

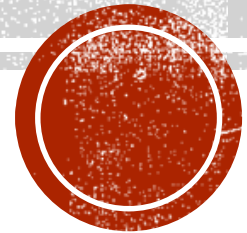
# MUTUAL SHAPING BETWEEN TECHNOLOGIES AND LAW: MEMORIES OF NORWEGIAN E-HEALTH INFRASTRUCTURES

PhD defense

by A. Zaytseva

Supervisors: M. Aanestad, S. Sahay, S. Finken

Committee: Y. Merali, E. Uprichard, J. Kaasbøll



# MOTIVATION

- PhD is just a start!...
- PhD is a fingerprint of my own intelligence
- PhD is a feedback to Norwegian taxpayers  
(REACH, Research Council of Norway)



**HOW DO TECHNOLOGIES [ICT] AND  
LAW MUTUALLY SHAPE EACH OTHER?**



# FINDINGS

## **Ontological contribution**

- Shaping of ICT and law is a holistic phenomenon, which emphasises:
  - Temporality and simultaneity
  - Mutuality of information shaping
  - Multiplicity of situations and uniqueness of learning

## **Epistemological contribution**

- A procedural, holistic, systems approach, which emphasises:
  - Time-tagging and conditionality
  - Relationships across elements/situations
  - Bottom-up information accumulation and predictability of learning



# EMPIRICAL SETTING

## HealthBook

## National Core Journal

### Similarities:

- E-health solutions
- Norwegian legislative context
- Emerging technologies

### Differences:

- |   |   |
|---|---|
| ▪ A private initiative                    | ▪ A public-sector initiative                  |
| ▪ Sharing data from patient to healthcare | ▪ Sharing data across healthcare institutions |
| ▪ Any data for healthcare purposes        | ▪ Critical health data                        |

**DATA: reports, proposals and opinions, e-mails, specifications (200 doc.), interviews (over 10), etc.**

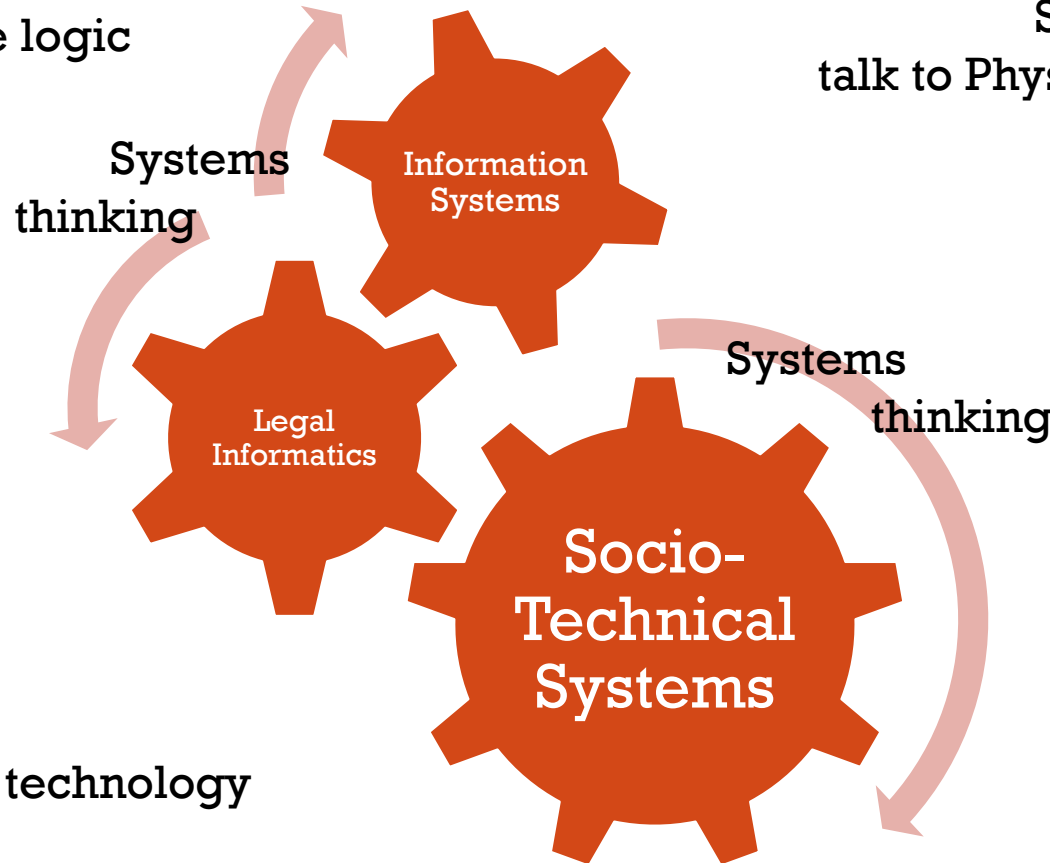


# KNOWLEDGE TO RESPOND: TRANSDISCIPLINARITY

Systems thinking:  
abstraction, computation of the logic

Systems thinking:  
talk to Physicists – they won't bite you

Systems thinking:  
visualization



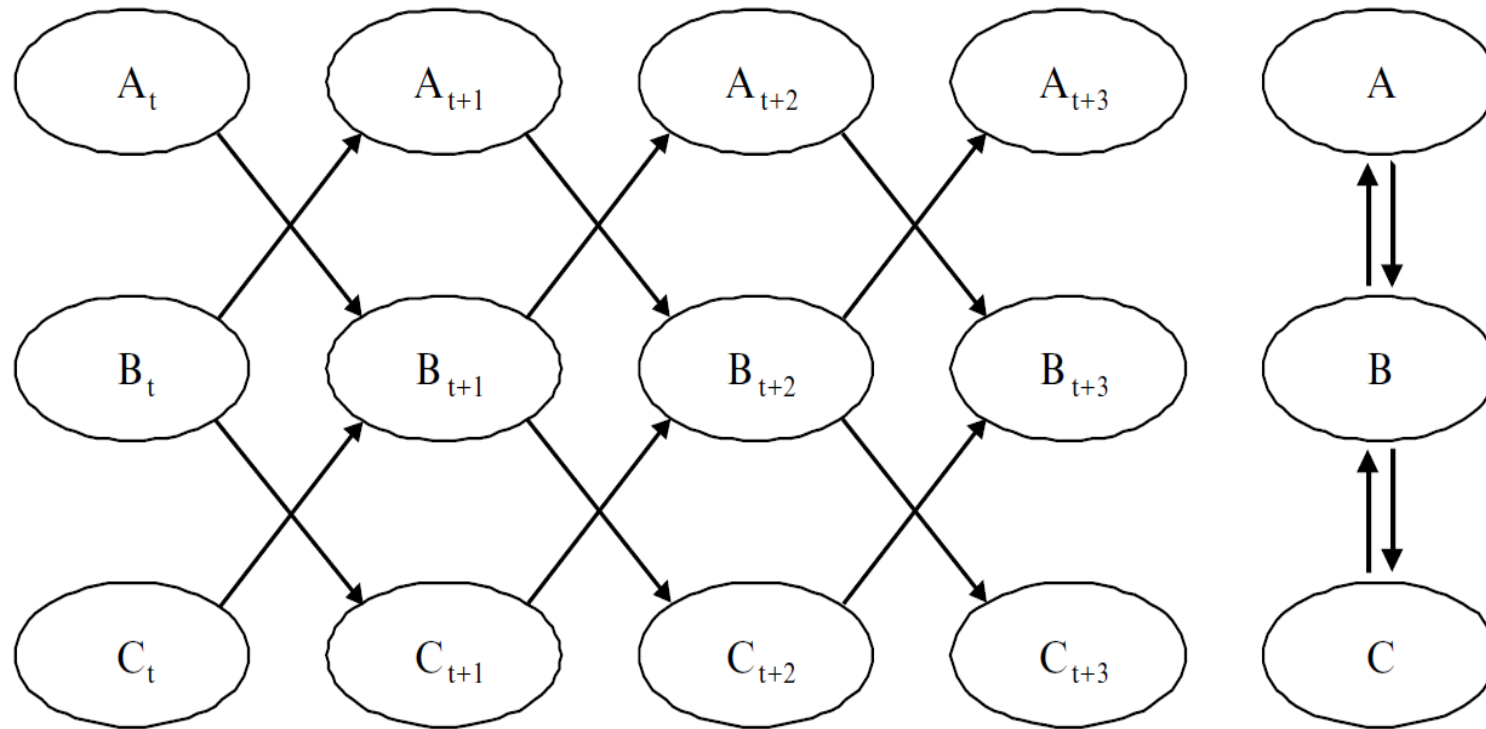
Systems thinking:  
logic as a technology, research as technology

