TactJam: a collaborative playground for composing spatial tactons

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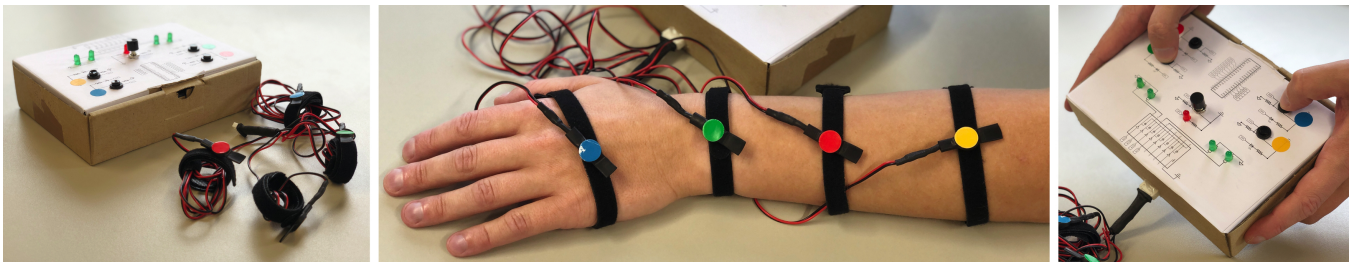

Figure 1: TactJam prototype: using a tangible interface, users can quickly design tactons while experiencing them on their body.

ABSTRACT

Tactons are vibrotactile patterns used to convey information. Conventionally, a small set of tactons is used on mobile phone or wearables to notify users of messages or emails received. However, tactons have multiple characteristics that one can vary to design a multitude of vibrotactile patterns. In addition, one can place vibrotactile actuators on different body areas to leverage the spatial dimension and the varying skin sensitivity across the body. Prior work proposed methods to design tactons based on musical or engineering knowledge, but hands-on methods remain scarce. For this studio, we adopt a hands-on approach for composing tactons. We leverage a simple instrument-like device that consists of vibrotactile actuators connected to dedicated buttons for designing tactons. While pressing a button, the corresponding actuator vibrates. Users can vary several characteristics of the tactons (e.g., duration and amplitude), and experience them in real time during the design process by placing the actuators on the body. These tactons can then be shared with other participants of the studio. Our goal with this studio is to observe users compose tactons collaboratively using a hands-on device, and better understand how they lay out the vibrotactile actuators on their body and what differences these layouts make in the tactile experience.

CCS CONCEPTS

• **Human-centered computing** → **Participatory design**; • **Hardware** → **Haptic devices**.

KEYWORDS

tactile perception, tactile feedback, tactons, sketching, prototyping, jamming

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1 INTRODUCTION

In 2004 Brewster et al. [1] coined the term *tacton* to describe vibrotactile patterns that convey structured tactile messages. Since then, tactons have been explored in research [2, 5, 6] as well as many commodity devices. They are particularly useful to communicate information through the tactile sense instead of the more commonly used visual sense. Most commodity devices like smartwatches and smartphones use a set of tactons to notify users of various events like receiving an email, the answer from a tweet, or warning messages that the device's battery is low. Small variations

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in the vibration patterns enable users to differentiate between tactons, hence providing information of what kind of notifications they represent, even before looking at the device's display and reading them.

Designing arbitrary unique tactons is rather a simple task considering all their parametric characteristics [3], but mapping (visual) data to tactons is, however, not trivial [5]. Consider, for example, translating the intention of a set of icons into tactile stimuli, how would you proceed? One possibility is to freely design and experience a large variety of these stimuli and find the most relevant for each icon. Previous work proposed such design tools for haptic stimuli in general like the Hapticon [4] that allows users to input manual trajectory for later reproduction, or mHIVE [8], an haptic instrument allowing users to map artistic performances to haptic stimuli.

In this studio, we build on these hands-on approaches and former TEI studios focused on exploring haptic sensations through tangible devices [7, 9]. Following a three-way split approach for ideation that consists in *thinking* about the concepts, *pairing* and designing collaboratively, and *sharing* thoughts, we propose to conduct 'tactile jam sessions' in which all participants can play with TactJam (see Fig. 1), an instrument-like device to compose tactons. Our primary goal in conducting these sessions is to observe how users collaboratively design tactons, and understand the various design strategies they adopt when reproducing the intentions of icons through tactile cues. Secondly, we are interested in how users lay out vibrotactile actuators on their body to experience tactons. Particularly, we wonder whether the layout plays an important role in the creation process.

2 STUDIO PROPOSAL

We plan to host the studio for enthusiastic participants to compose and experience tactons. Therefore, each participant will be provided with a ready to use TactJam device. Due to the limited number of available devices we have to limit the workshop to 16 participants. Participation without a device may not be practical to achieve the proposed learning objectives.

After a general introduction to the studio's topic and some grounding in theory, we plan to structure the studio into three major consecutive sessions: (1) think, (2) pair, (3) share (see Fig. 2). During the *think-session* participants will get familiar with TactJam and freely experiment with it. They will compose and experience spatial vibrotactile patterns produced in real-time. The goal for this session is to teach participants basic concepts of tactons, and how they can play with TactJam to compose them.

