FOCUSED OVERVIEW OF A SYSTEM FOR PRODUCING TACTILE REPRESENTATIONS OF ORGANISMS USING 3D PRINTING TECHNOLOGY

KAVERLJAG INTERNATIONAL SUMMER SCHOOL 2024 FROM THE STUDENTS' PERSPECTIVE

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Keywords

International Summer School Kaverljag 2024, tactile illustration, 3D printing, marine organisms, user-centred design, stylization, reduction

Abstract

The paper provides a comprehensive description of the processes involved in the International Summer School Kaverljag 2024, with a particular emphasis on the procedure for creating three-dimensional printed representations of organisms. The creation of a tactile representation of organisms using three-dimensional printing entails multiple pivotal stages that guarantee the accessibility, perceptibility, and quality of the end product. The initial phase encompasses the study of the selected organism, incorporating scientific illustration and the analysis of anatomical characteristics. The illustration is then stylized and reduced, maintaining biological accuracy while adapting the shape for tactile perception. The next step involves vectorizing a simplified illustration following standardized criteria adapted for optimal tactile sensing. The authors present the transfer of vectors into 3D modelling software, the conversion into 3D form and the technical adaptations that contribute to a better tactile experience. The project encompassed not only the basic illustration but also the intricacies of the organism, such as specific textures or body parts, thereby facilitating a better comprehension. The project integrated diverse 3D printing technologies and materials to ensure optimal outcomes. The authors present the final product in a systematic manner, incorporating all the elements in a tactile kit: the organism's name in braille, the basic illustration, and the detailed three-dimensional component. The article provides a structured presentation of the 3D printing technologies and materials employed in the project, emphasizing the integration of tactile elements to enhance the viewer's experience. The article also describes the design of the exhibition, where tailored descriptions and sound clips have been used to further enhance understanding.

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Project lead organizations:

→ Academy of Fine Arts and Design, University of Ljubljana, Ljubljana, Slovenia
→ Kaverljag Society, Šmarje, Slovenija

Project partners:

→ Academy of Fine Arts of Bari (Accademia di Belle Arti di Bari), Bari, Italy
→ Moholy-Nagy University of Art and Design – MOME (Moholy-Nagy Művészeti Egyetem), Budapest, Hungary
→ Faculty of Art, University of the National Education Commission (Wydział Sztuki, Uniwersytet Komisji Edukacji Narodowej w Krakowie), Krakow, Poland
→ Academy of Arts and Culture in Osijek (Akademija za umjetnost i kulturu u Osijeku), Osijek, Croatia
→ Center of Illustration (Center ilustracije), Ljubljana, Slovenia

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→ Union of the Blind and Partially Sighted of Slovenia (UBPSS)
→ National Institute of Biology (NIB)
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Results:

- → *What I Look at and What I See: Marine organisms for people with visual impairments*, exhibition, Center of Illustration Gallery, Ljubljana, 10 September–6 October 2024.
- → Visits to institutions, schools and guided tours of the exhibition.
- → *What I Look at and What I See: Marine organisms for people with visual impairments*, Insula Gallery, Izola, Slovenia, 10 October–6 November 2024.
- → Visits to institutions, schools and guided tours of the exhibition.

1. INTRODUCTION

A group of six students, including three illustration students and one industrial design student from the Academy of Fine Arts and Design, University of Ljubljana, as well as two biology students from the Biotechnical Faculty, University of Ljubljana, participated in the Kaverljag Summer School and in the subsequent phases of preparing the exhibition. Collaborating in such a large team was for us an almost new experience. Now that the work is completed, one of the biology students and the industrial design student have shared their impressions in this monograph, hoping that their experiences will contribute to future initiatives for blind and partially sighted people. In the present article, we focus primarily on the aspects that are not emphasized in other parts of this work. We discuss the overall organization of the Summer School and present the details of the systematic approach developed for creating tactile illustrations with 3D printing technology.

2. WHO SHOULD BE INVOLVED IN A PROJECT WHEN WORKING WITH THE VISUALLY IMPAIRED, AND WHY?

Society and technology are constantly evolving, influencing each other. This relationship is evident in all spheres. For instance, the development of infrastructure and transportation has led to globalization, and, through a positive feedback loop, globalization accelerates the technological advancements that enable it. A similar interdependence can be observed, for example, in the way human relations change in response to the development of communication technologies. Adaptations for marginalized groups must keep pace with all these changes, but simultaneously, new technologies offer new possibilities for adaptations. Consequently, adaptations must be a part of a continuous process of updating and adjusting to social and technological change, rather than being the subject of a one-off project.

Therefore, the development of adaptations for people with visual impairments—who represent a marginalized group—is also an ongoing and dynamic process. Developments in technology require new adaptations. Braille books and the invention of braille typewriters (braillers) enabled blind people to communicate in writing; however, with the advent of computers and the internet, this no longer sufficed. Braille keyboards and braille displays, in a way a counterpart to e-readers, were introduced. The emergence of touchscreen smartphones without keyboards presents a new challenge; nevertheless, it can be overcome through software solutions. Some smartphones can play back the text displayed on the screen, and an increasing number of websites and applications also offer different accessibility settings, such as changing text size and contrast. There is rapid development. Who therefore needs to be involved in work on such projects, and what insights can we gain from them?

