DIGITAL DESIGN CONSIDERATIONS FOR ETHOLOGY

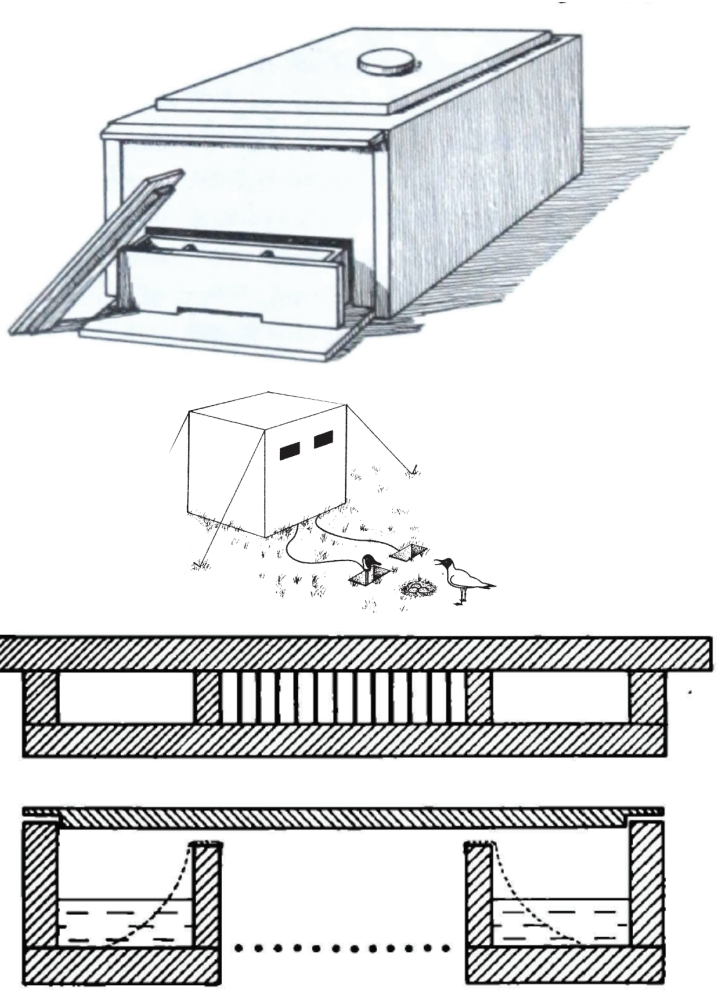
DigitalNaturalism

Andrew Quitmeyer
Digital Media - PhD Candidate

Michael Nitsche
Digital Media - Associate Professor

www.digitalnaturalism.org

>Field Reprogramming- Pipeline Road, Panama



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> Scientific tools developed and documented by Tinbergen and Frisch.

ETHOLOGY AND TECHNOLOGY

Digital Naturalism investigates the role of digital media within the study of wild animal behavior, or ethology.

Ethologists have a long history of developing their own custom techniques, practices, and tools for interacting with their specific research animals. The advent of new computer technology opens new possibilities for the science, but also brings with it new potential assumptions or erroneous methods which can hinder the knowledge gathering process.

Included in this book are guidelines developed over my PhD research studying the fields of Digital Media and Ethology. This initial framework is part of an eternally iterative project to find ways of designing new devices for animal interaction which can mutually benefit both scientists and digital designers.

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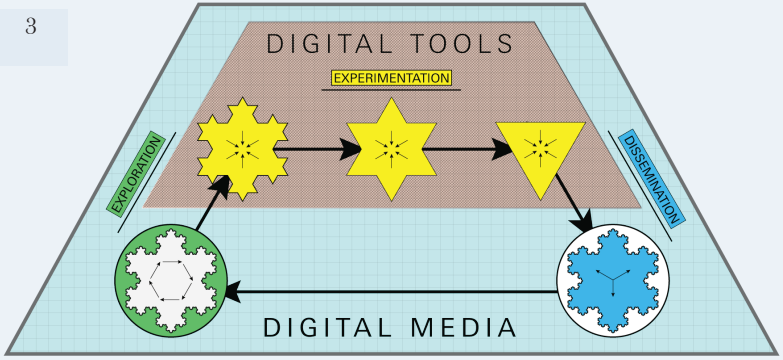
- Andrew Quitmeyer, May 2014

HOLISTIC DESIGN



A key to advancing both ethology and digital media will be to design for the entire process of Ethology. Most digital collaborations merely target the experimentation phase of research. Instead, designers should target the entire process of meaning-making. Tools should empower the earliest exploration, the final means disseminating ideas, and also provide reflection on their own use in the science.

