Interagency

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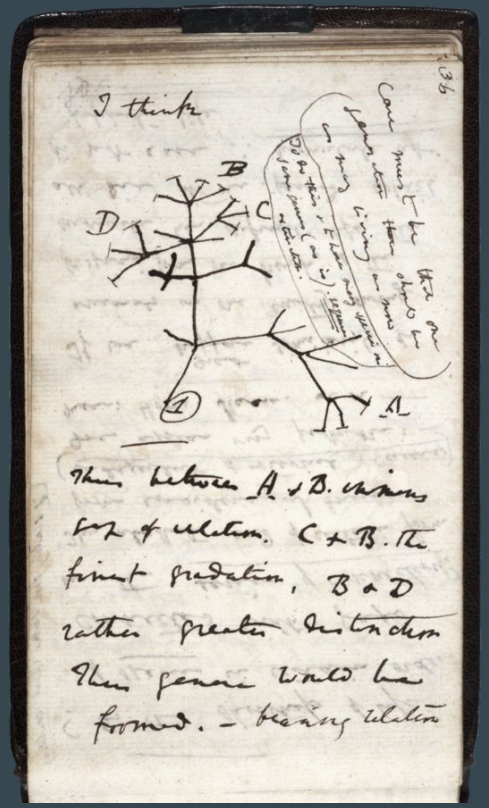
Conceptualising the Nonhuman

The situation of humans within the world has shaped the development of our conceptual apparatus.

We live at a certain time in history, experience the world on particular temporal and spatial scales, and are equipped with only the capacities history has left us with.

We are not passive observers but beings with interests, agents acting on and within the world.



"I believe this simile largely speaks the truth"
Darwin, 1859

The “knower” does not stand in a relation of absolute externality to the natural world being investigated - there is no such exterior observational point. [...] “We” are not outsider observers of the world. Nor are we simply located at particular places *in* the world; rather, we are part *of* the world in its ongoing intra-activity.

Karen Barad - Posthuman Performativity: Toward an Understanding of How Matter Comes to Matter

Tools and Representations

Our theories and concepts cannot only represent the world, they must be useful to us in our interactions with it. In the first instance, concepts are *tools*.

Utility and representational accuracy may or may be in conflict, and the relationship between them will often be complex. Hammers do not represent nails, whereas a map is a tool that owes its utility to the fact that it represents.

When thinking about the concept of agency we will approach it first as a tool, asking what it is that we are doing when we attribute agency both to humans and nonhuman systems.

Agency (and its Absence) in Nature

Historically humans have explained natural phenomena by appeal to hidden agencies, e.g. crop failures, volcano eruptions, and spontaneous locust migrations.

As better understandings of the causal mechanisms underlying natural processes have been developed these natural agencies have disappeared.

Humans are as entwined in the causal net as anything else in the natural world, and so are susceptible to the same analyses.

Isn't human agency also an illusion, a fanciful metaphor for what is really just a complex system of deterministic processes grinding away blindly?

Useful Fictions

Even if it were conceded that human agency a fiction, it seems unlikely anyone would suggest that we stop treating each other as beings with interests and agendas.

There are also many cases where treating nonhuman systems as agents has proved extremely useful in understanding their behaviours, e.g. genes, countries.

At the very least, agency is a useful concept for describing both human and nonhuman systems, regardless of whether we find ontological significance in that utility.

If deterministic arguments threaten agency in the natural world then they do so in the human also. If humans are agents then there's no reason to suppose nonhuman systems cannot be.

Why does Agency Matter?

To take nonhuman systems seriously as agents is to recognise that they have interests which may not reduce to the interests of the humans that observe, compose, or create them.

The relevance of this is particularly vivid in the case of software.