(Future) experts: The time scope for developing adaptations extends beyond the lifetime of an individual, and if the project is an intergenerational initiative, this ensures succession. The participation of students in the project enables the transfer of knowledge to younger generations newly entering the workforce. By familiarizing ourselves with people who are different from the 'standard' human being already at the level of sensory experience, our perspective is broadened. We examine what the statistically average person is and find that none of us actually corresponds to the archetypes. We begin to think more open-mindedly and act through considering different perspectives, gaining experiences that drive us to co-creating an inclusive society.

International dimension: The inclusion of people with visual impairments in society is a challenge on a global scale and must be addressed as such. It is not sensible to limit our search for solutions to a single country. That is why, besides Slovenian participants, the Summer School also brought together students, lecturers, and mentors from four other European countries: Croatia, Italy, Hungary, and Poland. Through the international exchange of knowledge and experiences, the project promotes a more efficient way of finding better solutions, bringing us closer to a unified system for producing materials aimed at the blind and partially sighted at the international level.

Interdisciplinarity: The production of illustrations is primarily the task of the illustrator. However, the success of such an integrated project requires collaboration between multiple disciplines. The participating illustrators needed knowledge of marine organisms. For this reason, they were provided with lectures on marine biology and visited the Marine Biological Station as well as the Piran Aquarium, Slovenia. Throughout the process, the collaboration of two biology students provided an opportunity for expert advice. Next, we deepened our understanding of the target users. The lectures were given by various experts with experience in creating solutions for the blind and partially sighted. Moreover, the illustrators' skill sets varied: some participants specialize in traditional illustration, others lean towards digital work, and a few practise 3-dimensional modelling. The industrial designer student also played a key role in the project, managing the practical aspects of the implementation phase, handling technical details, and finalizing the exhibition layout.

Challenges of working in a team

For the students, the project served as an introduction to the process of creating materials for the blind and partially sighted. Simultaneously, the project offered our student group general insights into the experience of collaborating on a large-scale project. In this way, we realized that general organizational skills are extremely important. To begin with, all participants need to be aware of the project's objective. Understanding the end goal facilitates our intermediate decision making, ultimately leading to the optimal outcome. The project should also be headed by a clearly identified manager. This person delegates tasks to the other participants and monitors their work. To ensure that the work is coordinated, all participants are kept properly informed. Communication noise, word-of-mouth transmission of information, and lack of information are best avoided by implementing an organized information system. In practice, this simply entails scheduling regular meetings attended by all the participants. Meetings are the occasion for discussing and agreeing, and, more importantly, reaching agreements. When addressing an issue, it is crucial to not only adopt a concretely defined solution but also assign a specific individual or team to implement it. These are just some of the simple and purely pragmatic rules that ensure the success of a well-conceived project.

3. DEVELOPING A SYSTEMATIC APPROACH TO 3D-PRINTED TACTILE REPRESENTATIONS OF ORGANISMS FOR PEOPLE WITH VISUAL IMPAIRMENTS

Following the International Summer School, a small group of students continued the project, establishing a preliminary system for creating tactile representations of organisms using 3D printing technology. Developing tactile content within a unified system is crucial for three reasons: accessibility, perception efficiency, and quality. Various learning aids for people with visual impairments are often handmade in one or a few copies as they are designed for specific individuals. Authors of such aids aim to mitigate the lack of accessible didactic materials. Although these examples of tactile content are particularly important, they remain inaccessible to a broader user base due to their production methods. Information in this type of content is usually presented inconsistently, affecting the efficiency and speed of perception. The implementation of uniform methods for presenting and organizing information, along with maintaining content credibility, contributes to the third aspect: the quality of the material. In the case of tactile illustrations of marine organisms, quality derives from anatomical accuracy.

The basic starting point for the preliminary version of the system is represented by the two tactile books—*Dotakni se ptice* (Touch a Bird) in *Žuželke od blizu* (Insects up Close)—which are the results of the previous Kaverljag Summer Schools, and the thirteen sets of illustrations of organisms produced during the International Summer School 2024.[1] The project differs from previous ones both in its subject matter (marine organisms) and in the choice of production technology. To create tactile representations, it relies on the use of 3D technology, specifically 3D modelling and 3D printing. This technology was chosen for its widespread use, low production costs and ease of reproduction, enhancing accessibility and enabling creation of materials in line with the interests of target audience. The system for producing tactile representations of organisms integrates a tactile simplified illustration of the whole organism, a 3-dimensional detail of a certain part of the organism, the species name of the organism in braille and an accompanying text describing the organism.

