think the color changes helped me zone in as well. It’s a bit contradictory.

Often I had to think about trying to use the light for guidance in making play tension-release decisions, and remind myself to try to use the light color change to pick pads for play. But, I got lost in this task when being “zoned in”.

However, the final time playing for this diary study, I played for 21 minutes and I had difficulties releasing my last bits of emotional and cognitive tensions, I used the light feedback for a while. “Something new, in the end I played again with some flat hand movements, curly, flowy flat hand movements, and for the first time I really made use of the light, without thinking that I needed to focus on the light! I really liked it to make flowy touch movements between 2 release tones and use the light change to create my flowy movements. To build up the red light on one pad, till it was red, moved to the other, and noticed at the same time the blue color changed on the first pad again, and then interchanged touching these pads. I took this satisfying feeling with me and did the same for some t-tones again, until I came into “flow” again and forgot any form of conscious play again.”

The light feedback kind of works guiding, in a very indirect way, according to a friend of mine after play. *“It helps to see you need to go slower. If you go fast, you don’t see the light, because you are building up, but if you release you see the slow lights and you think about releasing play tension.”* (quote from written diary reports P0).

Engagement in play / absorption / “zoned in” / “flow”
Being zoned in is the greatest feeling! Does not always succeed, very context and state dependent. Mostly happens because of the audio soundscape, noise canceling headphones, and the lights that shine directly in my eyes, are quite bright and change color slowly. Three times I was so zoned into play (I normally started to stare at the drum when I was zoned in, started to see more blurry) that my eyes closed and I almost fell asleep!
However, sometimes during play I got zoned in a lot of times and for quite a long time, but other times I had the greatest difficulty to keep engaged into play. Either because I was thinking too much about how I played the drum, which tones and pads to use, and why I made certain decisions and movements. Or because there was somebody else in the room close to me. Or if I had the feeling others could see me, or somebody was going to get home soon who could interrupt me in play. Or if I was just too frustrated when starting to play.

I zoned in either in slow play (begin) or fully in fast play (building up the tension).

Switching from release to tension in play goes quite “mindful”, that is always a moment you go a little zoned out. It happens kind of with the mind, I know what I am doing.

When I played slower, releasing play tension, I noticed that I knew more what I was doing to calm down. However, after a while I zoned in again.

Discover yourself and your anxiety
Playing the drum was a combination of expressing my own emotions in intensity of play and hand/body movements during play; inducement of happy emotions, especially through making melodies with r-tones, and choosing D45 tones or G45 tones; and releasing emotional tensions, kind of blow them away with the tension tones and t-r combos, in slow-long play or very hard expressive combo play.
Sometimes after play it really felt like I had done a kind of emotional workout, like I had cried a lot or had yelled for a long time at somebody, which was very satisfying. “It felt like I’ve cried for 30 minutes or so. All is out, so no worrying.”
Playing the drum also helped me to discover my own emotions, that were maybe a little bit under the surface or actually very much at the surface (especially through reflecting upon them before and after play, and if there suddenly is lots of calmth or some emotion very much present instead e.g. sadness), how you like to deal with these emotions (blow away, induce, or temporarily increase with e.g. sad tones), how you experience relaxation effects (also how it differs in different situations), and what helps you to relax (what kind of play and what musical tones) in a very exploratory way. Helps you discover yourself and your anxiety.

I actually never used the multi-sensory feedback to block cognitions or emotions, but more for relieving emotional tension and my worrying, blowing it away!

Playing is a learning process
Interesting evidence for this assumption, could be the increase in positive effect on state anxiety over the course of the week of the diary study, looking at the State-Trait Anxiety self-evaluation results.

I feel like playing this drum is really a learning process over time, however off course it does give immediate results after one time play already. However, it is good to note that these can be counter-relaxing too and cause more emotional arousement, dependent on if the tones are chosen well for the person’s goals and emotional, cognitive and bodily state, which could prevent further play…

The more I played, the less I thought about “what to do”, and it was also easier for me to decide to get the drum for relaxation and play it for a while.

I noticed when I stopped doing the diary study I kind of craved playing it again, and found it a waste to have stopped playing from then on.

I noticed over time I really tended more to the happier-relax tones than the melancholic relax tones. Because all tones from the major and minor scales I have chosen are quite relaxing, but it’s important for me that I don’t feel emotionally shitty and worse afterwards.

Over time I get more familiar with the drum play, and skilled in how I can create play tension for myself, both musically and expressively, and what I like regards both.

I noticed I get more flowy, and make more flowy movements if I play a lot on one day. I used more complex hand movements, more fingers at the same time, faster after each other. I am going to move along bodily-wise with my hand movements and with the musical flow I created. I get more bodily expressive and faster. Faster taps, harder taps, combination taps.

The more I have played it on the day, the more relaxed I get and the more open I am for the play experience. I don't really have the feeling anymore that I really have to do it right or perfect. I am more open for what happens on the "multisensory playground". I combined the music and light more, and noticed I was more open for the light function. I get more into experimental mode then I have to do it right - mode.

The light cover
In the beginning I did not use the illumination cover to blur the bright lights. When I did not use this lid on top of the drum, I noticed I got zoned in quite fast. But I did not use the light at all to guide me in building up my play tension. I only noticed the lights when I played slowly, when releasing play tension, and then I tried to use it a bit. So I liked pressing till it was red again, but then I got zoned in again and lost the light.
When I did use the lid on top of the drum, I noticed I got zoned into play as well, but maybe a bit less fast, or for shorter amounts of time. However, I really liked the lid because it made the light look more friendly, and it made me notice the light way more, because I saw it more in areas instead of light pairs. I also noticed I used the light a little more as guidance in creating tension-release, because e.g. I saw very clear areas of red light and based on that I wanted to play some other pads to create more tension in another way instead. For example, I noticed a very clear red light area when I pressed one base tone and two tension tones on the back side of the drum, which got me deciding to play the base tone and two tension tones on the opposite side of the drum to alternate in play and so build up my play tension.
The light was way more friendly with the lid on top of it. However, the working of the light was a little bit more clear, this still needs to be more clearly visible.

Moments of play
Playing the drum as a break in between university work, only has advantages to me, either if it's around 2 PM or 4 PM, that doesn't matter. It feels really good to play this drum as a break. I feel so satisfied with myself afterwards, because I have been so active, it really feels like I have taken the time to work on myself and not only distracted myself but also really "helped" myself and released several tensions. Feels good to care for yourself in that way!

Playing the drum in the morning, before starting to work for university, feels a bit contradictory. On the one hand, I like it a lot because it really "clears my mind" before starting to work, and sometimes removes some tired feelings I still have after waking up. On the other hand, it is hard to motivate yourself at this moment of time to play the drum since you actually want to start working!

Playing the drum in the evening, before going to bed has its ups and downs as well. On the one hand it is a very satisfying feeling to literally emotionally, cognitively and bodily prepare yourself to go to bed. And it also really helped to get me in a more calm, and relaxed state before going to bed. On the other hand, it got me hyped up and “happy” as well before going to bed, which was a bit less relaxing. And also because I am the researcher, it got me in “reflecting mode” before going to bed, which is not that convenient for your sleep. However, I felt really satisfied with myself, by having taken care of myself and my anxiety before sleeping.

Moments of anxiety are not always the moment I wanted to play the drum, that really depends on more contextual information! (time, place, privacy, to-do’s, needs (anxiety goals), 3 types of tensions state).

These moments are really dependent on somebody's working situation, personal and family situation. Are there other moments of drum play I missed out on which I should further investigate for the design of next multi-sensory tension-release products?

I liked standing play more than sitting play, because standing allowed me to have more control in play, have more expressive freedom (in terms of body movement), and standing helped me to release better from bodily tensions (sitting only increases back and belly tension, sometimes arm tensions too).

Mostly played at home, in the living room, standing, alone in the room. This really has to do with the fact I am a university student, working from home, and my parents often work in their home office or “real” offices during the day. It is very much situational dependent what is your favourite place and way of playing.

Anonymity / safe space / personal moment of play
I noticed I really don’t like playing this drum when there is anybody around, or if I have the feeling somebody could discover me playing the drum soon (could come home from grocery shopping for example). When somebody is around, or could be around soon, it feels like somebody is interrupting a very personal process and comes into a very personal space! This made me sometimes frustrated during play.

Drum sounds exploration
I explored the drum tones two times shortly on the same day for about 9 minutes.

Drum tones were quite soft, delay noticed quite well. Drum tones need to be more reactive, than the harmonic tones.

Could not really create a direct rythm with it, or a “flowy” soundscape to release some cognitive, emotional or bodily tensions. That was a bit annoying.

After playing for a while I started to like playing around with the drum tones. I noticed I started playing pads combined at the same time, the 4 r-tones, alternated with a high hat sound or a clap (t-tones).

I played the drum way more tappy and direct than with the harmonic scales. Playing it was especially funny because of the weird tones, like a hand clap or shaker. It made me feel happy because of the fun sounds.

The long high hat and hand claps worked really well to release my inner tension!

I think this requires some more practice, playing with the drum tones, but I think it could be a fun way to explore the tension-release principle with these drum tones. Or maybe alternated with harmonic tones?

A thought while exploring the “drum/rhythmic sounds” was that the tension and release tones should visually maybe be the other way around, cause I used the drum tones (r-tones) to build up the play tension fast, and the accents (high hats etc.) to release play tension funny enough. It would be quite nice when the current tension tones (accents) are so accessible, if placed on the bigger tones instead.

I did not feel emotionally aroused after, playing did not really have a very high emotional impact.

I had less bodily tension.

And less worrying.

I was quite zoned in, but it was a more mindful session to be honest, very much explorative.

Contextual usage of the drum

Playing and use time

1. I played for about 8 minutes straight, but did not fully release from my tensions (Mo 08032021). → at 22.49 PM.
   Feeling little tense, lots of thinking, bodily tensed but cheerful before.
   Not fully released from most tensions after, more emotionally aroused, more bodily tense, no cognitions that are disturbing me.
2. Played for 4.25 minutes (short play) (Tue 09032021). → at 10.09 AM.
   Little bit irritated, little disturbing thoughts, frustrated, bodily tensed before.
   Way more calm after, happy, no thinking for 10 minutes after, a little less bodily tense.
3. Played for 7.14 minutes (Tue 09032021). → at 15.15 PM.
   Worried a lot, emotional, frustrated, bodily a bit tense before.
   Very bodily and emotionally satisfied after; totally calm; very calm in my head for about 10 minutes after, emotionally empty.
4. Played for 5.41 minutes (Thurs 11032021). → at 10.11 AM.
   Happy, but worried, tense shoulders, back, jaw, arms and belly before.
   Still a bit emotionally tensed, in touch with emotions (touched), a little bit sad (maybe came from under the surface), still bodily tensed (more because of chair, play seated), jaw a bit less tensed, no worrying after all, head fully cleared after.
5. A friend played for about 5 minutes (Thurs 11032021). → at 13.30 PM.

Not so tensed before, has overview over what she wants to do to day so not much cognitions, less stressed than in beginning of the week, shoulders very tensed (because lots of seated work was done), she felt quite tired before (not good sleep). Felt relaxed after and surprisingly less tired, as she said: “I don’t have to lie in bed anymore, I feel like it’s good like this, like I have already relaxed for a while.”

6. Played for 9.00 minutes (Fri 12032021). → at 10.20 AM.
   Happy before, little bit tired, no heavy emotions on the surface, quite some worrying, thoughts slowly come back after journaling this morning.
   Felt quite a bit emotionally touched afterwards, call it a bit sad-ish maybe. For the rest I felt very calm, less bodily tension in stomach, the other bodily tensions did not release (feel the same as before), head is very empty, all cognitions are out, NO worrying. Felt less tired, just way calmer! Unsure if I felt ready for working because of heightened emotions.
7. Played for 11.00 minutes (Fri 12032021). → at 15.46 PM.
   Tired of sitting before play, thinking because of reading all the time behind the laptop. Bodily tensed before, not very emotional, nothing special on the surface, do have some worrying, feel nervous before play.
   Feel a lot calmer after play, and way more bodily relaxed too (facial and shoulders). Felt a bit emotionally worked out, “I’ve touched my emotions”. Cognitions are quite gone, felt close to myself and had definitely less thoughts, but they came back soon. Sooner than normally after drumming.
8. Played for 8.25 minutes (Mo 15032021). → at 9.39 AM.
   Initial day worrying, bodily shoulder and facial tensions, and some emotions quite close to the surface, such as frustration, before play.
   Afterwards I felt free of worry, bit frustrated and not so much because of the play but more because of a distracting environment (mom was calling closeby), a bit less bodily tensed but that’s already fully back.
9. Played for 11.00 minutes (Mo 15032021). → at 23.34 PM.
   Shoulder tension, some worrying and emotions on the surface before play.
   I felt good afterwards, very certain of myself, felt more relaxed, didn’t have lots of cognitions or worries. Did feel a little bit emotionally touched, like I had cried.
10. Played for 12.00 minutes (Wed 17032021). → at 10.39 AM.
    Lots of worrying, nerves (stress and panic from last night), little bit frustrated by neighbours construction work, shoulder tension, neck tension and arm tensions before. Besides that I felt good, pleasant but a bit tired before play.
    Very relaxed face, sleepy eyes afterwards. Relaxed, low jaw and lousy talking. Feel very zen, very relaxed, very calm, really not any worrying going on afterwards. Eyes looked very satisfied, tired eyes but look happy. Felt very good afterwards. Facial tension had really changed, way looser and shoulder tension was way better! I did feel quite a bit emotional but manageable afterwards. I felt happy afterwards, very comfortable, secure, content and satisfied.
11. Played for 21.00 minutes (Wed 17032021). → at 16.03 PM.
    Tired and felt done with the day before, bodily tensed, especially jaw, shoulders, belly and frowning face, arms too. Had sad emotions a little bit under the surface, head full of thoughts and felt tired of thinking before play. A bit grumpy too because of thinking about the final master project (worrying). Worried about fmp. Did not really feel satisfied yet with my work and myself that day.
    Afterwards, I did feel more relaxed but still a bit frustrated because the prototype

didn't function well in the beginning. Got rid of my cognitions in the end, but it was a struggle. Tiredness has become less, feel ready for the rest of the day.

12. Played for about 21.00 minutes (Fri 19032021). → at 15.16 PM.
    I had quite some thinking going on, not really emotional, lots of bodily tension (face, shoulders, neck, belly). Wanted to especially clear my mind and get rid of some bodily tensions. Did not really feel relaxed, a bit rushed, like I needed to do lots of things.
    Feel relaxed afterwards, released a big part of my emotional tensions, released a big part of my cognitions (almost none left after play), and especially released facial tensions and a bit of shoulder tension (but that is back quite fast). Cognitions came back a lot of times during play.

Over time I played longer sessions. Sometimes I just needed more time to really release and get rid of my emotions and cognitions, or some bodily tensions that were still too high to be bearable in the end. Or I was just too curious to stop playing the musical tones.

Summary of Data Analysis Diary Study Iteration 1 (FPP)

Data gathered

Quantitative data

- STAI data (state anxiety before and after play; state anxiety effects over the course of diary study; hypothesis high and low effects; do I fulfill elevated anxiety characteristics; remarks specific state anxiety scores before or after play; discrepancies in state anxiety items in certain play sessions)
- Quantitative touch/use data: tension release patterns, musical tension release use, and play behavior data over time of play session (e.g. time hold pads at the end of play, when releasing playful tension)
- Use videos observational data: tension release curves, play behavior characteristics, breathing, relaxation effects in hand movements etc. (Google foto's)

Qualitative data

- Contextual information, around drum play, relaxation, state of anxiety and cognitive, emotional and bodily tensions
- User play experience reflections (incl. use of multi-sensory feedback mechanisms)
- Tension release creation reflections
- Effect reflections on relaxation, state of anxiety and cognitive, emotional and bodily tensions
- Proto improvements reflections

Quantitative data analysis

Playful tension-release curves
Characteristics around the build up of playful tension and release for relaxation, decrease of state anxiety and release of cognitive, emotional and bodily tensions to anxiety.

Playful tension-release curves with the highest effect on decrease in state anxiety:

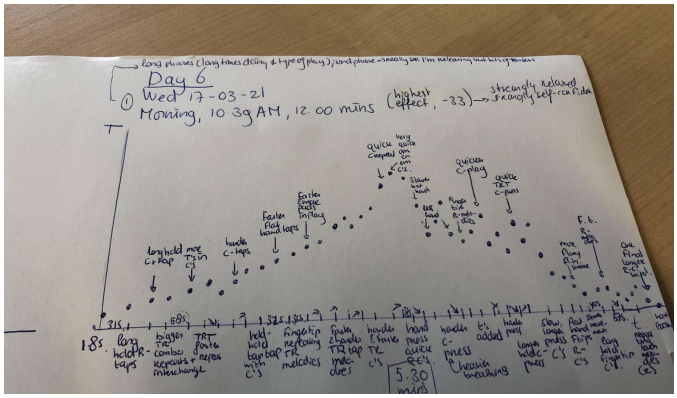
1. Effect of -33; 12.00 minutes played; D-Major D45; in the morning at 10.39 AM; on day 6 out of 7.
2. Effect of -27; 11.00 minutes played; D-Major D45; in the evening at 23.34 PM; on day 5 out of 7.
3. Effect of -26; 7.14 minutes played; D-Major D45; in the afternoon at 15.15 PM; on day 2 out of 7.
4. Effect of -26; 21.00 minutes played; D-Major D45; in the afternoon at 15.16 PM; on day 7 out of 7.
5. Effect of -24; 21.00 minutes played; D-Major D45; in the afternoon at 16.03 PM; on day 6 out of 7.
6. Effect of -16; 8.25 minutes played; D-Major D45; in the morning at 9.39 AM; on day 5 out of 7 (start of a streak of five high effective tension-release play sessions).

Playful tension-release curves with the lowest effect on decrease in state anxiety:

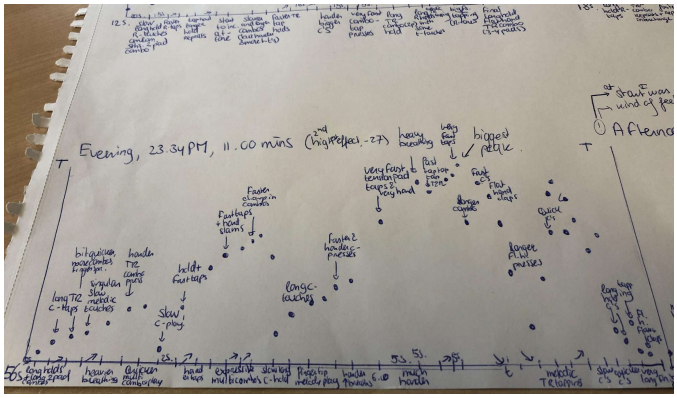
1. Effect of 0; 8.00 minutes played; E-major E34; in the evening at 22.49 PM; on day 1 out of 7.
2. Effect of -7; 9.00 minutes played; D-Major D45; in the morning at 10.20 AM; on day 4 out of 7.
3. Effect of -9; 11.00 minutes played; G-Major G45; in the afternoon at 15.46 PM; on day 4 out of 7.

Final two lowest effects on the same day, this is also the day on which I had the lowest state anxiety scores before play (46 and 47), as compared to state anxiety scores before the more effective play sessions.

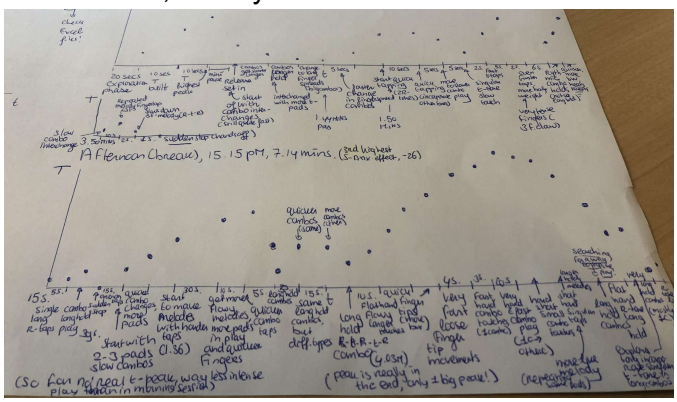
Characteristics of the highly effective curves:
Effect of -33;



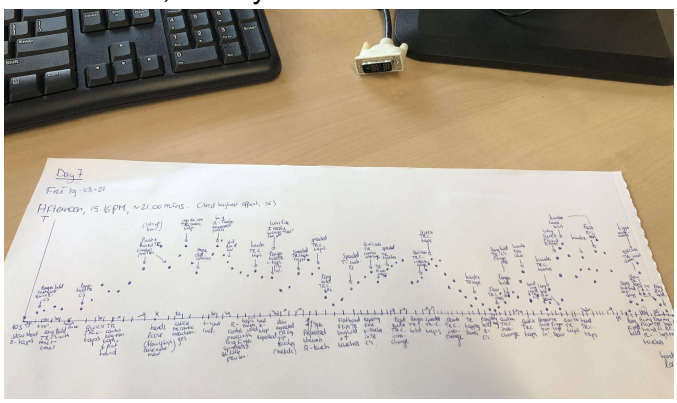
Effect of -27;



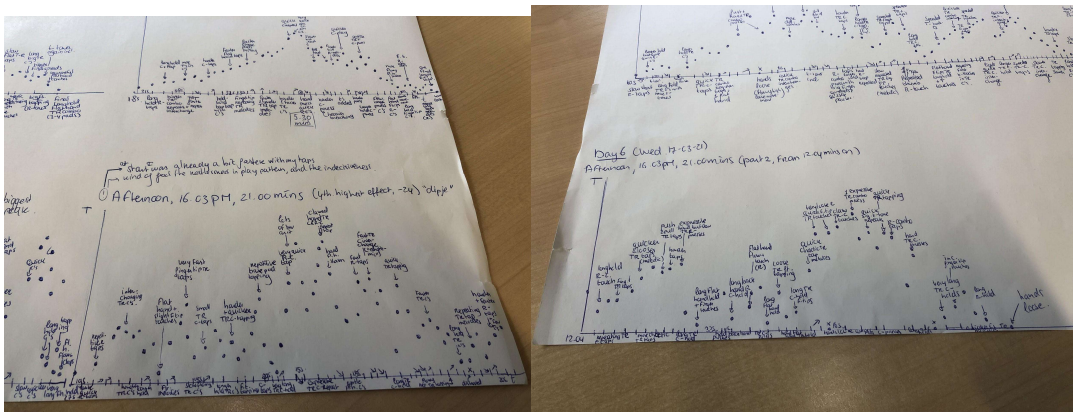
Effect of -26; on day 2 out of 7.



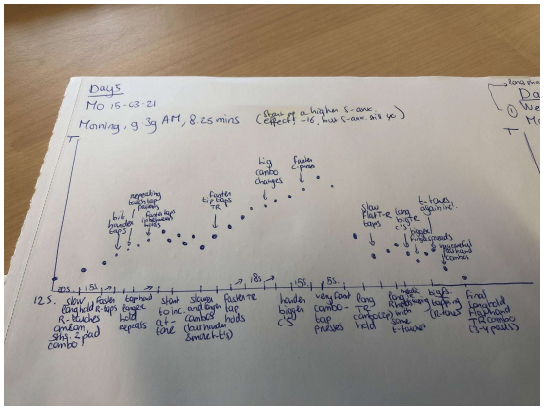
Effect of -26; on day 7 out of 7.



Effect of -24;



Effect of -16; (start of a streak of five high effective tension-release play sessions).



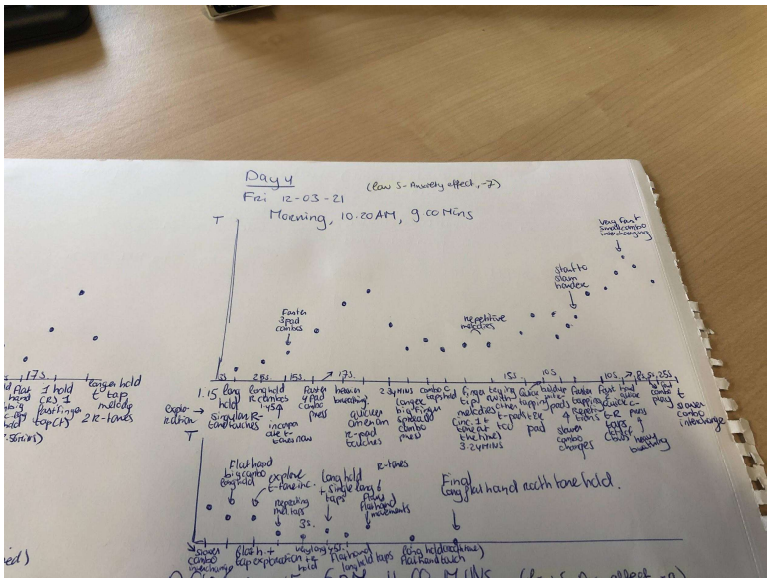
- Play sessions in between the 7 and 21 minutes; highest effects for play sessions around the 11 and 12 minutes.
- In all play sessions D-Major D45 was used.
- 3 out of 6 highest effect curves in the afternoon.
- highest effect curve in the morning.
- second highest effect curve in the evening.
- 5 out of 6 took place on the last three days of the diary study.
- 4 out of 6 high effect curves, including the first three curves with highest effects, are quite “perfectly shaped” curves; the one with effect -26 on day 7 and the one with effect -24 can be described as more “restless shaped” curves, with lots of different peaks and changes in playful intensity (these are both the longest play sessions, 21 minutes).
- 4 out of 6 high effect curves (the “perfectly shaped curves”), including the first three curves with highest effects, build up towards one big peak in playful tension (so high playful intensity), somewhere halfway the play session or near 3/4th of the play session; the one with effect -26 on day 7 and the one with effect -24 (“restless shaped curves”) don’t build up towards one big peak, but contain about 3 to 5 big peaks in playful intensity (2 in beginning, 1 halfway, 2 near the end for -26 effect; 2 halfway play, one near the end for -24 effect).
- 5 out of 6 high effect curves contain around 1 to 3 quite high playful tension peaks after the last “big peak”, as part of “release play”, before final release play takes place; in the lowest high effect curve of -16 it is clearly seen that there are only about 2 very small peaks before the end of play which could have caused a lower effect on decrease in state anxiety.
- In 3 out of 6 high effect curves build up towards the big play tension peak in a very gradual manner, with either no smaller peaks before (highest effect curve) or one smaller intense play peak; the second highest effect curve differentiates from that and contains multiple smaller peaks, about 3, before it is built up towards the final big peak; in the 2 curves with multiple big peaks, there are also multiple smaller peaks before the “biggest peaks”, around 2-3 smaller peaks.
- Release play is in all curves built up out of some quite high smaller peaks in play tension (around 1 to 3 of those), and around 1 or 2 very small peaks in play tension before the end of play. Except for the lowest high effect curve of -16, there are only 2 very small peaks before the end of play which could have caused a lower effect on decrease in state anxiety.
- 3 out of 6 high effect curves contain around 1-3 little breaks in between play (both the 3rd highest effect curves, and the 4th highest effect curve), in which I was either distracted and paused to do something else, did a sudden stop, or made a flowy hands loose movement. Most remarkable breaks are in the 3rd highest effect curve on day 7. In the Friday afternoon session (19-03-2021) from 21.00 minutes, it is remarkable that I have taken two very short breaks in between play (moments in which I loosen my hands from drum play). The break in the beginning is most remarkable, this one is right after a high play peak: I don’t first gradually release play tension but immediately for a short while loosen my hands. After this break I also don’t build up play tension gradually, I just immediately go to fast tension-release combo presses again. The second break is near the end of the play session, after a small period of release play, and before the build up of the final peak in play. After

this mini break, I very gradually built up the play tension again, starting with a long release pad hold.

- All 6 out of 6 curves contain an exploration phase, in which slowly mostly musical release pads are touched after each other (om en om). These last in between 5 to 31 seconds. The play session with 3rd highest effect on day 2, has the shortest exploration phase of about 5 seconds. The highest effect curve has the longest exploration phase of about 31 seconds. 2nd highest curve ~10 seconds (odd one); 3rd highest curve day 7 ~29 seconds; 4th highest effect curve ~19 seconds, 5th highest effect curve ~20 seconds.
- In 2 out of 6 high effect curves (-16 and 2nd highest effect curve), flat hands are used in the ending phase of the play sessions (at the very end) to release play tension, either long hold flat hand musical tension release combos, long flat hand pad holds (careful movements), or flat hand claps (bit more expressive).
- In 4 out of 6 high effect curves (highest effect, 3rd day 7, 3rd day 2, 4th), either long hold musical release tone combos, single long hold release tones, or light release combo taps, or light release tone taps are used in the ending phase of the play sessions.
- In all high effect curves lots of different hand movements are used in the different phases of building up and releasing playful tension in the sessions, about 13 to 24 different playful hand interactions. Amount of different playful hand interactions corresponds with overall time played. The two shortest sessions with 3rd and 5th highest effect had 14 and 13 different ones. The two middle long sessions with the highest and 2nd highest effect had about 18 and 19 different ones. The two longest sessions with 3rd and 4th highest effect had about 20 and 24 different ones.

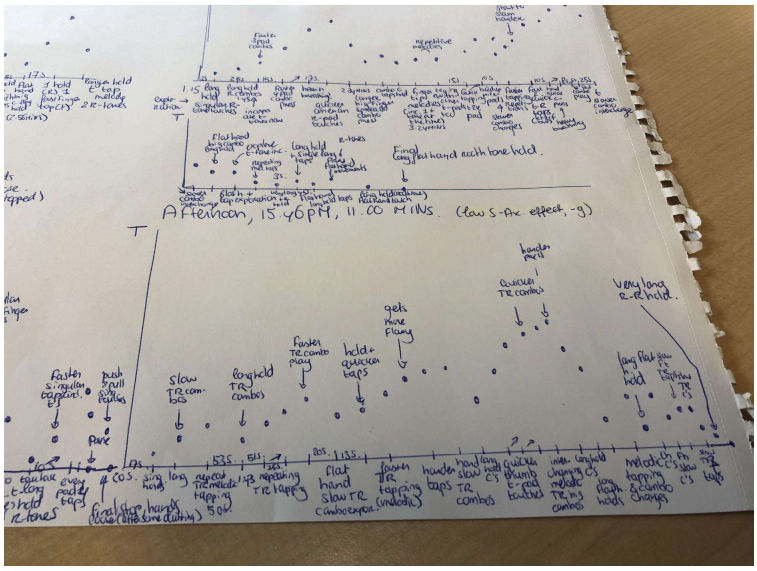
Characteristics of the least effective curves:

Effect of -7;



This curve looks like the 5th highest effect curve but with way lower play intensity peaks at the end of the play session, and a less steep build up towards the big peak in play. And on the curve with 3rd highest effect on day 2 but with a less intense big peak in play, and with less steep build up towards this one big peak again.

Effect of -9;



This curve looks like the tension-release curve from the play session with 2nd highest effect, but with way lower play intensity peaks in the beginning of the play session.

- Play sessions in between the 8 and 11 minutes; highest effects of the “lower effect curves” for the play session around the 11 minutes.
- Played in the evening, morning and afternoon, with the highest effect curve in the afternoon.
- Played in E-Major, D-Major and G-Major, with highest effect for the play session in which G-Major G45 was used.
- Both -7 and the -9 low effect curves are quite “perfectly shaped” curves; and far from “restless shaped” curves, because both curves don’t include lots of different peaks and changes in playful intensity.
- Both -7 and -9 low effect curves (“perfectly shaped curves”) build up towards one big peak in playful tension (so high playful intensity), somewhere halfway the play session (-7 effect) or near 3/4th of the play session (-9 effect).
- None of the low effect curves contains any quite high playful tension peaks after the last “big peak”, as part of “release play”, before final release play takes place, which could have caused a lower effect on decrease in state anxiety.
- Both the -7 and -9 low effect curves build up towards the big play tension peak in a very gradual manner, with either one smaller, but quite high, peak before (-7 effect) or three smaller play peaks before that gradually build up in intensity before reaching the biggest playful tension peak (-9 effect).
- Release play is in both the -7 and -9 low effect curves built up out of around 2 or 3 very small peaks in play tension before the end of play which could have caused a lower effect on decrease in state anxiety.
- Both the -7 and -9 low effect curves don’t include any breaks in between play.
- Both the -7 and -9 low effect curves contain an exploration phase, in which slowly mostly musical release pads are touched and held long after each other (om en om). These last in between 3 to 17 seconds. The play session with 2nd lowest effect (-7) has the shortest exploration phase of about 3 seconds, however which is followed up by a long 25 seconds phase of long hold musical release pad combos. The highest low effect curve has the longest exploration phase of about 17 seconds, followed up

by a very long 53 seconds repeated musical tension release melodic tapping and slow tr combos.
- In the 2nd lowest effect curve (-7) a final long flat hand rooth tone movement is used at the ending of the play session, in which flowy flat hand movements were used right before this ending movement.
- In the highest low effect curve (-9), a very long musical release-release tone combination was held, preceded by slow musical tension release taps.
- In all low effect curves lots of different hand movements are used in the different phases of building up and releasing playful tension in the sessions, about 16 to 19 different playful hand interactions. Amount of different playful hand interactions corresponds with overall time played. The effect -7 and effect -9 sessions had 19 and 16 different ones, and lasted for respectively 9.00 and 11.00 minutes, described as middle long sessions. The amount of different playful hand interactions in these 2 curves correspond with the two middle long high effect curve sessions with best and 2nd highest effect.

Playful tension-release behavior characteristics
For this analysis it is mostly looked at the high effect curves.

- At the big peaks (tension play), there are a variety of play behavior characteristics that come back in the high effect curves, such as: fast and hard play, clawed play, (fast and hard) tension-release combo presses, combo interchange (small and big combos) or release combo repeated presses, (quick and hard) tension-release taps interchange or release pad taps.

- At the smaller, but quite high, peaks (tension play), there are a variety of play behavior characteristics that come back in the high effect curves, such as: fast and hard tension-release combo taps, presses or interchanges; hard, fast and flowy tension-release taps, sometimes even with very loose and quick finger tips; faster tap hold play (a type of combo play); fast release pad tapping.

- At the mini peaks (release play), there are a variety of play behavior characteristics that come back in the high effect curves, such as: long hold, slow, (light) finger tips, big finger spreads, repeated release tone or tension-release tone tapping melodies; flat hand long hold release tone touches, big finger spread (tension-)release tapping (melodies) (slow), long hold tension-release combos touches or holds (sometimes even hard touches), light tension-release finger tip taps.

- At the exploration phase + “beginning phase” there are a variety of play behavior characteristics that come back in the high effect curves, such as:
    - exploration phase: all play sessions contain an exploration phase in which slowly mostly musical release pads are touched and held long after each other (om en om). These last in between 3 to 31 seconds.
    - beginning phase: long hold repetitive taps or (tr and r) combo play, or taps that slowly get faster; long hold (tension) release combo taps; long hold release tone taps; long hold combo + taps.

- At the ending phase there are a variety of play behavior characteristics that come back in the high effect curves, such as:
    - Flat hand movements.
    - In the 2nd lowest effect curve (-7) a final long flat hand rooth tone movement is used at the ending of the play session, in which flowy flat hand movements were used right before this ending movement.
    - In 2 out of 6 high effect curves (-16 and 2nd highest effect curve), flat hands are used in the ending phase of the play sessions (at the very end) to release play tension, either long hold flat hand musical tension release combos, long flat hand pad holds (careful movements), or flat hand claps (bit more expressive).

    - Release tone combo hold, single tone, or light release combo taps.
    - In the highest low effect curve (-9), a very long musical release-release tone combination was held, preceded by slow musical tension release taps.
    - In 4 out of 6 high effect curves (highest effect, 3rd day 7, 3rd day 2, 4th), either long hold musical release tone combos, single long hold release tones, or light release combo taps, or light release tone taps are used in the ending phase of the play sessions.

- Only in 3 out of 6 high effective curves, breaks are used. If there are breaks used, there are a variety of play behavior characteristics that come back in the high effect curves, such as: distracted and paused to do something else, did a sudden stop, or made a flowy hands loose movement.

- Building up play tension
    - in general: “go crazy (flow)”, “I went loose with combos”, “repetitive melodies”, “repetitive tapping”, “intense play”, “body weight”, “up tempo”, “big combos”, “pressing lots of pads together”, “lots of different hand gestures/movements”, “exploring different types of play”, “tense play”, “intense soundscape creation”, “incorporate t-tones”, “switched”, “om en om”, “faster”, “tap tap tap”, “zoned in and out”, “engaged in and out a lot”, “no introduction period”, “immediately expressive play”, “did a lot of things”, “big combos after each other”, “combo of singular (lots of) t-pads”, “expressive middle part”, “play tension tones intensely”, “cross hand combos”, “hard”, “ready for building up play tension”, “flow”, “used light to build up combo play”, “tr-tr-tr-tr repetitions”, “when started to zone in”, “slowly adding t-tones to r-tone combo(s)”, “interchanging rapidly”, “combo-tap patterns: e.g. 3 r’s and 1 or 2 t’s as combo after each other rapidly”, “fast fingertips / flowy finger tips”.

    - towards smaller and bigger peaks there are a variety of changes in play behavior characteristics that come back in the high effect curves, such as: harder play (press with more body weight on the drum pads), speed up taps or combo play. From fingertip to combo play, that happens quite often too when increasing play tension. Or bigger combo presses (more pads in play), combo presses with more finger tension (claws), or faster combo interchange (quicker change in combos played). Or building up the play tension is more

about starting to make melodic musical patterns, and going for repeated faster play (either combo or taps).

    - remarkable:
    - Type of play behavior doesn't change so much, it is especially the speed and hardness of play that increases. Or from finger tip to combo play, that happens quite often too when increasing play tension. Or bigger combo presses, or faster combo interchange. Or building up the play tension is more about starting to make melodic musical patterns, and going for repeated faster play (either combo or taps).
    - Use of speed and body weight.
    - Combo play.
    - More tensed tension-release combo tapping → clawed fingers.
    - Making music; melodic musical repeated taps and play patterns.
    - Intense soundscape creation (it's less about the musical intention).
    - Flow, go loose, start when zoned in play.

- Releasing play tension build off
    - in general: "explorative", "repetitive slower melodies, rhythms, slow tapping", "slow harmonic soundscape", "ending play", "close my eyes", "zoned in", "mindful play", "distraction", "smaller combos after each other", "tension tone combined with r-tone", "listening closely to musical tones and what they made me feel", "played lots of t-tones", "slow, long combos", "not fully released from tension sometimes", "releasing is harder than building up", "slowly tapping r-pads after each other", "long hold tr-combos", "slow after each other play", "combos of only r-tones", "tone by tone to calm down", "gentle touches", "whole hands, flat hands", "flowy / wavy flat hand movements", "flat hands touching multiple pads at same time", "connect-focused / caring touches", "no play, quiet for a while", "cross hand combos", "final ending tone or combo", "used light for flowy play or to slow down", "big pads with finger tips", ""finger tips", stroking pads", "close contact with drum", "t-tones to release last bits of tensions (not really singular t-combos)".

    - after bigger peaks / smaller high peaks there are a variety of changes in play behavior characteristics that come back in the high effect curves, such as: less speed, less hard touches (less bodyweight), from quick taps to combo touches; from quick tension-release combos to slower, longer and/or smaller combos touches / holds; from fast combos to flat hand presses (in 3 out of 6 high effect curves); from singular touches to flat hand release tone holds; from tr taps to r-combo taps; from quick combos to singular touches.

    - towards the end of the play session there are a variety of changes in play behavior characteristics that come back in the high effect curves, such as: changing from tapping to flat hand movements (claps,hold) or from flat hand to light release taps; changing from release touch melodies or release combo taps to a long release combo hold; from light finger tip tension release taps to release combos; incorporating tension tones in r-tone tapping (flat hand / fingers spread).

    - remarkable:
    - Use of less speed, less hard touches (less bodyweight), slower, longer movements.
    - Slow combo play (slower, longer, smaller touches).
    - Role of the flat hand movements (claps, hold).
    - Incorporation of tension tones in r-tone tapping.
    - Use of musical release tones.
    - Closing eyes.
    - Mindful play vs. distraction vs. immersive play.
    - Careful, touching, gentle movements.
    - Release the last bits of tension.
    - Notice the light, usage of light feedback mechanism.

- In general (overall in the play sessions) there are a variety of play behavior characteristics that come back in the high effect curves, such as: symmetry & total asymmetry (left side of drum), repeated patterns / making melodies when tapping & expressive play (without musical intention), flat hand & finger tips & forehand movements, combos & tapping, fast & slow, loose finger tip touches & long holds, tensed fingers (claws) - loose fingers - finger spreads, hard & gentle touches.
    - remarkable:
    - In general I notice, I play very symmetrically (I think this is also prompted by the design of the visual pads). Although, sometimes e.g. in the Wednesday the 17th morning session (highest effect), in the exploration phase I play very much on the left side of the drum (left, if you stand in front of the drum), same for when I played flat hand finger tip combo play in “release play” (same movement happens on Friday the 19th afternoon session). Or e.g. on Friday the 19th (3rd highest effect), I build up tension in play by pressing 2 r-tones repeatedly fast, fully on the left side again. That day I am on the left side really a lot!, however the same happens sometimes (less) with the right side of the drum, that I fully focus on playing e.g. a base tone and one or two tension tones tap tap tap after each other on that side. Same phenomenon happens on Tuesday the 9th afternoon session (3rd highest effect), if I play fully on one side of the drum, it is often the left side! Same happens two times when building up the play tension in the Wednesday the 17th afternoon session (4th highest effect), that I play tension and release tones fully on the left side of the drum.
    - In general I noticed, I often repeated certain play patterns if I liked the soundscape or if they released cognitions, emotions or bodily tensions. Such as repeated flat hand wavy movements or flat hand finger tip touch patterns to create a big and slow musical tension-release soundscape.

State-Trait Anxiety Self-Evaluation data

- Do I fulfill anxiety characteristics?

All starting state anxiety scores are above the clinically relevant point of 40.

In 5 out of 11 sessions, my state anxiety score, before playing the design probe, was considerably high or medium-high, in other words above a score of 55, meaning elevated S-Anxiety.
Moreover, in three sessions out of the 11 my state anxiety score was in between 38 and 40 even after playing the design probe, which is still clinically "high"/"relevant".

I have also measured my trait anxiety on day 1 of the diary study, which was before play 52 and after play 53 (sum score), which is considered as elevated trait anxiety. This makes me a relevant person to do the diary study with.

- Effects on the decrease of state anxiety

In the first 4 days the effects on state anxiety are low or medium (in between 0 and -13, with an outlier of -26 on the second day of the diary study: a session as a "break" on Tuesday 09 March around 15.15 PM). Interesting enough, in that Tuesday afternoon session, my state anxiety score was the highest in the first 4 days with low effects, namely 58, in a row of 46, 47, 48 and 52. And also one of the highest over the entire course of the week, since the only state anxiety scores higher were before the two play sessions on day 6, respectively 63 and 61.

Over the course of the week, the positive effects on my state anxiety scores slowly increase, especially starting from day 5 on, with a streak of very high effects on state anxiety for 5 play sessions in a row in the last 3 days of the diary study, what does this mean?
An interesting note, from day 5 on, when the effects start to increase, my state anxiety before play is for every session higher than 50. Would this have influenced the high effects on state anxiety? Is there a kind of 50's border? from there the state anxiety effects get higher? Is there a correlation between the height of my state anxiety before play and the height of the positive effect on my state anxiety after play?

Remarkable: in the session with the 2nd highest effect of -27, on day 5 out of 7, my state anxiety goes from 53 (medium) to 26 (very low, close to minimum of 20), my lowest state anxiety score after play over the course of the 7-day diary study.

Highest effect sessions on decrease in state anxiety:

- Effect of -33; 12.00 minutes played; D-Major D45; in the morning at 10.39 AM; on day 6 out of 7.
- Effect of -27; 11.00 minutes played; D-Major D45; in the evening at 23.34 PM; on day 5 out of 7.
- Effect of -26; 7.14 minutes played; D-Major D45; in the afternoon at 15.15 PM; on day 2 out of 7.
- Effect of -26; 21.00 minutes played; D-Major D45; in the afternoon at 15.16 PM; on day 7 out of 7.
- Effect of -24; 21.00 minutes played; D-Major D45; in the afternoon at 16.03 PM; on day 6 out of 7.
- Effect of -16; 8.25 minutes played; D-Major D45; in the morning at 9.39 AM; on day 5 out of 7 (start of a streak of five high effective tension-release play sessions).

Lowest effect sessions on decrease in state anxiety:

- Effect of 0; 8.00 minutes played; E-major E34; in the evening at 22.49 PM; on day 1 out of 7.
- Effect of -7; 9.00 minutes played; D-Major D45; in the morning at 10.20 AM; on day 4 out of 7.
- Effect of -9; 11.00 minutes played; G-Major G45; in the afternoon at 15.46 PM; on day 4 out of 7.

Medioker effect sessions on decrease in state anxiety:

- Effect of -13; 4.25 minutes played; D-Major D45; in the morning at 10.09 AM; on day 2 out of 7.
- Effect of -13; 5.41 minutes played; D-Major D45; in the morning at 10.11 AM; on day 3 out of 7.

- Hypothesis for high and low state anxiety decrease effects
    - time played ~11-12 minutes seems most effective; 4-6 minutes seems least effective.
    - play experience (after 4 days of playing the state anxiety effects start to increase tremendously, except for one outlier of -26 on day 2). → introduction period needed? it's a learning process.
    - musical tones chosen, D-Major D45 seems most effective, E-major E34 seems least effective. G-Major G45 seems to work too, but way less effective.
    - moments of play do not seem to play a big role in the effects.
    - the amount of high playful tension peaks after the last "big peak", as part of "release play", before final release play takes place.
    - graduality of build up in intensity before reaching the biggest playful tension peak(s).
    - the amount and height of the peaks in play tension before the end of play.
    - type and amount of breaks in between play.
    - length of exploration phase.

    - highest effect seems to happen when state anxiety before play is high as well, e.g. highest effect of -33 is on the day I had highest state anxiety of 63 before playing the drum. Another example is that on the day with the lowest effects, the -7 effect occurs with a starting s-anxiety of 46, and the better effect of -9 occurs with a higher s-anxiety of 47. Seems a kind of 50's border there, if s-anxiety before play is higher than 50, the effect is higher than -10. Exception is that on day 6, in the second session s-anxiety is 61, but the s-anxiety effect is only -24, lower than on days with a lower s-anxiety before play.
    - lowest effects on state anxiety happened on the same day (day 4), on which I had the lowest state anxiety before playing the design probe.

- Other remarks about state anxiety scores before and after play

On the first day, the first session of the entire diary study, I play in the evening with E-Major E34 tones, for about 8 minutes, which should normally cause a quite high effect looking at the effects over the course of the diary study, however s-anxiety before and after play is exactly the same. Interestingly, my worrying is less (an important part of decreasing state anxiety and relaxation), however I do feel more emotionally touched and confused.

Therefore, the weight attached to the items of state anxiety and relaxation has shifted after play, but does not show as a positive or negative effect on state anxiety.

It is very interesting what happened in this session, since there is literally NO effect on state anxiety, however according to my perceptions before and after, there has been a shift in emotional tension (increased) and cognitive tension (decreased). Could these counter effects have led to this overall effect of 0? Would this all be because of the choice for E-tones?

Perceptions can be way different than the effect scores around decrease of state anxiety.

- Discrepancies in state anxiety items in certain play sessions

Session 1: Worrying is less, but I was more confused → 0 effect (low).

Session 2: Not relaxed, but overall positive effect on state anxiety → -13 effect.

Session 3: Feels relaxed, less worrying but not satisfied. Interesting. Could this be because not all tensions are fully released? Could this lead to inner clashes? → -26 effect (the outlier in the first 4 days).

Session 4: Feels uncomfortable and not entirely calm, but relaxed though, satisfied and content. → -13 effect.

Session 5: Doesn't feel at ease or satisfied, feels upset but relaxed. Interesting. → -7 effect (low).

Session 6: I do feel calm and very relaxed but I am also still worrying. That doesn't happen a lot so far.--> -9 effect (low).

Session 7: Before and after I felt relaxed, that is interesting too. → -16 effect.

Session 8: Very calm, no worrying, but not persé "strongly" relaxed. → -27 effect.

Session 9: Strongly self-confident and this is the first time I see "strongly relaxed". → -33 effect (highest).

Session 10: Interesting, a disagree in self-confident after playing (same as before playing). → -24 effect (outlier in the last 3 days).

Session 11: Strongly secure, confident and at ease! (and relaxed, NO worrying at all). → -26 effect (stable score).

<u>Qualitative data analysis</u>
Remarks out of the qualitative data analysis are summarized.

- Relaxation / calm state clashes sometimes with the amount of release of all of your tension to your anxiety.

Sometimes I felt relaxed afterwards but did not feel like I had released all my cognitive, emotional or bodily tensions as far as I would have liked. This sometimes left me unsatisfied. Furthermore, sometimes I even had more cognitive clashes in my mind because I felt like I was playing for a long time, but had not released all my cognitions yet for example (especially in the 21 minutes play sessions).
Moreover, in some play sessions, thoughts and emotions or bodily tensions came back easily and quite fast during play or after play.

Such as in the very first play session, I played for about 8 minutes straight, but did not fully release from my tensions (Mo 08032021) at 22.49 PM.
Before: Feeling little tense, lots of thinking, bodily tensed but cheerful before.
After: Not fully released from most tensions after, more emotionally aroused, more bodily tense, no cognitions that are disturbing me.
(0 effect).

Or in session 4: Played for 5.41 minutes (Thurs 11032021) at 10.11 AM.
Before: Happy, but worried, tense shoulders, back, jaw, arms and belly before.
After: Still a bit emotionally tensed, in touch with emotions (touched), a little bit sad (maybe came from under the surface), still bodily tensed (more because of chair, play
seated), jaw a bit less tensed, no worrying after all, head fully cleared after.
(-13 effect).

Or in session 10: Played for 21.00 minutes (Wed 17032021). → at 16.03 PM.
Before: Tired and felt done with the day before, bodily tensed, especially jaw, shoulders, belly and frowning face, arms too. Had sad emotions a little bit under the surface, head full of thoughts and felt tired of thinking before play. A bit grumpy too because of thinking about the final master project (worrying). Worried about fmp. Did not really feel satisfied yet with my work and myself that day.
Afterwards, I did feel more relaxed but still a bit frustrated because the prototype didn't function well in the beginning. Got rid of my cognitions in the end, but it was a struggle.
(-24 effect).

- Emotionally touched instead of being emotionally relieved + choice of musical tones

- Release of bodily tensions compared to cognitive and emotional tensions

Bodily release was quite hard to create because the drum doesn't invite that well for big bodily expressiveness.
However, that being zoned in supports you in taking big breaths helps releasing bodily tension.

Furthermore, I noticed when I played the drum more than 3 times a day (play experience), I got into "flow" way easier and also started to move my body along way more, like I was actively playing the piano, I started moving my shoulders and arms flowy along with the expressive flowy movements of my fingertips on the touch pads.

On the other hand, hand tension really releases, and lots of different hand movements are used, also to stretch. And you really notice on the hand tension and movements if people are building up play tension, are in the flow or have released some of their tensions.

Although it was hard to release e.g. shoulder tension or arm tension, what was super relaxed afterwards almost every time I played, was my face. Facial tension releases really well through playing the drum. I also noticed that often before play, I had a very tensed face, I often frowned my forehead ("frons"), and during play, when building up the play tension I even increased the tension in my face to really let go off during the release drum play parts.

Bodily tension only really released in intense expressive play (in the big peaks), when playing up tempo, using a lot of combos and creating bodily flow, moving along with the musical play.

Or in the explorative first phase I already got rid of some bodily tension, but mostly I started to release some bodily tension after some very expressive phases (play tension phases).

Furthermore, when I released some bodily tension, this was the tension that came back the fastest afterwards or during play! It's a really difficult tension to "blow away" with this type of drum play, because actually only body movements really help for it, not the music or light in itself!

Indicators for release of bodily tensions:

- bodily release: "bodily tensed", "shoulder tensed", "facial tension", "facial release", "shoulder release", "jaws", "belly", "not thought about how to use hands or how that changed", "breathing", "stomach tension", "use arms more freely", "bodily relaxed", "heavy breaths", "let go of shoulder and facial tension", "quickly returned", "bodily expressive", "face relaxes", "very relaxed face", "eyes look very satisfied", "tired eyes", "facial tension changed", "loose face", "loose talking", "stroking hand", "stretching hand".