This endeavor requires individuals from both fields to train in ethological and digital practice, and serve as "Digital Naturalists" studying both animal behavior as well as its mediating technology.

[1]

"REFLECTIVE DESIGN ALLOWS USERS TO MAINTAIN CONTROL OF AND RESPONSIBILITY FOR THE MEANING-MAKING PROCESS. THIS REQUIRES ACTIVELY BUILDING FOR CO-CONSTRUCTION OF MEANING BETWEEN USERS, SYSTEMS, AND DESIGNERS...AND OPEN-ENDED SYSTEMS WHERE THE REFLECTION ITSELF IS AN IRREDUCIBLE PART OF THE FINAL EXPERIENCE."

-SENGERS ET AL,
"Reflective Design"

> Tinbergen with simple, homemade experimental tools.

EXPLORATION

Exploration lays the foundation of a scientific investigation. In this phase, complex systems are researched and examined, first hand, in order to develop a compelling research question to study during later experimentation.

Field Hackability

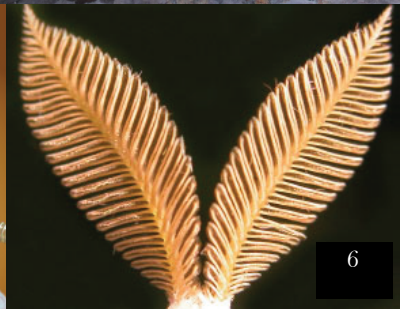
Devices not developed for the field may break, compound errors, or introduce unforeseen assumptions. A main cause of Tinbergen's concern over general laboratory rigor was that it might remove animals from the environment in which they evolved, introducing unforeseen artifacts that would disguise the true significance of their behavior. Creating tools within the target environment can help to avoid malfunctions and minimize interference with the creature's behavior. Context –specific tool making also reveals compounding environmental factors which should also be analyzed in tandem with the animal's behavior.

Sensory World Access

The distinctive sensory abilities of the target animals place them into different sensory worlds which we will never be able to fully access . Digital technology can take extra-normal sensory data from devices like electronic compasses or ultrasonic detectors and remap these stimuli to existing senses. Tools that let scientists experience the alien senses and timescales of research animals can grant access to understanding the creature's world.

Backcountry Hacking - Apache Wilderness, Arizona, USA <

>(below) Stereo Smelling Prototype | Moth antenna close-up (hsu.edu)



> Reflected light sensor (Used as prototype for ant traffic monitor)

Open-Ended Tools

Exploration seeks to increase chances of serendipitously stumbling across new phenomena. The broad knowledge collected in exploration facilitates deep research questions for experimentation. Engaging natural systems with high-level, undirected activities spurs encounters with novel behaviours. Thus the primary value to support in the exploration phase would be to create tools that promote open-ended exploration without a specified goal.

Feedback

The powerfully abstractive capabilities of digital technology can disconnect the observed cause-effect nature of behavioural phenomena. Time delays and disembodied probes could distance an observer from the witnessed actions. Creating devices that provide immediate feedback to scientists grants them greater agency to interpret the animals' interactions.

(1) Behavioural

Compared to post-processing tools, such as recording behaviours and computationally analyzing it back in the lab, on-site behavioural feedback can prevent lost work from malfunctioning tools or techniques. Additionally, creating feedback between the tool and the target organism itself can help one look deeper into more dynamic aspects of the behaviour.

(2)Environmental

Devices not developed for the field may break, compound errors, or introduce unforeseen assumptions. Creating tools within the target environment can help to avoid malfunctions and minimize interference with the creature's behaviour. Context –specific tool making can also reveal key environmental factors which require tandem analysis with the animal's behav-

> Exploring the behaviour of ants near the tops of jungle trees.

"THE VALUE OF BROAD DESCRIPTION ARISING FROM SHEER CURIOSITY SHOULD NOT BE UNDER-ESTIMATED."

