Taking self-governance from data to model to design

Seth Frey
Communication, University of California, Davis

The Topos Institute Colloquium
2024 09 26

#2020751, #1917908, #2421385
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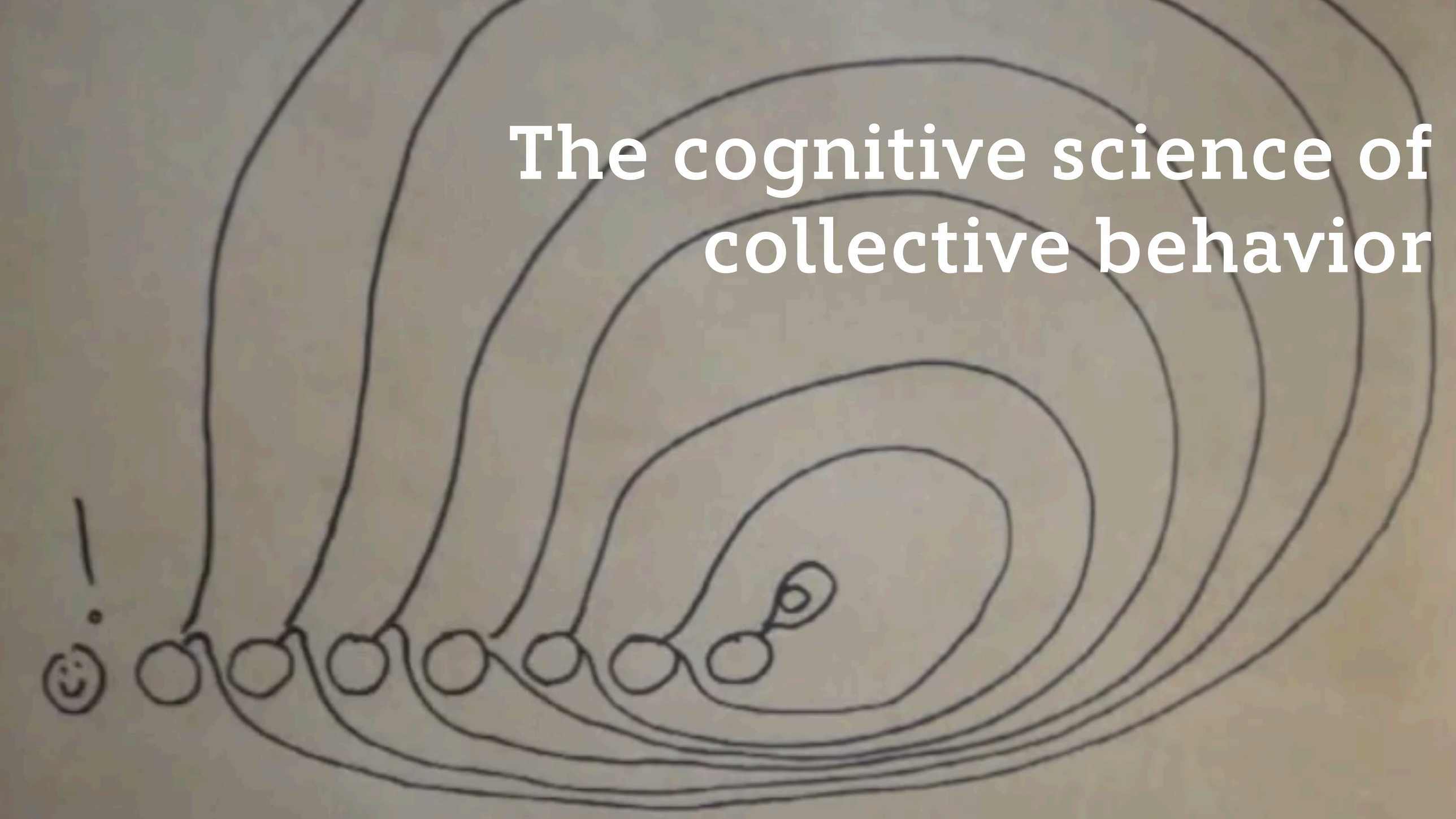


The cognitive science of collective behavior

The commons as a framework for collective behavior and intelligence

The internet as a lab for institution design

https://ried.studio/

Intentional community for social transformation

LEARN TO TIE YOUR SHOES

LEARN TO READ AND WRITE

LEARN TO

RUN A TEAM

HOLD SPACE

MANAGE TIME

PLAN AN EVENT

LEAD A MEETING

START A PROJECT

FULFILL YOUR DUTY

TO BUILD A COMMUNITY

Arc

- Empirics (data science)
- Simulation
- Design

Multiple methods for strong claims

Formal modeling

Simulation

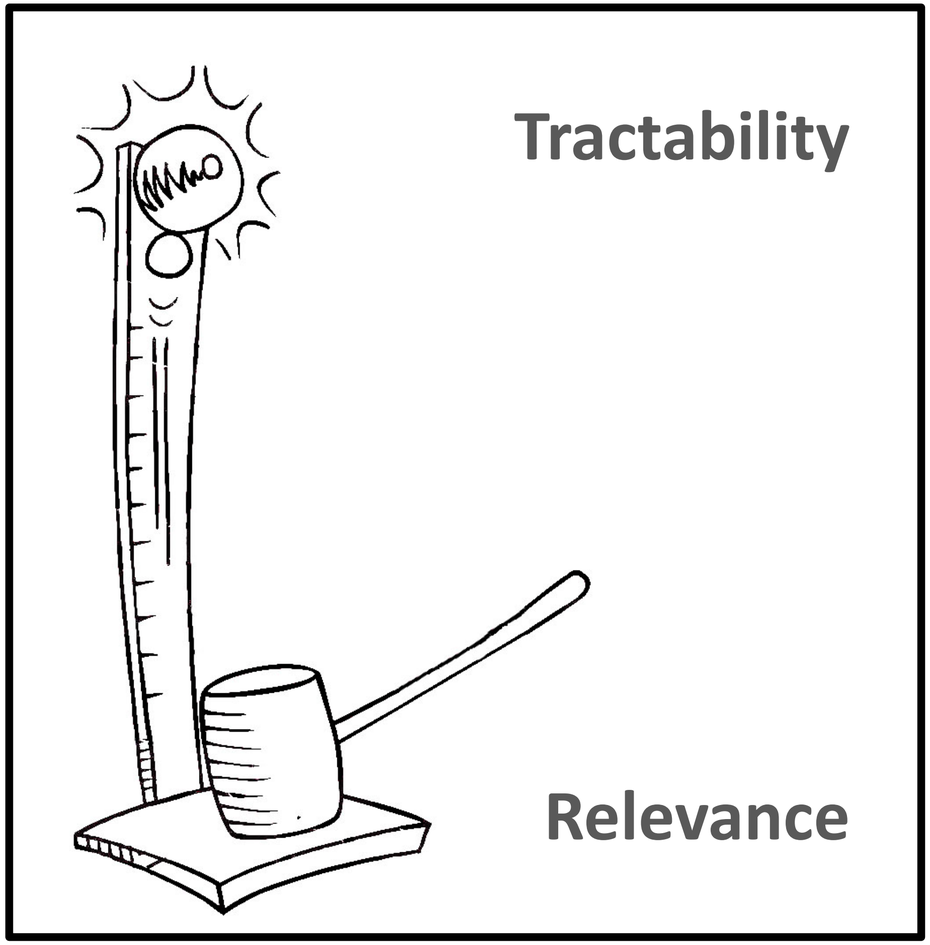
Cognitive modeling

Lab experiment

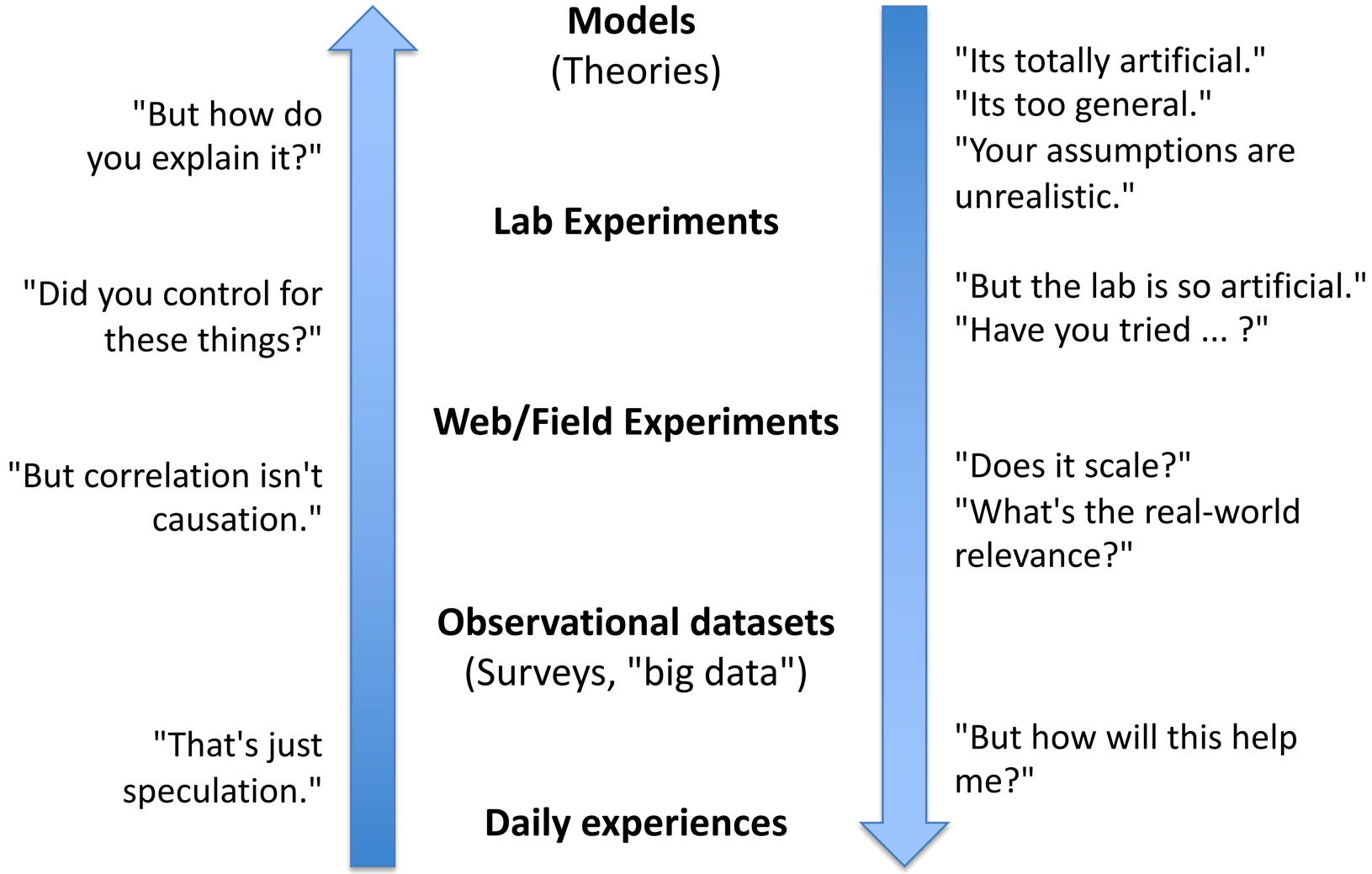
Field/Web experiment

Big data

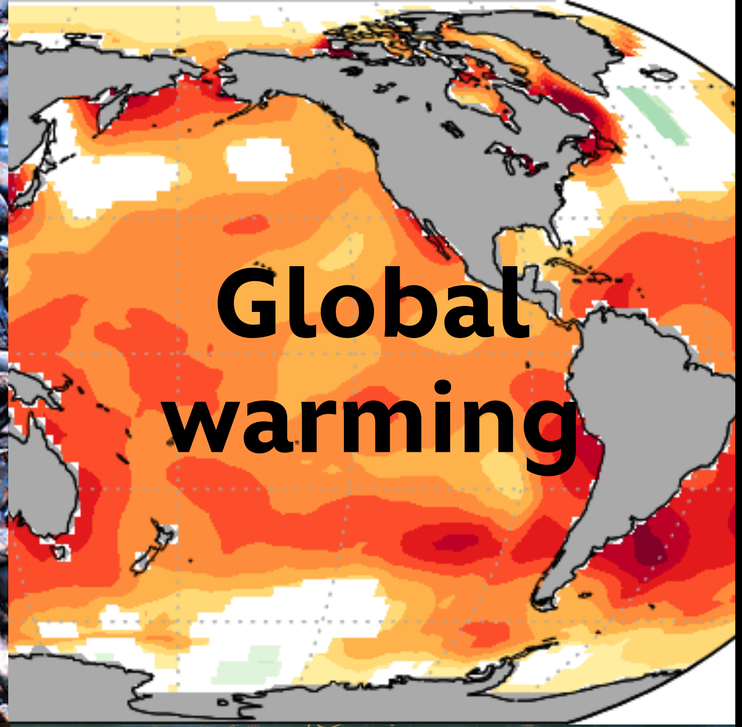
Daily experience



Multiple complementary methods



Overfishing

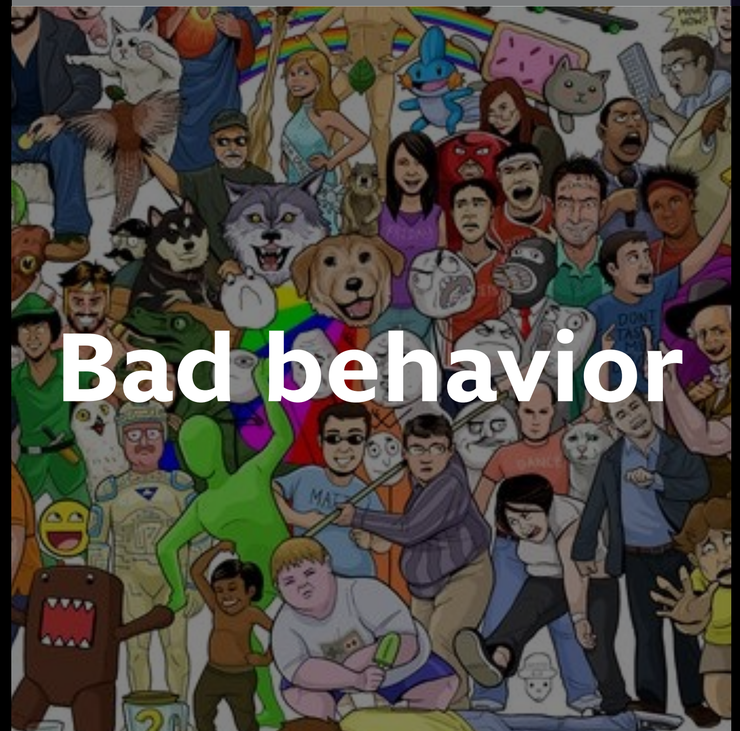

Global
warming

Antibiotic
resistance

Deforestation

Participatory media

Collective action



Bad behavior

Artificial intelligence abuses

Also
CPU/RAM
hacking
moderation
attention
network congestion

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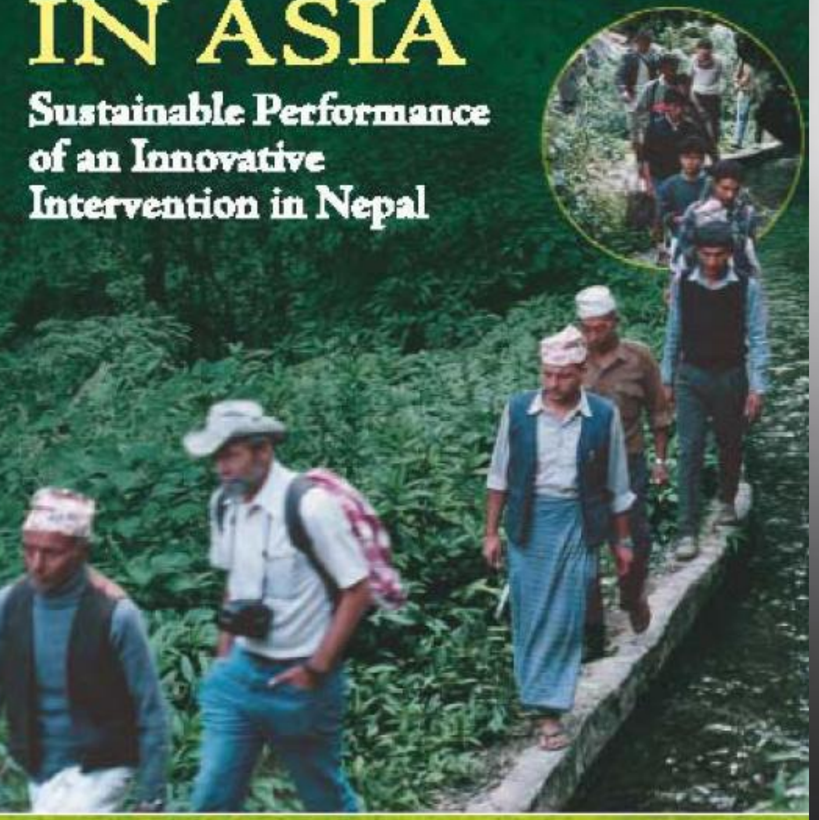
IMPROVING IRRIGATION IN ASIA

Sustainable Performance of an Innovative Intervention in Nepal



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People and Forests

Communities, Institutions, and Governance

Frey S, Sumner RW (2019) Emergence of integrated institutions in a large population of self-governing communities. PLoS ONE 14(7): e0216335. http://doi.org/c76k

WITH ONLINE COMMUNITIES COMPUTATIONAL SOCIAL SCIENTISTS CAN TEST GENERAL PRINCIPLES OF INSTITUTION DESIGN AND PERFORMANCE

The model organism

- *"Online behavior isn't real"*
- *"Lessons from online don't transfer"*
- *"Structure of online communities is specific to the Internet"*

The model organism

- *Drosophila melanogaster* for gene expression
- *Mus musculus* for medicine
- Online communities for institutional and organizational processes

The core unit

- Cell biologists study many cells.
- Psychologists study many individuals
- Why doesn't a social scientist primarily study many societies?

Why online communities?

(or other "engineered social systems")

- **"Societal" Unit of Analysis**
- "Real" "people"
- Simplified environment
- Multi-level data (Individual-, Social-, Pop-)
- General enough
- High Motivation
- Clear Goals
- Selection on Performance

General enough

The Wikipedias

r/TeensSupportTeens Rules

1. No NSFW Posts
2. Flair Yourself before Posting and Commenting
3. Remain Respectful of Others' Opinions
4. No Spamming
5. LGBT+ Safe Zone
6. No Suicide and Self-Harm Related Posts
7. No Repetitive Daily Posts
8. No Posting and Encouraging Drugs, Smoking, Alcohol, or Vaping

r/ModSupport Rules

1. No reporting rule violations or ban appeals

   Please send all rule violations and appeals to us via the appropriate report form. Posts or comments reporting these topics may be removed.

2. No calling out other users or subreddits

   Posts or comments calling out other users or subreddits may be removed. If you need to discuss something sensitive in nature about another user or community, please send a modmail to /r/ModSupport.

3. No insults or uncivil behavior

   Please keep posts and comments free of personal attacks, insults, or other uncivil behavior.

4. No off-topic posts

r/Showerthoughts Rules

1. All content must be original and unique.

   Submissions that match (or echo similar sentiments to) ideas offered by other people will be removed, regardless of whether or not those ideas have appeared on Reddit. Blatant reposting and plagiarism may result in a ban.»

2. All posts must be showerthoughts.

   Personal perspectives, crazy ideas, questions (rhetorical or otherwise) and meta submissions are not showerthoughts, and would be better suited to other subreddits. For an in-depth explanation of what a showerthought actually is (and is not), please read this page.

3. Your entire thought must be in the title.

   You may include examples, explanations, or further information in

MINECRAFT

WORLD OF WARCRAFT
Kegana
Taint of Madness>

WELCOME
CREATE ACCOUNT
JOIN COMMUNITY
ARMORY
GAME DATABASE

Welcome

Become a part of the old Vanilla world. Set up your client according to our guide.

If you have any questions, read the FAQ first. In case you don't find the answer, you can try asking on our IRC.