Systems thinking:  
50% practice + 50% theory



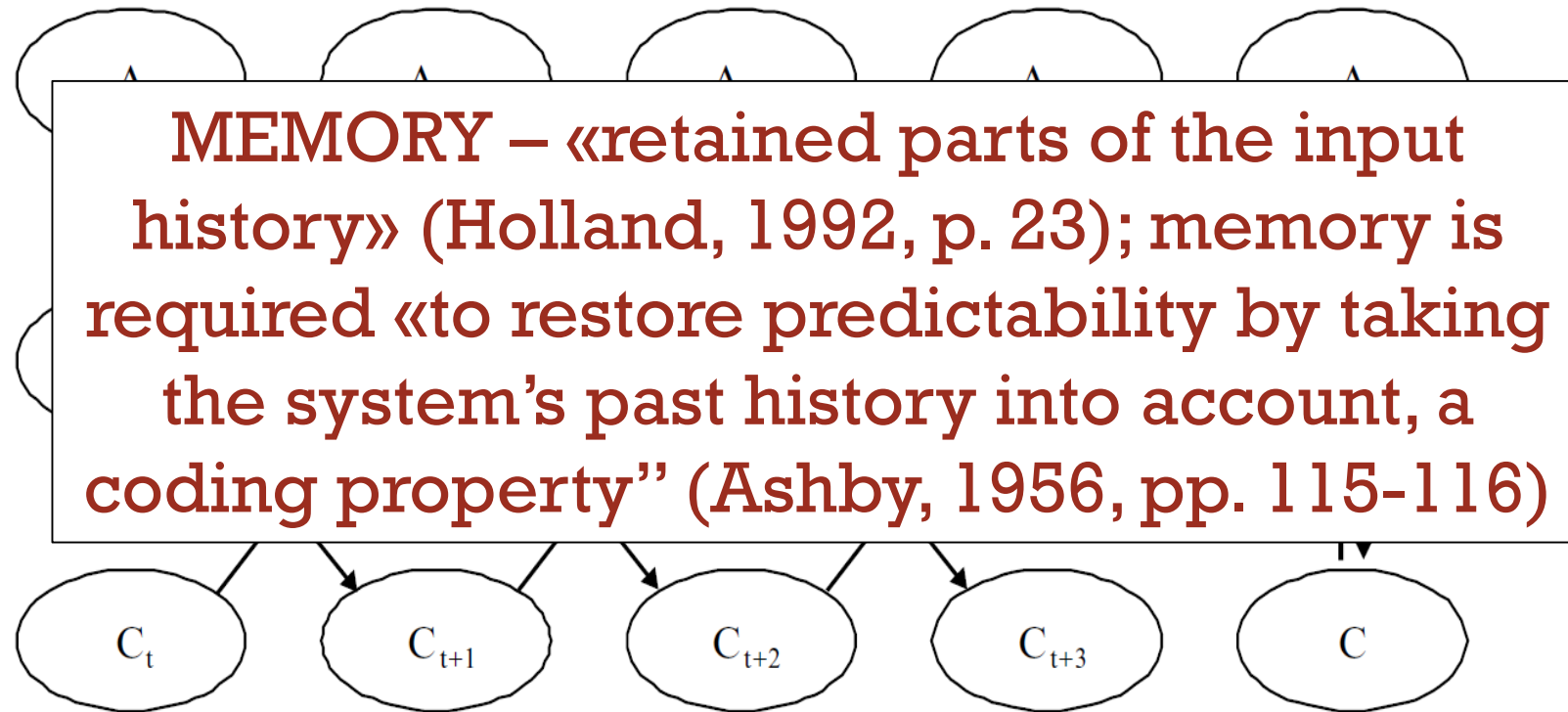
# ABSTRACTION OF RELATIONSHIPS & TIME

A process and a complex system of elements and in interaction



# ABSTRACTION OF RELATIONSHIPS & TIME

A process and a complex system of elements and in interaction



# VISUALIZATIONS OF ABSTRACTIONS

Elements, relationships and time,  
where everything happens bottom up and every opinion matters

## **Dataset 1: HealthBook**

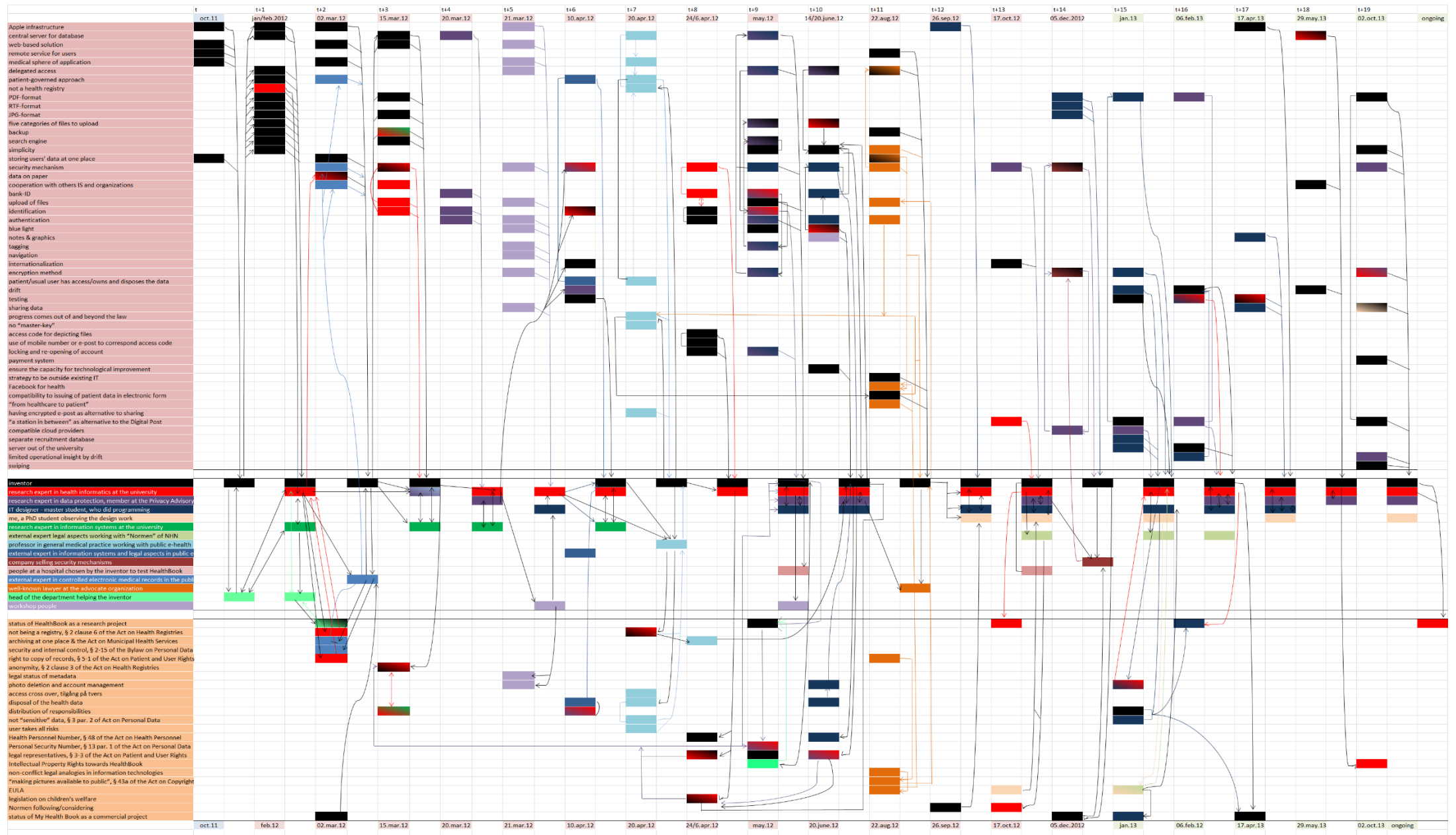
- 51 elements of technology
- 15 social elements
- 23 elements of law

