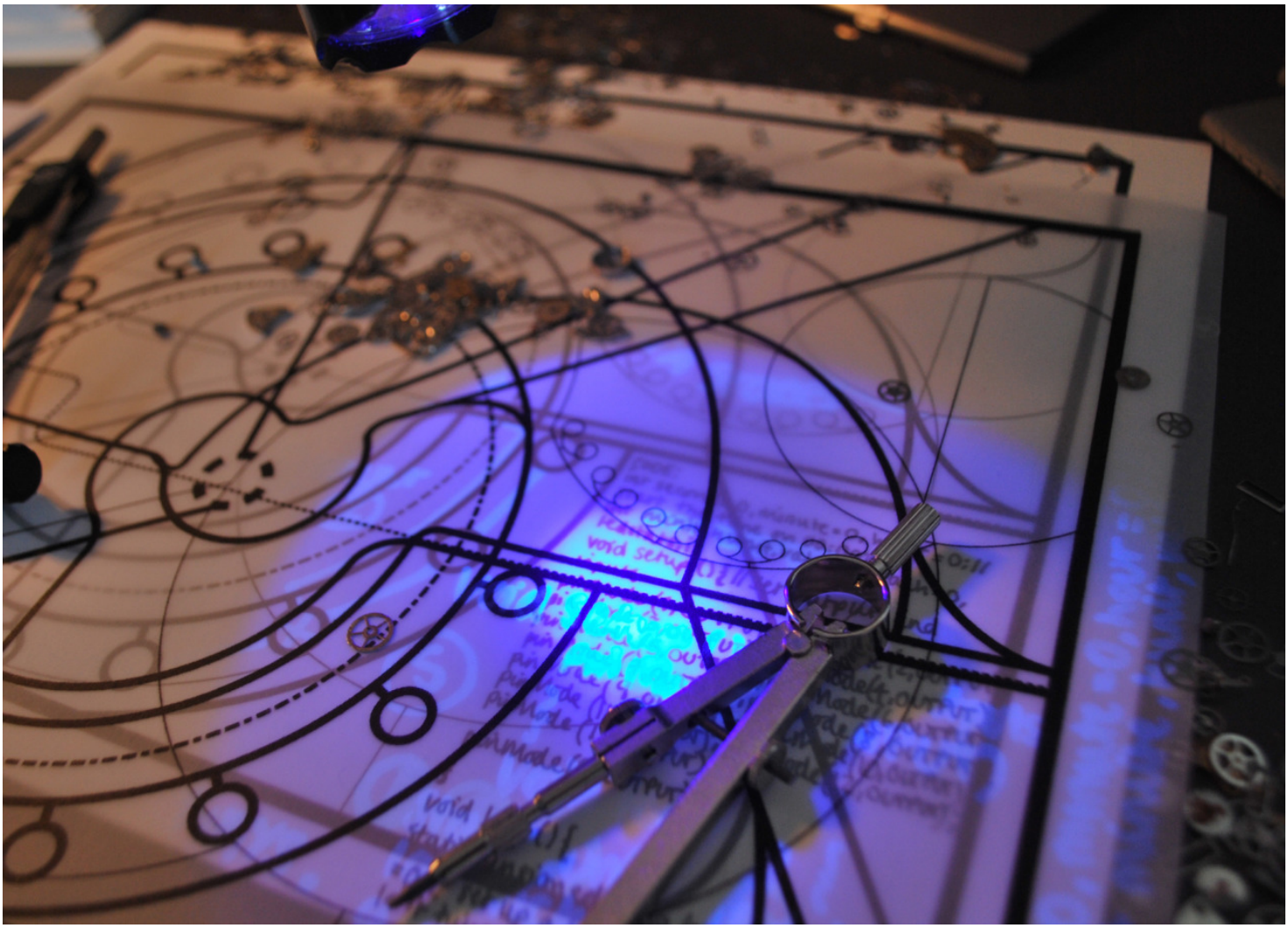
Resonance research

by Kevin Walker

Sonic reverence, social relevance
by Kevin Walker
Resonate, Belgrade 15 Apr 2016



[*Equinoctes by Heidi Benham*]

The Information Experience Design programme at the RCA engages in post-digital, post-disciplinary research + design.