Most our services are to be found on the web page of the TwinStar project, under which Kronos belongs.

https://www.kronos-wow.com/

HTTP Server

A

Accumulo
ActiveMQ
Airavata
Airflow
Allura
Ambari
Ant
Any23
APISIX
Archiva
Aries
Arrow
AsterixD
Atlas
Attic
Avro
Axis

Bahir
Beam
Bigtop
Bloodhc
BookKe
Brooklyr
Buildr
BVal

C

Calcite
Camel
CarbonData
Cassandra
Cayenne
Celix
Chemistry
Commons
Community
Development
Cordova
CouchDB
Creadur
cTAKES
Curator
CXF

D

Daffodil
DataFu
DataSketches
pike
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inScheduler
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ubbo

E

ECharts
Empire-d

F

Felix
Fineract
Flex
Flink
Flume
Fluo
FreeMarker

G

Geode
Geronimo
Giraph
Gobblin
Gump

H

Hadoop
HAWQ
HBase
Helix
Hive
HttpComponents
Hudi

I

Iceberg
Ignite
Impala
Incubator
IoTDB
Isis

J

Jackrabbit
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Joshua
JSPWiki
jUDDI
Juneau

K

Kafka
Karaf
Kibble
Knox
Kudu
Kylin

L

Libcloud

M

MADlib
Mahout
ManifoldCF
Maven
Mesos
MetaModel
MINA
Mnemonic
MyFaces
Mynewt

N

NetBeans
NiFi
Nutch

O

OFBiz
Olingo
OpenJPA
OpenMeetings
OpenOffice
OpenWebBeans
OpenWhisk
Ozone

P

Parquet
PDFBox
Perl
Petri
Phoenix
Pig
Pivot
Portals
Pulsar

Q

Qpid

R

Ranger
Ratis
REEF
River
RocketMQ
Roller
Royale
Rya

S

Samza
Santuario
Serf
ServiceComb
Sphere
SkyWalking
Solr
SpamAssassin
Spark
Sqoop
Steve
Storm
Streams
Struts
Submarine
Subversion
Superset

T

Tapestry
Tcl
Tez
Thrift
Tika
TinkerPop
Tomcat
TomEE
Traffic Control
Traffic Server
Trafodion
Turbine
TVM

U

UIMA
Unomi
Usergrid

V

VCL
Velocity

W

Web Services
Whimsy
Wicket

X

Xalan
Xerces
XML Graphics

Y

Yetus

Z

Zeppelin
ZooKeeper

THE APACHE SOFTWARE FOUNDATION ESTABLISHED 1999

Yin, L., Chakraborti, M., Schweik, C., Frey, S. Filkov, V. (2022), Open Source Software Sustainability: Combining Institutional Analysis and Socio-Technical Networks, ACM CSCW https://arxiv.org/abs/2203.03144

Product Solutions Resources Open Source Enterprise Pricing

matplotlib / governance Public

Notifications

Code Issues 2 Pull requests 4 Actions Projects Wiki Security

Files

main

Go to file

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README

conf.py

deput

funding.md

governance.md

index.rst

people.md

governance / governance.md

tacaswell GOV: add sponsorship acknowledgment ... 190

Preview Code Blame 395 lines (311 loc) · 20 KB

Main Governance Document

The official version of this document, along with a list of in
institutions in the roles defined in the governance section b
The Project Governance Repository at:

https://github.com/matplotlib/governance

The Project

The Matplotlib Project (The Project) is an open source soft

Yan, Y., Frey, S., Zhang A., Filkov, V., Yin, L. (2023) GitHub OSS Governance File Dataset MSR2023 Data & Tool Showcase MSR23data-98 https://doi.org/kvm4

What do all these have in common?

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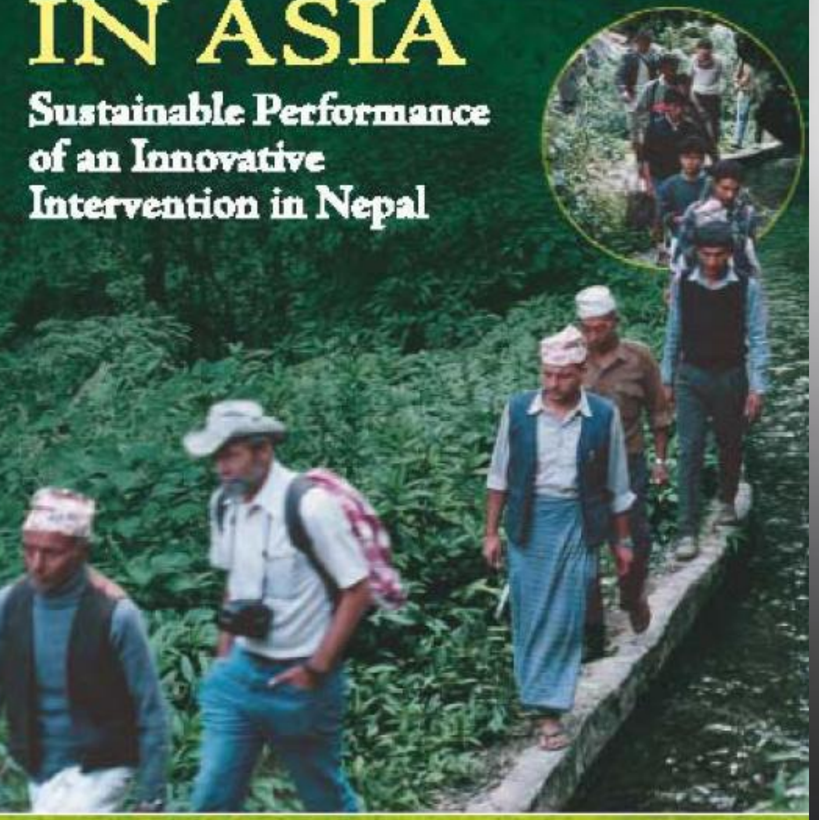

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People and Forests

Communities, Institutions, and Governance

Projects

- What governance systems do communities design for themselves and what works *with Bob Sumner*
- Is governance change due to selection or drift? *with Qiankun Zhong and Martin Hilbert*
- "Do we run how we say we run" *with Mahasweta Chakraborti*
- What are the varieties of polycentricity? *with Shagun Jhaver and Amy Zhang*
- Institutional preferences *with Ofer, Nori, Dalton, and Qiankun Zhong*
- The psychological mechanisms of the tragedy of the commons *with Christopher Frantz*
- Composing games into complex institutions *with Hedges, Tan, Zahn*
- NLP4GOV *with Mahasweta Chakraborti*

Projects

Minecraft — What governance systems do communities design for themselves and what works *with Bob Sumner*

Minecraft — Is governance change due to selection or drift? *with Qiankun Zhong and Martin Hilbert*

Apache Software Foundation — "Do we run how we say we run" *with Mahasweta Chakraborti*

12 platforms — What are the varieties of polycentricity? *with Shagun Jhaver and Amy Zhang*

Model and experiments — Institutional preferences *with Ofer, Nori, Dalton, and Qiankun Zhong*

ABM — The psychological mechanisms of the tragedy of the commons *with Christopher Frantz*

Formal framework — Composing games into complex institutions *with Hedges, Tan, Zahn*

Toolkit — NLP4GOV *with Mahasweta Chakraborti*

Each a different framework

Projects

Minecraft — **What governance systems do communities design for themselves and what works** *with Bob Sumner*

Minecraft — Is governance change due to selection or drift? *with Qiankun Zhong and Martin Hilbert*

Apache Software Foundation — "Do we run how we say we run" *with Mahasweta Chakraborti*

12 platforms — What are the varieties of polycentricity? *with Shagun Jhaver and Amy Zhang*

Model and experiments — **Institutional preferences** *with Ofer, Nori, Dalton, and Qiankun Zhong*

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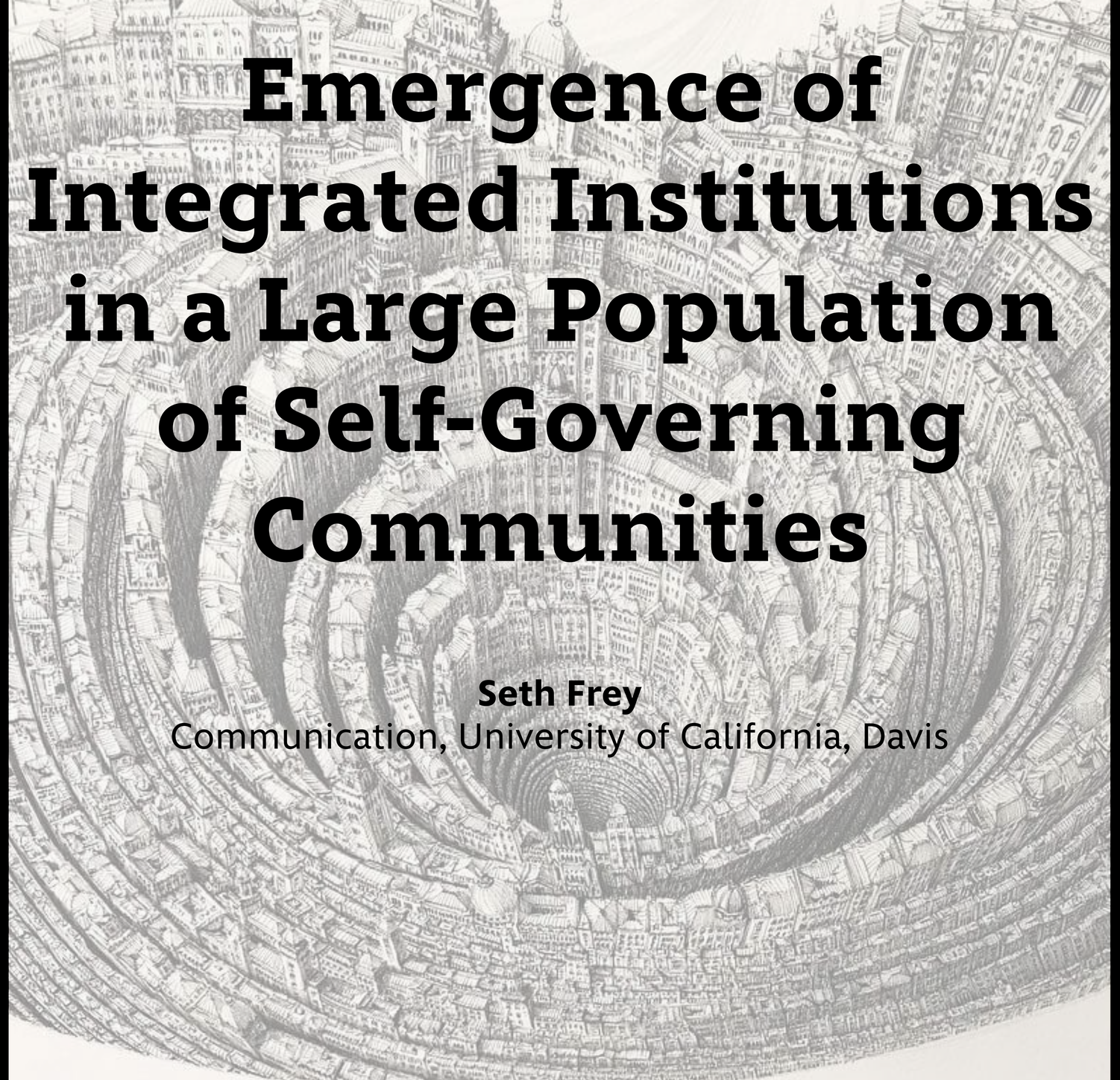

Emergence of Integrated Institutions in a Large Population of Self-Governing Communities

Seth Frey
Communication, University of California, Davis

Frey S, Sumner RW (2019) Emergence of integrated institutions in a large population of self-governing communities. PLoS ONE 14(7): e0216335. http://doi.org/c76k

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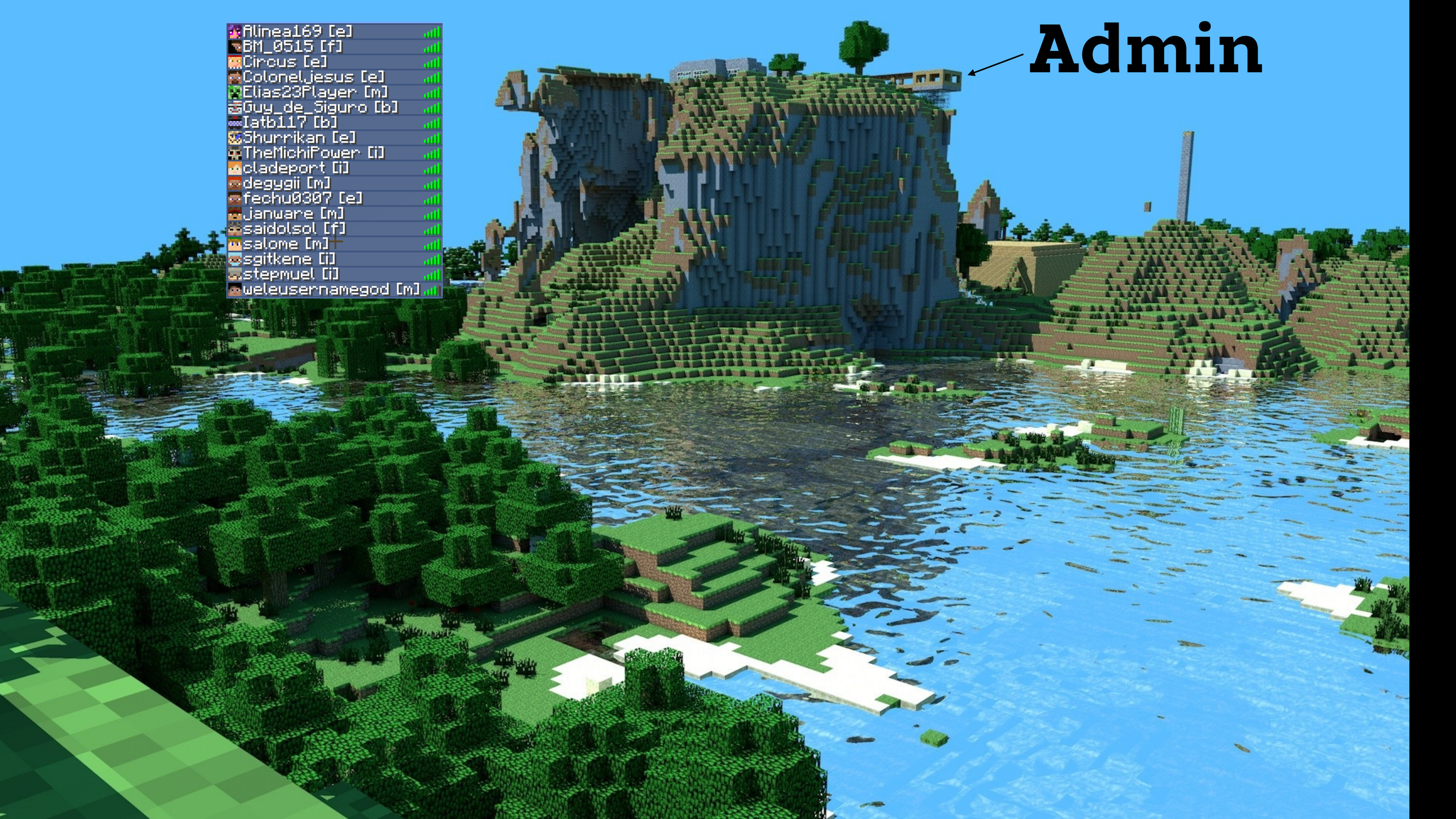
MINECRAFT

NCC-1701-D
1701-D
ENTERPRISE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BM_0515 [f]
Circus [e]
Colonel_jesus [e]
Elias23Player [m]
Guy_de_Siguro [b]
Iatb117 [b]
Shurrikan [e]
TheMichiPower [i]
cladeport [i]
degygii [m]
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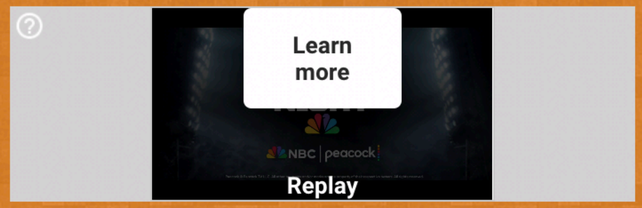
Admin



Want a better Minecraft server?
Read about SpigotMC here!

World Management

CATEGORIES

Bungee - Spigot	7,196
Bungee - Proxy	2,747
Spigot	65,886
Chat	5,561
Tools and Utilities	16,985
Misc	3,737
Fun	8,547
World Management	**1,701**
Mechanics	4,650
Economy	1,473
Game Mode	1,336
Skript	9,756
Libraries / APIs	1,403
No Rating	0
Standalone	115
Universal	462
Web	534

Sort By: Last Update

✨ FeatherRegen ✨ – Regenerating Custom Blocks (Hypixel inspired) 1.0
Xiztence, Today at 12:35 PM
Create your own Re-Generating Custom Blocks (Hypixel Inspired) \\ Easy to config! \\ FREE
0 ratings
Downloads: 7
Updated: Today at 12:35 PM

PerWorldPlugins 1.5.9
Tonimatas, Sep 12, 2021
PerWorldPlugins allows plugins to be set to hook onto certain worlds using the config.
49 ratings
Downloads: 22,637
Updated: Yesterday at 7:48 PM

[1.21.1] No Netherite [NoRight] 1.0
RosieX, Yesterday at 6:15 PM
Completely disable anything Netherite related from being used / crafted
0 ratings
Downloads: 11
Updated: Yesterday at 6:15 PM

Jmystics 0.0.1
jujjka, Jul 21, 2024
Create and manage mystical chests
0 ratings
Downloads: 328
Updated: Yesterday at 5:41 PM

AOMultiverse | MySQL | H2 | VOID & DEFAULT GEN 2.3
1 rating

A few Minecraft governance plugins

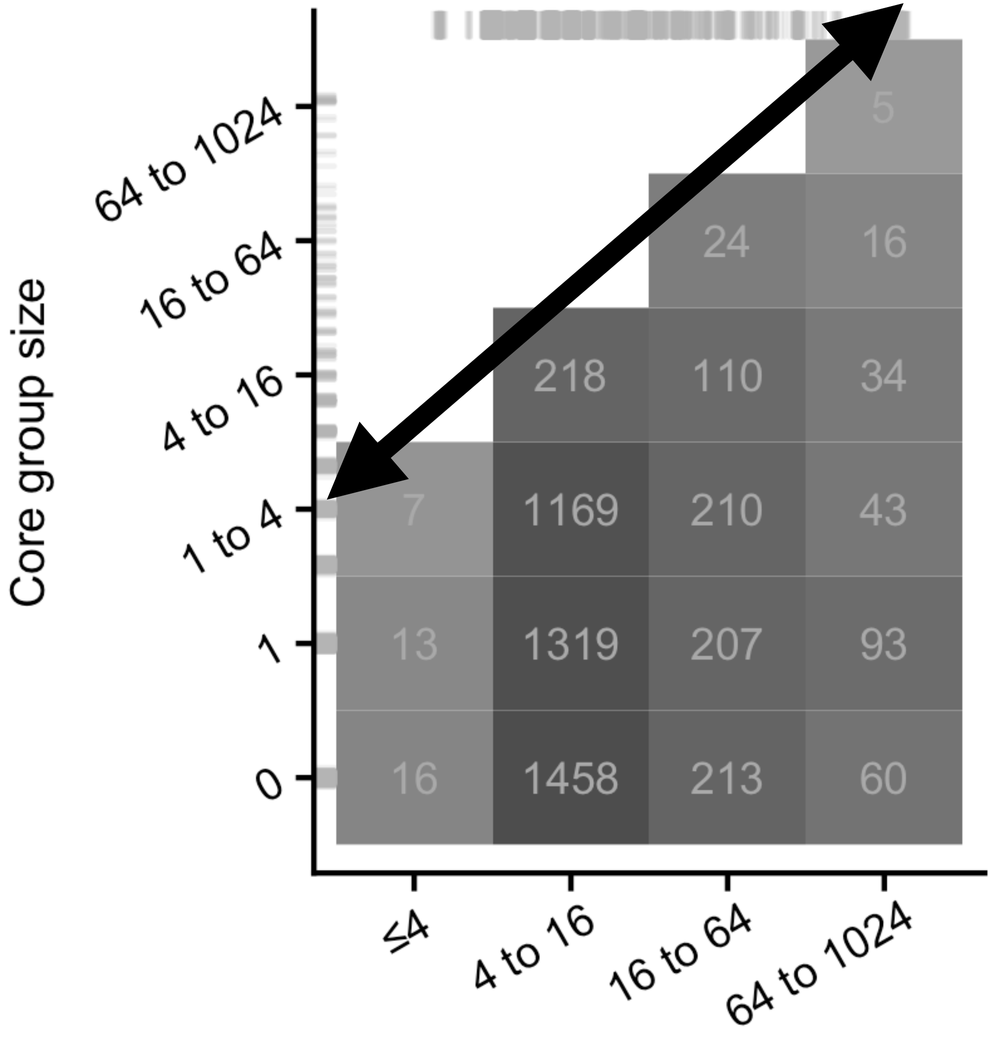
- **Communication**
  - Vault, Dynmap, Skype, AutoMessage, SimpleBroadcast
- **Enforcement**
  - Bounties, autobans
- **Monitoring**
  - LogBlock, LWC
- **Private property creation**
  - Lockette, Townies, ProtectionStones
- **Common property creation**
  - Whitelists, factions
- **Public goods provisioning**
  - BuyCraft, Enjin, GAListener, EchoPet
- **Grief prevention**
  - WorldGuard, PermissionsEx, LWC, GriefPrevention
- **Grief remediation**
  - WorldEdit, CoreProtect
- **Entropy management**
  - Essentials, Server.properties, WorldBorder
- **Hierarchy**
  - GroupManager, Nations
- **Economies**
  - iConomy, ChestShop, SignShop, GUIShop