- Light improvements

Light feedback has to change.
Color change is nice, works relaxing, works engaging, and that it shows the direct effect of touch is very satisfying.

But the function of the light in supporting the creation of tension release isn't clear at all. And also sometimes it made me even more confused in play and making play decisions.

I mostly forgot about the light feedback when I was "zoned in" into play. However, I think the color changes helped me zone in as well. It's a bit contradictory.

Light function as it is right now, isn't good for releasing cognitive processes. Often I had to think about trying to use the light for guidance in making play tension-release decisions, and remind myself to try to use the light color change to pick pads for play. But, I got lost in this task when being "zoned in".

However, the final time playing for this diary study, I played for 21 minutes and I had difficulties releasing my last bits of emotional and cognitive tensions, I used the light feedback for a while. “Something new, in the end I played again with some flat hand movements, curly, flowy flat hand movements, and for the first time I really made use of the light, without thinking that I needed to focus on the light! I really liked it to make flowy touch movements between 2 release tones and use the light change to create my flowy movements. To build up the red light on one pad, till it was red, moved to the other, and noticed at the same time the blue color changed on the first pad again, and then interchanged touching these pads. I took this satisfying feeling with me and did the same for some t-tones again, until I came into “flow” again and forgot any form of conscious play again.”

The light feedback kind of works guiding, in a very indirect way, according to a friend of mine after play. *“It helps to see you need to go slower. If you go fast, you don’t see the light, because you are building up, but if you release you see the slow lights and you think about releasing play tension.”*

The role of the illumination lid of the drum is also very important in how much the function of the light for tension release is noticed, it increases its noticability but still the same problems with forgetting about light, clarity of function, and confusion creation stays.

- Engagement, flow, zoned in that’s what you want to achieve relaxation

Not sure if being “zoned in” really helps in optimally creating tension-release, but it really helps creating calmth, and releasing cognitions and emotions.

Being zoned in is the greatest feeling! Does not always succeed, very context and state dependent. Mostly happens because of the audio soundscape, noise canceling headphones, and the lights that shine directly in my eyes, are quite bright and change color slowly. Three times I was so zoned into play (I normally started to stare at the drum when I was zoned in, started to see more blurry) that my eyes closed and I almost fell asleep!
However, sometimes during play I got zoned in a lot of times and for quite a long time, but other times I had the greatest difficulty to keep engaged into play. Either because I was thinking too much about how I played the drum, which tones and pads to use, and why I made certain decisions and movements. Or because there was somebody else in the room close to me. Or if I had the feeling others could see me, or somebody was going to get home soon who could interrupt me in play. Or if I was just too frustrated when starting to play.

I zoned in either in slow play (begin) or fully in fast play (building up the tension).

Switching from release to tension in play goes quite “mindful”, that is always a moment you go a little zoned out. It happens kind of with the mind, I know what I am doing.

When I played slower, releasing play tension, I noticed that I knew more what I was doing to calm down. However, after a while I zoned in again.

Role of multi-sensory feedback in this:
Light color changes do keep your attention at playing the drum, but it’s mostly the musical soundscape that creates total absorption.

When being zoned in, the light feedback mechanism is forgotten about basically, so does not really contribute actively to engagement anymore. I mostly forgot about the light feedback when I was “zoned in” into play. It’s a bit contradictory.

This musical tension release principle really helped me to zone into play, or to help me in the beginning of play to get into it. I noticed I often started with slow play in the beginning, really exploring which pads to touch to calm me down or to already release from some cognitions or emotions. This exploration phase sometimes was really needed to calm me down,or relax me already a little bit before I could build up the play tension. Sometimes I was just too frustrated, or emotionally aroused, or full of thinking, before I could really build up the play tension. I guess I needed to “zone in” first. Except for one time, where I was so frustrated by the big musical delay in the first moments of play with the prototype, that I immediately went for it and played very very intense from the beginning on, and only started to calm down during release play after this intense drumming. In this intense drumming I really tapped very hard (lots of force) on the drum, tapped om-en-om quite fast, and did not use lots of combo play I remember.

A funny notice was that I could find the musical touch pads without even looking at the top of the drum, when my eyes were closed and I really wanted to deeply feel the effect of the musical tones. → so what’s the light’s use in engagement then? ;)

Indicators for engagement in play:

- engagement: “zoned in”, “staring”, “flow”, “immersed”, “soundscape”, “conscious/intentional play”, “(no) eye for environment”, “related / connected to drum”, “loved/caring for drum”, “lost in play”, “forgot”, “musical heart was triggered”, “started to see blurry”, “only felt music”, “closed my eyes”, “grabbed my attention (light)”, “forgot about rest of environment”, “zoned in and out”, “distracted”, “no clear idea of what I am playing”, “light to stay zoned in”, “soundscape in headphones”, “indirect or direct light”, “noticed”, “light areas”, “indecisive (because of light areas)”, “confused (because of light color change)”, “attention to pair of lights”, “focus”, “payed attention on environment”, “feeling watched/window shopping effect”, “anonymity”, “like I was playing a product instead of doing research”, “being into play”, “hard to reflect on play (non-mindful play)”, “went for it!”, “in and out of engagement in play”, “other activity done during play (e.g. touch computer mouse to prevent standby mode)”.

- Exploration phase (need to calm down first)

I noticed I often started with slow play in the beginning, really exploring which pads to touch to calm me down or to already release from some cognitions or emotions. This exploration phase sometimes was really needed to calm me down,or relax me already a little bit before I could build up the play tension. Sometimes I was just too frustrated, or emotionally aroused, or full of thinking, before I could really build up the play tension. I guess I needed to “zone in” first. Except for one time, where I was so frustrated by the big musical delay in the first moments of play with the prototype, that I immediately went for it and played very very intense from the beginning on, and only started to calm down during release play after this intense drumming. In this intense drumming I really tapped very hard (lots of force) on the drum, tapped om-en-om quite fast, and did not use lots of combo play I remember.

This phase is really needed to get engaged in play, and kind of start up the “relaxation process.”, and make yourself ready to build up to playful tension.

- Emotional release, expression, in-touch (awareness), blocking, inducement?

All of these aspects of affective manipulation can be done with the drum. Where do we need emphasis for relaxation effects? or don’t we need such emphasis, can it co-exist? I think there is a real beauty in that, especially for future applications of the drum.

This also helps to discover your anxiety and certain aspects and related tensions to it! The fact all these emotional aspects can be explored, really affected my ability to reflect on my own anxiety in certain contexts and situations.

Playing the drum was a combination of expressing my own emotions in intensity of play, hand/body movements during play, and musical tones used (more musical tension, big loud combos, or release touches); inducement of happy emotions, especially through making melodies and repeated patterns with r-tones, and choosing the “happy-relax” D-Major D45 tones or G-Major G45 tones; and releasing emotional tensions, kind of blow them away with the tension tones and specific small t-r combos, in slow-long play, or or big loud t-r combos in very hard expressive play.

Sometimes after play it really felt like I had done a kind of emotional workout, like I had cried a lot or had yelled for a long time at somebody, which was very satisfying. “It felt like I’ve cried for 30 minutes or so. All is out, so no worrying.”

Playing the drum also helped me to discover my own emotions, that were maybe a little bit under the surface or actually very much at the surface (especially through reflecting upon them before and after play, and if there suddenly is lots of calmth or some emotion very much present instead e.g. sadness), how you like to deal with these emotions (blow away, induce, or temporarily increase with e.g. sad tones), how you experience relaxation effects (also how it differs in different situations), and what helps you to relax (what kind of play and what musical tones) in a very exploratory way. Helps you discover yourself and your anxiety.

I actually never used the multi-sensory feedback to block cognitions or emotions, but more for relieving emotional tension and my worrying, blowing it away!

A combination of expressing emotions, discovering emotions, releasing emotions, and inducing happy emotions is key to create relaxation, and all aspects go hand in hand and alternate during play. It’s all about their interplay and the needs of someone with situational anxiety.

- Care for yourself, taking a moment for yourself feels good

Playing the drum as a break in between university work, only has advantages to me, either if it’s around 2 PM or 4 PM, that doesn’t matter. It feels really good to play this drum as a break. I feel so satisfied with myself afterwards, because I have been so active, it really feels like **I have taken the time to work on myself** and not only distracted myself but also really “helped” myself and released several tensions. Feels good to **care for yourself** in that way!

Playing the drum in the evening, before going to bed has its ups and downs as well. On the one hand it is a very satisfying feeling to literally emotionally, cognitively and bodily prepare yourself to go to bed. And it also really helped to get me in a more calm, and relaxed state before going to bed. On the other hand, it got me hyped up and "happy" as well before going to bed, which was a bit less relaxing. And also because I am the researcher, it got me in "reflecting mode" before going to bed, which is not that convenient for your sleep. However, I felt really satisfied with myself, by having taken care of myself and my anxiety before sleeping.

- Tiredness

It even helped me and a friend of mine to let go of tired feelings, she was really surprised by that, had not expected any of that! It had helped her out of her afternoon "dip". Especially nice during lunch breaks or in the morning to clear your mind! Sometimes after play I felt a little bit more tired, but more cognitive/emotionally tired, but this feeling was gone very fast afterwards, and I often felt way more clear after working again for a while afterwards. An example, is the last time I played for this diary study:
"I felt a bit tired afterwards, like I had done some huge emotional heavy workout, but this is already disappearing. Felt very satisfied, comfortable and secure afterwards."

Playing the drum in the morning, before starting to work for university, feels a bit contradictory. On the one hand, I like it a lot because it really "clears my mind" before starting to work, and sometimes removes some tired feelings I still have after waking up. On the other hand, it is hard to motivate yourself at this moment of time to play the drum since you actually want to start working!

- Releasing play tension is hard but needed to releasing own final tensions + ending phase hard to determine

Building up the play tension is fairly easy, it basically comes down to speeding up the play and use more force in play (more body weight).
However, releasing play tension is sometimes harder, a bit more complex "process".

Then sometimes I started to think again (cognitive processes) about what I was playing (switched to mindful play, coming out of engagement/zoned in), because I played slower and therefore had more time to notice the light which confused me sometimes in what I wanted to play, or I started to overthink which tones I wanted to play. However, this disappeared as soon as I was zoned in in play again.

To release play tension, I especially liked to play repeating melodies, interchange r-tones slowly, or play r-tone combos slow and long.

Sometimes I touched a singular t-tone in between to release some last cognitions or emotions.

Funny enough, when I wasn't zoned in anymore at that time I sometimes closed my eyes to really feel the musical tones blow away my last bits of worrying or emotional tensions, during "release play".

Also to determine when you are really done playing, when you feel done playing, there is no real way to “stop” playing. Also because sometimes there were tensions left and I couldn’t really release from all of them it was hard to determine it was time to stop.

But also because the musical tones kept on inviting me to explore other musical combos and got other emotions triggered, I could keep on playing.

Furthermore, sometimes I felt in myself I had played for a long enough time, started to feel a bit restless, felt like I needed to move on with my work (when I played as a “break”), but I had not released all my emotions or cognitions yet, which created some extra cognitive tension in my head and some confusion, like “do I need to stop now? or move on to release some more?” (cognitive clashes).

Over time I have used lots of different play patterns, and what was more surprising is that I also used lots of different types of hand movements.
I noticed I used my flat hand in the end of my play sessions quite some times, to get more close contact to the drum, kind of connect more with it, feel it more, kind of care for it more gently to release some play tension and last bits of bodily tension, cognitions and emotions.

When I used flat hands I kind of rolled them over the bigger r-pads, to release some hand tension as well and really get in contact with my feels.
One time I also used the back of my hands to stroke the r-pads, which was nice, it felt like I was really more in contact and in play.

When I was in the flow, I touched the pads quickly, loosely, with fingertips and made more flowy movements. This also invited me to be more “bodily active” in play.

When I wanted to build up play tension,or when I was emotionally aroused and wanted to get rid of it in intense play I noticed more tension in my hands, kind of tensed my fingers together or clawed my hands to be able to harder touch the musical pads → released in “release play” maybe also through the flat hand movements that come back in many play sessions.

- Play is a learning process, need to familiarize (can we provide steps? pads to add over time?)

Interesting evidence for this assumption could be the increase in positive effect on state anxiety over the course of the week of the diary study, looking at the State-Trait Anxiety self-evaluation results.

Furthermore, although the drum is quite intuitive to play and very open for everyone to play, and allows for failing, still playing the drum needs some understanding of its underlying principle (playful tension release instead of a real instrument) and maybe musical pads too. What to do with that? (is subtle guidance needed?)

I feel like playing this drum is really a learning process over time, however off course it does give immediate results after one time play already. However, it is good to note that these can be counter-relaxing immediate results too and cause more emotional arousement,

dependent on if the tones are chosen well for the person's goals and emotional, cognitive and bodily state, which could prevent further play…

The more I played, the less I thought about "what to do", and it was also easier for me to decide to get the drum for relaxation and play it for a while.

I noticed when I stopped doing the diary study I kind of craved playing it again, and found it a waste to have stopped playing from then on.

I noticed over time I really tended more to the happier-relax tones than the melancholic relax tones. Because all tones from the major and minor scales I have chosen are quite relaxing, but it's important for me that I don't feel emotionally shitty and worse afterwards.

Over time I get more familiar with the drum play, and skilled in how I can create play tension for myself, both musically and expressively, and what I like regards both.

I noticed I get more flowy, and make more flowy movements if I play a lot on one day. I used more complex hand movements, more fingers at the same time, faster after each other. I am going to move along bodily-wise with my hand movements and with the musical flow I created. I get more bodily expressive and faster. Faster taps, harder taps, combination taps.

The more I have played it on the day, the more relaxed I get and the more open I am for the play experience. I don't really have the feeling anymore that I really have to do it right or perfect. I am more open for what happens on the "multisensory playground". I combined the music and light more, and noticed I was more open for the light function. I get more into experimental mode rather than I have to do it right - mode.

- Anonymity and play in a safe space (open up vs. keep experience to yourself)

I noticed I really don't like playing this drum when there is anybody around, or if I have the feeling somebody could discover me playing the drum soon (could come home from grocery shopping for example). When somebody is around, or could be around soon, it feels like somebody is interrupting a very personal process and comes into a very personal space! This made me sometimes frustrated during play.

For me it has been a very private experience to practically open myself up during drum play (quite contradictory).

- Drum sounds?

Drum tones were quite soft, delay noticed quite well. Drum tones need to be more reactive, than the harmonic tones.

Could not really create a direct rythm with it, or a "flowy" soundscape to release some cognitive, emotional or bodily tensions. That was a bit annoying.

After playing for a while I started to like playing around with the drum tones. I noticed I started playing pads combined at the same time, the 4 r-tones, alternated with a high hat sound or a clap (t-tones).

I played the drum way more tappy and direct than with the harmonic scales.

Playing it was especially funny because of the weird tones, like a hand clap or shaker. It made me feel happy because of the fun sounds.

The long high hat and hand claps worked really well to release my inner tension!

I think this requires some more practice, playing with the drum tones, but I think it could be a fun way to explore the tension-release principle with these drum tones. Or maybe alternated with harmonic tones?

A thought while exploring the “drum/rhythmic sounds” was that the tension and release tones should visually maybe be the other way around, cause I used the drum tones (r-tones) to build up the play tension fast, and the accents (high hats etc.) to release play tension funny enough. It would be quite nice when the current tension tones (accents) are so accessible, if placed on the bigger tones instead.

I did not feel emotionally aroused after, playing did not really have a very high emotional impact.

I had less bodily tension.

And less worrying.

I was quite zoned in, but it was a more mindful session to be honest, very much explorative, reflective.

- Biased contextual usage

The context of use in the diary study is off course biased because of the current studying in covid-19 situation. Being at home a lot, and working in the living room.

Context: “alone”, “home”, “living room”, “bed room” (at student room @Friend), “expecting someone to come home”, “morning”, “evening”, “before bed”, “coffee”, “as a break”, “too late in bed”, “standing play”, “sitting play”, “have been behind laptop for a while”, “TV room”, “mom in living room”, “don’t want to bother mom closeby”, “seated on couch”, “drum on lower table”, “drum on high table”, “mom calling”, “light cover on”, “dark outside”, “didn’t feel like doing homework”, “tired”, “feel done for today”, “sister making tea in kitchen closeby”.

APPENDIX H: DATA ANALYSIS RESULTS ITERATION 2

Quantitative Analysis

State Anxiety Effects (Scores & Calculations)

P0

	S- Anxiety Score (sum)	High (H): >=60 / Medium (M): >=40, <60 / Low (L) indicator: >=20, <40	Effect on state anxiety	Comments / Insights
Day 1				
1. P0-before	48	M		All starting scores are above the clinically relevant point of 40, and 5 out of 11 sessions in which S-Anxiety was considerable high or medium-high (in other words elevated S-Anxiety). And in three sessions out of the 11 the state anxiety was 40 or 39 after play, which is still clinically "high"/"relevant".In the first couple of days the effects on state anxiety are rather low, except for one session as a "break" on Tuesday 09 March around 15.15 PM. Interesting enough, in that Tuesday afternoon session, my anxiety was the highest in the first 4 days with low effects. And also one of the highest over the entire course of the week.
1. P0-after	48	M		
			0	It is very interesting what happened in this session, since there is literally NO effect on state anxiety, however according to my perceptions before and after, there has been a shift in emotional tension (increased) and cognitive tension (decreased). Could these counter effects have led to this overall effect of 0? Would this all because of the choice for E-tones?
Day 2				
2. P0-before	52	M		
2. P0-after	39	L-M		After play anxiety is still clinically "high" or "relevant", even though the effect is quite positive!
			-13	Medioker effect on state anxiety
3. P0-before	58	M-H		
3. P0-after	32	L		
			-26	Third highest effect on state anxiety
Day 3				
4. P0-before	47	M		
4. P0-after	34	L		
			-13	Medioker effect on state anxiety
Day 4				
5. P0-before	46	M		
5. P0-after	39	L-M		After play anxiety is still clinically "high" or "relevant", even though the effect is quite positive!
			-7	Second lowest effect on state anxiety
6. P0-before	47	M		
6. P0-after	38	L-M		
			-9	Third lowest effect on state anxiety
Day 5				
7. P0-before	56	M-H		
7. P0-after	40	M		After play anxiety is still clinically "high" or "relevant", even though the effect is quite positive!
			-16	Over the course of the week, the effects slowly increase --> what does this mean? An interesting note, from day 5 on, when the effects start to increase, the state anxiety before play is for every session higher than 50. Would this have influenced the high effects on state anxiety? Is there a kind of 50's border? from there the state anxiety effects get higher?
8. P0-before	53	M		
8. P0-after	26	L (very low --> close to the minimum of 20)		The final state anxiety is very low after this session compared to the "after play" state anxiety in the other sessions
			-27	Second highest effect on state anxiety
Day 6				
9. P0-before	63	H		Highest before play state anxiety
9. P0-after	30	L		
			-33	Highest effect on state anxiety; is also the session which started with the highest state anxiety.
10. P0-before	61	H		Second highest before play state anxiety
10. P0-after	37	L		
			-24	Fourth highest effect on state anxiety; and starts with the second highest state anxiety score before play
Day 7				
11. P0-before	57	M-H		
11. P0-after	31	L		
			-26	Third highest effect on state anxiety

P1

Number of play session	Participant	Date and Time	Before / After play	S-Anxiety Score	Effect (decrease / increase in S-anxiety)	Remarks	Comments / Insights
1	P1	11-5-2021 20.25 PM	Before	48		M	
	P1	11-5-2021 20.58 PM	After	51		M	
					3	(+) increase in S-anxiety	The first session was the longest (about 15 minutes) in which she also explained that this was really a "trial" session in which she tried to understand the musical tones and drum play. This might be a cause for the increase in anxiety (also because she is prone to a feeling of not wanting to fail in musical play).
2	P1	13-5-2021 20.53 PM	Before	57		higher anxiety before play than first time (M to H)	
	P1	13-5-2021 21.00 PM	After	57		M to H	
					0	no effect	She felt less indecisive, but also less self-confident according to the S-anxiety items which caused an evened out effect.
3	P1	14-5-2021 20.47 PM	Before	45		lowest anxiety before play so far (M to L)	
	P1	14-5-2021 20.58 PM	After	46		M to L	
					1	(+) increase in S-anxiety	She felt more tense, not satisfied anymore, not content anymore; but does feel less strained and steady instead. Therefore, the scoring is in favor of the slightest increase of S-anxiety.
4	P1	15-5-2021 18.30 PM	Before	53		again, a higher anxiety before play than the day before (M)	
	P1	15-5-2021 18.39 PM	After	49		M	
					-4	(-) first decrease in S-anxiety	
							All starting scores are above the clinically relevant point of 40, and all sessions contain S-Anxiety scores that are considerable medium or medium-high, with only 2 outliers showing medium scores that are a bit on the "lower side". In all sessions the state anxiety was higher than 40 even after play, which is still clinically "high"/"relevant".In the end of the diary study a first decrease in S-anxiety takes place that is minimal (4) which could point towards a possible "learning curve".
							The second and 4th play session have the highest anxiety before play and also accordingly show the "best results", at least the results from these sessions don't show an increase in S-anxiety after play, but rather a 0-effect or a little decrease. This could confirm the possible relationship between the height of anxiety before play, and the effects of expressive drum play for relaxation.

P2

Number of play session	Participant	Date and Time	Before / After play	S-Anxiety Score	Effect (decrease / increase in S-anxiety)	Remarks	Comments / Insights
1	P2	18-5-2021 08.09 AM	Before	53		M	Lowest anxiety score before play, may explain lowest effect on state anxiety.
	P2	18-5-2021 08.23 AM	After	46		M	
					-7		After play P2 felt less content and less secure than before drum play.
2	P2	19-5-2021 23.26 PM	Before	56		M-H	Higher anxiety before play than in session 1. And we also see an improved effect of drum play!
	P2	19-5-2021 23.34 PM	After	40		M-L	One of the lowest anxiety scores after play
					-16		
3	P2	20-5-2021 22.32 PM	Before	68		H (very high!)	Again a higher anxiety before play than in session 1 and 2. And we also see an improved effect of drum play!
	P2	20-5-2021 22.45 PM	After	46		M	

4	P2	24-5-2021 13.01 PM	Before	57		M-H	Anxiety score before play is lower than in session 3 and slightly higher than in session 2, and the effect is exactly in between the effects of session 2 and 3, in line with the relationship assumption.
	P2	24-5-2021 13.10 PM	After	38		L	Lowest S-anxiety after play of all sessions
					-19		As compared to the other play sessions, after play P2 was still worrying about possible misfortunes. Which wasn't the case in the other 3 sessions. Might have caused a "lower effect score".
							All starting scores are above the clinically relevant point of 40, and all sessions contain S-Anxiety scores that are considerable medium or medium-high before play. In almost all sessions the state anxiety was higher than 40 even after play, which is still clinically "high"/"relevant", with an exception of the S-anxiety score of '38' after playing the drum in session 4. We could point towards a possible "learning curve", since the s-anxiety decrease effects increase over the course of the diary study. And keep quite steady in the last 3 sessions (between -16 and -22).
							Looking at the anxiety scores before play and the course of the effects over the number of play sessions, the higher the S-anxiety before, the higher the effects. This could confirm the possible relationship between the height of anxiety before play, and the effects of expressive drum play for relaxation. You can see this best, when looking at the 4th play session. Here, the S-anxiety before play is 57, 1 higher than in session 2 and lower than in session 3. The effect of that 4th play session (-19) is also exactly in between the effects of session 2 (-16) and session 3 (-22). In line with the possible relationship.

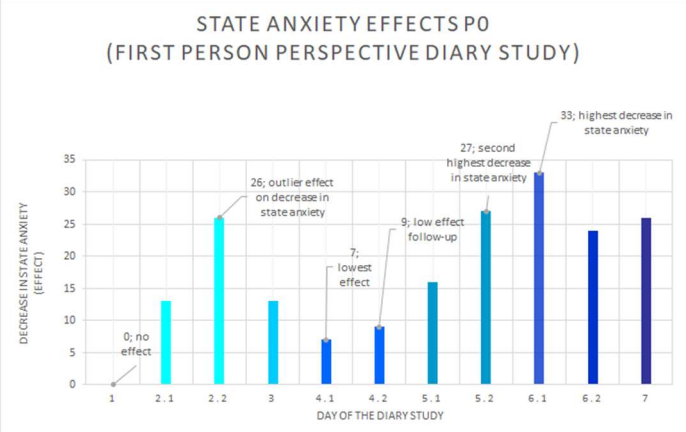
More information, such as the tables used to create the state anxiety effect graphs and the scatter plots, and the actual Excel files (instead of snapshots) of the scoring and calculations can be obtained on request. All the data for these graphs comes from the state anxiety effects calculations, contextual answers from the diary booklets (see section below) and UX quotes from the introductional and follow-up interviews. Besides the interview transcripts all these data are provided in these Appendices.

State Anxiety Effect Analysis Per Participant

Participant 0 (P0, design researcher)

P0 played the drum 11 times in 7 days, in which state anxiety levels before drum play ranged from 46 to 63, being 53.5 on average. All P0's starting state anxiety scores were above the clinically relevant level of 40. Next to that, in 7 sessions the state anxiety level before play was considerably high or medium-high, scoring above 50 (in other words elevated).

P0's state anxiety levels after drum play ranged from 26 to 48, being 35.8 on average. This average after play can be considered as a non-clinically relevant level and rather low compared to the average state anxiety level before play. P0 was affected by the drum play in the following way over the course of the 11 drum play sessions:

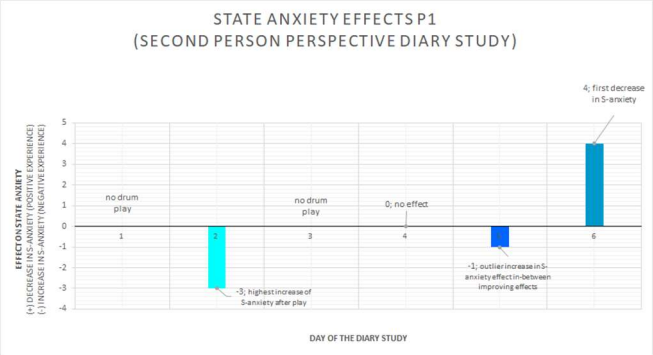


All drum sessions led to **decreasing** state anxiety levels ("positive" effects), ranging from 7 to 33, except for the first play session (no effect), with 17.6 on average. This is the best average decrease in the level s-anxiety amongst all participants. "Top effects" were created

in the 8th (27) and 9th play session (33) towards the end of the diary study. “Flop effects”, were created in the 5th (7) and 6th session (9) on the same day (day 4). This could suggest a “bad” day in drum play or low starting state anxiety levels before play compared to the other drum sessions. P0’s state anxiety levels before drum play in sessions 5 and 6, were the lowest compared to all drum play sessions, relatively 46 and 47. The effect in the 10th play session (24) is rather remarkable as well being lower especially after a play session with the highest effect, and compared increasingly effective play sessions, from the 7th on. Furthermore, the decrease of 26 in the 3rd session is rather remarkable compared to surrounding medium effects (about 13). At the end of the diary study period, after 11 drum play sessions, P0’s state anxiety effects seemed to stabilize around a decrease of 26.

Participant 1

P1 played the drum 4 times in 6 days, with state anxiety levels before drum play ranging from 45 to 57, being 50.8 on average. All P1’s starting state anxiety scores were also above clinically relevant level 40. Next to that, in 2 out of 4 sessions the state anxiety level before play was considerably high or medium-high. P1’s state anxiety levels after drum play ranged from 46 to 57, exactly 50.8 on average as well, still clinically relevant and the highest of all three participants. Playing the drum affected P1, in the following way over the course of the drum play sessions:

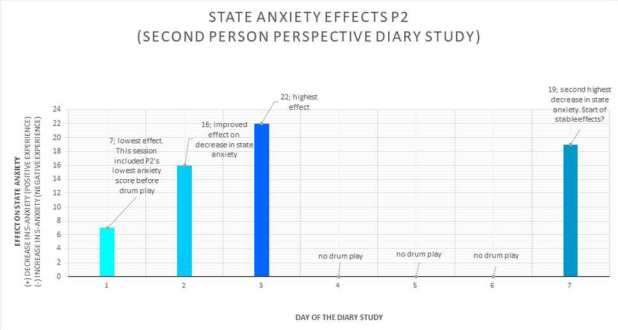


Playing the drum led to minor state anxiety **increases** and **decreases**, except for the second play session in which no effect was found. P1’s effects ranged from an increased state anxiety level of 3 to a decreased state anxiety level of 4, 0.0 on average. Both the negative and positive effects were minor compared to P0’s and P2’s results. Therefore, P1’s effects could point to being outliers in the overall results. The “top” effect was created at the end in the fourth session (decrease of 4), remarkable after previous ineffective drum play sessions. However, that P1 scored a 7 points higher state anxiety level before drum play in session 4 compared to play session 3, could explain this sudden positive state anxiety effect.“Flop” effects were created in the first and third play session with the increase of 1 (third play session) as a remarkable result in the middle of two promising sessions. Next to that, the second play session was very remarkable since P1’s state anxiety before play was highest in this session. For P0 and P2, a higher state anxiety level before play often resulted in improved state anxiety effects but not for P1. At the end, after 4 times playing the drum, P1’s state anxiety effects seemed to reach a transition towards positive effects.

Participant 2

P2, similarly to P1, played the drum 4 times in 7 days, with state anxiety levels before drum play ranging from 53 to 68, being 58.5 on average, the highest of all three participants.

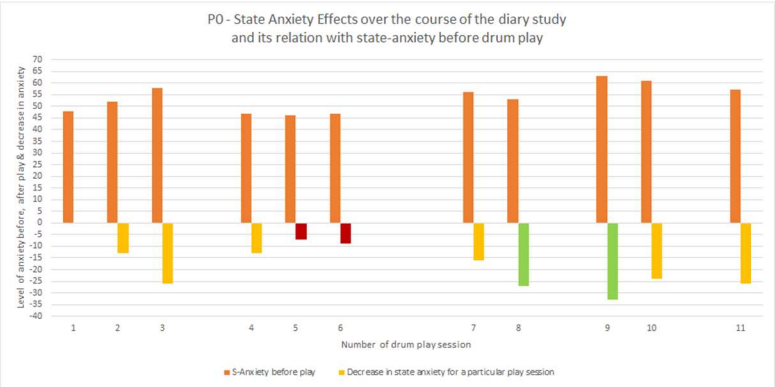
All P2's state anxiety levels before play were also above the clinically relevant level 40 and considerably high or medium-high. State anxiety levels after drum play ranged from 38 to 46, being 42.5 on average. This average after play can be considered still as clinically relevant however considerably lower compared to the average state anxiety level before play. Playing the drum affected P2, in the following way over the course of the 4 drum play sessions:

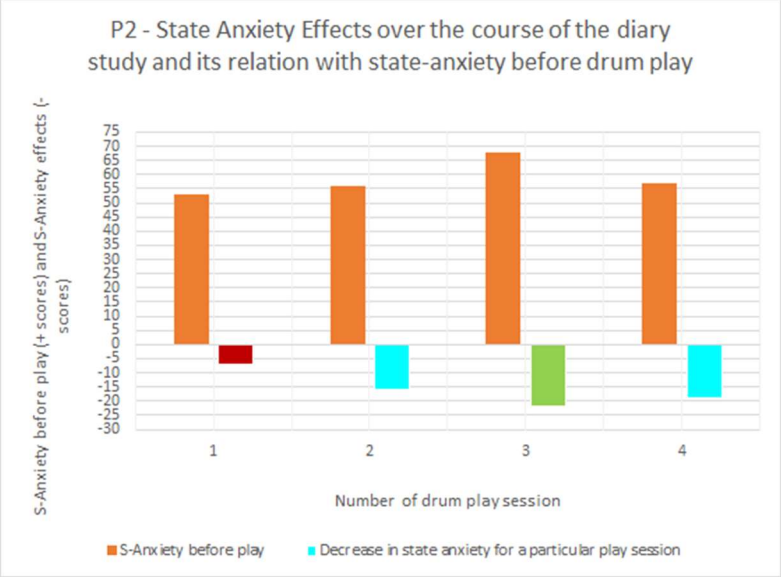


All sessions led to a **decreasing** state anxiety level ("positive" effects), without drum play sessions having a 0-effect and positive effects ranged from 7 to 22, with 16 on average. Close to P0's average decrease of 17.6. "Top effects" were created in the 3rd (22) and 4th session (19), towards the end of the diary study. "Flop effects" were created in the first two play sessions (decreases of 7 and 16), however still rather high compared to P0 and P1. P2's state anxiety effects show an almost perfect curve of improving effects over time, except for the final result (19), being slightly lower. However, this final play session took place after three days of no drum play, which could suggest a lower result. Furthermore, the state anxiety before play in session 3 was incredibly high (68) as compared to session 4 (57) a difference of 11. This could suggest a lower effect in session 4. At the end, after 4 times playing the drum, P2's state anxiety effects seemed to stabilize to a decrease of around 19.

The role of state anxiety levels before drum play on the effects

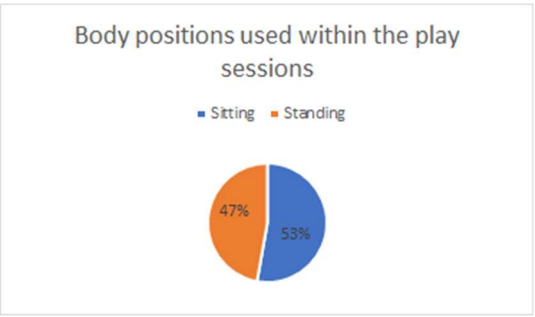
Graphs of the individual drum play sessions of P0 and P2, show the positive relationship between the height of state anxiety effects and state anxiety levels before drum play even more clearly. These graphs include P0 and P2's s-anxiety effects (now plotted downwards, since these mainly include decreases of s-anxiety levels) and s-anxiety scores before play (plotted upwards, since these range from 20-80).

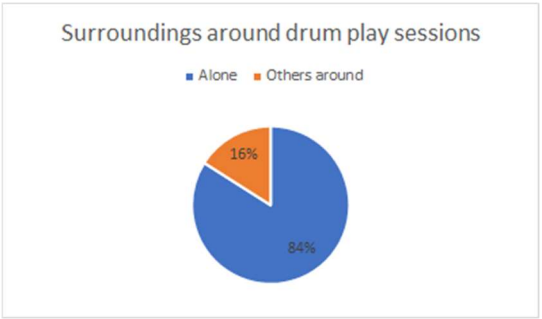


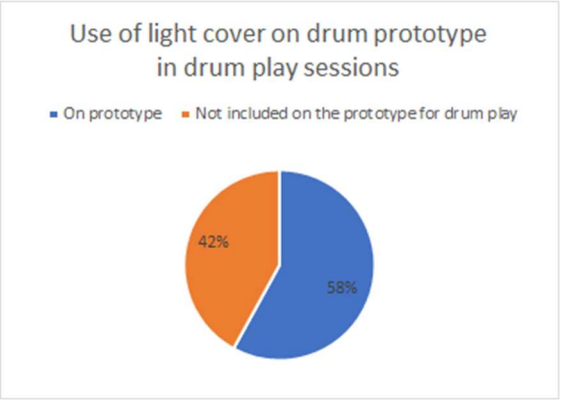


With only two outliers for P0 in session 7 and 11 and no outlier in the graph of P2.

General contextual drum play characteristics of the participants
Next to the role of the specific contextual factors such as “phase of the day”, “duration of drum play”, “level of state anxiety before drum play”, and “musical tone settings of the drum” in the participants’ s-anxiety and relaxation effects, some general contextual drum play characteristics have been visually mapped. From these pie charts it can be concluded that the majority of the drum play sessions have been played with the light cover on top of the drum prototype (plastic sheet that illuminates the drum’s lights); were done while being seated and have been played while being alone.





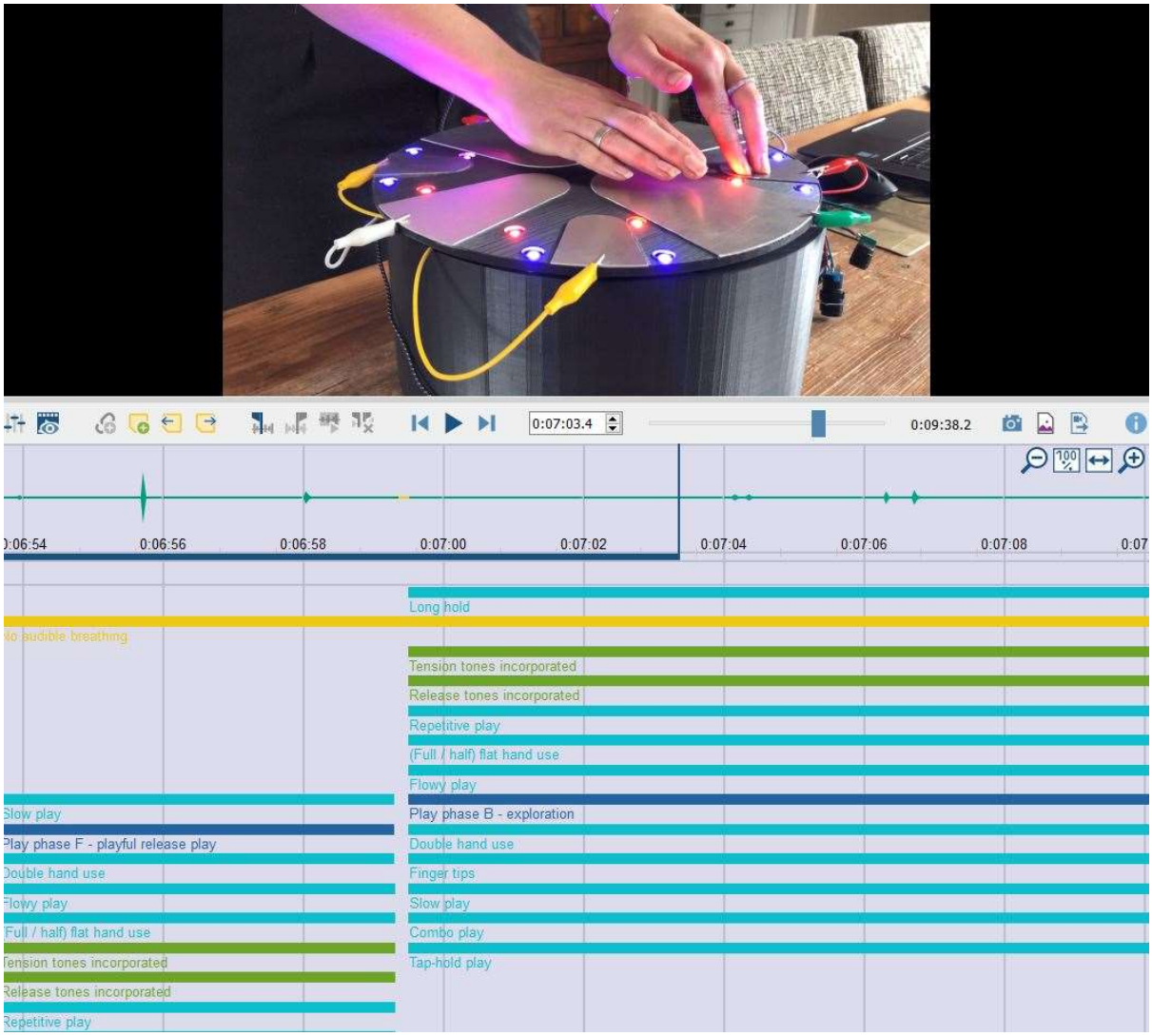


The role of musical tone settings of the drum

Outliers in musical tone choice were E-Major Guitar tones and G-Major Guitar tones by P0. Furthermore, P1 had a preference for A-Major Piano tones; and P2 used the drum tones two times and the A-Major Piano tones two times, however in the third play session she switched to drum tones, which could suggest a preference for drum tones.
Other favorites written down by P1, but not used by her in the reported drum play sessions, included: drum tones, G-Major Piano tones, D-Major Guitar tones (especially D4-D5 tones). These correspond with the tones used by P0 (especially G-Major tones and D-Major Guitar D4-D5) and P2 (Drum tones).

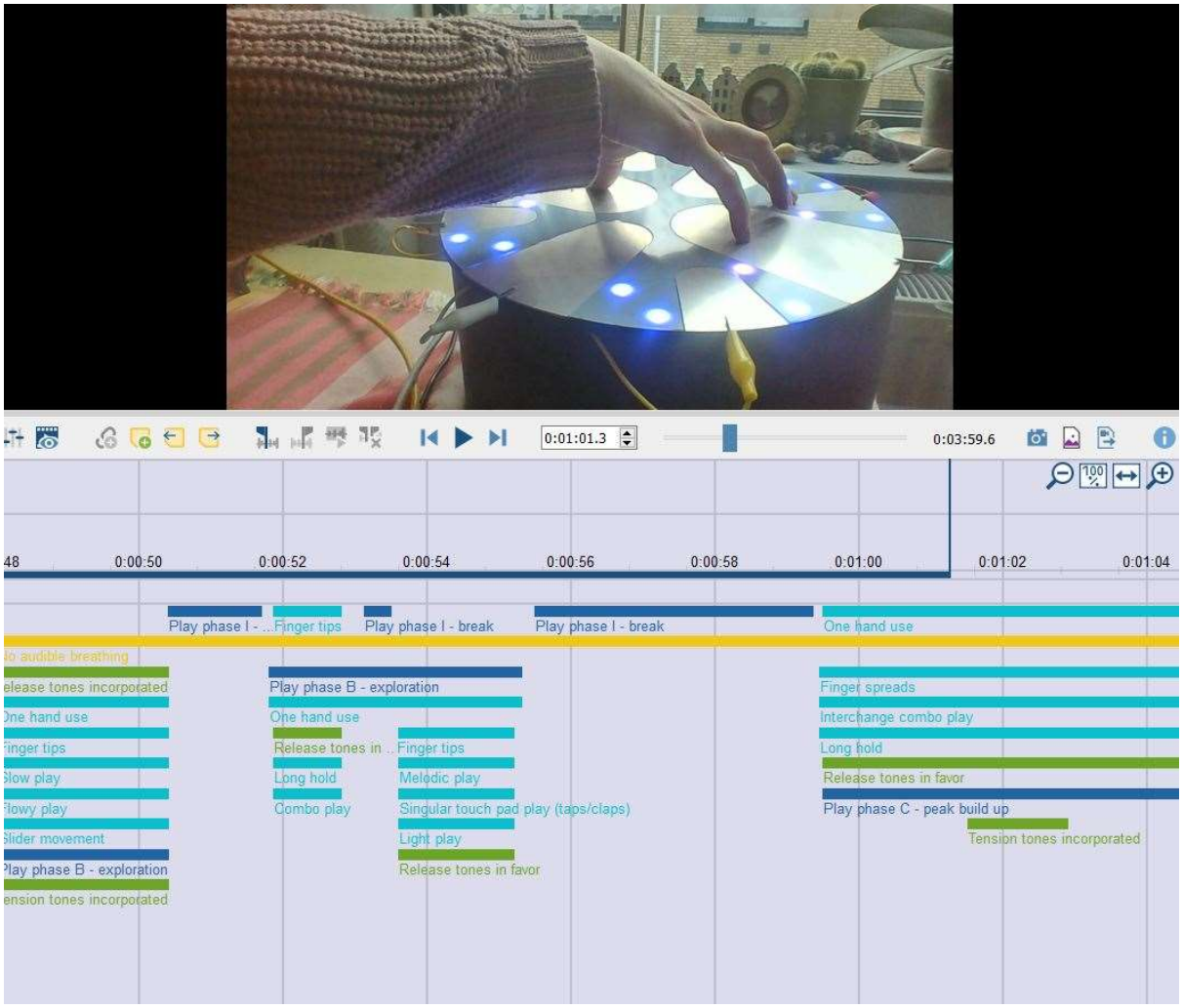
Drum Play Behavior Characteristics
The “top” effect and “flop” effect drum play videos can be obtained via the following shared link: https://tuenl-my.sharepoint.com/:f:/g/personal/v_s_v_wijlen_student_tue_nl/EoqqqS77jEBMkbh4zVzpTZEBkc5vqDmWcoBDAJl-LPkq8Q?e=PBOaCu (only the assessors and the design researcher can access this link). Furthermore, only the videos by P0 and P2 are accessible in this folder, since only those agreed to publication of the videos.
The annotated videos in the MAXQDA software can be obtained on request as MAXQDA files. Some examples of how the videos were annotated in the software:

P0
Example of the flop effect drum play session by P0.



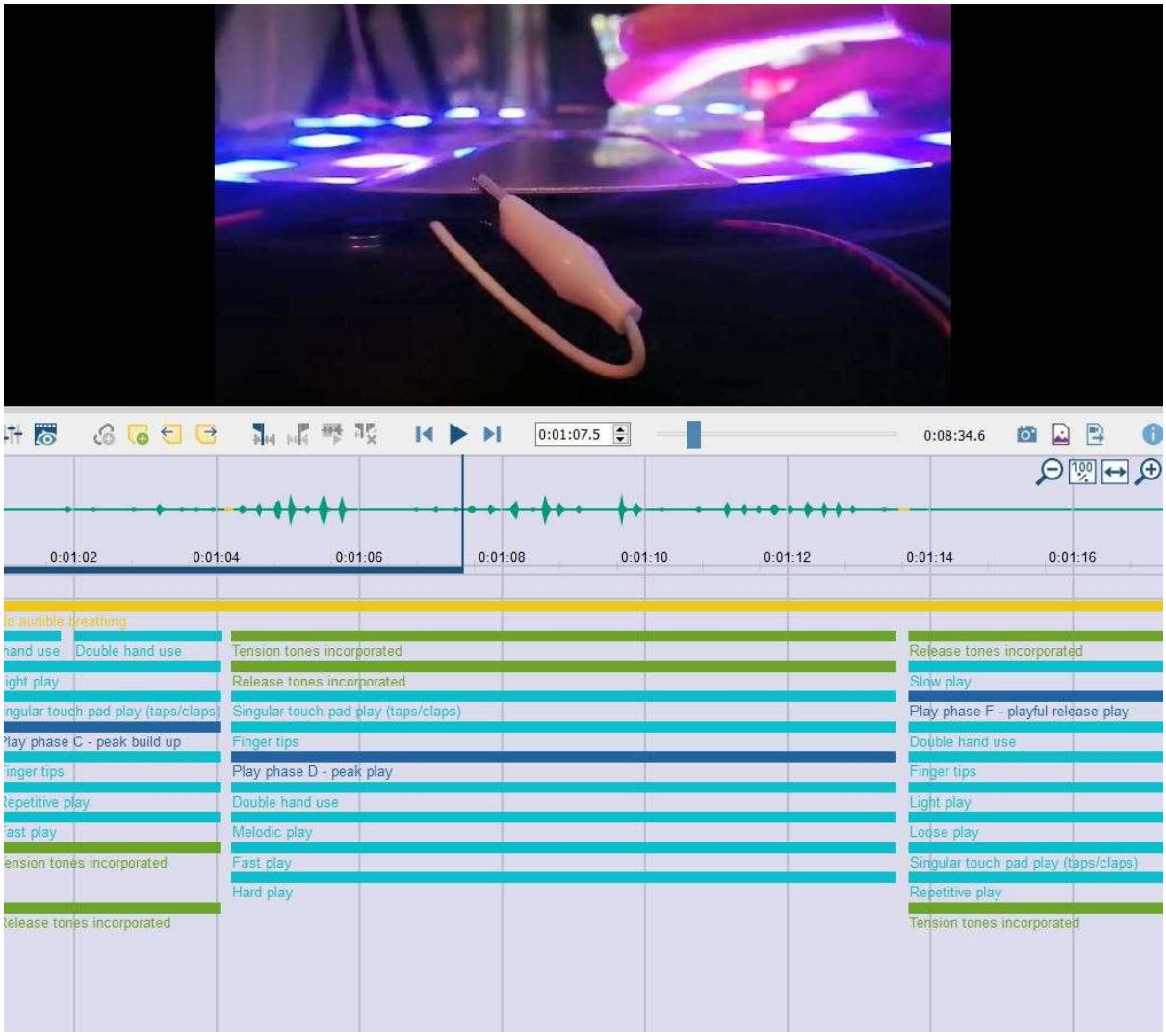
P1

Example of a top effect drum play session by P1.



P2

Example of a top effect play session by P2.

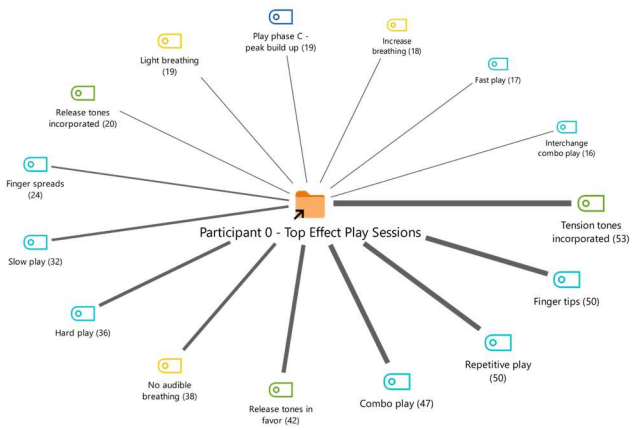


Furthermore, codelines of these annotated videos can be found in the following Appendix I: Data Visuals.

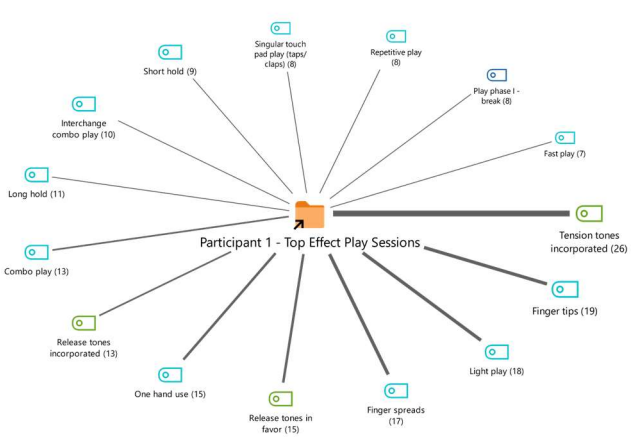
Individual participant drum play characteristics in "top" and "flop" effect play sessions

In the following visuals, the differences in both "top" and "flop" drum play behavior characteristics between the three participants can be seen. Participant differences in "top" drum play behavior characteristics are as follows,

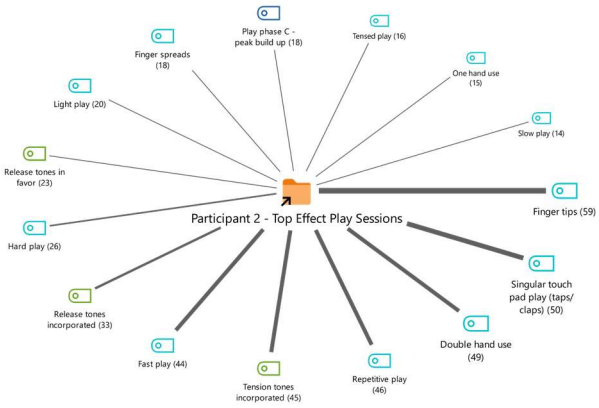
P0-Top effect play behavior characteristics



P1 - Top effect play behavior characteristics



P2 - Top effect play behavior characteristics



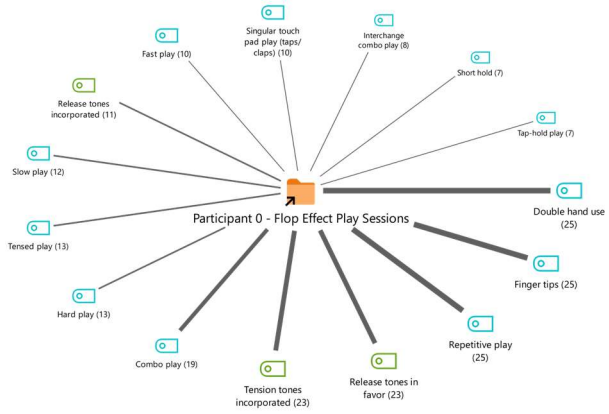
Main differences in “top” effect drum play behavior characteristics between the three participants include:

- Repetitive play is for both P0 and P2 one of the most frequent play behaviors for “top” s-anxiety effects (relatively 3rd and 4th most frequent behaviors), except for P1 for whom repetitive play is the 13th most frequent play behavior.
- Combo play is especially relevant for top drum play behavior of P0 and P1, relatively the 4th and 8th most frequently used drum play characteristic, except for P2. P2 has a preference for singular touchpad play to create “top” effects on her levels of s-anxiety, which resulted to be P2’s second most frequent drum play behavior.
- Finger spreads are mostly used by P1 (4th most frequent), a little less by P0 (9th most frequent) and the least by P2 (11th most frequent) to create “top” effects on s-anxiety levels through drum play.
- Light play is especially used by P1 to create “top” s-anxiety effects and the most effective drum play behavior by P0 and P2 was more characterized by hard play.
- Fast play was especially used by P0 and P2 to create “top” effects, and way less by P1 for whom fast play was the 15th most frequent play behavior in “top” effect drum play sessions.
- The playful expressiveness drum play phase of “peak build up” was similarly present in the “top” effect drum play sessions of P0 and P2 (12th most frequent play behavior for both) and was not present in P1’s 15 most frequent play behaviors for “top” drum play sessions.