[*@RCAIED grad Caroline Claisse undertaking micro-research*]

IED research embraces artistic strategies, investigative techniques, critical perspectives, research through practice. Technology is treated as a question, an object as a hypothesis, and we believe that any topic can be explored through decomp or pcomp.

[*Pneumatic Nomadic by Ozgun Kilic*]

IED Sound Design research is a new area, investigating concepts of resonance, presence, communication, sonification, notification, synthesis & sampling.

[*The Translation of Sound by Ziyang Zhang, Kawther Alsaffar, Václav Mlynář, and Kristian Knobloch*]

Resonance occurs in natural systems when an object's natural vibration frequency responds to an external stimulus of the same frequency. [Go to 8.00 in this video.] Resonance can investigated in terms of oscillations, vibrations, waves, fields.

We are interested in social as well as sonic aspects of resonance. In social systems, resonance is opposite to alienation, and relates to the way ideas and experiences generate meaning individually and collectively.

In both cases, resonance thus involves movement and temporality, and is expressed as a set of relations. Three example projects are described here – using electrical resonance, a vibrating string, and an air resonating chamber; all incorporate social aspects of resonance.

Related work

Nicola Tesla patented a mechanical resonator in 1893 designed to generate electricity; it could be precisely tuned to mechanically vibrate at specific frequencies, and he apparently claimed it could generate earthquakes or destroy a building if placed in the right spot. This claim was later investigated and found to be exaggerated – though it could generate tremors felt several hundred feet away.

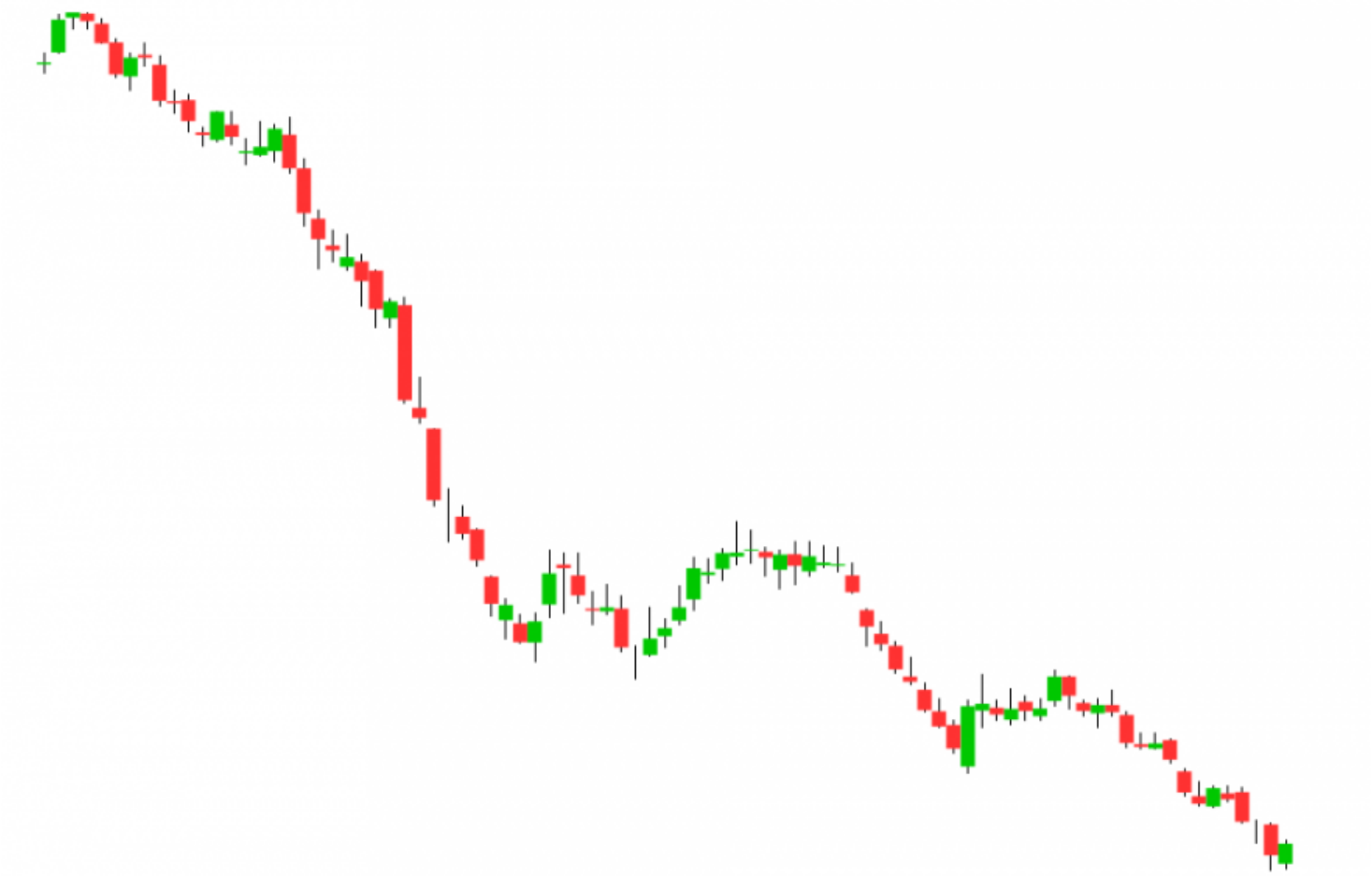
More recently, sound artist Jakob Kierkegaard, who gave a talk at RCA on 16 Feb 2016, has resonated plates of metal using a contact microphone and surface transducer attached to each; different metals produce different resonant frequencies. Each was also affected by air perturbations caused by the movement of gallery visitors, bringing our attention to the links between sonic and social aspects of resonance.