Results

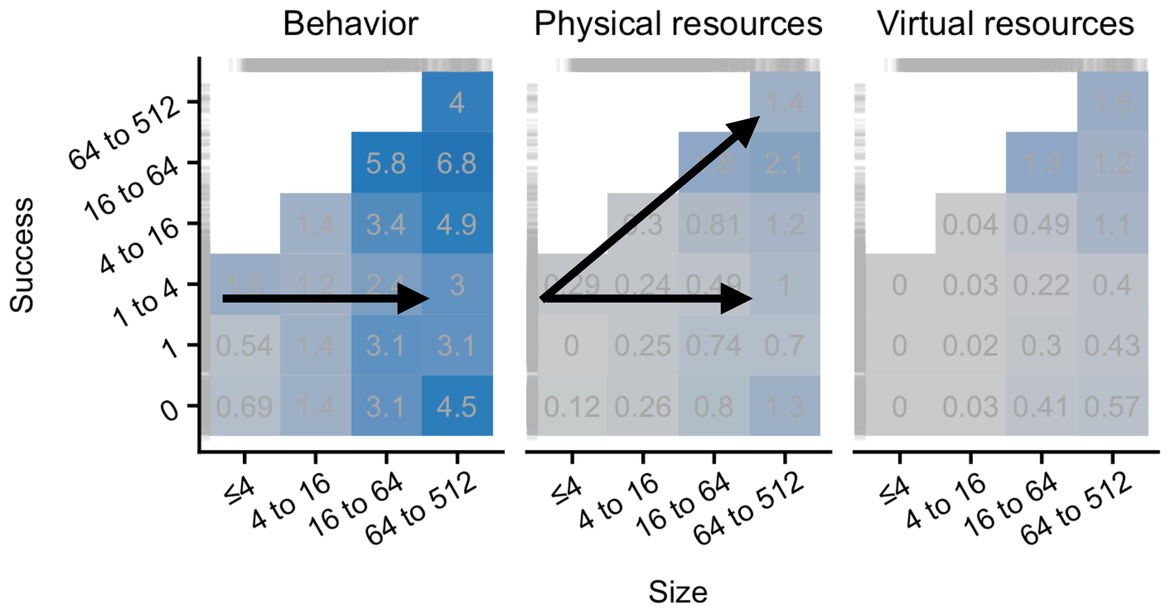
- Scanned the Internet for two years
  - ~hourly
  - found 300,000 servers
    - visited 50,000,000 times
    - by 10,000,000 players

Frey S, Sumner RW (2019) Emergence of integrated institutions in a large population of self-governing communities. PLoS ONE 14(7): e0216335. http://doi.org/c76k

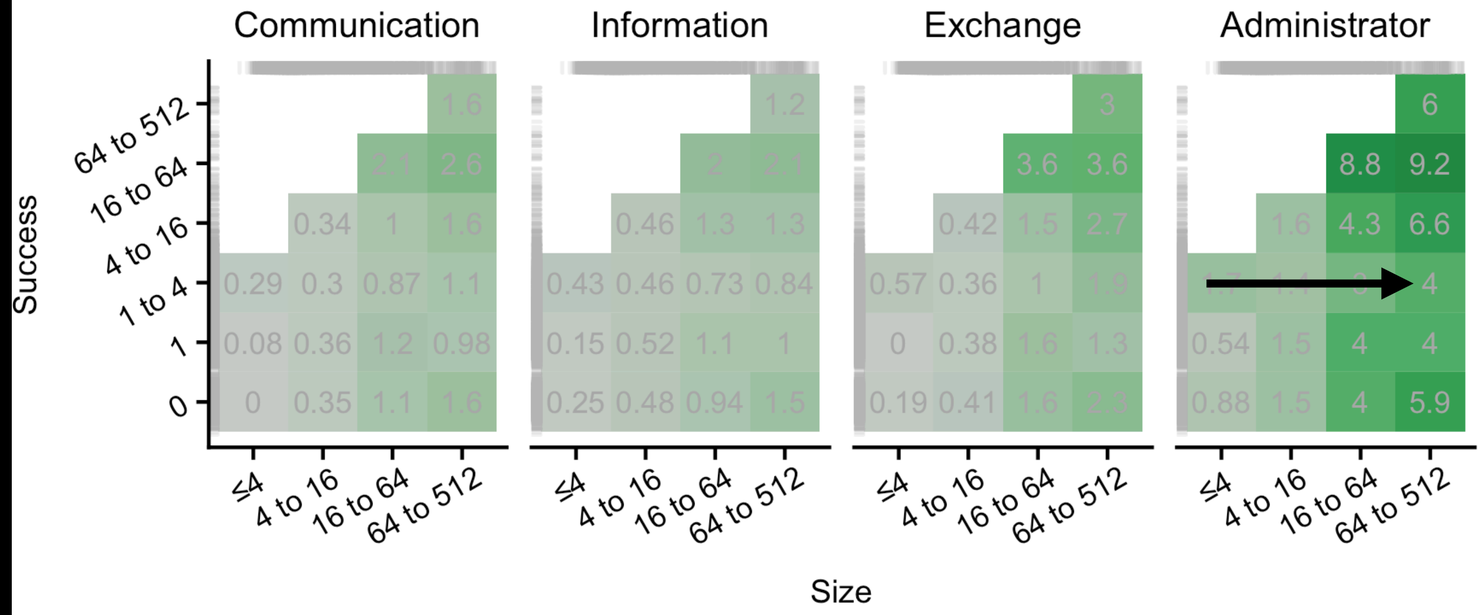
Most communities are small or unsuccessful



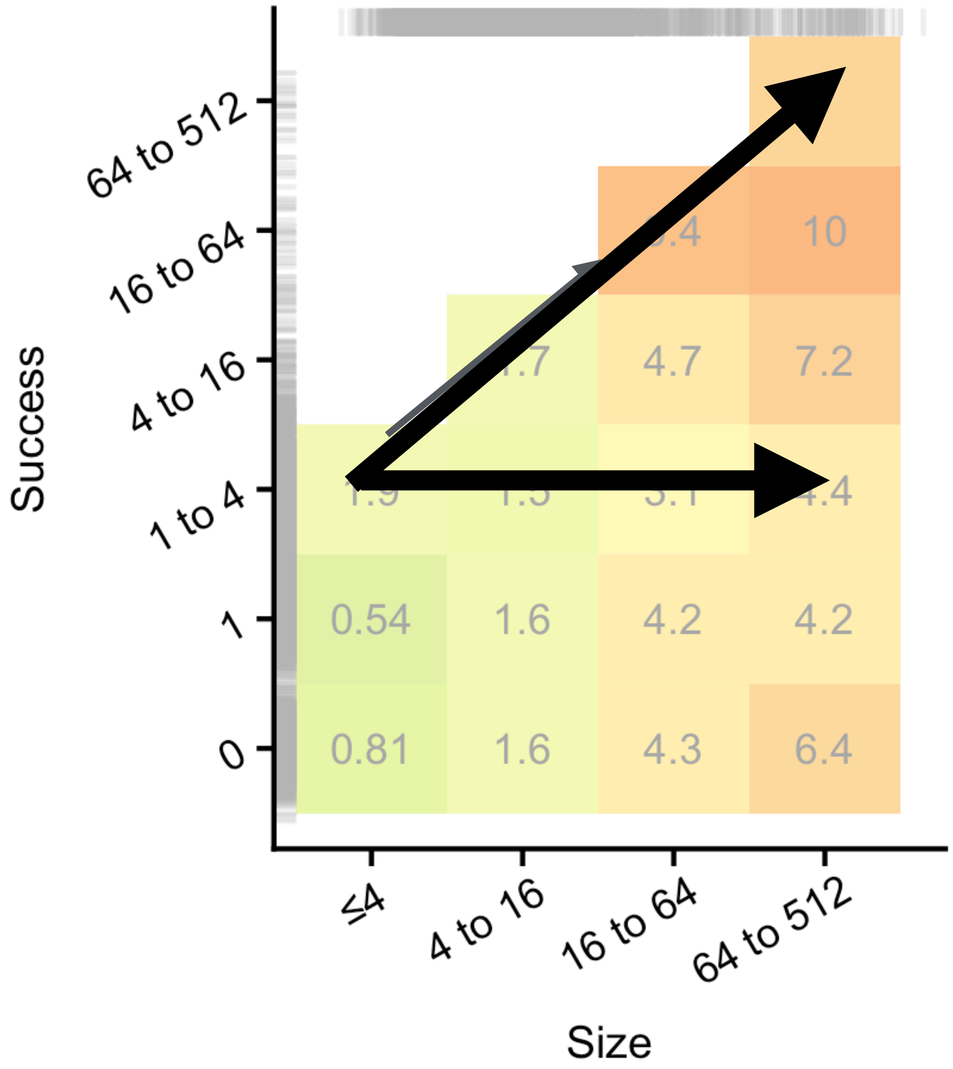
Problem type



Solution type

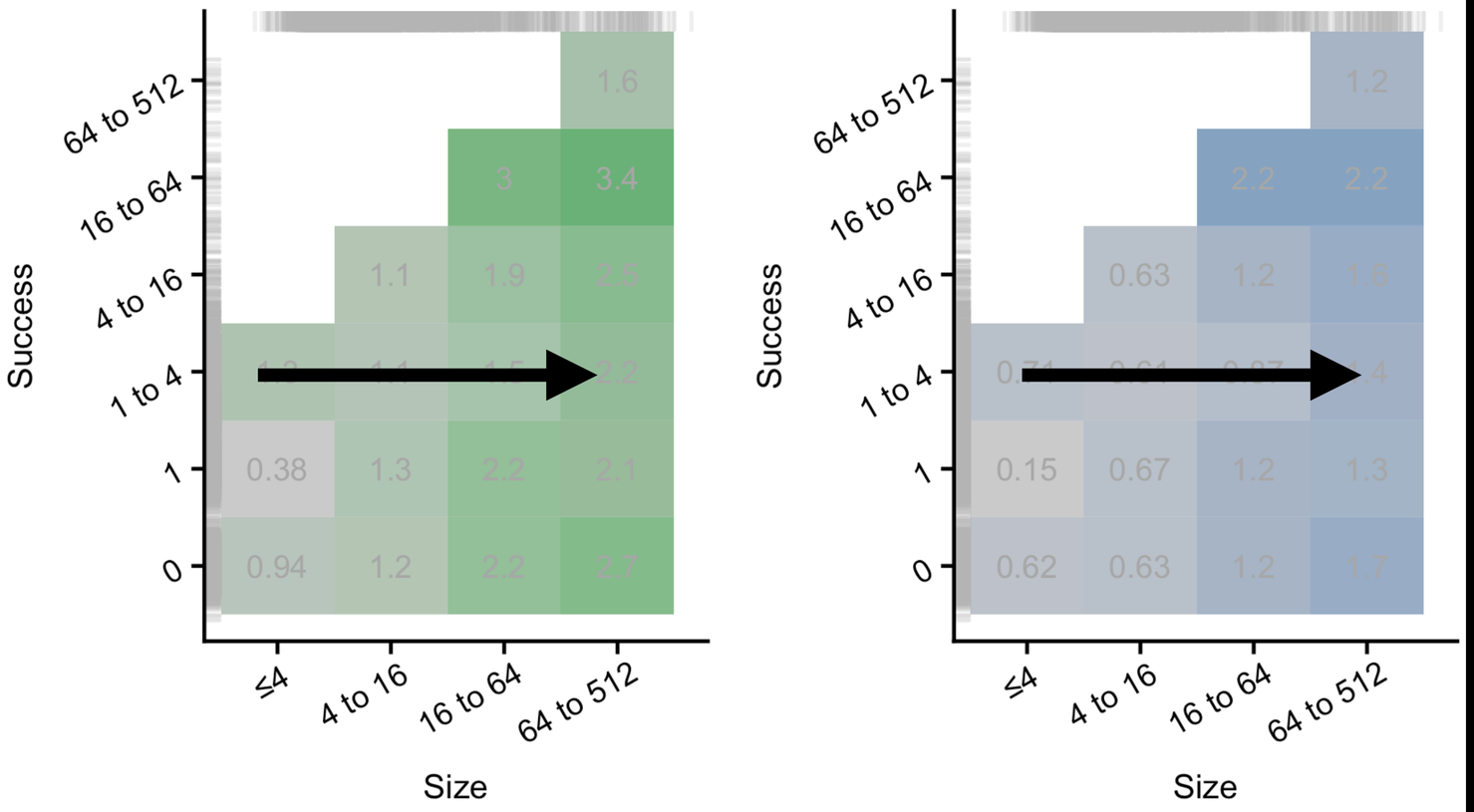


Rule count


Success
64 to 512
16 to 64
4 to 16
1 to 4
1
0
10
4.7
4.7
7.2
0.54
1.6
4.2
4.2
0.81
1.6
4.3
6.4
≤4
4 to 16
16 to 64
64 to 512
Size

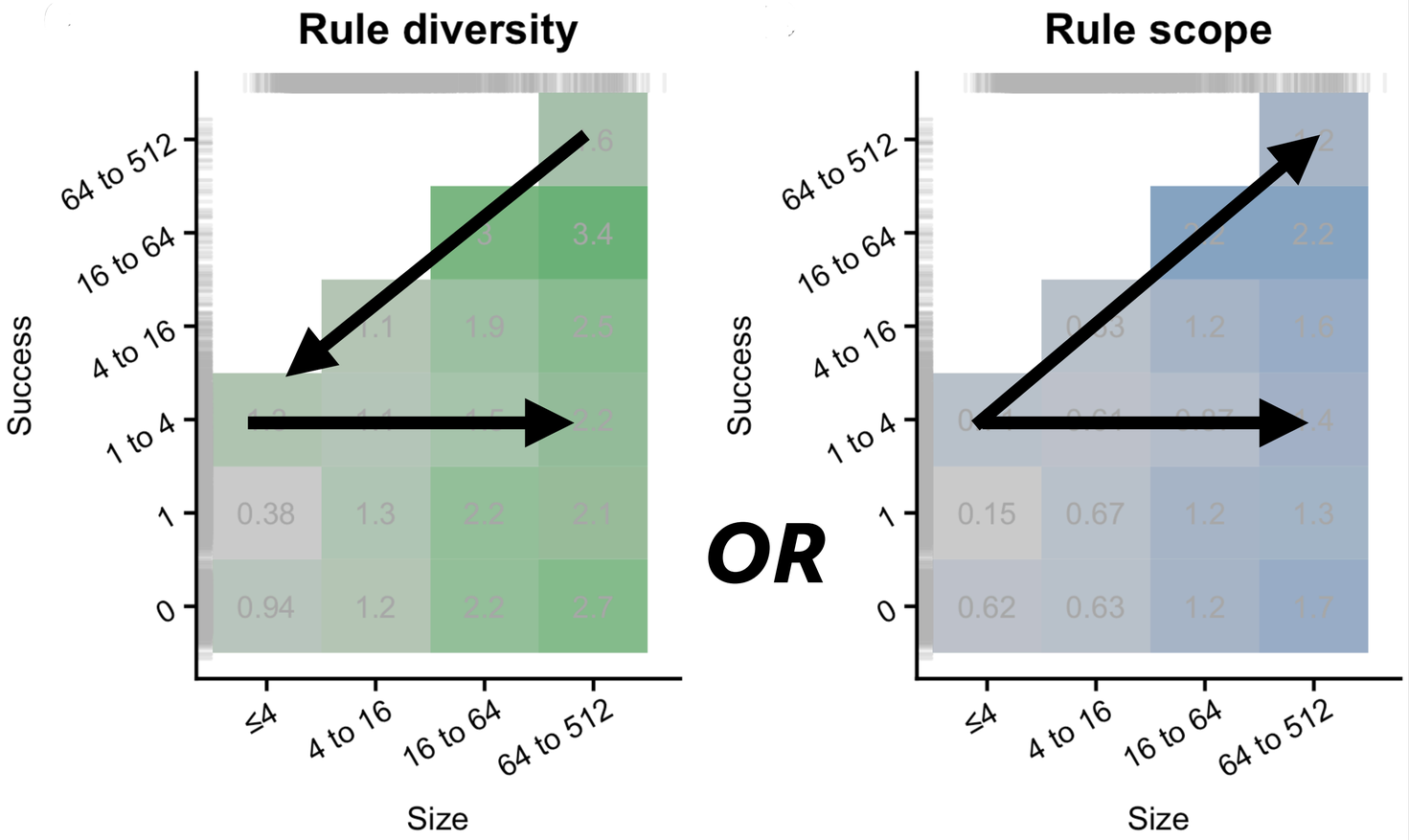
Institutional diversity

Variety in problems addressed and ways of addressing them



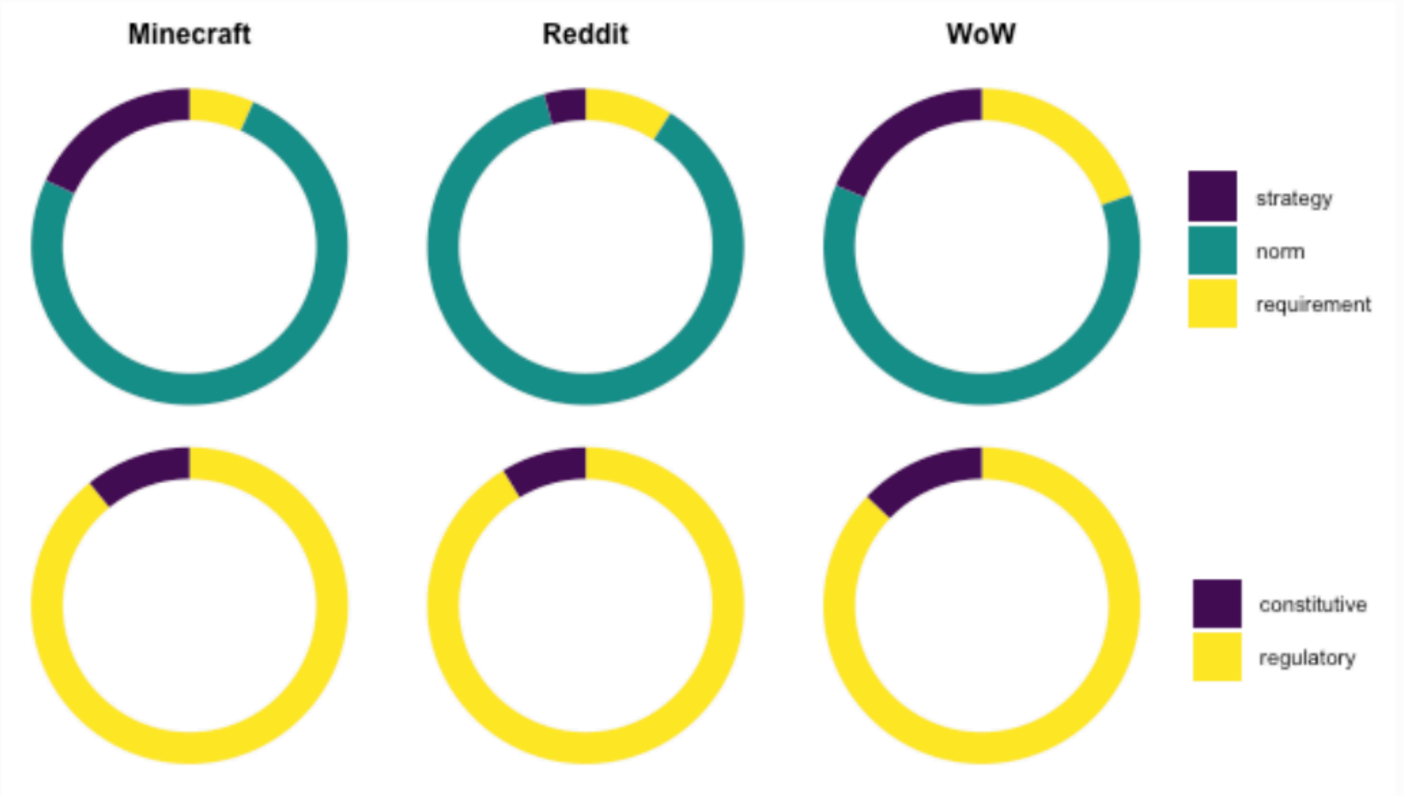
Institutional diversity

Variety in problems addressed and ways of addressing them



Frey S, Sumner RW (2019) Emergence of integrated institutions in a large population of self-governing communities. PLoS ONE 14(7): e0216335. http://doi.org/c76k

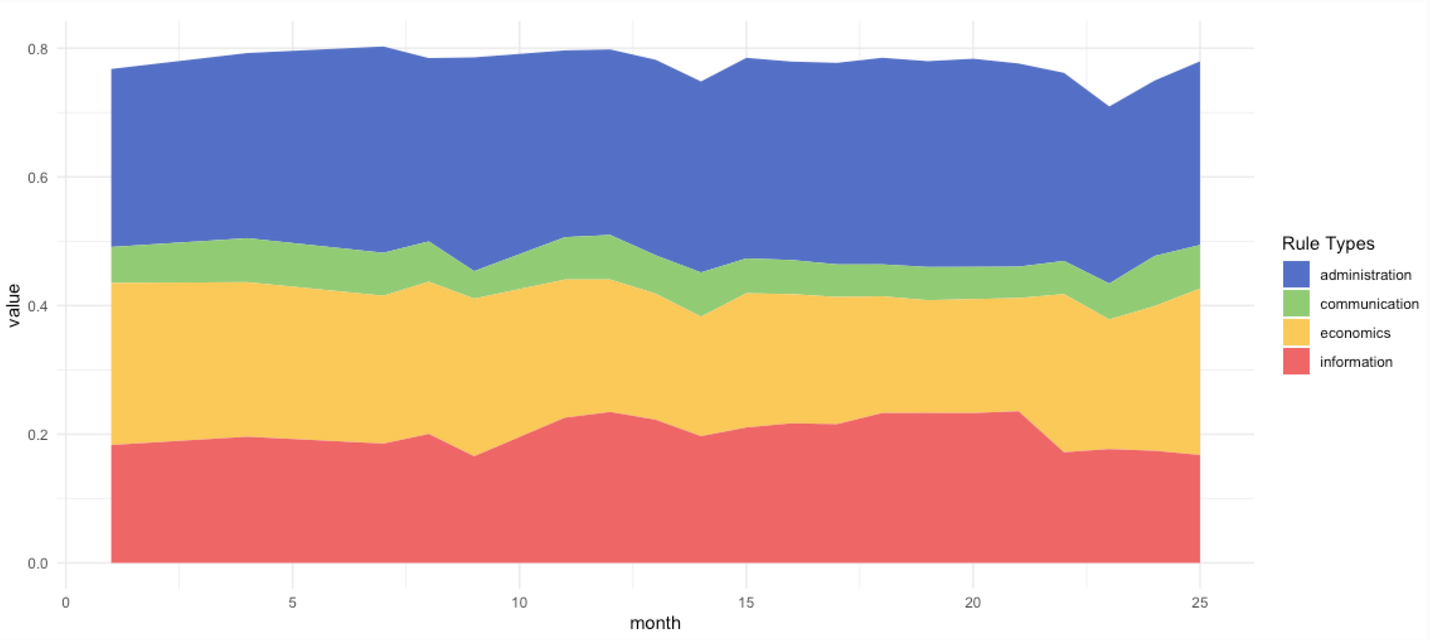
Communities use rules more to set expectations, less to engineer incentives



Frey, S., Zhong, Q. Q., Bulat, B., Weisman, W. D., Liu, C. M., Fujimoto, S., Wang, H. (2021) Governing online goods: Maturity and formalization in Minecraft, Reddit, and World of Warcraft communities. Proc. ACM Hum.-Comput. Interact. CSCW.