-Paul Martin,
Measuring Behaviour

EXPERIMENTATION

Experimentation rigorously dissects and examines the complex, multidimensional research question developed in exploration. This process abstracts and amplifies decisions and assumptions driving the experimental model in order to discover a generalizable article of knowledge.

Adaptability

Experimental tools should responsibly serve the scientific research, however the cost and intricacy of many devices can lead scientists to create experiments around the tools rather than their original questions. This can be avoided by enabling the tools to be hack-able and modifiable by oneself and others.

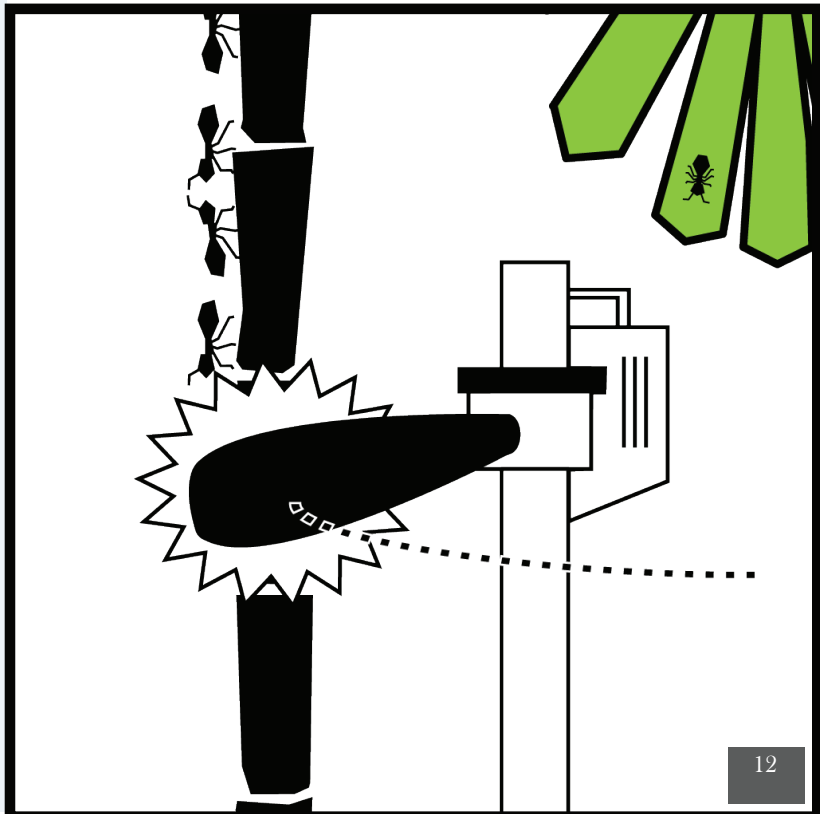
Transparency

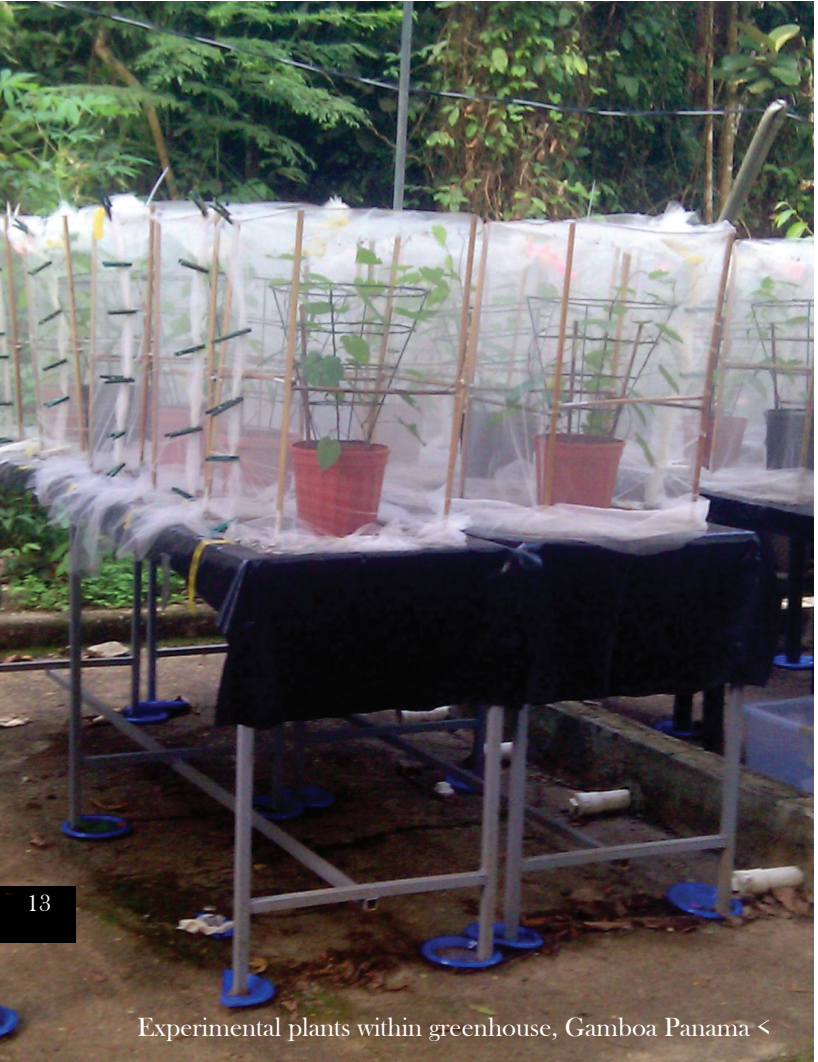
Error from unknown variables can become exacerbated during experimentation. Therefore, the technology used during experimentation should both avoid introducing error into the measured interactions as well as reliably make known any potential disturbances it causes.