Our RCA colleague Jon Wozencroft has investigated, with archaeologist Paul Devereux, the resonating properties of large bluestones, as used at Stonehenge and other neolithic archaeological sites, hypothesising that such 'ringing rocks' in these circles may have been struck for ritual purposes ('the original rock music').

Artist Angela de Weijer (aka Miss Millivolt), another of our recent visiting lecturers, has investigated the phenomenon of 'infinite sound,' originally posed by Marconi, in speculative design work aiming to extract historic sounds from (socially) resonant objects; and to conversely embed sounds into objects.

Resonating systems

With a new Systems Research Group, we propose that any phenomenon can be investigated as a system, or part of a system, of varying complexity; the key to usable research outcomes is finding the appropriate level of description (see Hofstadter, 1979). Resonances can be found in and between systems at all levels.



[*Oil price Jun 2014 – Jan 2016*]

For example in financial trading, commonly used oscillators include the Relative Strength Index (RSI) which plots an asset's price increases over its decreases over a given time period, mapped to a scale of 0 to 100. It tends to oscillate between these poles as the asset alternately becomes overbought and oversold. But the name RSI is a misnomer, since the asset is not measured relative to another (Murphy, 1998).

Resonances can instead be found in and between markets by applying concepts from physics – for example stochastic resonance arises in nonlinear systems with information-carrying signals and noise, when a given signal corresponds strongly to the frequency of an external signal (Krawiecki and Holyst, 2003). An example of this can be seen in the way the oil price has recently influenced a range of other assets, from commodities to currencies – specifically, as the oil price dropped significantly between July 2014 and January 2016, a number of markets have followed with relative price drops, in resonance.

As well as sharing features of natural systems (such as resonance and harmonics), markets fundamentally reflect social psychology, as traders react to unpredictable market conditions in predictable ways. In the other direction, market movements have real-world social consequences – for example the drop in the oil price has affected jobs,

companies, and entire national economies.

Social resonance

While oscillators and price swings are common in financial markets, at human scale, a commonly used example of an oscillator is, coincidentally, a playground swing. A swing has a resonant frequency at which it oscillates, relative to the height at which it is hung (its amplitude). A person can attain maximum speed and height (and presumably pleasure) by following, and exploiting, this resonant frequency. A second person can push the swinger to attain maximum height, or to maintain a constant velocity. But if the swinger or an external pusher tries to swing at a different tempo than the natural resonant frequency of the swing, the rhythm will be broken and the swing will slow down, make smaller arcs or erratic movements, because the movements are out of phase with the resonant frequency.

[*Swing – Helga Schmid*]

The playground swing is used in chronobiology as a metaphor for internal and external timing mechanisms – the swing and swinger in resonance representing the circadian rhythm of the body, and an external pusher representing societal time-givers such as clocks and calendars (Roenneberg et al, 2003). Our RCA colleague Helga Schmid argues for an 'unlearning' of societal time, against external time-givers and toward a 'uchronia' based on internal, individual chronotypes.