Selection versus drift in institutional evolution?

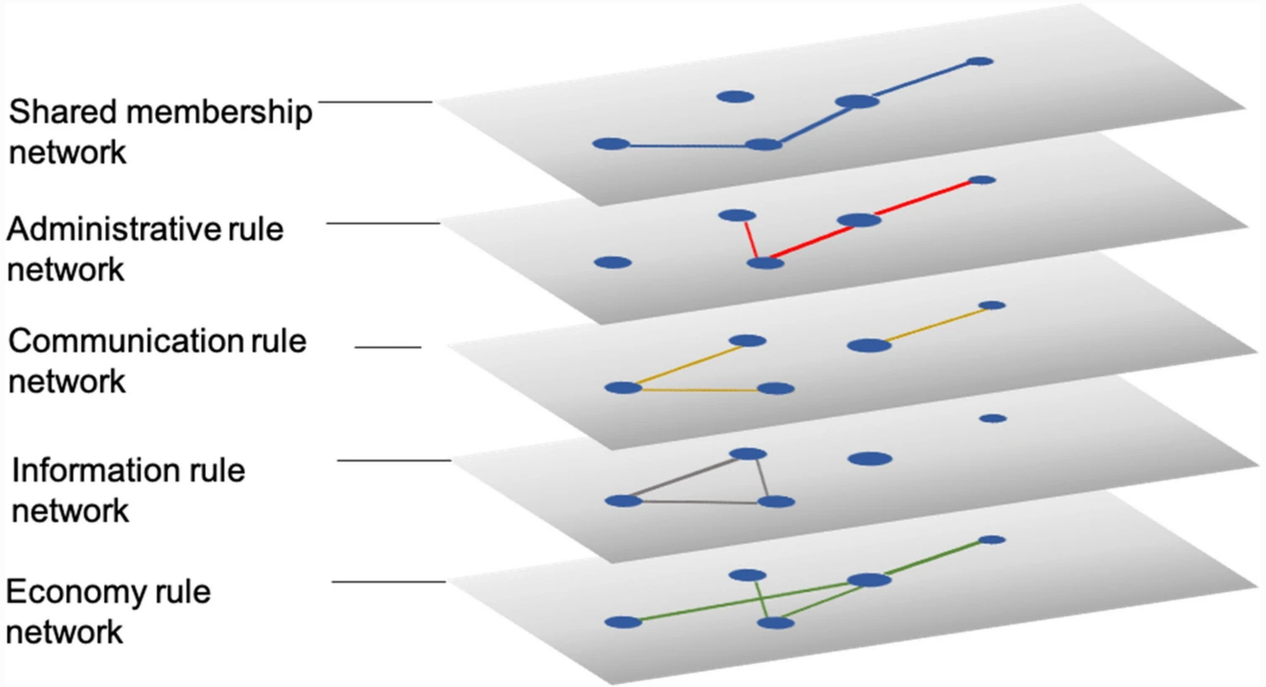
Price equation over communities to show strong selection among Minecraft servers



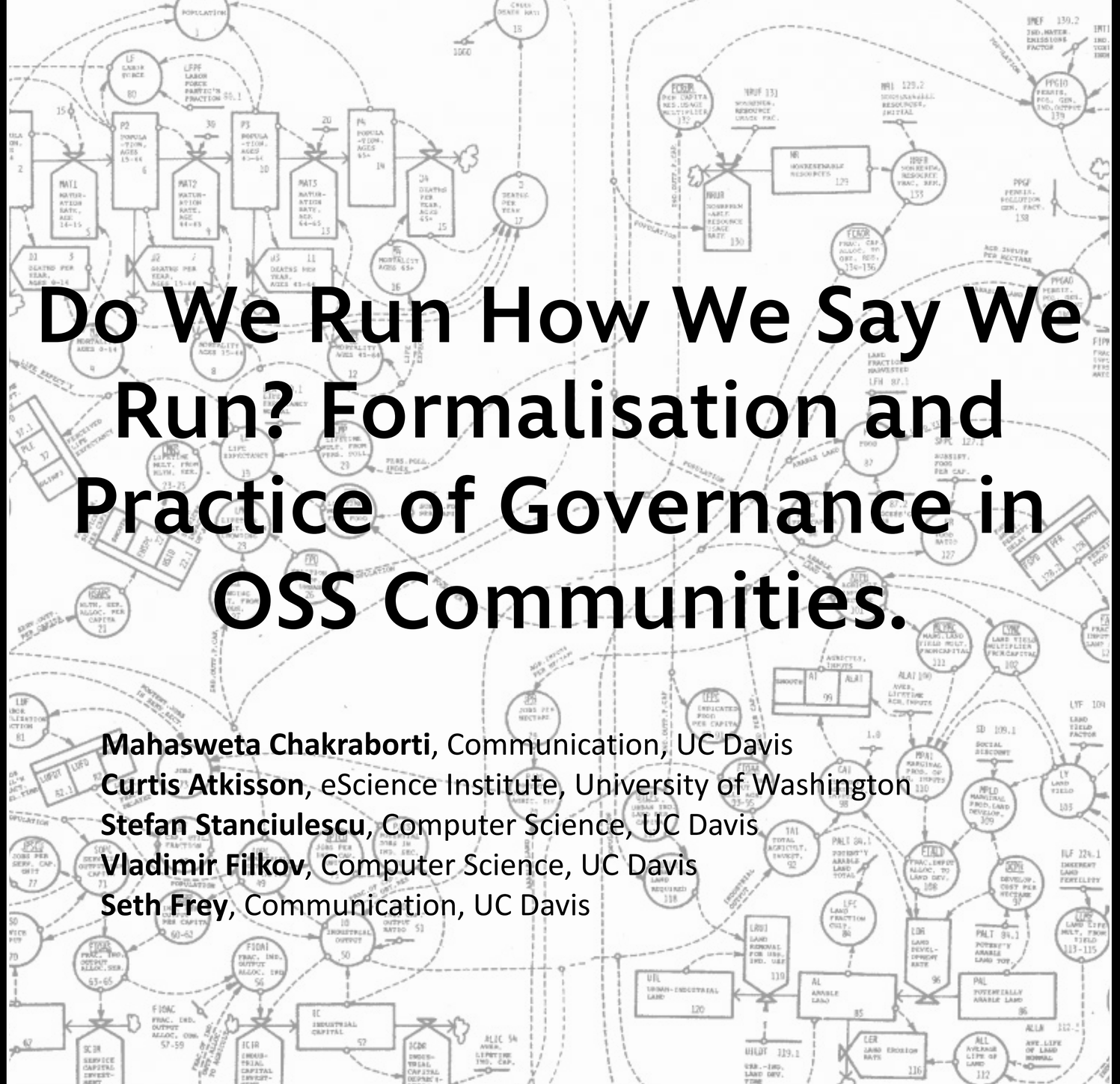
Zhong, Q., Frey, S., & Hilbert, M. (2022). Quantifying the Selective, Stochastic, and Complementary Drivers of Institutional Evolution in Online Communities. Entropy, 24(9), 1185. https://www.mdpi.com/1099-4300/24/9/1185

Institutional similarity drives cultural similarity

- Communities that govern themselves with similar types of rules are more likely to subsequently attract similar users.



Zhong, Q., Frey, S. (2022) Institutional similarity drives cultural similarity among online communities. Nature Scientific Reports 12, 18982. https://doi.org/jq56



Do We Run How We Say We Run? Formalisation and Practice of Governance in OSS Communities.

Mahasweta Chakraborti, Communication, UC Davis
Curtis Atkisson, eScience Institute, University of Washington
Stefan Stanciulescu, Computer Science, UC Davis
Vladimir Filkov, Computer Science, UC Davis
Seth Frey, Communication, UC Davis

Chakraborti, M., Atkisson, C., Stanciulescu, S., Filkov, V., and Frey, S. (in press). Do We Run How We Say We Run? Formalisation and Practice of Governance in OSS Communities. Proceedings of the ACM on Human-Computer Interaction. https://doi.org/10.48550/arXiv.2309.14245

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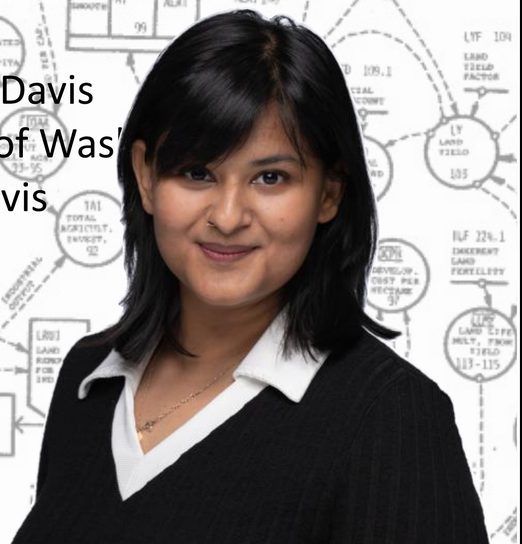
Seth Frey, Communication, UC Davis



Chakraborti, M., Atkisson, C., Stanciulescu, S., Filkov, V., and Frey, S. (in press). Do We Run How We Say We Run? Formalisation and Practice of Governance in OSS Communities. Proceedings of the ACM on Human-Computer Interaction. https://doi.org/10.48550/arXiv.2309.14245

- **Open source matters**
- It depends on behavior
- It has a structure (policy)
- We have theory about those things
- But we still don't know if it's good
- Does behavior in an org reflect structure
- Is that a good thing?

HTTP Server

A

Accumulo
ActiveMQ
Airavata
Airflow
Allura
Ambari
Ant
Any23
APISIX
Archiva
Aries
Arrow
AsterixD
Atlas
Attic
Avro
Axis

Bahir
Beam
Bigtop
Bloodhc
BookKe
Brooklyr
Buildr
BVal

C

Calcite
Camel
CarbonData
Cassandra
Cayenne
Celix
Chemistry
Commons
Community
Development
Cordova
CouchDB
Creadur
cTAKES
Curator
CXF

D

Daffodil
DataFu
DataSketches
pike
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inScheduler
uid
ubbo

E

ECharts
Empire-

F

Felix
Fineract
Flex
Flink
Flume
Fluo
FreeMarker

G

Geode
Geronimo
Giraph
Gobblin
Gump

H

Hadoop
HAWQ
HBase
Helix
Hive
HttpComponents
Hudi

I

Iceberg
Ignite
Impala
Incubator
IoTDB
Isis

J

Jackrabbit
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Joshua
JSPWiki
jUDDI

K

Kafka
Karaf
Kibble
Knox
Kudu
Kylin

L

Libcloud

M

MADlib
Mahout
ManifoldCF
Maven
Mesos
MetaModel
MINA
Mnemonic
MyFaces
Mynewt

N

NetBeans
NiFi
Nutch

O

OFBiz
Olingo
OpenJPA
OpenMeetings
OpenOffice
OpenWebBeans
OpenWhisk
Ozone

P

Parquet
PDFBox
Perl
Petri
Phoenix
Pig
Pivot
Portals
Pulsar

Q

Qpid

R

Ranger
Ratis
REEF
River
RocketMQ
Roller
Royale
Rya

S

Samza
Santuario
Serf
ServiceComb
ix
Sphere
SIS
SkyWalking
Solr
SpamAssassin
Spark
Sqoop
Steve
Storm
Streams
Struts
Submarine
Subversion
Superset

T

Tapestry
Tcl
Tez
Thrift
Tika
TinkerPop
Tomcat
TomEE
Traffic Control
Traffic Server
Trafodion
Turbine
TVM

U

UIMA
Unomi
Usergrid

V

VCL
Velocity

W

Web Services
Whimsy
Wicket

X

Xalan
Xerces
XML Graphics

Y

Yetus

Z

Zeppelin
ZooKeeper

THE APACHE SOFTWARE FOUNDATION ESTABLISHED 1999

Chakraborti, M., Zhong, Q., Bulat, B., Frey, S. (2021). Deconstructing written rules and hierarchy in peer produced software communities. https://arxiv.org/abs/2206.07992

Yin, L., Chakraborti, M., Schweik, C., Frey, S. Filkov, V. (2022), Open Source Software Sustainability: Combining Institutional Analysis and Socio-Technical Networks, ACM CSCW https://arxiv.org/abs/2203.03144

Chakraborti, M., Atkisson, C., Stanciulescu, S., Filkov, V., and Frey, S. (in press). Do We Run How We Say We Run? Formalisation and Practice of Governance in OSS Communities. Proceedings of the ACM on Human-Computer Interaction. https://doi.org/10.48550/arXiv.2309.14245

"THE APACHE WAY TO ME..."

> **"open, respect and collaborate"**
> **—Shaofeng Shi, 15 year user of Apache Tomcat, Kylin, Hadoop, Spark, Kafka, MyBatis, HBase, Flink, contributor to Apache Kylin, Superset, Spark**

WHAT MAKES THE APACHE WAY SO HARD TO DEFINE?

The Apache Way is a living, breathing interpretation of one's experience with our community-led development process. Apache projects and their communities are unique, diverse, and focused on the activities needed at a particular stage of the project's lifetime, including nurturing communities, developing great code, and building awareness. What is important is that they embrace:

- ***Earned Authority:*** all individuals are given the opportunity to participate, but their influence is based on publicly earned merit – what they contribute to the community. Merit lies with the individual, does not expire, is not influenced by employment status or employer, and is non-transferable (merit earned in one project cannot be applied to another). More on merit.
- ***Community of Peers:*** individuals participate at the ASF, not organizations. The ASF's flat structure dictates that roles are equal irrespective of title, votes hold equal weight, and contributions are made on a volunteer basis (even if paid to work on Apache code). The Apache community is expected to treat each other with respect in adherence to our Code of Conduct. Domain expertise is appreciated; Benevolent Dictators For Life are disallowed. More on individual participation.
- ***Open Communications:*** as a virtual organization, the ASF requires all communications related to code and decision-making to be publicly accessible to ensure asynchronous collaboration, as necessitated by a globally-distributed community. Project mailing lists are archived, publicly accessible, and include:
    - dev@ (primary project development)
    - user@ (user community discussion and peer support)
    - commits@ (automated source change notifications)
    - occasionally supporting roles such as marketing@ (project visibility)

...as well as restricted, day-to-day operational lists for Project Management Committees. Private decisions on code, policies, or project direction are disallowed; off-list discourse and transactions must be brought on-list. More on communications and the use of mailing lists.

- ***Consensus Decision Making:*** Apache Projects are overseen by a self-selected team of active volunteers who are contributing to their respective projects. Projects are auto-governing with a heavy slant towards driving consensus to maintain momentum and productivity. Whilst total consensus is not possible to establish at all times, holding a vote or other coordination may be required to help remove any blocks with binding decisions, such as when declaring a release. More on decision making and voting.
- ***Responsible Oversight:*** The ASF governance model is based on trust and delegated oversight. Rather than detailed rules and hierarchical structures, ASF governance is principles-based, with self-governing projects providing reports directly to the Board. Apache Committers

Apache Software Foundation Incubator (ASFI)

- Founded by Apache Software Foundation in 2002
- Mentored over 300 projects
- Projects are autonomous in development and community specifics
- Incubator regulates administration, licensing, infrastructure, branding and production standards

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different asf projects have different policies. the important part is that we should have a common understanding about our commit policy. there might e.g. be a branch for the next release where rtc (review then commit) is applied. that's useful when preparing a release or for maintenance releases we still actively maintain. and beside that we might have a 'future' branch (e.g. on master) or multiple feature branches where ctr (commit then review) is standard. most asf projects have the whole repo on ctr...

Research Question

- How do foundation policies relate to project operations and performance?

Do Not Touch
Leave Unlocked
LOCKE
UNLOC

Research Question

- How do foundation policies relate to project operations and performance?
  - What is the relationship of *rules-in-form* and *rules-in-use*?
- Does formalization relate to extent of structured operations?
- How much do members internalize formal regulation?
- Do governed activities and policy internalization relate to project outcome?

Data

- ASF incubator policies (Sen et al, 2022).
  - About 250 sentences
- Developer emails of 208 projects scraped from public ASFI mailing list archives (Yin et al, 2021)
  - About 2M sentences from 700,000 emails
- Project covariates: development scale and membership (Stănciulescu et al, 2022)
  - Active committers
    - Number of commits
    - Lines of code contributed
  - Total time in incubation

Governance practice

different asf projects have different policies. the important part is that we should have a common understanding about our commit policy. there might e.g. be a branch for the next release where rtc (review then commit) is applied. that's useful when preparing a release or for maintenance releases we still actively maintain. and beside that we might have a 'future' branch (e.g. on master) or multiple feature branches where ctr (commit then review) is standard. most asf projects have the whole repo on ctr...

Governance practice

Original Policy:
'After a vote has finished, the ipmc must send a notice email to the board and then wait for 72 hours before inviting the proposed member'

Semantic Role Parsing:
'ARG0': ['the ipmc'], 'ARGM-MOD': ['must'], 'V': ['send'], 'ARG1': ['a notice'], 'ARGM-DIR': ['email'], 'ARG2': ['to the board'], 'ARGM-TMP': ['after a vote has finished']
'ARG1': ['the ipmc'], 'ARGM-MOD': ['must'], 'V': ['wait'], 'ARGM-TMP': ['after a vote has finished', 'then', 'for 72 hours', 'before inviting the proposed member']

Performance Programs (After reconstitution):
'After a vote has finished the ipmc must send a notice email to the board'
'After a vote has finished the ipmc must then wait for 72 hours before inviting the proposed member'

Table 1: Activities from compound sentences through Semantic Role Labeling (SRL). ARG0 denotes agent, ARG1-ARG5 are direct/indirect objects, ARG-MOD indicate modals while ARG-TMP and ARG-DIR are the temporal and directional arguments respectively

Original Sentence:
'(1) I'll be away from my computer starting Friday and through the New Year, so I won't be able to do much to help if folks want to release 2.1 during that time (not even testing).' (Apache Roller, 12/21/2005)

After SRL and reconstitution:
'I'll be away from my computer starting Friday and through the New Year' (Schedules/Events)

I won't be able to do much to help if folks want to release 2.1 during that time (not even testing)'
(Release Management)

Table 2: Capturing granularity: Sentences spanning multiple, thematically distinct operations. In this example, a developer shares their vacation timeline to the community in general, while also discussing implications for a tentative release. Topics indicated for each activity are inferred as described in Section 5.3.3

Institutional grammar

Policy	Attribute	Object	Deontic	Aim
Each podling in incubation must report to the incubator pmc .	each podling in incubation	pmc	must	report
A mentor must be an ipmc member	a mentor	an ipmc member	must	be
IPMC members are free to volunteer to mentor a podling . to do so , they should mail the podling stating their intentions	ipmc members are free	a podling to do, the podling stating their	should	to volunteer to mentor, mail
It 's also good to encourage developers by suggesting new related work they may like to volunteer to work on	—	developers, new related work, like to volunteer to	may	good to encourage, suggesting

Chakraborti, M., Zhong, Q., Bulat, B., Frey, S. (2021). Deconstructing written rules and hierarchy in peer produced software communities. https://arxiv.org/abs/2206.07992

