Marcial Koch

(Mis)using digital tools

Experiences with experimental-exploratory learning processes in teaching of Interaction Design

The Bachelor of Arts in Interaction Design at the Zurich University of the Arts (ZHdK) is "situated at the intersections of multiple disciplines, offering a comprehensive education that tests the boundaries of design" (BA Interaction Design ZHdK, 2022). To achieve its objectives, the programme offers a range of courses in which students actively apply their expertise to individual or group projects while deepening their knowledge. The curriculum adheres to the practice of studio-based learning and teaching, a model that originated with the Bauhaus movement and is still widely used in architecture, design and art education today.[1] Studio-based learning (SBL), is an approach that aims to prepare students for the workplace by exposing them to realistic design processes.[2] Projects are regularly reviewed and discussed with stakeholders including instructors, peers, team members, industry

1 Green & Bonollo, 2003.
2 Smirnov et al., 2017.

professionals and actual clients. By doing so, the projects undergo different levels of iterative cycles. Furthermore, SBL fosters a high level of autonomy among students, meaning that they are—to some extent—responsible for designing their own learning activities and environments to advance their projects and push themselves.[3] The approach emphasizes practical, hands-on learning that encourages exploration and experimentation.

If a teacher does not provide structure, it can lead to confusing and counterproductive situations where students feel lost in their processes. I call these structures "didactic buoys", in a reference to sea buoys in navigation, as they provide orientation points with open space for exploration. Familiar buoys within our study programme include input and mentoring, workshops, technologies, user tests, presentations and feedback from fellow students. These didactic buoys can arise not only from teachers but from students as well. However, finding the right balance of buoys and open situations without interference is a crucial part of a teacher's role. Nowadays, the role of the teacher is increasingly becoming that of a coach who accompanies the learning process and does not determine it alone.[4] The teacher sets most buoys in advance but must be prepared to adjust them at any time during the lesson. In particular, the uncertainties that arise during exploratory-experimental learning processes require a more flexible structure. Therefore, it is highly important to reflect with the students not only during the lesson, but also—and especially—at the end. Finally, this mixture of didactic buoys and open situations should support each student's learning process accordingly, meaning that the balance will differ with each individual.

The purpose of this paper is to examine technologies as didactic buoys. I will reflect on my experiences as a teaching assistant for two courses, "Sonic Interaction Design" in 2021 and 2022, with regard to the topic of (mis)using digital tools to encourage experimental-exploratory learning processes. Case 1 of my reflections was the (mis)use of SonoBus, an audio telephony application, in 2021; case 2 was the (mis)use of smartphones and their applications in 2022. I will conclude my observations with a catalogue of findings.

3 Lima et al., 2012.
4 Truniger, 2019.

Sonic Interaction Design course: context of the study

"Sonic Interaction Design" is a two-week course designed for third-semester BA Interaction Design students at ZHdK. To receive all 3 ECTS credits, each student is required to submit an individual initial assignment during the first week and additionally participate in input sessions and workshops. After this, they work in groups on the main task and present their concept at the end of the first week, followed by an intermediate prototype presentation in the middle of the second week. On the last day, each group showcases their final project using a format of their choice. The course was attended by 17 students in 2021 and 15 students in 2022. Students in both courses were between the ages of 20 and 30, coming from diverse backgrounds like graphic design, engineering, crafts, business, IT, or secondary school. The course was taught by a visiting lecturer who mainly works in the film industry. He had been teaching this course for a few years and I joined him for 2021 and 2022. Together, we defined the course goal as a systematic, creative exploration of sound and its importance in shaping interaction, affordance, and communication. Our teaching methods followed the learning cycle described by David Kolb, where students continually experience, observe, conceptualize and experiment. It does not matter at what point in the cycle students begin, as long as they follow it.[5] In both years of the course, we introduced a digital tool through a workshop to provide a concrete experience for the students. At this stage, students were involved along with others in everyday situations, playing around with a predefined setup of the digital tools. However, due to a lack of equipment, half of the students took on the role of a reflective observer, analysing the situation where those digital tools were being defamiliarized from their initial purposes. The roles were alternated. At the end of the workshop, students sat down in their groups to discuss their experiences. In the abstract conceptualization stage, ideas were formed to gain an understanding of sound design for interactive objects and spaces. This was followed by the stage of active experimentation, where students fleshed out the ideas through prototyping. Several situations, such as the intermediate prototype presentation, forced students to repeat the cycle, starting again with a concrete experience. This iteration

5 Kolb, 2014.

was not always initiated by the instructors but also arose from students during independent group work.