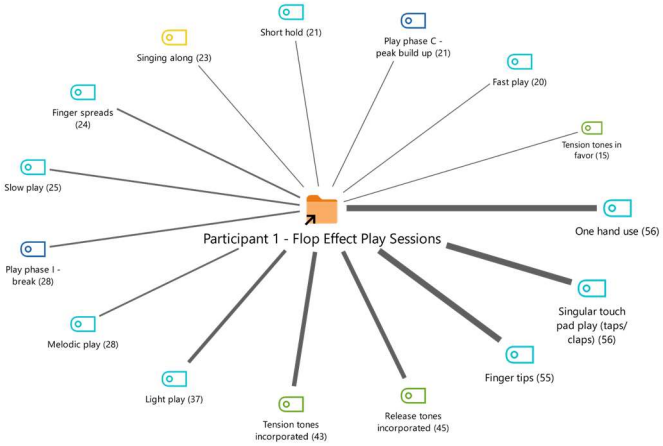
Furthermore, P0 was an outlier in the occurrence of “increased breathing” (heavy breathing during drum play) and slow play in the “top” effect drum play sessions. P1 was an outlier in the use of one hand during play, long touchpad holds and taking breaks. Finally, P2 was an outlier in tensed play, in other words using tensed hands or fingers (like claws) during drum play.

Participant differences in “flop” drum play behavior characteristics are as follows,

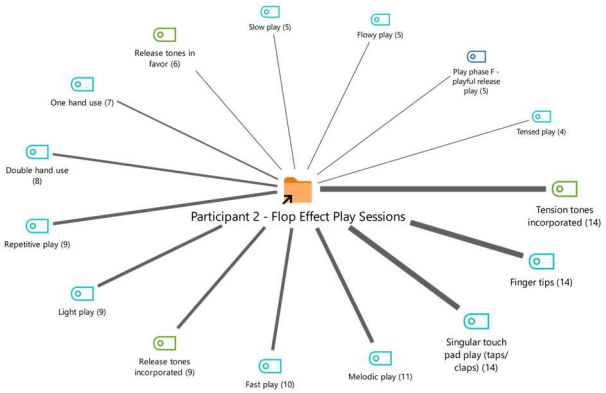
P0 - Flop effect play behavior characteristics



P1-Flop effect play behavior characteristics



P2 - Flop effect play behavior characteristics



Main differences in “flop” effect drum play behavior characteristics between the three participants include:

- Double hand use is exceptional for P0, for whom this is the most frequent play behavior in the “flop” sessions, compared to the 9th most frequent play behavior for P2 and it doesn’t even occur as one of the 15 most frequent play behaviors of “flop” play P1. On the other hand, one hand use is the most frequent play behavior for P1 and the 10th most frequent play behavior (so less than double hand use) for P2.
- Singular touchpad play is one of the most frequent “flop” play behaviors for P1 (2nd most frequent) and P2 (3rd most frequent) compared to P0 (12th most frequent).
- Repetitive play is more a general drum play characteristic of P0 (3rd most frequent in “flop” drum play behavior) rather than a characteristic for “flop” effect drum play compared to P2 (8th most frequent) and P1 (not present in 15 most frequent “flop” play behaviors).
- Melodic play is an especially relevant “flop” play behavior characteristic for P2 (4th most frequent) and P1 (7th most frequent) compared to P0, for whom melodic play does not occur in the 15 most frequent “flop” play behaviors. Same holds for light

play, which is frequently used by P1 (6th most frequent) and P2 (7th most frequent) and not present in the 15 most frequent “flop” play behaviors for P0.
- Fast play is an especially relevant “flop” play behavior characteristic for P2 (5th most frequent) and P0 (11th most frequent) compared to P1 (14th most frequent). Both P1 and P0 have slow play as a “flop” play behavior characteristic, being for both the 9th most frequent “flop” play characteristic, compared to a lower occurrence for P2 (12th most frequent).

The role of the exploration phase: the “top” effect drum play sessions had an exploration phase of about 30 to 40 seconds for P0 and P1, with an exception of about 4 seconds for P2. However, P2 was the only one using drum tones in her “top” drum play session which might have caused a shorter exploration phase. Furthermore, it was remarkable that within the “top” effect drum play sessions both P1 and P2 had about three exploration phases over the course of drum play and P0 only one in the beginning of drum play. Which might have been caused by the fact P0 was more experienced with the drum, being the design researcher. The “flop” effect drum play sessions had an exploration phase of about 10 to 60 seconds, and often included multiple short exploration phases (3 from about 20 seconds for P2; 12 from about 5-10 seconds for P1; and 2 from about 20 seconds for P0). For the codelines of the “top” and “flop” effect drum play sessions of all participants, see Appendix I: Data Visuals.

Qualitative Analysis
Transcripts from the introductional and followup interviews can be obtained based on request, since only quotes have been agreed on to share in the participants’ consent forms.

Diary Booklet Answers
Both participants agreed with the reporting of diary booklet answers within the consent form.

<u>P0</u>
The design researcher created written diary reports in the first iteration, also in order to explore which elements of contextual play, UX and perceptions would be useful to report on in terms of providing an answer to the research questions.

08 - 03 - 2021

22.49 h.

At home, before brushing teeth & sleep

Feeling a little tense, lots of thinking bodily tensed but cheerful.

In living room

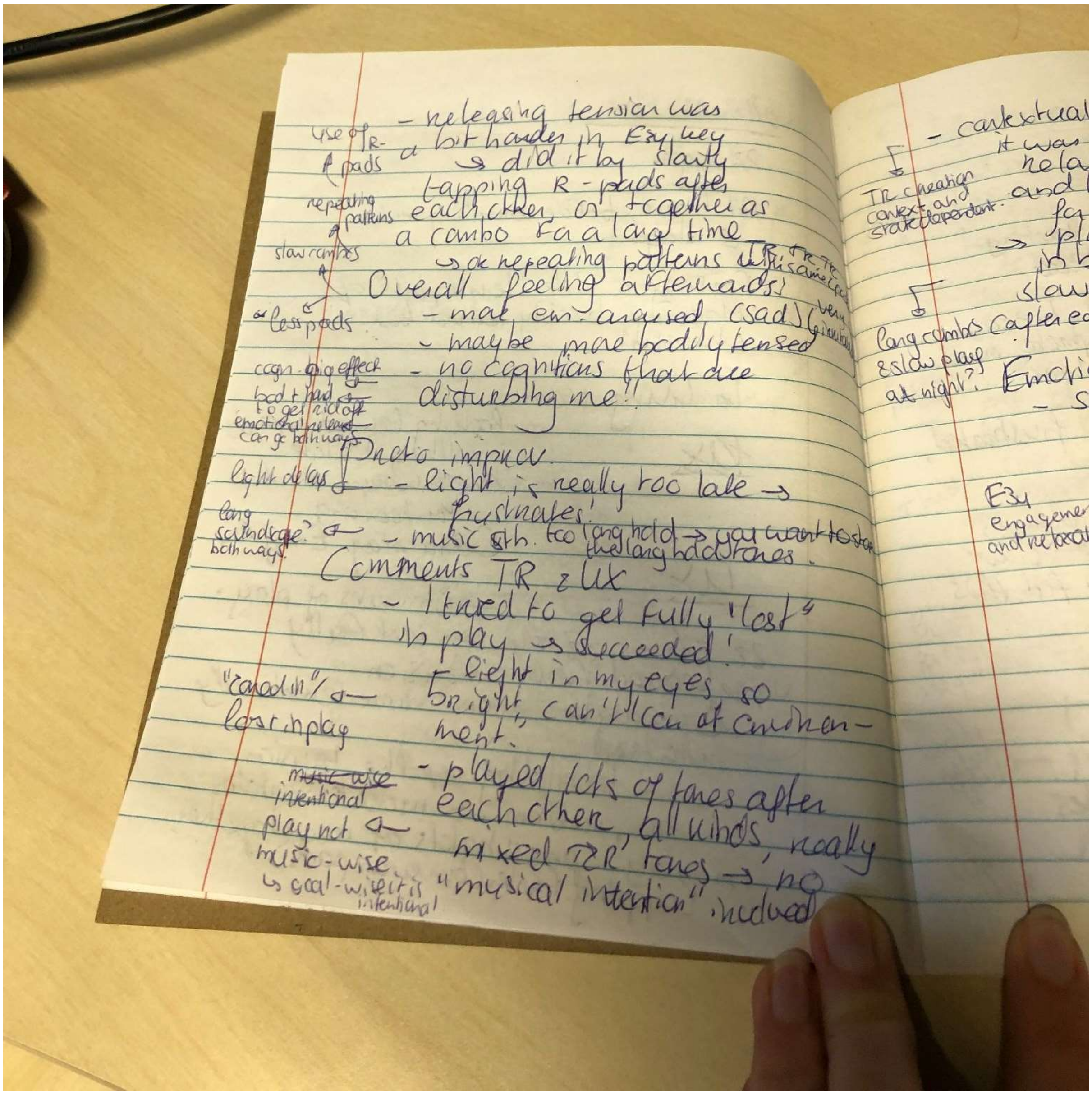
~~Ux~~

looking forward to playing, although it's late.
Don't wanna do it for too long.
Gonna play Emaj 13/4

Ux

→ 8 minutes of play.

22.56 - 23.04 → not fully released from tension & maybe even more emotionally aroused
- building up the tension no problem → more tension tones in play pressing lots of keys together. tapping faster (came on own pads)



- releasing tension was a bit harder in Esy, very
  → did it by slowly tapping R-pads after each other, or together as a combo for a long time
  → or repeating patterns with same pads

Overall feeling afterwards:
- more em. aroused (sad) (very ...)
- maybe more bodily tensed
- no cognitions that are disturbing me!!

Dreko improv.
- light is really too late → frustrates!
- music sth. too long hold → you want to stop the long hold tones.

Comments TR & UX
- I tried to get fully "lost" in play → succeeded!
- light in my eyes, so bright, can't look at environment.
- played lots of tones after each other, all kinds, really mixed TR tones → no "musical intention" involved

use of R-pads; repeating patterns; slow combos; less pads; cogn. effect; bad + hard to get rid off; emotional release can go both ways; light delays; long soundscape? both ways; "zoned in"/lost in play; ~~music wise~~ intentional play not music-wise → goal-wise it is intentional

- contextual TR play:
  - It was late so I tried to relax by playing slowly, and holding TR combo's for a long time
  - played this a bit faster in between but mostly slow and long hold combos (2-4 pads)

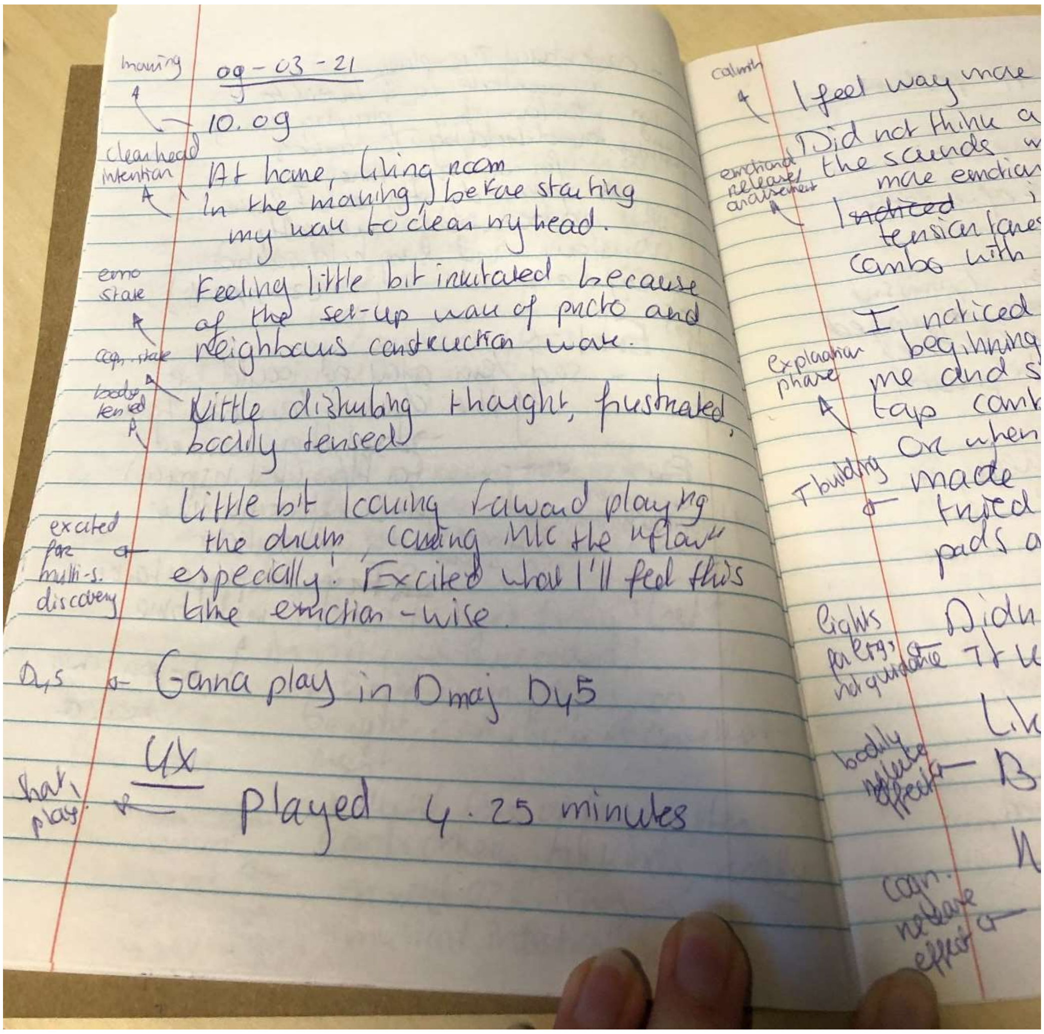
TR changes context and state dependent.

long combos (after eg.) & slow play at night?

Emotions
- sad / em. aroused could be of the darker low E34 tones
  - but they wanted for flow (lost in space) and relaxing inner vibrations
  - try happier tones next time.
    - happy tones needed.

E34 engagement and relaxation

E34 more em. aroused


09-03-21

10.09

At home, living room
In the morning, before starting my work to clear my head.

Feeling little bit irritated because of the set-up work of pacto and neighbours construction work.

Little disturbing thought, frustrated, bodily tensed

Little bit looking forward playing the drum, causing me the "flow" especially! Excited what I'll feel this time emotion-wise.

Gonna play in Dmaj D45

4x

played 4.25 minutes

morning
clear head intention
emo state
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D45
short play

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explanation phase
building
lights feeling
bodily release effect
cogn. release effect

[calmth] I feel way more calm after.

[emotional release/arousement] Did not think a lot while playing, the sounds made me happy. Not more emotionally aroused, only ~~I noticed~~ if I played lots of tension tones in a combo, or a combo with lots of pads.

[explanation phase] I noticed I played softly in the beginning, exploring how the tones affected me and soon started making tap-tap combo's quick and expansive.

[T building] Or when building up the tension I made combo's with lots of pads & tried to only press a combo of T-pads a with lots of T-tones.

[lights for engag., not guidance] Didn't really use the light. Although, It kept engaging me in play.

Liked the Dys scale a lot!

[bodily release effect] Bodily tension was a bit less after.

[cogn. release effect] No thinking really takes about 10 mins before I start worrying again after. Feel I have a clean mind!

[TR over time] Really played diff. patterns over time.

- Fast tap tap tap
- Combos
- Quick combos after each other

[release play] To release tension I pressed combos of R-tones, or played them slowly after each other & light didn't help with releasing tension.

[[illegible]] Not bothered by light delay or sound delay this time.

09-03-21

09-03-21 15.15h.

Just had a call with German housemate. Now feeling a bit sad cause I miss them. Still need to do some work for tmr today

Worried about my FMP.

Emotional after phone call → sad
A bit frustrated by noise neighbours.

Bodily a bit tensed.

Home, Livingroom.

Dys again, cause I liked it this morning. Considered C-Maj or G-Maj as well for happy tones.

UX 7.14 mins.

Feels like I've done an emotional workout. Feel really bodily & emotionally satisfied. Totally calm. Like I've yelled at sb. for a while, very hard.

Have really expressed myself via the musical tones.

Using lots of T-tones to release my inner tension.

Building up the expressive tension to get closer to my emotions again.

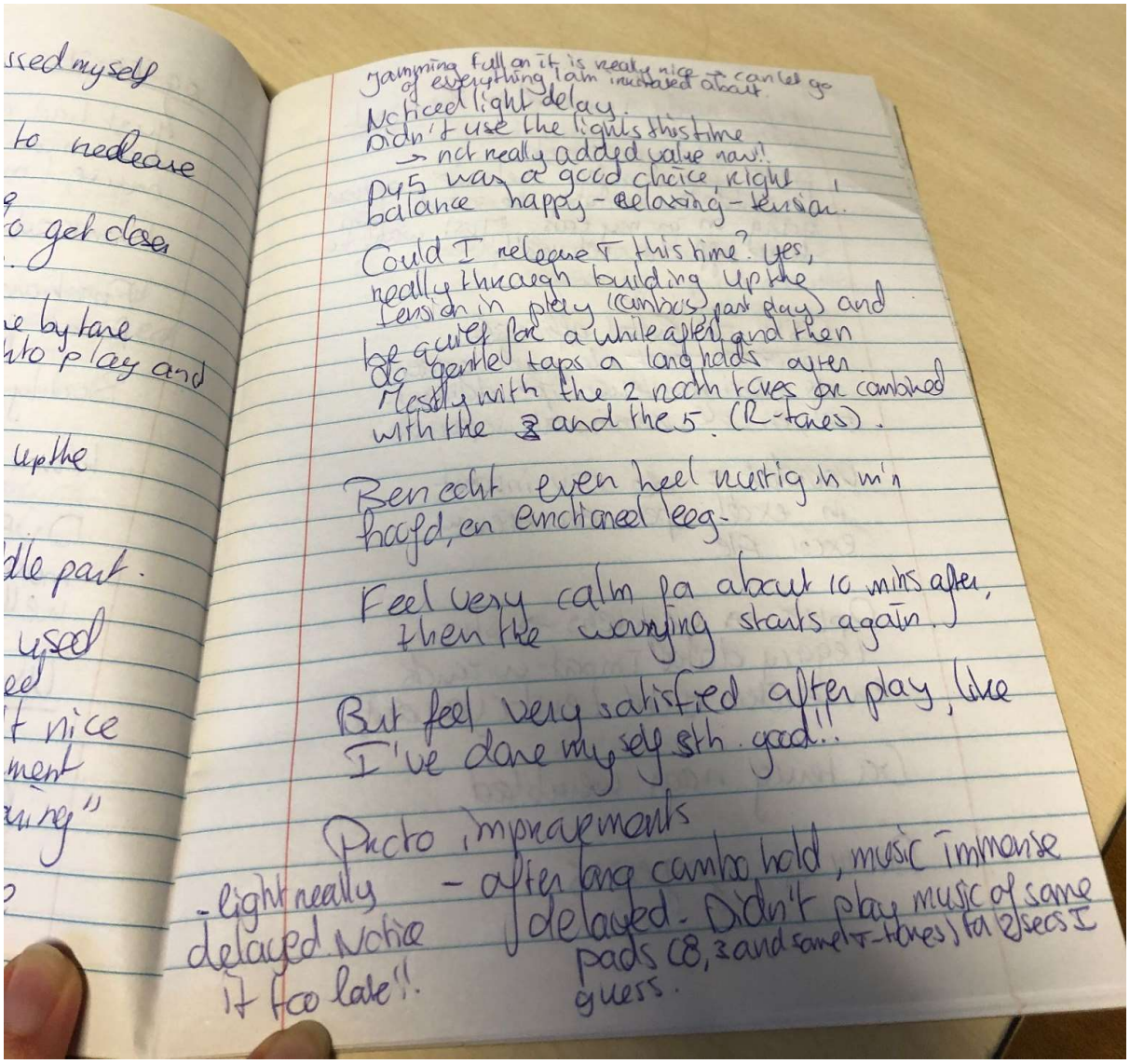
Played really slowly tone by tone in the beginning to get into play and calm down.

Longer combos to turn up the tension.

Had a very expressive middle part.

Lots of gentle touches. Also used whole hand this time combined with some finger tips → felt nice and connected to the instrument
→ "related" / "loved" / "caring"

Was totally in play. Had no eye for my environment.



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jamming full on it is really nice - can let go of everything, I am immersed about.
Noticed light delay.
Didn't use the lights this time
→ not really added value now!
Py5 was a good choice, right!
balance happy - relaxing - tension.

Could I release T this time? Yes, really through building up the tension in play (combos, part play) and be quiet for a while after and then do gentle taps a long holds after. Mostly with the 2 roath tones for combined with the 3 and the 5. (R-tones).

Ben echt even heel rustig in m'n hoofd, en enchineel leeg.

Feel very calm for about 10 mins after, then the worrying starts again.

But feel very satisfied after play, like I've done myself sth. good!!

Practo improvements
- light really delayed. Notice it too late!!
- after long combo hold, music immense delayed. Didn't play music of same pads (8, 3 and some T-tones) for 8 secs I guess.

11-03-21

10.11 With Kyara in the room.

At Kyara's room in Eindhoven. Before doing my homework. After an intense drive to EH.

I feel happy, but bit worried about my eel and driving back, and plans today.

Tense shoulders, back, jaw and arms, and belly.

Dys again, like those tunes. Happy, very relaxing.

Gonna play seated this time instead of standing.

4x 10.15 –
5.41 minutes.

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Still feeling a bit emotionally tensed because of that I really got in touch with them through playing the tension tones intensly. Either in combo with a R-tone, or in a combination with some other T-tones and R-tones.

(!) Feeling a bit emotionally touched maybe as well after play → bit sad or so. Maybe that was one of my surface (under the surface) emotions.
Still bodily tensed → sitting on a chair is not the best way to release bodily tension, maybe even more in your back and shoulders and belly. Jaw a bit less tensed.

No worrying after all! Head is fully cleared!

Play was nice. Fully zoned in most of the times. This time I also felt a little indecisive which combos or pads to play sometimes, but as soon as I just played sh I forgot about that, musical heart was triggered!

Light did not really add value in decision-making. More a supportive engaging role. Slow color changes do give a relaxed feeling in itself.

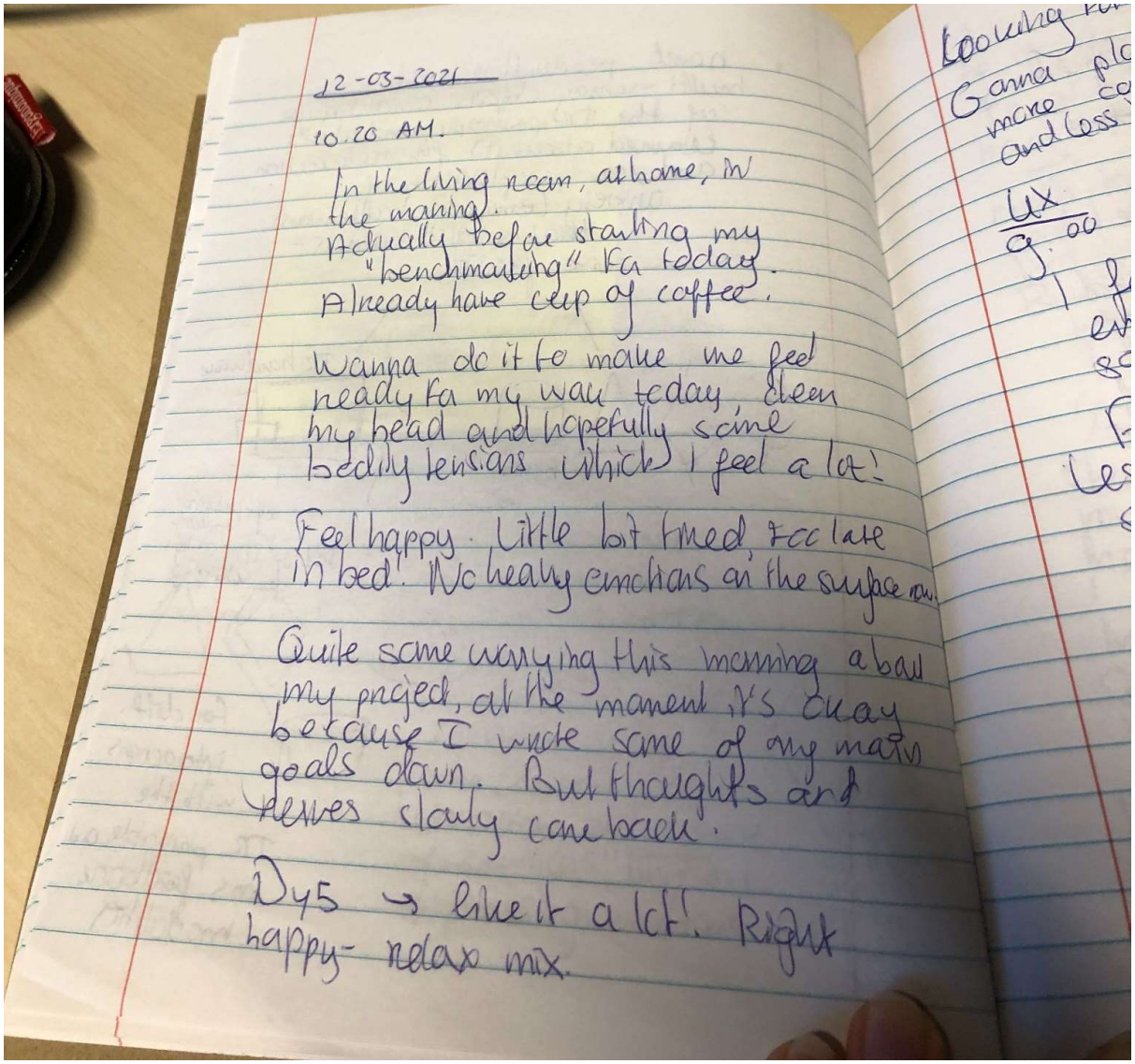
Proto improvements

- light needs to have clearer role / function displayed
- with quick taps, music needs to update sooner
- with long touches long-long you notice it stops after 5 secs but that's not too bad!

Used lots of big finger spreads, cross hand combos and even flat hands to cover more pads at same time.

I like to hold multiple pads for a long time to really release emo tension, or play repetitive patterns (tau-tau-tau) / combos multiple times pressed after each other) to release my inner tensions. (slow winds of)

To release tension in end of play I like to use only the 4 R-hands. Pressed long in combos, a taps after each other!



12-03-2021

10.20 AM.

In the living room, at home, in the morning.
Actually before starting my "benchmarking" for today.
Already have cup of coffee.

Wanna do it to make me feel ready for my work today, clean my head and hopefully some bodily tensions which I feel a lot!

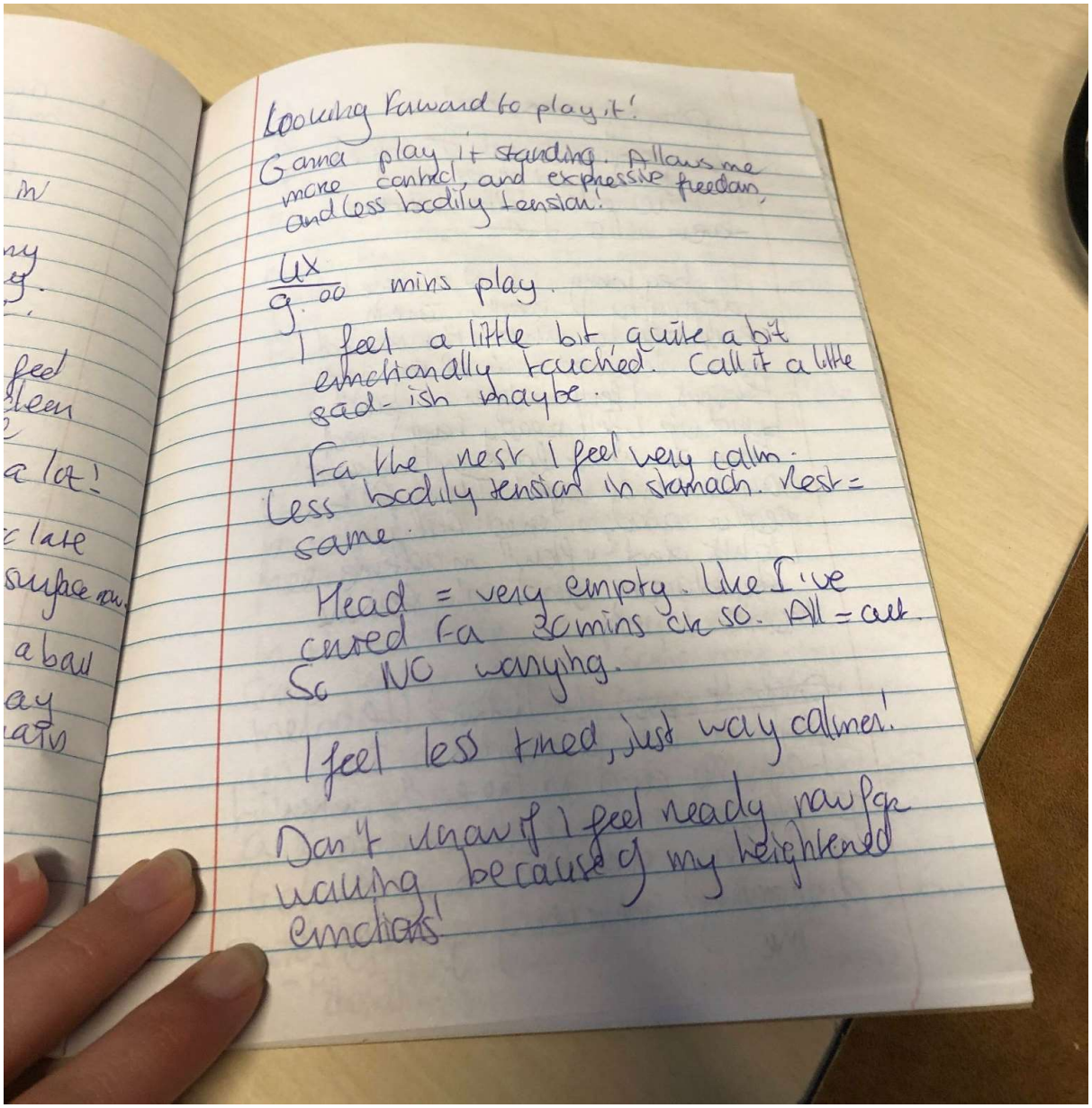
Feel happy. Little bit tired, too late in bed. No heavy emotions on the surface now.

Quite some worrying this morning about my project, at the moment it's okay because I wrote some of my main goals down. But thoughts and nerves slowly came back.

Days → like it a lot. Right happy-relax mix.

Looking
Gonna
more
and less

UX
9.00



Looking forward to play it!
Gonna play it standing. Allows me more control, and expressive freedom, and less bodily tension!

UX
9.00 mins play.
I feel a little bit, quite a bit emotionally touched. Call it a little sad-ish maybe.

Fa the rest I feel very calm. Less bodily tension in stomach. Rest = same.

Head = very empty. Like I've cried fa 30 mins ck so. All = out. So NO worrying.

I feel less tired, just way calmer!

Don't know if I feel ready now for working because of my heightened emotions!

Playing was nice!

Very explorational. I noticed I used all kinds of hand movements. ~~So I didn't even notice it~~

In beginning I had a little bit difficulty to really tone in. But after a while, the musical tones released some of my finger tensions, I felt calmer, I could build up (felt ready for it) and then I went loose with combos and faster taps! That felt really good, toned fully in. Lights and "flow" made me see blurry and only feel the music.

~~Didn't use the~~ I used the light a bit for guidance in beginning and in the end, when I played slowly. Color change grabs my attention → was distracting, not really guiding for me.

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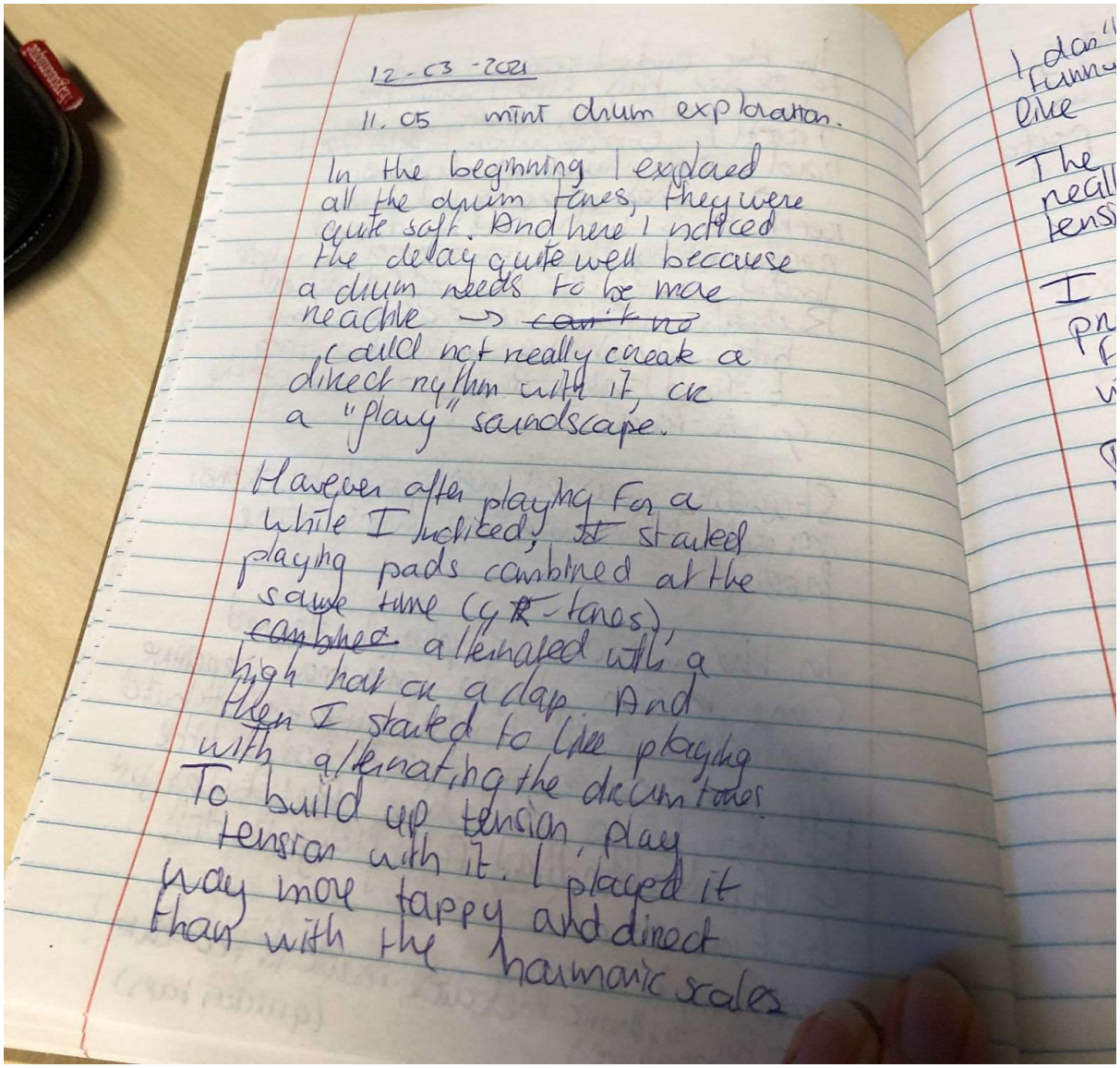
In the end I really tried
to explore this time, when the
play feels done, "ended" for me.
Tried to explore when it felt like I
had really released my tensions
→ when pressing the 2
reeth tones with flat hand and
really letting these tones enter my whole
body → quite a mindful process!
But also tried to "remove" some last
bits of thinking with slow long
E-tones interchanged by one of the
R-tones!
↳

Standing worked really well to express
myself! And use my arms more
freely!

In the middle of play I released
some tension playing some more repetitive
melodies. Didn't really use them to build
up play tension or inner tension, a little
bit maybe for play tension. But it was just
a fun alternation, felt "flowy" to do!!
Got me zoned in too :).

~~Proto improvements:~~
- for rythmic melodies, music is too late!
(repetitive) (quicker taps)



12-03-2021

11.05 mint drum exploration.

In the beginning I explored all the drum tones, they were quite soft. And here I noticed the delay quite well because a drum needs to be more reachie → ~~can't no~~ could not really create a direct rythm with it, or a "play" soundscape.

However after playing for a while I noticed, ~~it~~ I started playing pads combined at the same time (g# - tones), ~~combined~~ alternated with a high hat or a clap. And then I started to like playing with alternating the drum tones. To build up tension, play tension with it. I played it way more happy and direct than with the harmonic scales

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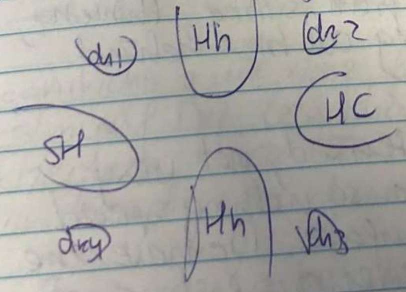
I don't know, playing it was especially funny because of the weird tones like hand clap & shaker.

The long high hat and hand claps really worked to release my inner tension!

I think this requires some more practice but I think it could be a fun way to explore the TR principle with these drum tones.

But I think the T & R tones should be the other way around maybe



cause I used the drum tones to build up T fast and the "accents" to release play tension funny enough!

Quite nice the T tones are so accessible...

(not sure after another 9.14 3 mins explanation

Didn't feel emotionally aroused after, less bodily tension, less worrying.

quick cancel in, but more mindful session.

Suddenly lights of T-pad
left up not working, and I
flickering in wrong colors... →
wires too unreliable → proto
improvement.

12-03-21
15. 46

Very much in need of a
break after a long time
behind my laptop.

Livingroom, at home.

Tired from sitting, thinking,
reading all time behind
laptop.

Bodily tensed, not very
emotional as nothing special
on the surface. Do have some
worrying/nervous feelings going
on. About my work I've done
today, and this week especially.

pad
and 1
→
→ practo

Looking forward to play. Standing.
wanna play sth. happy cause it's
the end of the day which I want
to "end/go into" joyfully!

⇒ playing in G45!

4X
11.00 mins.

Feel a lot calmer. This time I am
way more bodily relaxed too

Feel a bit emotionally worked out
→ I've "touched" them.

Cognitions quite gone feel close
to myself. Def. less thoughts, but
they are back soon. Sooner
than normally after drumming this time.

G-Major was a bit doubtable
experience! Some tones were really
soothing, and relaxing, resonated
deeply. Others were really scratchy
(e.g. the 8th tone).

However I did like to use those scratchy tones in the end to resolve some last bits of tension

In beginning I did notice the light those tone and held tones till they were ned to get slowly into play. I always like the exploratory part in the beginning, it calms me down.

The big combinations were not that helpful to release my tension because they did not sound nice together too "scratchy", too much musical tensions.

What helped was really creating melodies, tapping "an eh an" with some T and R tones that resolved some of my emotional and cognitive tensions!

Inclined I did some heavy breaths when "caved in" and building up the play tension which helped me to

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really let go of my shoulder and facial tensions!

↳ However they are already returned haha.

Was zoned in play already after a few touches this time. Saw "wazig" and totally forgot about the rest of the environment!

↳ Still have that feeling a bit afterwards (it's a sort of ~~staring~~ "staring" feeling).

Zoned in and out over play time

↳

Don't know if I would play in G45 soon again actually!

G45 Didn't really allow me to play very bodily expressive.

I wanted to play more repetitive tapping melodies in this scale, but proto didn't really allow that → too slow!

Feel a little bit tired, like having done a workout, but satisfied though.

15-03-2021

9.39 h. AM.

First round of A-Maja fits what I want to achieve → clear mind and less body tension and happier emo state → but sounds are too "dark". Feel like D-Maja is nice for the evening. The sounds was relaxing though.

Then I'm gonna play in D45 as usual!

In the TV room, in the morning before starting final benchmarking. To make myself ready for the day and release from same initial day worrying, also after a weekend of doing nothing for us. Wanting to release some body

shoulder and facial tensions
And release from some emotions
quite close to the surface →
nerves and tension. A bit frustrated.

Nan is in living room, don't
wanna bother her too much, that's
why in TV room next to living
room where I normally play
when no-one's home.

Play seated on the couch,
drum on lower table.

Curious for play results.

4X

8.25 mins of play.

Was away this time to sit. Felt
more comfi than last time.
Could not always fully engage in play
because of mom calling and being
close.

Dys was very good choice! Worked very relaxing and could really help me in releasing some emo. tensions.

- Free of worrying.
- Bit frustrated, not really cause of play, more of environmental distraction
- A bit less bodily tensed, but that's already fully back ...

In beginning I explored how I could calm down a bit before increasing play tension. That was by making use of slow, and melodic, longer patterns sth. repetitive with all the R-tones. Using the big pads with my finger tips.

When I felt more relaxed, less facial tension and bodily tension felt I started to "come in", I increased play tension. Starting with adding 1 T-tone to the YR combo in repetitive patterns.

and then interchanging them more rapidly, and then pressing 3 R's and 1 or 2 T's as a combo after each other more rapidly.

To release tension I went back to the R-tones with sths a T tone in between to release some last bits of worrying or emotional tension.

I noticed when I zoned in I started "staring" not really having a clear idea any more of what I'm playing
→ either in slow play (breath) or fully in fast play (↑ tension)

→ switching from release to tension goes quite "mindful"! (with the mind, know what I'm doing)

→ When I play slower, releasing play tension, I know more what I'm doing to calm down. However, after a while I zone in.

When I increase play tension, I notice

I use more t-tones and it really helps me play away some emotional tensions or worrying
I also notice my face relaxes when I start to "zone in"
And when I increase play tension I start to breath more deeply which helps releasing bodily tension (shoulders especially.

→ a paradox :)

Funny thing is, when increasing play tension I don't increase emo/cog/bod. tension, I actually really release it. And when releasing play tension, I kind of come to senses again, and calm down more → go to the relaxed state, and release some last bits of cogn on emo. tensions.

Bodily tension only really released in intense play! Up tempo, lots of combo's → making a flow → moving along with the musical play!

In beginning it was already easier to use rythms or repetitive patterns/melodies

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to get into play. I do, I started earlier on with having melodies than "before".

Proto improvements
↳ make sure it's on a flat surface. A wobbling drum is very annoying
↳ it feels quite fragile with the open lid and the wires and the "open" LED's

I used light only a bit in the end when trying to get myself in a relaxed state → it helped me moving some final "play" slower movements, waiting for the color to rise to red. But that was for a short while in play! → then I turned back to "musical" guidance instead.

Light did help me to stay tuned in! Just like the soundscape in my ear because of the headphones!

I feel like playing this drum really is a learning process over time, however it does give 'immediate results' after one-time play' → but there could be counter-relaxing too → more emotionally aroused, because you come close to emotional expression, and musical tones do affect you while playing. Depending on the musical scale → ⊕/⊖

The more you play, the less you think about "what to do" and it's easier to go play the drum.

Neig meer naar de wat happier-relax tones, dan de zwaardere, melancholische relax tones.
Ze zijn allemaal wel relaxing, maar, toch belangrijk dat je je NIET emotioneel nog "ruimte" voelt achteraf!

Ma 15-03-21

23.34. At home.

In livingroom just before bed.

Doing to calm down a bit, was to get rid of shoulder tension and some worrying. → goal setting?

Emotions on the surface.

Gonna play in P45.

Light cover on, otherwise too flashy in my eyes, cause it's very dark in the living room, and outside!

UX

11.00 mins played

Played with lots of different hand gestures.

When I put illumination cover over it, I get less zoned in, during

play, because I guess the light wasn't directly in to my eyes.

And I noticed the light was more than before. I used it way more, I think it's because you see more the areas of light instead of that you really have to pay close attention to the pair of lights.

I also noticed what was different than before, that I sometimes closed my eyes, to feel the music resolve my emotional tension → experience the effects of the music more deeply.

I played longer than normal because I felt over and over again that I did not fully release my shoulder tension and my little emotional tension, frustration I guess, ~~and~~

Now I feel good (says that very certain of what she feels).

I feel more relaxed however I don't have any cognitions now, any worries.

(!) But I do feel a little bit emotionally touched, like I've cried or something. That's weird.

anonymity ↑

(!) And I also payed more attention during play on my environment because it was evening and I feel like I am in a window window shopping situation basically. Cause the light is so bright everybody can see it on the street so that's annoying.

I guess that's why I played a lot longer as I guess.

This time it felt more like I was playing a game product instead of doing my research, so that was good! {I guess this was also a mindset I took, and because it was dark/evening, it didn't feel like doing HW!)

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Codes to UX from diary!

Codes to TR stories in diary!

Qual. info.

pick improvements.

Have to update the R-C document

Video/audio diary records of UX after play = very useful to notice sb's state afterwards (talking, lazy/energetic, facial expression) + easier to express what's just felt/experienced.

next diaries

From play videos, notice the breathing → TR data

data analysis TR behavior

I explored really different types of play.

I always notice, in the end I play with flat hands because I feel like I wanna stroke it, getting close contact with the object itself to have some pure and pleasant feeling in the end I guess.

Instead of this tense play! (when building up the play tension).

17-03-2021 (Tue)   10.39

Livingroom, morning. At home.

Wanna play, before starting some First data analysis tasks.

Want to get my head in ready mode and want to resolve lots of worrying, nerves (stress from last night / had a rough panicky sleep night, still feel that in my body) and just wanna calm down before this exploratory data process.

+ wanna resolve some shoulder tension, neck tension and arm tensions.

Besides that I feel good, pleasant but a bit tired because of rough sleep.

(!) Gonna play with illumination cover on, to see if with day light, this also helps me to make use of the light, and if it affects the

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UX
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10.39

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"zone-in" quality of drum play!
I'm all alone at home.
Bit frustrated by neighbour's construction work this morning, again!

UX

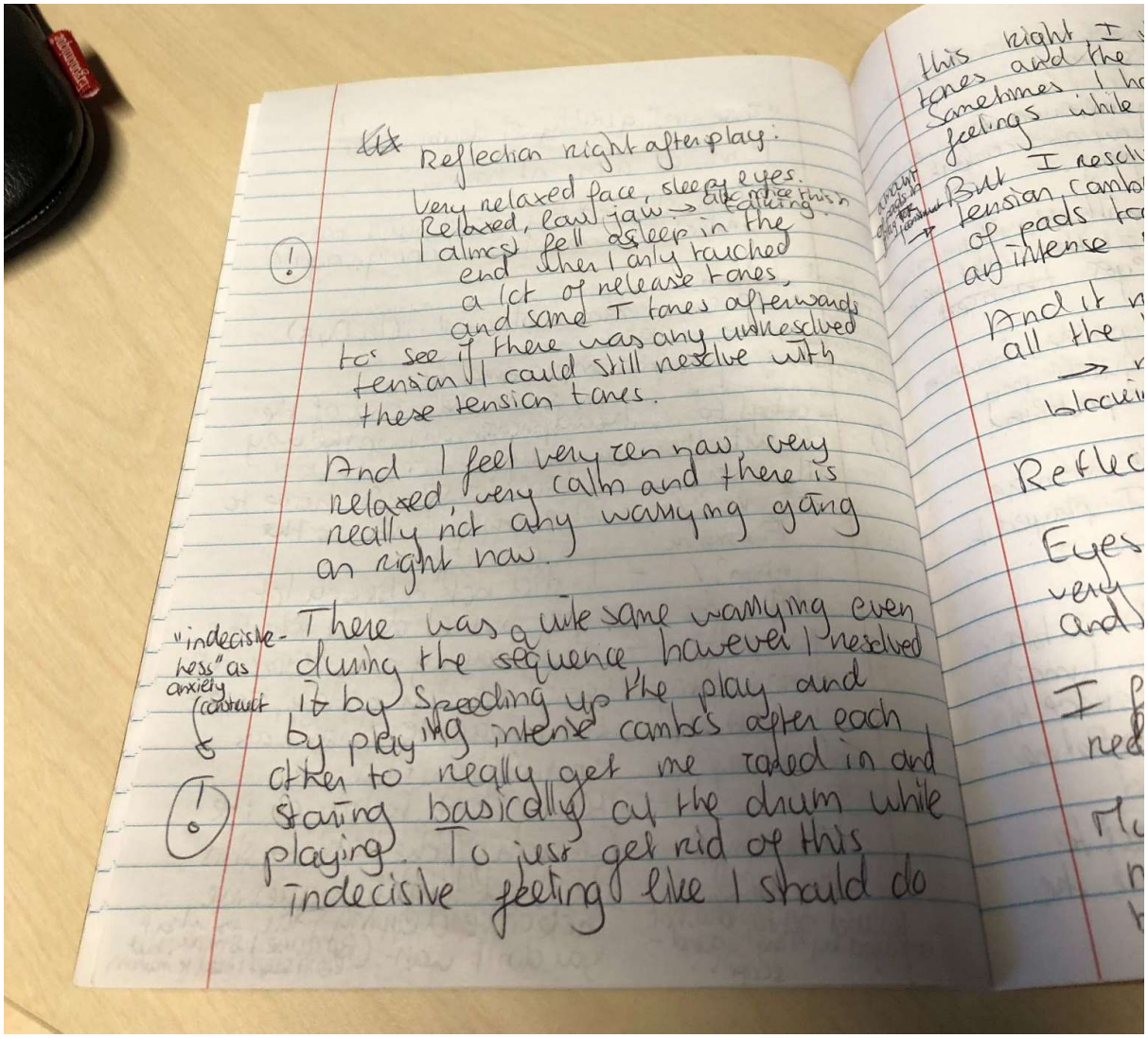
12.00 mins played. (In D45)
↳ longer

Proto improvements

- what to do with the ill. cover? ① — loose? / fix mechanism? / diff. types for lots of direct light or more "blurry" light ↳ experiment in itself

- Sths the cord of the headphones are in the way of playing, or it's too short so you have to be very close to the prototype
- I did not notice a lot of musical delay this time
- light delay was distractive sometimes during play, or not that reactive → isn't as satisfying as can be
(!) — really have to look at the function of the light → sths the "red" light makes me indecisive during play → what you don't want! (Because) music, but light says I need to move on)

- sound not too loud, not annoyed by "long" soundscapes.