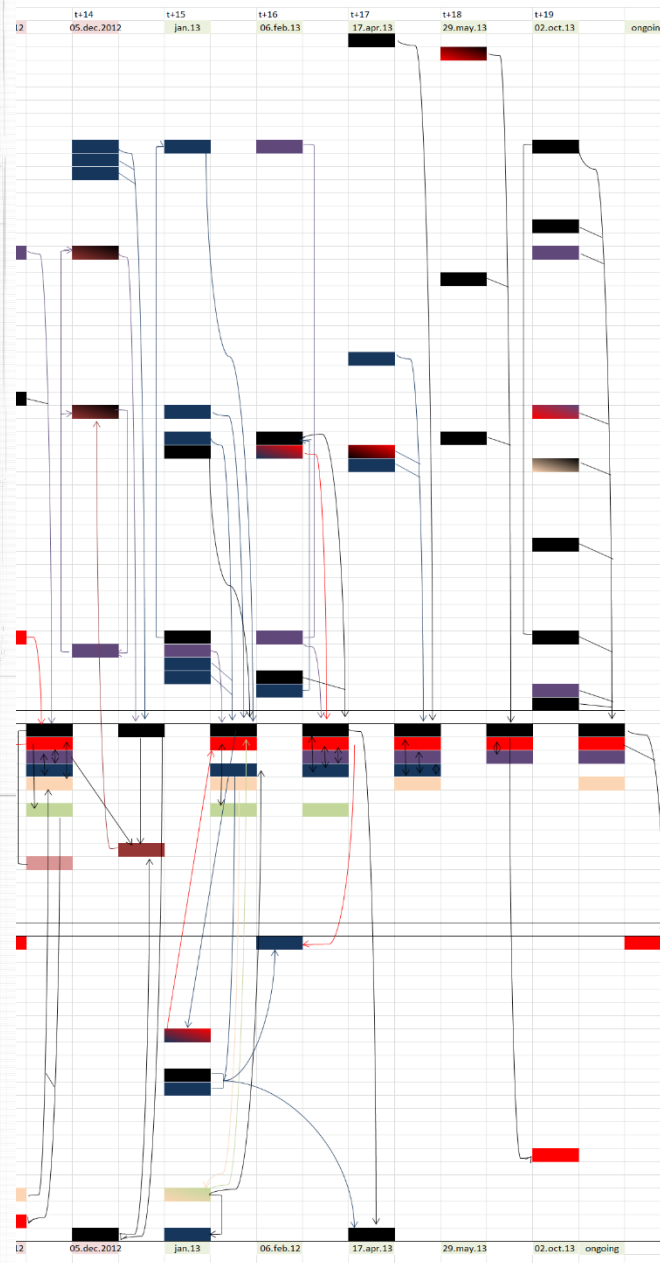
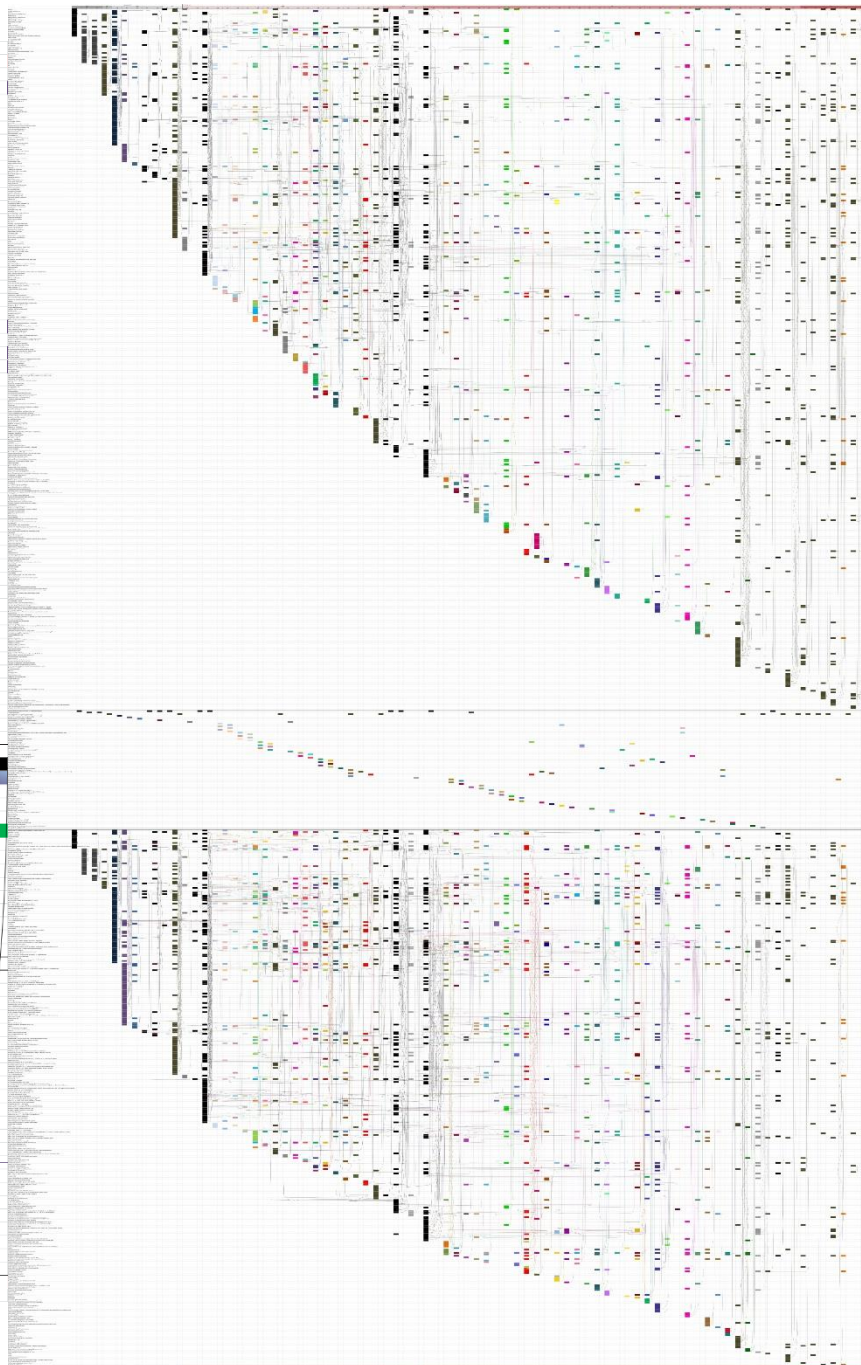
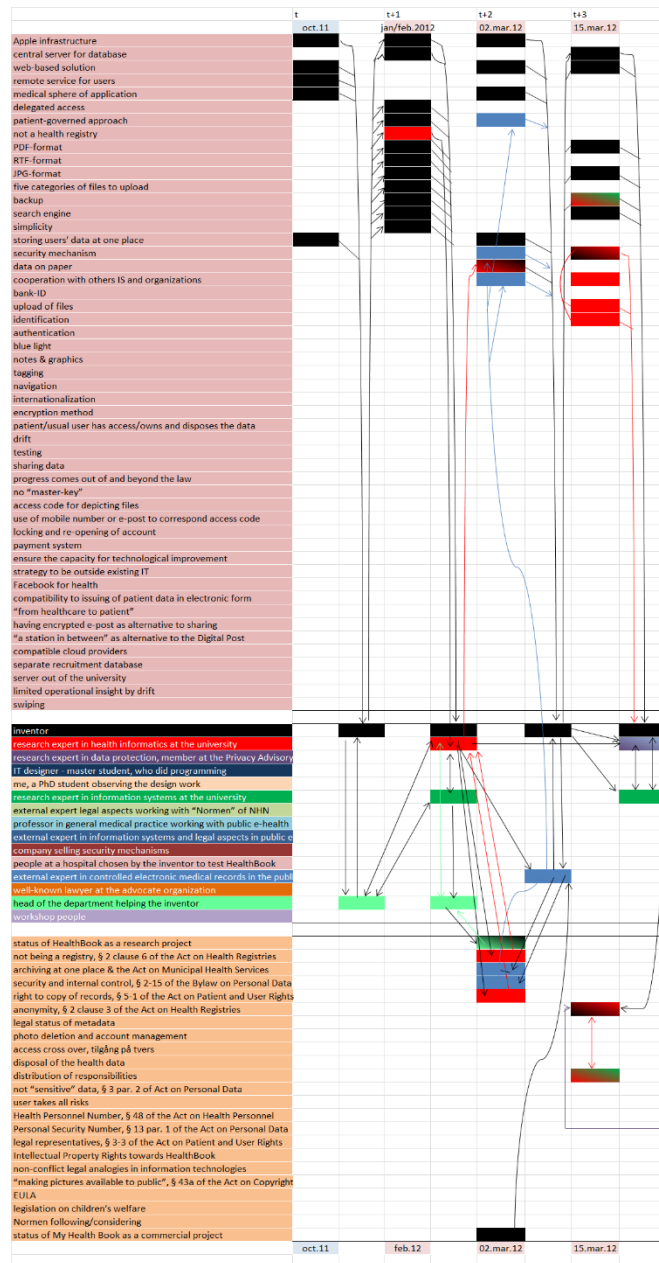
## **Dataset 2: National Core Journal**

- 451 elements of technology
- 77 social elements
- 346 elements of law









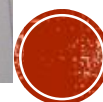
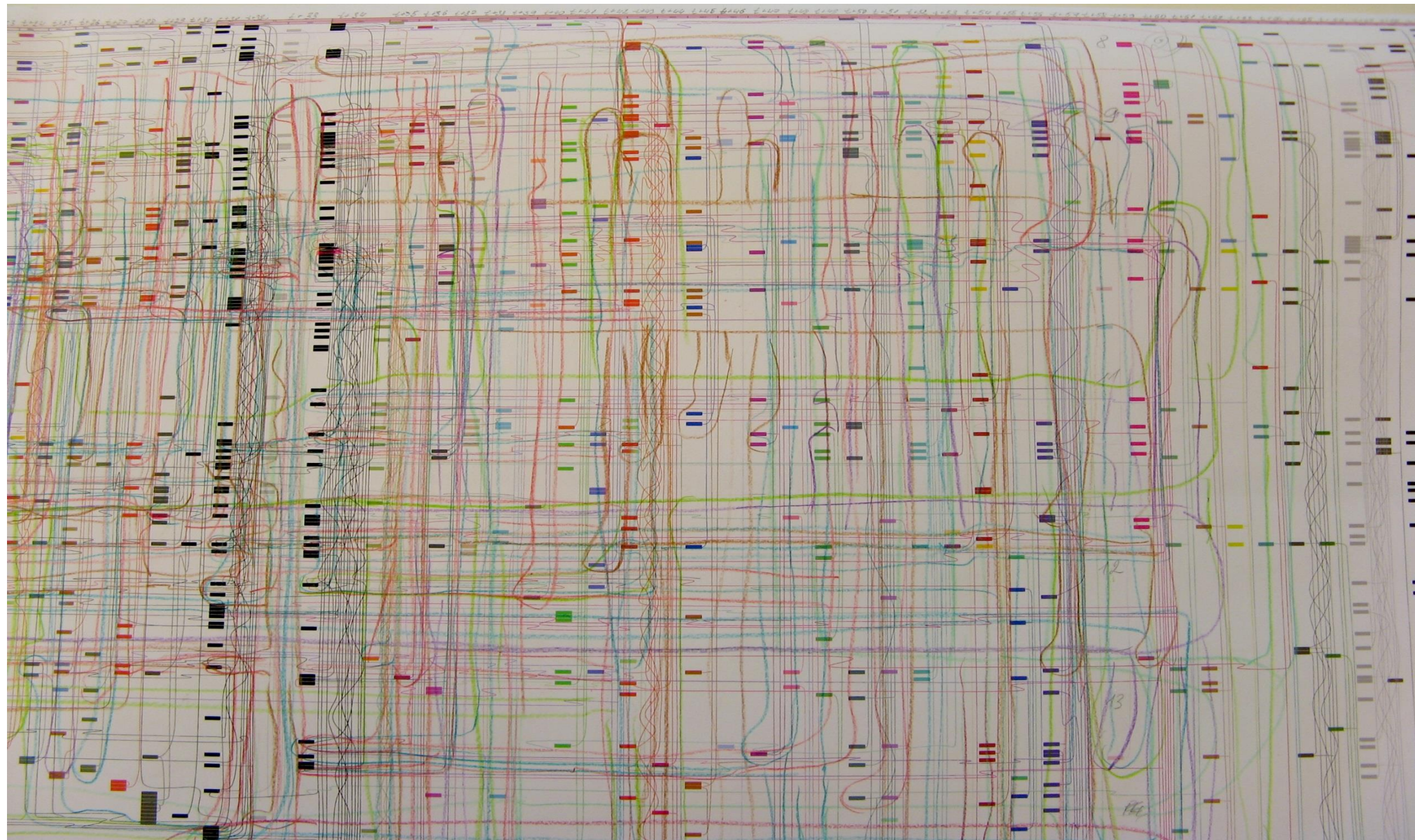
# RELATIONSHIPS AND THEIR CLUSTERS