The didactic concept of (mis)using builds on the term "experimentation", which involves purposefully manipulating equipment and/or variables.[6] From this perspective, experimentation requires some kind of setup or equipment. Providing students with a digital tool and encouraging them to (mis)use it gives the students a setup to build upon, while leading them down the natural path of experimentation. Ultimately, this is what interaction design students do continuously in their design process. In this case, they experiment with an aspect of sound by systematically changing the parameters of what defines a sound within a digital audio workstation (DAW). Teaching sound design is exceedingly challenging. On the one hand, most people rely more heavily on their visual sense, making it difficult to work primarily with the auditory sense at first.[7] On the other hand, sound design is highly subjective and depends greatly on spatial conditions, so both teaching and learning require a sense of exploration. Experimenting with the various aspects of sound facilitates the active teaching and learning technique known as "learning by doing" or "learning by exploring". Both terms could be summarized under the term "learning from experiences", which refers to the experiential learning theory described by Kolb and is supported by many learning psychology theories nowadays.[8] Following this approach, each student has the opportunity to experiment with and explore the intangibility of sound.[9] Assuming that students require time between input sessions, mentoring sessions, and presentations to work on their projects independently. This course is based on the SBL format, which grants them the autonomy to decide when they will advance to the next stage of Kolb's learning cycle. Additionally, we encouraged them to change their learning environment to meet their current needs. The different groups constructed audio setups in different locations and swapped learning environments, allowing them to experience the impact of spatial conditions on acoustics. To prevent overload, we, as teachers, provided them with a task and various didactic buoys. In addition to more commonly used buoys such as mentoring sessions, presentations and input sessions, we introduced two distinct tool-

6 Sumfleth & Walpuski, 2012.
7 King, 2008.
8 Gibbs, 1988.
9 Green & Bonollo, 2003.

technology-based buoys: "SonoBus" in 2021 and "smartphone as an input device for a spatial audio installation" in 2022.

Long before the advent of digital tools, humanity invented a multitude of physical tools to extend its capabilities. While it is true that there have been instances where tools designed for specific purposes were used for something else, an act we would call "misusing", the question arises as to whether tools serve a predefined intention. It is because of this that I have placed the "mis" of (mis)using in brackets, since tools, especially digital ones, often serve a wide range of purposes. Given the vast number of digital tools flooding the market, one might think there is a perfect digital tool for every need. This is not the case. We (mis)use digital tools when there is no alternative or when the alternative does not work properly. It is thus important to reflect on such (mis)uses as it exposes the limitations of the available tools. Many digital sound tools can be overwhelming, especially for beginners, due to the complex DAWs used in sound design. Our idea was to (mis)use the two digital tools mentioned to limit what a DAW could do, thereby helping students get started and navigate the vast field of sound design.

Case 1: (Mis)using SonoBus, an audio telephony application (2021)

Working from the notion that life in the pandemic could no longer be imagined without video conferencing tools, we sought to experiment with this format. Among the various conferencing applications available, some are open-source-based and allow for easy manipulation. The subsequent discussion presents the concept of (mis)using two open-source technologies, namely SonoBus and FaceOSC.

