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# "zones of flow (iii)": a Paper and Light-based Immersive Water Environment

ROCIO VON JUNGENFELD, University of Kent, UK



Fig. 1. "zones of flow (iii)" installation: origami flotilla activated by the projection onto the large paper sculpture.

"zones of flow (iii)" is a photo-sensitive installation that investigates the fluid and changing connections between people, sea and land. It addresses the instantaneous but sometimes asynchronous connectivity between things as they move, are placed or displaced in their environments. The artwork brings origami structures, electronics and audiovisual media together to create an immersive cogitative environment. A video projection depicting water surfaces is mapped onto a 2.5m paper-boat. Underneath, arrays of light sensors receive waves of information and send signals to small paper-boats scattered across the floor. The flotilla of small paper-boats is activated and becomes a changing water surface where non-linear patterns emerge over time.

CCS Concepts: • **Applied computing** → **Media arts**; • **Hardware** → *PCB design and layout*.

Additional Key Words and Phrases: origami boats, water flows, audiovisual installation, light-dependent, hybrid environment

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## 1 INTRODUCTION

Water is pervasive, corrosive and essential for life. When in balance, water-based systems thrive but when the distribution of energy within is disrupted, the system can be under threat. Changes may be subtle and slow, while sometimes sudden disruption is needed to reconfigure interactions and achieve a new balance; an ongoing play between organisms and their environments as they adjust, entangled in a “web of life that consists of networks within networks” [2].

Water reflects light. Its surface makes visible some of the energy the sea carries. Surface waves show energy moving through the system, but water itself does not move much; its molecules spin in circular movements [5]. Surface tension is made of pyramidal structures; with heavier negatively-charged Oxygen atoms and pairs of smaller positively-charged Hydrogen atoms. Each atom attracted and repulsed by neighbouring molecules [4]. When in liquid form, the hydrogen bonds of  $H_2O$  molecules push and pull, never truly touching nor falling apart, forming a fluid fabric.

Whether contemplating the sea from a shore, vessel, or city, the sea is a place for encounters between forces (non-human and human alike). Its rhythms offer reassurance of the recurrence and flow of life. When the sea is calm, it may induce contemplation but during a storm while at sea, we might feel overwhelmed, uncomfortable and distressed. The sounds the sea produces are distinct: soothing, lapping sounds vs roaring, battering sounds, which are determined by the amount and size of bubbles, as they form and explode inside the water [9] and against things.

## 2 DESCRIPTION OF THE WORK

“zones of flow (iii)” is a photo-sensitive installation involving a flotilla of paper boats. The artwork is part of a series of experiments inspired by a sailing trip across the ocean where I encountered gentle and rough meteorological conditions, and where the relationships between people, sea and land, and how these are negotiated, were experienced first-hand.

In its current state (Fig.2), the installation plays audiovisuals in a loop. The mapped projection triggers sways of light across the floor. The intention is to give visitors a glimpse of what it is like to be in the sea and experience the natural forces. The digitally enhanced environment changes with the played media. Slow gentle moving images and sounds recorded when the sea was calm present a soothing space that may induce meditative states in visitors. The media piece also contains sections with sudden movement, choppy waters and loud sounds. These sections resonate in the space like a storm, with the intention of transmitting a visceral experience, maybe even trigger minor sensory discomfort.