Pipeline

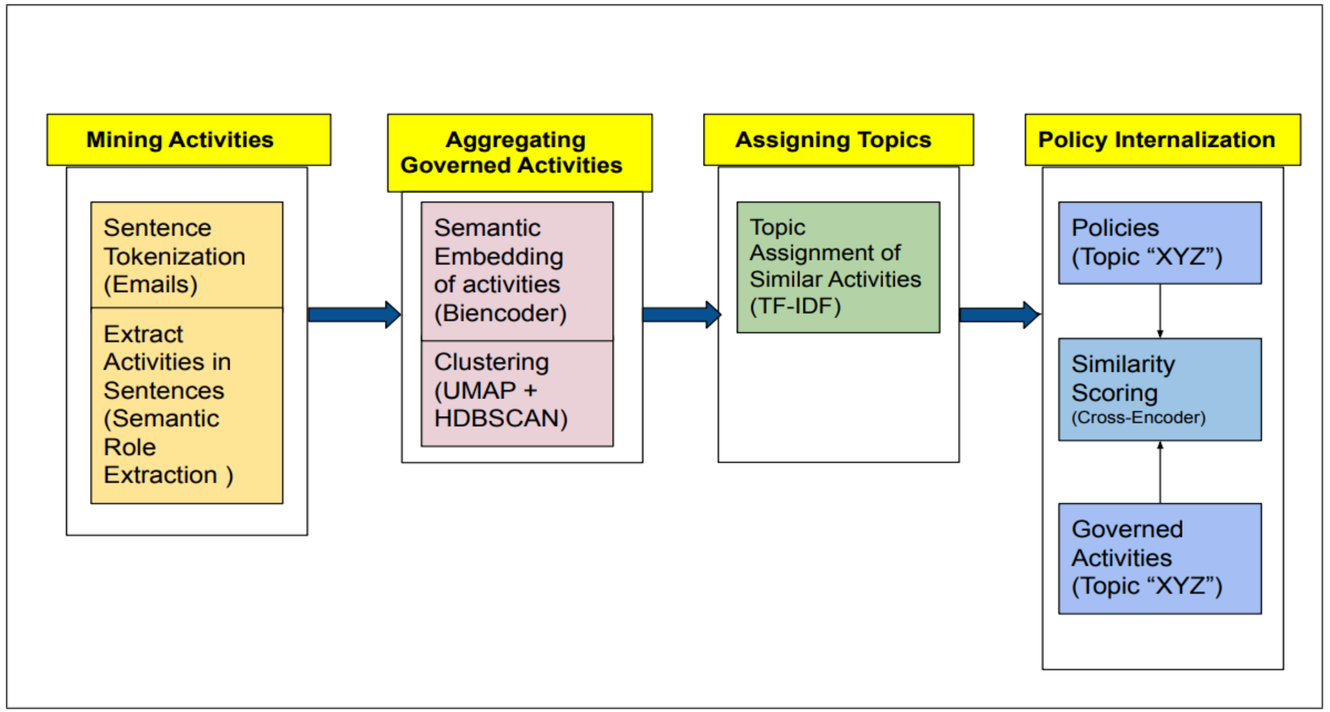
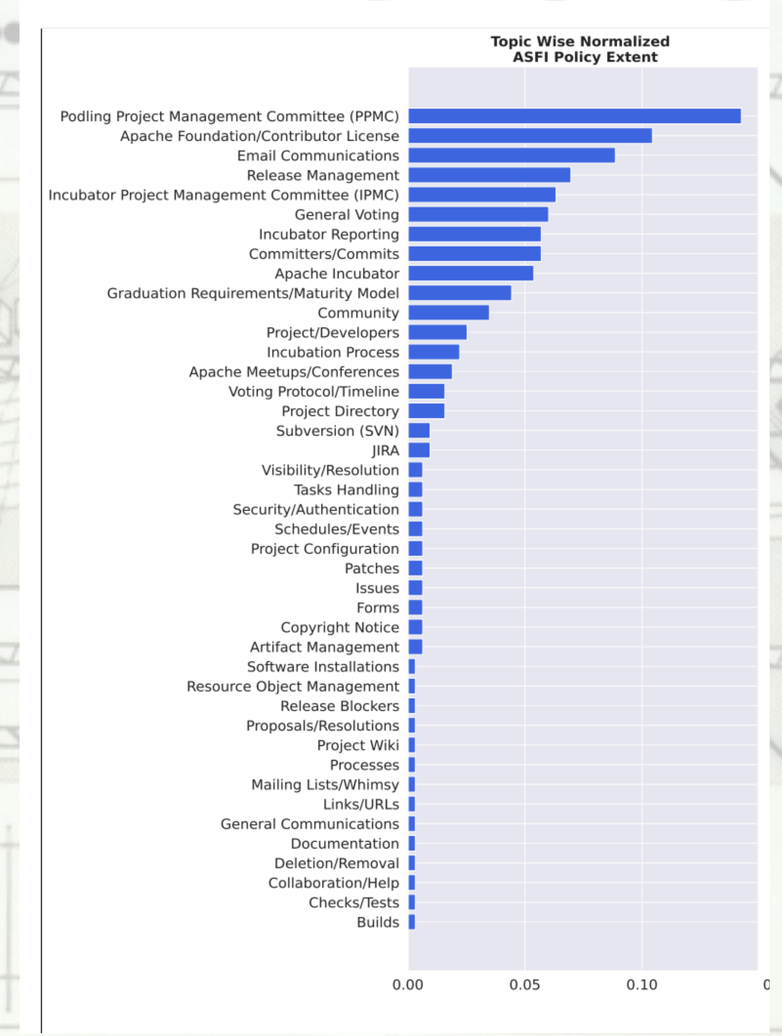


Figure 1: Language modeling pipeline for extracting activities, aggregating routine governed behavior, and evaluating internalization.

What are the governed topics?



Chakraborti, M., Stănciulescu, S. Filkov, V., Frey, S. (in review) OSS Governance, Compliance, and Success: A Study of ASF Incubator Projects.

Are more heavily governed topics discussed more or less?

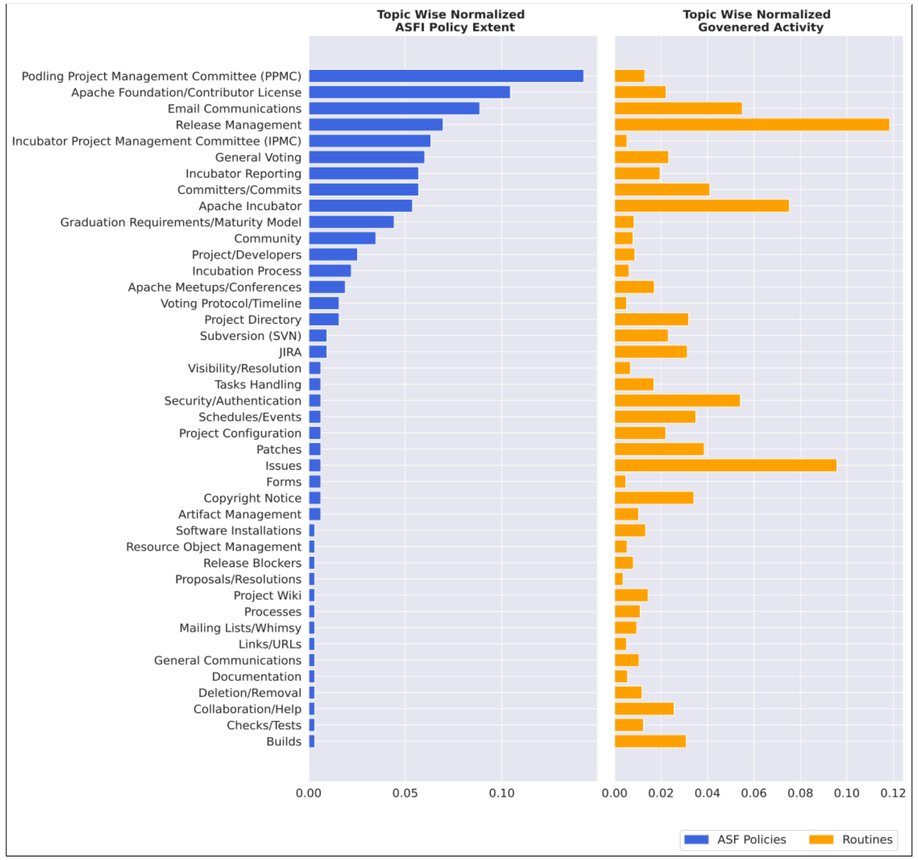


Figure 2: Left: Distribution of ASFI policy extent across governance topics. Right: Distribution of governed activity of projects across different governance topics. Governed activity was not found to be significantly correlated to policy extent.

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Is more policy associated with more internalization?

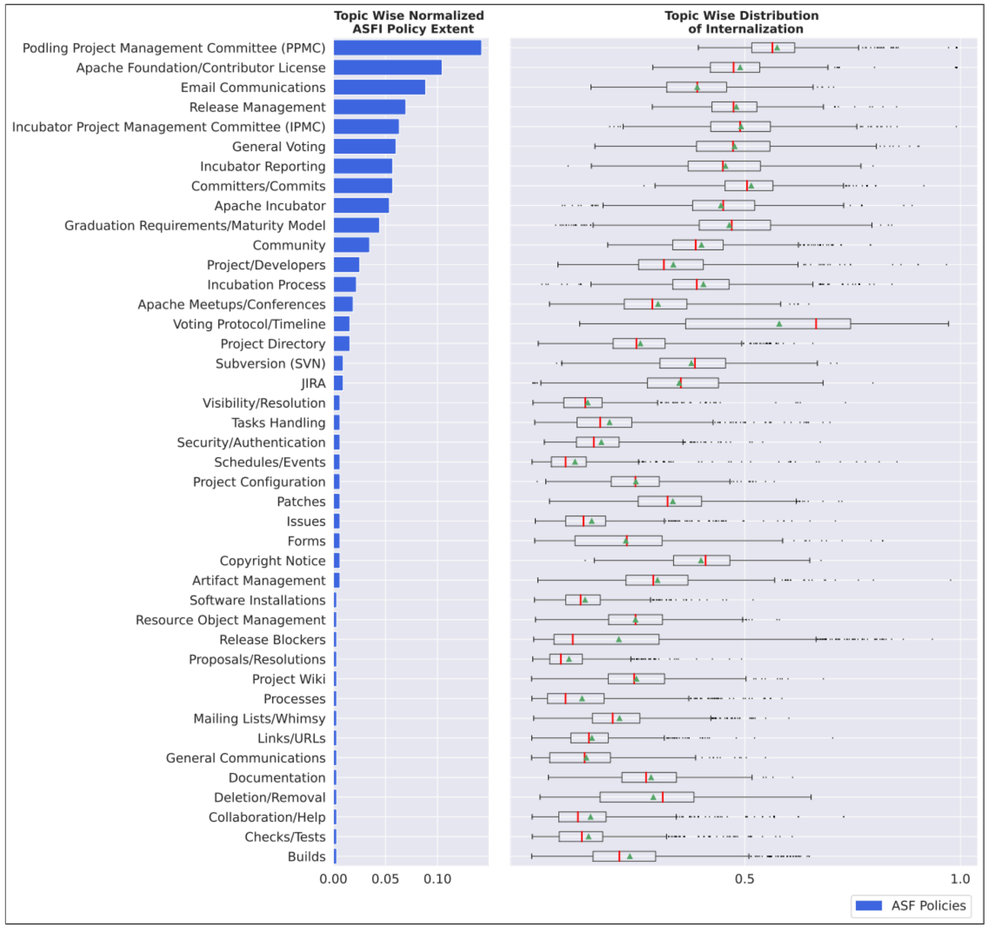


Figure 3: Left: Distribution of ASFI policy extent across governance topics. Right: Distribution of internalization scores within topics. Red and Green markers indicate the median and mean respectively. Internalization is observed to be higher in governance topics which are more regulated.

Chakraborti, M., Stănciulescu, S. Filkov, V., Frey, S. (in review) OSS Governance, Compliance, and Success: A Study of ASF Incubator Projects.

Does practice or internalization influence outcomes?

Table 3: Summary RQ3: Binomial(Logit) GLM regression of project governance against Graduation/Retirement

	Covariates		**Covariates and Governed Activity**		**Covariates and Internalization**		**All**	
Predictor	Coefficient	**p**	Coefficient	**p**	Coefficient	**p**	Coefficient	**p**
Intercept	2.490	0.000	3.032	0.000	3.252	0.000	4.427	0.000
Committers[2]	0.077	0.874	-0.018	0.973	–0.3074	0.637	0.127	0.875
Commits[2]	0.705	0.140	0.615	0.243	0.772	0.195	0.197	0.793
Developer Emails[2]	0.807	**0.016**	1.069	**0.020**	1.000	**0.020**	1.188	0.079
Incubation time[1]	-0.518	**0.011**	-0.181	0.555	-0.799	**0.004**	-0.334	0.420
Incubator Reporting[2]			-1.210	**0.011**			-1.827	**0.002**
Patches[2]			0.688	**0.011**			1.009	**0.009**
Project Configuration[1]					0.765	**0.002**	0.623	**0.043**
Task Handling[1]					-0.511	0.054	-0.609	0.084
Project Wiki[1]					-0.720	**0.032**	-1.417	**0.005**
Voting Protocol/Timeline[1]					0.428	0.129	0.933	**0.013**
Graduation Requirements/Maturity Mode[1]					0.898	**0.001**	1.058	**0.002**
Observations: 208	R^2 (Tjur):	0.258	R^2 (Tjur):	0.360	R^2 (Tjur):	0.486	R^2 (Tjur):	0.648
	AIC:	139.91	AIC:	124.96	AIC:	113.34	AIC:	90.29

Chakraborti, M., Stănciulescu, S. Filkov, V., Frey, S. (in review) OSS Governance, Compliance, and Success: A Study of ASF Incubator Projects.

Conclusion

- Communities *do not run how they say they run*
- More policy making frame operations, but does not follow how extensively communities govern themselves.
- Successful projects tend to govern themselves along less formalized domains

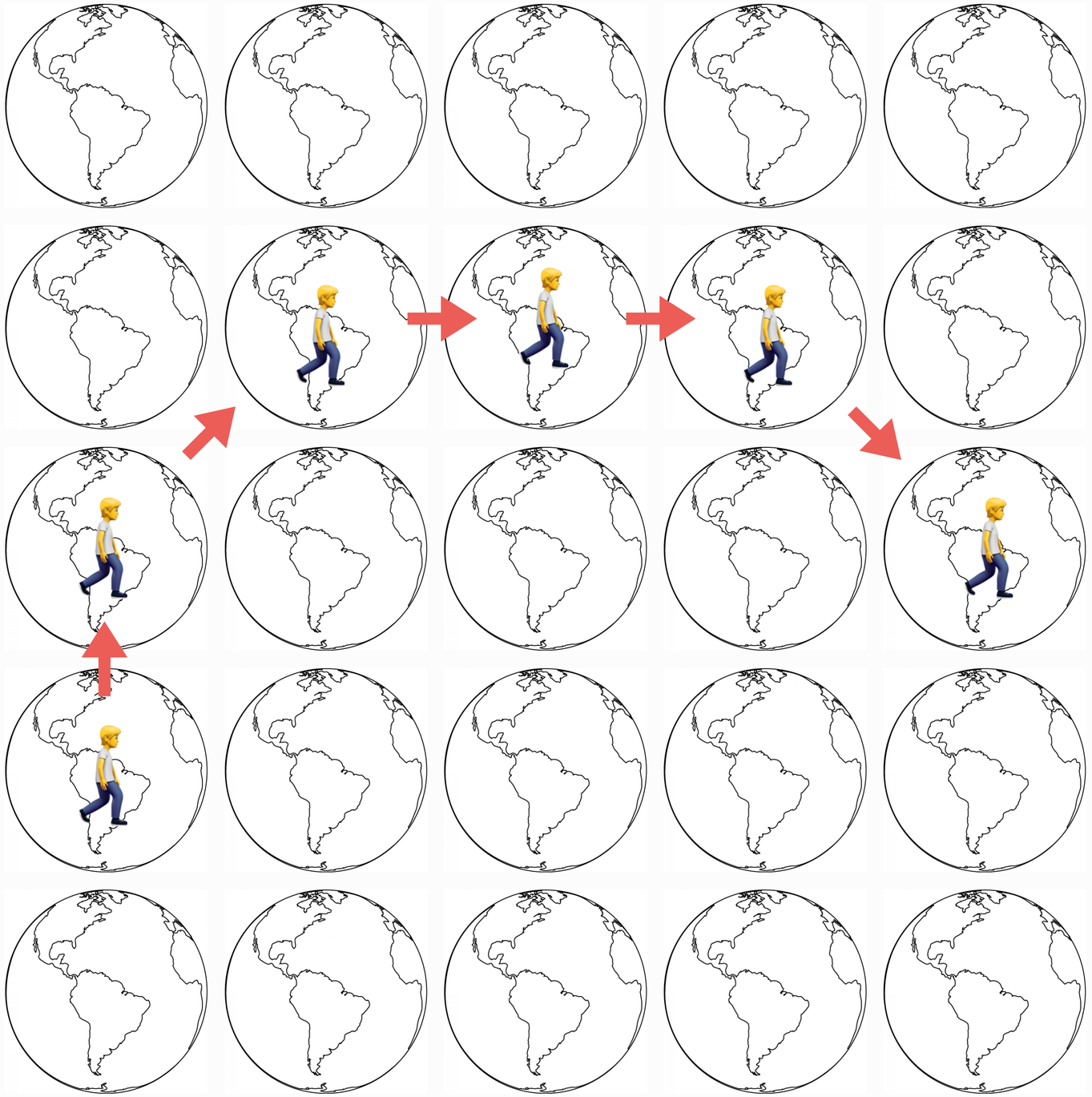
- Should we run how we say we run?

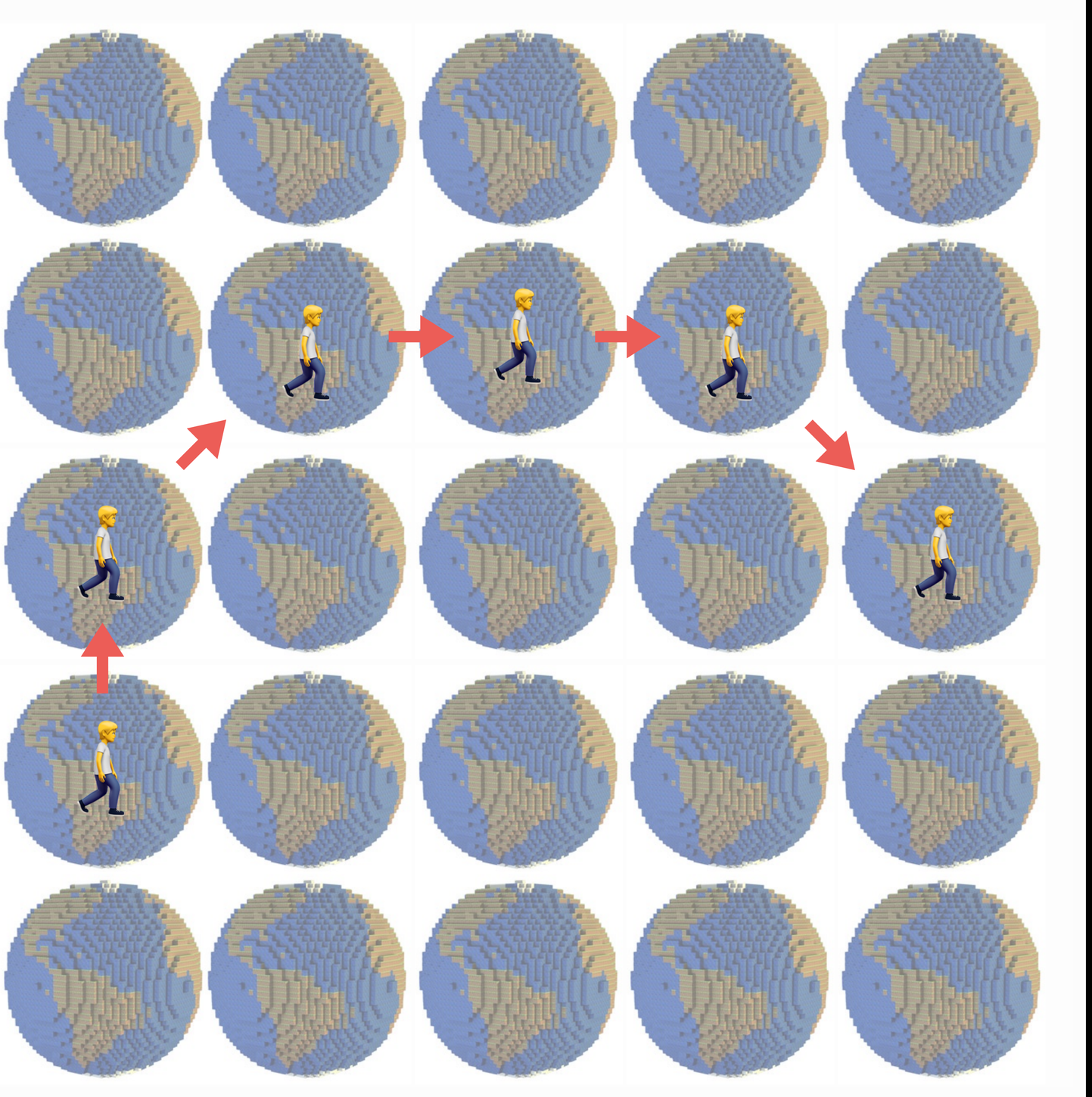
Dynamics over games and institutional preferences