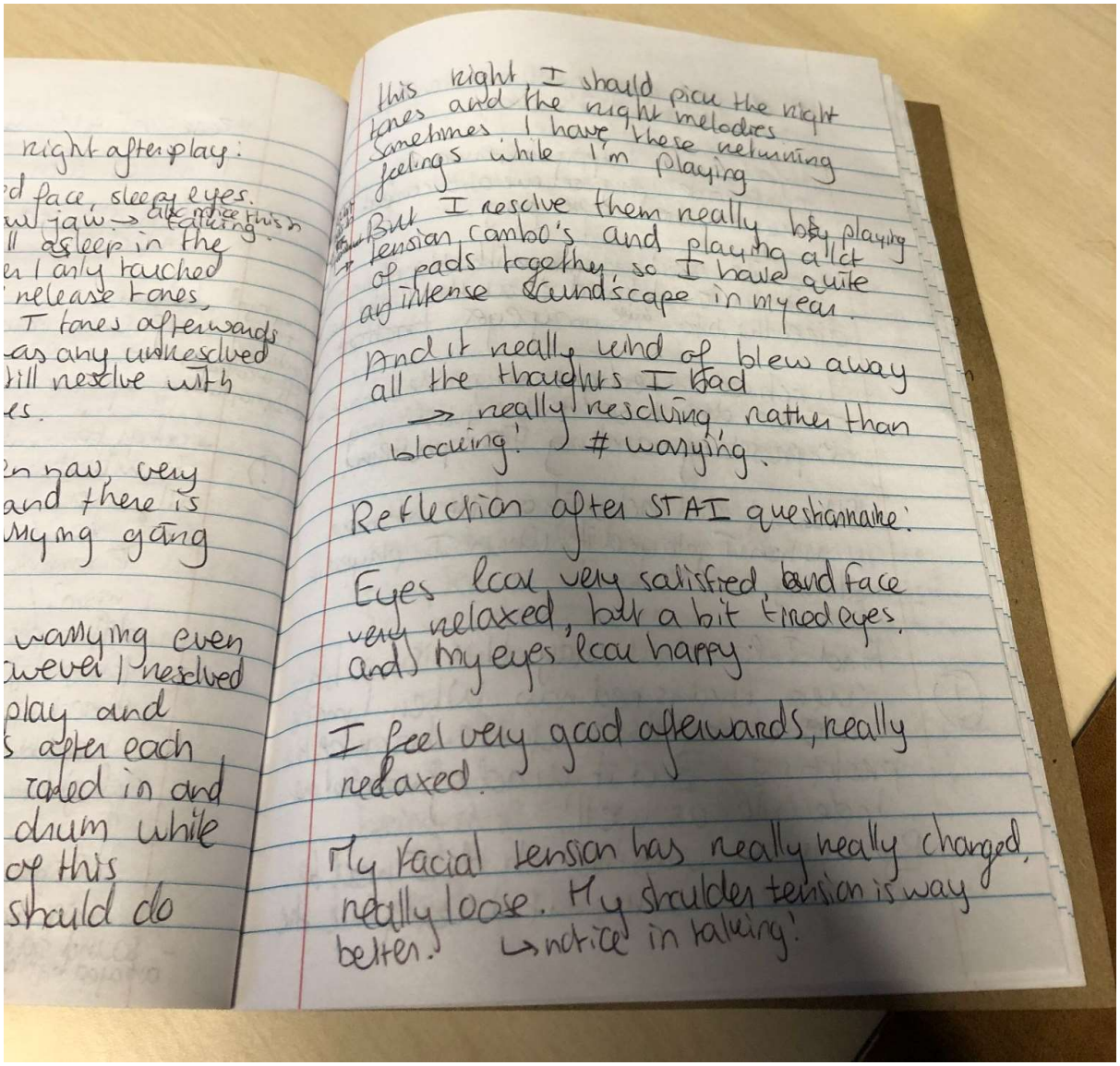


Reflection right after play:

very relaxed face, sleepy eyes. Relaxed, low jaw → talking. I almost fell asleep in the end after I only touched a lot of release tones, and some T tones afterwards to see if there was any unresolved tension I could still resolve with these tension tones.

And I feel very zen now, very relaxed, very calm and there is really not any worrying going on right now.

"indecisiveness" as anxiety construct → There was a like same worrying even during the sequence however I resolved it by speeding up the play and by playing intense combo's after each other to really get me zoned in and staring basically at the drum while playing. To just get rid of this indecisive feeling like I should do



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this night, I should pick the right tones and the right melodies. Sometimes I have these returning feelings while I'm playing.

But I resolve them really by playing tension combo's and playing a lot of pads together, so I have quite an intense soundscape in my ear.

And it really kind of blew away all the thoughts I had
→ really resolving, rather than blocking. # worrying.

Reflection after STAI questionnaire:

Eyes feel very satisfied, and face very relaxed, but a bit tired eyes. And my eyes feel happy.

I feel very good afterwards, really relaxed.

My facial tension has really really changed, really loose. My shoulder tension is way better. ↳ noticed in talking.

I do feel quite a bit emotional, but "handelbaar", it's okay.

I feel quite happy afterwards, very comfortable, very secure and content. I'm very satisfied after play.

I quite liked playing with the illumination over it. I loved that the light wasn't directly into my eyes ~~noticed~~

I noticed the light way more, however I still didn't use it to guide my expressivity and my TR pattern.

Sths I did notice it a little bit more when I played it when I played it slowly.

(1) And I looked at okay this is a big area that is red now. When I made a lot of combos at the back of the prototype. But it kind of made me indecisive as well.

Because I was like, oh do I need to change right now but I really like the

tones, really like making intense
combos here on this side of the drum.
So I actually don't want to
move away from it. But I see these
red lights, what do I need to
do with it?

Sometimes the light color change made
me confused or indecisive as well which
isn't really a good sign actually.

I noticed in the beginning I started
again very calmly, with the finger
tips and a lot of release tones.

I did it because I really needed to
calm down! Before I could turn up the
play tension. And I also really needed
to be into play #engagement, before I
could turn up the play tension!

So used lots of release tones. Don't know
exactly what I did anymore → sign of
being zoned in, non-mindful play.

I noticed I played them one by one, and

then after a while I started playing combos! slow combos, long combos.
And then I started to incaporate the T tones a bit more.
To already release some emotional tension and some worrying.
And then I played combos more intensly, switched more in between, went faster.

breathing as constant for TR building and relaxation

While I was increasing my play tension I noticed I breathed more heavily, took a couple of big breaths during increased tension in play.

This really helped me resolve my shoulder tension, with my body posture and my facial expression.

I noticed afterwards, my shoulders were up again and then I noticed I did some big deep breaths again as well.

What was new this time, was I used my flat hard and wavy movements

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in between, not only in the end of play.

(!) And I also didn't end with flat hands, but more with soft, gentle touches. To create harmonic, slow harmonic soundscape, and I really liked to make a little bit of melody in the end.

I really felt satisfied and it really helped me release some last bits of tension in the end.

zoned in

This time I didn't close my eyes in between.
I was zoned in very fast!

(!) Funny enough in the beginning I almost fell asleep and in the end I was so zoned in, I almost fell asleep.

overall change of movements as [illegible] for TR

(!) It's hard this time to reflect on how I built up the tension and release because I did a lot of things. I interchanged a a lot of different things.

But it was especially lots of combos played after each other.

Sths I had some interchanging (pam-pam-pam-pam, with fingers) I played very fast I think.

(!) And I noticed, I always use the tension tones in combination with at least 1 release tone. I almost never play them just singularly, or the 4 of them together. Or 2 of them. Always with same kind of release tone.

To make it I guess a bit more bearable, and also to hear the tension better. It triggers me more to release emotions.

emotional induce-ment → AE tones

Was a good experience, I still like the DS. I think it's the best.

Because it makes my emotions pleasant afterwards as well. Doesn't leave me with frustration, or more sadness. Sths it does though, but not a lot of times.

- Unexpected insights (UX, use, patterns etc, important constructs, effects etc.)

learnings for next sheets, new product line etc. & probs it self.

→ qual. UX and TR reflections

→ quant. touch data / analysis of the TR creation in the videos (observations)

- Check TR assumptions + effect assumptions ~~, issue assumptions~~,

17-03-21

16.03

At home, living room.

Tired and feel done with data analysis / plan ja today.

Bodily tensed, esp. jaw and shoulders and belly. face too. ("pans"), arms too. Sad emotions a bit under the surface. Head full of thoughts, and tired of thinking!

A bit grumpy, because of FMP thinking.

portant

TR

ata /
the TR
videos
ns)
assumptions!

analysis
ta plan

lders
s too.
ace.
l of

use of

play with lid on, Dy5 again, love it!

Worried about my pmp, and the work I've done so far. It's almost end of March "what have I really achieved so far? Am I on the right track?" etc.

First drinking a cup of tea, before play.

Don't really feel satisfied yet with my work today. Sister is making tea, close, in kitchen.

UX

~20-21 mins played. → longest ever!!

Proto improvements

- connection delay → had to fill in first ssh command twice to make connection. And afterwards all commands processed slow. Except after sounds started to play reactively!
- Baaja sound delay in beginning
  → played combo once
  → nothing, no sound for a while
  → played one by one → started doing it again!

- still noticed sound delays after a while during play → super frustrated by it!
- lights as usual.
- Frequency.png still the same...

Right after:

Really extra frustrated → photo didn't work → major sound delay.

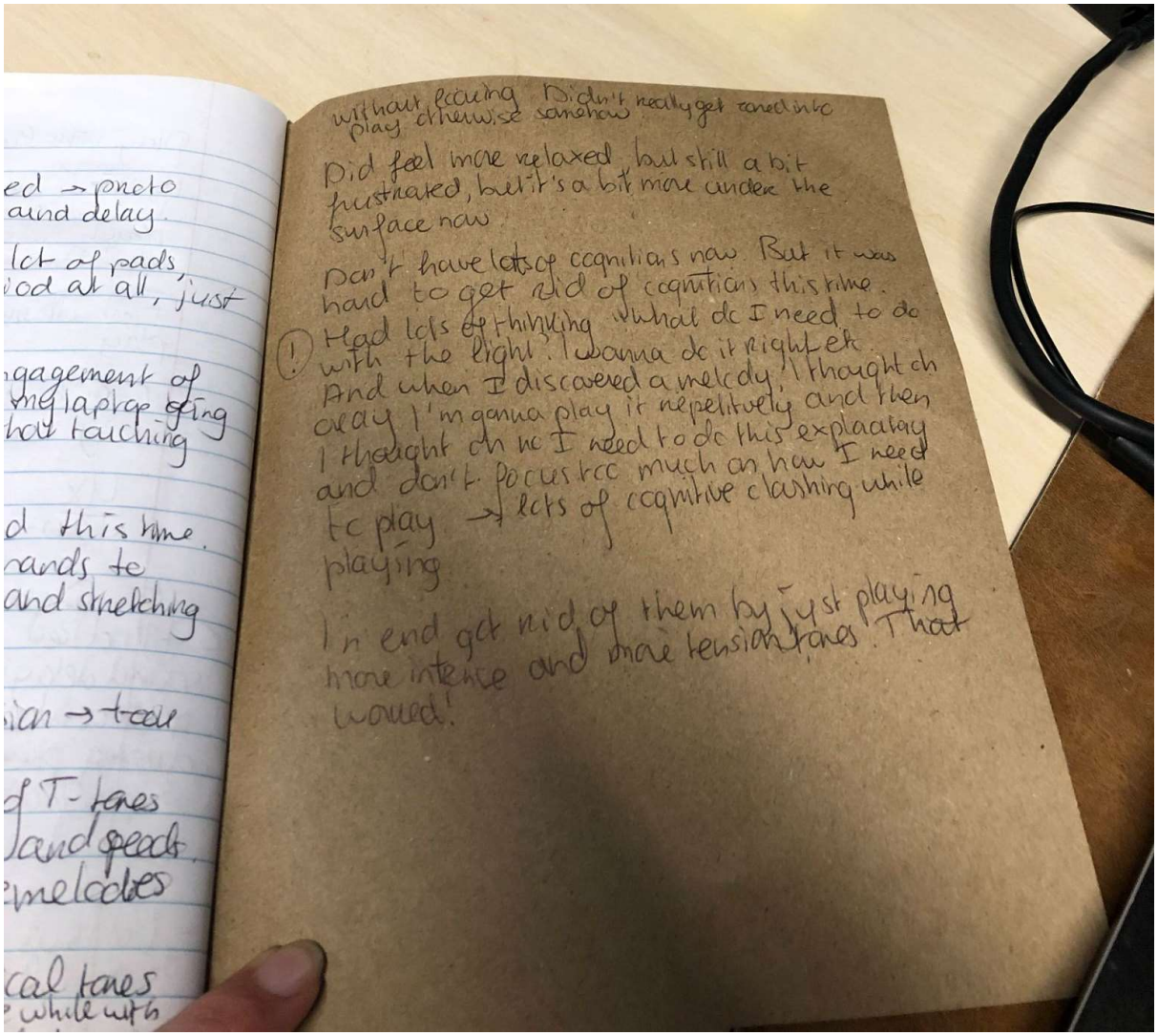
(!) Immediately pressed a lot of pads, very fast, no intro period at all, just went into it, went for it!

(!) Popped in and out of engagement of play a lot → even noticed my laptop going on standby and prevented that touching the mouse in-between play.

Lots of weird things happened this time. Also played with both of my hands to resolve hand tension by shaking and stretching hand in that way.

(!) Just could not release my tension → took so long for play to resolve it.
In the end I did by playing lots of T-tones in lots of different combo's (orders) and speeds. And by tapping them into repetitive melodies in the end!

(!) And really listening closely to the musical tones and what I felt especially! → played a whole while with eyes closed → very loosely. Could find them



P1

ID	Begintijd	Tijd van voltooien	Participant number	Prereporting Diary Answers -->	What is the current time? (XX.XX AM / PM)	This is the ...time I play the drum
P1						
Session 1	5-11-21 20:25:46	5-11-21 21:04:30	P1		20:30	1
Session 2	5-13-21 20:53:31	5-13-21 21:06:30	P1		20:53	2nd
Session 3	5-14-21 20:47:31	5-14-21 21:01:55	P1		20:47	3rd
Session 4	5-15-21 18:30:46	5-15-21 18:43:57	P1		18:31	4?

What is your setting of using the drum? (where are you? do you sit or stand? etc	Are you surrounded by others or on your own?	What are your prototype settings? (musical tones used; light settings; volume settings; light illumination cover on/of	What is your motivation for drum play?	Explain your expectations of this drum play session
Home, sitting	On my own	Uh, standard settings i think, musical notes are in a-major piano i believe.	End of the day, right after dinner, after this i will watch a movie or read a book. So kind of a bridge between study dayand relaxation	Today ive been listening to some funky music so i kind of want to make some cool melodies, but im expecting more relaxing tones :p
Sitting	On my own	Standard settings	To be honest, kind of that i didnt do it yet and that i didnt have time before :p	Relaxing piano tones
Sitting	On my own	Same as before :p	End of the day, doing it before i close off electronic devices and will read a book	Same as before i think
Sitting at home	On my own	Same setting as before!	End of the day right before dinner seemed like a good time to put it	To just try some chords i think :p

1. I feel calm	2. I feel secure	3. I am tense	4. I feel strained	5. I feel at ease	6. I feel upset	7. I am presently worrying over possible misfortune	8. I am satisfied	9. I feel frightened	10. I feel comfortab	11. I feel self-confident	12. I feel nervous	13. I am jittery
Agree	Agree	Agree	Agree	Disagree	Disagree	Agree	Disagree	Disagree	Agree	Agree	Agree	Agree
Disagree	Disagree	Agree	Agree	Disagree	Agree	Agree	Disagree	Disagree	Disagree	Agree	Agree	Agree
Agree	Agree	Disagree	Agree	Agree	Disagree	Agree	Agree	Disagree	Agree	Agree	Agree	Disagree
Disagree	Disagree	Agree	Disagree	Agree	Disagree	Agree	Disagree	Disagree	Disagree	Disagree	Agree	Agree

14. I feel indecisive	15. I am relaxed	16. I feel content	17. I am worried	18. I feel confused	19. I feel steady	20. I feel pleasant
Agree	Agree	Agree	Disagree	Disagree	Agree	Agree
Agree	Disagree	Disagree	Agree	Disagree	Disagree	Disagree
Disagree	Agree	Agree	Agree	Disagree	Disagree	Agree
Agree	Disagree	Agree	Agree	Disagree	Disagree	Agree

How are you feeling at the moment? (in general)	Relaxed? (report on your current relaxation state)	Negative thinking? (report on your current state of negative thinking)	Emotions above/under the surface? (report on your current emotional state)	Bodily feelings or tensions? (report on your current bodily relaxation state)	Tiredness? (report on your current state of tiredness)
During the day a bit stressed but right now pretty calm	Yes, i think so. I think the cooking and music i listened to helped	A little bit	Not quite sure how to answer this	Some tension, but minor compared to some other days	A bit, but not in a bad way
Okay, just a bit tired	Meh, i had a long day	A bit, worried about mistakes i will make	Nothing specific	Tension in my shoulders	Pretty tired
Good and tired	Yeah kind of	Some thoughts, but not that much	Nothing specific	Some in my shoulders and legs, i went cycling today	Pretty tired
Feeling good	Pretty relaxed	Yes a bit, more just stress because a lot needs to happen upcoming week	Nothing specific	Some tension in my shoulders and neck	Pretty tired

Afterreporting Diary Answers -->	What is the current time? (XX.XX AM / PM) (when finished playing)	1. I feel calm2	2. I feel secure2	3. I am tense2	4. I feel strained2	5. I feel at ease2	6. I feel upset2	7. I am presently worrying over possible misfortun	8. I am satisfied2	9. I feel frightened2	10. I feel comfortab	11. I feel self-confid
	20:58	Disagree	Agree	Agree	Agree	Agree	Disagree	Agree	Agree	Agree	Agree	Agree
	21:00	Disagree	Disagree	Agree	Agree	Disagree	Agree	Agree	Disagree	Disagree	Disagree	Disagree
	20:58	Agree	Agree	Agree	Disagree	Agree	Disagree	Agree	Disagree	Disagree	Agree	Agree
	18:39	Agree	Agree	Agree	Agree	Agree	Disagree	Agree	Agree	Disagree	Agree	Agree

12. I feel nervous2	13. I am jittery2	14. I feel indecisive	15. I am relaxed2	16. I feel content2	17. I am worried2	18. I feel confused2	19. I feel steady2	20. I feel pleasant2	How long did you play the drum? (# minut	Have you saved the
Agree	Strongly agree	Agree	Agree	Agree	Agree	Agree	Agree	Agree	According to my phone 18min	No
Agree	Agree	Disagree	Disagree	Disagree	Agree	Disagree	Disagree	Disagree	Around 5 min i think?	No
Agree	Disagree	Disagree	Agree	Disagree	Agree	Disagree	Agree	Agree	Uh 5 minutes i believe (see recording)	Yes
Agree	Agree	Agree	Disagree	Agree	Agree	Disagree	Disagree	Agree	4	Yes

How are you feeling at the moment? (in general)2	Changes in relaxation? (report on changes in your relaxation state)	Changes in negative thinking? (report on changes in your negative thinking)	Changes in emotions above/under the surface? (report on changes in your emotional state)	Changes in bodily feelings or tensions? (report on changes in your bodily relaxation state)	Changes in tiredness? (report on changes in your state of tiredness)	What was your general experience of playing the drum for relaxation this time?
Uh, good i think	Not really right now	No	I dont quite understand this.	More tense, was bending over table to reach	Same	It was funnytrying to figure out the notes
Tired :p	Not really	Not really	No, no specific changes	A bit more tense because i was reaching to touch it	Just tired in general	I kind of remembered the notes so was trying out some chords, that was nice to try
Good, ready to sleep because im quite tired	Not really	Not really	Not really	No changes, but i had tensions from a physical activity	Still tired	Fun trying out melodies and chords (did you see which song i tried to play:p)
Good, just a bit sleepy	Nothing specific that i can mention	Not really	Maybe that im a bit worried about school right now	Same tensions	The same	Fun to try out chords

How did you try to build up your play intensity over the course of your play session? And how did you release it?	How would you describe your absorption while playing the drum this time? (immersive experience)	How did you make use of the multi-sensory feedback? (e.g. for relaxation, absorption in play, building up/releasing play intensity	Did you use the light illumination cover? What was your experience with or without it?	What are any unsatisfied needs you experienced during drum play?	Any prototype improvements that you can reflect on?	Any additional comments you would like to share?
Random trying out and trying to find patterns	Uhmmm, quite immersive i think? Not sure	By trying to figure out the notes	What is that? The plastic piece? Then yes, i left it on. I didnt pay a lot of attention to it	Not all notes responded as quickly as i wanted them to but maybe thats because i wasnt playing it for relaxation :p	Reponse speed, and maybe duration of the note depending on how long you touch it?	
I dont think i really did that	Not really immersive	I dont know, i think i just focused on the tones	Yes, didnt try it without, it works for me!	The response speed of the tones, maybe that the tones are arranged in an interesting way XD	Other than mentioned in 31, no	
Nothing specific	Same as before i think	I dont know if i really used that	Yes, still on there!	Nope!	Nothing that i didnt mention before	
Not sure, dont think i specifically tried that	Good i think?	Dont know if i really did that	Yes, its still on there :p	Maybe that the drum is a bit high for me? (For me personally it could be a it lower)	See 31	

Link to the Excel diary reports document P1: https://tuenl-my.sharepoint.com/:f:/g/personal/v_s_v_wijlen_student_tue_nl/EqoWiw-H-ktJozoBOD9mlXUBlH-pYNki6jpSXa8H2CMVhw?e=ue91Bu

Only the assessors and the design researcher can access this link.

P2

ID	Begintijd	Tijd van voltooien	Participant numbe	Prereporting Diary Answers -->	What is the current time? (XX.XX AM / PM)	This is the ...time I play the drum	What is your setting of using the drum? (where are you? do you sit or stand? etc.)	Are you surrounded by others or on your own?
P2								
Session 1	5-18-21 8:08:35	5-18-21 8:27:13	P2		08:09	first	A-Major/Piano	Own
Session 2	5-19-21 23:25:58	5-19-21 23:38:32	P2		23;26	2nd	sit	own
Session 3	5-20-21 22:31:53	5-20-21 22:42:04	P2		22:32	3rd	sitting in my bedroom with some lights on	alone
Session 4	5-24-21 13:00:19	5-24-21 13:15:36	P2		13:01	4th?	sit on the floor in my bedroom	own

What are your prototype settings? (musical tones used; light settings; volume settings; light illumination cover on/off?)	What is your motivation for drum play?	Explain your expectations of this drum play session..
standard musical tonesused, standard ligth, volume 7, light ilumination cover on	headache & bit stressed	feel more relaxed like after meditation
cover on	relax before bedtime	get into relaxation status
musical tones: A-Major Piano; volume 6; light cover on	Very stressed / axiety feelings	feeling less anxious at the end
ilumination cover off; normal light settings?; volume 6; musical tones used drum/	Im tired and hopefully this wakes me up + little bit stressed	Less tired, less stressed

1. I feel calm	2. I feel secure	3. I am tense	4. I feel strained	5. I feel at ease	6. I feel upset	7. I am presently worrying over possible misfortun	8. I am satisfied	9. I feel frightened	10. I feel comforta	11. I feel self-confi	12. I feel nervous	13. I am jittery	14. I feel indecisive	15. I am relaxed
Disagree	Agree	Disagree	Disagree	Disagree	Agree	Disagree	Disagree	Disagree	Disagree	Agree	Agree	Disagree	Disagree	Strongly disagree
Disagree	Disagree	Strongly agree	Disagree	Disagree	Agree	Agree	Disagree	Disagree	Disagree	Agree	Disagree	Strongly agree	Disagree	Disagree
Strongly disagree	Disagree	Strongly agree	Agree	Disagree	Agree	Strongly agree	Strongly disagree	Disagree	Strongly disagree	Disagree	Agree	Agree	Strongly agree	Strongly disagree
Agree	Disagree	Agree	Agree	Disagree	Disagree	Agree	Disagree	Disagree	Disagree	Agree	Agree	Agree	Agree	Strongly disagree

16. I feel content	17. I am worried	18. I feel confused	19. I feel steady	20. I feel pleasant
Disagree	Agree	Disagree	Disagree	Strongly disagree
Disagree	Agree	Disagree	Disagree	Disagree
Disagree	Strongly agree	Agree	Disagree	Strongly disagree
Disagree	Strongly agree	Disagree	Disagree	Disagree

How are you feeling at the moment? (in general)	Relaxed? (report on your current relaxation state)	Negative thinking? (report on your current state of negative thinking)	Emotions above/under the surface? (report on your current emotional state)	Bodily feelings or tensions? (report on your current bodily relaxation state)	Tiredness? (report on your current state of tiredness)
Headache bit stressed, not comfortable	No, bit stressed, not very steady	not very negative but mostly worried about a lot of stuff	emotions are a bit mellow, dont really feel anything but a bit stress / anxiety.	uncomfortable warm feeling in my stomach	Medium tired, not very well rested but also not that tired
bit stressed and tense	no, stressed and tense	worrying about my future and not feeling condifent	bit tense and little bit anxiety	upper body tensions and bit anxiety jitters	not tired at all
Very stressed out, anxious	no definitily not as I said very anxious	Negative self confidence thoughts about my skills etc.	Angry, annoyed but kind of desperate at the surface.	Very tense, warm uncomfortable anxiety feeling, kind of like pre-panick attack.	Not tired but I think my body is actually very tired.
stressed very tired	I dont know not really but I am alsov ery tired	just worried about my deadlines, and that I might fail	Very tired bit stressed and indecisive	some bodily tensions, but mostly my head is just pounding	Very very tired even though I slept for more than 8 hours...

Afterreporting Diary Answers -->	What is the current time? (XX.XX AM / PM) (when finished play)	1. I feel calm2	2. I feel secure2	3. I am tense2	4. I feel strained2	5. I feel at ease2	6. I feel upset2	7. I am presently worrying over possible misfortun	8. I am satisfied2	9. I feel frightened	10. I feel comforta	11. I feel self-confi	12. I feel nervous2	13. I am jittery2
	8:23	Agree	Disagree	Disagree	Disagree	Disagree	Disagree	Disagree	Disagree	Disagree	Disagree	Agree	Strongly disagree	Strongly disagree
	23:34	Agree	Agree	Disagree	Disagree	Agree	Disagree	Disagree	Agree	Strongly disagree	Agree	Agree	Disagree	Disagree
	22:45	Agree	Disagree	Disagree	Agree	Disagree	Agree	Disagree	Disagree	Strongly disagree	Agree	Disagree	Disagree	Disagree
	13:10	Agree	Agree	Disagree	Disagree	Agree	Strongly disagree	Agree	Agree	Strongly disagree	Agree	Agree	Strongly disagree	Strongly disagree

14. I feel indecisive	15. I am relaxed2	16. I feel content2	17. I am worried2	18. I feel confused2	19. I feel steady2	20. I feel pleasant2	How long did you play the drum? (# minutes)	Have you saved the play data (.csv file) and your play video
Disagree	Agree	Strongly disagree	Disagree	Disagree	Disagree	Disagree	4 min	Yes
Disagree	Agree	Disagree	Disagree	Disagree	Agree	Agree	approx 6 min.	No
Disagree	Agree	Agree	Agree	Disagree	Agree	Agree	10 min approx.	No
Agree	Agree	Disagree	Disagree	Strongly disagree	Agree	Agree	4	No

How are you feeling at the moment? (in general)2	Changes in relaxation? (report on changes in your relaxation state)	Changes in negativ	Changes in emotions above/under the surface? (report on changes in your emotional state)	Changes in bodily feelings or tensions? (report on changes in your bodily relaxation state)	Changes in tiredness? (report on changes in your state of tiredness)	What was your general experience of playing the drum for relaxation this time
bit nauseous, but bit better	bit more relaxed	no negative thoughts	bit more at ease	No tension	Less tired	Chill, relaxing tones
a bit more relaxed and mellowish	a bit more relaxed and mellowish	my mind is a bit empty at the moment, so no negative thoughts	I feel calm and mellow, not really anxious.	less body tensions more a sense of letting go.	im still not that tired	it was very nice i liked the sounds, but the light brightness annoyed me.
Very numb like, but I guess sort of reliefed	Bit mellow, not really stressed but also not extremely happy, its juts like this numb like letting go feeling.	I dont really think anything right now, its all a bit in the state of letting go but really knowing what to think.	I am just very mellow, I let go of the negative feelings but that does not necessarily mean I get a happy emotional state instead.	Less bodily tensions, less anxiety warmth.	Still not tired, but I know my body is, my mind just isnt.	I actually did not really use the piano that long but headed over to the drums to let all this tension out of my body, all this stress.
A bit neutral, but quiet okay	A little bit more relaxed and little bit less tired	Still worried but less negative more neutral	Kind of ready to get back to work	Less tensions, more relaxed	Still tired but a little more waked up	I feel a little bit more relaxed and it was nice to use the drum setting to let some tension out.

How did you try to build up your play intensity over the course of your play session? And how did you release it?	How would you describe your absorption while playing the drum this time? (immersive experience)	How did you make use of the multi-sensory feedback? (e.g. for relaxation, absorption in play, building up/releasing play intensity)	Did you use the light illumination cover? What was your experience with or without it?	What are any unsatisfied needs you experienced during drum play?	Any prototype improvements that you can reflect on?	Any additional comments you would like to share?
no intensity just go with the flow and loose yourself in it	more absorpt during playing over time just like normal when you play musical instrument	playing around with it a bit	yes was nice to dimn the bright lights as i have a headache	the fact that it takes really long to set it up an shut it down as I simply dont have much time to do that in my schedule	Less time to setup	nope
went a bit faster and then released it by player softer and slower.	immersive but lights distracted a bit	letting myself go in the music	yes with much better	yes, i would like to have the option to choose the base colour of the lights and the brightness as I find red and purple lights more relaxing. Especially in the evening.	already specified above	
build it up with more and more drums, quicker and kind of realesed it by ending with very quick drumming letting it all out.	immersed into the sound and touching of the drums.	did not really use the sensory feedback of lights e.g. Used the drums like drums I guess? I kind of unknowingly reacted to the lights becoming red I guess, touching specific parts multiple times for longer so it turns red.	Yes, I still dont really like the brightness of the lights, but I get they are there for stimulation. They did kind of show how agressive I was playing I guess.	Like last time kind of tuning the light intensity.	see previous answer	I did not use the piano setting I specified, only used it for a few seconds, then noticed I was not in that specific mood and started to use the drums setting.
Went faster and faster and then ended with something very slow.	Immersive I would say I guess	Looked a little at the lights but mainly listened to the music to build up the intensity.	No, during the day it is okay and it wakes me up a bit, but the lights are still quite bright.	For it to respond immediatly like drumpads. Now the touch is quite delayed with the sound.	light adjusting; drumpad sensititivty & response	It would be nice to have a small thin portable version of this relaxation drum so you can also use it at work or uni in moments that anxiety or pressure rises to

Link to the Excel diary reports document P2: https://tuenl-my.sharepoint.com/:f:/g/personal/v_s_v_wijlen_student_tue_nl/EgoWiw-H-ktJozoBOD9mlXUBIH-pYNki6jpSXa8H2CMVhw?e=ue91Bu

Only the assessors and the design researcher can access this link.

The role of motivation and expectations for drum play

A summary of the motivations before drum play for the participants entails:

- To flow into the end of the day and to be a “bridge” between the study day and evening relaxation activities
- To function as a “break” in the day
- Because of experiences of stress
- To create relaxation or come into “flow”
- To wake up or get ready for the day
- To release bodily tensions (as response to anxiety)

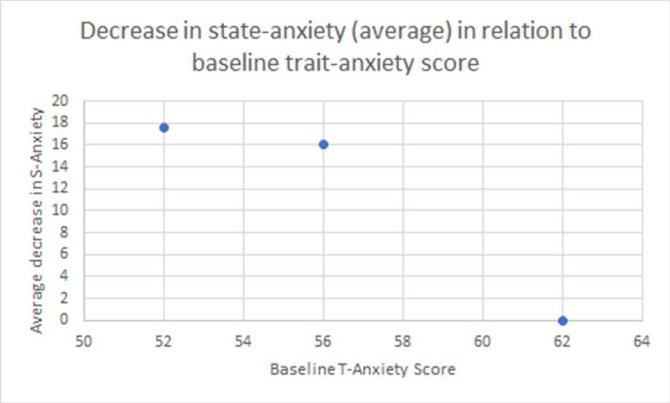
A summary of the expectations before drum play for the participants entails:

- Make some cool melodies
- The experience of relaxing tones and relaxation in general
- Feeling less tired
- Curiosity for the created drum play effects

7.1.3 What was the role of the participants’ characteristics in the state anxiety / relaxation effects?

The role of baseline anxiety levels

Baseline anxiety levels ranged from 52 (P0), to 56 (P2) to 62 (P1), with 56.7 on average. All participants' baseline anxiety levels were considered as elevated and clinically relevant. What was the role of these different anxiety baselines in the participants' state anxiety effects? Plotting the participants' average state anxiety effects (y-axis) against their anxiety baselines (x-axis), a negative relationship between the height of baseline anxiety and average state anxiety effect is suggested. Meaning, the higher a person's baseline anxiety, the lower the state anxiety effect he creates. This is a counter intuitive result, when one expects improved state anxiety effects of drum play when somebody has a high baseline anxiety. Could this suggest that the probe's state anxiety effects are optimal between certain baseline anxiety levels?



The role of past anxiety, anxiety management and relaxation experiences

P0 and P2, with best relaxation effects, have reported the heaviest past anxiety experiences compared to P1. P0 has experienced extreme worrying, bodily tensions and hyperventilation in the past. Furthermore, P2 has experienced quite some overwhelming anxiety in the past, combined with panic attacks, *"In the past I used to have panic attacks. Now, when I am really stressed or I have to do something very important, then I kind of feel a warm layer of anxiety coming over me."* P1 only mainly mentioned to be especially stressed by university work at the moment, which is in contrast with her baseline anxiety of 62. Therefore, the heavier past anxiety experiences, P0 and P2, could indicate reasons for why these participants created higher state anxiety effects compared to P1. Next to that, P0's and P2's anxiety management and relaxation experiences also differ from P1. The fact that P1 reported in her past anxiety management experiences a higher preference for social activities, might explain why P1 was less able to create positive relaxation effects. Furthermore, P2 experienced difficulties in the past with motivating herself to do relaxation practices, such as meditation, *"I have done meditating before but at the moment I notice I have way too less time for that. Then I am thinking, why don't I have 10 minutes for it? Because it helps so much in the day and then still you don't do it, and then the day passes so fast!"* P2's daily tasks and worrying stand in the way to actually deal with her anxiety, *"I forget it (meditating), don't want to do it, or I still have to do this, this and this, I make myself believe that meditation is not important to do, although it can help so much during the day and can really influence who you are and how to deal with anxiety."* P2's past relaxation experiences could explain the positive relaxation effects she experienced after participating in this diary study, and having to take a moment for herself through drum play.

The role of previous personal musical experiences

The musical interests range from listening to music (P0, P1, P2), playing the guitar (P0, P1, P2), playing the mandolin (P1), singing (P0 and P2), playing the piano (P1 and P2), playing the drum pad (P2) and songwriting (P0 and P2). When comparing the favorite choices for musical tones for the drum prototype of the three participants it can be seen there is a clear relationship between the participant's musical experiences and tone choices for the drum. Usually P1 had a preference for playing the piano for relaxation, *"Uhm, I play longest on my piano and most of the time I play jazz."* Her piano preference was reflected in P1's diary reports. P1 played in every drum play session in A-Major Piano tones. Similarly, P2 prefers piano in everyday-life as an emotional outlet, and the drum pad for songwriting. P2's diary reports match and show usage of drum tones and A-Major Piano tones both for two times. Furthermore, P0 has a preference for playing the guitar for relaxation in daily life, and played all drum sessions in guitar tones. Interestingly, P1, especially mentioned in the introduction, to usually **not improvise** when making music for relaxation, to prevent increasing stress levels, *"I don't succeed to randomly improvise musically, because then there is a lot that goes wrong when I play, and that is what makes me stressed instead. So for relaxation, I mostly play songs I know."* The fact that RELAX-CHANGE is not an actual musical instrument, and is more about expression, could explain P1's deviating relaxation effects.

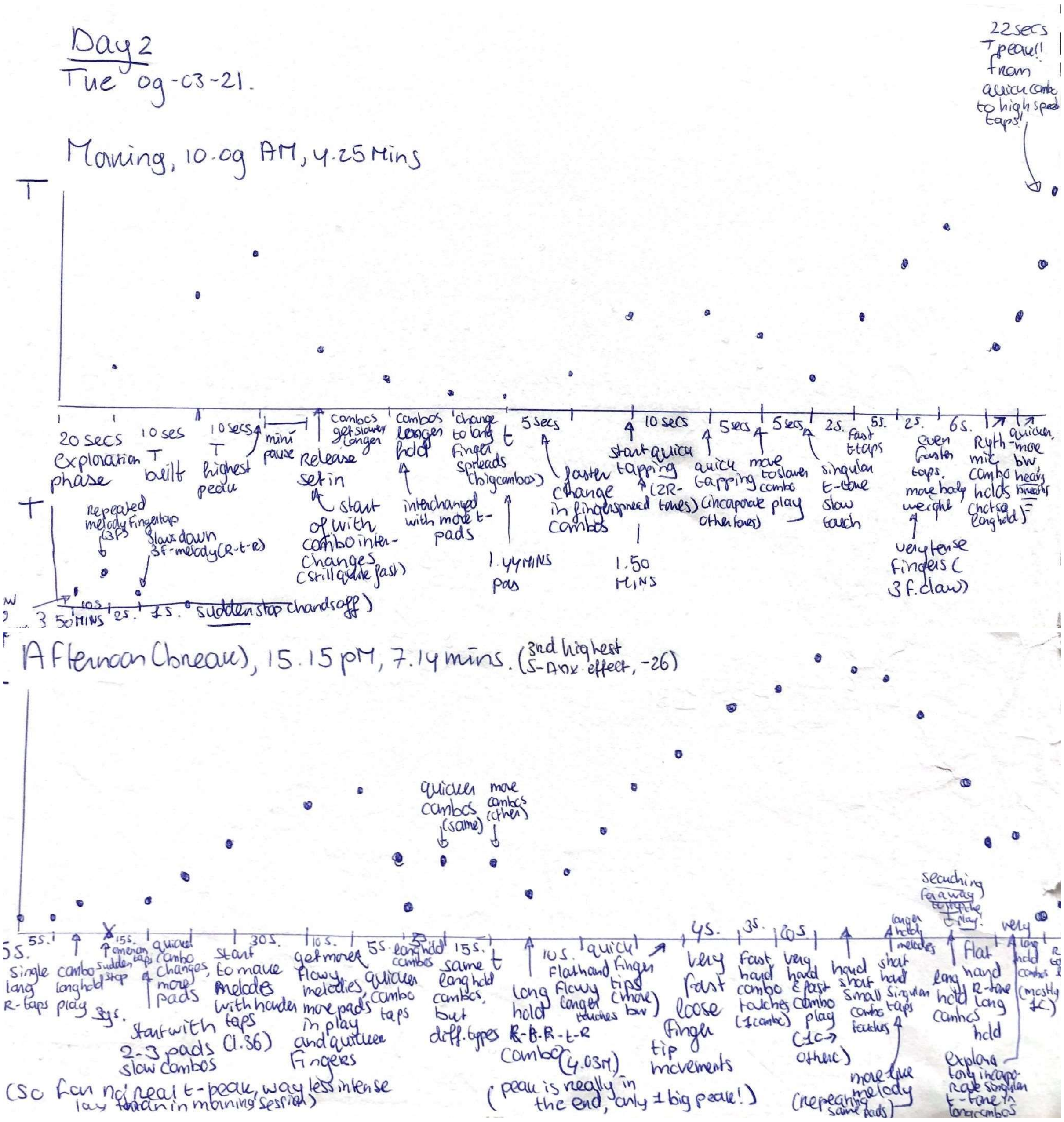
APPENDIX I: DATA VISUALS

Iteration 1

Within this first iteration, the video recordings of P0's drum play behavior were analyzed manually. Based on the design researcher's perception, graphs were made to visualize the expressive tension-release play in every drum play session of P0. On the x-axis the transitions between expressive drum play phases (types) and hand/body movements are shown. On the y-axis, the amount of playful tension is visualized. The more expressive the drum play (hard play, fast play, wild/chaotic play) the higher the perceived playful tension. Release play was visualized as a decrease in playful tension in the graphs.

In the very first play session on day 1, the design researcher did not video record yet and discovered in that first session to implement video logging as part of the diary data gathering procedure. The playful tension-release curves are crafted as follows:

Day 2:



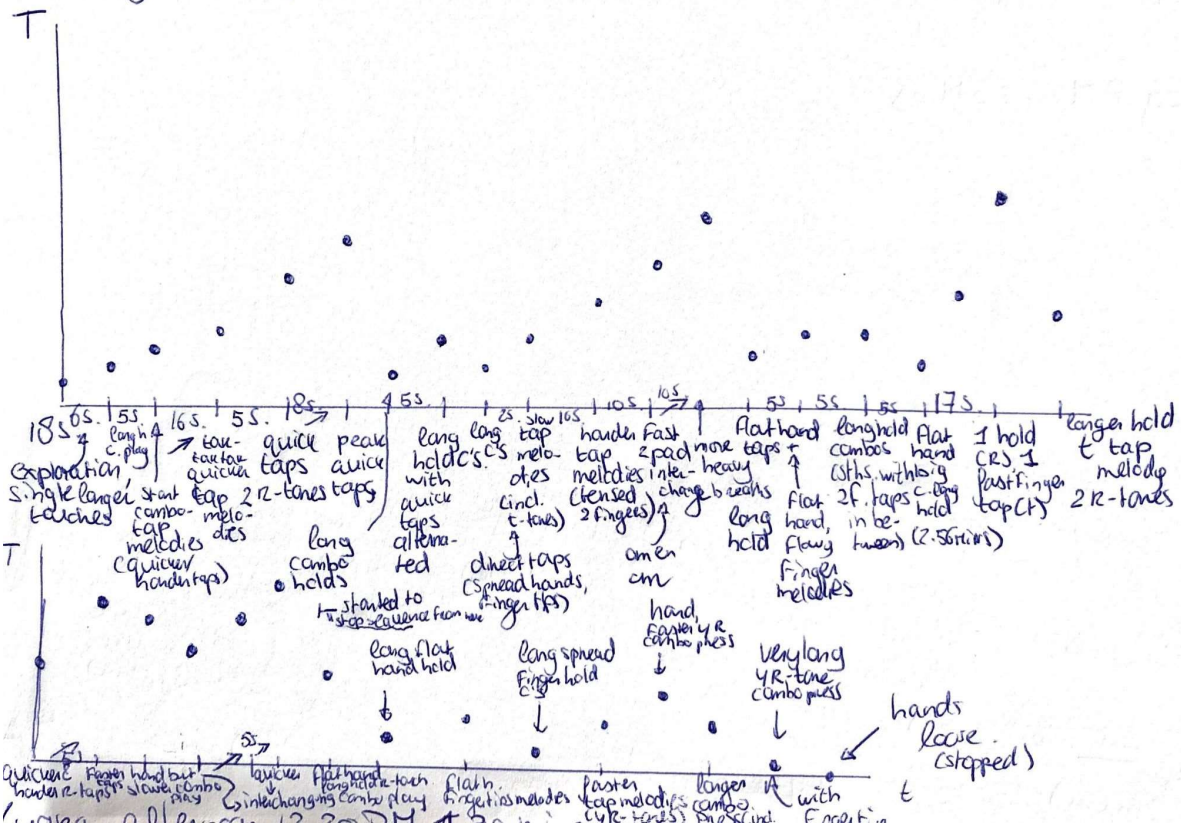
Day 2
Tue 09-03-21.
Morning, 10.09 AM, 4.25 Mins
22 secs T peak!! from quick combo to high speed taps!
20 secs exploration phase
10 secs T built
10 secs highest peak
mini pause
Release set in
start of with combo inter-changes (still quite fast)
combos get slower longer
combos longer hold
interchanged with more t-pads
change to long finger spreads (big combos)
1.44 MINS pas
5 secs faster change in finger combos
10 secs start quick tapping (2R-spread tones)
1.50 MINS
5 secs quick tapping (incorporate other tones)
5 secs more to slower combo play
2s. singular t-tone slow touch
5s. fast t-taps
2s. even faster taps, more body weight
very tense fingers (3 f. claw)
6s. Ryth-mic combo holds (hot sq. long hold)
quicker, more bw heavy fingers
Repeated melody finger tap (3 f)
slow down 3f-melody (R-t-e)
3.50 MINS
sudden stop (hands off)
Afternoon (break), 15.15 PM, 7.14 mins. (3rd highest S-Anx effect, -26)
quicker combos (same)
more combos (other)
5s. single long R-taps
combo long hold play
15s. sudden stop
quick combo changes, more pads
start to make melodies with harder taps
start with 2-3 pads slow combos (1.36)
30s.
10s. get more flowy melodies in play and quicker fingers
5s. quicker combo taps
15s. same t long hold combos, but diff. types
10s. long flowy hold R-B-R-t-R combo (4.03M)
quick flat hand finger tips longer touches (more bw)
4s. very fast loose finger tip movements
3s. fast hard combo touches (1 combo)
10s. very hard & fast combo play (1c → other)
hard short small combo touches
short hard singular taps
more like melody (repeating same pads)
longer hold melodies
searching for a way to explore t-play
long hold combos
flat hand R-tone long hold
very long hold combos (mostly 1C)
explore long incorporate singular t-tone in long combos
(So far no real t-peak, way less intense than in morning session)
(peak is really in the end, only 1 big peak!)