The established system guidelines were applied to a set of illustrations of five marine animal species produced during the International Summer School. The choice of species was challenging, as marine life is very diverse but at the same time poorly known. Despite covering most of the Earth's surface, only a small percentage of the seabed has been explored by mankind. First, we limited the selection to Slovenian species and, in the next step, excluded the organisms that are easier to represent in other ways. For example, it

1 For a more detailed description and information on the production process, see article by Assist. Prof. Mag. Marija Nabernik, p. 102.

is not sensible to design teaching aids for fish, as they can be experienced more effectively and holistically if they are simply purchased from a fishmonger. Similarly, bivalve and gastropod molluscs are best represented by their shells. From the remaining groups of organisms, we selected those in which reduction would not result in substantial information loss. In practice, this means that we opted for species with at least a slightly flattened body structure; the starfish meets this criterion, while the barrel jellyfish does not, as it is difficult to represent in two dimensions. In the final stage, we selected organisms that are as different from each other in body structure as possible, to best capture the rich diversity of marine life. The final selection of organisms consisted of the common cuttlefish (*Sepia officinalis*), the long-snouted seahorse (*Hippocampus guttulatus*), the Mediterranean green crab (*Carcinus aestuarii*), the green chiton (*Chiton olivaceus*), and the smooth brittle star (*Ophioderma longicaudum*).

The five tactile representations prepared under the first version of the system were presented during two exhibitions (*What I Look at and What I See: Marine organisms for people with visual impairments*, exhibition, Center of Illustration Gallery, and *What I Look at and What I See: Marine organisms for people with visual impairments*, exhibition, Insula Gallery) and evaluated through testing involving visually impaired individuals.

Presentation of the process for creating tactile representations

The following section describes the process for creating tactile representations using the long-snouted seahorse (*Hippocampus guttulatus*) and the Mediterranean green crab (*Carcinius aesturaii*) as examples. The respective illustrations were realized under the first version of the system developed for creating tactile representations with 3D technology. Each of the five tactile representations includes the Slovenian name of the organism printed in braille, a simplified illustration of the organism that is distinguishable from the background, and a detail, i.e. a realistic, magnified representation of a part of the organism.

Tactile illustration

Prior to simplifying the illustration, it is essential for the designer to gain a deeper understanding of the organism and, if possible, represent it in a scientific illustration. Subsequent to this, the designer proceeds with stylization and reduction, taking into account both the biological and the graphical aspects. Through this process, it is important to maximize the clarity of the representation while retaining enough anatomical detail to ensure that the illustration is not misleading. These two aspects conflict; on one extreme, the illustration becomes overly stylized, resulting in an unscientific representation, while on the other, photorealistic accuracy is achieved, where noise overwhelms the information.

Concurrent with the simplification process is the development of a description for the selected species, which explains the animal's biology and relates it to its physical structure. Moreover, it provides guidance on how to explore the illustration through the sense of touch. The texts were written by the two biology students involved in the project. For less familiar animals, the description begins by situating the organism within the tree of life, highlighting related species or the broader group to which it belongs. This provides a general understanding of the animal's approximate identity. What follows is a description of the physical structure of the species. The individual body parts are listed in sequence according to their position on the animal's body; in this manner the text seamlessly guides the user through tactile exploration of the illustration, avoiding interruptions. Next, the animal's ecology is briefly outlined, focusing on its habitat and diet. Lastly, information regarding the animal's size is presented. The descriptions were also included in the exhibition as audio recordings, which visitors could listen to through headphones located near the tactile representations.

Description of the long-snouted seahorse:

The seahorse is an unusual fish. It owes its name to the shape of its head, which resembles that of a horse. Its head is positioned perpendicular to the body, and its mouth extends into a snout. There are also a pair of tiny fins on the head. It has a dorsal fin growing out of its back, and another very small fin just beneath its abdomen. It has no tail fin, which makes it a poor swimmer. It lives among seagrass, which it holds on to with its prehensile tail. By swimming slowly, it inconspicuously approaches tiny crustaceans and other small organisms, sucking them up with its snout. The eggs are taken care of by the male seahorse. Until they hatch, it carries them in a special embryo sac located at the lower part of its abdomen. The seahorse grows up to 14 centimetres in length.

Description of the Mediterranean green crab:

The Mediterranean green crab has a strong, flattened, pentagon-shaped shell. At the front of the shell, it has short antennae, and alongside these, eyestalks with eyes that can retract into the eye sockets. The sides of the shell feature spikes offering additional protection. It moves with four pairs of legs, while the fifth pair of appendages consists of pincers that it can use to pinch. It uses them for both defence and picking up food. It is most commonly found on sandy, silty banks, where it hides between individual stones. It also often roams on land. It is not picky and feeds on what it finds: dead organisms, small animals, and algae. It can grow up to six centimetres.