In physical systems, from quantum to mechanical, each degree of freedom has its own resonant frequency (a playground swing, for example, has one degree of freedom). At human scale, we speak of degrees of freedom in individuals in terms of free will, and in social systems in terms of social norms and political freedoms. If clocks and calendars – and indeed digital technologies – have created an artificial disconnect from nature and an increasing sense of social acceleration, as Schmid claims, then the answer, according to sociologist Hartmut Rosa (2016), is resonance – the temporality of a good life. He identifies 'moments of [social] resonance' (as opposed to alienation), and stable 'axes of resonance' (love, family, nature, art, religion) which give access to such experiences.

Resonance is also used in social terms as a metaphor for the way information or experiences connect with people emotionally.

Methodology

Experiences are the focus of our practice, as the name of our programme suggests. We have developed a methodology called de-computation to interrogate phenomena using the steps of computational thinking combined with experimental design practice. The steps of computational thinking are: de-construction of the phenomenon under study into smaller parts; pattern recognition; abstraction; and design. De-computation is explained in more detail in (Walker and Fass, 2015).

We applied this to the concept of resonance, in a project in Autumn 2015, briefing our MA students to create a project that referenced both sonic and social aspects of resonance. This was a three-week project. Wozencroft was invited as a guest to discuss his research described above, and Dr Libby Heaney, who leads the IED Systems Research Group, discussed quantum resonance.