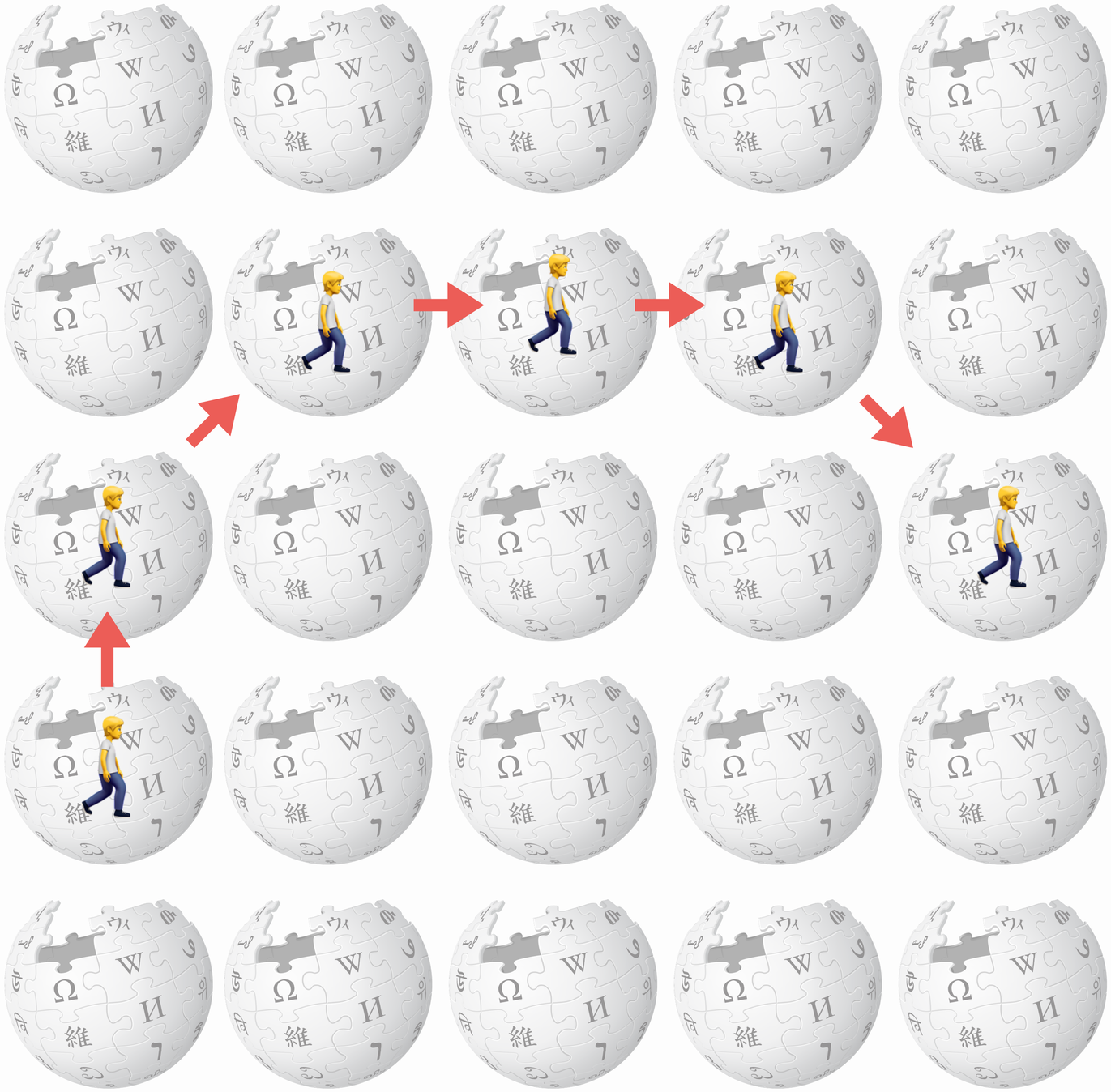
Seth Frey
Communication, University of California, Davis

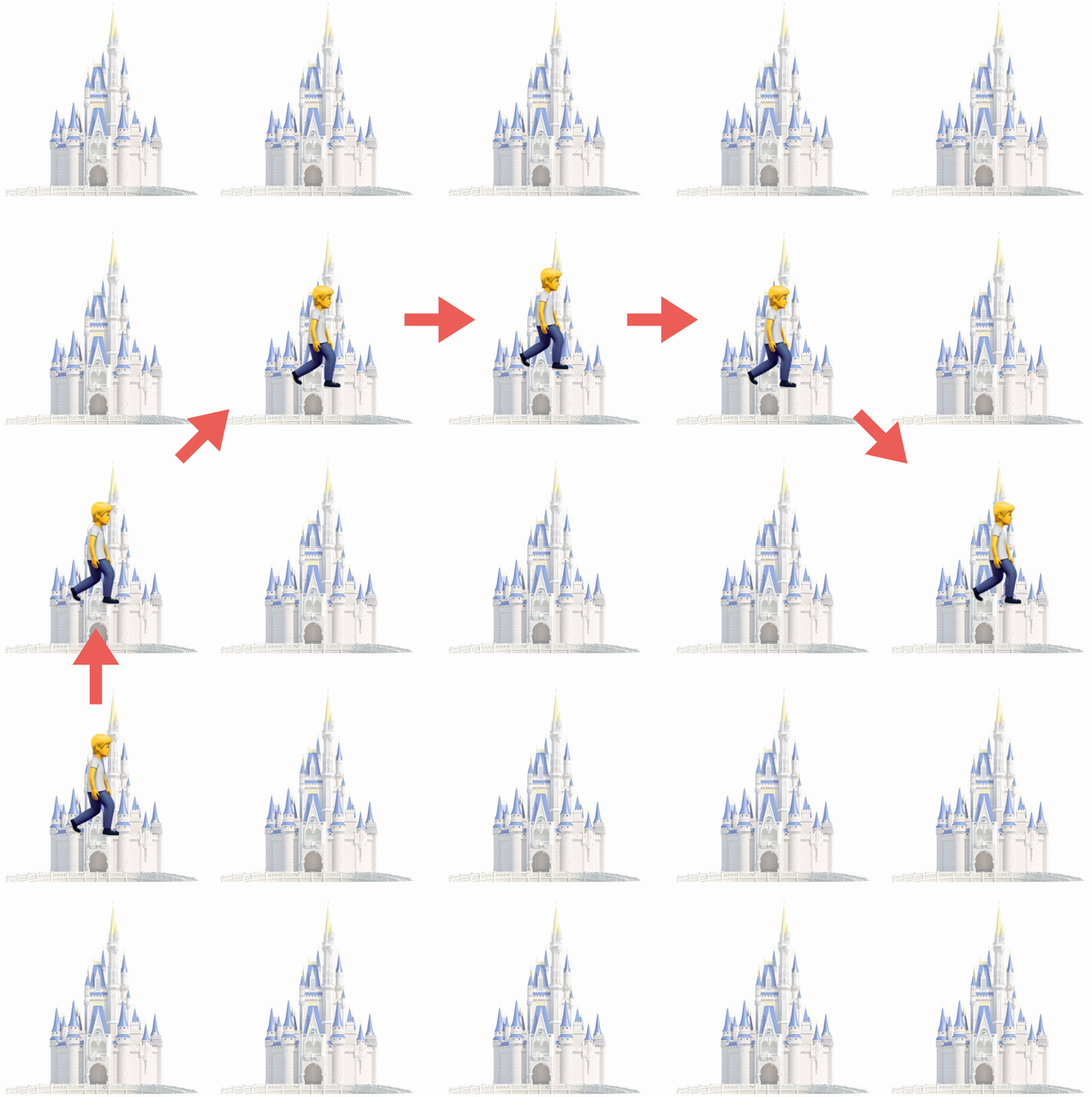
Frey, S. and Atkisson C. (2020) A dynamic over games drives selfish agents to win–win outcomes Proc. R. Soc. B.28720202630. https://doi.org/fnq2

UCDAVIS
UNIVERSITY OF CALIFORNIA









Tip
15%

or

Tip
20%

or

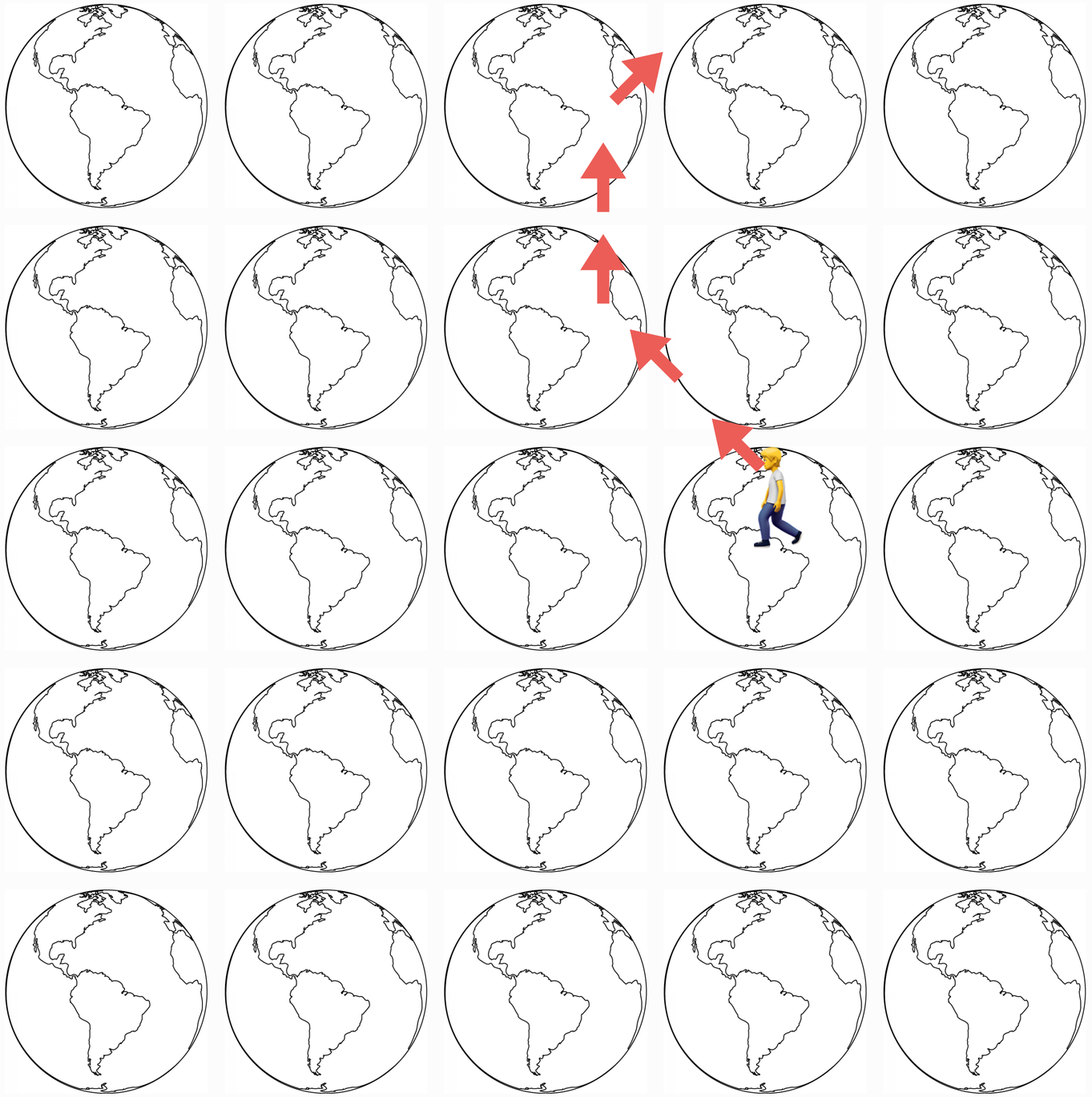
or

And in philosophy…

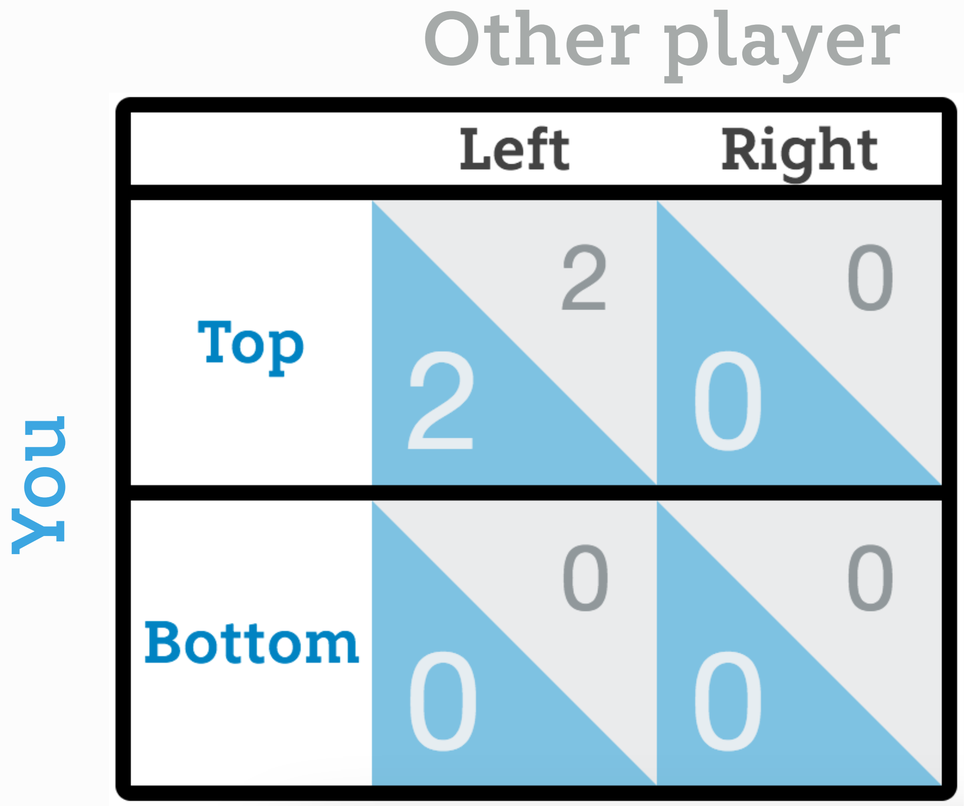
Philolaus' Antichthon
Rawls' veil of ignorance
Tiebout competition
Hirschman's exit and voice
Nozick's utopia

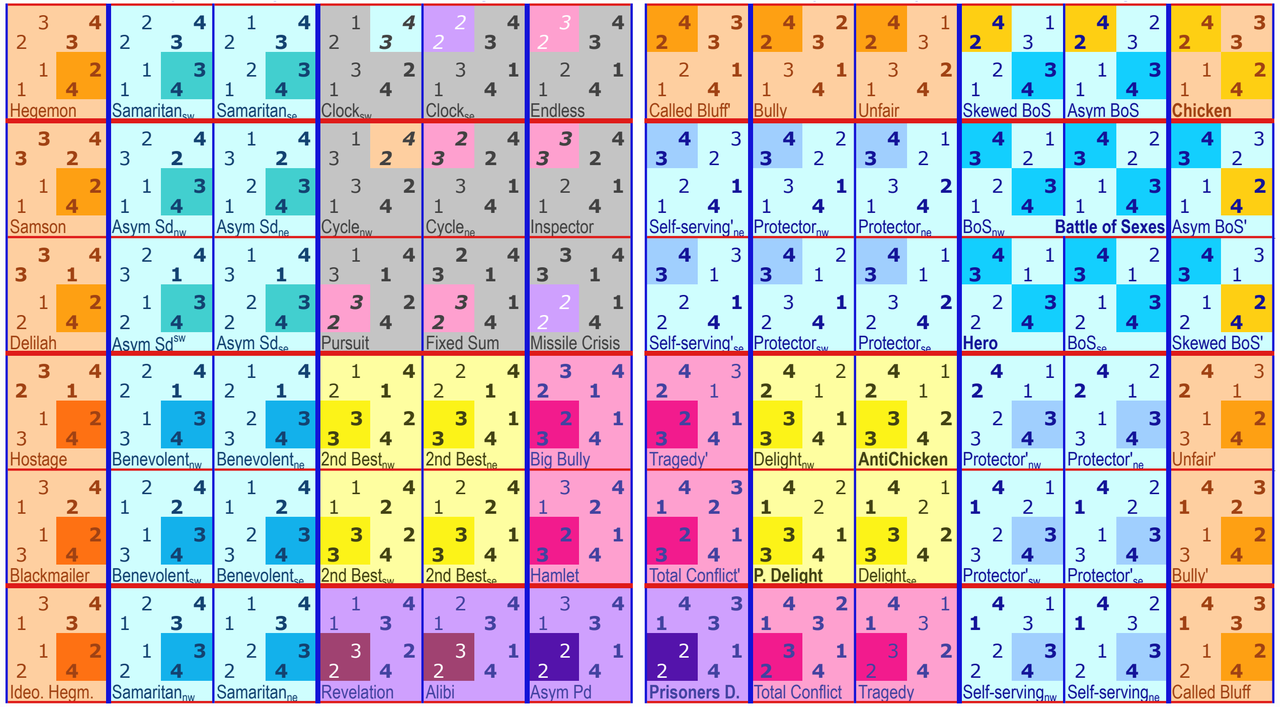
Institutional change is a dynamic ***over*** a space of systems.

This is a powerful *general* framework for the empirical study of cultural evolution.