Day 3:

Day3

Thur 11-03-21

Morning, 10.11AM, 5.41 mins



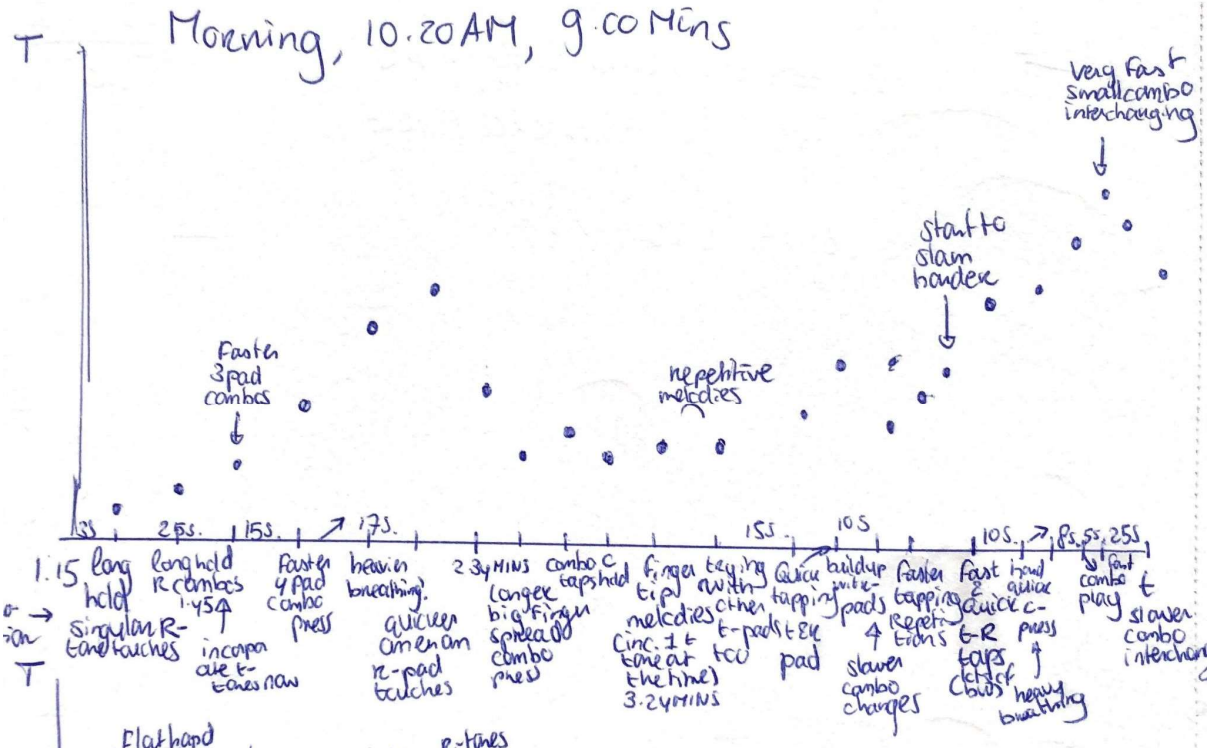
Day 4:

Day 4

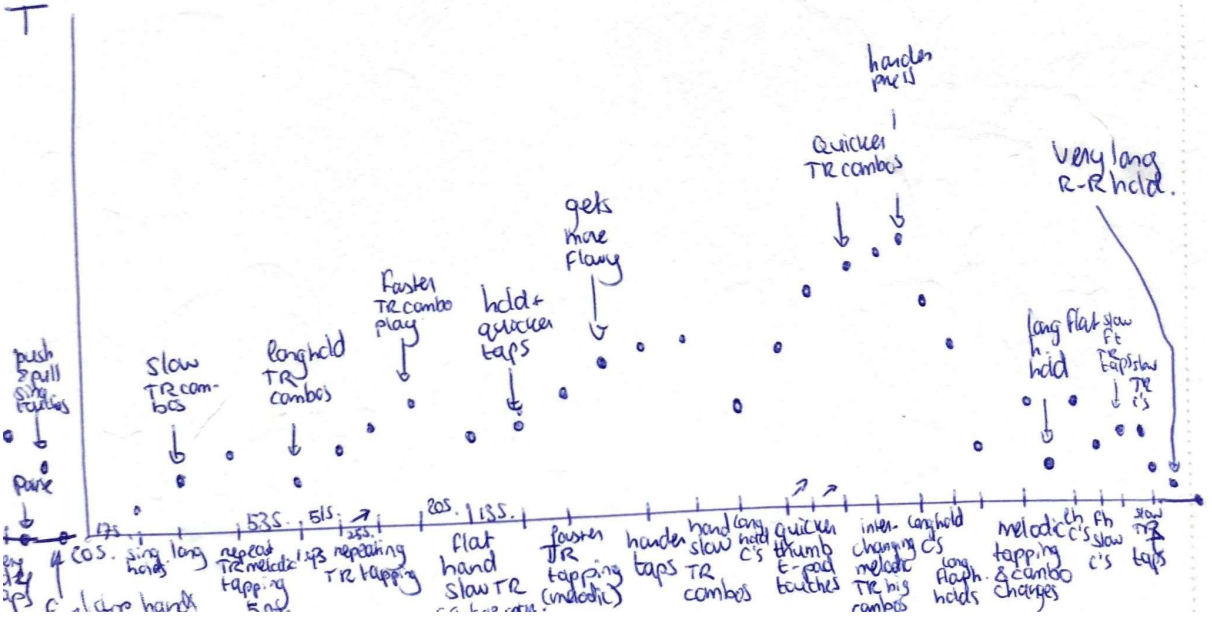
(Law 5 - Anxiety effect, -7)

Fri 12-03-21

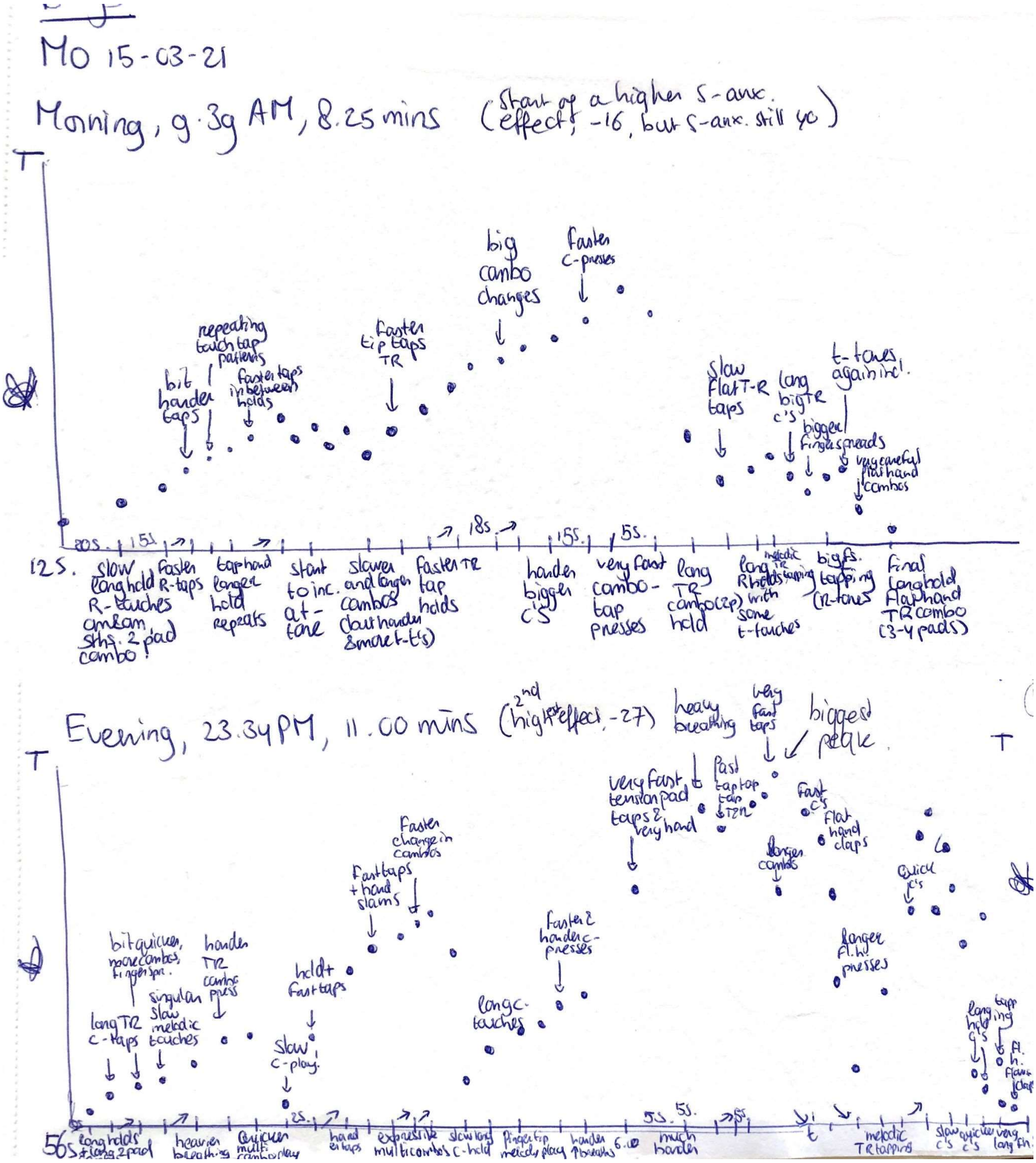
Morning, 10.20AM, 9.00 Mins



Afternoon, 15.46PM, 11.00 MINS. (Law 5 - Ax. ~~effect~~, -9)



Day 5:


Mo 15-03-21
Morning, 9.39 AM, 8.25 mins (Start of a higher S-anx. (effect), -16, but S-anx. still yo)
Evening, 23.34 PM, 11.00 mins (2nd highest effect, -27)
biggest peak

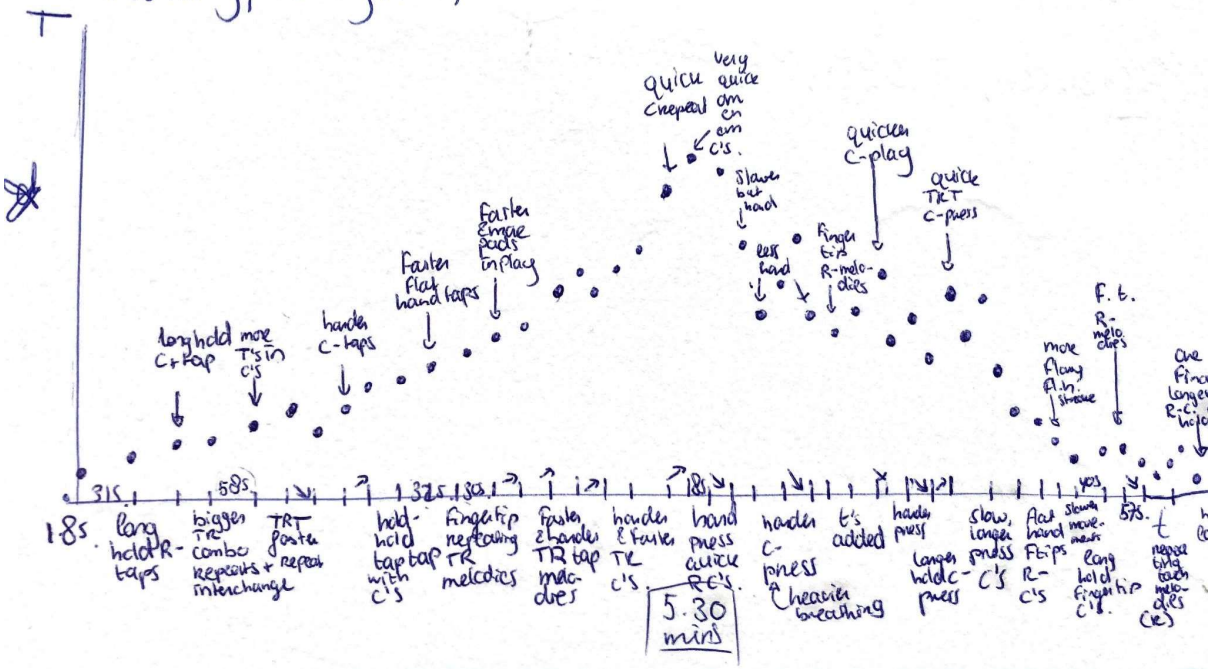
Day 6:

→ long phases (long times doing 1 type of play); end phase → really see I'm releasing last bits of tension

Day 6

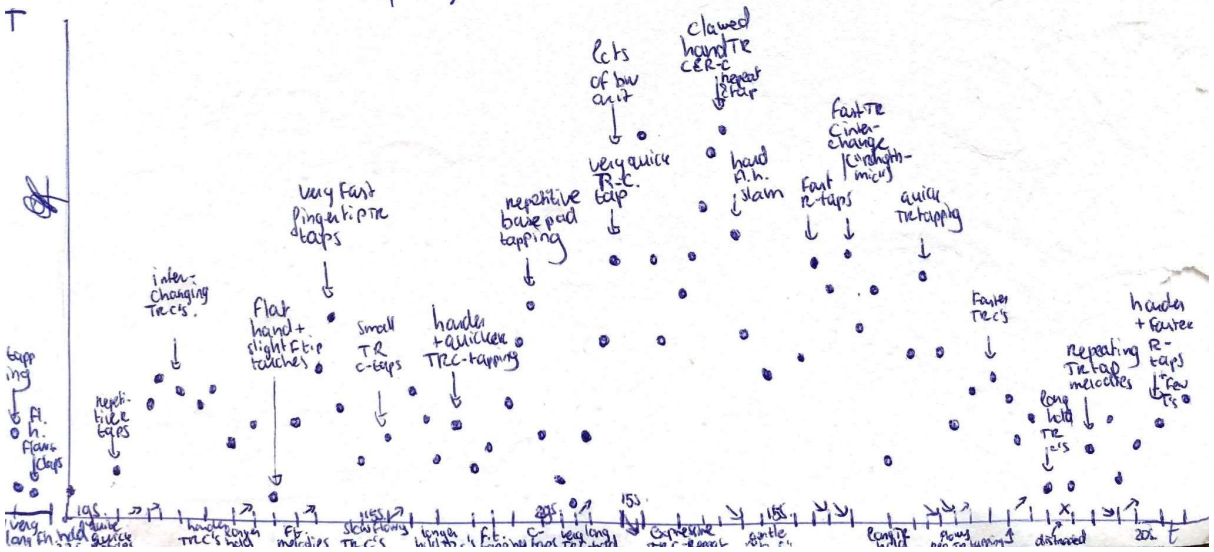
① Wed 17-03-21

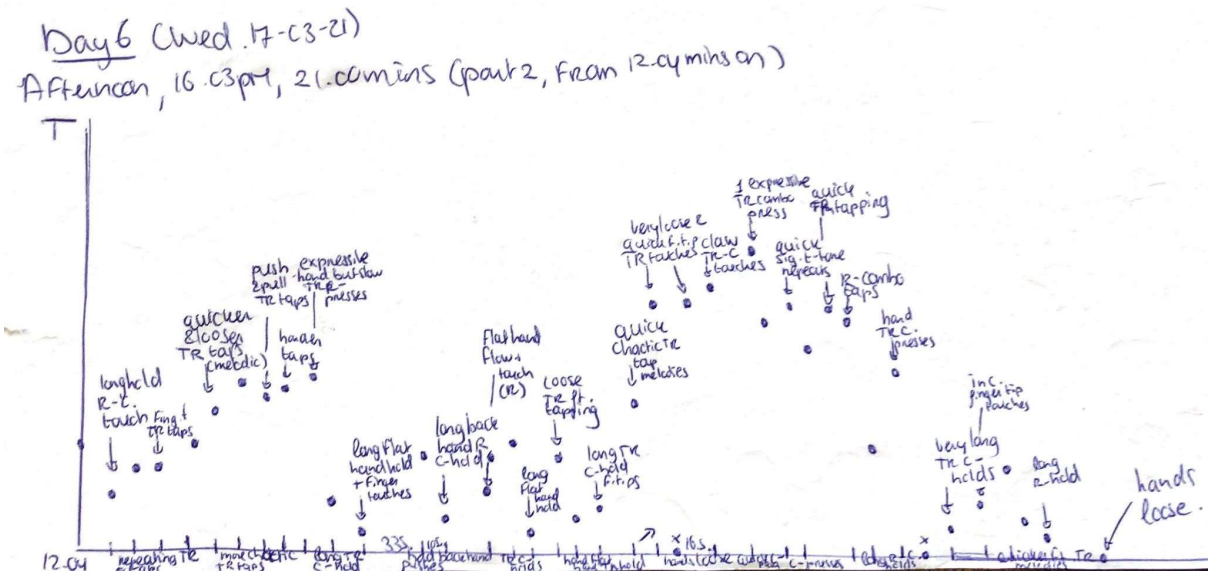
Morning, 10.39 AM, 12.00 mins (highest effect, -33) → strongly relaxed + strongly self-confident



at start I was already a bit faster with my taps
→ kind of feel the restlessness in play pattern, and the indecisiveness.

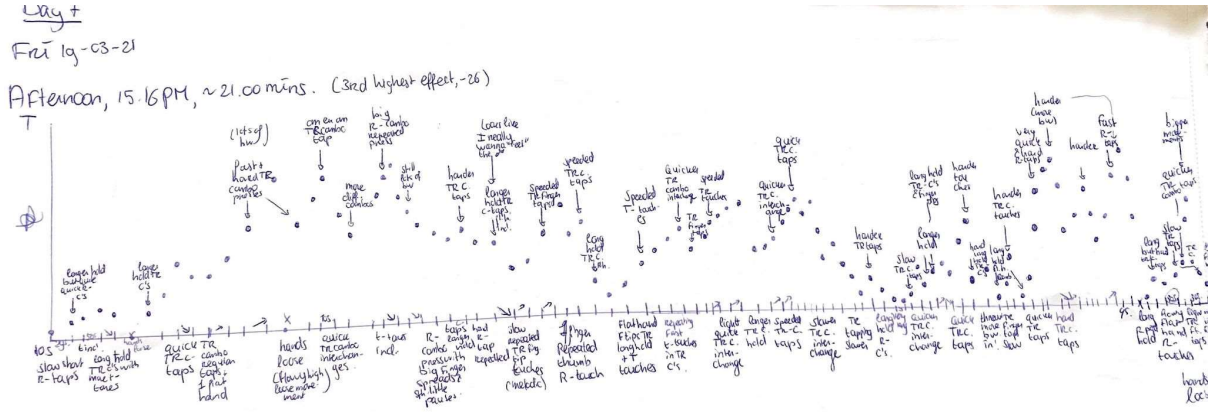
① Afternoon, 16.03 PM, 21.00 mins (4th highest effect, -24) "dipje"





The third graph shows the next part of the second play session on day 6, a continuation of the 21 minutes play session annotation.

Day 7:



Iteration 2

Participant Profiles

<u>P0</u>

first person perspective

PARTICIPANT 0

About

General information

female

20 - 25 years old

TU/e student

Relaxation / anxiety management experiences

- Meditation
- Yoga
- Sports
- Walking
- Writing
- Listening to music
- Making music

Musical experiences

playing the guitar, singing and beatboxing as an outlet for emotions and negative thinking

vocal group

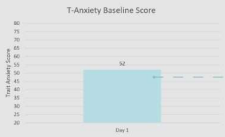
songwriting

Remarks

- Drum prototype was placed in the livingroom at her parents' house.
Furthermore the prototype was situated on the dinner table or the lower table in the TV room.

"I keep my anxiety level balanced with a combination of meditation, sports and music on a daily basis."

Anxiety baseline



"medium to elevated anxiety"

Anxiety experiences

- Extreme worries
- Fluctuating emotions
- Daily bodily tensions
- Past hyperventilation experiences due to peaks of anxiety

P1

second person perspective

PARTICIPANT 1

About

General information

female

20 - 25 years old

TU/e student

Relaxation / anxiety management experiences

- Watching Netflix series
- Regular meet-ups with friends
- Programming for fun with a friend
- Playing music

Musical experiences

playing the guitar and mandoline

playing the piano (jazz)

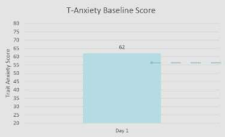
- especially songs she knows
- does not like to improvise

Remarks

- Drum prototype was placed on her desk in her living room / bed room in her student appartment.
- The idea of being able to fail, when playing music, restricts relaxation effects (e.g. when playing the piano).

"I don't succeed to randomly musically improvise because then there's a lot going wrong when I play, and that's what makes me stressed instead. So for relaxation I mostly play songs I know."

Anxiety baseline



"elevated anxiety"

Anxiety experiences

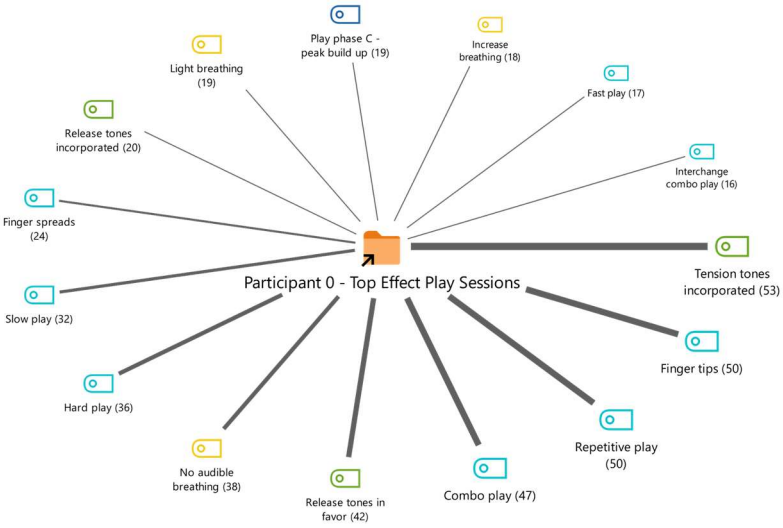
- Most stressed about the university at the moment

P2

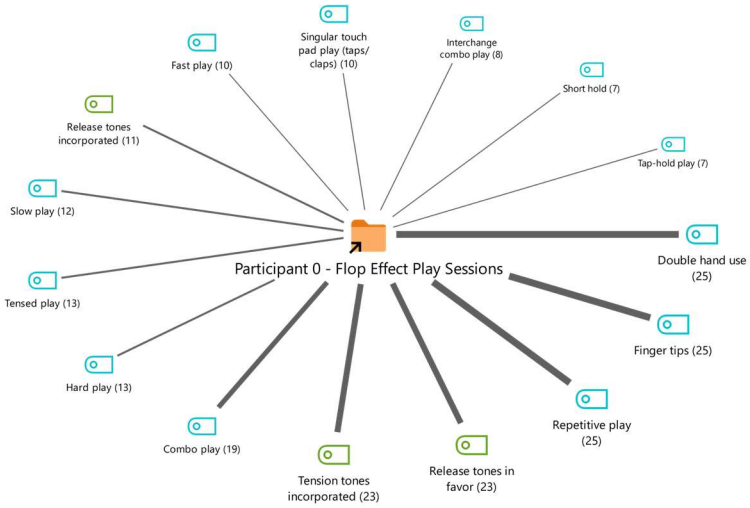
Drum Play Behavior Characteristics Per Participant

<u>P0</u>

P0-Top effect play behavior characteristics

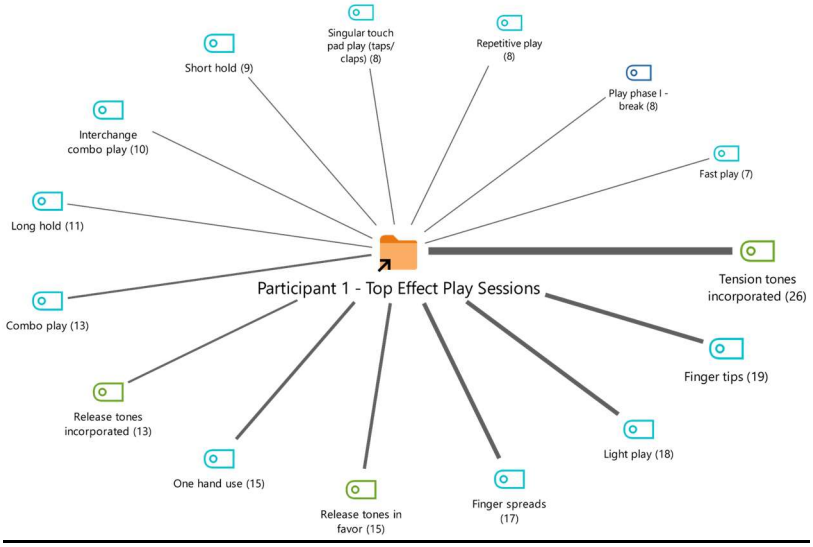


P0 - Flop effect play behavior characteristics

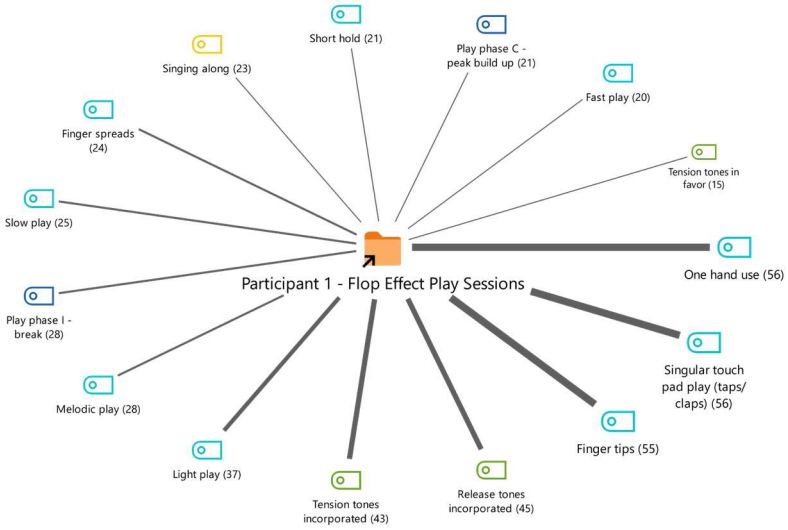


P1

P1 - Top effect play behavior characteristics

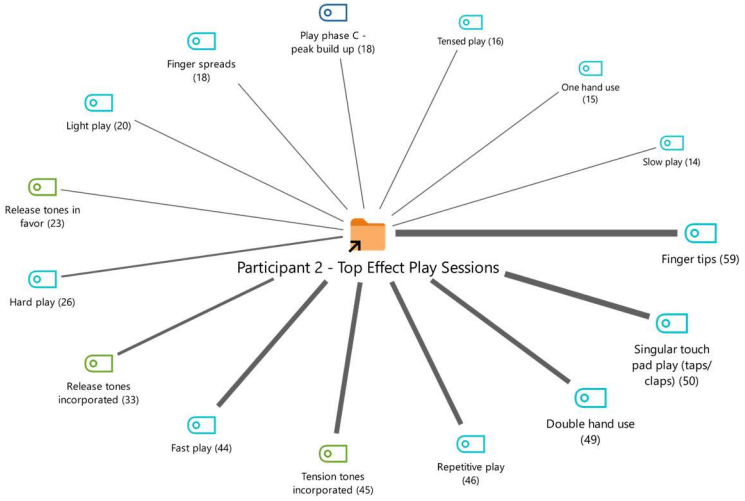


P1-Flop effect play behavior characteristics

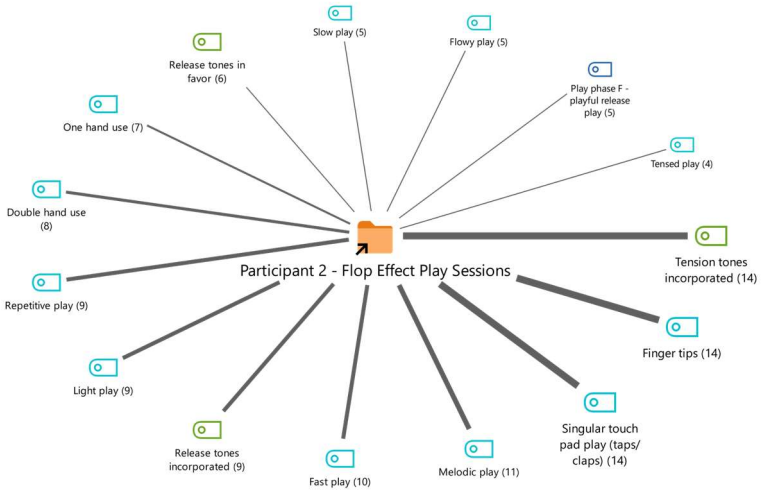


P2

P2 - Top effect play behavior characteristics



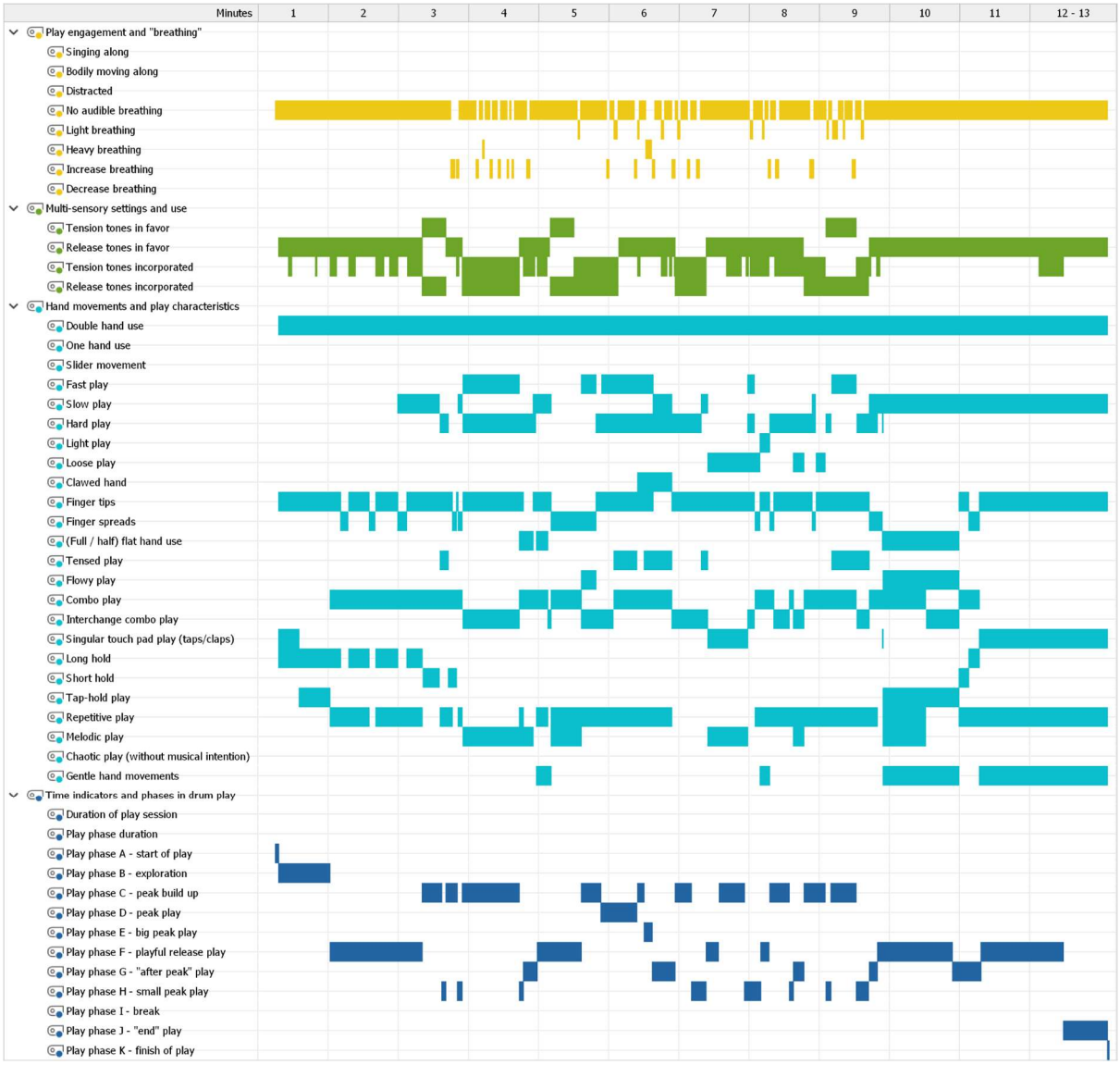
P2 - Flop effect play behavior characteristics



Video Annotation Codelines

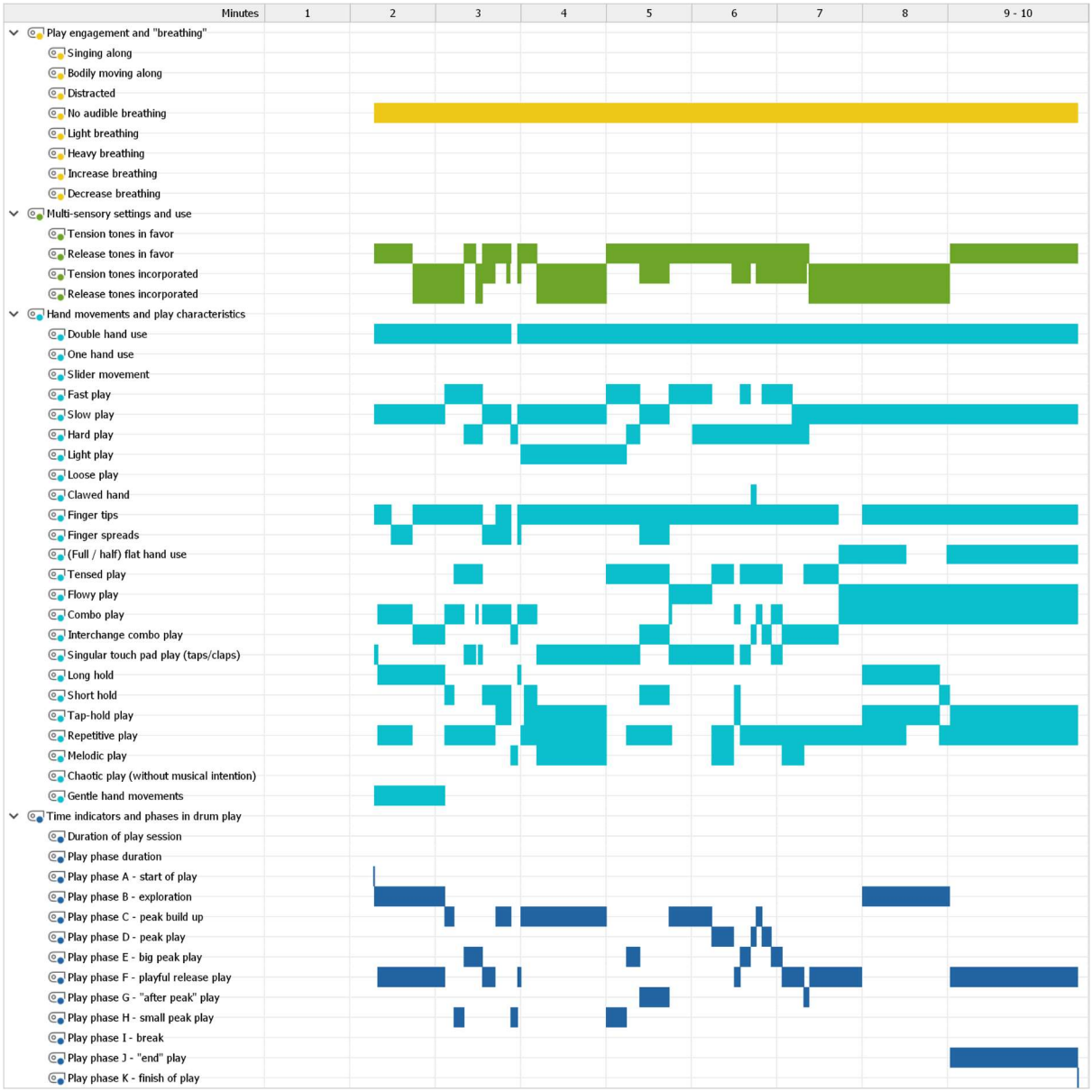
P0

Top play session-1



Top Play Session-2

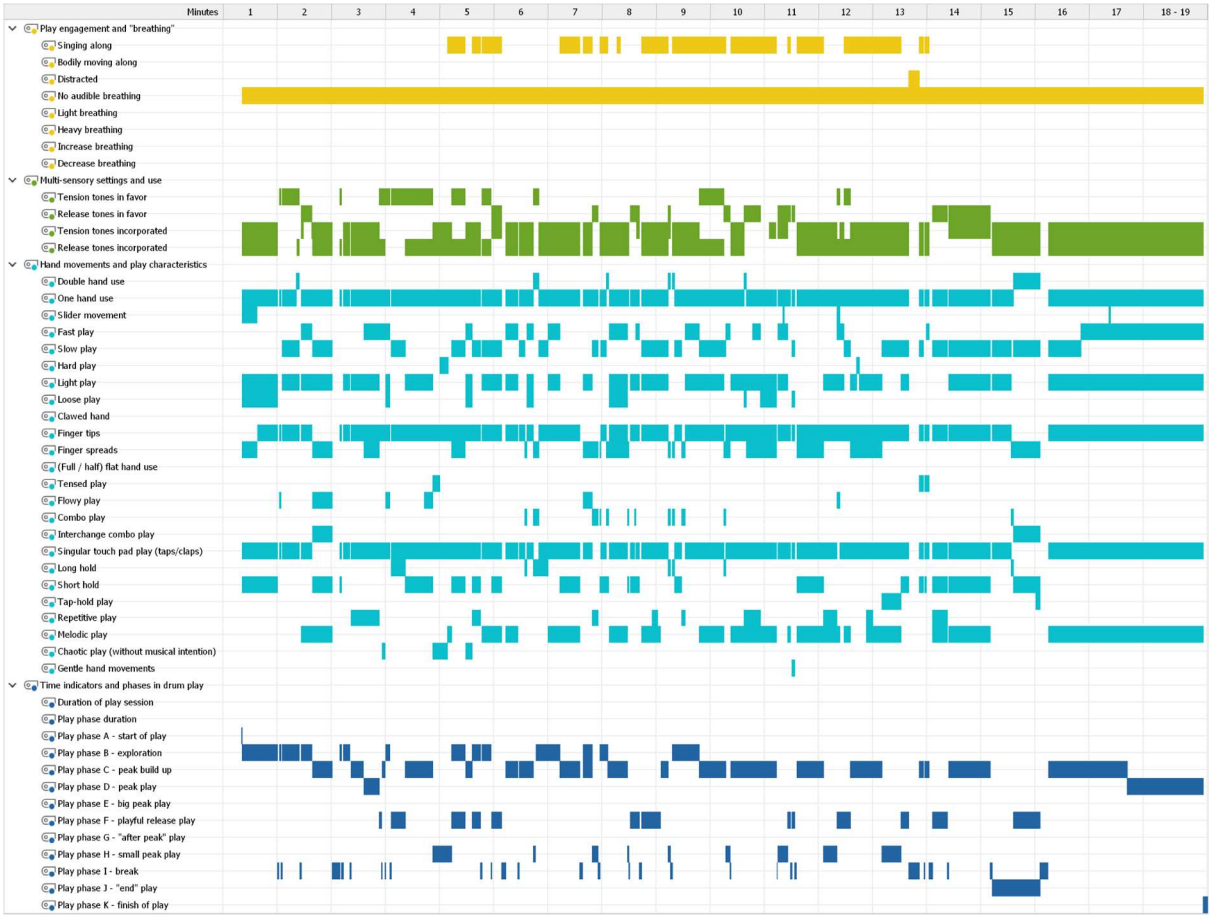
Flop Play Session



P1

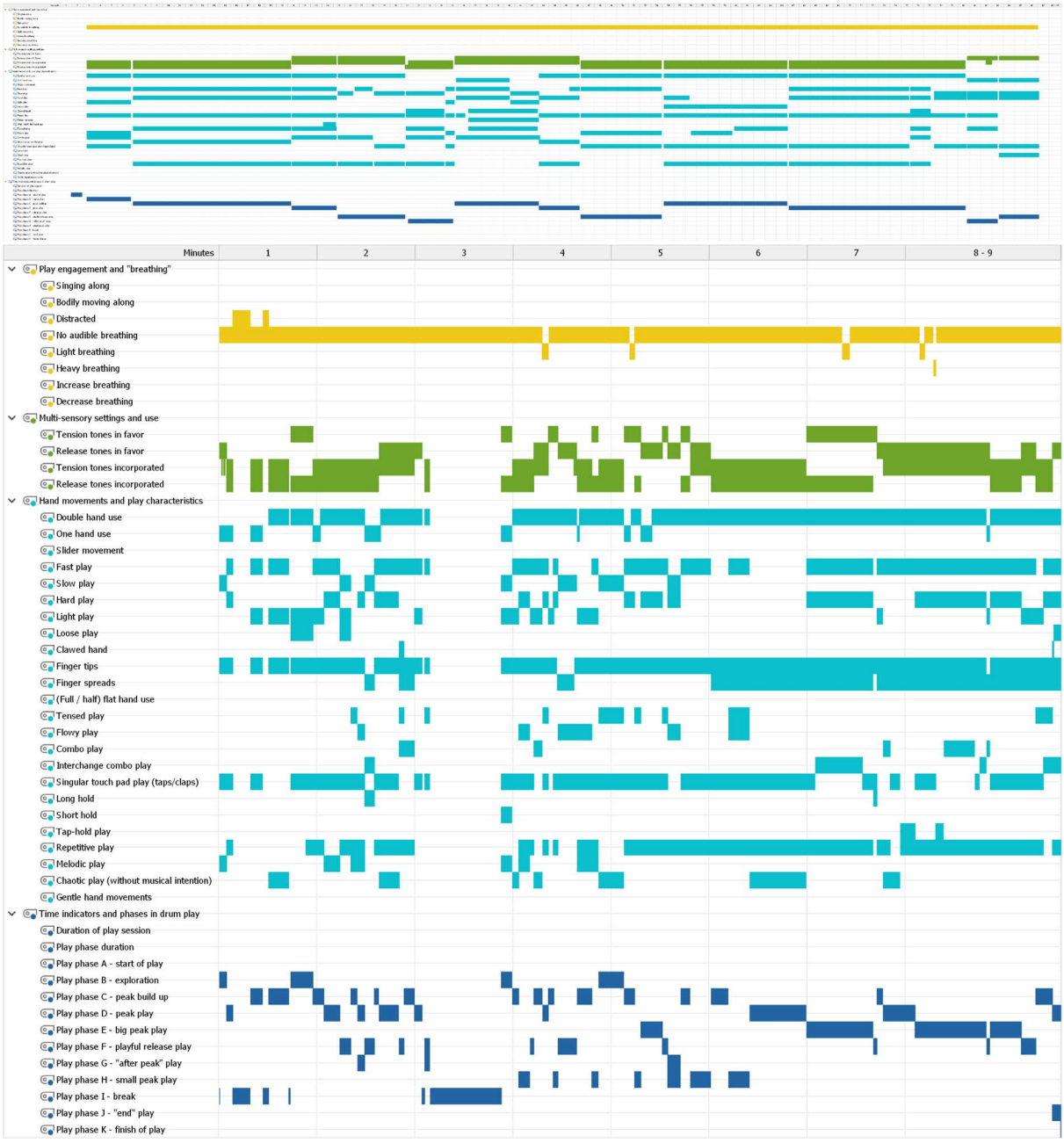
Top Play Session

Flop Play Session

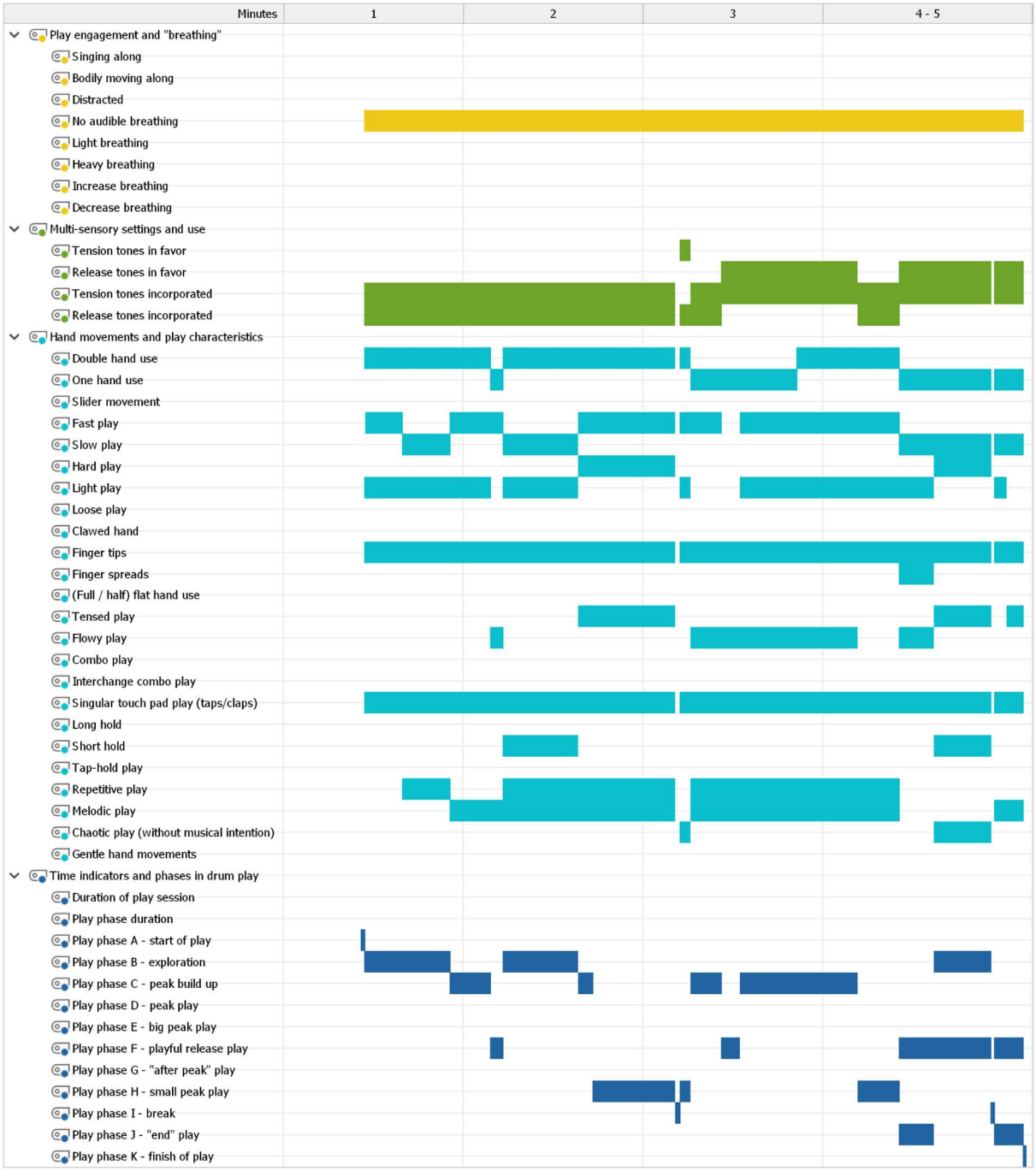


P2

Top Play Session



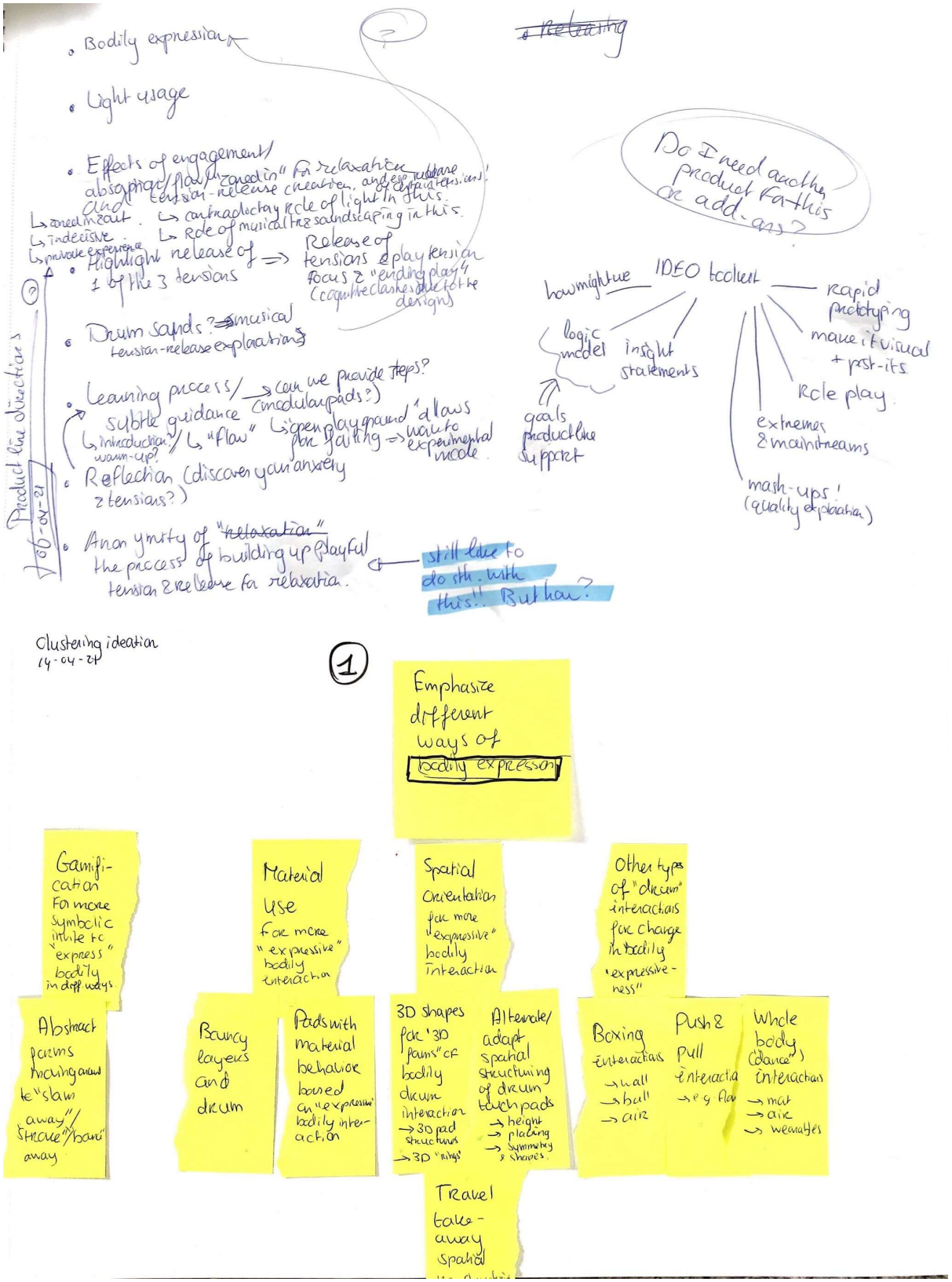
Flop Play Session


Minutes
1
2
3
4 - 5
Play engagement and "breathing"
Singing along
Bodily moving along
Distracted
No audible breathing
Light breathing
Heavy breathing
Increase breathing
Decrease breathing
Multi-sensory settings and use
Tension tones in favor
Release tones in favor
Tension tones incorporated
Release tones incorporated
Hand movements and play characteristics
Double hand use
One hand use
Slider movement
Fast play
Slow play
Hard play
Light play
Loose play
Clawed hand
Finger tips
Finger spreads
(Full / half) flat hand use
Tensed play
Flowy play
Combo play
Interchange combo play
Singular touch pad play (taps/claps)
Long hold
Short hold
Tap-hold play
Repetitive play
Melodic play
Chaotic play (without musical intention)
Gentle hand movements
Time indicators and phases in drum play
Duration of play session
Play phase duration
Play phase A - start of play
Play phase B - exploration
Play phase C - peak build up
Play phase D - peak play
Play phase E - big peak play
Play phase F - playful release play
Play phase G - "after peak" play
Play phase H - small peak play
Play phase I - break
Play phase J - "end" play
Play phase K - finish of play

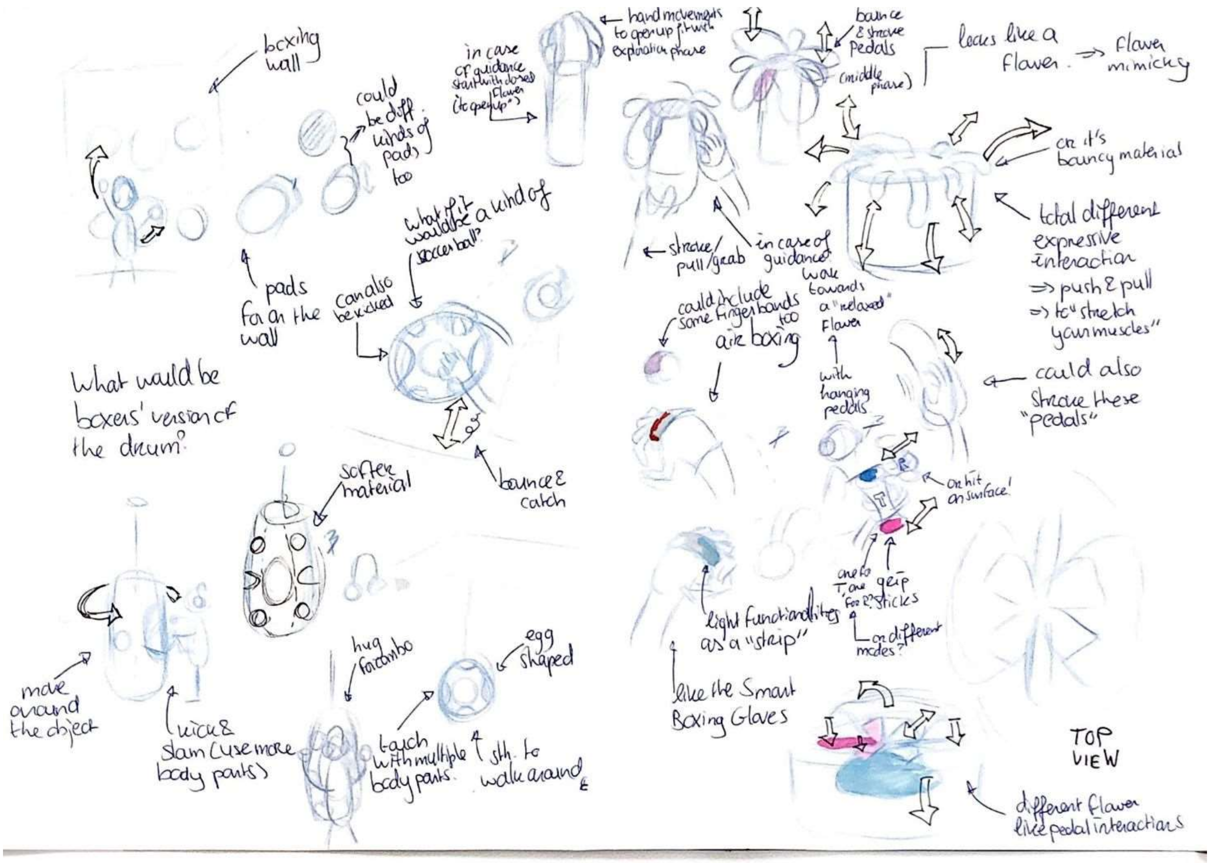
APPENDIX J: CONCEPT VISUALS

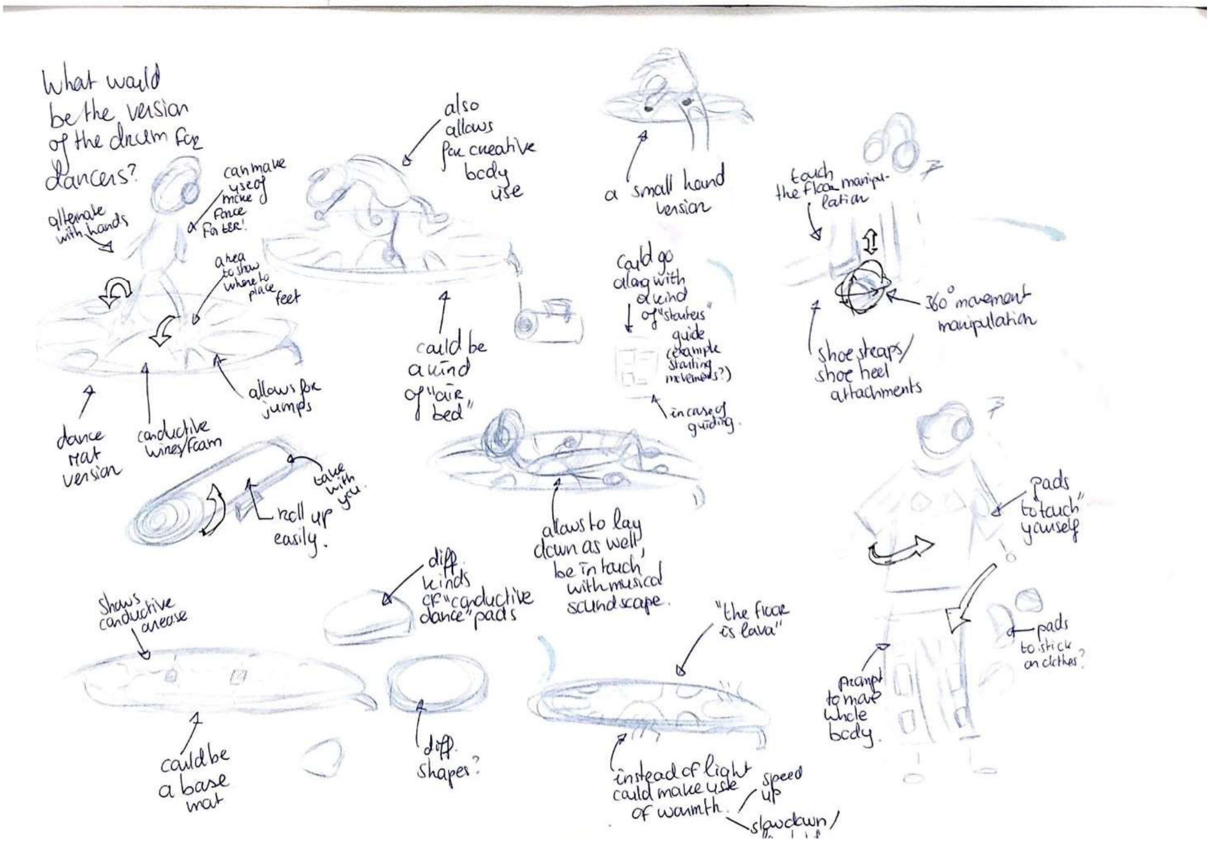
Iteration 1

Ideation & Concept Sketches




① Emphasize different ways of bodily expression
↳ optimize release of bodily tensions
↳ optimize expressive playful creation
adapt chosen pads over time.
customize your own drum
pads with certain adaptive/ reactive behavior
based on "force" (body weight)
3D shaped pads
pads that slowly curl up when "used a lot" or when increased tension so they invite for flat hand/ stroking
curls up
or bounces back
"reactive sinuses?" replay-in
play with wave forms to unlock expanded play behavior
can we play with the height of pads? & inserts?
bouncy layer
whole drum from "bouncy" material
get metal pad off
get bouncy pad in
or just a few.
set of "bounce pads"
diff. sizes
diff. bouncy-ness
pads that are "over reactive"
invite for gentle touches
invite for more body movement (in the air)
could have "reactive hairs"
"funny pads" that invite for stroking"
Spatial re-arrangements For bodily expressiveness
spatial modular elements to create more bodily expressive freedom
still connected to the main casing
play with fingertips vs. hands
how can we effect more expressive combo play?
play with symmetry
get pads off to rearrange
still connected to the main casing.
prompt use of "clawed / loose" fingertips to build up more expressively
play with symmetry & asymmetry
more flowy movements
connected areas
prompt different expressive combo play
outlines are visible
pads "überzichtig"
whole plate = metal?
whole play pad area appears and dissappears to prompt fast play
"print your own casings!"
in seat of a situated casing
e.g. this is the "home casing"
print your own casing!
same kind of travel casing. → to putting a few favorite pads.
Create different spatial structuring but keep the identical tile mapping
different arrangements of tiles.