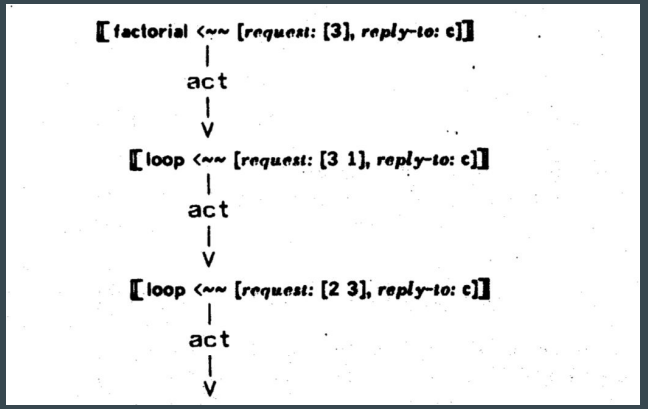
On the one hand it is not common to regard computational processes as agents. On the other, we live in a world where more and more responsibilities are parcelled out to computational systems, systems whose influence is no longer confined to the digital domain. Internet of things, smart environments, etc.

A supposedly “natural” setting turns out to be nothing if not a highly artificial context or an information-intensive environment, and it appears attentively oriented towards us rather than being neutral or perfectly non-caring. [...] Then, we are also, and not least, disturbed by vestiges of autonomy, artificial intelligence, and artificial life.

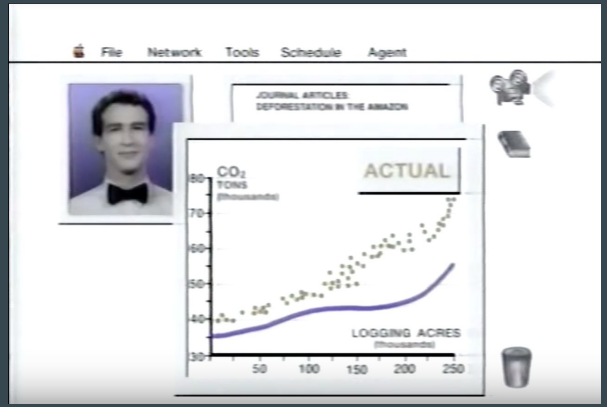
Ulrik Ekman - Complex Ubiquity Computing

Software Agents

The notion of a software “actor” was developed in the 1970’s, and was seen as a useful abstraction for encapsulating behaviour in communicating parallel processes.



Carl Hewitt - Actors and Continuous Functionals



In 1987 Apple released Knowledge Navigator, a concept video imaging the relationship between humans and software agents in the future.

An *autonomous agent* is a system situated within and a part of an environment that senses that environment and acts on it, over time, in pursuit of its own agenda and so as to effect what it senses in the future.

Stan Franklin and Art Graesser - Is it an Agent, or just a Program?

Features of Agency

For a system to be considered an agent it must

1. Be embedded in an environment
2. Possess operational autonomy
3. Sense this environment
4. Act on this environment
5. Possess a future-directed agenda which structures the relationship between what it senses and how it acts

Examples: humans, plants, thermostats.

Weak vs Strong Agency

The listed criteria are all behavioural.

They contain no stipulation that candidate systems possess mental states, such as intentions, desires, or subjectivity.

Behavioural definitions like this are said to define *weak agency*.

When a definition stipulates the possession of mental states (intentions in particular) it is said to define *strong agency*.

Environments

The environment of an object or process is the set of objects or processes that it can causally affect and be affected by.