The next step involves adapting the simplified vector illustration. First, the size is determined. The organism should be positioned on the surface so that the outermost parts of the illustration touch the edge of an imaginary 17 cm diameter circle. The suggested dimension is based on the size of an adult's two hands (as people with visual impairments typically use both hands simultaneously for tactile exploration) as well as on the constraints posed by the size of the printing area (printers commonly use a 20 × 20 cm plate). The subsequent step entails dividing the illustration into areas featuring broader 1.5 mm lines to represent prominent elements, such as the organism's outline and distinct anatomical features; narrower 0.75 mm lines for details like texture representation, patterns, and minor structures; and planar elements to depict features such as eyes, appendages, fins, or to distinguish different organism parts. When editing an illustration for the visually impaired, symmetry should be considered where anatomically appropriate (e.g. the symmetric arrangement of walking appendages versus the differing sizes of the left and right crab pincers). It is important that the method for adapting illustrations is uniform and consistently applied to all organisms. Finally, the appropriately sized illustration is positioned at the centre of a larger circle with a diameter of 19 cm. This circle defines the boundary of the tactile area and clearly separates the illustration from the text in braille and the representation of an individual detail.

The next step involves transferring the vector illustration into 3D modelling software and converting it into a solid by means of the 'extrude' command to add thickness. The circle with the diameter of 19 cm is 1 mm thick and has an edge that is 1.5 mm wide and 2 mm thick. The illustration rises 1 mm above the surface. The edges are rounded using various tools available in the selected program to create a more pleasant and secure feeling when experiencing the image through tactile perception.

The last phase is the production of the tactile illustration using material extrusion technology, more specifically fused deposition modelling (FDM). The selected technology offers the possibility of producing models from thermoplastics, which are heated and transformed into a semi-liquid form as they enter the extruding head. The melted thermoplastic strands are bonded together within the same layer and between adjacent layers through a process of polymer fusion or sintering. The size of the nozzle is an important factor in limiting the printing scope, as it determines the accuracy of the printed design. In the case of illustration printing, the chosen technology offers the advantage of simple post-processing, which is frequently not necessary (Muck 2015, 71–80). A commonly noted disadvantage of the technology is the stepped transitions

Figure 1: Participants and mentors of the Kaverljag
International Summer School 2024
(Petra Černe Oven, personal archive, 2024)

Figure 2: Long-snouted seahorse
(Petra Černe Oven, personal archive, 2024)

Figure 3: Mediterranean green crab
(public domain, online source:
https://en.wikipedia.org/wiki/Carcinus_aestuarii)

Figure 4: Long-snouted seahorse, print
(Žiga Gorišek, project archive, 2024)

Figure 5: Long-snouted seahorse, embossed print
(Žiga Gorišek, project archive, 2024)

Figure 6: Mediterranean green crab, print
(Žiga Gorišek, project archive, 2024)

Figure 7: Mediterranean green crab, embossed print
(Žiga Gorišek, project archive, 2024)

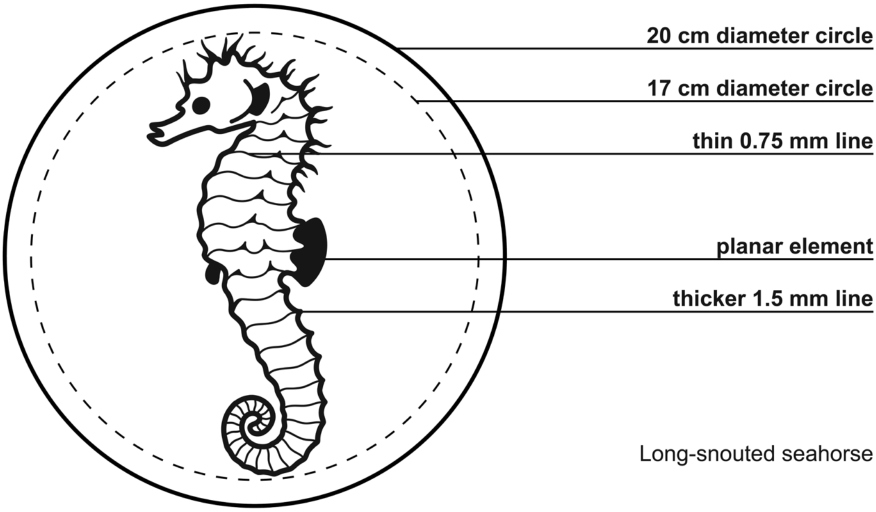

Figure 8: Long-snouted seahorse, vector illustration
(Zoja Čepin, personal archive, 2024)

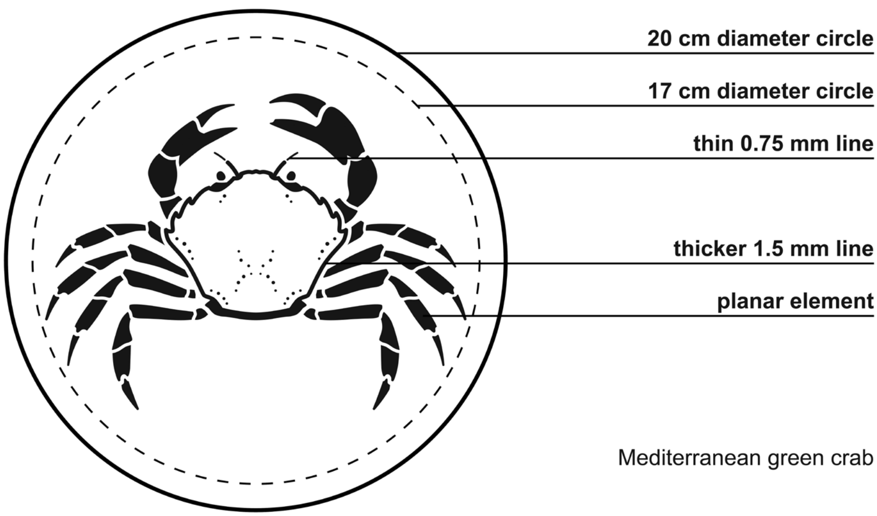

Figure 9: Mediterranean green crab, vector illustration
(Zoja Čepin, personal archive, 2024)