Economic games are minimal institutions

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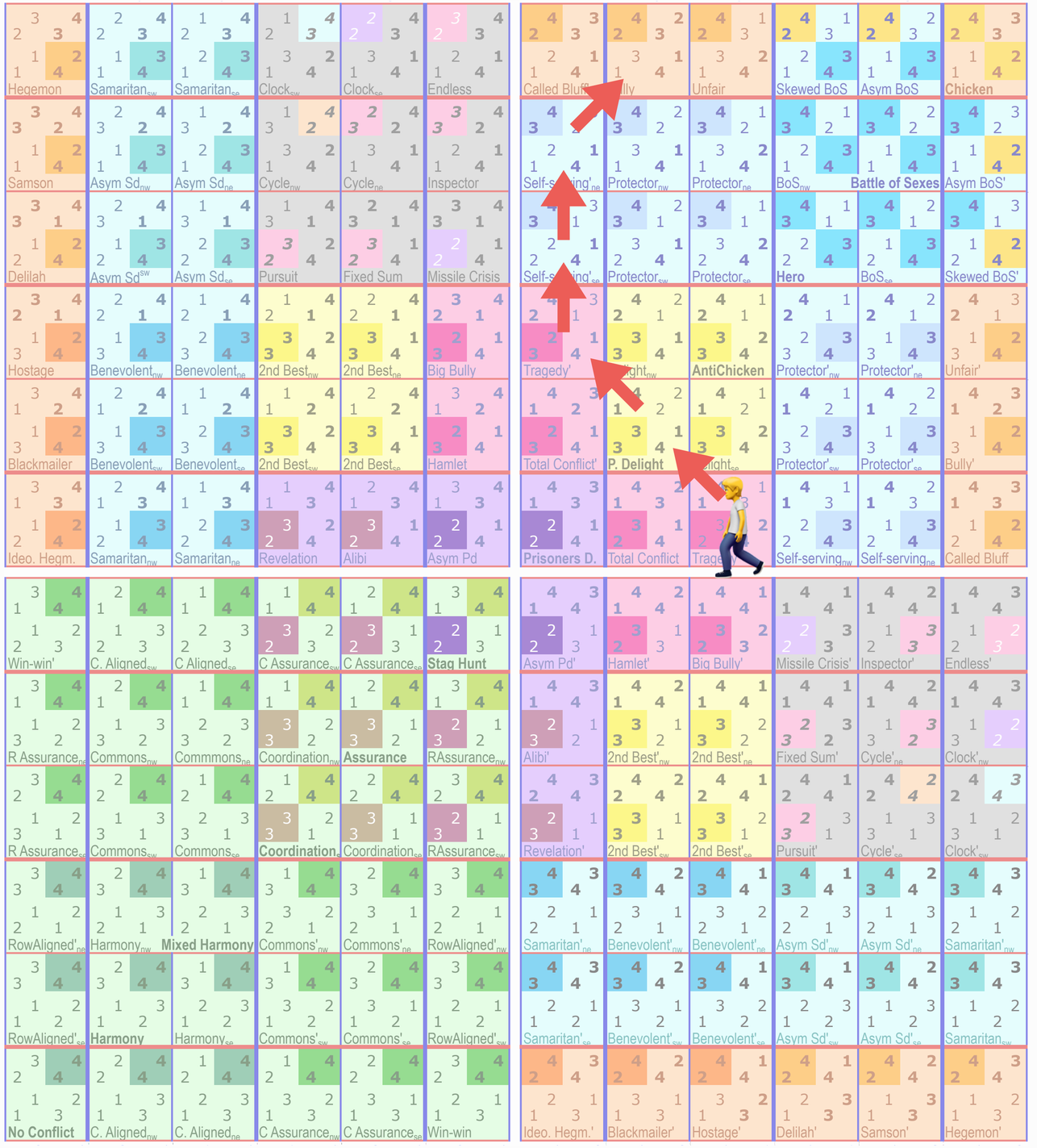
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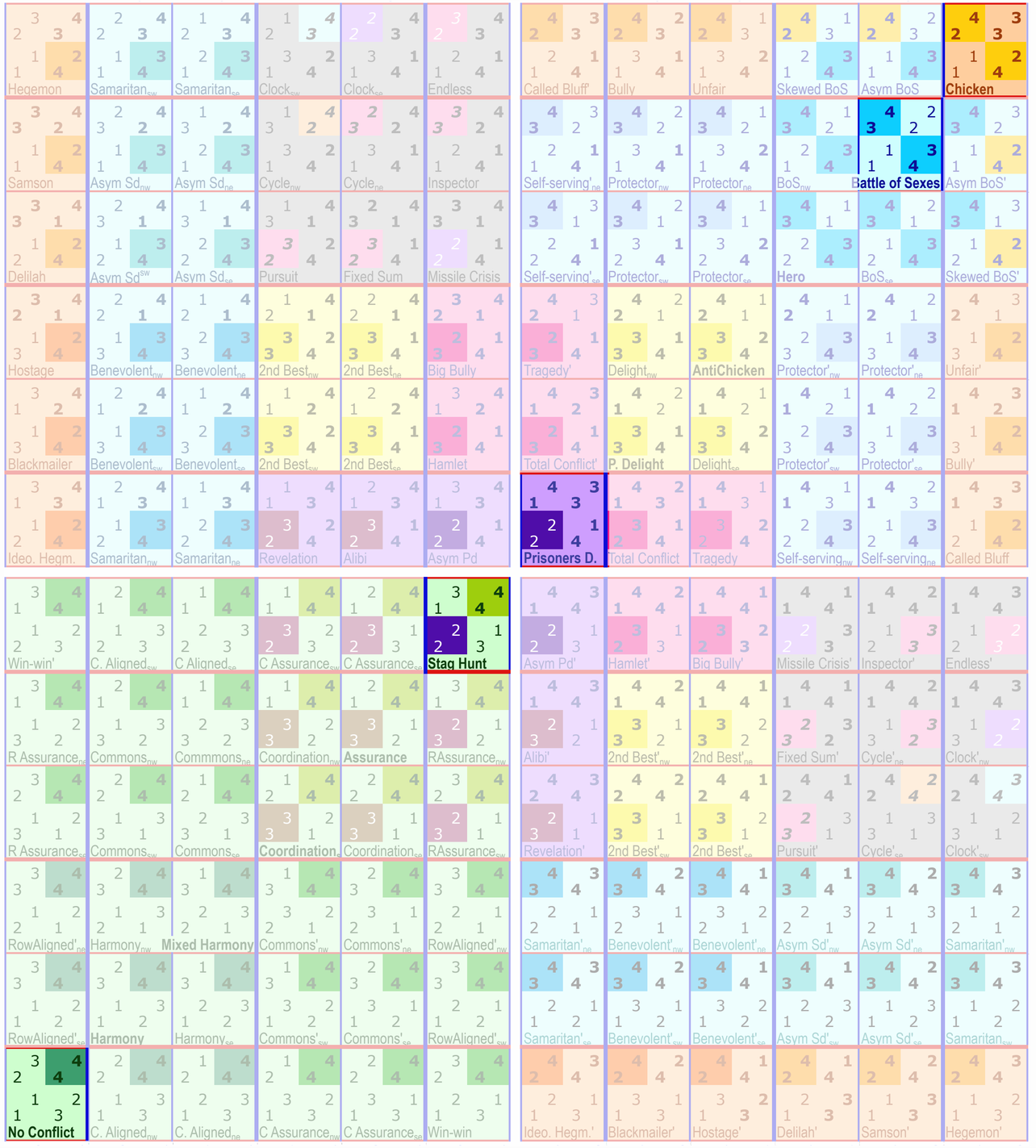
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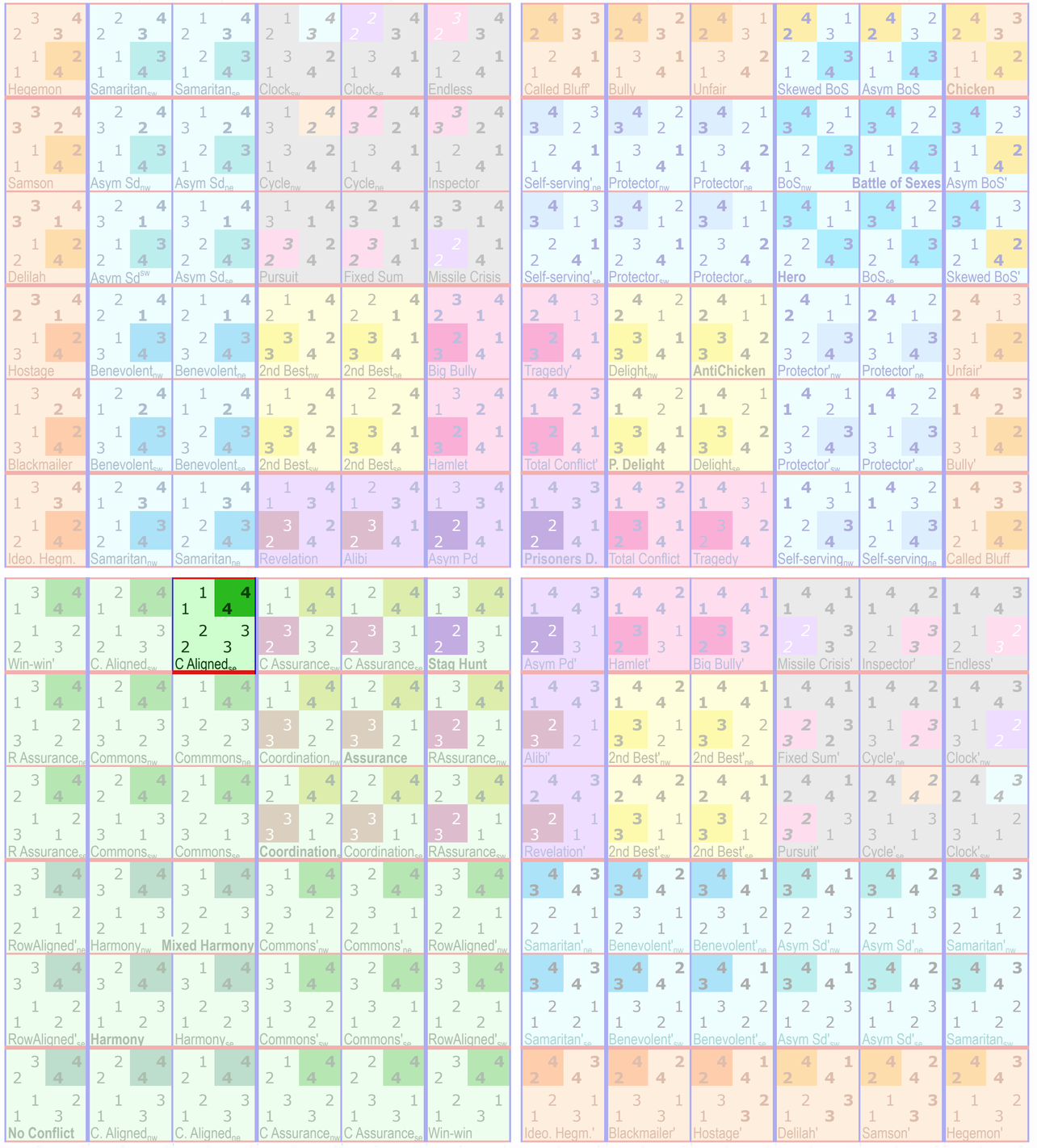
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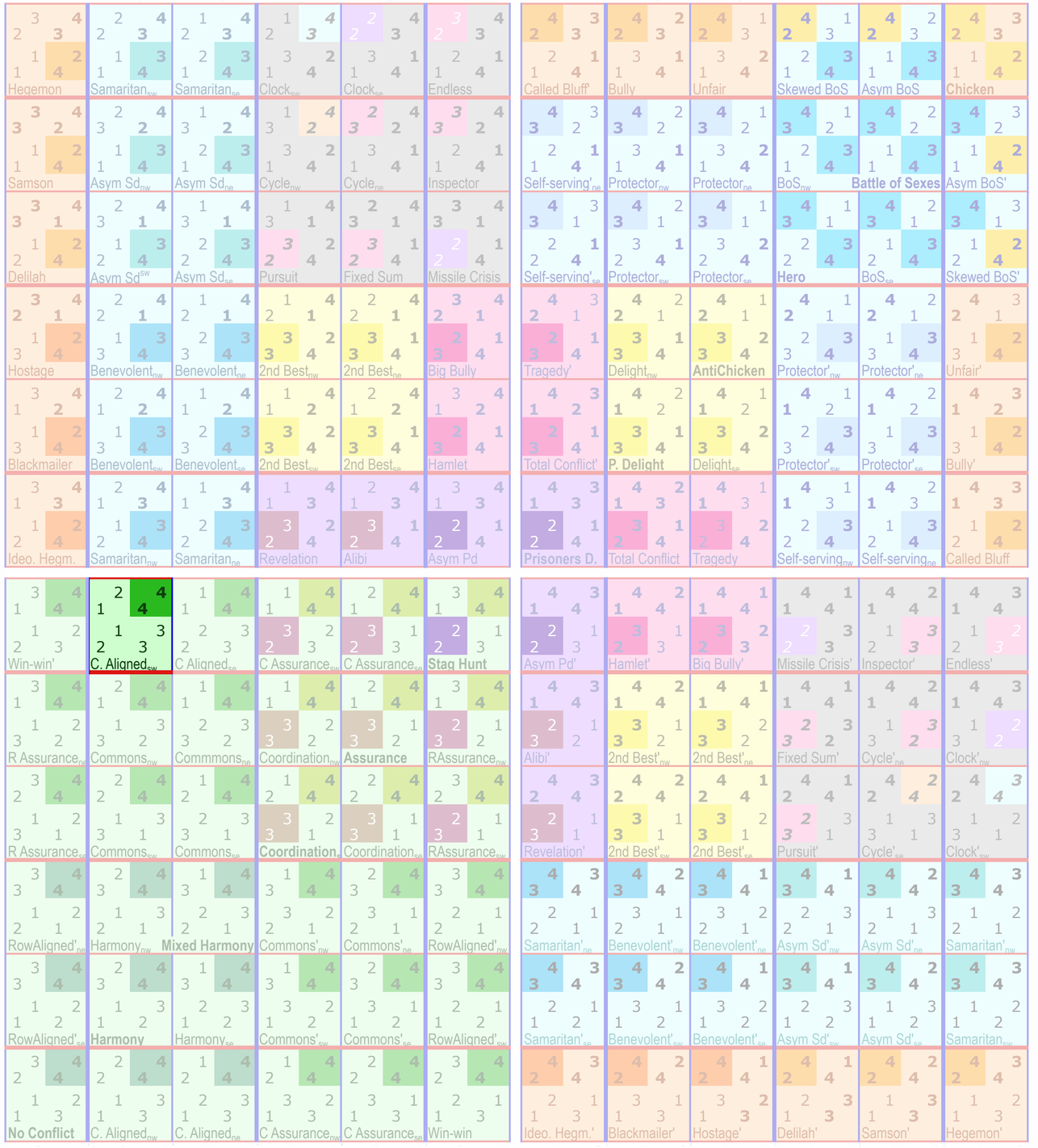
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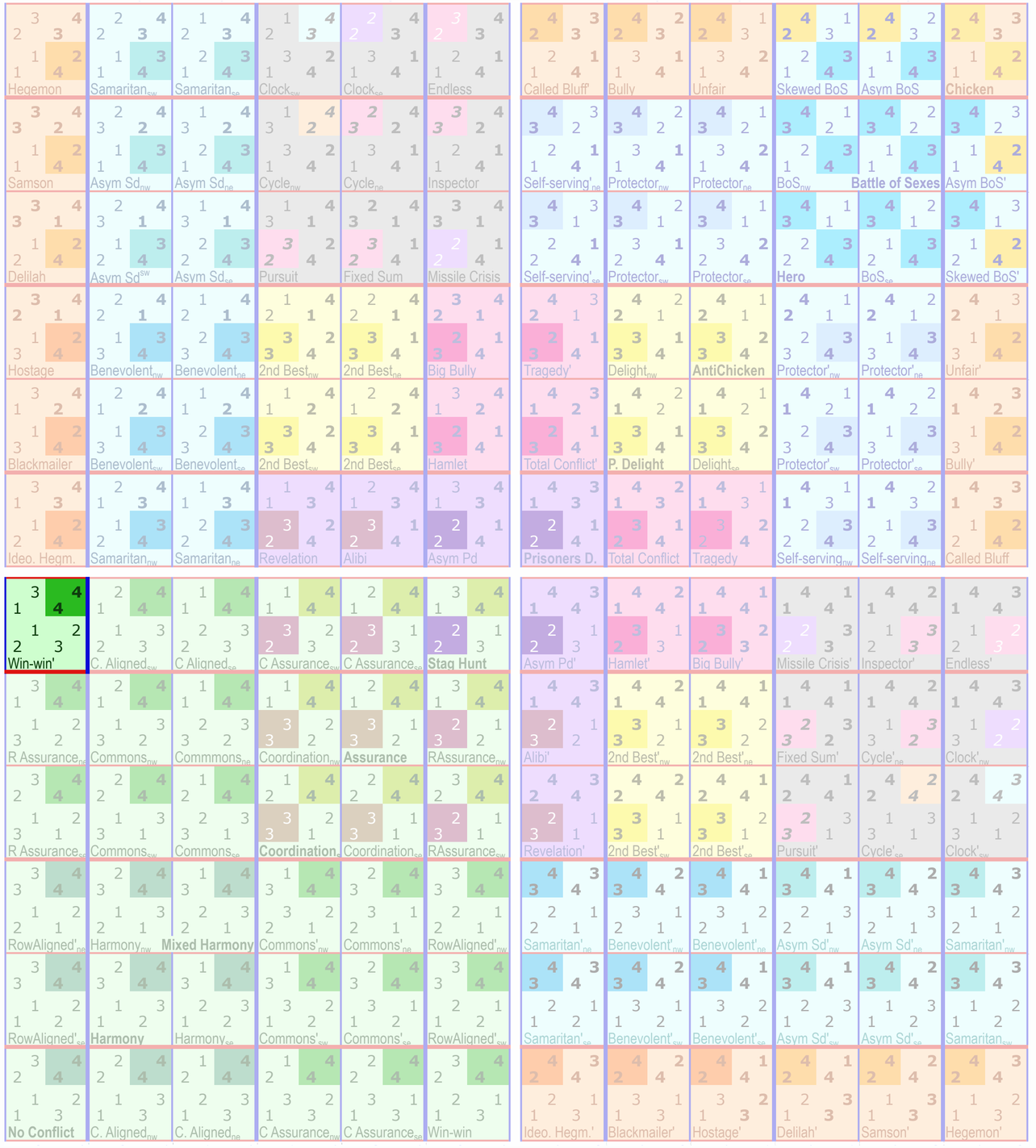
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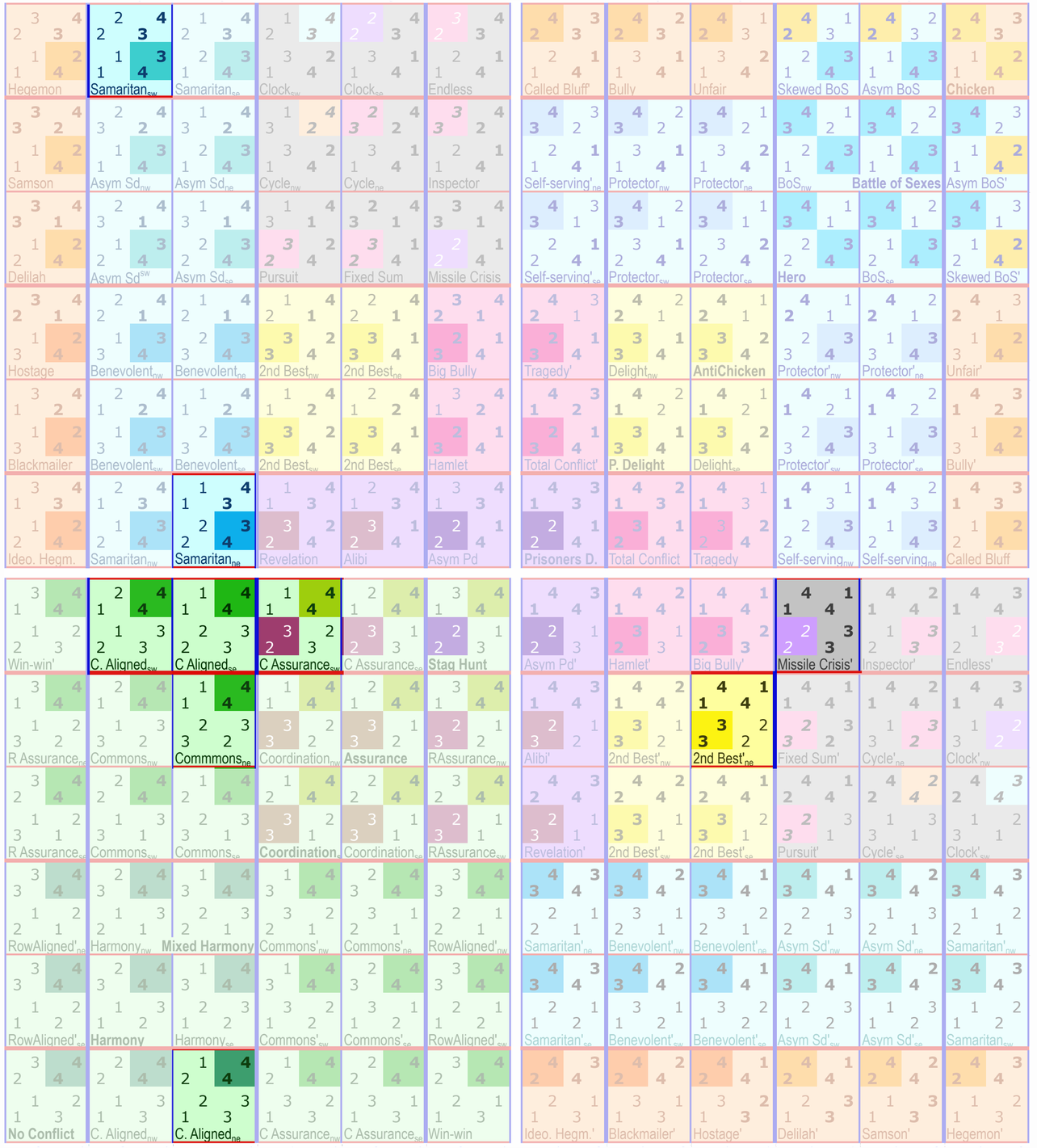
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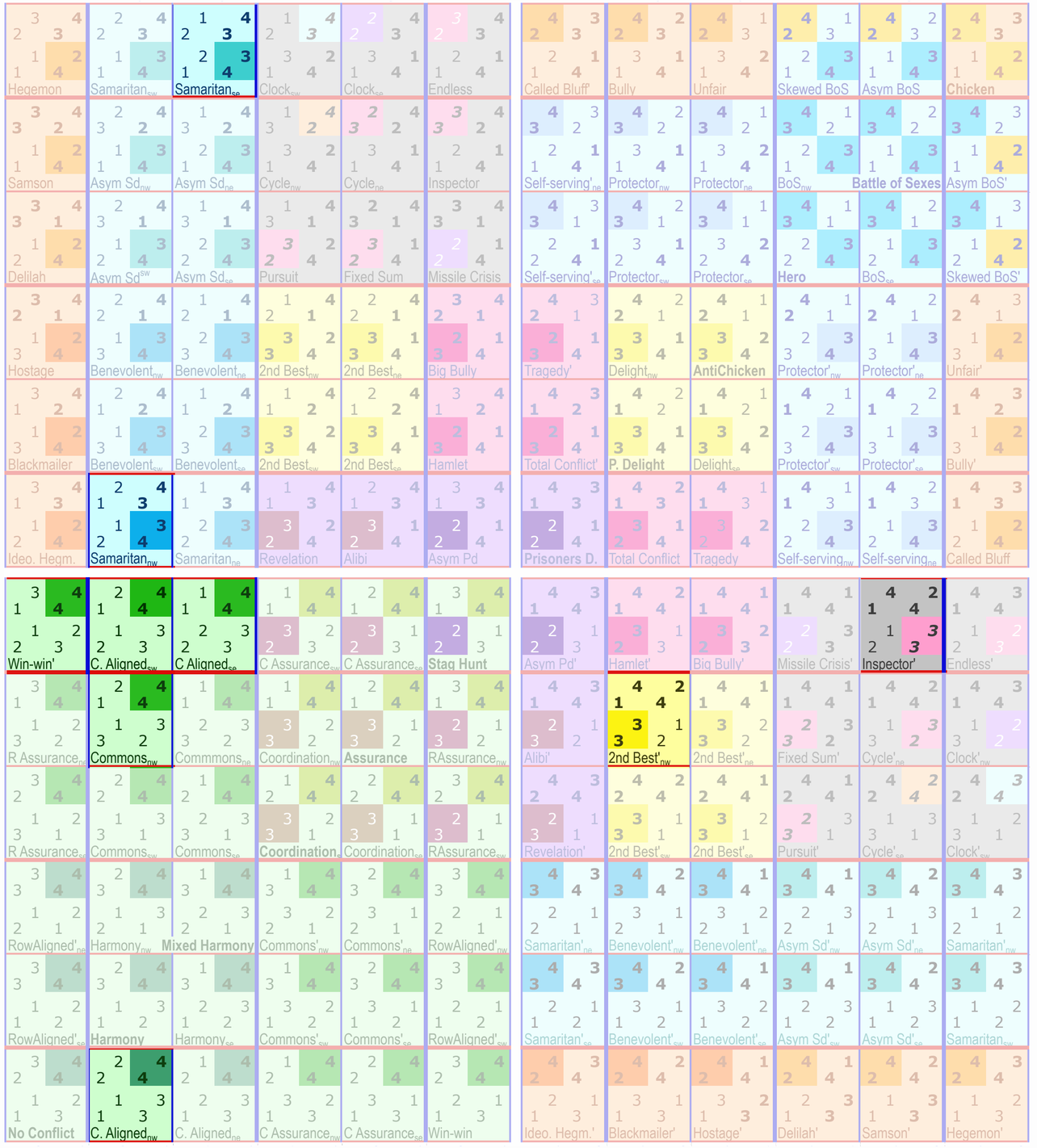
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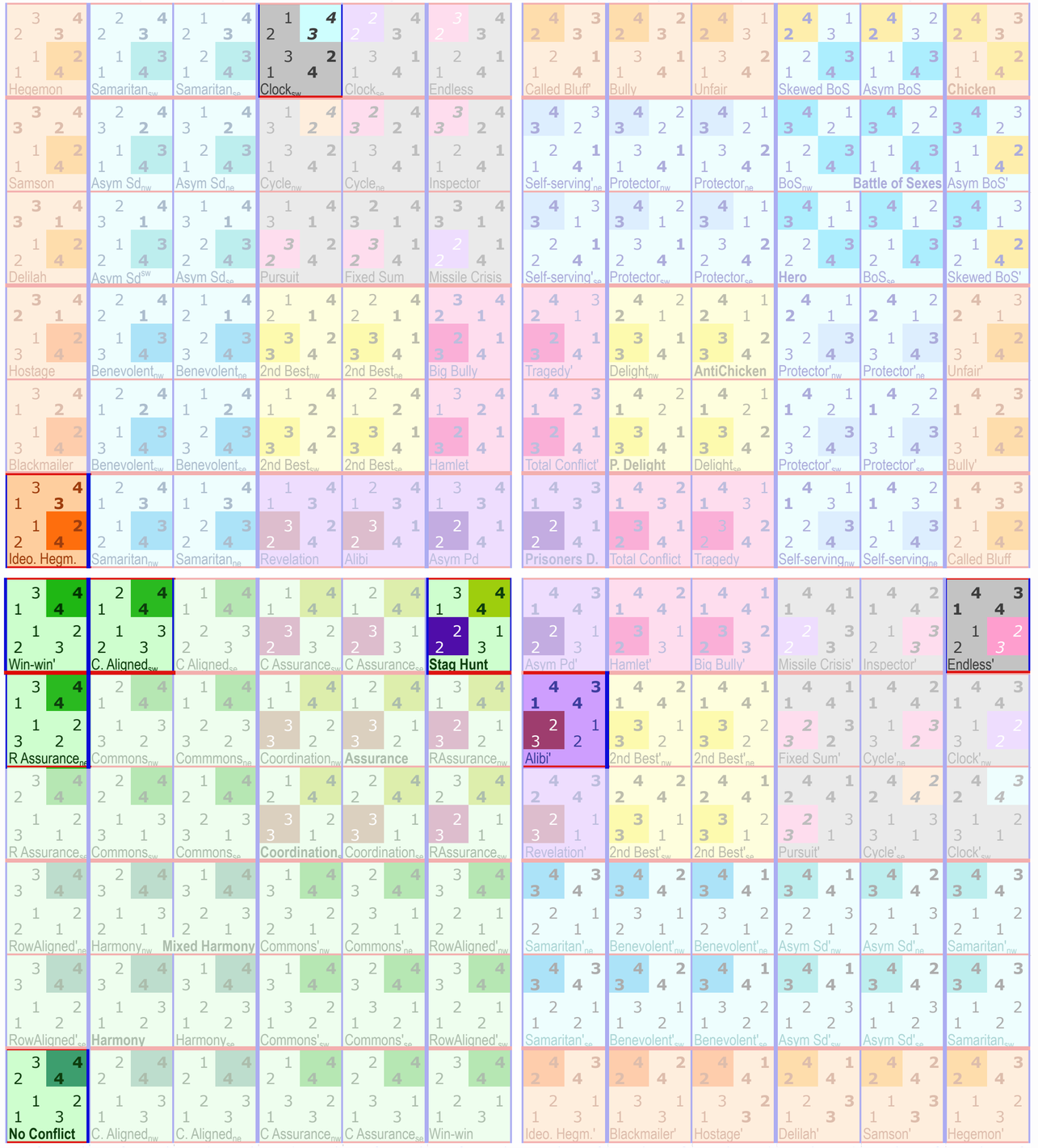
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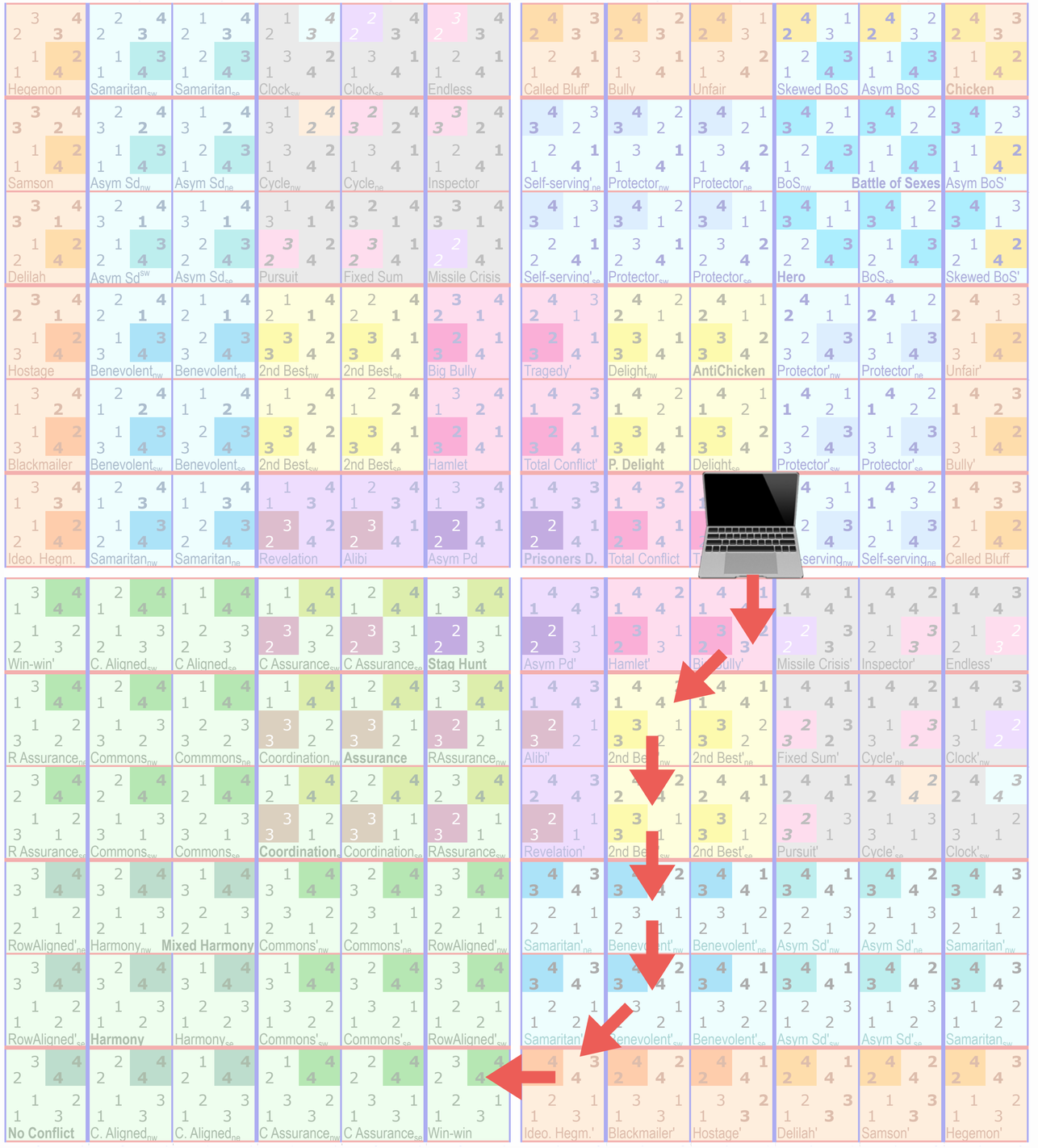
Hegemon'