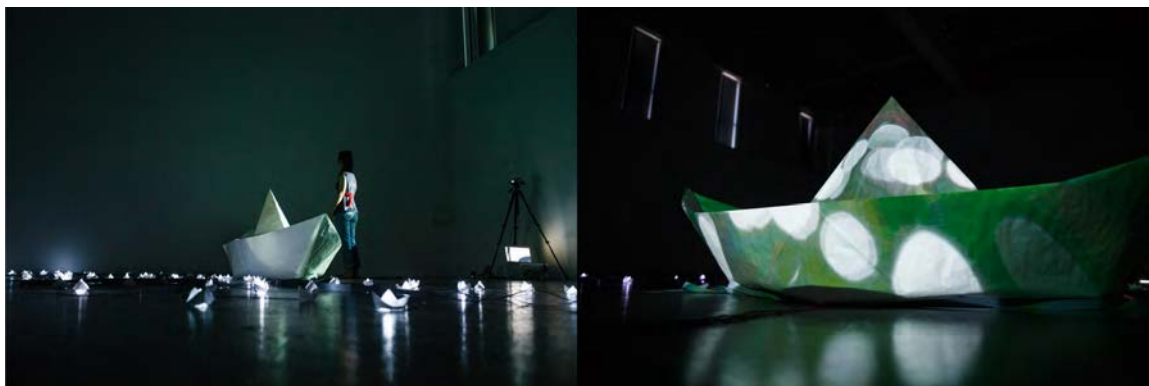
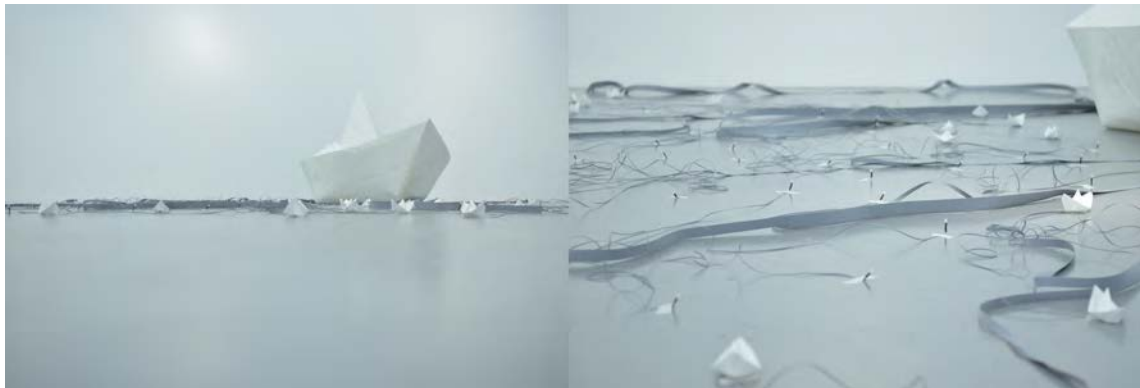


Fig. 2. “zones of flow (iii)” test setup for installation at Studio 3, University of Kent. Left: scale of paper boats in relation to human. Right: projection onto large paper boat, where the activation of LDRs underneath the paper triggers sways of light across the floor.

105 The sound composition is made with sounds that were recorded inside a vessel. During rough weather the hull  
106 becomes like a giant bubble from where to listen to the roaring sea: waves and bubbles [3] crashing against the boat.

107 The artwork deals with notions of place and displacement, where human and non-human agents flow between  
108 boundaries. Even when solid constructions are erected and demarcations are drawn between zones, agents such as the  
109 paper boats become nodes within networks, connected even in the distance [6]. The boundaries of origami structures  
110 are permeable. Light waves pass through in both directions, and they act as a connecting agents.  
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127 Fig. 3. Origami structures of different scales are connected through electronics. Elements are arranged in an organic manner.

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130 The materials of the installation are physically bound by their composition, position and shape (Fig. 3). The large  
131 paper boat is a sculptural canvas where projected visuals are revealed. Arrays of light sensors (LDRs) are hidden under its  
132 surface acting as low-res panels that send signals to the flotilla. Like water molecules, without changing position *per se*,  
133 the small paper boats let energy pass through them, and their pyramidal structures emulate the arrangement that water  
134 molecules adopt to create a surface. The small paper boats do not follow a rigid panel structure, instead they are arranged  
135 so that evolving patterns can emerge across the floor (i.e. the metaphorical water surface). Origami boats have been  
136 used in previous artistic endeavours such as Aether & Hemera's *Voyage* (2012) [7]. However, this artwork moves away  
137 from a geometric distribution of structures in favour of an organic nonlinear one to create an immersive environment  
138 where visitors are enveloped in light and sounds. Video documentation available here: <https://vimeo.com/322576328>.  
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### 142 3 TECHNICAL ASPECTS