Enhanced Repetition

Historically, increasing the throughput of experimental trials has been the chief concern of scientific technological interventions. Being able to collect and quickly analyze large amounts of data reduces the impact of noisy information. Such effective and rapid processing can only be achieved through carefully considering the factors and processes leading to this experimentation.

> The Flick-O-Matic's evolution into service as experimental tool.





Experimental plants within greenhouse, Gamboa Panama <

In the naturalist's collection ...[plants are] reassembled, reunited, redistributed according to entirely new principles that depend on the researcher, on the discipline of botany,... and on the institution that shelters them, but they no longer grow as they did in the great forest.

The botanist learns new things, and she is transformed ... but the plants are transformed also. Knowledge derives from such movements, not from simple contemplation of the forest.

-Bruno Latour,
Pandora's Hope

DISSEMINATION

Responsible scientists must properly share their findings. Instead of relying on the formats of other scientific fields or centuries-old traditions, the key challenge for ethological dissemination is to find new ways to effectively communicate the rich details of wild animal behavior.

Procedural Rhetoric

The dynamic qualities of animal behaviour are difficult to convey in traditional means, but now communication tools can actually enact behaviours themselves. Digital media's ability to rapidly carry-out complex processes can more directly share and connect with behavioural ideas and actions. Behavioural media like computer simulations and interactive exhibits could empower ethological dissemination.

Interactive Reflection

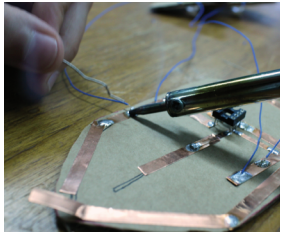
Animals' behaviours are mired in specific times, places, and contexts. Situating audiences into similar environments and actions can grant them the direct experience required to tacitly understand the implicit impulses behind the creatures' actions.

Open Research

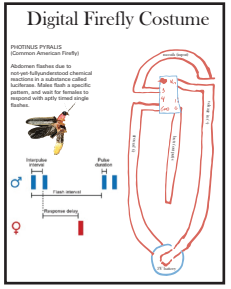
The scientific and technological discoveries made during exploration and experimentation are incomplete and useless if locked up in the mind of one individual. Documenting and sharing scientific practices and devices with free technology licenses lets others recreate, verify, and build upon your research.

> Programming and Enacting Firefly Flashes

Audience-AntRobot interaction during performance <



open source hardware



> Documentation and Licensing for Free Tech.

> Post-performance reflection with real ants and participant experiences.

"Often I have been frustrated with the journal articles that come out of the research because only the finished results are given. All the excitement of the process has been squeezed out so that the results will conform to certain expected standards...

My hope is to capture... the sounds and sights, the endless chores and happy accidents, the obsessions, the wonder of it all."

-Bernd Heinrich,

In a Patch of Fireweed