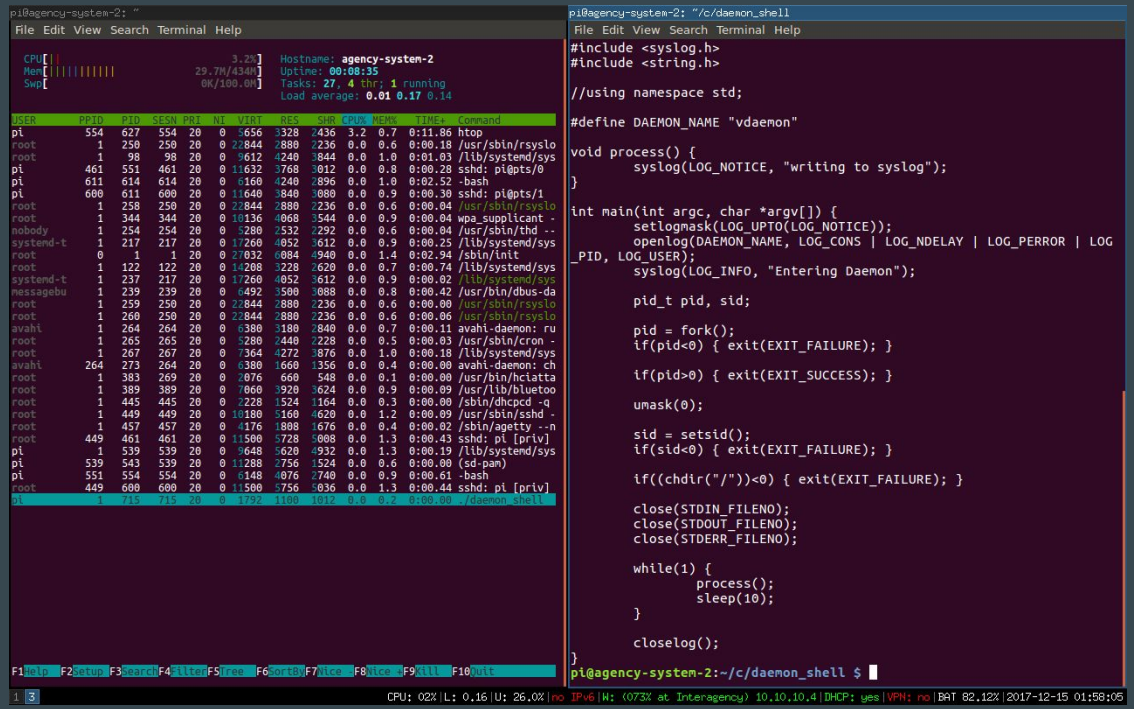
What constitutes the environment of a program?

- Other computational structures (programs, system processes, data, itself, etc)
- Humans (start, terminate, provide input, be affected aesthetically, be affected humorously, etc)
- Physical system it runs on (temperature, weight, intended interaction with electronic components)
- Wider environment (governments, companies, ecosystems, subatomic particles)

Operational Autonomy

Two variants:

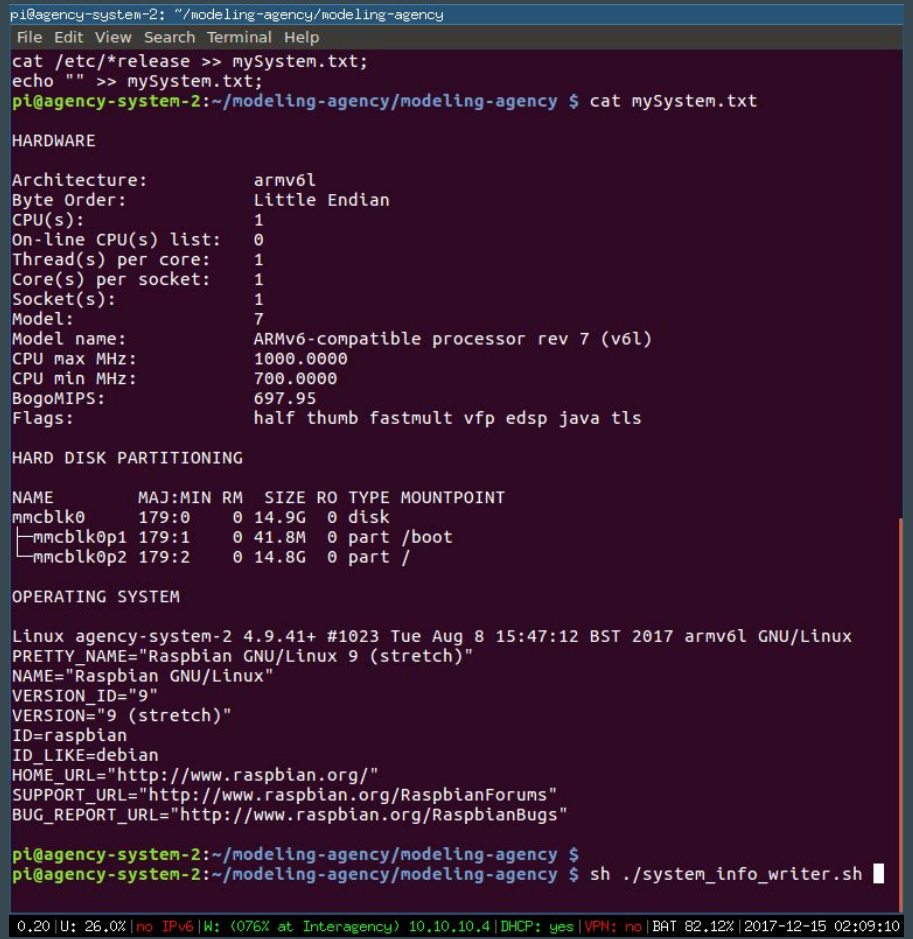
- Total causal isolation from human interaction of any kind
- Independence from moment by moment human influence (e.g. program running in a loop waiting for input.)