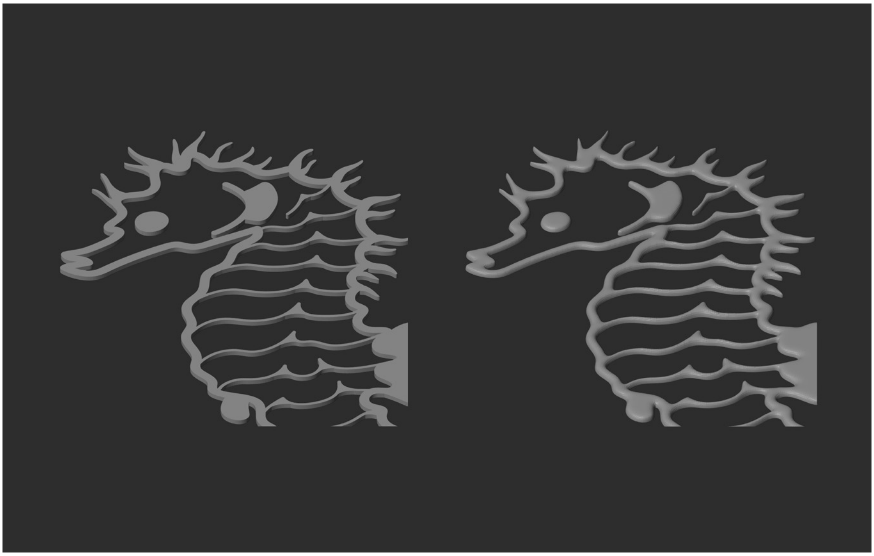

Figure 10: Long-snouted seahorse, rounding the 3D model edges (Damir Omić, personal archive, 2024)

Figure 11: Mediterranean green crab, rounding the 3D model edges (Damir Omić, personal archive, 2024)

Figure 12: Detail accompanying the illustration
of the long-snouted seahorse
(Žiga Gorišek, project archive, 2024)

Figure 13: Detail accompanying the illustration
of the Mediterranean green crab
(Žiga Gorišek, project archive, 2024)

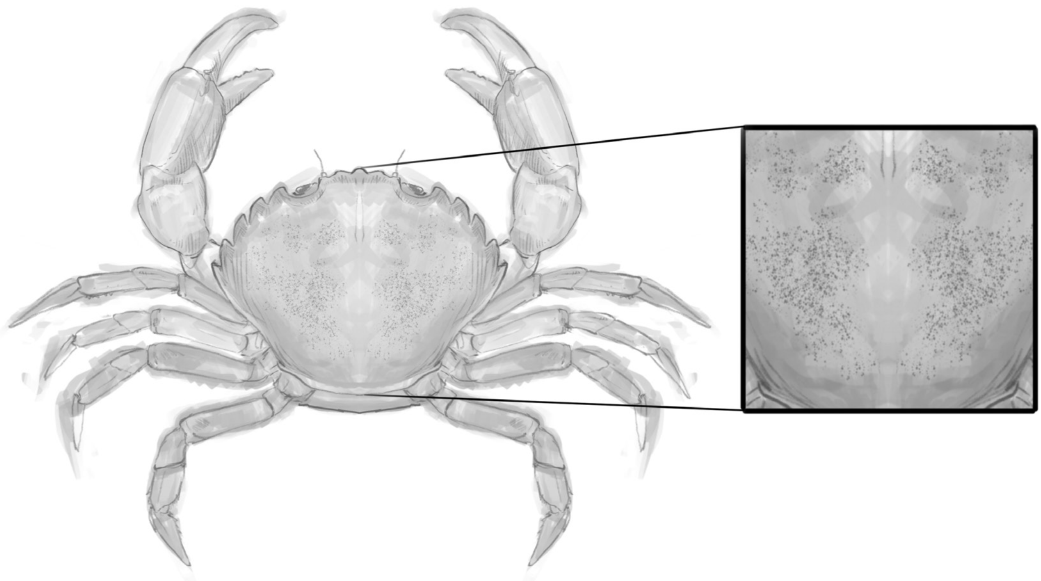

Figure 14: Sketch for producing
the detail of the long-snouted seahorse
(Ana Turičnik, personal archive, 2024)