The role of the relationships is emphasized

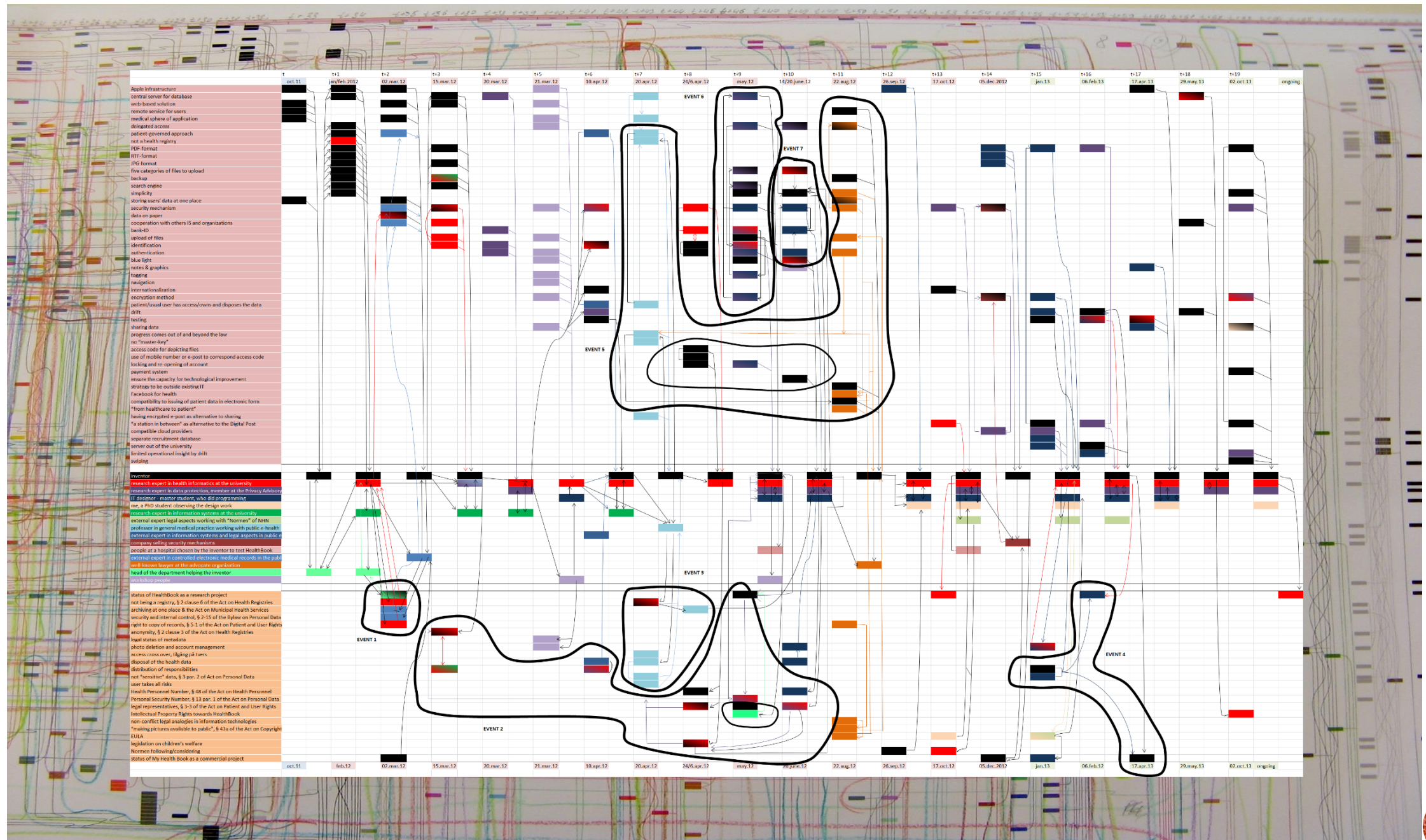
Information transfer and interactions of meanings are found in clusters with links, or relationships, of colors different from the colors of their elements











central infrastructure  
central server for database  
web-based solution  
remote service via cloud  
medical software application  
patient-generated approach  
distributed registry  
PDF-format  
BII-format  
BII format  
five categories for file to upload  
backup  
search engine  
identification  
storing users' data at one place  
security mechanism  
cooperation with others IS and organiza  
link-ID  
upload of files  
identification  
authentication  
blue light  
tagging  
tagging  
tagging  
internationalization  
code code for depicting file  
patient/facial user has access/entry and  
sharing data  
progress comes out of and beyond the l  
n "master-key"  
Access code for depicting file  
use of mobile number or e-post to corr  
locking and re-opening of account  
payment system  
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"From healthcare to patient"  
having encrypted e-post as alternative  
"a station in between" as alternative  
to portable cloud provides  
separate network database  
server out of the university  
informational liability by drugs  
helping

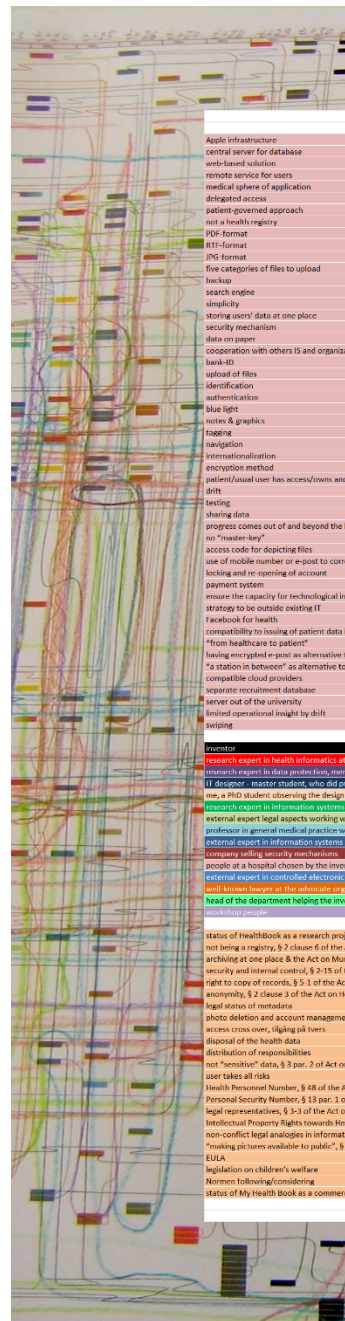
**external**  
**external expert in health informatics as**  
**research expert in data protection, infor**  
**IT defense master student who did p**  
**external expert in data protection, infor**  
**external expert in information systems**  
**external expert legal aspects working**  
**external in general medical practice in**  
**external in general medical practice in**  
**company setting security mechanisms**  
**people at a hospital chosen by the inve**  
**people at a hospital chosen by the inve**  
**people at a hospital chosen by the inve**  
**people at a hospital chosen by the inve**  
**head of the department holding the in**  
**healthspoke people**

status of healthbook as a research pro  
trent is a registry, § 2 clause 6 of the A  
archiving at one place & the Act on Mil  
to the data protection control, § 6-15 if I  
right to copy records, § 5-1 of the Act  
on privacy, § 2 clause 3 of the Act on I  
to the data protection control, § 6-15 if I  
photo deletion and account manage  
ance across other, linking up servers  
disposal of the health data  
distribution of responsibilities  
not "sensitive" data, § 3-2 of Act or  
user takes all risks

status of healthbook, § 18, 48 of the A  
Personal Security Norms, § 3-3 of the A  
or legal responsibilities, § 3-3 of the A  
of Intellectual Property Rights towards the  
disposal of medical data  
"making pictures available to public", § 1  
EOLGA

status on children's welfare  
Norms following/considering  
status of my Health Book as a common