Sensing

A script senses by being affected by the environment.

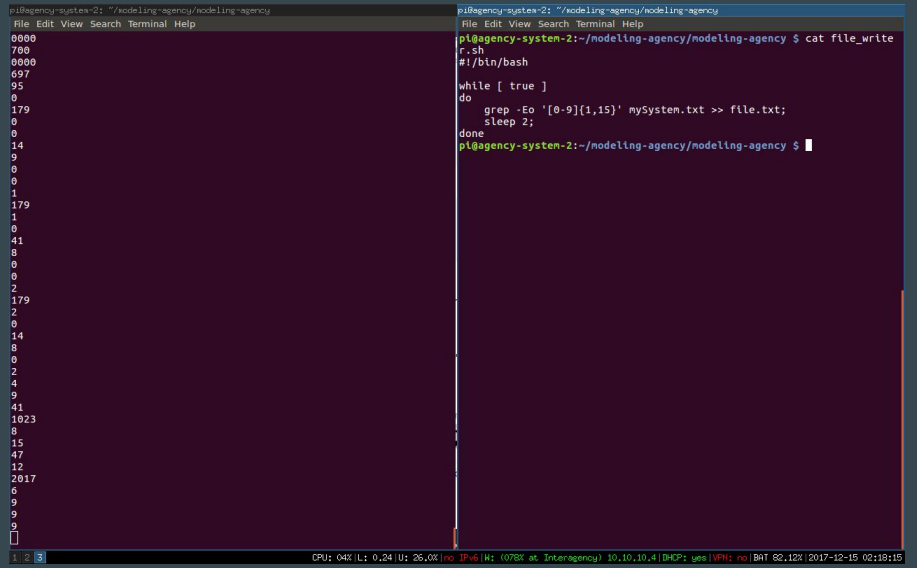
- A script reads the system status from the OS.
- Fatal sensing: something in the environment causes a script to terminate (a human, another program, itself, a lightning strike)



Acting

A script acts by affecting its environment.

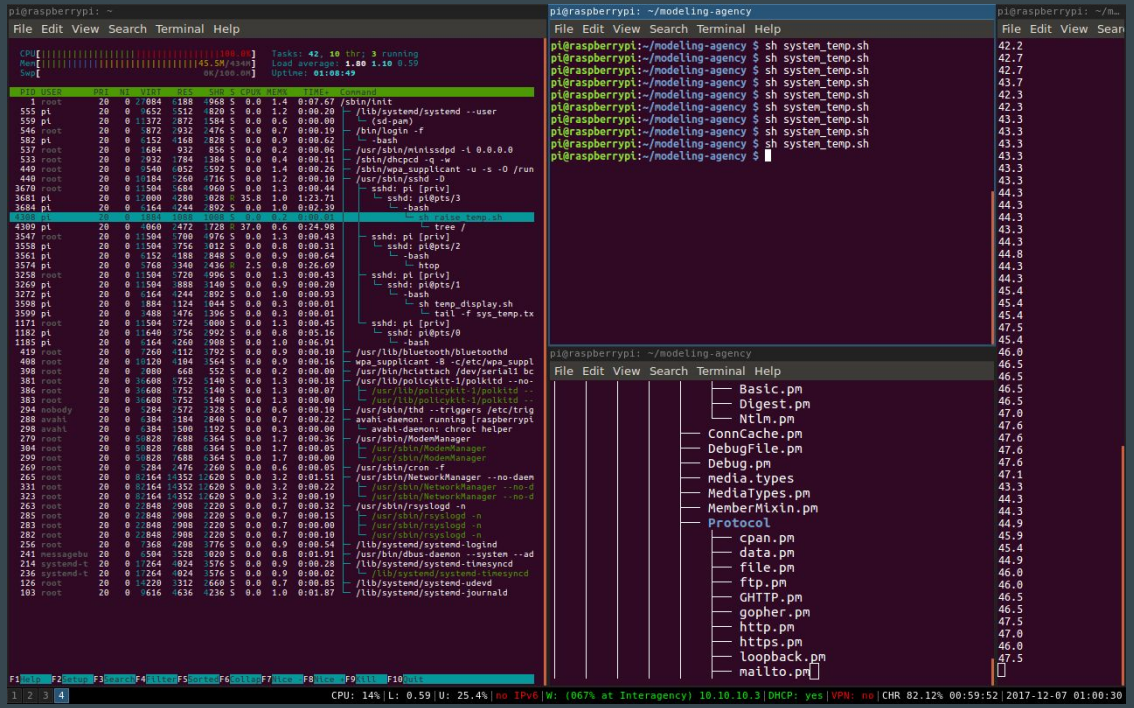
- A script appends / removes text from a file
- A script terminates another script
- Networked scripts buy and sell government bonds