143 The installation involves a 2.5m paper boat (made with a folded 12m<sup>2</sup> Konnyaku-starched Japanese paper), 8 custom-  
144 made PCBs (printed circuit boards), ca. 100 LDRs (light-dependent resistors), ca. 100 LEDs (light-emitting diodes), ca.  
145 100 small paper boats (Japanese paper), video mapping (projector) and stereo sound (speakers).  
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147 When the large paper boat is included, the installation requires 4m<sup>2</sup> (minimum). In a smaller space, the large paper  
148 boat can be replaced by a smaller or flattened one to use as projection surface and install the PCBs. The room needs  
149 to be blacked out. The custom-made PCBs (Fig. 4) have in-built calibration and can be adjusted to different settings  
150 (more/less light) so total darkness is not essential. A minimum of 4 power sockets is required, but fewer are acceptable  
151 if extension cables are available. The following elements are provided: paper boats (big/small), PCBs, ribbon cables with  
152 LEDs, and software. A small data projector, compact speakers and laptop may be provided, but it would be beneficial to  
153 have a computer, a more powerful projector and speakers available on site.  
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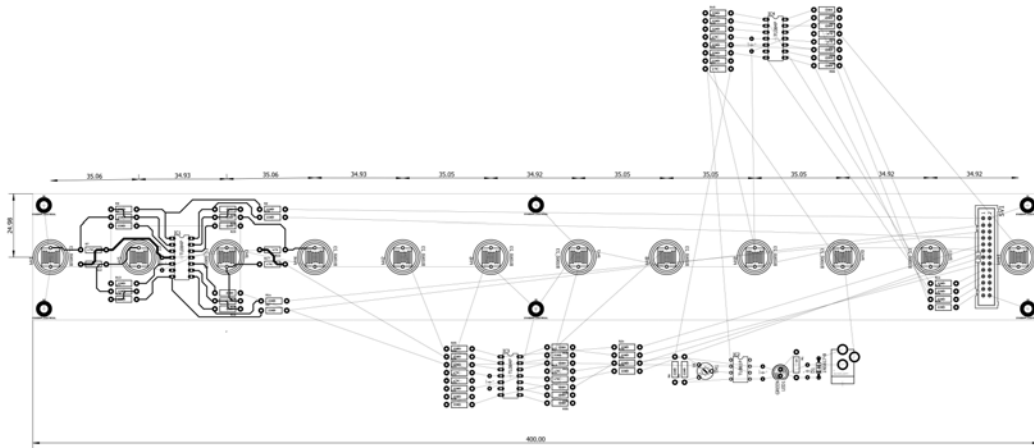


Fig. 4. Diagram of custom-made PCB designed at the School of Engineering & Digital Arts showing arrangement of LDR sensors.

The artwork (Fig.5) can be installed in a day if the space is blacked out and empty, but 2 days would be more suitable to enable better calibration. Once installed, the artwork needs to be turned on/off daily, although this can be automatized. Invigilation is not compulsory, but the paper parts and electronics are fragile, so occasional checks are welcome. No soldering is required for the installation since all electronics are prefabricated and the system tested beforehand. However, if components are damaged in transit or during installation, soldering might be needed.

An existing library of sounds and moving images has been used to produce the artwork, but there is the possibility of sourcing new media directly on site (e.g. record new water sounds and light reflections), and incorporate these into the artwork. This can be done a few days prior to the installation to make the artwork trully site-responsive.

For the 2021 online exhibition, existing video documentation, graphics and still images can be used. A selection of resources can be accessed here: <https://www.rociojungenfeld.eu/post/183357557500/zones-flow-3>.