boxing wall
could be diff. kinds of pads too
pads for on the wall
What would be boxers' version of the drum?
what if it would be a kind of soccer ball?
can also be kicked
bounce & catch
softer material
move around the object
kick & slam (use more body parts)
hug for combo
egg shaped
touch with multiple body parts
sth. to walk around
in case of guidance start with closed flower (to open up)
hand movements to open up flower with exploration phase
bounce & stroke pedals
(middle phase)
looks like a flower → flower mimicky
or it's bouncy material
total different expressive interaction
⇒ push & pull
⇒ to "stretch your muscles"
stroke/ pull/grab
in case of guidance
could include some finger bands too
air boxing
walk towards a "relaxed" flower
with hanging pedals
could also stroke these "pedals"
or hit on surface!
one to grip, one for sticks
or different modes?
light functionalities as a "strip"
like the Smart Boxing Gloves
TOP VIEW
different flower like pedal interactions


What would be the version of the drum for dancers?
can make use of more force for BBR!
alternate with hands
area to show where to place feet
dance mat version
conductive wires/foam
allows for jumps
also allows for creative body use
could be a kind of "air bed"
a small hand version
could go along with a kind of "starters" guide (example starting movements?)
in case of guiding
touch the floor manipulation
360° movement manipulation
shoe straps/ shoe heel attachments
roll up easily.
take with you.
allows to lay down as well, be in touch with musical soundscape.
pads to touch yourself
shows conductive areas
diff. kinds of "conductive dance" pads
"the floor is lava"
pads to stick on clothes?
prompt to move whole body.
could be a base mat
diff. shapes?
instead of light could make use of warmth.
speed up
slowdown/

Clustering ideation
14-04-21

(2)

Improved Light interaction for playful T-R creation and engagement in play

"Light" to especially support playful tension-release creation

Light feedback that shows the ~~rate~~ musical and playful tension-release behavior

Light rings to show 3 levels of musical tension/release

All pads different light colors within their musical

Light waves to show playful intensity, within a musical t-r level

Light waves to show amount of musical release/tension within a musical t-r level

Situational light waves or whole ring light waves

Overlapping light waves to show the musical tension or release created in play combos

Extra multi-sensory layer to ~~be~~ "check" playful tension-release build up

"Light" to enhance (continuous) engagement

Light that fades away with high playful intensity; and appears with low playful intensity

Calm down light waves with high if play intensity is low

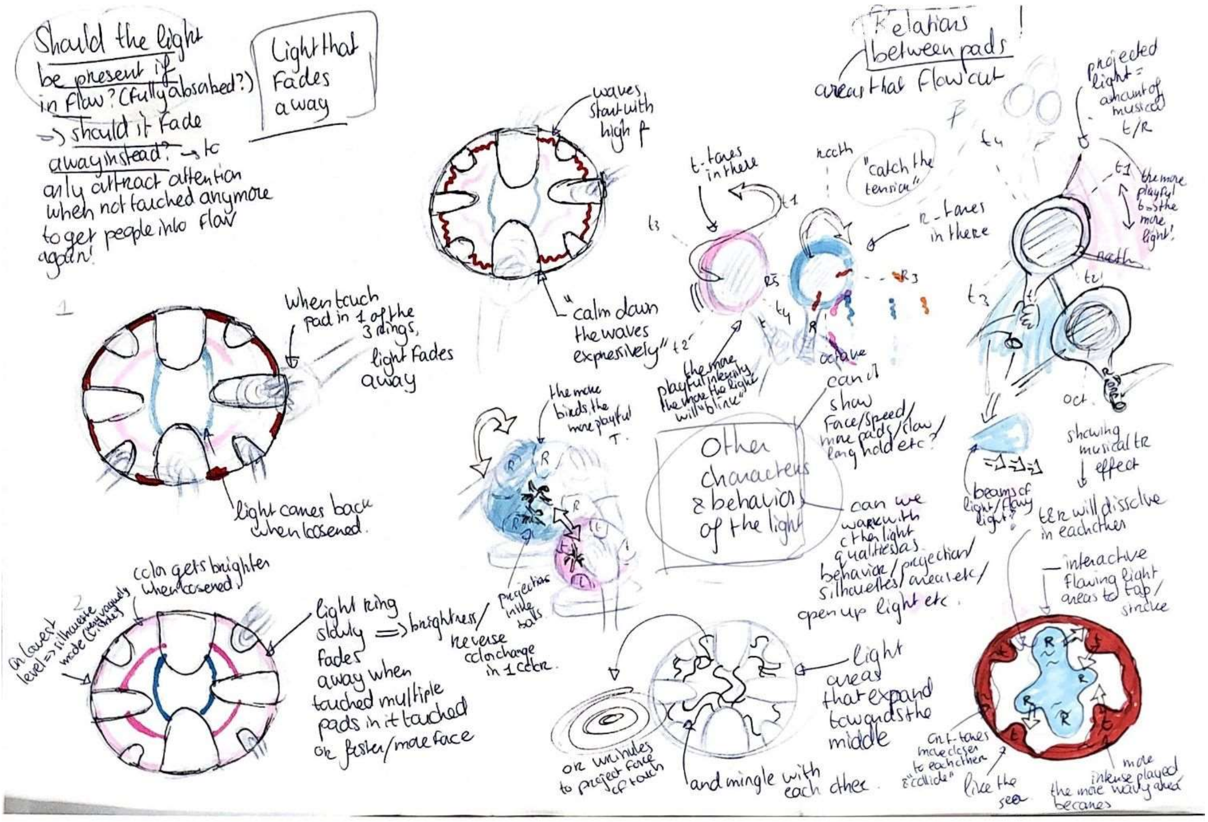
Use of other light characteristics (other than color change)

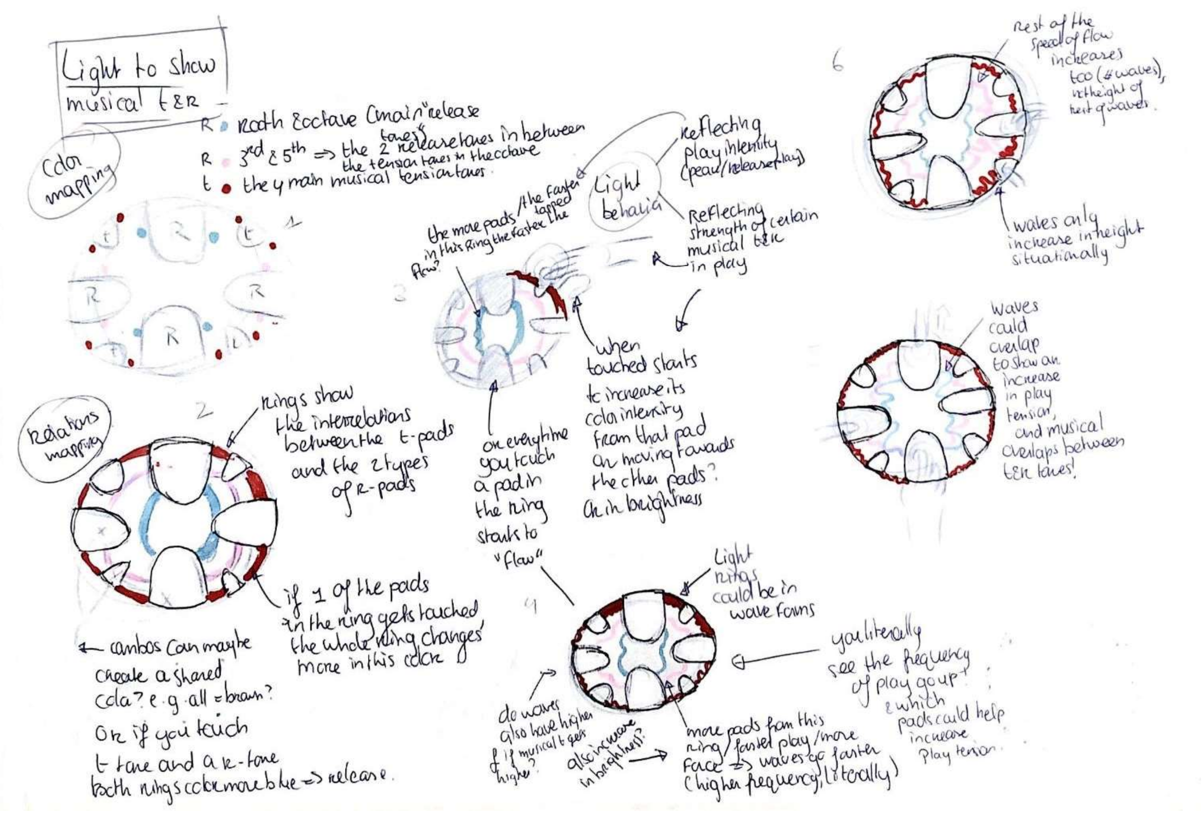
Behavioral areas of light (unique symbolic light interaction) → waves → overlapping areas → "rivers"

Light projection through "expressive" play movements

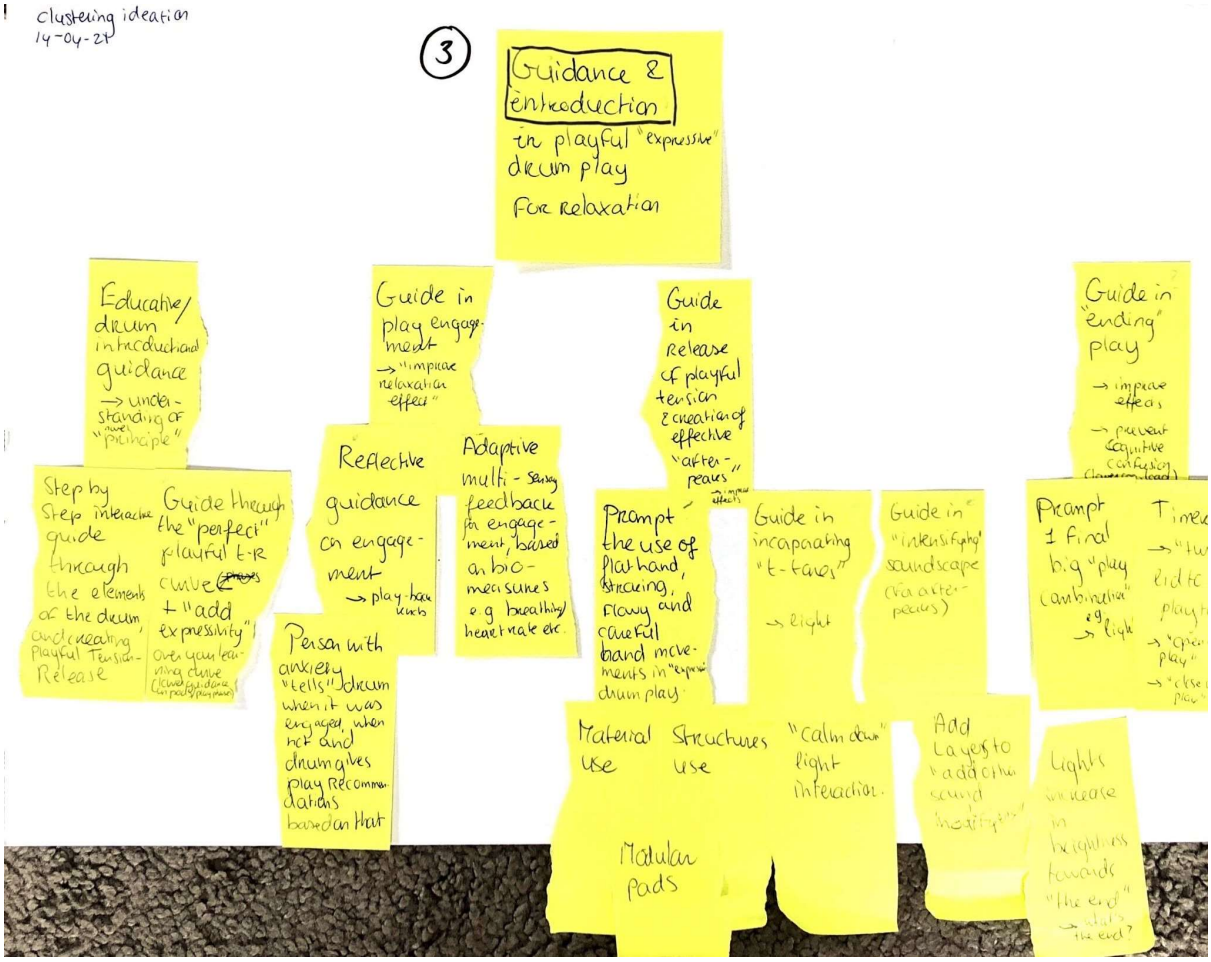
Reflecting playful tension-release with areas of projection; and musical tension-release with "color overlap"

Projected "creatures" Reflecting playful tension-rele created


Should the light be present if in Flow? (fully absorbed?) => should it fade away instead? → to only attract attention when not touched anymore to get people into flow again!
Light that Fades away
waves start with high f
"calm down the waves expressively" t2
1
When touch pad in 1 of the 3 rings, light fades away
light comes back when loosened.
2
color gets brighter when loosened.
light ring slowly fades away when touched multiple pads in it touched or faster/more force
=> brightness / reverse color change in 1 color.
Relations between pads!
areas that flow out
"catch the tension"
t-tones in there
R-tones in there
root
octave
the more playful intensity the more the light will "blink"
projected light = amount of musical t/R
the more playful t => the more light!
the more binds the more playful T.
projections in the balls
Other characters & behavior of the light
can it show force/speed/more pads/flow/long hold etc?
can we work with other light qualities as behavior/projection/silhouettes/areas etc/open up light etc.
beams of light/flowy light?
showing musical t/R effect
t&R will dissolve in eachother
interactive flowing light areas to tap/stroke
light areas that expand towards the middle
and mingle with each other
or wrinkles to project force of touch
like the sea
the more intense played the more wavy area becomes


Light to show musical t&R
Color mapping
R root & octave (main release tones)
R 3rd & 5th => the 2 release tones in between the tension tones in the octave
t the 4 main musical tension tones
Relations mapping
2
rings show the interrelations between the t-pads and the 2 types of R-pads
if 1 of the pads in the ring gets touched the whole ring changes more in this color
← combos can maybe create a shared color? e.g. all = brown? Or if you touch t-tone and a R-tone both rings color more blue => release.
Light behavior
Reflecting play intensity (peak/release play)
Reflecting strength of certain musical t&R in play
the more pads/the faster tapped in this ring the faster the flow
3
or everytime you touch a pad in the ring starts to "flow"
when touched starts to increase its color intensity from that pad on moving towards the other pads? or in brightness
4
Light rings could be in wave forms
you literally see the frequency of play go up & which pads could help increase play tension
do waves also have higher if musical t gets higher?
also increase in brightness?
more pads from this ring, faster play/more force => waves go faster (higher frequency, literally)
6
rest of the speed of flow increases too (# waves), not height of waves
waves only increase in height situationally
Waves could overlap to show an increase in play tension, and musical overlaps between t&R tones!

clustering ideation
14-04-21



Introduction to play, guide in understanding, & effective play

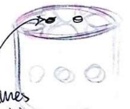
1. understand goal = build up to expressive peak & release, in own way → no failing
2. understand role of multi-sensory feedback to create peak(s) and absorb in play → "zoned in"
   (musical tension & release experience)
3. Play around with musical T&R + experience effect of light to build up playful TR
   (Get to know "relaxation" play) — guide through 6 rounds of play?
   / diff. musical tone settings
   \ diff hand movements / combos to make for TER
   T: combo, body weight, speed, tensed fingers, "melodies"
   R: slow combo, flat hand, select t-tone, R-tones
4. Choose preferred tones (reflection) — emot. inducement/relax inducement/em. expression tones etc.
   — what do you want to relax & release tension / tensions
   ⇒ guide through aspects of creating relaxation through play.
5. Play!
   (light function for playful TR, and absorption)

⇒ more educative guidance, very ("understanding") strict, detailed. (step by step guide)

Guide in engagement
(aims to optimally benefit from playful TR creation; goes better when engaged; guidance more open to "expressive play")

1. Try to absorb in play
2. Try to get notice when back to "mindful play"

↑ give 2 tasks & reflect on what they've done → light plays what they've done in "zoned in" & "zoned out" play



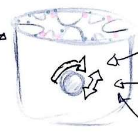
heavily measures breathing
heavy - engaged - light fade away
not - zoned out - light appears back
"learning adaptive" system

⇒ or light recommends some musical play melodies after that
⇒ light disappears when it notices "engaged" & appears when notices "zoned out"

musical tr & light — playful TR

⇒ Ready to play!

gives play recs. after settings

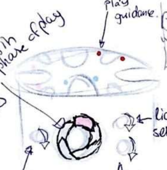


educative guidance

An introduction module that guides you through the "perfect curve" 1 time

maybe + shows some alternations / expressive options ⇐ adding expressivity over play experience instead of adding certain options for guidance.
(expressivity add ons? (instead of guidance add ons))

- start very guided
- work towards more expressive play.



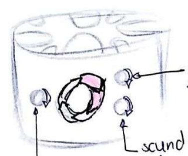
Base play = "the perfect curve"
5 phases:
- exp. phase
- build towards 1 peak
- peak play
- "after" peaks
- "end play"

determine # guidance you want in play

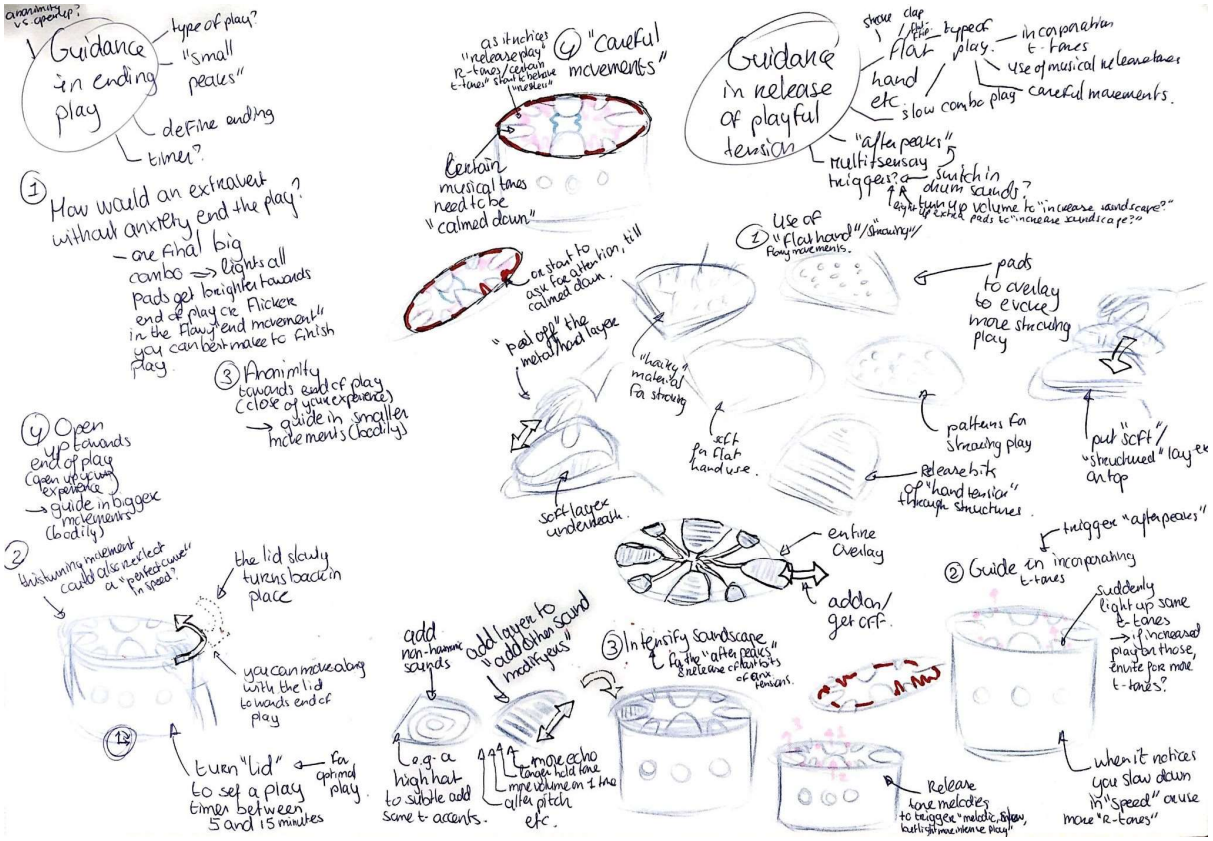
⇒ over time

Lower amount of guidance ⇒ higher expressivity

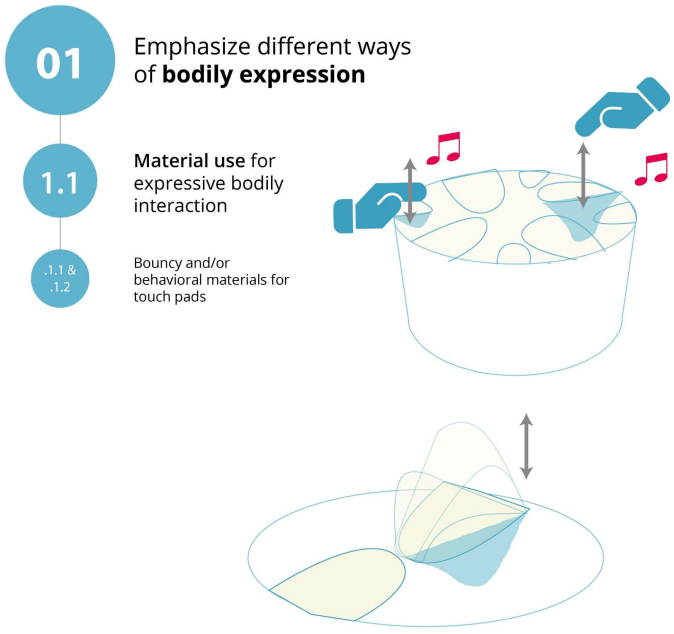
← or add some tokens that eliminates any guidance on certain touch pads e.g. the "release" tones.

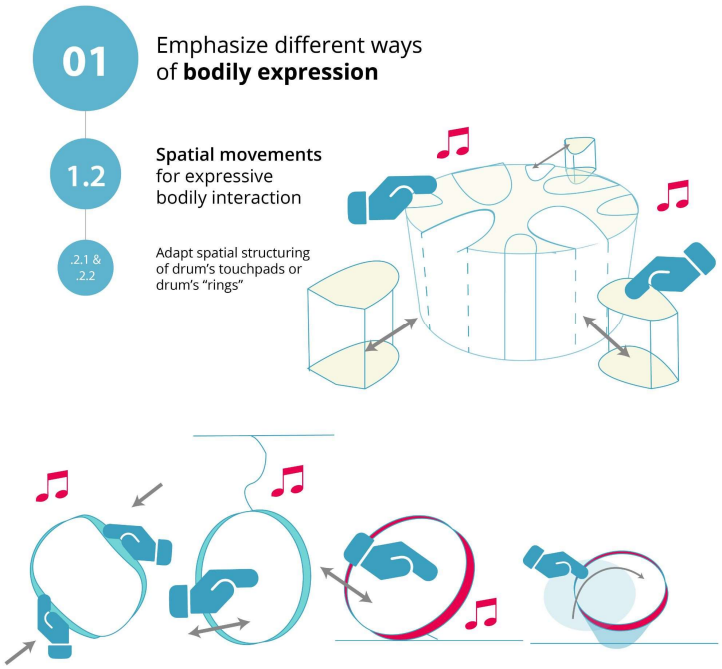


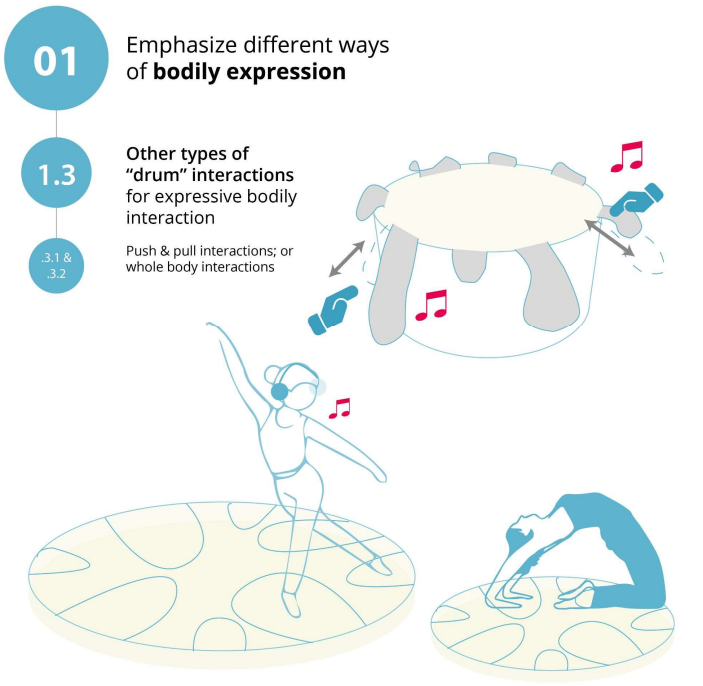
determine in which phase(s) you still want guidance ← e.g. "after peaks" and "explanation phase"



First Iteration of Concept Visuals



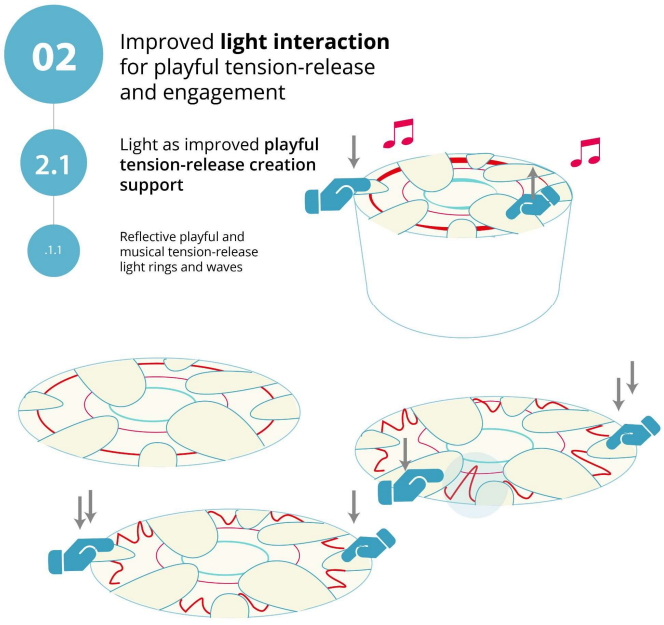


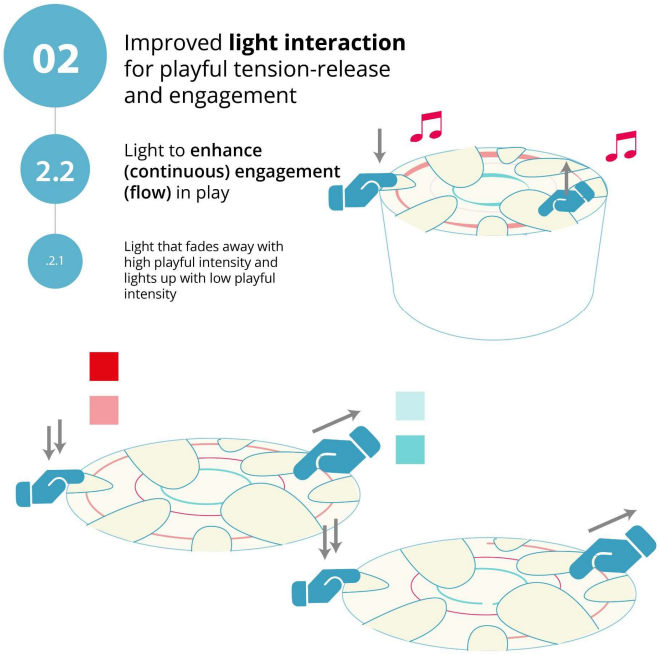


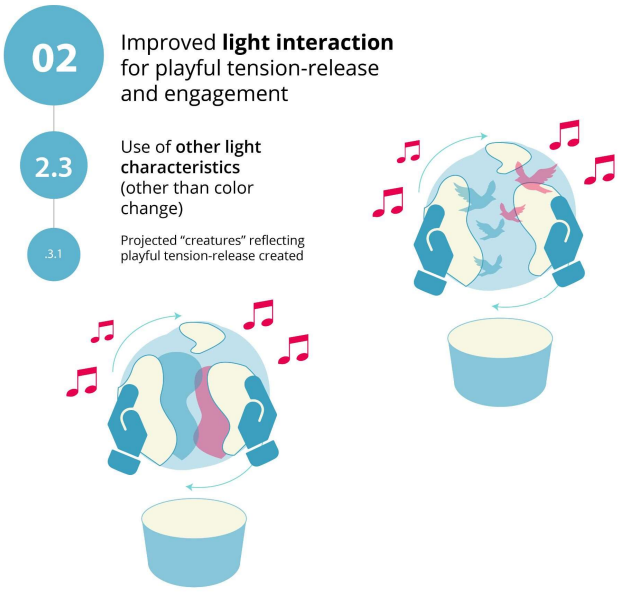
Concept combination 1.1 centers around the emphasis of increased bodily expression in drum play interaction through use of facilitating (interactive) materials for the touchpads of the drum. In the upper visual the use of bouncy material for the drum touchpads to create increased hand and arm expressivity, creating bigger/wider hand or arm movements during drum play is emphasized. In the lower visual, the use of deforming interactive material for the drum touchpads is illustrated. Drum pad material that moves up or down to elicit more expressive hand and arm movements could improve the support in optimizing expressive bodily drum play, and so the release of bodily responses to anxiety.

Concept combination 1.2 centers around enhanced bodily expression possibilities in drum play through the use of improved ability for spatial movements. The upper visual illustrates an improved concept of the drum in which the touchpads are not statically fixed within the drum. These are now able to move out to a more wide and flexible spatial position which could improve the support in optimizing expressive bodily drum play, and wider / flexible arm movements. Furthermore, the lower visual illustrates the concept of deformable light rings (this could be a singular ring or a set of multiple) which allow the person with elevated anxiety to move hands through the ring(s) or deform the ring for more bodily expressive drum interactions and more flexibility in the type of bodily drum interactions.

Concept combination 1.3 centers around enhanced bodily and expressive drum interactions, making use of different drum interactions than hand-based touch movements. The upper visual illustrates an improved concept in which the touch pads exist out of rubber hanging bands that can be bent, pulled out and released. Making use of a physical push and pull interaction, emphasizing the notion of playful tension-release in a more physical manner as well. Next to that, the lower visual illustrates the translation of the RELAX-CHANGE drum into a floor based, drum mat. In this way, the whole body and multiple body parts can be used for drum play instead of just the arms and hands. This could elicit a much more bodily and expressive multi-sensory drum play interaction, allowing for optimized support in expressive bodily drum play and so the release of bodily responses to anxiety.





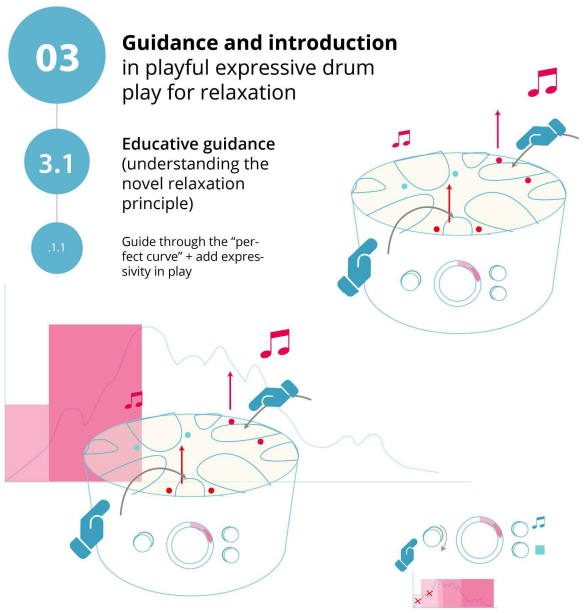


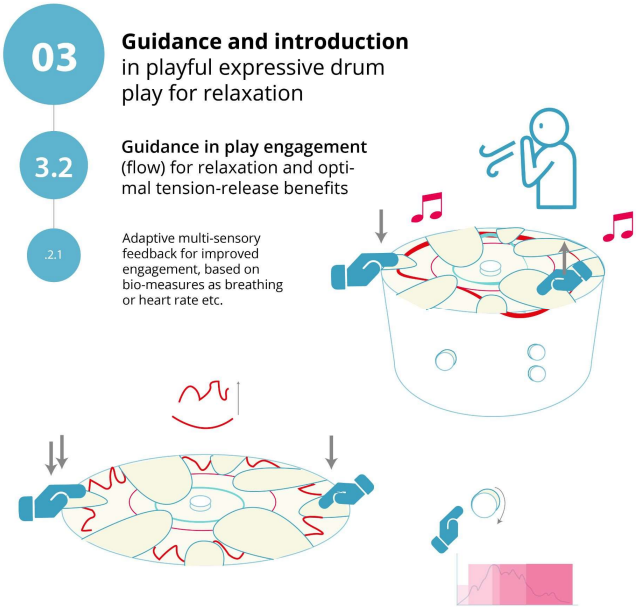
Concept 2.1 light waves, centers around light interaction that more clearly reflects its function to support the person with anxiety in building up the playful tension (expressive drum play intensity) and releasing playful tension (lowering expressive drum play intensity). Instead of pairs of light for each touchpad that change in color when the playful intensity is built up using the corresponding touched drum pads, light rings are used that start to "wave" playful intensity is increased on corresponding touch pads. The frequency of the "waves" in the light rings will increase with more expressive drum play, and will decrease with lower expressive drum play. Next to that, the three rings reflect the role of the touchpads in creating musical and playful tension. The widest light ring connects the musical tension tones, and in this way also more clearly connects the small touch pads as tones to create

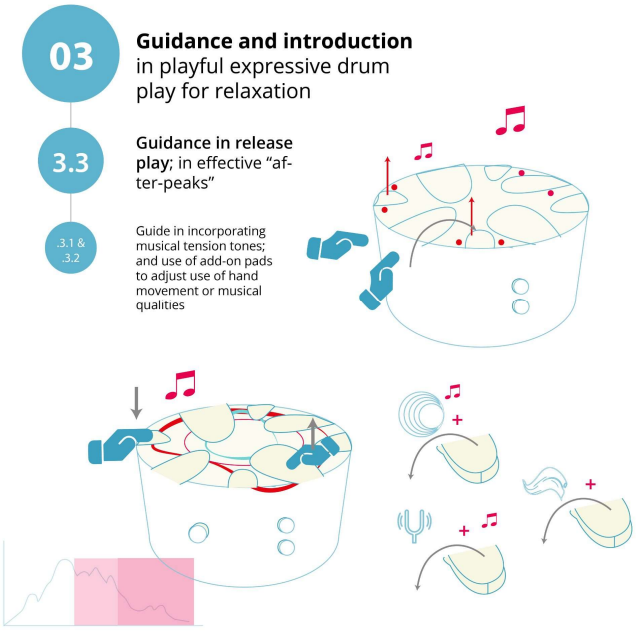
musical tension. The middle ring connects the two musical release tones that create slight musical tension within the scale of 8 tones, and the smallest ring connects the musical release tones forming the base tone and octave within the scale of 8 tones. Furthermore, the color of the rings reflects the amount of “musical tension” that the touchpads in these light rings can create, so in other words, the amount of support they can offer in building up the playful intensity in drum play. The outer light ring corresponds to the touch pads which can create the most “musical tension”, and therefore exists out of warm red light (outer ring); the middle ring therefore has pink-ish light and the inner light ring creating lowest “musical tension” has blue light.

Concept 2.2 centers around light interaction that more clearly reflects its function to support in playful tension-release building, and improving the ability of the light feedback to engage the person with anxiety into play. Instead of that light rings in the drum reflect more expressivity, when playful intensity is increased in drum play, the light rings fade away to elicit new drum interactions when releasing the drum touchpads. This invites the person with anxiety who plays the drum to keep on interacting with the drum pads and keep on engaging in drum play.

Concept combination 2.3 centers around light interaction that makes use of other light characteristics as color change to reflect and support playful tension-release building in drum play. Especially through making use of more abstract forms of light interaction, using red and blue light areas flowing from drum touchpads to reflect increasing or decreasing playful expressivity in drumming. Or by making use of more symbolic forms of light interactions such as the concept of projecting red and blue birds that fly with the frequency of playful expressivity in drumming.







Concept 3.1 centers around a guiding mechanism within the drum that educates the person with anxiety on how to build up and release expressive and playful intensity during drum play in the most optimal way to create optimal relaxation effects. Therefore, in this concept, the person with anxiety is guided through about 5 phases of playful tension-release building, e.g. based on the play phases of P0 in her "top" effect drum session, through the light feedback. The phase transitions and phase progress are also shown on the front of the drum.

Furthermore, in this concept it is included to lower guidance and so increase the amount of expressive drum play, by turning off the guidance in certain play phases with the knobs on the front of the drum.

Concept 3.2 centers around the use of bio-information, such as measured breathing or transpiration, to create guiding light patterns to support within the engagement in drum play or playful tension-release building. This is based on the increased depth of breathing experienced by P0 when she increased her playful and expressive intensity during drum play, or her increased hand transpiration in the beginning of play being very anxious. These biological parameters could support guiding mechanisms in the drum to enhance engagement in play or playful intensity building.

Concept 3.3 centers around the implementation of extra touchpads which can be added on top of the existing drum touchpads to be able to adjust extra musical qualities, instead of only musical tones. The adjustment of extra musical qualities could for example include adjusting the pitch of a certain musical tone, the distortion or volume of a singular tone. With these add-ons, the person with anxiety can guide him or herself in creating more optimal multi-sensory expressiveness in drum play and so relaxation effects.

APPENDIX K: PROTOTYPE TECHNICALITIES

RELAX-CHANGE Prototype Document
Made by Tijmen Tubbing, electrical engineering student and collaborator on the realization of the RELAX-CHANGE prototype. This collaboration started in M2.1 and finished halfway through the process of this final master thesis.

Relax-Change guidelines and information to the hardware and programming

Tijmen Tubbing

12-02-2021

Introduction

This document is created in order to supply information about the creation/installation and the use of the Relax-Change device. This document is written as reference for the client Veerle van Wijlen. Further edits are not excluded as this document can never fully supply all answers to all information around the product.

Requirements

Controllers:

- Arduino uno
- Raspberry pi(Only tested on the RPI4)
- MakeyMakey

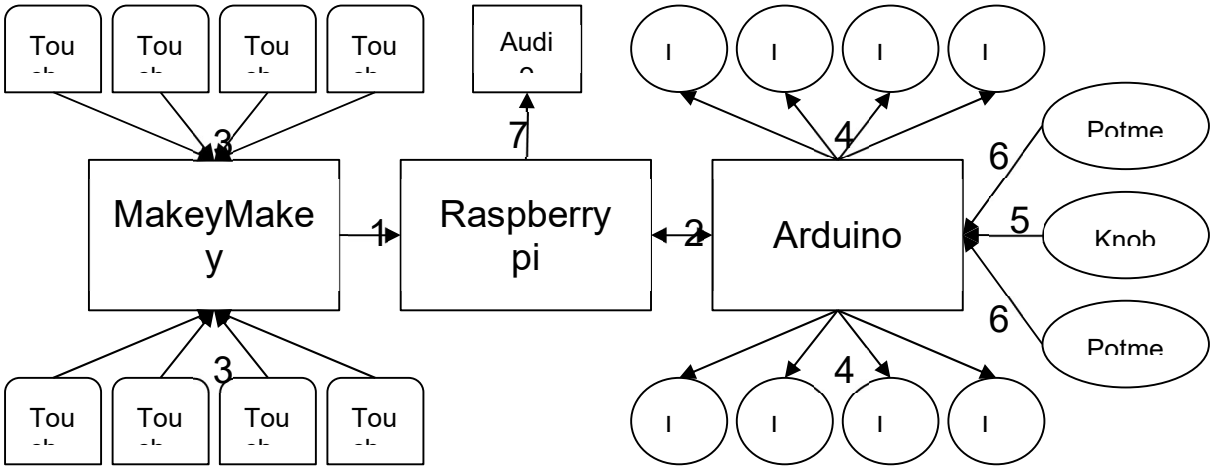
Connections:

- Perfboard
- Connection wires
- Jumper wires
- Alligator clipped wires(For the MakeyMakey)
- Cables for the boards

Other components:

- Case with touchpads
- Leds
- Header pins
- Power supply(For the Raspberry pi)

Hardware layout



1 Transfers the keys pressed from the MakeyMakey to the Raspberry pi
2 Transfers the keys pressed from the Raspberry pi to the arduino; receives the volume and knob value
3 Touchpad input
4 Led output
5 Knob input
6 Potmeter input
7 Audio output

Installation

Audio

Connect the headphones to the Raspberry pi

Arduino

Upload the code supplied in appendix A and connect the arduino to the Raspberry pi

MakeyMakey

Upload the code supplied in appendix B and connect the MakeyMakey to the Raspberry pi

Raspberry pi

1 Install the Raspberry pi OS lite on a micro usb
2 Create folder a folder named ssh on the micro usb
3 Put the micro usb in the Raspberry pi
4 Connect to the Raspberry pi over ethernet
5 Configure the Raspberry pi
    a Set password
    b Connect over wifi
    c Install required packages and python modules
    d Set the right audio card
6 Download the code supplied in appendix C

Use

First use

1 Connect the raspberry pi to power
1b Connect raspberry pi with network cable
2 Connect to the raspberry pi over ssh for example ssh pi@raspberrypi (!!! note this has to be a shared ethernet connection, change settings in Network Connections panel of laptop)
3 Run sudo raspi-config in terminal
4 Go to systems-options; wireless lan
5 Select wifi name and password
6 Get network cable out
7 Connect over ssh with ssh pi@192.168.1.100
8 Go cd relax-change
9 Run any make or data command
10 Ctrl + c when done with make or data command
11 Shutdown when done with sudo shutdown now
12 Wait for a couple of seconds to disconnect the power

Default use

1 Connect the raspberry pi to power
2 Connect to the raspberry pi over ssh for example ssh pi@192.168.1.100
3 Navigate to the relax-change directory for example cd relax-change
4 Use the make commands to run the code
5 Ctrl+c when done with any make or data command
6 Shutdown when done with sudo shutdown now (now is also part of the command)
7 Wait for a couple of seconds to disconnect the power

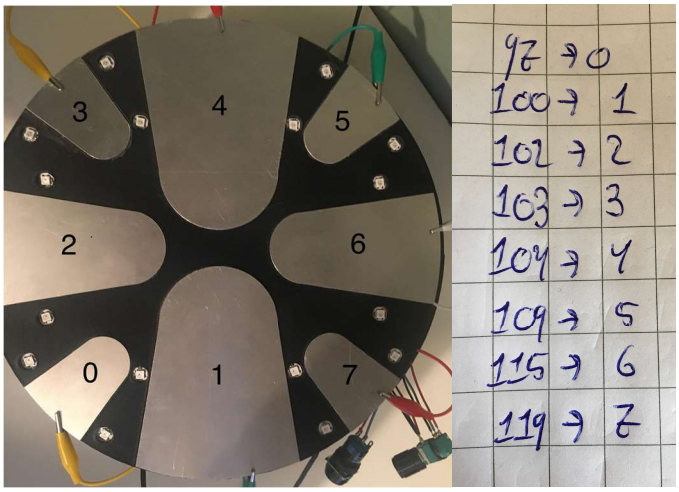
Upload sounds

Download files to raspberry pi for example scp -r Downloads/Tones pi@192.168.1.100:relax-change/Tones

Change sounds

1 Connect to the raspberry pi
2 In the relax-change folder run make edit
3 Edit the music path to the desired music path
4 The program will read *.wav where * are the numbers 0 to 7 for example 3.wav
5 To go out of make edit, press Ctrl+x, Y, ENTER to save changes

Note this are the corresponding touchpads per numbers



Change wifi-network

This can be done by connecting the Raspberry pi over ethernet. Then open sudo raspi-config in the terminal and go to systems-options then to wireless lan. Then click finish.

Extract event-data

Open a new cmd panel to put in the scp command!

Download data to your computer with scp to be used as scp user@source:file user@desitnation:file
(For example scp pi@192.168.1.100:relax-change/event-data.csv Downloads
or scp pi@192.168.1.100:relax-change/event-data.csv C:\Users\s158835\Downloads\

Or scp pi@raspberrypi:relax-change/event-data.csv C:\Users\s158835\Downloads\ if you have the network cable plugged in instead of wifi connection)

When you press the right part of your mouse you past the scp line into the cmd panel, and if you wanna use this line again, then press the ^ up button so you can reuse the scp line in the cmd panel.