For the *pair-session* participants will come together in small remote groups using the Discord chat application[1] and map the intention of given visual pictograms into tactons. They will share and discuss their strategies to compose tactons in their groups and eventually vote for the best solutions or create entirely new ones by merging ideas. All produced tactons and discussions will be processed and saved in a Git repository and a dedicated wiki by the organizers to document the progress during the studio afterwards.

During the *share-session*, participants will present their strategies and share their tactons with all other groups. They will have the time to share their personal bodily experiences with TactJam and reflect on the creation process to compose tactons. Ideally, all participants will end this session with a list of dos and don'ts in mind when composing tactons. These are also documented in the wiki by the organizers. We would also like to encourage the participants to summarize their impressions and findings in a short paragraph, which will be published in the wiki by the organizers.

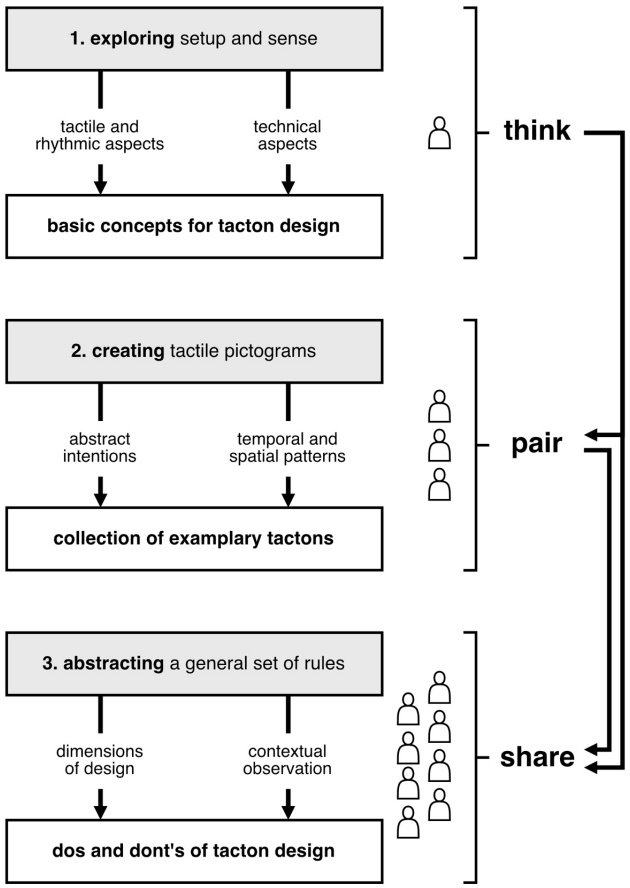

Figure 2: Studio Schedule

Based on the quality of the empirical data, we plan on writing a scientific paper aimed at a renowned HCI conference (TEI, CHI or others) or rather opt for an article in a magazine like Interactions. The results remain accessible after the studio and all sources will be licensed under Open Source or Creative Commons (depending on type of source).

2.1 Hands-on design of tactons with TactJam

TactJam (see Fig. 3, left) is an instrument-like device which enables users to quickly explore tactons and freely create new ones by playing them live or even record tactons and play them back later. Recording tactons enables participants to share their tactons with others. To do so they need to transfer the desired tactons via a dedicated software (also provided by the organizers) to their computer and then send the files via Discord.

The device provides eight vibrotactile actuators (see 3, left, top row), each coupled to one push button on the device's left or right

[1] https://discord.com/

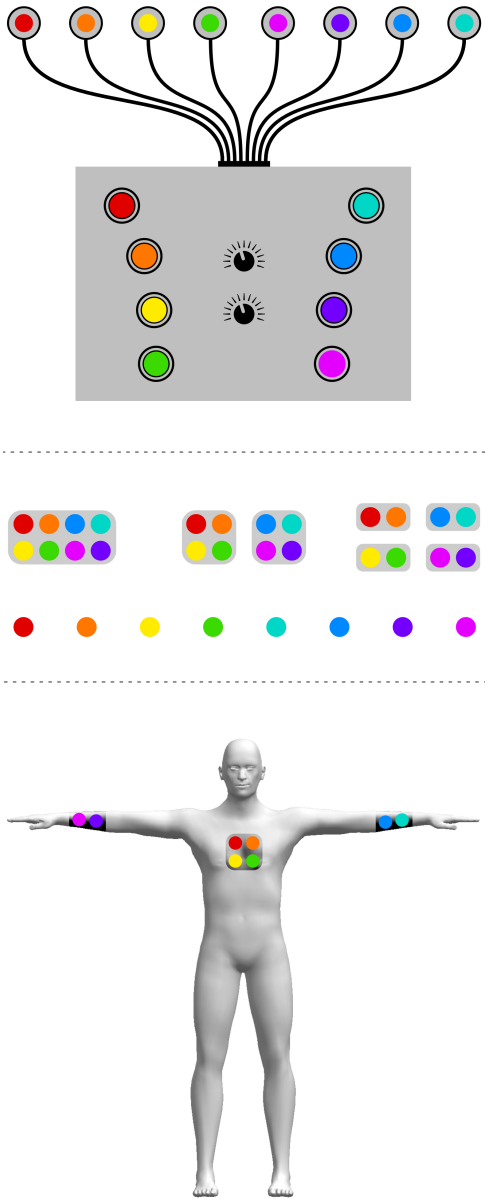

Figure 3: TactJam is an instrument-like device (top) for exploring spatial tactons. The connected actuators can form a shape, groups, or act individually (center) and can be placed anywhere on the body, e.g. grouped (bottom).