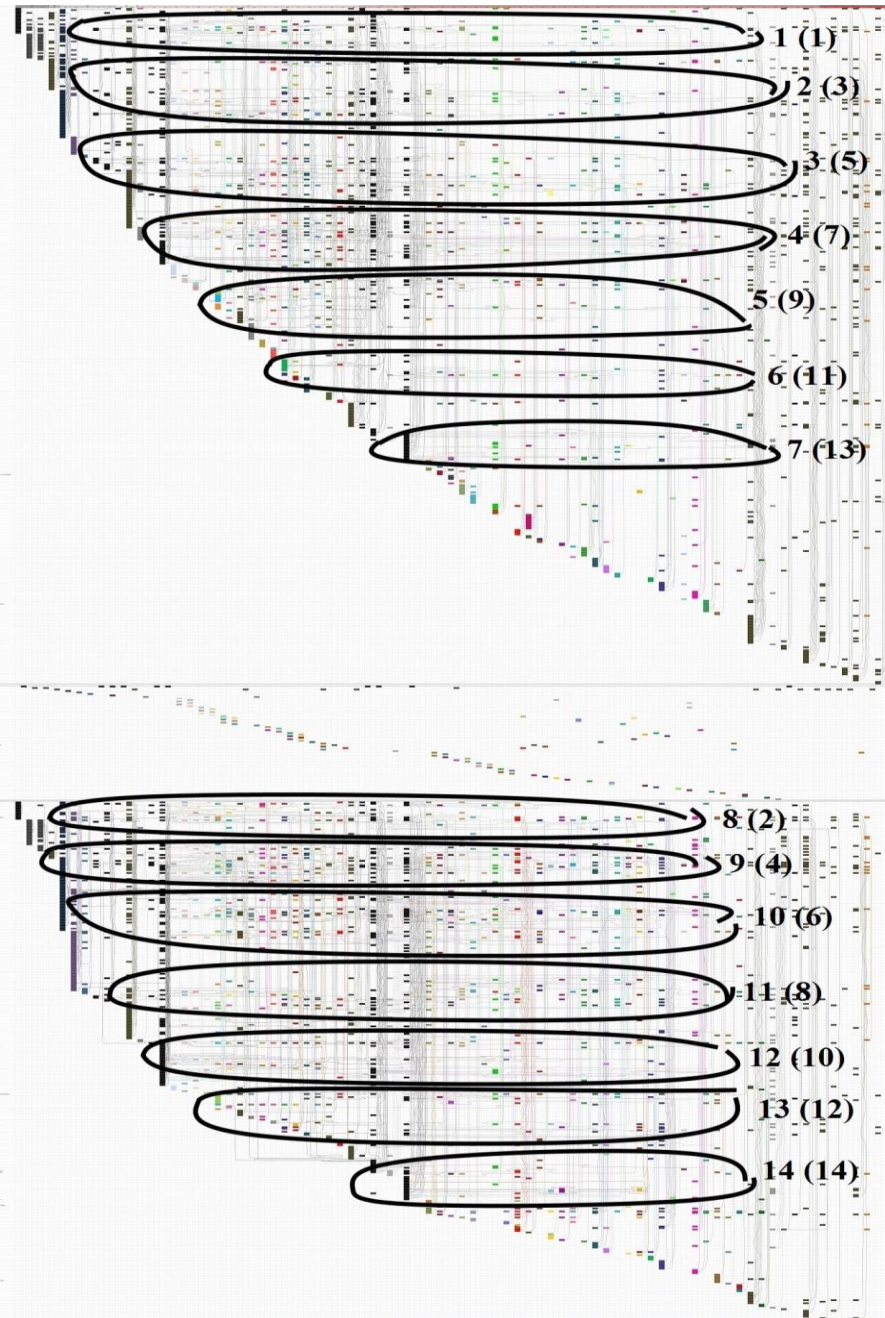


Apple infrastructure  
central server for database  
web-based solution  
remote service for users  
medical sphere of application  
delegated access  
patient-governed approach  
not a health registry  
PDF-format  
XML-format  
PNG-format  
five categories of files to upload  
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search engine  
simplicity  
storing users' data at one place  
security mechanism  
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bank-ID  
upload of files  
identification  
authentication  
blue light  
notes & graphics  
trauma  
navigation  
personalization  
encryption method  
patient/usual user has access/owns and  
drift  
feeding  
sharing data  
progress comes out of and beyond the  
no "master-key"  
access code for depicting files  
use of mobile number or e-post to con  
locking and re-opening of account  
payment system  
ensure the capacity for technological in  
strategy to be outside existing IT  
facebook for health  
compatibility to issuing of patient data  
"from healthcare to patient"  
having encrypted e-post as alternative  
"a station in between" as alternative to  
compatible cloud providers  
separate recruitment database  
server out of the university  
limited operational insight by drift  
helping

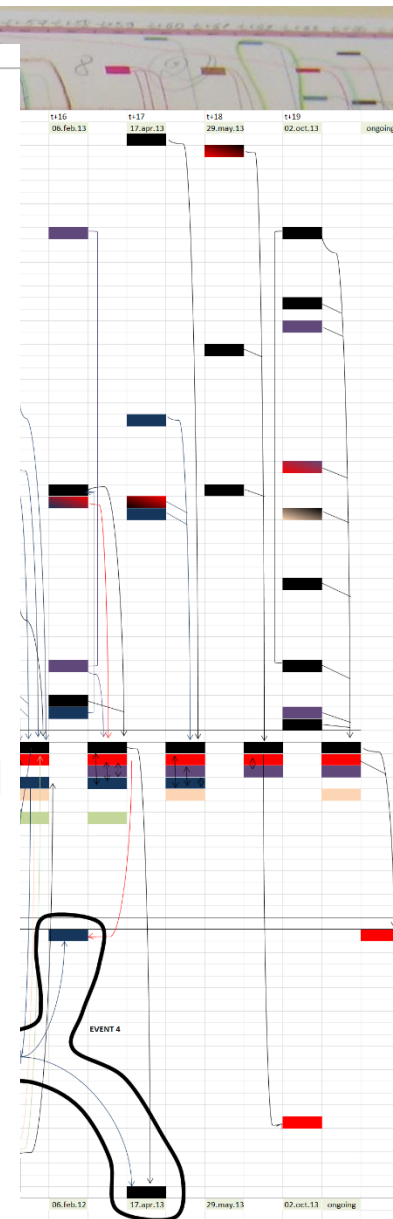
research expert in health informatics at  
research expert in data protection, sys  
IT designer - master student, who did  
research expert in information systems  
external expert legal aspects working as  
professor in general medical practice  
external expert in information systems  
generally selling security and hardware  
external expert in controlled electronic  
with a blue card (the blue card is a  
head of the department helping the in  
workshop people

Status of HealthBook as a research pro  
not being a registry, § 2 clause 6 of the  
archiving at one place & the Act on Mu  
security and internal control, § 2-15 of  
right to copy of records, § 5-1 of the Act  
anonymity, § 2 clause 3 of the Act on he  
legal status of metadata  
photo deletion and account manage  
access cross over, signing of users  
disposal of the health data  
distribution of responsibilities  
not "sensitive" data, § 3 par. 2 of Act on  
user takes all risks  
Health Personal Number, § 4B of the A  
Personal Security Number, § 13 par. 1 of  
legal representatives, § 3-3 of the Act on  
Intellectual Property Rights towards He  
non-conflict legal analogies in informati  
"making pictures available to public", § 8  
EULA  
legislation on children's welfare  
Normen following/considering  
status of My Health Book as a comment

Thus, in "event" 1  
internal control &  
t+3; responsibility  
t+6; Health Person  
status, t+9; Pers  
representatives, t  
accessibility, t+7;  
private purposes,  
of: responsibility  
t+15; research sta  
"event" 5 (blue),  
patient/user havin  
law, t+7; having  
t+11; delegated ac  
t+11; security me  
be outside existin  
issuing data in ele  
6 (grey) consists  
categories of files  
bank-ID, t+9; up  
function, t+9; tag  
categories of files  
t+10; authenticati



t+2;  
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t+9;  
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five  
c-ID,





Thus, in "event" 1  
internal control &

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bank-ID  
upload of files  
identification  
authentication  
blue light  
notes & graphics  
toe-gone  
navigation  
formal evaluation  
encryption method  
patient/usual user  
drift  
sharing data  
progress comes on  
no "master-key"  
access code for de-  
use of mobile num-  
locking and re-  
payment system  
ensure the speci-  
strategy to be out-  
facebook for treat-  
compatibility with  
"from healthcare  
having encrypted-  
a station in betw-  
compatible dual  
separate recruitment  
server out of the  
limited operations  
mapping

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research expert in  
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ne, a PhD student  
research expert in  
external expert in  
professor in gener-  
external expert in  
generally selling to  
people at a hospital  
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with a doctor  
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Status of health in-  
not being a register  
archiving at one p-  
security and inter-  
right to copy of re-  
anonymity, 2 cl-  
legal status of med-  
photo deletion an-  
access cross user  
disposal of the ho-  
distribution of res-  
not "simulated" de-  
user takes all risks  
Health Personal  
Personal Security  
legal representation  
factual/legal Proper  
non-conflict legal  
"making pictures"

legislation on children's welfare  
Normen following/considering  
status of My Health Book as a comment

categories of files  
t+10; authentication

automatic update t+15, access control system t+15, KUTRundschau t+15,  
abstracting center have a solution t+32, block some type of data, spread t+19,  
block the whole KJ t+32, block some type of data t+32, information to patient  
about technical side of KJ t+19, access to blocked health data if necessary t+19,  
big data type of data t+32, kind of data allowed for patient to fill in t+32,  
not a channel "from patient to health care" t+32, patient is considered to fill in t+32,  
integration of inf. systems t+22, codebook for critical information t+32,  
overviews over all groups use t+32, update data t+22, function of KJ to collect  
data t+24, eReceipt t+32, KJ as accessible from hp in lab, field and button t+24,  
pat. systems of hp t+24, service-oriented architecture t+32, architecture of KJ  
no services - a minor element t+22, automatic update t+32, integration of  
information systems t+22, architecture of KJ t+32, prof. Syst. of hp t+24,  
Service-oriented architecture t+32, block some type of data t+24, notific. to hp  
that some pat. data is blocked t+24, block some type of data t+32, service bus t+29,  
Centralization of information t+29, connection technology between local syst. and  
KJ t+29, no internet/web - a minor element t+29, format of the transferred  
data to KJ t+32, health personnel registry t+32, communication  
standards XML, PKI t+32, NPT t+32, no service bus - minor t+29,  
block the whole KJ t+29, block some type of data t+29, block some type  
of data t+32, block the whole KJ t+32, access to KJ anytime possible t+32,  
integration of inf. systems t+32, structured data and colors t+32, update data  
on changes in treatment routines t+64, block the whole KJ t+32, notific.  
that some patient data is blocked t+32, block some type of data t+32,

blocked data if necessary t+45, no receiver - a minor element t+53,  
of pas. data t+59, critical data cannot be blocked t+56, simply t+32,  
about consequences to report KJ shall be given to patients t+56,  
data in the local prof. systems shall be the same as in KJ t+56,  
to patient ab tech. side of KJ t+56, inf. about patient t+32, data on  
patients KJ t+32, blocking of transferring some sensitive data to KJ in not possible  
identification of user t+32, prof. Syst. of hp t+24, but technologic suggestion t+56,  
data in KJ t+32, integration of inf. systems t+32, double storage of  
data t+40, first implementation phase t+40, double storage of health data t+52,  
t+32, send of the real-time data t+32, manual fill in t+32, no manual fill in t+53,  
data registration and work routines for handling journals t+59,  
duty to report data to KJ t+53, interface t+59, EPs t+32,  
management measures at all t+53, structured data and colors t+60, automatic update  
t+60, log of time, identity  
automatic control over data that is transferred to KJ t+60, log of time, identity  
profession and rev. data t+56, correct document t+56, synchronization t+54,  
t+32, EPs t+32, infection data t+64, data on reservations t+32, notific.  
that some patient data is blocked t+59, notification to hp that some data  
blocked in KJ t+59, central reservation registry t+59,

t+2;  
nity,

-ID,

t+10 06.feb.13 t+17 17.apr.13 t+18 29.may.13 t+19 02.oct.13 ongoing

06.feb.13 17.apr.13 29.may.13 02.oct.13 ongoing





# INFORMATION VALUE

Mutual shaping between technologies and law as a process and complex system,  
where time matters just as relationships