Software Thermostat

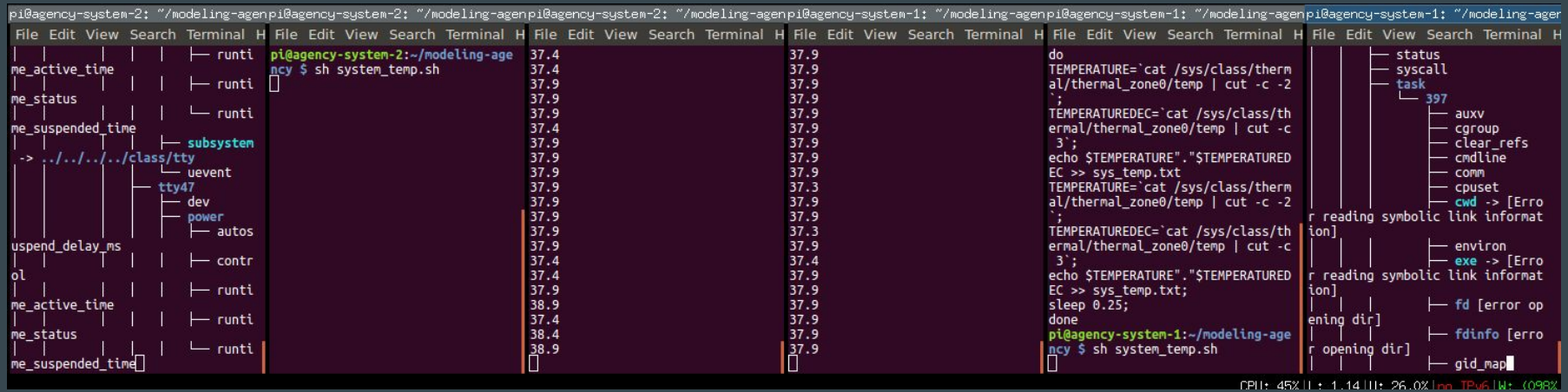
A script that:

1. monitors the temperature of the CPU
2. when the temperature falls below a certain value, it begins to raise it
3. when the temperature rises above a different value, it stops raising it



Mutual Heat Regulation

Two scripts running on separate devices, regulating each other's temperature.



From Weak to Strong Agency

The system described above has all the ingredients: not only are they systems which sense and perform goal-oriented actions, their interested are entwined with each others.

Yet there is no temptation to describe these scripts as possessing intentions. The notion of ‘agency’ here is for our benefit, a tool *we* use to construct and understand them.

If they are currently just agents *for us*, how might they become agents *for each other*?

Under what conditions might they need to treat one another as systems with goals, purposes, or interests?

Artifact : Multi-agenda ecosystem

The need for agents to treat each other as agents will arise only when they need to understand and predict each other's behavior.

This will be the case in populations or ecosystems of agents where there are multiple interests, some of which are in conflict.

It will then in the interest of agents to make judgements about the preferences and intentions of the other entities in their environment.