side. Pushing the button triggers the actuator, and the actuator keeps vibrating as long as the button is pressed. Potentiometers (nobbs in the center) control the intensity of the actuators or the speed of recording and playback (like a digital metronome). The freely mountable actuators can be combined in several ways to either form a single shape, smaller groups, or distributed anywhere on the body and acting individually (see Fig. 3, center). The actuators' wires are about 1.5m long to enable whole body placement (see Fig. 3, right).

3 TOPICS THIS STUDIO COVERS

- Introduction to tactile perception and vibrotactile patterns in general (tactons)
- Hands-on design of tactons through a simple instrument-like device (TactJam)
- Sharing tactile experiences with others: discussing bodily experiences and design processes
- Identifying similar design strategies of vibrotactile cues

4 LEARNING GOALS

- A good understanding of basic modalities of the tactile sense
- Knowledge of methods to explore spatial vibrotactile feedback
- Knowledge on mapping visual intentions to tactile intentions
- Bodily experiences of tactons based on individual preferences
- Derived dos and don'ts for the design of tactons and the hands-on design process

5 STUDIO SCHEDULE

The studio is a one-day online event and will last about six hours divided into three sessions – *think*, *pair*, and *share* (see Sec. 2). To accommodate multiple time-zones we offer two exemplary schedules – one optimized for Europe and Asia (see first row in Table 1) and the other optimized for Europe and Americas (see second row in Table 1). Only one of the two schedules will be eventually used. The start can be adjusted later on, depending on the demand of participants and where they are located on Earth. Therefore, the organizers will start a poll at the latest one week before the event. The detailed schedule is shown in Table 2.

Since a pure online event can be very exhausting for the participants, the organizers have tried to keep the schedule flexible. In addition to some breaks, there will also be sections in which the participants do not necessarily have to be online (e.g. while composing tactons). The organizers will however be available all the time for questions.

6 STUDIO SUPPORTING RESOURCES

Each participant will get an assembled TactJam device. To ensure that all equipment arrives on time worldwide, shipping will take place no later than three weeks before the workshop. Additionally, the authors provide a public accessible Git repository[2] where participants get schematics and firmware code for the dev-kit to build their own devices and are able to extend the hardware or software according to their own ideas later on. The repository also hosts the studios' website providing all important information, e.g. schedule, tutorials, documentation and other supplementary materials. During the studio participants can share and discuss ideas or artifacts on a Discord server. This server will also be used for video calls and online presentation via screen sharing.

[2]https://github.com/derikon/TactJam

Table 1: Studio schedule with two possible start and end times, each optimized for different time zones.

San Francisco PST (UTC-8)	*New York* EST (UTC-5)	*Berlin* CET (UTC+1)	*Tokyo* JST (UTC+9)	*Melbourne* AEDT (UTC+11)
Thu, Feb 18 22:00 – 4:00	**Fri, Feb 19 1:00 – 7:00**	**Fri, Feb 19 7:00 – 13:00**	**Fri, Feb 19 15:00 – 21:00**	**Fri, Feb 19 17:00 – 23:00**
Fri, Feb 19 6:00 – 12:00	**Fri, Feb 19 9:00 – 15:00**	**Fri, Feb 19 15:00 – 21:00**	**Fri, Feb 19 23:00 – 5:00**	**Sat, Feb 20 1:00 – 7:00**

Table 2: Detailed studio schedule.

	Duration	*Description*
Open	**40 minutes**	**introducing the studio**
	20 minutes	short presentation of the members, participants and topic
	10 minutes	introduction to theory (e.g. tactons) and the studio procedure
	10 minutes	introduction to hardware and software
Break	10 minutes	
Think	**50 minutes**	**exploring the setup**
	10 minutes	get used to the system (manual and how-to)
	30 minutes	freely place actuators on the body and test some configurations
	10 minutes	create groups of 2–4 members and distribute 1–2 pictograms per group
Break	30 minutes	
Pair	**110 minutes**	**creating tactile pictograms**
	90 minutes	abstraction of pictograms' intention, map it to a tacton, and compare/discuss different solutions
	10 minutes	voting for the best tactile pictogram
	10 minutes	documentation in a predefined format
Break	10 minutes	
Share	**80 minutes**	**abstracting a general set of rules**
	50 minutes	group-wise presentation of the tactons
	30 minutes	discuss impressions, pros, and cons and derive dos and don'ts
Break	10 minutes	
Close	**20 minutes**	**concluding the session**
	20 minutes	summary of the results and outlook for further cooperation

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