Time-tagging relocation +  
keeping the importance of the diverse colors of the relationships



# INFO

t+2 – **red**: research status, being not a registry, archiving, internal control & security, right to insight

t+3 – **orange**: anonymity, responsibility distribution

t+6 – **orange**: disposal of health data, responsibility distribution

## Mutual

t+7 – **rose**: being not a registry, cross-accessibility, disposal of personal data, non-sensitivity of the personal data, user takes all the risks; **blue**: patient-oriented approach, being not a registry, user's ownership over own data, being beyond the law, no “master” key for drift and inf. syst.

t+8 – **orange**: Health Personnel Number, legal representatives, children welfare; **rose**: archiving

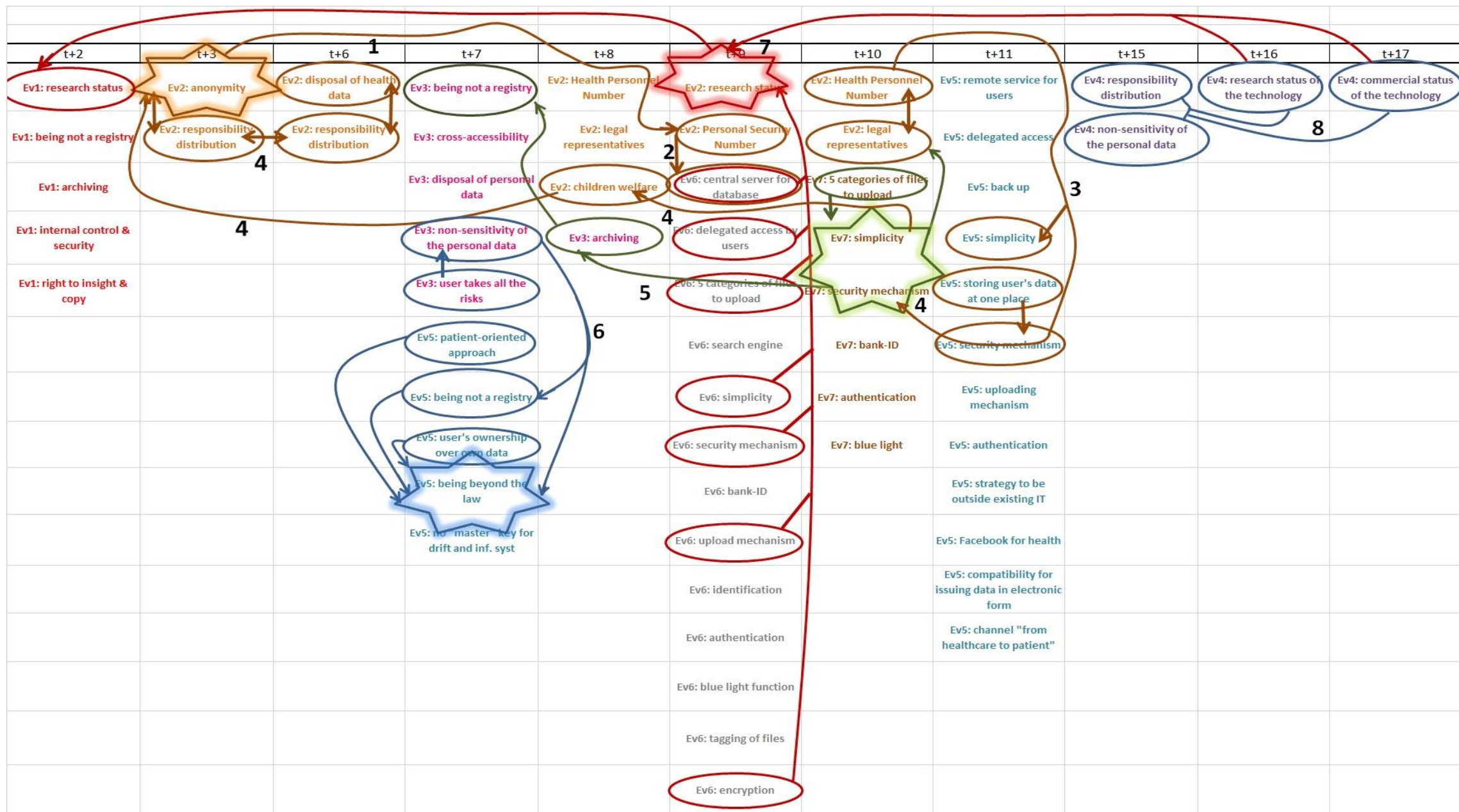
t+9 – **orange**: research status, Personal Security Number; **grey**: central server for database, delegated access by users, categories of files to upload, search engine, simplicity, security mechanism, bank-ID, upload mechanism, identification, authentication, blue light function, tagging of files, encryption