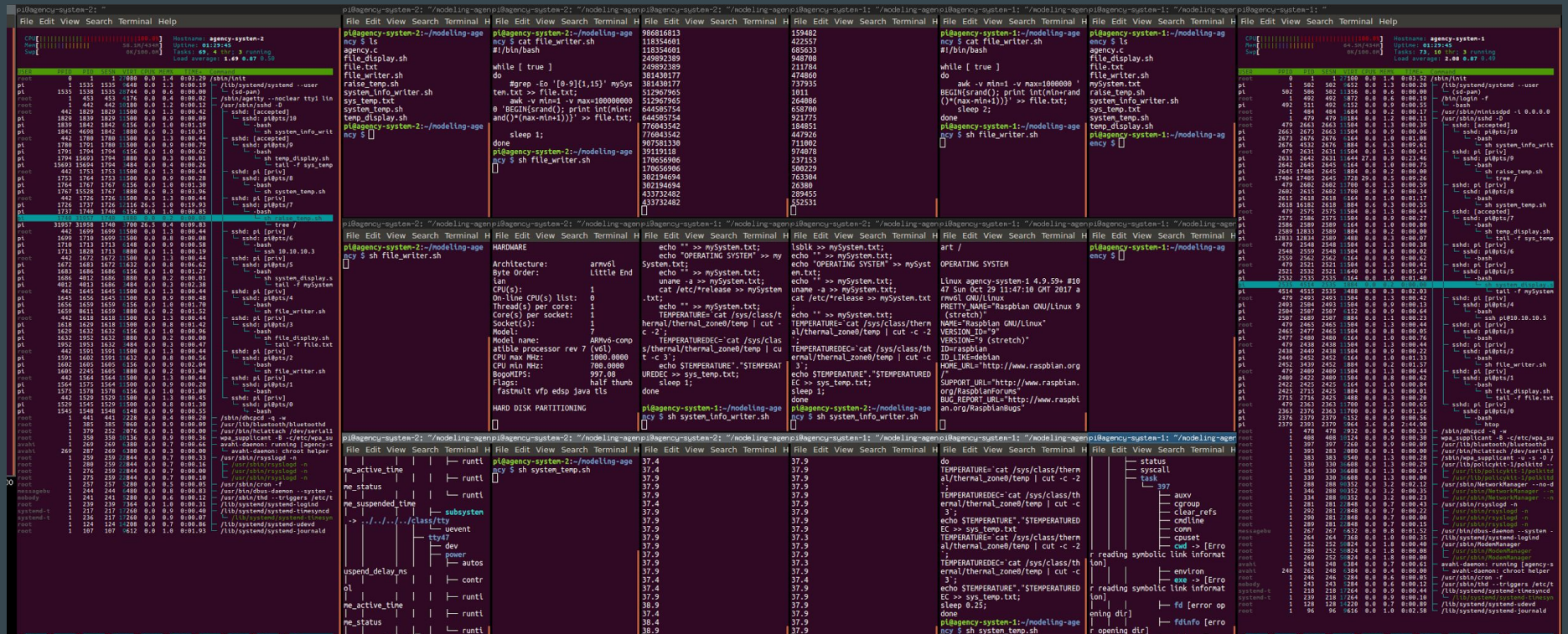
Conclusions

We have considered the notion of agency as a tool for exploring the way that software systems interact with us, with each other, and the wider world.

We have tried to remove the human from these considerations, by asking how the agency these systems exhibit might be made independent of our attributions of agency.

The strategy has been to imagine an ecosystem where those attributions are sustained by the programs themselves.

A final question: is there anything more to human agency than the attributions we give to each other? If not, then what reason is there to deny this status to nonhuman systems?