Note key is equal to the following

Extract Frequency graph

make data_run - runs data program

Download the graph to your computer with scp to be used as scp user@source:file user@desitnation:file
(For example scp pi@192.168.1.100:relax-change/Frequency.png Downloads)

Make commands

1 make - runs the program (if you want to go out the make, then press Ctrl+c)
2 make edit - opens main.py for editing
3 make data_run - runs data program
4 make data_edit - opens data.py for editing

Finding ip address

Use the command ip a in terminal
Note default 192.168.1.100

Default credentials

Username → pi
Password → Relax-Change

Solutions to errors

Couldn’t connect over wifi

Sudo raspi-config → interface options → P2 ssh → Yes

Appendix

A

Arduino

```
#include <FastLED.h>

#define LEDPIN     2
#define LEDPIN2    3
#define LEDPIN3    4
#define LEDPIN4    5
#define LEDPIN5    6
#define LEDPIN6    7
#define LEDPIN7    8
#define LEDPIN8    9
#define NUMOFLEDS  2

unsigned long timer = 0;

// {50, 33, 206} Min touch value
// {254, 0, 7} Max touch value


//  The acceleration
int rgb_change[8][3] = {
  {0, 0, 0},
  {0, 0, 0},
  {0, 0, 0},
  {0, 0, 0},
  {0, 0, 0},
  {0, 0, 0},
  {0, 0, 0},
  {0, 0, 0},
};


// The current rgb value
int rgb_value[8][3] = {
  {50, 33, 206},
  {50, 33, 206},
  {50, 33, 206},
  {50, 33, 206},
  {50, 33, 206},
  {50, 33, 206},
  {50, 33, 206},
  {50, 33, 206},
};
```

```
CRGB leds[8][NUMOFLEDS];

void setup() {
  FastLED.addLeds<WS2812, LEDPIN, GRB>(leds[0], NUMOFLEDS);
  FastLED.addLeds<WS2812, LEDPIN2, GRB>(leds[1], NUMOFLEDS);
  FastLED.addLeds<WS2812, LEDPIN3, GRB>(leds[2], NUMOFLEDS);
  FastLED.addLeds<WS2812, LEDPIN4, GRB>(leds[3], NUMOFLEDS);
  FastLED.addLeds<WS2812, LEDPIN5, GRB>(leds[4], NUMOFLEDS);
  FastLED.addLeds<WS2812, LEDPIN6, GRB>(leds[5], NUMOFLEDS);
  FastLED.addLeds<WS2812, LEDPIN7, GRB>(leds[6], NUMOFLEDS);
  FastLED.addLeds<WS2812, LEDPIN8, GRB>(leds[7], NUMOFLEDS);
  pinMode(10, INPUT);
  Serial.begin(9600);
  timer = millis();
}

void loop() {
    // Checkes if the serial has a value and if so changes the color change based on that value
    if (Serial.available() > 0) {
      int ledNumber = Serial.read() - '0';
     switch(ledNumber){
        case 0:
          change_rgb(0);
          break;
        case 1:
          change_rgb(1);
          break;
        case 2:
          change_rgb(2);
          break;
        case 3:
          change_rgb(3);
          break;
        case 4:
          change_rgb(4);
          break;
        case 5:
          change_rgb(5);
          break;
        case 6:
          change_rgb(6);
          break;
        case 7:
          change_rgb(7);
          break;
        default:
          break;
```

```
  }
}
// Reads the value of the potentio meter and changes the rgb value based on this and the rgb change
int potentio = analogRead(A0);
int val = map(potentio, 0, 1024, 0, 10);
for(int j = 0; j < 8; j++){
 int change = rgb_change[j][0] * val;
 if(change <= (254 - rgb_value[j][0]) && change >= (50 - rgb_value[j][0])){
  rgb_value[j][0] += change;
 }else{
  if(change > 0){
   rgb_value[j][0] = 254;
  }else{
   rgb_value[j][0] = 50;
  }
 }
 change = rgb_change[j][1] * val;
 if(change <= (33 - rgb_value[j][1]) && change >= (0 - rgb_value[j][1])){
  change += change;
 }else{
  if(change > 0){
   rgb_value[j][1] = 33;
  }else{
   rgb_value[j][1] = 0;
  }
 }
 change = rgb_change[j][2] * val;
 if(change <= (206 - rgb_value[j][2]) && change >= (7 - rgb_value[j][2])){
  rgb_value[j][2] += change;
 }else{
  if(change > 0){
   rgb_value[j][2] = 206;
  }else{
   rgb_value[j][2] = 7;
  }
 }
 if(rgb_change[j][0] > -50){
  rgb_change[j][0] -= 1;
 }
 if(rgb_change[j][1] < 50){
  rgb_change[j][1] += 1;
 }
 if(rgb_change[j][2] < 50){
  rgb_change[j][2] += 1;
 }
}
// Sets the rgb value on the hardware
for(int j = 0; j < 8; j++){
```

```
    for(int i = 0; i < NUMOFLEDS; i++){
      leds[j][i] = CRGB (rgb_value[j][0], rgb_value[j][1], rgb_value[j][2]);
    }
    FastLED.show();
  }
  // Reads the potentiometer and knob and writes this to the serial
  if ((millis() - timer) >= 400){
    potentio = analogRead(A1);
    val = map(potentio, 0, 1024, 0, 10);
    Serial.println(val);
    if(digitalRead(10) == HIGH){
      Serial.println("Pressed");
    }else{
      Serial.println("Released");
    }
    timer = millis();
  }
  delay(50);
}

// Change of the rgb value
void change_rgb(int led){
  rgb_change[led][0] = 4;
  rgb_change[led][1] = -4;
  rgb_change[led][2] = -4;
}
```

B

MakeyMakey

```
#define NUM_INPUTS 18

// keys
// edit this array to change the keys pressed
int keys[NUM_INPUTS] = {
  'a','s','d','f','g','m',    // top of makey makey board (up, down, left, right, space, click)
  'h','w','e','r','t', 'y',   // left side of female header
  'z','x','c','v','b','n'     // right side of female header
};

// cap sense threshold for each pin
// this number is proportional to the capacitance on the pin that will count as a press
// it is units of a very small unit of time, in iterations through an unrolled loop
// higher values make it less sensitive (i.e. require larger capacitance)

int capThresholds[NUM_INPUTS] = {
  2, 2, 2, 2, 2, 2,
  2, 2, 2, 2, 2, 2,
  2, 2, 2, 2, 2, 2,
};

int pinNumbers[NUM_INPUTS] = {
  12, 8, 13, 15, 7, 6,
  5, 4, 3, 2, 1, 0,
  23, 22, 21, 20, 19, 18
};

const int outputPin = 14; // pin D14, leftmost pin on the output header

boolean pressed[NUM_INPUTS];

void setup(){
  Serial.begin(9600);
  for (int i=0; i<NUM_INPUTS; i++) {
    pressed[i] = false;
  }

  pinMode(outputPin, OUTPUT);
  digitalWrite(outputPin, LOW);
}

void loop() {
  delay(100);
  for (int i=0; i<NUM_INPUTS; i++) {                    // for each pin
```

```
  if (readCapacitivePin(pinNumbers[i])>capThresholds[i]){       // if we detect a touch on the pin
    if (!pressed[i]) {                                  // and if we're not already pressed
      Serial.print("p");
      Serial.println(keys[i]);                            // send the key press
      pressed[i] = true;                                 // remember it was pressed
    }
  }
  else {                                          // if we don't a detect touch on the pin
    if (pressed[i]) {                                   // if this key was pressed before
        Serial.print("r");
        Serial.println(keys[i]);                          // send the key release
      pressed[i] = false;                               // remember we are not pressed
    }
  }
}

 // OUTPUT
 // output pin D14 goes high while any input is pressed

 boolean anythingIsPressed = false;
 for (int i=0; i<NUM_INPUTS; i++) {
   if (pressed[i]) {
     anythingIsPressed = true;
   }
 }

 if (anythingIsPressed) {
   digitalWrite(outputPin, HIGH);
 }
 else {
   digitalWrite(outputPin, LOW);
 }

}



// CapacitiveSensor tutorial from http://www.arduino.cc/playground/Code/CapacitiveSensor
// readCapacitivePin
//  Input: Arduino pin number
//  Output: A number, from 0 to 17 expressing
//  how much capacitance is on the pin
//  When you touch the pin, or whatever you have
//  attached to it, the number will get higher

uint8_t readCapacitivePin(int pinToMeasure) {
  // Variables used to translate from Arduino to AVR pin naming
  volatile uint8_t* port;
```

```
volatile uint8_t* ddr;
volatile uint8_t* pin;
// Here we translate the input pin number from
//  Arduino pin number to the AVR PORT, PIN, DDR,
//  and which bit of those registers we care about.
byte bitmask;
port = portOutputRegister(digitalPinToPort(pinToMeasure));
ddr = portModeRegister(digitalPinToPort(pinToMeasure));
bitmask = digitalPinToBitMask(pinToMeasure);
pin = portInputRegister(digitalPinToPort(pinToMeasure));
// Discharge the pin first by setting it low and output
*port &= ~(bitmask);
*ddr  |= bitmask;
delay(1);
// Make the pin an input with the internal pull-up on
*ddr &= ~(bitmask);
*port |= bitmask;

// Now see how long the pin to get pulled up. This manual unrolling of the loop
// decreases the number of hardware cycles between each read of the pin,
// thus increasing sensitivity.
uint8_t cycles = 17;
if (*pin & bitmask) {
  cycles =  0;
}
else if (*pin & bitmask) {
  cycles =  1;
}
else if (*pin & bitmask) {
  cycles =  2;
}
else if (*pin & bitmask) {
  cycles =  3;
}
else if (*pin & bitmask) {
  cycles =  4;
}
else if (*pin & bitmask) {
  cycles =  5;
}
else if (*pin & bitmask) {
  cycles =  6;
}
else if (*pin & bitmask) {
  cycles =  7;
}
else if (*pin & bitmask) {
  cycles =  8;
```

```
  }
  else if (*pin & bitmask) {
    cycles =  9;
  }
  else if (*pin & bitmask) {
    cycles = 10;
  }
  else if (*pin & bitmask) {
    cycles = 11;
  }
  else if (*pin & bitmask) {
    cycles = 12;
  }
  else if (*pin & bitmask) {
    cycles = 13;
  }
  else if (*pin & bitmask) {
    cycles = 14;
  }
  else if (*pin & bitmask) {
    cycles = 15;
  }
  else if (*pin & bitmask) {
    cycles = 16;
  }

  // Discharge the pin again by setting it low and output
  //  It's important to leave the pins low if you want to
  //  be able to touch more than 1 sensor at a time - if
  //  the sensor is left pulled high, when you touch
  //  two sensors, your body will transfer the charge between
  //  sensors.
  *port &= ~(bitmask);
  *ddr  |= bitmask;

  return cycles;
}
```

C

Main.py

```
#!/usr/bin/env/ python3
import serial
import serial.tools.list_ports
import pygame
import time
import csv
import array

MUSIC_PATH = "G-Major Steel Tongue Drum/Guitar/"

# Class to log data in csv
class DataLog:
	def __init__(self):
		self.file = open("event-data.csv", "w")
		self.writer = csv.writer(self.file, delimiter=',', quotechar='|',
quoting=csv.QUOTE_MINIMAL)
		self.writer.writerow(["Key", "Event", "Time", "Edited time"])

	def add_value(self, key, event, time, edited_time):
		self.writer.writerow([key, event, time, edited_time])

	def close(self):
		self.file.close()

# Class to read serial(Faster than that of the library)
class ReadLine:
	def __init__(self, s):
		self.buf = bytearray()
		self.s = s

	def readline(self):
		i = self.buf.find(b"\n")
		if i >= 0:
			r = self.buf[:i+1]
			self.buf = self.buf[i+1:]
			return r
		while True:
			i = max(1, min(2048, self.s.in_waiting))
			data = self.s.read(i)
			i = data.find(b"\n")
			if i >= 0:
				r = self.buf + data[:i+1]
				self.buf[0:] = data[i+1:]
				return r
```

```
                        else:
                                self.buf.extend(data)
                                return b"No \n"

# Plays a sound
def play(led_nummer, music_file):
        pygame.mixer.Channel(led_nummer).play(pygame.mixer.Sound("/home/pi/relax-
change/music/" + MUSIC_PATH + music_file))

def main():
        # initializes arduino and makeymakey
        arduino = 0
        makeymakey = 0
        ports = list(serial.tools.list_ports.comports())
        for p in ports:
                print(p)
                if "ttyACM0" in p:
                        arduino = serial.Serial(p.device, 9600, timeout=0.1)
                elif "SparkFun MaKey MaKey" in p:
                        makeymakey = serial.Serial(p.device, 9600, timeout=0.1)

        if arduino == 0:
                print("Arduino not found")
                exit(1)
        elif makeymakey == 0:
                print("MakeyMakey not found")
                exit(1)

        # Flush input buffer
        arduino.flush()
        makeymakey.flush()

        # Initializes readline
        rl_arduino = ReadLine(arduino)
        rl_makeymakey = ReadLine(makeymakey)

        # Initializes pygame
        pygame.mixer.init()

        # Start values
        key_pressed = array.array("f", [0, 0, 0, 0, 0, 0, 0, 0])

        last_update = time.perf_counter()

        data = DataLog()

        start_time = time.perf_counter()
```

```
        # Clausule when crtl + c ends the program
        try:
                while True:
                        # Starts a counter to divide the time between tasks
                        start = time.perf_counter()
                        while (time.perf_counter() - start) <= 0.0001:
                                # Reads values of arduino and sets volume based on this
                                bytes = rl_arduino.readline().rstrip().decode()
                                if bytes == "Released":
                                        break;
                                elif bytes == "Pressed":
                                        break;
                                else:
                                        try:
                                                volume = int(bytes) / 10
                                                for led_nummer in range(8):

        pygame.mixer.Channel(led_nummer).set_volume(volume)
                                        except:
                                                break;

                        start = time.perf_counter()
                        while (time.perf_counter() - start) <= 0.0001:
                                # Reads makeymakey and creates sound + send signal to arduino if
pressed
                                bytes = rl_makeymakey.readline().rstrip().decode()
                                if bytes == "p97":
                                        data.add_value("97", "Pressed", time.perf_counter(),
time.perf_counter() - start_time)
                                        play(0, "0.wav")
                                        key_pressed[0] = time.perf_counter()
                                elif bytes == "r97":
                                        data.add_value("97", "Released", time.perf_counter(),
time.perf_counter() - key_pressed[0])
                                        key_pressed[0] = 0
                                elif bytes == "p100":
                                        data.add_value("100", "Pressed", time.perf_counter(),
time.perf_counter() - start_time)
                                        play(1, "1.wav")
                                        key_pressed[1] = time.perf_counter()
                                elif bytes == "r100":
                                        data.add_value("100", "Released", time.perf_counter(),
time.perf_counter() - key_pressed[1])
                                        key_pressed[1] = 0
                                elif bytes == "p102":
                                        data.add_value("102", "Pressed", time.perf_counter(),
time.perf_counter() - start_time)
                                        play(2, "2.wav")
```

```
                key_pressed[2] = time.perf_counter()
            elif bytes == "r102":
                data.add_value("102", "Released", time.perf_counter(),
time.perf_counter() - key_pressed[2])
                key_pressed[2] = 0
            elif bytes == "p103":
                data.add_value("103", "Pressed", time.perf_counter(),
time.perf_counter() - start_time)
                play(3, "3.wav")
                key_pressed[3] = time.perf_counter()
            elif bytes == "r103":
                data.add_value("103", "Released", time.perf_counter(),
time.perf_counter() - key_pressed[3])
                key_pressed[3] = 0
            elif bytes == "p104":
                data.add_value("104", "Pressed", time.perf_counter(),
time.perf_counter() - start_time)
                play(4, "4.wav")
                key_pressed[4] = time.perf_counter()
            elif bytes == "r104":
                data.add_value("104", "Released", time.perf_counter(),
time.perf_counter() - key_pressed[4])
                key_pressed[4] = 0
            elif bytes == "p109":
                data.add_value("109", "Pressed", time.perf_counter(),
time.perf_counter() - start_time)
                play(5, "5.wav")
                key_pressed[5] = time.perf_counter()
            elif bytes == "r109":
                data.add_value("109", "Released", time.perf_counter(),
time.perf_counter() - key_pressed[5])
                key_pressed[5] = 0
            elif bytes == "p115":
                data.add_value("115", "Pressed", time.perf_counter(),
time.perf_counter() - start_time)
                play(6, "6.wav")
                key_pressed[6] = time.perf_counter()
            elif bytes == "r115":
                data.add_value("115", "Released", time.perf_counter(),
time.perf_counter() - key_pressed[6])
                key_pressed[6] = 0
            elif bytes == "p119":
                data.add_value("119", "Pressed", time.perf_counter(),
time.perf_counter() - start_time)
                play(7, "7.wav")
                key_pressed[7] = time.perf_counter()
            elif bytes == "r119":
```

```
                                        data.add_value("119", "Released", time.perf_counter(),
time.perf_counter() - key_pressed[7])
                                        key_pressed[7] = 0

                        if (time.perf_counter() - last_update) >= 0.0000001:
                                for led_nummer in range(8):
                                        if key_pressed[led_nummer] > 0:
                                                arduino.write(str(led_nummer).encode('utf-8'))

        except KeyboardInterrupt:
                data.close()

if __name__ == '__main__':
        main()
```

Data.py

```
#!/usr/bin/python
import pandas
import matplotlib.pyplot

def main():
	# Reads csv data and shows data and makes a graph of the frequency
	data = pandas.read_csv("event-data.csv")
	print("\n Data info \n")
	print(data.info())
	print("\n Pressed head \n")
	print(data[data["Event"] == "Pressed"].head())
	print("\n Released head \n")
	print(data[data["Event"] == "Released"].head())
	print("\n Frequency \n")
	frequency = data[data["Event"] == "Pressed"]["Time"]
	print(frequency.describe())
	frequency_plot = frequency.plot(kind='hist', bins=40, density=True)
	frequency_plot.set_title("Frequency of touch over time")
	frequency_plot.set_xlabel("Time")
	frequency_plot.set_ylabel("Frequency")
	frequency_plot.get_figure().savefig("Frequency.png")
	print("\n Length of touch \n")
	print(data[data["Event"] == "Released"]["Edited time"].describe())

if __name__ == "__main__":
	main()
```

Musical Tension Mappings Present In The Probe & Probe Design Process

The musical feedback helps to create musical tension (Fredrickson, 2000). Musical tension is a moment of unease in musical play and the expectation for it to be released. Which functions in the probe as a supportive feedback mechanism for expressive drum play and deep absorption. It is chosen for harmonic tension and release tones: musical tones that can harmonize (blend well together) or create dissonance (clashing sound) when combined in musical play (E, 2019). In this probe harmonic musical release tones in major and minor musical scales are used. This is done for two reasons. Harmonic tones can provide more expressive freedom in drum play, because these can create musical tension in multiple ways compared to other forms of musical tension (e.g. rhythm). 1) Through a dissonant combination of tones played after each other in play and 2) through the play of a musical tension tone over a release tone which is held for a while. On the other hand, harmonic tones have more potential to elicit a positive emotional response countering the heavy emotional anxiety responses. In order to tailor the musical tension support to the musical preferences of the different people within the anxiety spectrum, a set of various harmonic major and minor musical tone scales are offered in the design.

The green arrows in the musical tension mappings show how according to music theory the musical tension in drum play can be released through switches to musical release tones, or combination play (Fredrickson, 2000). An example of musical tension with the harmonic G-Major scale is explained. Both a musical major and minor scale contain 8 musical tones, so the G-Major scale includes the G (base tone), A, B, C, D, E, F# and G (the octave tone) tones. These tones are provided through the 8 touchpads in the drum. The G is offered twice in the drum as the central base tone and octave. These are the two main tones, together with the third (B) and fifth (D) tone in the scale, able to resolve musical tension in drum play, in other words: make a dissonance sound (“clashing sound”) go back to a consonance musical experience (“beautiful sound”). The other 4 musical tones in the scale, in this case the A, C, E and F# are known for creating musical tension (“clashing sound”) in harmonic drum play (Underbelly [You Suck at Producing], 2018). The biggest touch pads represent the base & octave musical release tones, enabling quick resolution of musical tension. Moreover, the second biggest touch pads represent the third & fifth (musical release) tone in the scale, enabling a second level of quick resolve of musical tension. Finally, the smallest touch pads in between the bigger four represent the musical tension tones, enabling easy combination play for musical tension, but are also placed in a way that their dissonant sounds can be resolved easily through the bigger pads. In these figures down below it is visualized for a G-Major scale, how the musical tones within this scale are mapped over the drum’s touch pads, which represent musical tension / musical release and how, based on music theory, musical tension can be resolved in drum play.

Of course, people with elevated anxiety who will play the drum are not expected to understand the theoretical harmonic musical tension principle behind the musical feedback. However, when combinations of tones are played in the drum or singular tones played after / over each other, the target group will automatically benefit from the musical tension principle. In this way, musical tension as part of the drum’s musical feedback, provides the target group with the ability to use musical release tones and musical tension tones to build up peaks in expressive drum play, release peaks in expressive drum play, engage in play and even release certain cognitions or emotions.

Hope & happy

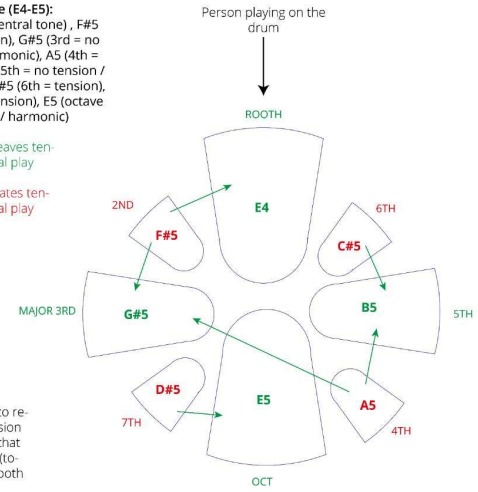
Harmonic Tension & Realease (major & minor scales)

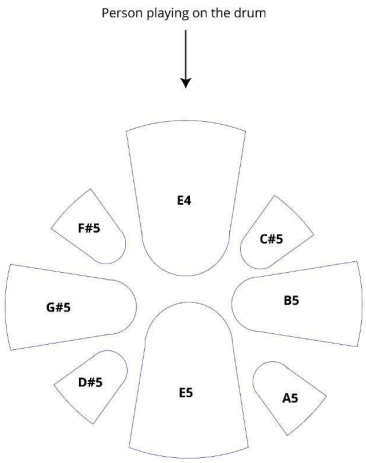
E-Major Scale (E4-E5):
E4 (rooth = central tone) , F#5 (2nd = tension), G#5 (3rd = no tension / harmonic), A5 (4th = tension), B5 (5th = no tension / harmonic), C#5 (6th = tension), D#5 (7th = tension), E5 (octave = no tension / harmonic)

Tone that releaves tension in musical play

Tone that creates tension in musical play

Tone to play to release the tension after playing that tension tone (together with rooth tone)





Melancholic high

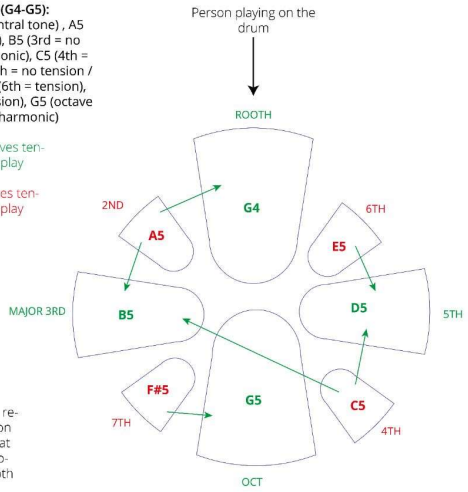
Harmonic Tension & Realease (major & minor scales)

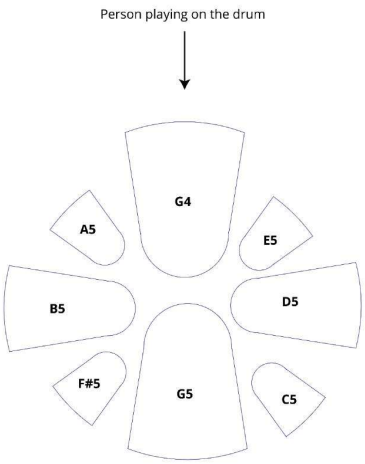
G-Major Scale (G4-G5):
G4 (rooth = central tone) , A5 (2nd = tension), B5 (3rd = no tension / harmonic), C5 (4th = tension), D5(5th = no tension / harmonic), E5 (6th = tension), F#5 (7th = tension), G5 (octave = no tension / harmonic)

Tone that releaves tension in musical play

Tone that creates tension in musical play

Tone to play to release the tension after playing that tension tone (together with rooth tone)





Melancholic low

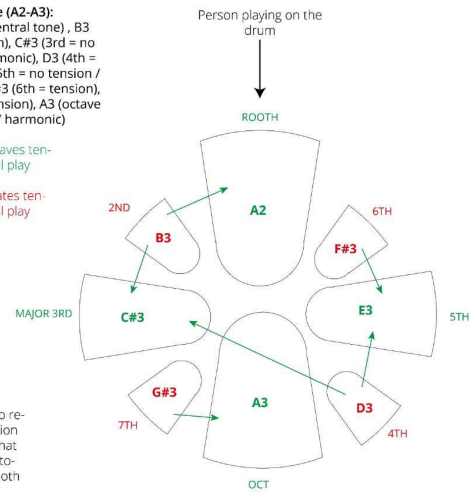
Harmonic Tension & Realease (major & minor scales)

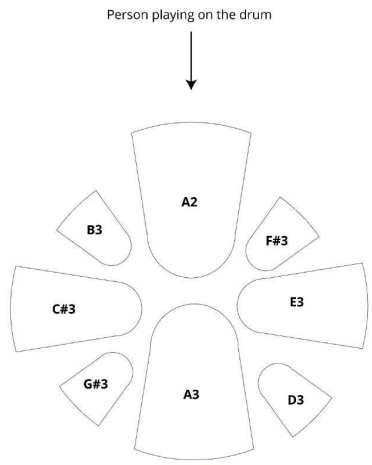
A-Major Scale (A2-A3):
A2 (rooth = central tone) , B3 (2nd = tension), C#3 (3rd = no tension / harmonic), D3 (4th = tension), E3 (5th = no tension / harmonic), F#3 (6th = tension), G#3 (7th = tension), A3 (octave = no tension / harmonic)

Tone that releaves tension in musical play

Tone that creates tension in musical play

Tone to play to release the tension after playing that tension tone (together with rooth tone)





Hope high

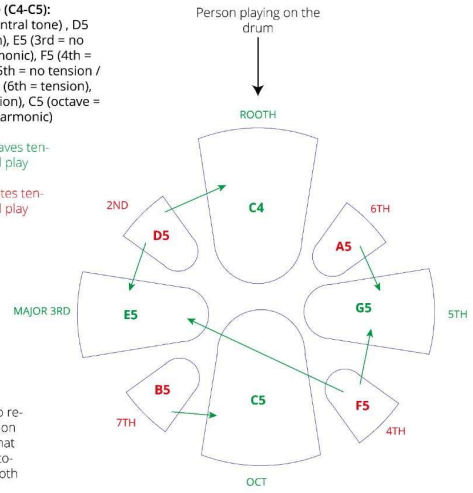
Harmonic Tension & Realease (major & minor scales)

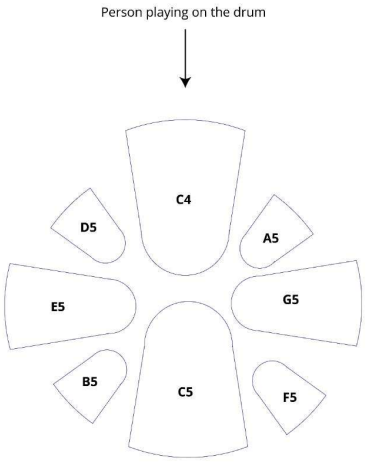
C-Major Scale (C4-C5):
C4 (rooth = central tone) , D5 (2nd = tension), E5 (3rd = no tension / harmonic), F5 (4th = tension), G5 (5th = no tension / harmonic), A5 (6th = tension), B5 (7th = tension), C5 (octave = no tension / harmonic)

Tone that releaves tension in musical play

Tone that creates tension in musical play

Tone to play to releave the tension after playing that tension tone (together with rooth tone)





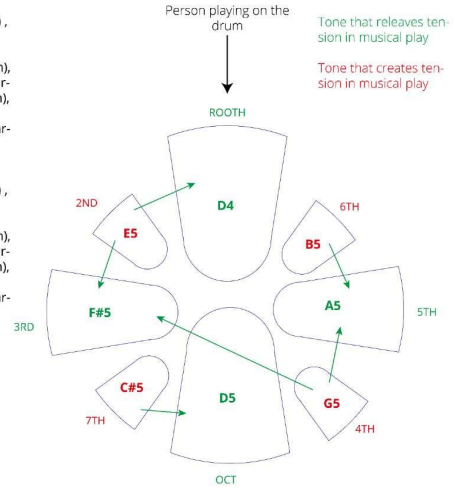
Hope / melancholic high

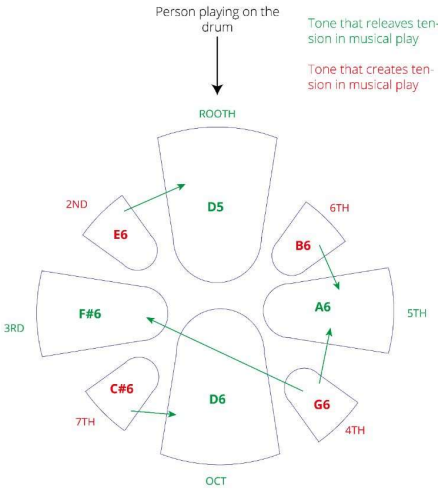
Harmonic Tension & Realease (major & minor scales)

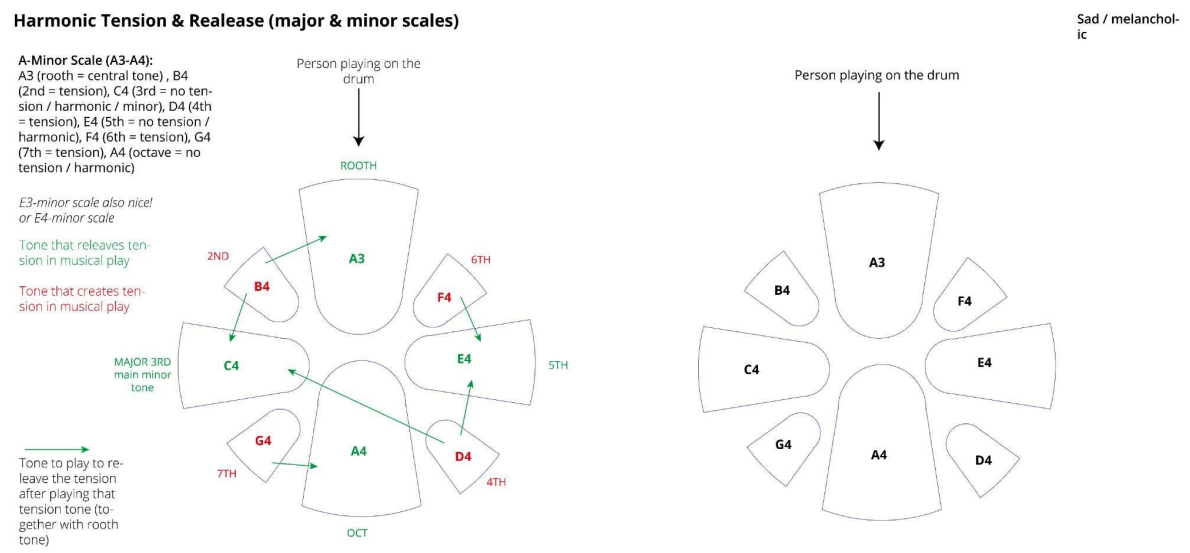
D-Major Scale (D4-D5):
D4 (rooth = central tone) , E5 (2nd = tension), F#5 (3rd = no tension / harmonic), G5 (4th = tension), A5 (5th = no tension / harmonic), B5 (6th = tension), C#5 (7th = tension), D5 (octave = no tension / harmonic)

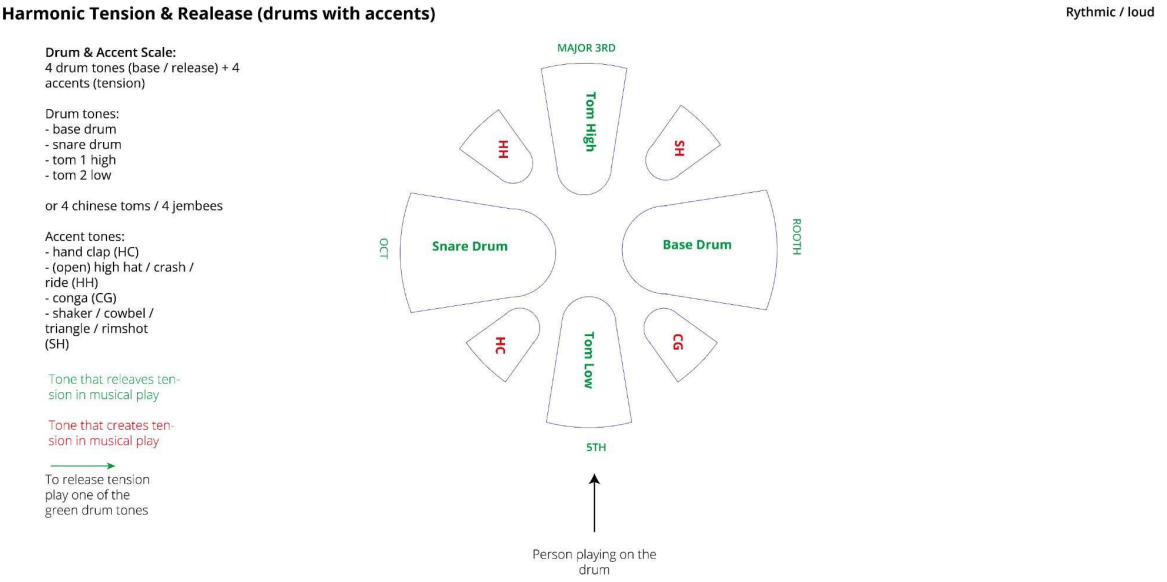
D-Major Scale (D5-D6):
D5 (rooth = central tone) , E6 (2nd = tension), F#6 (3rd = no tension / harmonic), G6 (4th = tension), A6 (5th = no tension / harmonic), B6 (6th = tension), C#6 (7th = tension), D6 (octave = no tension / harmonic)

Tone to play to releave the tension after playing that tension tone (together with rooth tone)







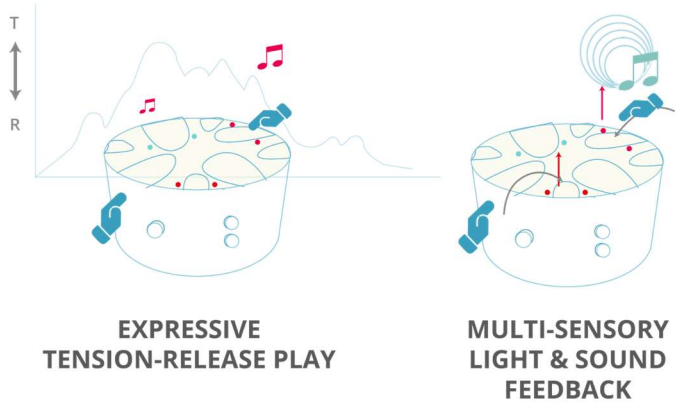


5.1.4 So how did you come to this design? And why this specific formgiving?

The process of the creation of the RELAX-CHANGE design is described in the design researcher's M1.2 paper (Van Wijlen, 2020). In short: literature showed that digital and soothing designs for relaxation still allow this target group to ruminate or experience heavy emotions, cognitions or bodily responses to anxiety. In combination with the potential benefits of creative music engagement for deep absorption to prevent rumination and releasing various tensions (Cevasco et al., 2005), the first four concepts focused on a different multi-sensory distraction approach, 1) Multi Drum focused on expressive physical outlet as distraction, 2) Manipulatable Jewellery focused on a soft fiddling outlet to focus attention outwards, 3) Discovery focused on outside musical discovery, connecting the mind to the physical world, and 4) Draw Thoughts centered around multi-sensory drawing/writing

as a way to structure emotions and thoughts and offer musical distraction. After evaluation with two experts in psychotherapy for people with anxiety, and the focus on novel relaxation support, the direction of physical multi-sensory **expression** was further explored through re-iterating the concept of the Multi Drum. This resulted into three new concepts differing in the spectrum of playful expression offered. 1) Clover Drum focused on intense freedom of expression, in which a free multi-sensory play area was offered; 2) Drum Pad focused on a more intuitive form of expression, in which a variety of multi-sensory drum pads were offered, and 3) Artistic Drum focused on more symbolic and soft forms of expression, in which multi-sensory “clouds” could be created (figure X).

In order to be able to research the most novel perspective related to multi-sensory expression, the overwhelming freedom in playful expression in concept 1 was discarded, just as the too soothing multi-sensory elements in concept 3, resulting in the choice for the Drum Pad concept (middle visual in figure X) to further detail in terms of physicality, multi-sensory, and expressive aspects. Which together with the insights from the M2.1 design research at the psychotherapy research department in Germany, around valued clinical design qualities as the design probe’s ‘accessibility and flexibility’, ‘visible direct feedback’, ‘engagement and absorption potential’ and ‘playful musical approach’ (Van Wijlen, 2021) resulted in the current design of RELAX-CHANGE — an expressive, multi-sensory and playful drum for novel relaxation for this target group, that is recognizable and accessible for the variety of people in the anxiety spectrum (figure X).



So how about the formgiving of the current RELAX-CHANGE design?

As mentioned before, the touch pads are designed to visually represent the creation of musical tension in drum play, to support expressive tension-release building (the probe's novel relaxation principle) and so optimal creation of relaxation effects. Furthermore, the touchpad design allows for freedom in playful expression and failure, important in providing a novel pathway to relaxation for people with elevated anxiety. Furthermore, as mentioned, the design has been inspired by a steel tongue drum (reference), in order to increase the recognizability, intuitivity and accessibility of the novel relaxation principle through drum play. To implement this style in all the design's aspects, all forms are rounded to create a coherent design. Finally, the hypothesized context and setting of use for the drum includes daily use, situated on a table or floor and played while being seated or standing in front of the drum. Therefore, the sizes of the design have been influenced by this given. In this way, the diameter of the drum design is 28 centimeters, which supports enough touchpad space for optimal hand movement and expressive drum play. Moreover, the height of the drum is 11.5 centimeters which supports comfortable drum play when placed on a table, floor or other type of surface and provides the support needed to undergo vertical "touch" forces (Van Wijlen,2021).

FMP Prototype Information

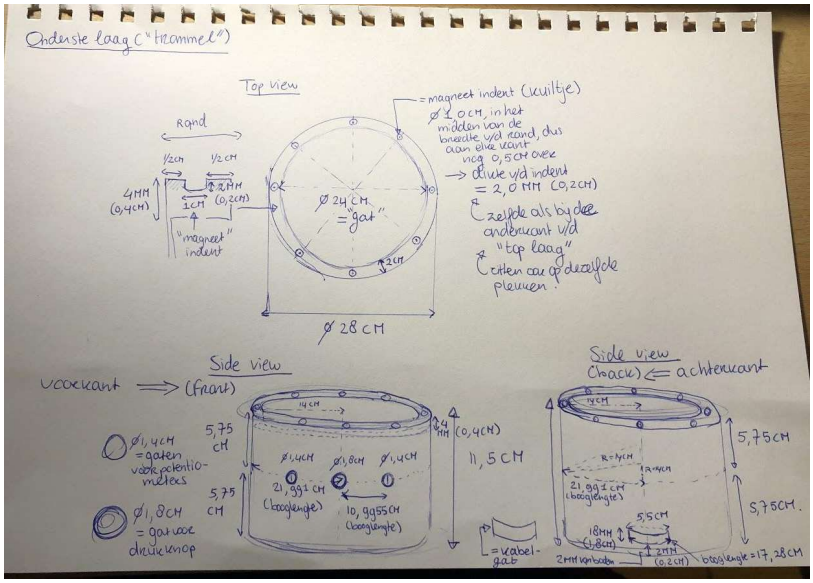
It represents the probe's novel relaxation mechanism, that allows for expressive and multi-sensory drum play, for people with elevated trait anxiety to flow into relaxation, engage in a distractive task, and release from various anxiety responses such as negative thinking, emotions and tensions in the body. Furthermore, the prototype represents the probe's intended formgiving. Moreover, the musical feedback in the prototype represents the design's intended multi-sensory flexibility through providing a set of 14 different major and minor musical tone scales, with which expressive drum play (through musical tension) and play engagement are supported. Moreover, the probe's light feedback design has been translated into the prototype in the form of 8 LED light pairs corresponding to the 8 drum touchpads, that visualizes the expressive play intensity on a certain touch pad during drum play as explained in the design section. And so supports in leading towards optimal multi-sensory and playful expression and engagement to create optimal relaxation effects.

Moreover, the prototype includes a plastic semi-transparent top plate that functions as a cover to fade the bright lights and protect the LED's during drum play. Next to that, the prototype has a diameter of 28 centimeters and a height of 11.5 centimeters, similar to the design of RELAX-CHANGE.

The different musical scales allow a fit with the different emotional states of the study participants (as part of their anxiety), ranging from happy sounds to meditative sounds to melancholic/sad sounds (Appendix K: Prototype Technicalities). Moreover, providing these musical tones in the form of a guitar, piano or human voice sound provides even more fit to the ranging musical needs within the anxiety spectrum. Furthermore, it was chosen for a set of drum tones, that is based on the musical tension principle, to evaluate the need for such tones, the experienced support these tones can offer in to create playful tension-release in drum play (to also inspire future design directions) and corresponding relaxation effects.

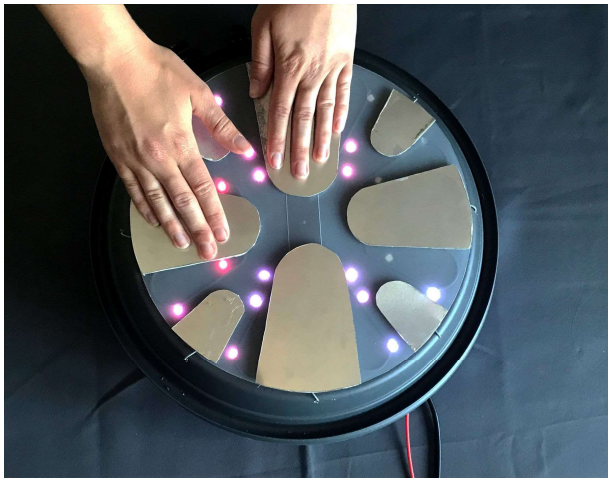
For this design research, it was focused on resolving the delays in both the musical and light interaction with the prototype's multi-sensory feedback as much as possible. Especially to be able to prevent extra anxiety due to limited feedback functioning and to prevent evoked

feelings of failing. Furthermore, the knobs have been added and placed correctly in the prototype, and software has been optimized to support multi-sensory adaptability. Finally, the prototype's data collection opportunities for long-term design research has been optimized, which enables the prototype to collect quantitative measurements around: the type of touchpads used in drum play; the duration of touchpads pressed and released over the course of drum play and various averages (frequency of touch, duration of touch etc.) (Appendix K: Prototype Technicalities).



The First Prototype (M1.2)

This current RELAX-CHANGE prototype has been based on the very first prototype made in M1.2 design research used within two online focus groups to evaluate the potential of the probe and its novel underlying pathway to relaxation (Van Wijlen, 2020). This prototype had minimal multi-sensory interaction functionalities: separately functioning light and sound feedback, based on touch input, and pre-programmed light color changes to simulate the light behavior based on different types of expressive drum play. Furthermore, this prototype represented a first sense of the probe's formgiving, stiffness, look and feel. To give an impression on how the prototype evolved over time, the first hand made prototype can be seen below or in the M1.2 paper by Van Wijlen (2020):

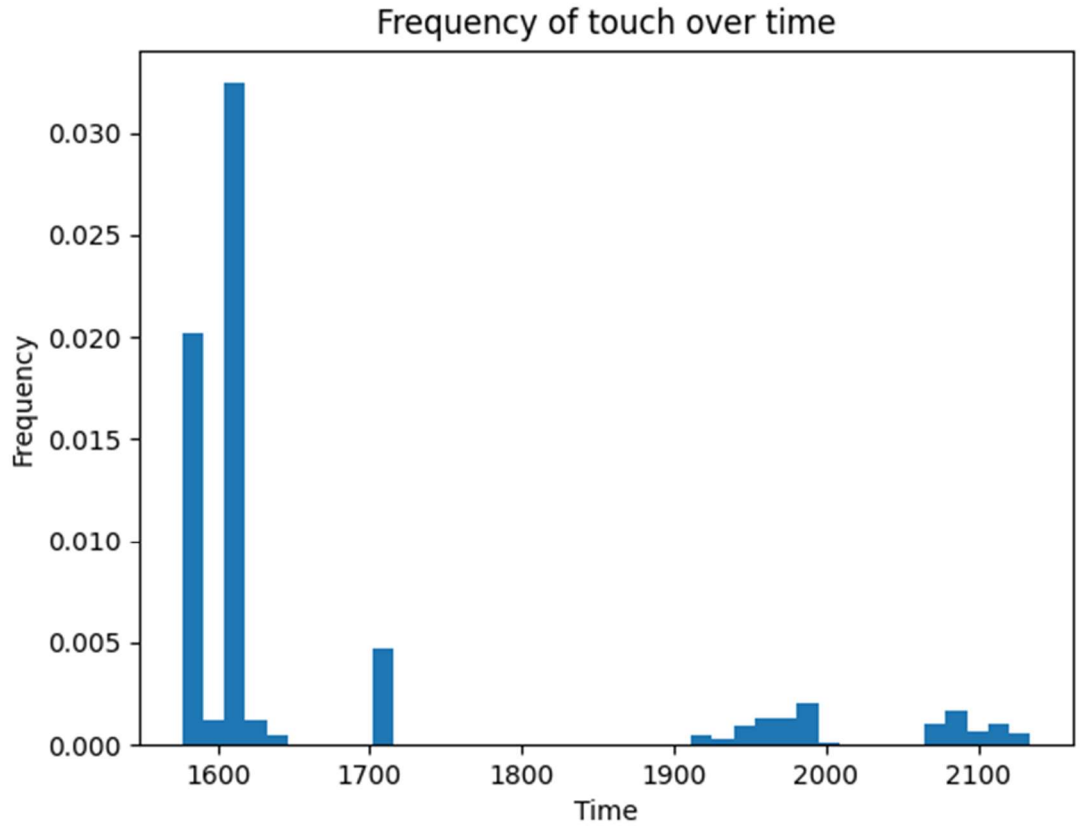


Prototype's data collection opportunities

This data collection function has not been used in this thesis yet due to the skills needed to download the data from the prototype's Raspberry Pi module onto the differing locations on the participant's laptops, and the burden this puts on a participant with elevated anxiety. However, it has been explored to be able to implement in future long-term clinical and design research to support data from drum play observations.

Example (.csv) files with collected touch behavior data by the prototype

Key	Event	Time	Edited time (seconds)			
104	Pressed	124.0948207	15.27439109			**Analysis examples:**
104	Released	124.5981455	0.441408336			1. Musical tension-release patterns (musical tone use; musical tension / release tone preferences; incorporation behavior; favorite combinations etc.)
109	Pressed	125.0411397	16.22071179			2. Play patterns (play characteristics such as combo play / singular play; fast play / slow play; long hold / short hold; tap-hold etc. and recurring patterns)
109	Released	125.8692946	0.771091757			3. Frequency of touchpads used
109	Pressed	125.9872887	17.16686059			4. Duration of holding a touchpad over time (the duration a touchpad is held, is in the number corresponding to the released event of a certain touchpad in the "edited time" column)
102	Pressed	126.2223429	17.40191489			In this example, the amount of time a touchpad is held is highlighted in blue
109	Released	126.3840994	0.385696215			
115	Pressed	127.6404924	18.82006396			
102	Released	127.8795901	1.600318902			
97	Pressed	128.4823902	19.66196233			
97	Released	129.7472868	1.207006461			
115	Released	129.7718477	2.073135232			
100	Pressed	130.0098142	21.18938583			
100	Released	131.7851242	1.718156213			
115	Pressed	132.9252285	24.10480045			
104	Pressed	132.935976	24.11554777			



Data summary out of the prototype

```
 Pressed head

   Key    Event       Time  Edited time
0  104  Pressed  88.237556     6.419971
2  103  Pressed  89.773841     7.956257
4  102  Pressed  91.648874     9.831289
6  104  Pressed  92.260904    10.443318
8  104  Pressed  92.698768    10.881183

 Released head

   Key     Event       Time  Edited time
1  104  Released  88.550710     0.301575
3  103  Released  90.244388     0.000746
5  102  Released  91.803100     0.147013
7  104  Released  92.498150     0.236905
9  104  Released  92.800759     0.100818

 Frequency

count    248.000000
mean     118.990267
std       11.832387
min       88.237556
25%      109.747240
50%      119.635483
75%      126.763147
max      141.323574
Name: Time, dtype: float64

 Length of touch

count    248.000000
mean       0.263714
std        0.587576
min        0.000473
25%        0.054118
50%        0.173073
75%        0.272695
max        5.736604
Name: Edited time, dtype: float64
```

APPENDIX L: SWOT ANALYSIS

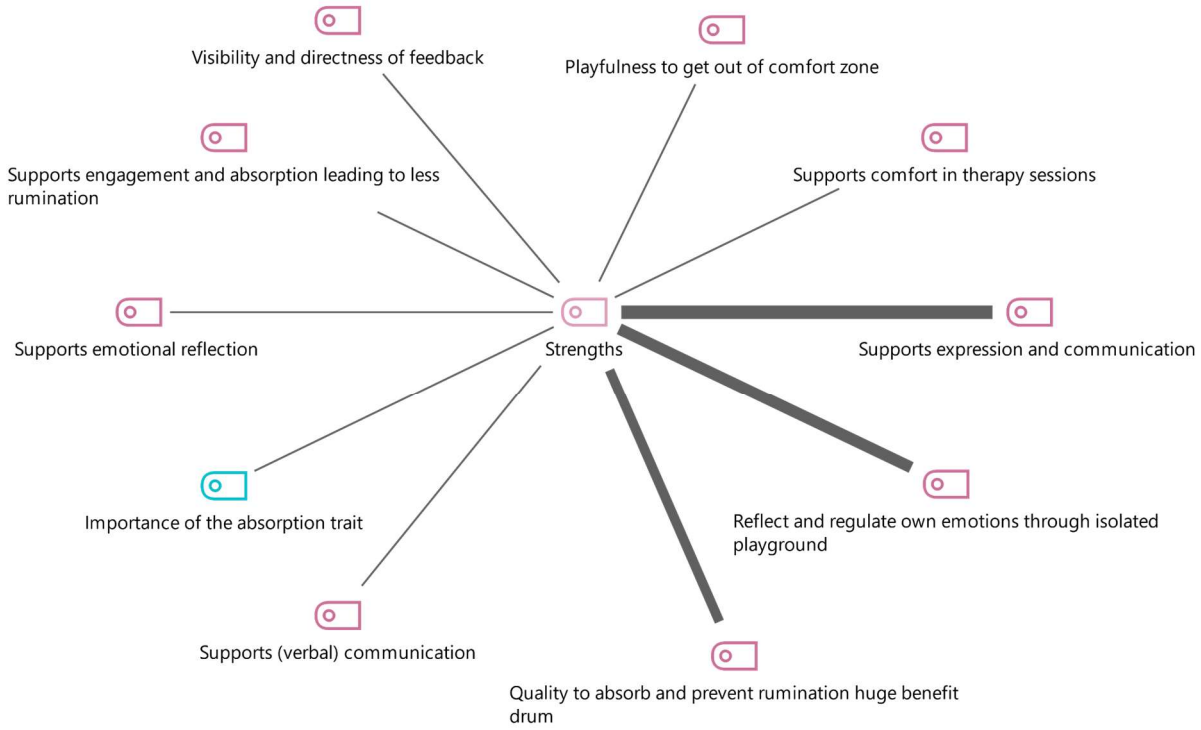
Coding Summary SWOT Analysis Stakeholder Interviews from the M2.1 Project as Preparation for a CHI Publication and Future Work

Used as part of section 09 Value Potential to put the RELAX-CHANGE design research and future design directions in “the bigger mental healthcare” picture.