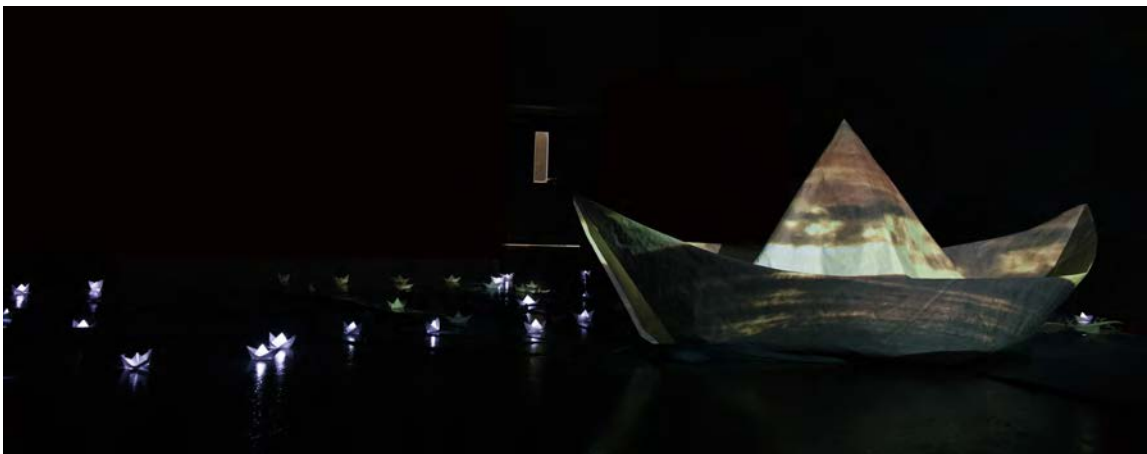


Fig. 5. Video projection mapped onto 2.5m paper boat and light permeating through the flotilla's paper on the floor.

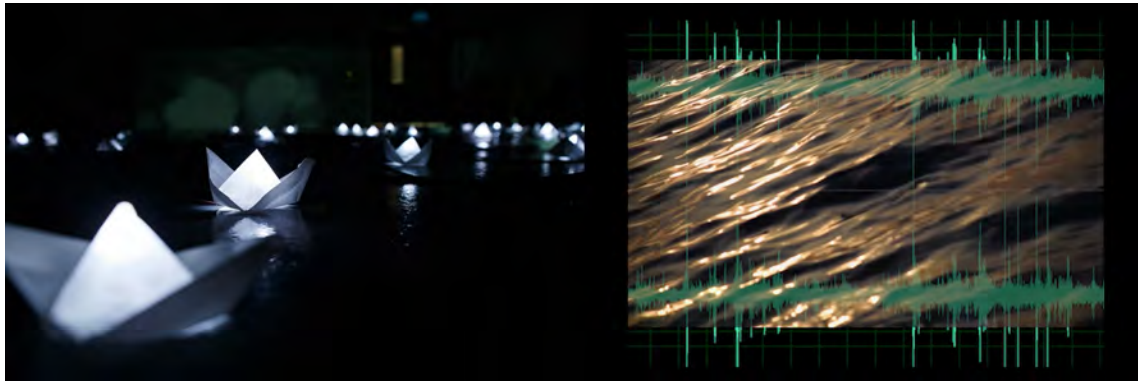


Fig. 6. In the 3.2 iteration, the flotilla (left) will emulate a water surface using audiovisual data (right) that feeds off people's actions.

#### 4 FUTURE DEVELOPMENT

The “zones of flow (3.2)” iteration will react to people, whose presence and movements will have a direct effect on the installation environment. I plan on designing an open system capable of identifying people's presence and using movement and noise data to control audiovisual outputs, and consequently the activation of the flotilla (Fig.6). The system will feed off people and generate sonic and visual outputs in response to what happens inside the space; human and electrical signals feeding off each other, with all agents interacting horizontally [1]. When entering the space, people will disrupt the environment but once they settle down, the environment will return to its quiet initial state and offer a place for quiet cogitation. Together, the installation and those present will co-create a self-organising system [2].

As explored by Samanci and Caniglia [8], harnessing people's emotional states through EEG in the context of a water-simulation interactive installation can lead to meditative states, concentration and collaboration. With “zones of flow (3.2)”, the aim is to offer an immersive environment where meditative states and creative flows can be achieved when people are patient, calm and mindful of each other's effect on the ecosystem. However, people will encounter an environment that reacts to their collective presence, and as Samanci and Caniglia observe, people may prefer to exercise their agency by collaborating to agitate the installation's environment [8] (p.418) instead of calming it down.

Wherever there is water, there is a dance of connected paths and departures between atoms and agents. Much like the creative process, it is unfinished: a continuum; a matter of perspective, of shifting grounds and unfolding horizons.

#### ACKNOWLEDGMENTS

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