In the Sonic Interaction Design course of 2021, we faced the extraordinary challenge of teaching sound design—which depends heavily on the spatial environment—through a hybrid (partly remote and physical) approach. We adapted the assignment to meet this challenge by having the students investigate, rethink, and redesign audio in remote situations. Students were tasked with defining and working on a specific case within the framework of virtual sonic spaces. SonoBus is an open-source, audio-only telephony tool that can run on multiple platforms, including the digital audio workstation (DAW) Ableton Live. It allows students to create audio channels and (mis)use

Ableton Live as a voice conference application with all its DAW-specialized settings and effects. At the start of this experimental-exploratory phase, we launched a remote audio-only workshop where students experimented with various settings and effects on multiple channels. By regularly switching between channels, they acquired comparable impressions of different virtual sound environments. In addition, we introduced FaceOSC, another open-source application that sends camera data of detected faces, such as face position and orientation, to another application like Ableton Live to control parameters (Fig. 1). FaceOSC, in conjunction with SonoBus and Ableton, forms a very powerful foundation for exploring and experimenting with virtual audio spaces.

Case 2: (Mis)using smartphones and their applications (2022)

In the Sonic Interaction Design course of 2022, we defined the smartphone, together with its sensors, as a didactic buoy. The assignment was to design an object that allows for an immersive sound experience; that experience should enable an exploration of the sonic relationship between the object and a defined space. To make the object interactive, it needed to be equipped with a smartphone (Fig. 2). Various applications such as GyrOSC, Holonist, and TouchOSC can send raw sensor data to a computer via the Open Sound Control (OSC) protocol. Theoretically, the raw data could be used directly in a DAW like Ableton Live to control different parameters. However, in the interest of providing more opportunities, we used the computer open-source application "Processing" to map the values before linking them to Ableton Live. We facilitated a half-day workshop to provide a step-by-step introduction to the entire setup.

The smartphone can serve as a very powerful prototyping tool. With its numerous built-in sensors, it transforms into a smart gadget. Amongst a range of sensors, it has a gyroscope that indicates the facing direction of the phone while using localization applications, light sensors to adjust screen brightness, and an accelerometer that facilitates the orientation change of mobile applications. Working with the raw data from these sensors allows us to quickly create interactive prototypes.

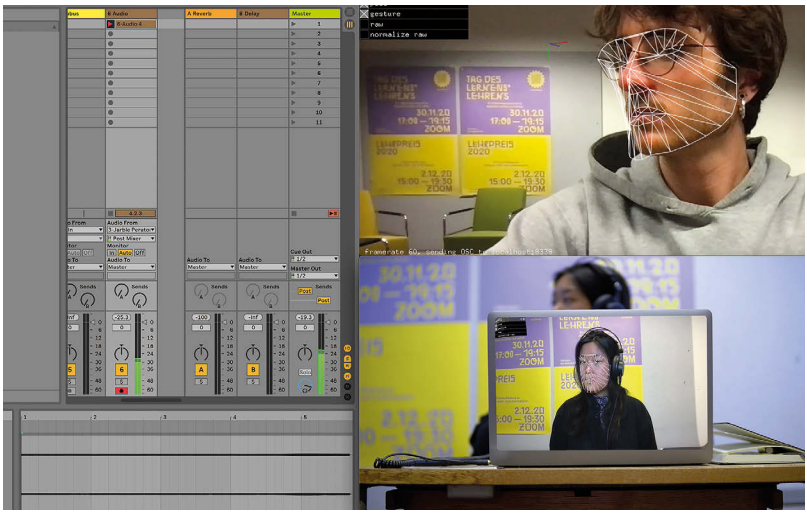

FIG. 1: Case 1, 2021: Dasein by Alec Nikolov, Alessia Wiss, David Wollschlegel, and Sonia Tao