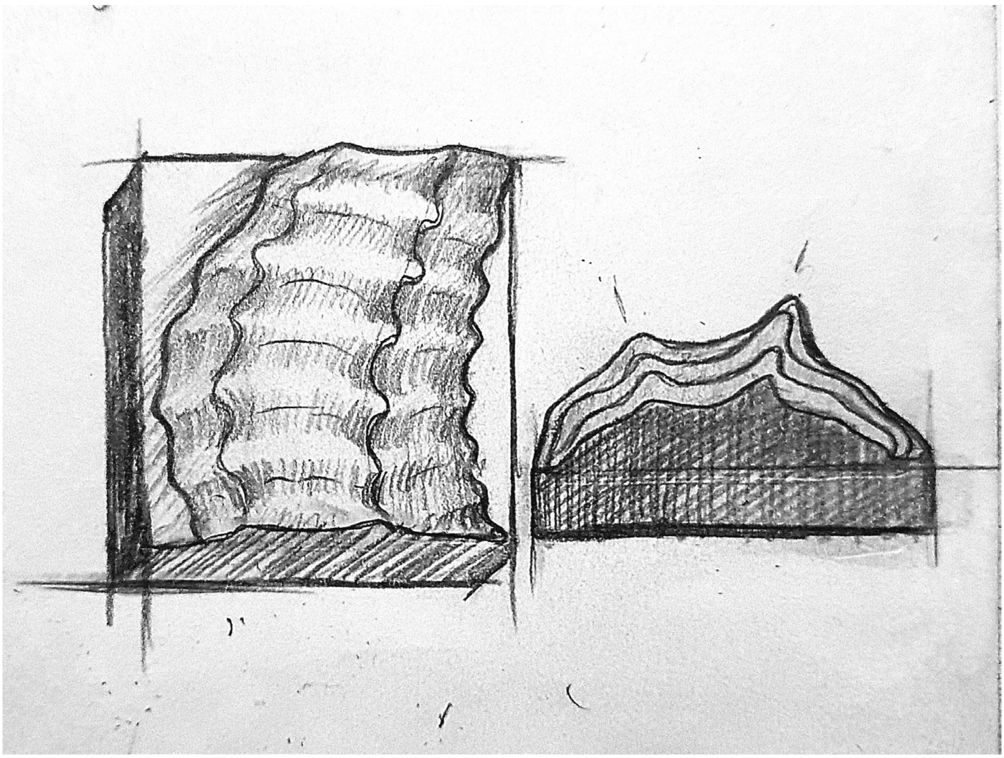

Figure 15: Sketch for producing
the detail of the Mediterranean green crab
(Damir Omić, personal archive, 2024)

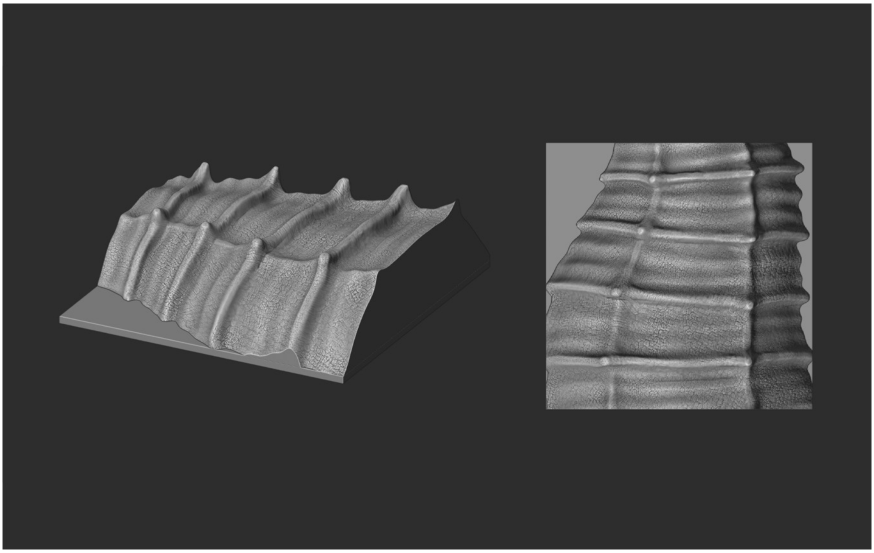

Figure 16: 3D model of the detail, long-snouted seahorse
(Damir Omić, personal archive, 2024)