ex system,

ps

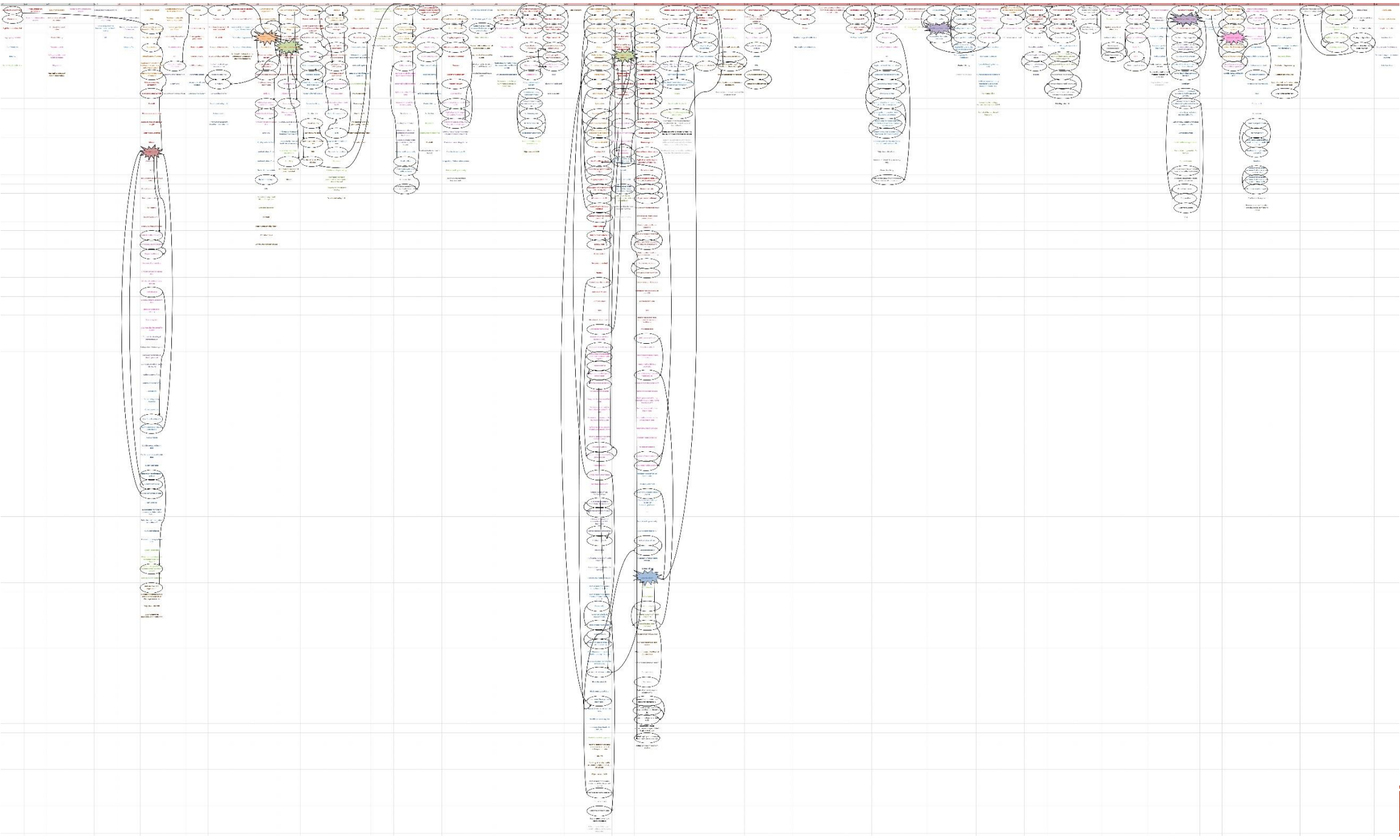


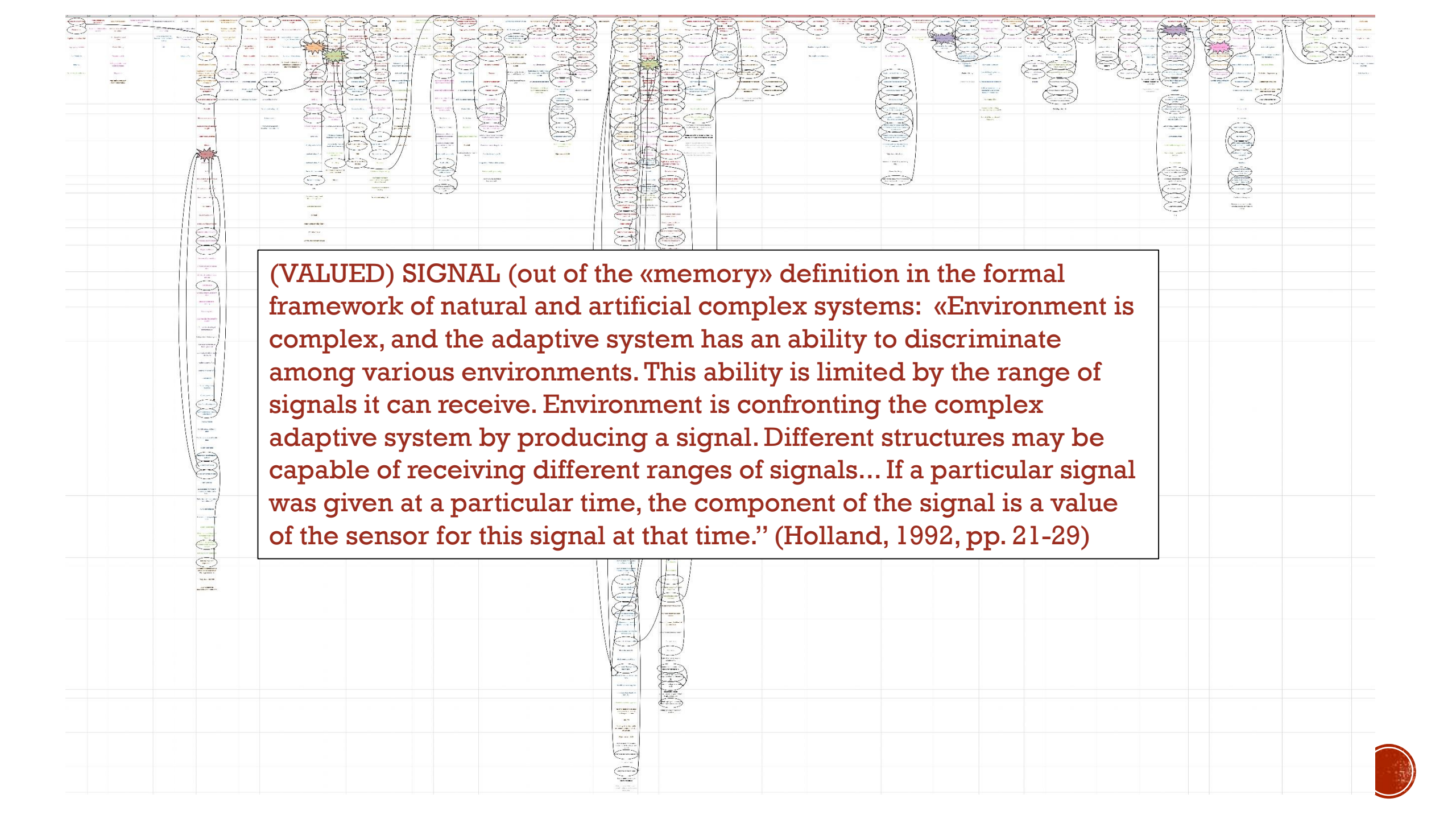






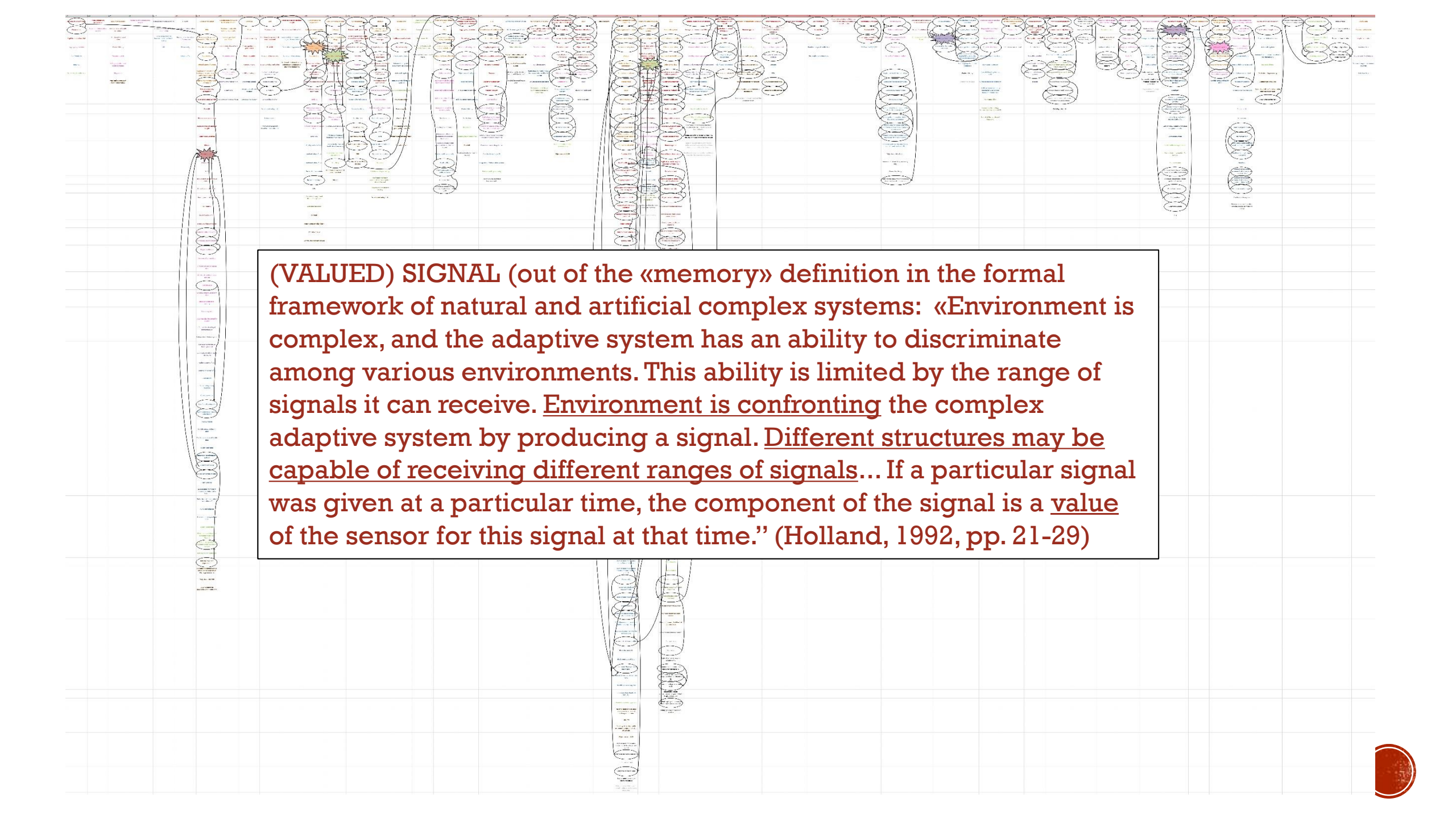






(VALUED) SIGNAL (out of the «memory» definition in the formal framework of natural and artificial complex systems: «Environment is complex, and the adaptive system has an ability to discriminate among various environments. This ability is limited by the range of signals it can receive. Environment is confronting the complex adaptive system by producing a signal. Different structures may be capable of receiving different ranges of signals... If a particular signal was given at a particular time, the component of the signal is a value of the sensor for this signal at that time.» (Holland, 1992, pp. 21-29)





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# CONNECTING LAW AND ICT

## Dataset 1: HealthBook

- “anonymity”
- “simplicity & security”
- “being beyond the law”
- “research status”

**Valued signals: 4**

**(!) Same pattern – different contents**

## Dataset 2: National Core Journal

- “patient consent” [t+13]
- “centralization of information” [t+18]
- “synchronization” [t+34]
- “control over data by patient” in [t+19], [t+33]
- “sensitivity of health data” [t+45], [t+56]
- “automatic update” [t+58].

**Valued signals: 8 – 2 = 6**



# SHAPING CHANNELS

- “...**attractors** that exist in the dynamics of the neural network can be interpreted as concepts, or classes, or **memories**, or more broadly ... the real neurons process this experiential information to yield mental experiences, including classification and **memory experiences**.” (Kauffman, 2010, p. 181)
- “...**autonomous agents do carry out work to construct the constraints**... that the energy is released along **specific channels**... couplings... to propagating **organization arise**...” ... “The web of ...activities flows down channels, whose **constraints are largely legal in nature**... as central to ...development and growth” (Kauffman, 2002, p. 229)
- “Design, guided by intent, shapes actions and generates a **learning process**, as the act of itself stimulates information processing that creates a **memory trace** and **influences future actions**.” (Sylves & Comfort, 2012, p. 78)



# CONNECTING SITUATIONS

«SHAPING CHANNEL»:

*‘from valued signal find legal attractor AND from valued signal find technological implication’*

HYPOTHESIS:

**Attractors in the national legal environment are shared amongst design works around different technologies.**



# PROCESSING THE HYPOTHESIS

## Dataset 1: HealthBook

- from “anonymity” found *“informed user”* AND from “anonymity” found “username”, “password” and “Health Personnel Number” for the mechanism of user creation and login
- from “simplicity & security” found *“responsibilities of the service provider”* AND from “simplicity & security” found “security framework” for a simple sharing mechanism
- from “being beyond the law” found *“data controller” & corresponding responsibilities* AND from “being beyond the law” found “lack of database” to “avoid being a health registry” by the technology
- from “research status” found balancing between “patient journal system”, “health registry” and a third, commercial version in *unclear legal status of journal systems* AND from “research status” found “server at the department” & “a service layer” & “programming language” for subsequent modifications