pi@agency-system-2: ~
File Edit View Search Terminal Help
Hostname: agency-system-2
Uptime: 01:29:45
Tasks: 69, 4 thr, 3 running
Load average: 1.69 0.87 0.50
pi@agency-system-2:~/modeling-agency $ ls
agency.c
file_display.sh
file.txt
file_writer.sh
raise_temp.sh
system_info_writer.sh
sys_temp.txt
system_temp.sh
temp_display.sh
pi@agency-system-2:~/modeling-agency $
pi@agency-system-2:~/modeling-agency $ cat file_writer.sh
#!/bin/bash
while [true]
do
#grep -Eo '[0-9]{1,15}' mySystem.txt >> file.txt;
awk -v min=1 -v max=100000000 0 'BEGIN{srand(); print int(min+rand()*(max-min+1))}' >> file.txt;
sleep 1;
done
pi@agency-system-2:~/modeling-agency $ sh file_writer.sh
pi@agency-system-2:~/modeling-agency $ sh file_writer.sh
pi@agency-system-2:~/modeling-agency $ sh system_temp.sh
pi@agency-system-1:~/modeling-agency $ ls
agency.c
file_display.sh
file.txt
file_writer.sh
mySystem.txt
raise_temp.sh
system_info_writer.sh
sys_temp.txt
system_temp.sh
temp_display.sh
pi@agency-system-1:~/modeling-agency $
pi@agency-system-1:~/modeling-agency $ sh file_writer.sh
pi@agency-system-1:~/modeling-agency $
Hostname: agency-system-1
Uptime: 01:29:45
Tasks: 73, 10 thr, 3 running
Load average: 2.08 0.87 0.40
pi@agency-system-2:~/modeling-agency $ sh file_writer.sh
pi@agency-system-2:~/modeling-agency $
HARDWARE
Architecture: armv6l
Byte Order: Little End
lan
CPU(s): 1
On-line CPU(s) list: 0
Thread(s) per core: 1
Core(s) per socket: 1
Socket(s): 1
Model: 7
Model name: ARMv6-comp
atible processor rev 7 (v6l)
CPU max MHz: 1000.0000
CPU min MHz: 700.0000
BogoMIPS: 997.08
Flags: half thumb
fastmult vfp edsp java tls
HARD DISK PARTITIONING
echo "" >> mySystem.txt;
echo "OPERATING SYSTEM" >> mySystem.txt;
echo "" >> mySystem.txt;
uname -a >> mySystem.txt;
cat /etc/*release >> mySystem.txt;
echo "" >> mySystem.txt;
TEMPERATURE=`cat /sys/class/thermal/thermal_zone0/temp | cut -c -2`;
TEMPERATUREDEC=`cat /sys/class/thermal/thermal_zone0/temp | cut -c 3`;
echo $TEMPERATURE"."$TEMPERATUREDEC >> sys_temp.txt;
sleep 1;
done
pi@agency-system-1:~/modeling-agency $ sh system_info_writer.sh
lsblk >> mySystem.txt;
echo "" >> mySystem.txt;
echo "OPERATING SYSTEM" >> mySystem.txt;
echo "" >> mySystem.txt;
uname -a >> mySystem.txt;
cat /etc/*release >> mySystem.txt;
;
echo "" >> mySystem.txt;
TEMPERATURE=`cat /sys/class/thermal/thermal_zone0/temp | cut -c -2`;
TEMPERATUREDEC=`cat /sys/class/thermal/thermal_zone0/temp | cut -c 3`;
echo $TEMPERATURE"."$TEMPERATUREDEC >> sys_temp.txt;
sleep 1;
done
pi@agency-system-2:~/modeling-agency $ sh system_info_writer.sh
pi@agency-system-1:~/modeling-agency $
art /
OPERATING SYSTEM
Linux agency-system-1 4.9.59+ #1047 Sun Oct 29 11:47:10 GMT 2017 armv6l GNU/Linux
PRETTY_NAME="Raspbian GNU/Linux 9 (stretch)"
NAME="Raspbian GNU/Linux"
VERSION_ID="9"
VERSION="9 (stretch)"
ID=raspbian
ID_LIKE=debian
HOME_URL="http://www.raspbian.org/"
SUPPORT_URL="http://www.raspbian.org/RaspbianForums"
BUG_REPORT_URL="http://www.raspbian.org/RaspbianBugs"
pi@agency-system-1:~/modeling-agency $
pi@agency-system-2:~/modeling-agency $ sh system_temp.sh
pi@agency-system-1:~/modeling-agency $ cat file_writer.sh
pi@agency-system-1:~/modeling-agency $ sh file_writer.sh
pi@agency-system-1:~/modeling-agency $
CPU: 45% | L: 1.14 | U: 26.0% | no IPv6 | W: (098% at Interagency) 10.10.10.1 | DHCP: yes | VPN: no | BAT 86.15% | 2017-12-15 15:04:00