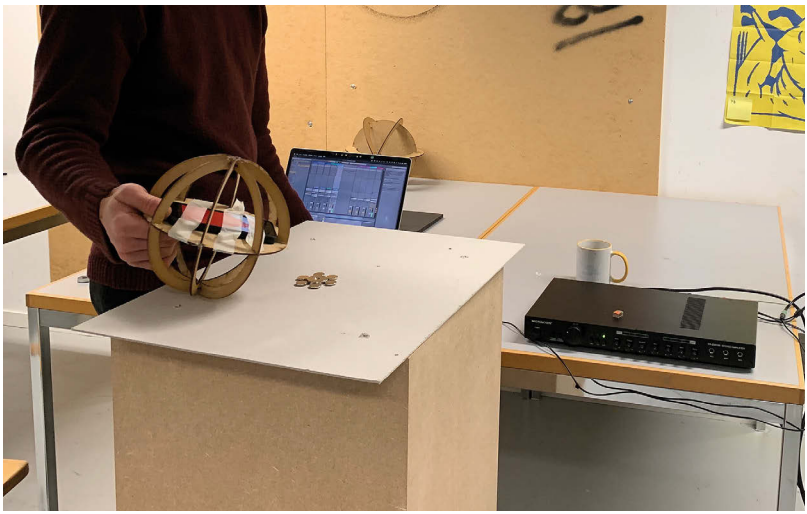

FIG. 2: Case 2, 2022: Ohrbit by Sandro Beti, Nadia Westermann, and Nicola Bischof.

Case analysis

Analysis of the cases below is based on three factors: my own observations during the course; my colleague's observations, which I collected during a reflection discussion with him after the course; and feedback from students collected during a plenary session on an open document. The document contained the following questions and feedback fields:

- Did the seminar meet your expectations?
- How much did you learn?
- Did you hope for more, were you pleasantly surprised?
- How was the teaching?
- What was good, and what could we improve for next time?
- Commitment of the lecturer
- General feedback: I liked:
- General feedback: Could be improved:

Case 1: (Mis)using SonoBus, an audio telephony application (2021)

The two didactic buoys of SonoBus and FaceOSC provided students with ample freedom for their own ideas. Projects developed in different directions by exploring the possibilities of how to (mis)use the two applications, but they all remained relevant to the main topic and were thus comparable to each other. Due to the pandemic, remote sessions had become tiresome for everyone, so this experimental setup was well-received. Participants appreciated the absence of video and the ability to focus on audio only. Since the setup provided a plug-and-play solution, students were able to fully concentrate on creating sound spaces using effects and their own sounds while exploring the DAW. They were quick to design and test their experiments.

On the downside, students often struggled with technical issues, and as a result, good ideas were sometimes not pursued further because they were not realizable with the given setup. Furthermore, due to the ease of adding more and more effects, SonoBus reached a point of exhaustion where it could no longer handle so many modifications. Additionally, the introduction of the two tools took a significant amount of time, which could have been used for basic sound design input. According to student feedback, basic sound design input was not given enough attention.

Case 2: (Mis)using smartphones and their applications (2022)

In general, the simplicity of working with this setup was appreciated by all students. It supported their practice, as they did not have to engage in building an input system with sensors and could, therefore, focus on exploring DAWs by themselves. The ability to create and adapt experiments quickly allowed for more time to explore the field of sound design, which was the main lesson of this course. For many students, it was their first point of contact with the subject of sound design. Dealing with both aspects, input and output, would have been too overwhelming for the two-week time frame. Students agreed that using the smartphone to create sensor prototypes quickly could be very helpful for future projects as it allows them to try out ideas without wasting too much time. There were also some suggestions for improvement. As we only used one phone operating system to prepare the course, we did not have an alternative application for other operating systems available. Consequently, students using different operating systems encountered difficulties. This highlighted the limitations of the tool. Some students expressed a desire to connect multiple phones to one computer, but this turned out to be quite complex and hindered their projects. Although the introduction allowed all participants to use their smartphones as input devices to control sound parameters, some found it to be too time-consuming, as the handling of the setup could have been obtained independently online. This time could have been used for direct instruction on the basic functions of a DAW.

Conclusion

In both cases, students faced challenges that arose from exceeding the capabilities of the tools. As a result, they had to modify their concept accordingly. While this highlights the limitations of the tools, I believe that the benefits of reducing complexity outweigh the resulting constraints. Adapting to a situation is also a valuable skill that students are certain to encounter in the future. However, the introduction of the tools took up a significant amount of time, which students perceived as wasted. We could have made the introduction a self-preparatory activity but opted not to, as we wanted to avoid overloading students with too many exercises in advance. Besides, there will always be students who do not manage to prepare adequately.