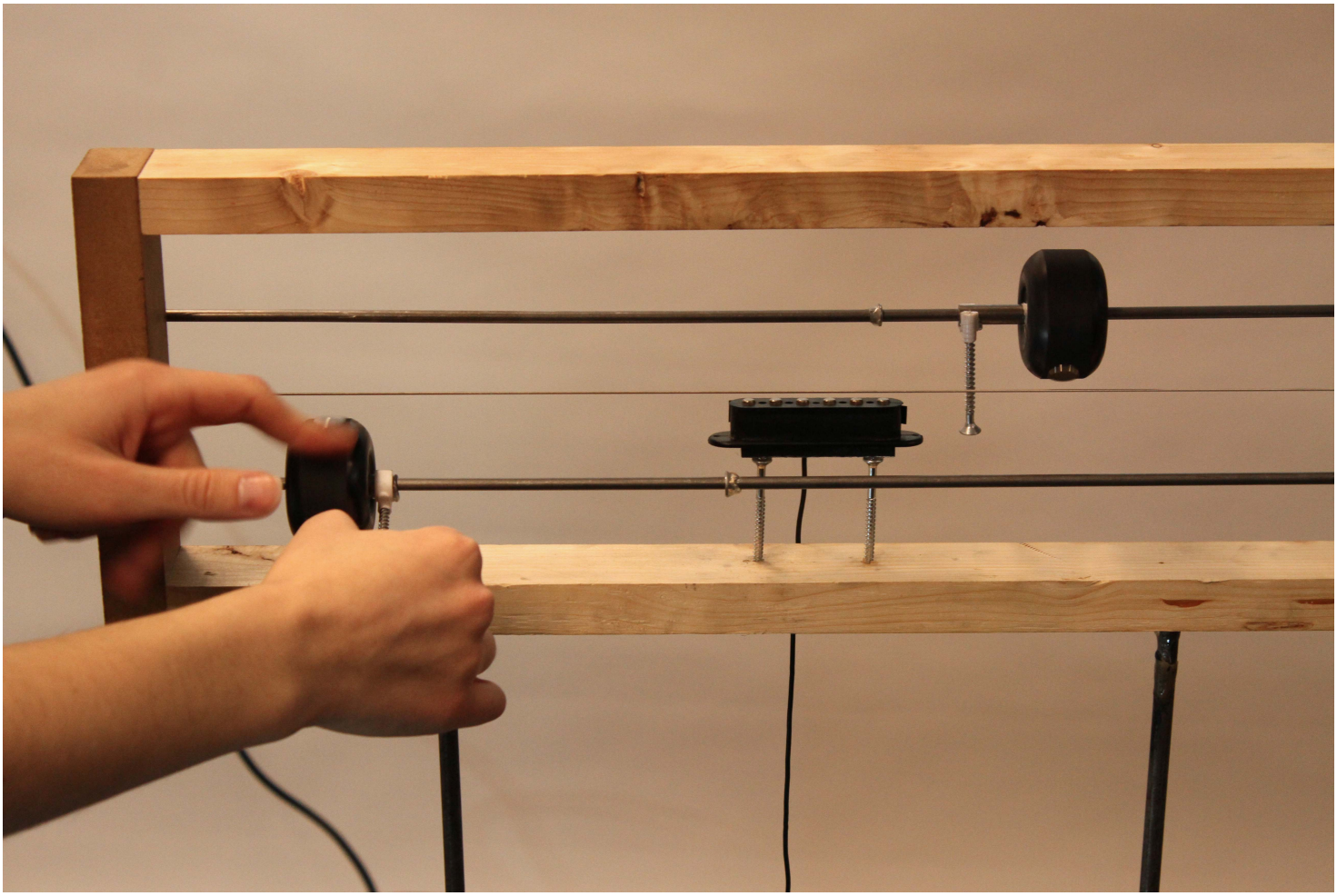
Results

[*Resonance by Grace Crannis, Emilie Loiseleur, Suramya Kedia, and Biying Chen*]

Grace Crannis, Emilie Loiseleur, Suramya Kedia, and Biying Chen made a room-sized resonating system. This installation was intended to exploit the space in between speaker, amp and microphone, generating other responses to an ordinary audio system. The project demonstrates resonance between two or more users as they play with the installation together in a set up of three separate feedback loops. Speakers were suspended from the ceiling with

white string, and black cables hung from speakers to the floor, with microphones held in wall-mounted clips.

Both speakers in the same circuit produced the sound of the corresponding microphones. This allowed users to experiment both in pairs (or by holding both microphones), as well as with the wider system of multiple users. Each microphone and speaker pair generated a varied range of tones, pitches and volume. The sound produced could be altered by the distance between the components, and the position of the microphone around the speaker. Experimental compositions could be thus created in an iterative and intuitive process.



[*Resonating Bodies by Virna Koutla*]

Resonating Bodies by Virna Koutla is an ambient sound instrument consisting of a wooden frame, a single metal string and two rotating magnets as sound activators. It is played by two people at once. The string running through the frame is not plucked; the two magnets, embedded into the black wheels, cause the string to vibrate as they spin near it. The sound produced by this interaction is then amplified by a guitar pickup. The system as a whole stands as a metaphor for the physical resonance created by two bodies that come together into one.

[*Pneumatic Nomadic by Ozgun Kilic*]

Pneumatic Nomadic was Ozgun Kilic's final MA project, created over a longer period in 2015 and exhibited in the

RCA Show that year. It was not part of the same De-computation project as the previous two, but Kilic used the methodology as a rough guide to her research and development. The project is based on Helmholtz (1863) who developed a resonating chamber to isolate particular frequencies, exploiting the movement of air across a surface – a common example is blowing across the top of a bottle. According to myth, particular frequencies (termed ‘Solfeggio frequencies’) are believed to induce particular mental states of fear, connection etc, and were reputed to have been used for example by Gregorian monks.

[*Pneumatic Nomadic by Ozgun Kilic*]

Kilic drew also from theories of acoustic ecology and the work of composer John Cage. She created various

resonators to filter specific frequencies, then used these in sound walks in urban spaces in London and Istanbul to explore the question of how these environments might sound through such filtered means.

Discussion

Resonance reaches across the sonic and social, the physical and metaphorical; in this sense the concept itself resonates between different categories. Sonic resonance is well understood in its physical properties and, to a lesser degree, effects on humans – it has been the cause of much speculation, myth and pseudoscience. At the same time, scientific findings continue to find interesting sonic phenomena in natural systems (e.g. plants), and technologies exploit sonic phenomena in sometimes surprising ways (e.g. surveillance). The work of Wozencroft, as with the practical projects described here, shows how physical and sonic resonances might have social effects, while Rosa and Schmid show ways the concept can be more broadly applied to social phenomena.

We find value in artistic research by combining or disrupting these categories, and the de-computation methodology is specifically aimed at interrogating social and political phenomena through experimenting with relevant technologies, making physical objects, installations and interventions, and testing them in the real world. This involves following a parallel approach – conducting research to inform a practical project, in a traditional manner; but in turn, simultaneously exploring a concept through experimentation with making and materials. Whether journalistic or artistic, the outcomes should clearly communicate concept and intentions, and practical projects such as those presented here can engage both artist and audience in ways that traditional research cannot.

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