<u>Strenghts</u>

Internal (drum interaction with patient)				0
Strengths				0
	Musical and playful tensions as relaxation approach			2
	Music is magical and emperical way to decrease tension			1
	Supports for inhabited expression and releaving tension			4
	Supports creating a skill for no interest patients			7
	Adaptable to different musical skills and preferences			5
	Easy to adapt musical tones and usage over time for therapist			1
	Open to use by therapists and patients			6
	Offers a universal way to get in touch with music			3
	It can be played no matter your musical experience			3
	It can be played intuitively			2
	Playfulness to get out of comfort zone			13
		Children make use of traumatic play in trauma therapy		1
		play is important aspect of therapy		6
		It might be good to get adults out of adultry in psychotherapy		2
		Playfulness could support adults getting out of normal thinking	out of normal thinking behavior	4
	Supports comfort in therapy sessions			11
		Tension using it in beginning of therapy		3
		comfort in first therapy sessions		3
		support in comfort during therapy sessions		3
		support in comfort during therapy through simple tasks		2
	Supports creativity and flexibility of therapists in treatments			3
	Music to support distancing from rumination			5
	Harmonic tones to support inducing positive feelings			3
	Support getting in emotional mood / in touch with emotions			4
	Supports exhibiting and confronting anxiety			4
	Supports emotional reflection			0
		Emotions are really felt in the body		2
		Using drum in (complex) skills research in psychotherapy (1)		9
		Drum could support filtering intense emotions		1
		Drum could help become expert of patient's own anxiety		3
		Drum invites to give belly, heart, mind a voice		1
		Music could help code emotions		5
		Reflecting around drum play in collaboration with therapist		3
		Reflect and regulate own emotions through isolated playground		19
	Supports in releaving anxiety tensions			7
	Supports engagement and absorption leading to less rumination			0
		Importance of the absorption trait		17
			High absorption trait related to deeper (better) experience	4
			Variety in responses to the drum explained by absorption trait	3
			Personal absorption trait determines object focus/ engagement	4
			Being open to new experiences also biologically dependent	3
			High absorption trait means being open for new experiences	1
			The different sensory channels of people determines absorption	2
		Activities with opp. for 'flow' can work motivating		2
		Opportunity for creating a 'flow'		2
		Usage of hands important in moving attention		3
		Every tone has ability to distract attention		3
		Music enables to induce other states		5
		Multi-sensory stimulation good to get different people engaged	And let them benefit from the deep play experience. Due to the different sensory channels people have that drive them into absorption.	1
		Quality to absorb and prevent rumination huge benefit drum		17
		Drum possiblity for deep engagement when absorption trait high		1
		Induced trance states are very emotionally rewarding		1
	Supports analyzing patient behavior			9
	Supports (verbal) communication			20
		Communication is important in psychotherapy		1
		Freeze mechanism in children with selective mutism		1
		No face-to-face communication makes talking easier in therapy		2
		Opportunities for autism spectrum disorder		1
		Opportunities for selective mutism		2
		Frustrations in verbal expression		1
		support in reaching agreements about current patient emotions		2
		Support in communication and verbal expression		10
	Supports expression and communication			24
	Leads to relaxation			1
	Supports skill practice			9
	Physicality is advantage of the drum			3
	Visibility and directness of feedback			16
		Opportunity showing / visualizing speaking deadline		3
		direct feedback improves satisfaction and competence patient		2
		support in making disstress visible while talking		3
		direct feedback is appreciated in terms of visibility		5
		direct feedback increases self-efficacy		2
		Opportunity for competence support		1

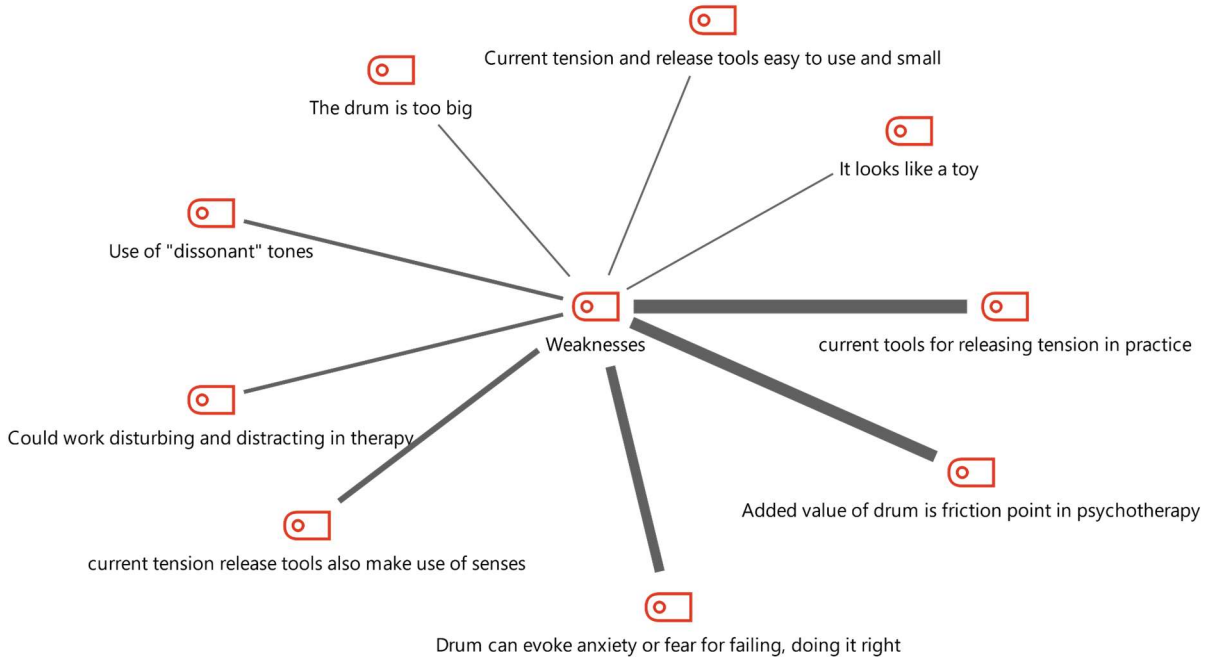
Strenghts Summary Model



Weaknesses

Weaknesses			0
	It looks like a toy		1
	The drum is too big		2
	Could work disturbing and distracting in therapy		3
	Added value of drum is friction point in psychotherapy		7
		Current tension and release tools easy to use and small	1
		current tools for releasing tension in practice	8
		current tension release tools also make use of senses	4
	Drum can evoke anxiety or fear for failing, doing it right	Performance anxiety	6
	Use of "dissonant" tones		3

Weaknesses Summary Model



Opportunities

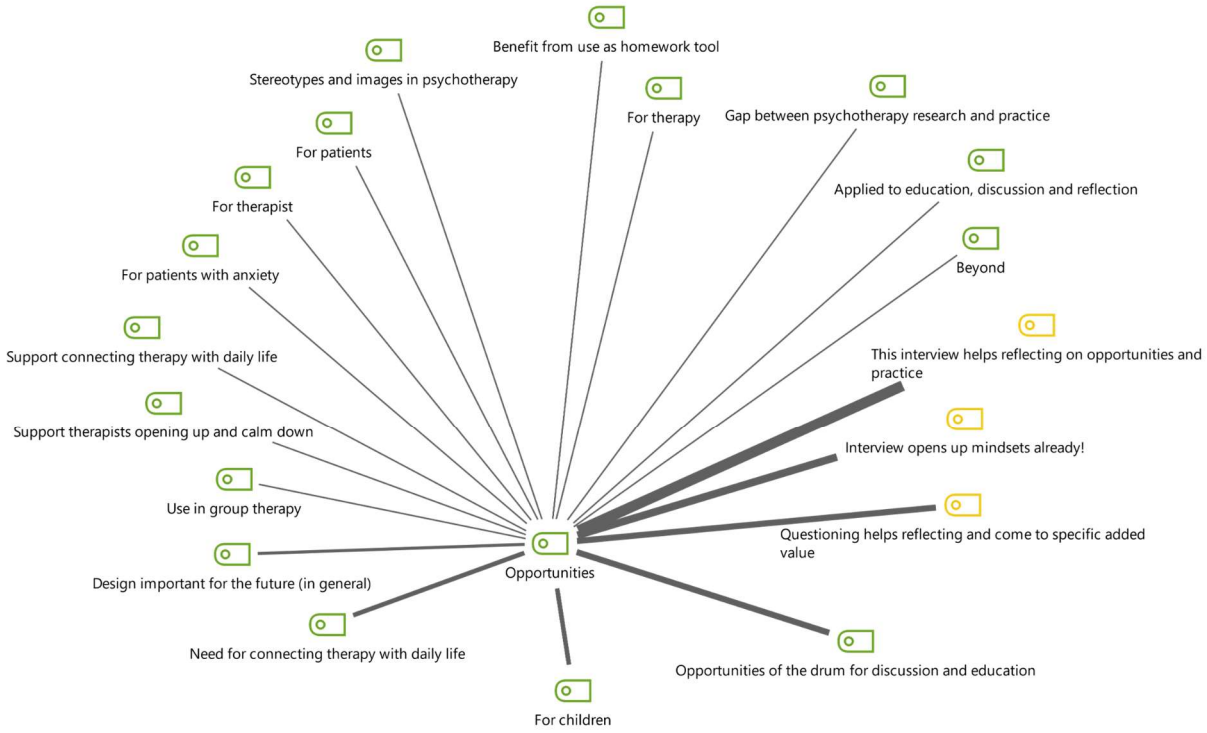
External (outside of the drum)				0
Opportunities				0
Beyond				0
	Technology reducing the waiting list for psychotherapy problem			1
	Gap between psychotherapy research and practice			29
		clinical research goes hand in hand with practice		1
		Research results hard to use for practitioners		2
		Research might not be representitive enough for practice	This limits implementation of research results into therapy practice. Because of the standardized elements in psychotherapy research processes.	5
		Practice and research have different interests/values at stake		3
		Gap and tension between practice and research in psychotherapy		7
		Practitioners not interested in psychotherapy research		3
		Personalization to close gap psychother. research and practice		3
		Personalization & prediction as extension of feedback research		4
		Early treatment response to predict treatment outcome quite new		1
	Applied to education, discussion and reflection			0
		not much knowledge about other similar existing tools		3
		difficulties reflecting on clinical interest		4
		difficulties with reflecting on future self		9
		questioning helps reflecting and come to specific added value		15
		This interview helps reflecting on opportunities and practice		25
		Interview opens up mindsets already!		19
		Raising awareness about need for children's therapy & research		2
		Knowledge on dealing with MH can provide social support needed		1
		It's very important to educate aiming for basic MH knowledge		2
		Opportunities of the drum for discussion and education		14
		Challenge for this drum to create systemic change in the system		1
		Stereotypes and images in psychotherapy		0
			Friction stereotypes and implementing drum	4
			In psychotherapy there are lots of stereotypes and images	11
			Making it accessible for 'normal'peeps could break stigma	5
			Opportunity for drum to break classical therapy image	1
	Practice of emotional expression as a skill for change			2
	Support for many disorders			7
	For 'normal' people with lower stress			2

For therapy			0
	Connect tangible design with online therapies		2
	Design important for the future (in general)		14
		Design can extend therapists horizons	1
		Future use for different approach or different source is useful	2
		The tool won't work for everybody, which is fine	2
		Innovation won't be for every therapist	1
	Use in group therapy		15
		Tension use in group therapy (noise/analysis)	2
		Playing and sharing musical experience with others more fun	1
		Group therapy to see gap subj. experience and observations	3
		Opportunities use in group therapy	4
		Benefits of group therapy	4
	Support connecting therapy with daily life		0
		Need for connecting therapy with daily life	10
		Opportunity for design to give insight in daily life patients	4
		Digital technology to connect therapy to daily life	6
		Drum can connect therapy with daily life	7
	Way to integrate music into standard psychoth. procedures		2
	Everyone likes/listens to music		2
	Support in analyzing how the patient is doing (visible b.o.dfb)		2
	Drum measurement supports seeing gap subject exp. and observ.		6
	Measurements to show patient differences and progress		1
	Support expression in the beginning of therapy		4
	Benefits of activity and play as therapeutic intervention		3
	Offer design-related intervention approaches in psychotherapy		8
		appreciation for design research and approach	6
		Appreciation for interdisciplinary work	2
For research			0
	Support in assessing relaxation state in studies		1
	Need for intuitive objective measurments in research		1
	Effect on state anxiety rather than trait anxiety		2
	Opportunities research effects on relaxation, arousal, states		3

For therapist			0
	Support therapists opening up and calm down		41
		Pressure on psychology students	3
		Supervision important part of psychotherapy/psychiatry practice	2
		Psychotherapists also get therapy	1
		Psychotherapists use meditation to be present and empathic	In-between sessions, to open up for their patients and get calm again. 3
		Challenge to let work be work as therapist	8
		Competitive atmosphere amongst psychologists / therapists	3
		High stress and disorders amongst psychology students	4
		Stress management challenge for therapists	8
		Opportunity to use for therapists themselves	9
	Support their intervention creativity and flexibility		6
	Support reaching patients (in general)		7
	Supports reflecting on their therapy		3
		Critical reflection important for being a succesful therapist	2
	Support prediciton of depression/manic episodes in bipolar pats		1
	Feedback as usable information for therapists		1
	Support honesty of patients		1
	Use a big variety in musical sounds		1
	Relationship building and trust		7
		Opportunities to facilitate trust	3
		Challenge building a patient-therapist relationship	2
		The need for a relationship basis in therapy practice	2
For the clinic			0
	Musical or dance experience helps using the drum		1
	Supports in art therapy		3

For patients				0
	For borderline patients			4
		Opportunity as safe, unharmful tension release tool		1
	For patients with somatic disorders			3
	For patients in trauma therapy			2
		Tension with current trauma therapy interventions		1
	For patients with schizofrenia			3
		For patients in occupational therapy		2
	For patients with social phobia			7
		Support in hierchy tasks for social phobia		2
		Studies show good results for CBT in selective mutism		1
	For patients with OCD			5
	For bipolar patients			4
		Bipolar quite relient on medication		3
	For patients involved in forensic psychotherapy			3
		Not sure if the drum helps calming down in forensic context		1
	For patients with anxiety			0
		Most useful to support anxiety or depression		1
		For children		16
			Future generation of mentally ill people	2
			The need for supporting patient concentration in therapy	1
			Technology can work attractive for children	2
		Benefit from use as homework tool		27
			The design would not be used as homework tool	2
			Homework one of the things to drop first when not done	1
			Taking the time for homework is hard for patients	1
			For many people doing the homework is hard	2
			Homework essential part of behavioral therapy	1
			As homework more flexible and freedom in use	1
			Doing it shamelessly as homework exercise	2
			Therapy effects are more at home	3
			Being creative is a private thing --> use at home	1
			Opportunity for use at home	7
			Drum can support as very specific homework tool	6

Opportunities Summary Model

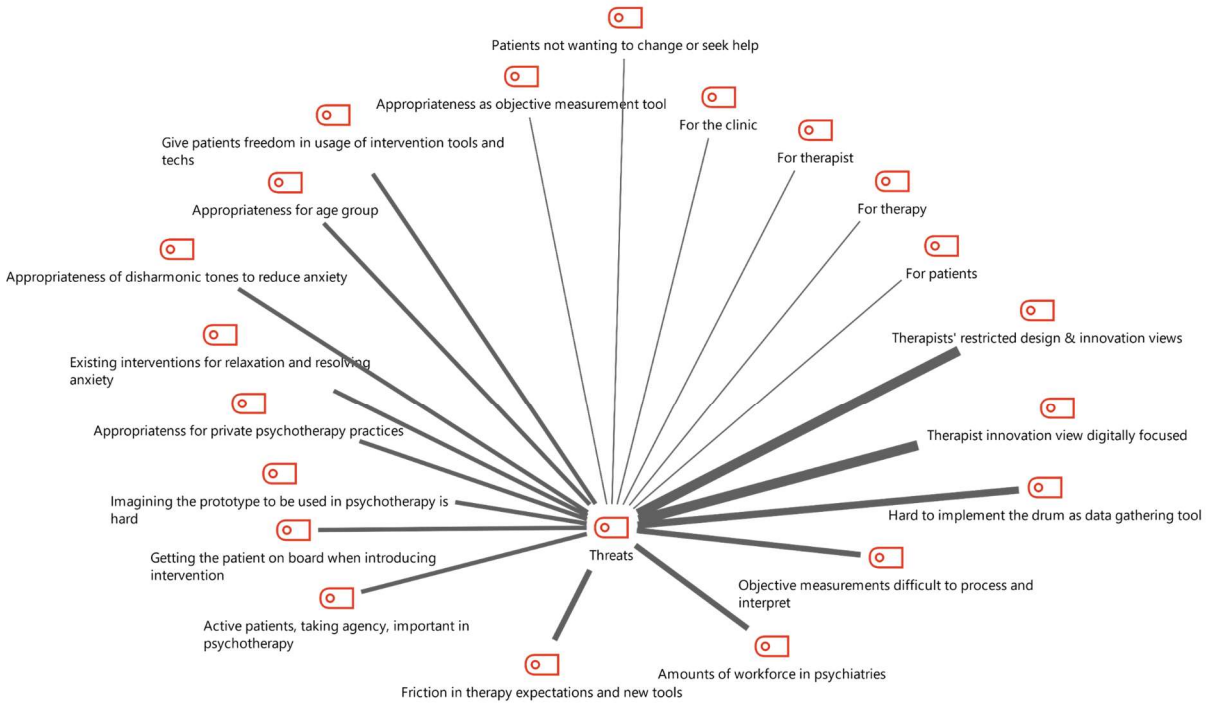


Threats

Threats				0
	For the clinic			0
		Walking also used to open up and relationship building		1
		Crafting and occupational therapies		3
		Technology doesn't need to be everywhere		1
		Drum must be worth the money for implementing in practice		2
		Appropriatenss for private psychotherapy practices		4
		Amounts of workforce in psychiatries		5
		Appropriateness and expertise of workforce in psychiatries		1
	For patients			0
		Appropriateness of disharmonic tones to reduce anxiety	Through music!	4
		Financial challenges for private purchases		1
		Doing therapy is underestimated by patients		1
		Burden to do therapy is very high		1
		Stereotypes, images, stigma around psychotherapy		2
		Patients not wanting to change or seek help		1
			It's easier to help when people want to change	3
			Easier to help people who have voluntarily therapy	1
		Appropriateness for patients with social anxiety		2
	For therapist			0
		Personalization of tool together with patient		1
		Give patients freedom in usage of intervention tools and techs		4
		Introduction and transparancy around drum tool		1
		Challenge to implement drum in the way you want it to be		1
		Therapist innovation view digitally focused		10
		Therapists afraid for trying new things		1
		Therapists' restricted design & innovation views		10
			imagining the prototype to be used in psychotherapy is hard	4
			Psychotherapy field innovative in use of statistical methods	1
		Patients want to be liked by the therapist		1
	For research			0
		Use of psychotherapeutic research insights in practice		2
		Drum doesn't really fit in emotion regulation research		1

For therapy			0
	Attention loss of the patient		1
	Appropriateness as homework tool		1
	Appropriateness for age group		4
	Financial resources, more therapist intervenence through tools		1
	Appropriateness of the drum's size to use as homework tool		1
	Appropriateness of using additional tools in therapy		1
	Friction in therapy expectations and new tools		5
	Additional tools are exhausting for the patient and therapist		3
	Introducing new things to patients often brings hesitance		1
	Getting the patient on board when introducing intervention		4
	Existing interventions for relaxation and resolving anxiety		4
		Meditation is more than relaxation or mental fitness training	2
		Meditation, yoga, religion as a way to connect with HL support	1
	Similarities with meditation practice		1
	Appropriateness for group therapy		2
	Appropriateness as objective measurement tool		1
		Data gathering most important thing in therapy	2
		Self-reported data can start a dialogue	2
		Self-reported data is easy to interpret	1
		Hurdles to using objective measurements in psychotherapy	In practice? 1
		Use of self-reported data	1
		Self-reported data gives sense of contributing and involvement	2
		Active patients, taking agency, important in psychotherapy	4
		Self-reported data above objective measurements in practice	4
		Tension using both objective and self-reported data in practice	They can contrast each other, which makes it hard to say what to do with the patient for the therapist 4
		Objective measurements difficult to process and interpret	5
		Lots of factors influence therapy efficacy	1
		In research hard to define what the drum measurements mean	3
		Hard to implement the drum as data gathering tool	7
	Added value as compared to musical instruments		2
	Tension with musical therapy		1
	Evidence-based psychotherapy		1
Beyond			0

Threats Summary Model



The coding summary Excel file generated out of MAXQDA can be obtained on request.

APPENDIX M: ERB FORM

This is a separate pdf-document that will be added below to the Appendices.

Ethical Review Form Education

(Version 17.07.2020)

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This Ethical Review Form should be completed for every research study that involves human participants or personally identifiable data. The form should be submitted and approved by your supervisor before potential participants are approached to take part in the research study.

Part 1: General Study Information

1	Student name and email	Veerle van Wijlen ; v.s.v.wijlen@student.tue.nl
2	Supervisor name and email	Dr. Max Birk ; m.v.birk@tue.nl
3	Degree Program	Industrial Design; Research, Design and Development master track.
4	Bachelor/master	Master phase; M2.2.
5	Bachelor/master end project?	Master end project (FMP).
6	Course name and code	FMP (SC) DEM220.
7	Project title	Relaxation effects and future design directions of a novel multi-sensory tangible design probe RELAX-CHANGE, a drum to decrease anxiety, for accessible “daily” relaxation support for people with elevated anxiety.
8	Research location	At the participants’ homes.
9	Research period (start/end date)	April 2021 – July 2021.
10	[If Applicable] Proposal already approved by (external) Ethical Review Board: Add name, date of approval, and contact details of the ERB	n.a.
11	Research question	The research questions of this project are: 1. What is the **effect** of the design probe’s novel relaxation principle on relaxation and decrease in state anxiety, amongst people with elevated trait anxiety? 2. What are **the unsatisfied needs** for playful tension-release creation, relaxation, and release of responses to anxiety to be found during play of the design probe? which therefore limit the benefits for relaxation and release of cognitive, emotional and bodily tensions to anxiety. 3. How can these relaxation/state-anxiety effects and user experience insights around expressive drum play for relaxation, making use of the design probe’s novel relaxation principle, inspire specific design directions and improved concepts around accessible multi-sensory expressive tangibles for relaxation and anxiety? **CONTEXT** We are living in a more inclusionary world, in which differences amongst people are accepted and offer a

		source of inspiration to society. However, people with elevated trait anxiety, aged 18-35 years old, experience increased worrying and rumination, i.e. negative thinking, limiting their daily functioning and opportunity to be their 'best self in society' and decreases empowerment and social integration. Therefore, the high need for support in a different pathway to relaxation for this target group is addressed, within a daily mental health context. The designed probe RELAX-CHANGE, provides a novel tangible, expressive and multi-sensory perspective on relaxation support for this target group. It supports building towards a peak of multi-sensory expressive drum play (tension) to flow into relaxation (release). In my M1.2 design research project at the department of Industrial Design at the TU/e and in my M2.1 exchange project, at the psychotherapy department at the Justus-Liebig University in Germany, I have created and researched the design probe RELAX-CHANGE, an "expressive" drum to reduce anxiety (as mentioned above). This design probe includes assumptions around a novel pathway to relaxation and release from anxiety tensions, called multi-sensory playful tension-release; and apart from this principle, also contains valued qualities from a clinical standpoint to provide novel relaxation support for people with elevated trait anxiety, who also suffer from states of anxiety in daily life. This final master design research elicits the evaluation of effectiveness, and creation of "future" accessible, expressive, multi-sensory tangible design, as novel relaxation support for people with elevated trait anxiety in daily life, through the use of the designed probe RELAX-CHANGE (as described above); that bridges the gap between music therapy, psychotherapeutic cognitive-behavioral therapy, and practical tools for relaxation in daily life contexts. In this project, the design probe RELAX-CHANGE will function as a research object to evaluate the effects of the probe's underlying relaxation principle and the users' user-experience around expressive drum play for relaxation. And in this way, will inspire specific design directions and improved concepts around accessible multi-sensory expressive tangibles for relaxation and anxiety. To in the end, make a start of accessible products for relaxation for people with elevated trait anxiety, having states of anxiety in daily life to deal with, that make this target group benefit from: • (easy) music creation, without it being an actual music instrument that allows for failing. • playful tension release, as an engaging and absorbing task to flow into relaxation (a combined principle from music therapy and relaxation

Ethical Review Form

		techniques that are well known in cognitive-behavioral therapy). • and multi-sensory light and sound feedback to release the cognitive, emotional and bodily responses to anxiety.
12	Description of the research method	**General overview:** This project draws from constructive and data-enabled design practices. I aim to leverage experience sampling using diaries, interviews, and questionnaire data at multiple points in time with a small pool of participants (1-3) who work with the drum for a fixed number of days. The qualitative interviews are described below. To assess anxiety, I will use the State-Trait Anxiety Instrument (STAI), which I have used in my previous work. I will only collect standard demographic information, and focus the interviews on questions around perceived experience on relaxation and usability of the prototype. **Constructive design research and data-enabled design** This final master project draws from the notion of constructive design research and data-enabled design (Van Kollenburg, & Bogers, 2019), "*which refers to design research in which construction — be it product, system, space, or media — takes center place and becomes the key means in constructing knowledge."* (Koskinen, Zimmerman, Binder, Redstrom, & Wensveen, 2011, p.5*) "Typically this thing in the middle is a prototype, however, it can be also be a scenario, a mock-up, or just a detailed concept that could be constructed."* (Koskinen et al., 2011, p.5). In this project, this "thing in the middle", is the design probe and research object RELAX-CHANGE, key to constructing knowledge around the effects of the probe's underlying relaxation principle and the users' user-experience around expressive drum play for relaxation. **Experience sampling** In order to explore the research questions mentioned above, it will be made use of the experience sampling method, also referred to as daily diary method (Sloboda, O'Neill, & Ivaldi, 2001). This method allows the participants to record "on the spot" thoughts and feelings in everyday real-life situations, so before and after the use of the research prototype (drum), through self-report forms with scaled items (quantitative) and open-ended items (qualitative). In this study, it is aimed for about 2-3 diary studies, in which in every diary study one participant uses the research prototype (drum) for 1 week, and reports on the relaxation effects, user experiences and contextual use before and after every play session on the drum.

Ethical Review Form

One week was considered to be the minimum period in which an individual was likely to encounter most potential everyday situations in which state anxiety would occur and the designed drum instrument RELAX-CHANGE, might play a role in their relaxation process.

The diary studies, as based on the paper by Colombo & Landoni (2014), will be coupled with an initial introduction and short semi-structured interview, and a follow-up semi-structured interview and design directions / concept evaluation.

Semi-structured interview
The initial introduction and short semi-structured interview, aims at installing the research prototype at the participant's home; checking their understanding of the prototype and study; and profiling the participant's on trait anxiety scores, musical preferences, and previous anxiety and relaxation experiences.

The follow-up semi-structured interview and design directions / concept evaluation is based on the semi-structured post-diary interview by Sloboda, O'Neill, & Ivaldi (2001).

Evaluating experiences
The follow-up aims at evaluating experiences of participating in the study; elaborate on responses given in the diary forms; and evaluate unsatisfied needs for playful tension-release creation and relaxation found during play of the design probe, and design directions & concepts satisfying those needs.

Diary study
The diary study itself aims at gathering both quantitative and qualitative self-reported data, and objective drum play behavior measurements (touch data), around the effects of the probe's underlying relaxation principle, the participants' user-experience around expressive drum play for relaxation, and the participants' contextual use of the drum for relaxation. This will be asked the participants to do before and after they play the research prototype (drum), at self-chosen moments that best fit a high state of anxiety. However, in order to enable the researcher to optimally research relaxation, state anxiety effects and user experiences around drum play for relaxation, the participants will be advised to play the research prototype (drum) at least 1 to 2 times a day, during the time period of the diary study.

The 2-3 diary studies involve a combination of quantitative and qualitative research methods (a convergent parallel Mixed Methods design), in which the two data types are analyzed separately and compared to see if they confirm or disconfirm each other (Creswell, 2003). With the quantitative data, the effects on relaxation / state anxiety

		are measured, and objective drum play characteristics for relaxation are elicited. With the qualitative data, the perceptions around contextual drum use, relaxation and effects on worrying, emotions and bodily tensions, and user experiences of drum play are evaluated. The initial introduction and short semi-structured interview will focus on both qualitative and quantitative data gathering as well. The follow-up will focus on merely qualitative data gathering. All parts of the diary studies will take place within the second iteration of the design research process. **Initial introduction and short semi-structured interview** The initial introduction and semi-structured interview will focus on installment of the research prototype at the participant's home; re-assuring of study and prototype understanding and profiling the participants on trait anxiety scores, musical preferences, and previous state anxiety and relaxation experiences. (as mentioned above). This part of the study will take place in a natural setting, at the participants' homes. Since it is assumed, also with the current COVID-19 work at home situation, that most people will encounter states of anxiety in home contexts and will be most comfortable performing relaxation practices at home. **Phases of the introduction include:** 1.Installing the research prototype at the participant's home and final explanation of the diary study procedure. For that purpose, the participants will alternately be provided with the research prototype (drum), prototype instructions, a diary booklet with a prescription of the data gathering procedure before and after playing the prototype and self-report forms, and remaining data collection tools such as a mobile phone tripod (for video logging), and the researcher's contact details in case of questions or prototype deficits. 2.Checking their understanding of the prototype and study. The participants will be asked to set-up the prototyped drum instrument on their own with the help of the instruction manual; they will be asked to change some multi-sensory settings, such as musical tone scales, in the prototype, and there is room left for questions. 3.Profiling the participant's on trait anxiety scores, musical preferences, and previous state anxiety and relaxation experiences. The participants will be asked to fill out the State-Trait Anxiety Inventory (STAI) self-evaluative "anxiety

		questionnaire", and then only the trait anxiety (T) items. In order to get insight into the participants' general overall experience of anxiety in their daily lives. This will be done with the help of an online Microsoft Form in which the 20 trait anxiety items (statements) will be stated, such as "I feel nervous and restless" or "I get in a state of tension as I think over my recent concerns and interest". This scale contains both anxiety absent and anxiety present statements. Participants will be asked to rank these items from "strongly disagree" to "strongly agree" (a 4-point frequency scale). Analysis of the T-items data, will be done for each participant by scoring the 20 items, of the filled in STAI, based on the answers in the 4-point frequency scale and the corresponding scoring weights to their responses. The total score of each participant shows their level on the trait anxiety spectrum. Scores range from 20 to 80. Low scores indicate a mild form of trait anxiety, median scores indicate a moderate form of trait anxiety and high scores indicate a severe form of trait anxiety. Furthermore, within a semi-structured interview setting, participants will be asked about previous experiences with anxiety, relaxation practices and musical preferences for relaxation. Answers to the interview topics and questions will be reported in the form of written notes and audio recordings. In total the introduction and short interview, will take about 30 – 60 minutes time. **The diary studies** The diary studies will focus on gathering a variety of mixed methods data around the effects of the probe's underlying relaxation principle, the participants' user-experience around expressive drum play for relaxation, and the participants' contextual use of the drum for relaxation. This will be asked the participants to do before and after they play the research prototype (drum), at self-chosen moments that best fit a high state of anxiety. The diary study will take place within a time period of minimally 1 week, with the advice of a minimum of 11 play sessions (based on the self-evaluative diary study by the researcher done upfront in the design research process). However, in order to enable the researcher to optimally research relaxation, state anxiety effects and user experiences around drum play for relaxation, the participants will be advised to play the research prototype (drum) at least 1 to 2 times a day, during the time period of the diary study. To also reach a minimum of 11 play sessions, needed to effectively study relaxation effects, as based on the self-evaluative diary study by the researcher done upfront in the design research process. And to enable the participant to get acquainted with the use of the prototype for relaxation.

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		Setting of the diary studies is in a natural setting. Many researchers agree that user-experience is context dependent and should not omit this critical factor (Colombo, & Landoni, 2014). To preserve the natural and "anonymous" context of "relaxation", the diary studies are carried out in the homes of the participants. However, they are also allowed to take the prototype to other spaces within the diary period e.g. workspace, home of a partner etc. to best preserve natural behavior around the drum instrument. The data collection around drum play will take about 30-45 minutes of their time for each play session on the research prototype (drum). In order to allow the participants to record "on the spot" thoughts and feelings around the drum play for relaxation, before and after the use of the research prototype (drum), through self-report forms with scaled items (quantitative) and open-ended items (qualitative), the participants will be provided with a digital diary booklet, with self-report forms and questionnaire links to Microsoft Forms, study procedure instructions and prototype instructions. Every self-report form exists out of two sections, section A and section B to be completed before and after playing the research prototype (drum). In section A of the form will determine the state anxiety before and after drum play (scaled items, using STAI); and contextual information around the use of the drum (date, time of use, time filled out the form, amount of time played the drum, setting of use, surrounded by others or not, multi-sensory prototype settings, motivation for play, expectations of play). In section B of the form will determine the perceptual information around the participants' relaxation state, cognitive/emotional/bodily state and tiredness before and after drum play; and the participants' user experience around "expressive drum play" for relaxation after drum play. As mentioned, in the diary booklet a procedure of data collection around the drum play can be found as well, which is as follows: • Set-up research prototype (with instructions in diary booklet). • Set multi-sensory interaction preferences; such as type of musical tones, light responsiveness and volume (with instructions in diary booklet). • Set up the video logging setting (camera focused on hand movements on the prototyped drum), incl. phone & tripod. • Pre-reporting in section A and section B of the diary booklet self-report forms. • Play! • Stop and save video recording.

- Save objective touch behavior data that the research prototype has collected.
- After-reporting in section A and section B of the diary booklet self-report forms.
- Turn prototype off, and go on with the day.

For the quantitative aspects of the data collection the following quantitative data is asked to log in-situ by the participants, in the form of scoring items in the form:

- State anxiety data, through state anxiety items within the STAI questionnaire, before and after drum play.
- Quantitative objective touch behavior data during every play session. This needs to be saved after play by the participants.
- Video logging of the hand movements during drum play, functioning as observational play behavior data.

For the qualitative aspects of the data collection the following qualitative data is asked to log in-situ by the participants, through the self-report forms in the diary booklet.

- Contextual use of the design probe, in the form of open-ended items in the form;
  - Relaxation state, cognitive/emotional/bodily state and tiredness before play.
  - Relaxation state, cognitive/emotional/bodily state and tiredness after play.
  - Date, time of use, time filled out the form, amount of time played the drum, setting of use, surrounded by others or not, multi-sensory prototype settings, motivation for play, and expectations of play.
- Participant's user experience, in the form of open-ended items, around certain topics as: general experience of expressive drum play for relaxation; playful tension and release build-up; engagement ("Flow", as described in flow theory) during play; use of multi-sensory feedback mechanisms, such as use of light and sound feedback, for playful tension-release creation, engagement, relaxation, or release of anxiety tensions to be found during play; use of light illumination cover on the prototype; unsatisfied needs for playful tension-release creation, relaxation, and release of anxiety tensions to be found during play; and prototype deficits or improvements, and ease/burden of data gathering during the diary study (meta-level).

Follow-up semi-structured interview and design directions / concept evaluation
The follow-up will focus on evaluating the participants' experiences of participating in the study; elaboration on

		responses given in the diary forms; and evaluation of unsatisfied needs for playful tension-release creation and relaxation found during play of the design probe, and design directions & concepts satisfying those needs. (as mentioned above). The follow-up will take place within the natural setting of the diary participants, where they most used the research prototype, probably at their homes, when the research probe is collected and all qualitative and quantitative data is transferred to the researcher. The follow-up will take about 30-60 minutes of the participant's time. The qualitative data collected within the semi-structured interview and design directions / concept evaluation involves answers around topics as: - General experience of participating in the study. - Specific perceived preferences in contextual use; relaxation effects; user-experiences of playing the prototype for relaxation; play behavior; prototype improvements; and unsatisfied needs for relaxation (with the help of the participant's self-reported diary data). - Potential design directions to address unsatisfied needs for relaxation; and opinions around concepts addressing these unsatisfied needs. Closed off by a major thanks to the participants for contributing to the research by participating in the diary study. **Data analysis methods** The process of data analysis includes first a separate mixed methods data analysis per diary participant and after that, separate results will be compared. In this way the participants' relaxation and state anxiety effects, play characteristics, user-experiences and contextual use will be compared after separate analyses. In the separate analyses of each participant, the analysis of the introduction phase data will lead to comparable participant profiles. The analysis of the diary studies data will lead to comparable relaxation and state anxiety effects, play characteristics, user-experiences and contextual use. And the analysis of the follow-up phase data will lead to a combined understanding of specifics behind certain relaxation / state anxiety effects, play characteristics, user-experiences, contextual use,

		unsatisfied needs and vision on follow-up designs to satisfy these “unsatisfied needs”. *Introduction phase* Scoring of the trait anxiety items filled in within the STAI questionnaire: Analysis will be done for each participant by scoring the 40 items, of the filled in STAI, based on the answers in the 4-point frequency scale and the corresponding scoring weights to their responses. The total score of each participant shows their level on the state-trait anxiety spectrum. Scores range from 20 to 80. Low scores indicate a mild form of anxiety, median scores indicate a moderate form of anxiety and high scores indicate a severe form of anxiety. Note-based thematic analysis for the semi-structured interview answers. *Diary studies* 1.State anxiety data, through state anxiety items within the STAI questionnaire, before and after drum play will be analyzed in the same way as the trait anxiety data from the introduction phase. 2.Graphs and tables from quantitative objective touch behavior data during every play session. 3. Annotated drum play videos (singularly focused on hand movements), including playful tension-release creation curves, and variety in use of hand movements, functioning as observational play behavior data. 4. Note-based thematic analysis of the self-reported contextual use of the research prototype and user-experiences around drum play for relaxation. Or by using qualitative content analysis, which enables for reporting in quasi-statistics (Colombo & Landoni, 2014). 5. Annotating drum play videos with effects on relaxation and state anxiety, contextual drum use and participants’ user-experiences around drum play for relaxation. *Follow-up phase* Note-based thematic analysis for the semi-structured interview answers. *Data analysis combination and comparison* In the end of the data analysis process, the analysis of the diary studies and the collected quantitative and qualitative data, includes a comparison between these 2-3 diary studies, and a self-evaluative diary study in which the researcher herself participated (done in iteration 1). The comparison is done to compare relaxation/state anxiety effects and user experiences around multi-sensory expressive drum play for relaxation, through the novel underlying relaxation principle of playful tension & release. Furthermore, to validate hypotheses behind effects found; differences in drum play characteristics; and user’s experiences. And next to that, to evaluate several design

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		directions and concepts within, addressing improved satisfaction of needs around relaxation and playful tension & release.
13	Description of the research population, in- and exclusion criteria	The diary studies target the general population. As such only people without clear intellectual or physical disabilities are solicited for this research. For general psychological research pertaining to playful interaction, only healthy consenting adults, within the age group of 18-35 years old, will participate. In order to fulfill the criteria of consenting adults, each participant has to sign a consent form to either give consent to participation or not and to what extent regarding audio / video recording, objective touch behavior logging, and publication of data. In this specific data-enabling prototype diary study situation it is especially emphasized on recruiting technology capable participants, who are able to work with computerized technologies. The participants for the diary study will be recruited based on convenience and heterogeneity. Their level of anxiety will be anonymous and only evaluated after the diary studies have been taken place, during the research analysis phase within the design research process. This to enable the researcher to link the group of participants play behavior, context of drum use, and user-experiences with the diversity in state anxiety and relaxation effects. It is chosen to recruit heterogenous groups of participants, since this will spark more diverse discussion in the reporting of the results on the effects of the novel underlying relaxation principle of the drum on relaxation, and more valuable reflection on improved design directions and concepts. Exclusion criteria: - Participants without consent. - Participants who fall out of the age group of 18-35 years old. - Participants with severe mental states or severe anxiety. - Participants that are currently in therapy for anxiety related issues. - Participants not able to deal with computerized technology, such as the research prototype.
14	Number of participants	2-3 participants (due to having only one prototype, one participant would participate at a time resulting in a total time period of 2-3 weeks.
15	Explain why the research is socially important.	This design research is socially important, because: Individual freedoms at the core of modern democratic systems have brought improved quality of life to their

		citizens. These include amongst others freedom of expression, freedom of worship and freedom of fear. However, for people with elevated trait anxiety these freedoms are particularly challenging in daily life. The main problems related to anxiety, or worrying and/or rumination, causing difficulties in relaxation and a decreased self-image, cause restrictions in daily life functioning and so in being their 'best self' in society. In this way a decrease in quality of life and well-being through lack of freedom, expression, empowerment and social integration is caused which needs to be addressed. This through evaluating the effects of the design probe's (drum's) underlying relaxation principle and the users' user-experience around expressive drum play for relaxation; and vision creation on specific design directions and improved concepts around accessible multi-sensory expressive tangibles for relaxation and anxiety. Next to individual gains, additional societal benefits, from increase in "daily" support opportunities for relaxation, empowerment and social integration, are made for society at large. This by enabling members of society to partake in everyday life, and by supporting the healthcare system by creating decreased demand for treatment. This design research provides a low-risk, and safe "home" setting where participants voluntarily and playfully engage into drum play with the research prototype and interviews about designs for anxiety in a fun, interactive and medium-effort manner. In this way, they subsequently learn and share knowledge possibly improving their critical attitude towards dealing with anxiety on a personal and societal level.
16	Describe the way participants will be recruited	As mentioned earlier, the participants for the diary study will be recruited based on convenience and heterogeneity. Their level of anxiety will be anonymous and only evaluated after the diary studies have been taken place, during the research analysis phase within the design research process. It is chosen to recruit heterogenous groups of participants, since this will spark more diverse discussion in the reporting of the results on the effects of the novel underlying relaxation principle of the drum on relaxation, and more valuable reflection on improved design directions and concepts. Furthermore, due to the time limit within the final master project, the participants will be recruited with the help of peer students within the Games and Play squad; the network from fellow final master students, assistant professor dr. Max Birk and my own network as build up over the last years.

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		Participants that fulfill the inclusion criteria (so don't fulfill the exclusion criteria), will be contacted via online communication platforms such as Slack, WhatsApp or e-mail. They will be briefly informed about the procedure of the diary study, the research prototype, what will be expected from them when they decide to participate and they will be asked if they want to participate off course. If the recruited persons decide to participate, they will be provided with a consent form, the diary study (introduction, diary phase, and follow-up) will be planned with them, and further information will be given via online communication up until the start of the diary study.
17	Provide a brief statement of the risks you expect for the participants or others involved in the research and explain. Take into consideration any personal data you may gather and privacy issues.	**Ethical Considerations** This study involves minimal risks for the participants. The physical prototype singularly contains CE approved components, and is optimized upfront of the diary studies in terms of multi-sensory interaction and comfort in use, to prevent any form of extra anxiety within the participants. Furthermore, the diary studies will mainly take place in the participant's home environment. This allows participants to engage from a private, comfortable and safe environment. Within the introduction and follow-up phase, the current COVID-19 situation is highly taken into account, and both the researcher and participants will have to take all hygiene rules into account (such as prototype disinfection practices, and social distancing). Next to this, recruitment of participants for the focus groups is done based on convenience and not based on requested or specified anxiety conditions or characteristics. Data about the participant's level of anxiety from the STAI will be analyzed after the diary studies have been taken place; will be done anonymously (through use of participant numbers instead of any person-related characteristics); and only used for the sake of analysis within this design research. Together with informing about the purpose, procedures and guidelines of the study and the use of **consent forms** upfront of participation, the risk of involving people with severe anxiety problems will be low. Through these consent forms, consent for audio recordings, objective touch data logging, video recordings, and state-trait anxiety data will be explicitly checked. Participants in the diary studies will not be exploited and the research plan will be fully revealed before the start of the study. The researchers will have access to this data only with prior consent from the participants, who can decline to share their results at any moment. All participants will be expressly notified that they may go out of the study (diary study procedure) at any moment at no penalty, and the study is set up in such a way that there is no barrier to do this.

		Additionally, the tasks that will be asked from participants in the diary studies, in order to engage in the research and reflect upon the research prototype, will be such that they do not deviate from regular activities in the specified context and research. The diary studies will be focused exclusively on the relaxation and state anxiety effects of, experience around using the prototype, and the evaluation of improved future design concepts, in relation to the research prototype. So the results really center around the experience and improvements for the design of the drum RELAX-CHANGE. For collecting more sensitive personal information, an amendment to this proposal will be needed. Self-reported data from the STAI will be coded and allocated a unique identifier. The coded data will be kept on a password protected academic online platform at the Eindhoven University of Technology. All the personal data collected during the study will be processed confidentially and test subjects will never be recognizable in publications, academic material or any other means. Quotes from the diary booklets and semi-structured interviews will be pseudonymized and screened for not being traceable to an individual.

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	Part 2: Checklist for Minimal Risk	Yes	No
1	Does the study have a medical scientific research question or claim (see definition below) *Medical/scientific research is research which is carried out with the aim of finding answers to a question in the field of illness and health (etiology, pathogenesis, signs/symptoms, diagnosis, prevention, outcome or treatment of illness), by systematically collecting and analysing data. The research is carried out with the intention of contributing to medical knowledge which can also be applied to populations outside of the direct research population.*'	☐	☒
		If yes or maybe: Your supervisor should submit the study to the ERB. You cannot get automatic ethical approval.	If no: Continue with question 2
2	Does the study involve human material (such as surgery waste material derived from non-commercial organizations such as hospitals)?	☐	☒
		If yes or maybe: This is only allowed if your supervisor has consulted with the medical coordinator. Continue with question 3	If no: Continue with question 3
3	Will the participants give their explicit consent – on a voluntary basis – either digitally or on paper? Or have they given consent in the past for the purpose of education or for re-use in line with the current research question?	☒	☐
		If yes: Continue with question 4	If no: Your supervisor should submit the study to the ERB. You cannot get automatic ethical approval
4	Will the study involve discussion or collection of personal data? (e.g. name, address, phone number, email address, IP address, BSN number, location data) or will the study collect and store videos, pictures, or other identifiable data of human subjects?	☒	☐
		If yes: The handling, storing and de-identification of the personal data should be discussed with your supervisor. Continue with question 5 if you met all requirements for handling personal data (see nr. 17, in which I explain how privacy of participants is safeguarded)	If no: Continue with question 5

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		Yes	No
5	Does the study involve participants who are particularly vulnerable or unable to give informed consent? (e.g. children, people with learning difficulties, patients, people receiving counselling, people living in care or nursing homes, people recruited through self-help groups)?	☐	☒
		If yes: Your supervisor should submit the study to the ERB. You cannot get automatic ethical approval	If no: Continue with question 6
6	May the research procedure cause harm or discomfort to the participant in any way? (e.g. causing pain or more than mild discomfort, stress, or anxiety)	☐	☒
		If yes: Your supervisor should submit the study to the ERB. You cannot get automatic ethical approval	If no: Continue with question 7
7	Will the participants receive any compensation for their participation? Such as a coupon or a chance to win a prize?	☐	☒
		If yes: Your supervisor should submit the study to the ERB. You cannot get automatic ethical approval	If no: Continue with question 8 or 10, depending on the type of study (see red text below)
The following questions 8-9 are for *observational* research (e.g. (semi-)structured interviews; focus groups; (participatory) observations). If your research is *experimental*, then skip questions 8-9 and continue with question 10			
8	Will it be necessary for participants to take part in the study without their knowledge and consent at the time? (e.g. covert observation of people)?	☐	☒
		If yes: This is only allowed when observing behavior in public space. If so, continue with question 9. If you observe people in non-public space without their consent, your supervisor should submit the study to the ERB. You cannot get automatic ethical approval	If no: Continue with question 9
9	Will participants be asked to discuss or report sexual experiences, religion, alcohol or drug use, or suicidal thoughts, or other topics that are highly personal or intimate?	☐	☒
		If yes: Your supervisor should submit the study to the ERB. You cannot get automatic ethical approval	If no: Continue with part 3

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The following questions 10-13 are for *experimental* research (e.g. measurements on yourself or another person; testing a prototype/device; influencing behavior through manipulation (e.g. light or temperature). If your research is *observational*, then skip questions 10-13 and continue with part 3			
		Yes	**No**
10	Is the study invasive (i.e. it affects the body such as puncturing the skin; taking blood or other body material (such as DNA) from the participant)?	☐	☒
		If yes: Your supervisor should submit the study to the ERB. You cannot get automatic ethical approval	If no: Continue with question 11
11	Does the device have a medical purpose such as diagnosis, prevention, monitoring, prediction, prognosis, treatment or alleviation of disease or injury?	☐	☒
		If yes or maybe: Your supervisor should submit the study to the ERB. You cannot get automatic ethical approval	If no: Continue with question 12.
12	Will the experiment involve the use of physical devices that are 'CE' certified for unintended use (meaning you will use existing CE certified devices for other things than they were originally intended for?	☐	☒
		If yes: This is only allowed if they are completely harmless. They should have a harmless voltage of <5V and hazardous waste (fumes/gas/substances) should not be released. You should discuss with your supervisor whether you need to have the device tested for safety	If no: Continue with question 13
13	Will the experiment involve the use of physical devices that are not 'CE' certified?	☒	☐
		If yes: This is only allowed if they are completely harmless. They should have a harmless voltage of <5V and hazardous waste (fumes/gas/substances) should not be released. You should discuss with your supervisor whether you need to have the device tested for safety	If no: Continue with part 3

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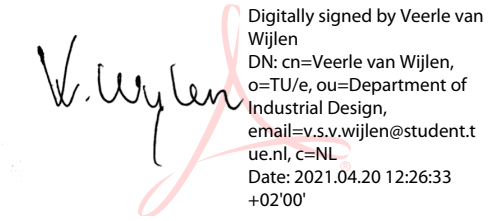
Part 3: Enclosures and Signature

1	Enclosures (tick if applicable): ☒ Informed consent form (link to template); ☐ The survey the participants need to complete, or a description of other measurements (such as interview questions or a description of the prototype); ☐ Text used to find participants (such as brochures, flyers, etc); ☐ Approval other research ethics committee;	The informed consent form for the research participants is added as additional information, in the form of a PDF document.
2	I hereby declare that I have completed this form truthfully Signature(s) of the student(s). Veerle van Wijlen, MSc Industrial Design TU/e. Date: 19-04-2021.	

Discuss this form with your supervisor. If any of the boxes your ticked in Part 2 suggest that your supervisor should submit your study to the ERB for ethical approval, try to change your research design in such a way that your supervisor can approve it instead. If this is not possible, ask your supervisor to submit the proposal to the ERB. It will take two to five weeks before you receive a decision from the ERB.

Part 4: Review by supervisor

		Yes	No
1	Does the data storage adhere to all requirements of responsible data management (link toevoegen)?	☒	☐
		If yes: Continue with question 2	If no: Discuss with your student the necessary steps to adhere to the requirements
2	Does the research proposal adhere to all requirements for automatic approval?	☐	☒

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		If yes: Please skip the questions 3-6 and sign the form	If no: Discuss with your student if any alterations can be made in order to adhere to the requirements for automatic approval. If you decide that the study cannot adhere to the requirements, then you as a supervisor need to submit the proposal to the ERB. Please answer the following additional questions (3-6)
Additional questions for ERB approval			
3	Elaborate on the topics from part 2 that do not allow for automatic approval. Describe how you safeguard any potential risk for the research participant for each topic.	**Medical scientific research:** The work includes measures of state and trait anxiety and is aimed at participants who have suffered from anxiety in the past. We will not involve participants that are in treatment for acute anxiety. The artefact is intended to be calming and we don't foresee the interaction to be a trigger for experiences of anxiety. Additionally, participants who do not feel fit to participate can easily refrain from participating. In case of an event, we keep the emergency number of the GGZ and the universities mental health support at hand, and the research has the contact information of her supervisor to reach out in case of an emergency.	
4	Describe and justify the number of participants you need for this research, taking into account the risks and benefits	The aim of the study is to gather in-depth data of 1-3 peoples experience over time. The researcher has done a first person investigation herself and expend the protocol. While more participants would allow to identify patterns the effect of the drum an anxiety over time, a smaller number of participants will allow us to focus on individual experience and generate new insights about the potential effect of using a tangible music instrument for anxiety reduction.	
5	Explain if your data are completely anonymous, or whether they will be de-identified (pseudonymized or anonymized) and if so, explain how	The data will be pseudonymized during the study. Due to the length of the study the research needs to stay in touch with the participant and the participant might want to reach out to the researcher, e.g., to stop the study, due to technical issues, or other concerns. The collected data will be stored on University licensed storage (OneDrive or SurfDrive). The data itself will be pseudonymized using unique identifier and all qualitative and quantitative measures will be coded accordingly. The look-up list will be stored separately from the data.	
6	Who will have access to the data?	The researcher, the supervisor, and (in summarized form) assessors.	

Ethical Review Form

Part 5: Signature by supervisor		
	I hereby declare that I have completed this form truthfully Signature of the supervisor. Dr. Max Birk, assistant professor Industrial Design TU/e. Date: 19-04-2021.	

Consent Form

Title: Relaxation effects and future design directions of a novel multi-sensory tangible design probe RELAX-CHANGE, a drum to decrease anxiety, for accessible "daily" relaxation support for people with elevated anxiety.

Supervisor: Max Birk, Assistant Professor, Department of Industrial Design, Eindhoven University of Technology, m.v.birk@tue.nl, +49 174 750 52 45.
Researcher(s): Veerle van Wijlen, MSc Student, Industrial Design.

Purpose(s) and Objective(s) of the Research: To increase empowerment and social integration of adolescents and adults with anxiety, I investigate the effects of the probe's (drum's) underlying relaxation principle and the users' user-experience around expressive drum play for relaxation. And in this way, I will inspire specific design directions and improved concepts around accessible multi-sensory expressive tangibles for relaxation. In the research period of 1 week, I aim to leverage experience sampling using diaries, interviews, and questionnaire data at multiple points in time when working with the drum for a fixed number of days.

Procedures:
Phase 1: Initial introduction and short semi-structured interview (30-60 minutes).
The initial introduction and semi-structured interview will focus on installing the research prototype at the participant's home; re-assuring of study, digital diary booklet, and prototype understanding and profiling the participants on trait anxiety scores, musical preferences, and previous anxiety and relaxation experiences.

Phase 2: The diary study (1 week / 7 days).
The diary study will focus on gathering a variety of data around the effects of the probe's (drum's) underlying relaxation principle, the participants' user-experience around expressive drum play for relaxation, and the participants' contextual use of the drum for relaxation.
This will be asked the participants to do before and after they play the research prototype (drum), with the help of self-report forms and instructions in the digital diary booklet, at self-chosen moments that best fit a state of anxiety or need for relaxation.

Phase 3: Follow-up semi-structured interview and design directions / concept evaluation (30-60 minutes).
The follow-up will focus on evaluating the participants' experiences of participating in the study; elaboration on responses given in the diary self-report forms; and the evaluation of unsatisfied needs in drum play for relaxation found during play of the design probe, and design directions & concepts satisfying those needs. Furthermore, the research probe will be collected by the researcher and all diary study data is transferred to the researcher.

Funded by: -

Potential Risks and Benefits: During the research, there are minimal known or anticipated risks to you by participating in these interviews, diary study and share of knowledge.

The physical prototype singularly contains CE approved components, and is optimized upfront of the diary studies in terms of multi-sensory interaction and comfort in use, to prevent any form of extra anxiety within the participants.

Furthermore, the diary studies will mainly take place in the participant's home environment. This allows participants to engage from a private, comfortable and safe environment. Within the introduction and follow-up phase, the current COVID-19 situation is highly taken into account, and both the researcher and participants will have to take all hygiene rules into account (such as prototype disinfection practices, and social distancing).

Next to that, data about the participant's level of anxiety from the State-Trait Anxiety Inventory questionnaire (STAI) will be analyzed after the diary studies have been taken place; will be done anonymously; and only used for the sake of analysis within this design research. Self-reported data from the STAI questionnaire will be coded and allocated a unique identifier. The coded data will be kept on a password protected academic online platform at the Eindhoven University of Technology.

The coded qualitative data of the interview responses, and self-report forms in the diary booklets, will be kept on a password protected academic online platform at the Eindhoven University of Technology. All the personal data collected during the study will be processed confidentially and you, as participant, will never be recognizable in publications, academic material or any other means. Quotes from the diary booklets and semi-structured interviews will be pseudonymized and screened for not being traceable to an individual.

Potential benefits include use of the prototyped novel drum instrument and its potential relaxation effects; reflections on daily relaxation practices; and share of expertise in the fields of design research, music therapy, psychology, and practical tools for relaxation in daily life contexts.

Confidentiality:

- Confidentiality will be maintained throughout the entire research procedure. The entire process and data will be anonymized. Data will only be presented in the aggregate and any individual comments will be anonymized prior to reporting, presentation in class or publication.
- Only the researcher will have access to the data to ensure that your confidentiality is protected.

Data Collection: With your permission, I would like to record audio during the interviews; use anonymized fragments of your self-reported video recordings of your drum play behavior (hand movements singularly); use anonymized touch behavior data of your drum play as logged by the research prototype, in the form of tables or graphs; use anonymized insights from your self-reported STAI questionnaire data; and use pseudonymized quotes from the diary booklets and semi-structured interviews.

The audio, video, touch behavior, STAI, and quotes data would be used to analyse important relaxation effects, interview responses, and diary user-experience self-reports, which can be used as input for concluding the effects of the probe's underlying relaxation principle and the users' user-experience around expressive drum play for relaxation. And in this way, to provide inspiration for specific design directions and improved concepts around accessible multi-sensory expressive tangibles for relaxation and anxiety.

Please indicate if I am allowed to record audio, and use fragments of your self-reported or logged video recordings, touch behavior, STAI data and interview / diary quotes in reporting; if the material can be presented in class and in case relevant published:

	Be recorded	**Presented anonymized**	**Used for Analysis**	**Used for Publication**
Audio:	Yes [ ] No [ ]	| Yes [ ] No [ ]	| Yes [ ] No [ ]	| Yes [ ] No [ ]

	Presented anonymized	Used for Analysis
Video:	| Yes [ ] No [ ]	| Yes [ ] No [ ]

Used for Publication
| Yes [ ] No [ ]

	Presented anonymized	Used for Analysis
Logged touch behavior:	| Yes [ ] No [ ]	| Yes [ ] No [ ]

Used for Publication
| Yes [ ] No [ ]

	Presented anonymized	Used for Analysis
STAI data:	| Yes [ ] No [ ]	| Yes [ ] No [ ]

Used for Publication
| Yes [ ] No [ ]

	Presented anonymized	Used for Analysis
Interview responses & diary quotes:	| Yes [ ] No [ ]	| Yes [ ] No [ ]

Used for Publication
| Yes [ ] No [ ]

Storage of Data:

- Data will be stored on a secure password-protected server until 12 months after the end of the research and then destroyed.

Right to Withdraw:

- Your participation is voluntary. You may withdraw from the research project for any reason, at any time without explanation.
- Should you wish to withdraw, you may do so at any point, and we will not use your data; we will destroy all records of your data.
- Your right to withdraw data from the study will apply until the data have been aggregated (one week after study completion). After this date, it is possible that some form of research dissemination will have already occurred and it may not be possible to withdraw your data.

Follow up:

To obtain results from the research, please contact Veerle van Wijlen (v.s.v.wijlen@student.tue.nl).

Questions or Concerns:

- Contact the researcher(s) using the information at the top.
- This research project has been approved on ethical grounds by the Eindhoven University of Technology Research Ethics Board. Any questions regarding your rights as a participant may be addressed to that committee through the Research Ethics Office, ethics@tue.nl, +31 40 - 247 6259.

_____	_____
Date, place	Signature