(Mis)using digital tools as a didactic buoy generally works well for experimental-exploratory processes. It provides students with a starting point and sparks their first ideas, which is crucial in preventing them from getting lost in such processes. Since hearing is a rather passive sense for most people and sound design is subjective, it can be challenging for those who want to dive into this topic. This didactic buoy creates a playful approach that reduces inhibitions and encourages students to conduct their first experiments. Furthermore, it supports the practical process by saving time with an already functioning setup, leaving more time for exploration. Especially for courses like sound design, which rely on a complicated setup, this didactic buoy could be highly beneficial. In both cases, the digital tools accelerated the prototyping process. This allowed for more iterations, meaning that Kolb's learning cycle was repeated several times, thus supporting the concept of "learning from experience". To answer the question of how to (mis)use digital tools to encourage experimental-exploratory learning processes, I have compiled a list of insights from the past two years in the Sonic Interaction course:

- Use open-source applications/tools. They are free, eliminating the need for additional budget, and can be easily modified to suit different contexts of use.

- Check how much freedom the tools offer. Before using them in class, do some little experiments on your own. Analyse their functions and assess whether they are suitable for your class. Students should have enough freedom to really delve into the topic.

- Ensure that the application is compatible with all operating systems. Does the application work on all known operating systems? If not, check with the students beforehand and group them accordingly, or look for a similar application that runs on all operating systems. One can also provide students with extra devices, just in case.

- Playfully introduce the tools with a workshop and/or instructional video. The introduction should encourage students to play around with the tool while explaining it. It should also spark off various ideas. We consider a half-day workshop a suitable time frame for introducing the tool. Recording the entire instruction session can also serve as a useful reference for both students and instructors.

- Encourage students to explore different directions, to think outside the box and think unconventional ideas while fully exploring the tool. The tool itself will provide enough limitations to restrict the topic.

There are thousands of tools and applications out there, each waiting to be (mis)used for experimental-exploratory learning processes. This paper has presented only two examples from a wide range of possibilities. It is worth noting that these approaches are not only applicable to teaching/learning sound design, but to a range of other subjects with a practical, hands-on element as well. Try them out and have fun!

References

BAAKI, J. & LUO, T. (2019). Instructional designers guided by external representations in a design process. *International Journal of Technology and Design Education, 29*, 513–541. DOI: https://doi.org/10.1007/s10798-018-09493-2.

GIBBS, G. (1988). *Learning by doing: A guide to teaching and learning methods*. Oxford: FEU.

GREENZ, N. L. & BONOLLO, E. (2003). Studio-based Teaching: history and advantages in the teaching of design. *World Transactions on Engineering and Technology Education, 2*(2), 269–272.

KING, A. J. (2009). Visual influences on auditory spatial learning. *Philosophical Transactions of The Royal Society B Biological Sciences, 364*(1515), 331–339. DOI: https://doi.org/10.1098/rstb.2008.0230.

KOLB, D. A. (2015). *Experiential Learning: Experience as the Source of Learning and Development* (Second edition). Upper Saddle River, NJ: Pearson Education, Inc.

LIMA, R. M., SILVA, J. M., JANSSEN, N., MONTEIRO, S. B. & SOUZA, J. C. F. (2012). Project-based learning course design: A service design approach. *International Journal of Services and Operations Management, 11*(3), 292–313. DOI: https://doi.org/10.1504/IJSOM.2012.045660.

SMIRNOV, N., EASTERDAY, M. W. & GERBER, E. M. (2018). Infrastructuring Distributed Studio Networks: A Case Study and Design Principles. *Journal of the Learning Sciences, 27*(4), 580–631. DOI: https://doi.org/10.1080/10508406.2017.1409119.

SUMFLETH, E., & WALPUSKI, M. (2012). Experimental learning environments. In N. M. Seel (ed.), *Encyclopedia of the Sciences of Learning* (pp. 1229–1233). Boston, MA: Springer. DOI: https://doi.org/10.1007/978-1-4419-1428-6_1868.

TRUNIGER, P. (2021). *Die Lehrperson als Coach: Beratung in kreativen und künstlerischen Prozessen* (2nd ed.). München: kopaed.

Figures