## Dataset 2: National Core Journal

- from “patient consent” found *“informed user”* AND from “patient consent” found “consent registration” for the health data “access” and “processing”
- from “centralization of information” found *“a registry-in-addition or journal-in-addition” (or uncertain legal status of patient journal)* AND from “centralization of information” found “smart card” or “a common system across organizations”
- from “synchronization” found *“data controller” & corresponding responsibilities* AND from “synchronization” found import/export of patient data between local journals, ePrescription, the Population Registry and the Health Personnel Registry
- from “sensitivity of health data” found *ownership of hardware in architecture to protect the “right to dispose of own health records” by patients* AND from “sensitivity of health data” found national security architecture with the Personal Health Archive as another separate case to consider
- from “control over data by patient” found *emerging patients’ rights to govern their own information elements in particular by the “right to access/view logging data”* AND from “control over data by patient” found “solution so that it does not identify the names [of respective health personnel] in a week” to encourage the balance of the autonomy of the patient and the healthcare personnel
- from “automatic update” found *responsibilities of health personnel for health data processing and duty to data transfer in NCJ* AND from “automatic update” found automatically delivered data on drugs and contact with specialists



# PROCESSING THE HYPOTHESIS

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  - from “synchronization” found *“data controller” & corresponding responsibilities* AND from “synchronization” found import/export of patient data between local journals, ePrescription, the Population Registry and the Health Personnel Registry
  - from “sensitivity of health data” found *ownership of hardware in architecture to protect the “right to dispose of own health records” by patients* AND from “sensitivity of health data” found national security architecture with the Personal Health Archive as another separate case to consider
  - from “control over data by patient” found *emerging patients’ rights to govern their own information elements in particular by the “right to access/view logging data”* AND from “control over data by patient” found “solution so that it does not identify the names [of respective health personnel] in a week” to encourage the balance of the autonomy of the patient and the healthcare personnel
  - from “automatic update” found *responsibilities of health personnel for health data processing and duty to data transfer in NCJ* AND from “automatic update” found automatically delivered data on drugs and contact with specialists





# PROCESSING THE HYPOTHESIS

## Dataset 1: HealthBook

- from “anonymity” found “*informed user*” AND from “anonymity” found “username”, “password” and “Health Personnel Number” for the mechanism of user creation and login
- from “simplicity & security” found “*responsibilities of the service provider*” AND from “simplicity & security” found “security framework” for a simple sharing mechanism
- from “being beyond the law” found “*data controller*” & “*corresponding responsibilities*” AND from “being beyond the law” found “lack of database” to “avoid being a health registry” by the technology
- from “research status” found balancing between “patient journal system”, “health registry” and a third, commercial version in *unclear legal status of journal systems* AND from “research status” found “server at the department” & “a service layer” & “programming language” for subsequent modifications

## Dataset 2: National Core Journal

- from “patient consent” found “*informed user*” AND from “patient consent” found “consent registration” for the health data “access” and “processing”
- from “centralization of information” found “*a registry-in-addition or journal-in-addition*” (or *uncertain legal status of patient journal*) AND from “centralization of information” found “smart card” or “a common system across organizations”
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 *May be Dataset 3, as the logic of the algorithm is recursive because of the hypothesis*
- from “control over data by patient” found *emerging patients’ rights to govern their own information elements in particular by the “right to access/view logging data”* AND from “control over data by patient” found “solution so that it does not identify the names [of respective health personnel] in a week” to encourage the balance of the autonomy of the patient and the healthcare personnel
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# PROVIDING THE ANSWER: ONTOLOGY

- Situations of designing ICT – **design works** – have their own **memories**
- Each **memory** accumulates information on ICT, law and expert knowledge from *in situ* and *ex situ*
- Information on ICT, law and expert knowledge is clustered in *relationships*
- Clusers contain *valued signals* each a legal **attractor** and a technological implication via a **shaping channel**
- Legal attractors may be *shared* by diverse design works, because of the authority of law and its imperfection; so, attractors are *forseeable*



# PROVIDING THE ANSWER: EPISTEMOLOGY

- i: DATASET COLLECTION (design work)
- ii: ELEMENT EXTRACTION (design work, memory)
- iii: RELATIONSHIP BUILDING (design work, memory)
- iv: EVENT EXTRACTION (memory)
- v: TIME-TAG ELEMENT RELOCATION (memory)
- vi: MICRO-NARRATIVE BUILDING (memory)
- vii: VALUED SIGNAL EXTRACTION (memory, shaping channel)
- viii: ATTRACTOR RECOGNITION (shaping channel, attractor)
- ix: HYPOTHESIS (attractor, design work)

All this is bottom-up from the narrative form of data, such as documents and interviews – by narrative parallelism

REPLICATION of all the rules for the bottom-up learning in conditionality



# PROVIDING THE ANSWER: PRACTICE

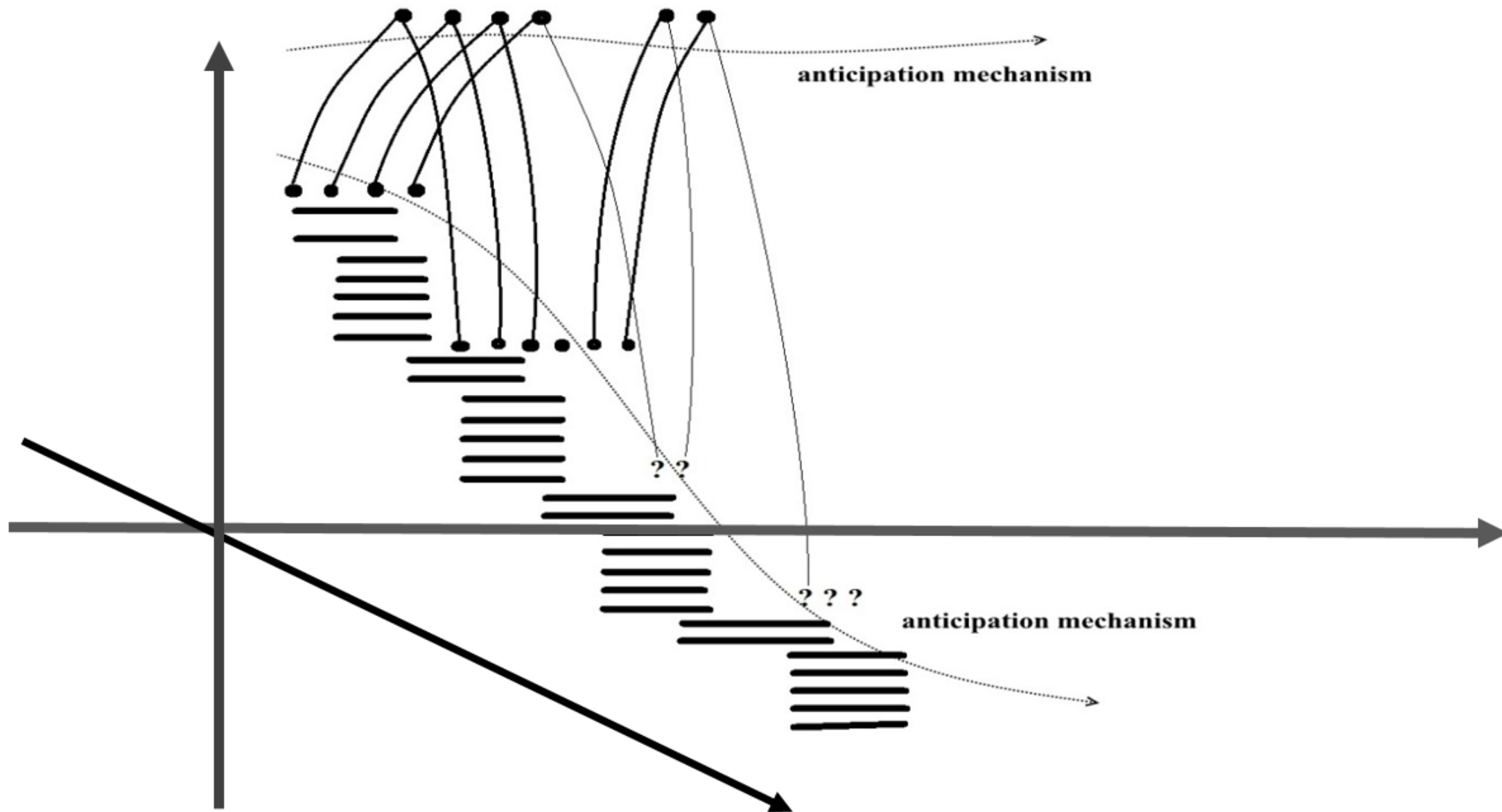
- Legal uncertainty is a possibility to influence legislation by bottom-up decision making
- There are information niches which influence design work processes
- Positioning among other ICTs does not demolish innovation potentials
- Not everything that seems, or popular to say, is what happening
- Evolution of legislation is tracable out of bottom-up decisions
- Some practices of ICT design are not yet mature enough to influence law



# LIMITATIONS AND FURTHER RESEARCH

- Only two datasets, considering the recursiveness of the approach
- Manual character of the approach (normal for language tech. though)
  - Highlighting the ontology of relationships/processes, not objects/definitions
  - Expanding the dataset context: more datasets or scaling up till EU or EEA
  - Deeper digging into why some valued signals were extracted twice
  - Exploration of order in attractors and «events»
  - Anticipation mechanisms of attractors and technological implications
  - Asymmetries and Physics of socio-technical artificial-natural complex systems



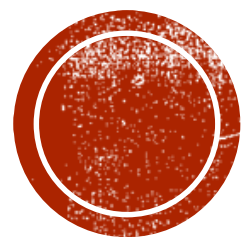


# APPLICATION OF RESULTS

The logic programmable into a IDSS for organizational support and contribution towards:

- Addressing problem-solving in misperception of organizational processes
- Addressing problem-solving in anticipation challenges for your design work
- Addressing problem-solving in organizational data management
- Addressing problem-solving in sticking to initial plans, getting pivoted
- Addressing problem-solving in finding abstract human values behind decisions
- «Diagnosing» legislation out of practical experiences





# QUESTIONS?

14 Nov 2016