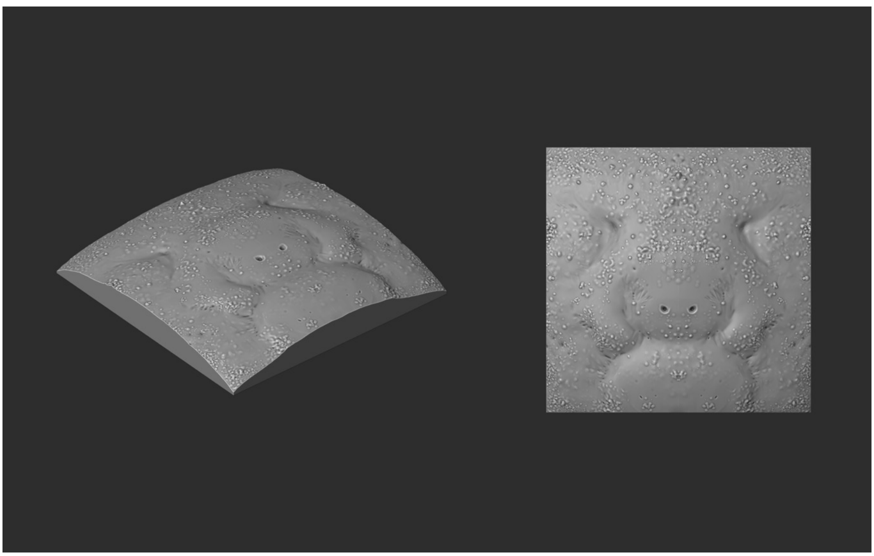

Figure 17: 3D model of the detail, Mediterranean green crab
(Damir Omić, personal archive, 2024)

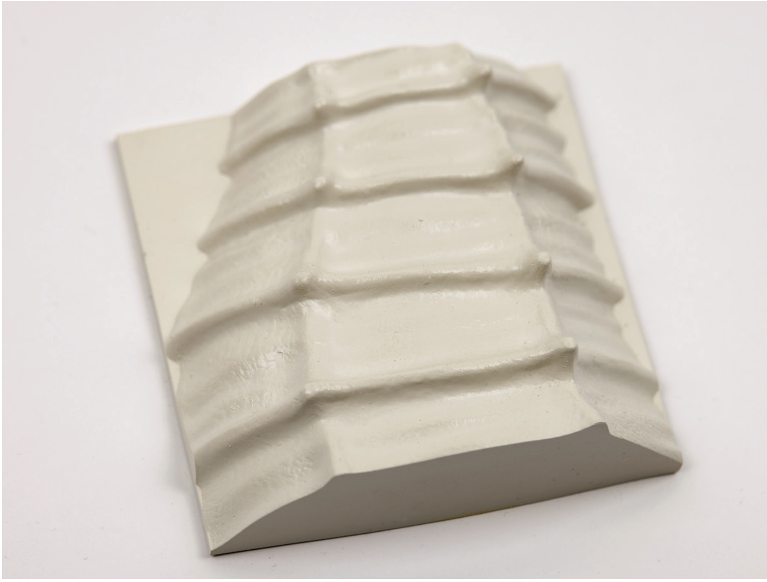

Figure 18: Long-snouted seahorse, detail
(Žiga Gorišek, project archive, 2024)

Figure 19: Mediterranean green crab, detail
(Žiga Gorišek, project archive, 2024)

Figure 20: Long-snouted seahorse,
tactile representation in a form of a plate
(Žiga Gorišek, project archive, 2024)

Figure 21: Mediterranean green crab,
tactile representation in a form of a plate
(Žiga Gorišek, project archive, 2024)

Figure 22: Exhibition *What I Look at and What I See*, exhibition at the Center of Illustration Gallery (Žiga Gorišek, project archive, 2024)

Figure 23: Presentation of the
long-snouted seahorse at the exhibition
(Žiga Gorišek, project archive, 2024)

Figure 24: A visitor at the exhibition *What I Look at and What I See*
(Žiga Gorišek, project archive, 2024)

Figure 25: Visitors at the exhibition *What I Look at and What I See*
(Žiga Gorišek, project archive, 2024)

between layers; however, these did not interfere with the tactile perception process when using a 0.4 mm nozzle. The model in the photographs is made from PLA.

Detail – a realistic representation of part of an organism

The detail serves as a supplementary element to the tactile illustration, providing insight into a part of the organism with an interesting surface. The incorporation of a realistic representation of a part of an organism part enhances the tactile exploration of the organism. The perception of the simplified form is thus enriched by realistic complexity, enabling people with visual impairments to obtain more information about the organism.

The first phase consisting of the selection of the detail of the organism is based on identifying a key element for understanding the organism, while also ensuring it is tactilely engaging. There is no uniform method of identifying the detail to be represented, as the choice depends on each individual organism. When possible, the representation from the most representative view is preferred (for marine organisms, typically from above, but sometimes from the side or front).

Subsequently, a sketch of the selected part of the organism part is prepared, which serves as the foundation for the design in the 3D modelling software. During the sketching process, the enlargement and placement of the segment on a 9 × 9 cm square surface are determined.

The solid is created in the selected 3D modelling software. Compared to creating a tactile illustration model, constructing a detail model requires a better knowledge of the software, as more complex, organic structures predominate. The surfaces of organic models mostly feature rounded edges and are therefore composed of a large number of polygons. The greater the number of polygons, the more accurate the model. If the produced model will be fixed, it is essential to identify the fixation method and design the undersurface of the model accordingly.

The subsequent step involves producing the model using technology based on vat photopolymerization, particularly stereolithography apparatus (SLA). The printing process entails curing of the photopolymer using a guided external light source (laser or DLP projector). The light source scans the surface of the liquid photopolymer and cures the model's walls. Next, a new layer of liquid filament is evenly levelled, and the photopolymer surface is allowed to settle completely. The process is repeated for each subsequent layer. SLA is an 'additive' technology and as such requires a base and support structures to ensure successful production of a model. Supports need to be printed for all model parts with an angle of inclination less than 30 degrees or greater than 150 degrees. After the completion of printing, post-processing follows, with the primary step being additional UV curing. The irradiation process imparts the final strength to the model. The advantages offered by the chosen technology are high-quality surface and precision, enabling the printing of details and braille. The primary disadvantage concerning the creation of the accompanying detail lies in the complex, time-consuming processing, which also has an adverse ecological impact (Muck 2015, 82–88). For the creation of the model, photosensitive resin was used.

A set of tactile representations

To enhance the efficiency and speed of perception, the final stage of creating a tactile representation of an organism consisted of assembling all elements into a set. The method presented below arises from the need to produce tactile representations for the exhibition. Future project development could focus on exploring alternative methods for organizing and linking the different parts of an organism, as well as storing a larger collection of organism representations.

The individual elements of the organism representation are arranged on an A3-sized panel. At the top, there is a plaque with the name of the organism printed in braille; below, a circular base features a simplified illustration of the organism; and, finally, at the bottom of the panel, a realistic, enlarged representation of a section of the organism is displayed within a square. The uniformity achieved through color and texture of all elements enhances the tactile distinction between the touchable elements and the empty space on the panel.

Exhibition *What I Look at and What I See*

The results of our work were presented at the exhibition *What I Look at and What I see: Marine organisms for people with visual impairments*. It was opened at the Center of Illustration (Stritarjeva ulica 7, Ljubljana), where it was held between 10 September and 6 October 2024. Subsequently, it moved to the Insula Gallery (Smrekarjeva ulica 20, Izola), where it was displayed between 9 October and 6 November. The exhibition's content aimed to showcase the diverse living world of the Slovenian part of the Adriatic Sea. More than 20 species of marine animals and algae were represented. Although a substantial portion of the content was adapted for people with visual impairments, the exhibition was also intended for a general audience, promoting awareness of the importance of inclusive design.

The atmosphere was created by the sounds of the sea played through loudspeakers. On the walls of the exhibition space, we displayed the original works by the participants of the Kaverljag Summer School—linoprints and embossed prints—along with the results of intermediate stages in the creative process—sketches, watercolors, and digital drawings. The centrepiece of the exhibition was the representation of five marine animals in the form of tactile sets, uniformly produced following the system described in this article. Since tactile illustrations are easier to explore on a fixed horizontal surface, we placed the sets on shelves at a height slightly above one meter, rather than adopting the conventional wall display method. The sets were not fixed, allowing individuals, including children, who might have difficulty accessing the shelves, to try interacting with them. Each set was accompanied by a description of the animal's biology, available in printed text form and as an audio track played through headphones.

4. LOOKING FORWARD

The project, carried out within the context of the International Summer School Kaverljag 2024, was conceived very broadly with the intent to establish a system for improving the accessibility of illustrated didactic materials for people with visual impairments. Although the project was designed for a clearly defined target group—individuals with visual impairments—the outcomes of the International Summer School also appeal to a wider audience. Through both exhibitions, we introduced visitors to the experience of perceiving information by touch and hearing and encouraged them to explore alternative ways of 'seeing'. Tactile representations, in particular, offer sighted people the opportunity to learn about organisms in a different manner. These materials also resonate well with children, who, in addition to visual information, commonly rely on tactile feedback. Inclusive design thus demonstrates that, through careful consideration and involvement of marginalized groups, it is possible to enhance the experience not only for the target user but also for the wider public.

By incorporating new technology, the foundational work developed by previous Kaverljag Summer Schools has served as the basis for a preliminary version of the system to produce 3D printed representations. It is crucial that the project does not stop at this point, but instead offers a launchpad for designing a system that will be freely available on an international scale. The refinement of the existing system should be guided by the insights obtained during the development of tactile representations and their testing with users.

By developing the solution and expanding the range of organisms (currently, only five species are adapted according to the system), students of illustration and other disciplines acquire one of the key skills for designing didactic materials tailored to people with visual impairments: the ability to simplify, which is associated with highlighting key information. Through the process of designing tactile content, students gain competences that enable them to identify the essential aspects in an information-saturated world and communicate them in a comprehensible way. The presented project of the International Summer School can thus serve as a potential reference for choosing project topics that challenge students, professors and external collaborators of the Academy of Fine Arts, University of Ljubljana. Engaging in learning and exploration through inclusive design, where users actively participate in the work process of an interdisciplinary group, empowers students to acquire skills of collaboration, develop empathy, and gain experience with proactive engagement in addressing social issues.

By taking part in projects like these, we become aware of the urgency to contribute to the societal development, both as design students and as members of the broader society. The inclusion of marginalized groups is not optional; it is a duty of contemporary society. Hence, progress in this field is essential, and through such interdisciplinary, international, multicultural, and intergenerational projects, we work towards the ideal of a society that values equality and provides equal opportunities for all.

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