Hegemon
Samaritan$_{sw}$
Samaritan$_{se}$
Clock$_{sw}$
Clock$_{se}$
Endless
Called Bluff'
Bully
Unfair
Skewed BoS
Asym BoS
Chicken
Samson
Asym Sd$_{nw}$
Asym Sd$_{ne}$
Cycle$_{nw}$
Cycle$_{ne}$
Inspector
Self-serving'$_{ne}$
Protector$_{nw}$
Protector$_{ne}$
BoS$_{nw}$
Battle of Sexes
Asym BoS'
Delilah
Asym Sd^{sw}
Asym Sd$_{se}$
Pursuit
Fixed Sum
Missile Crisis
Self-serving'$_{se}$
Protector$_{sw}$
Protector$_{se}$
Hero
BoS$_{se}$
Skewed BoS'
Hostage
Benevolent$_{nw}$
Benevolent$_{ne}$
2nd Best$_{nw}$
2nd Best$_{ne}$
Big Bully
Tragedy'
Delight$_{nw}$
AntiChicken
Protector'$_{nw}$
Protector'$_{ne}$
Unfair'
Blackmailer
Benevolent$_{sw}$
Benevolent$_{se}$
2nd Best$_{sw}$
2nd Best$_{se}$
Hamlet
Total Conflict'
P. Delight
Delight$_{se}$
Protector'$_{sw}$
Protector'$_{se}$
Bully'
Ideo. Hegm.
Samaritan$_{nw}$
Samaritan$_{ne}$
Revelation
Alibi
Asym Pd
Prisoners D.
Total Conflict
T
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Self-serving$_{ne}$
Called Bluff
Win-win'
C. Aligned$_{sw}$
C Aligned$_{se}$
C Assurance$_{sw}$
C Assurance$_{se}$
Stag Hunt
Asym Pd'
Hamlet'
Bully'
Missile Crisis'
Inspector'
Endless'
R Assurance$_{ne}$
Commons$_{nw}$
Commmons$_{ne}$
Coordination$_{nw}$
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RAssurance$_{nw}$
Alibi'
2nd Be$_{nw}$
2nd Best'$_{ne}$
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Cycle'$_{ne}$
Clock'$_{nw}$
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Commons$_{se}$
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Asym Sd'$_{sw}$
Asym Sd'$_{se}$
Samaritan$_{sw}$
No Conflict
C. Aligned$_{nw}$
C. Aligned$_{ne}$
C Assurance$_{nw}$
C Assurance$_{se}$
Win-win
Ideo. Hegm.'
Blackmailer'
Hostage'
Delilah'
Samson'
Hegemon'

Simple dynamic

Agent

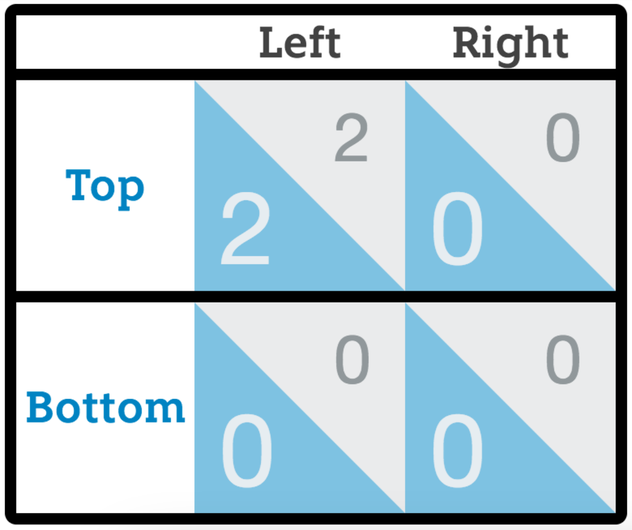
- Compares all neighbors of a game based on its **features** as an institution
- Chooses preferred neighbor
- Repeats
- Converges on the end-product of institutional evolution

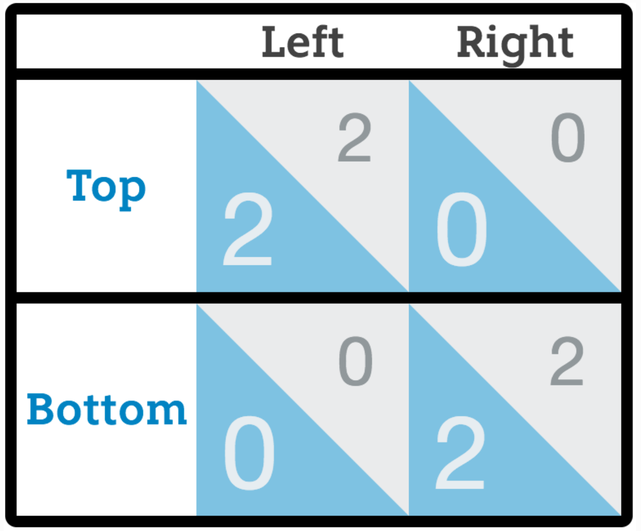
Feature: Efficiency

	Left	Right
Top	2 / 2	0 / 0
Bottom	0 / 0	0 / 0

	Left	Right
Top	3 / 3	0 / 0
Bottom	0 / 0	0 / 0

Feature: Stability





Feature: Predictability

	Left	Right
Top	2 / 2	0 / 0
Bottom	0 / 0	0 / 0

	Left	Right
Top	0 / 4	4 / 0
Bottom	4 / 0	0 / 4

Feature: Fairness

	Left	Right
Top	2 / 2	0 / 0
Bottom	0 / 0	0 / 0

	Left	Right
Top	3 / 2	0 / 0
Bottom	0 / 0	0 / 0

"Rational" within games **and between them**

Simple dynamic

Agent compares all neighbors of a game:

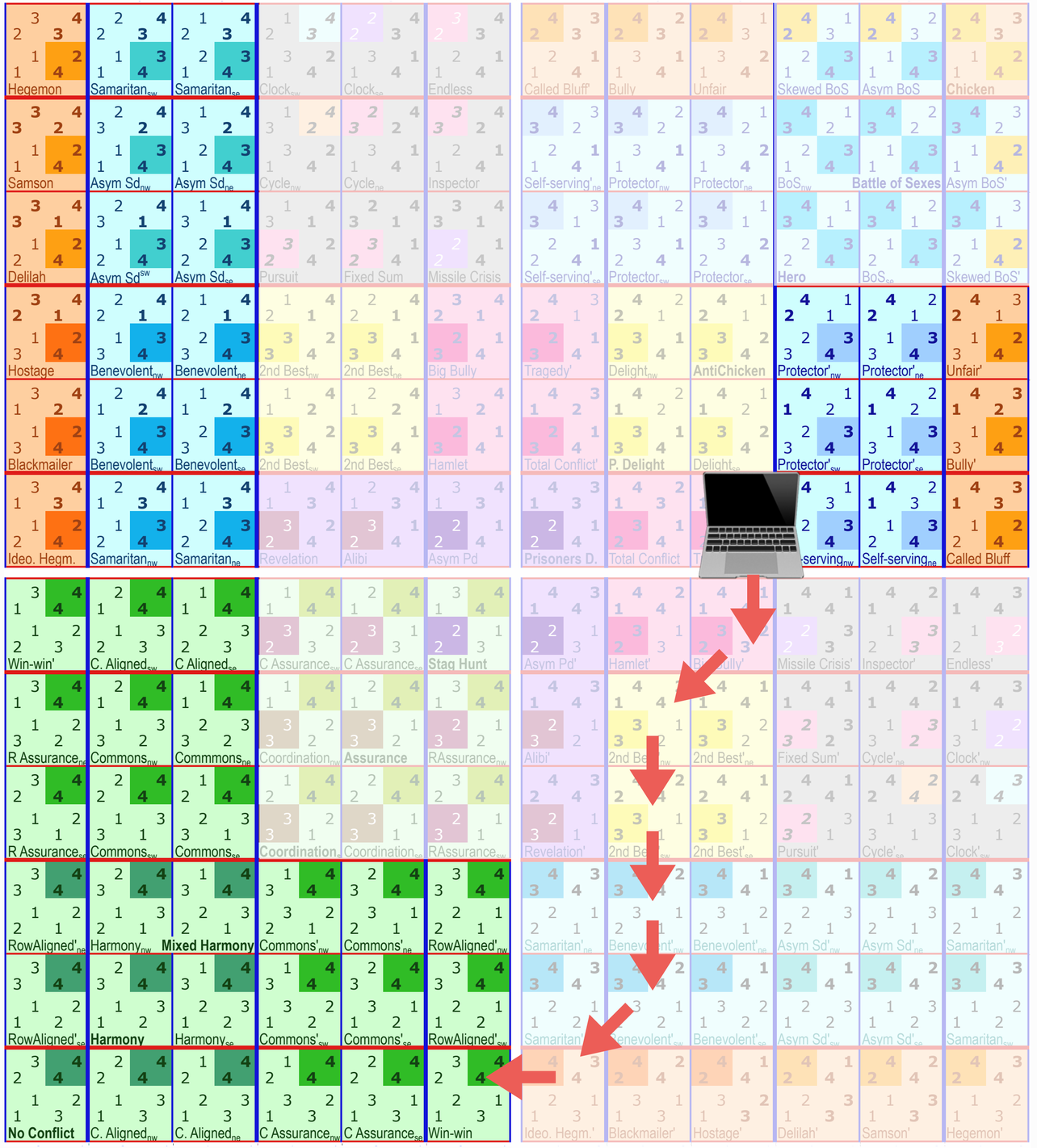
- **Stability**: *Prefer games with unique Nash equilibrium*
- **Predictability**: *Prefer pure Nash equilibrium*
- **Efficiency**: *Prefer games with most profitable equilibrium*
- ~~**Fair**: *Social preferences*~~

Hegemon	Samaritan$_{sw}$	Samaritan$_{se}$	Clock$_{sw}$	Clock$_{se}$	Endless
Samson	Asym Sd$_{nw}$	Asym Sd$_{ne}$	Cycle$_{nw}$	Cycle$_{ne}$	Inspector
Delilah	Asym Sd^{sw}	Asym Sd$_{se}$	Pursuit	Fixed Sum	Missile Crisis
Hostage	Benevolent$_{nw}$	Benevolent$_{ne}$	2nd Best$_{nw}$	2nd Best$_{ne}$	Big Bully
Blackmailer	Benevolent$_{sw}$	Benevolent$_{se}$	2nd Best$_{sw}$	2nd Best$_{se}$	Hamlet
Ideo. Hegm.	Samaritan$_{nw}$	Samaritan$_{ne}$	Revelation	Alibi	Asym Pd

Called Bluff'	Bully	Unfair	Skewed BoS	Asym BoS	**Chicken**
Self-serving'$_{ne}$	Protector$_{nw}$	Protector$_{ne}$	BoS$_{nw}$	**Battle of Sexes**	Asym BoS'
Self-serving'$_{se}$	Protector$_{sw}$	Protector$_{se}$	**Hero**	BoS$_{se}$	Skewed BoS'
Tragedy'	Delight$_{nw}$	**AntiChicken**	Protector'$_{nw}$	Protector'$_{ne}$	Unfair'
Total Conflict'	**P. Delight**	Delight$_{se}$	Protector'$_{sw}$	Protector'$_{se}$	Bully'
Prisoners D.	Total Conflict	T	-serving$_{nw}$	Self-serving$_{ne}$	Called Bluff

Win-win'	C. Aligned$_{sw}$	C Aligned$_{se}$	C Assurance$_{sw}$	C Assurance$_{se}$	**Stag Hunt**
R Assurance$_{ne}$	Commons$_{nw}$	Commmons$_{ne}$	Coordination$_{nw}$	**Assurance**	RAssurance$_{nw}$
R Assurance$_{se}$	Commons$_{sw}$	Commons$_{se}$	**Coordination$_{a}$**	Coordination$_{se}$	RAssurance$_{sw}$
RowAligned'$_{ne}$	Harmony$_{nw}$	**Mixed Harmony**	Commons'$_{nw}$	Commons'$_{ne}$	RowAligned'$_{nw}$
RowAligned'$_{se}$	**Harmony**	Harmony$_{se}$	Commons'$_{sw}$	Commons'$_{se}$	RowAligned'$_{sw}$
No Conflict	C. Aligned$_{nw}$	C. Aligned$_{ne}$	C Assurance$_{nw}$	C Assurance$_{se}$	Win-win

Asym Pd'	Hamlet'	Bi[illegible]ully'	Missile Crisis'	Inspector'	Endless'
Alibi'	2nd Be[illegible]$_{nw}$	2nd Best'$_{ne}$	Fixed Sum'	Cycle'$_{ne}$	Clock'$_{nw}$
Revelation'	2nd Be[illegible]$_{sw}$	2nd Best'$_{se}$	Pursuit'	Cycle'$_{se}$	Clock'$_{sw}$
Samaritan'$_{ne}$	Benevo[illegible]ent'$_{nw}$	Benevolent'$_{ne}$	Asym Sd'$_{nw}$	Asym Sd'$_{ne}$	Samaritan'$_{nw}$
Samaritan'	[illegible]enevolent'$_{sw}$	Benevolent'$_{se}$	Asym Sd'$_{sw}$	Asym Sd'$_{se}$	Samaritan$_{sw}$
Ideo. Hegm.'	Blackmailer'	Hostage'	Delilah'	Samson'	Hegemon'


Hegemon
Samaritan$_{nw}$
Samaritan$_{se}$
Clock$_{sw}$
Clock$_{se}$
Endless
Called Bluff'
Bully
Unfair
Skewed BoS
Asym BoS
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Samson
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Asym Sd$_{ne}$
Cycle$_{nw}$
Cycle$_{ne}$
Inspector
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Protector$_{nw}$
Protector$_{ne}$
BoS$_{nw}$
Battle of Sexes
Asym BoS'
Delilah
Asym Sd^{sw}
Asym Sd$_{se}$
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Protector$_{se}$
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Cycle'$_{ne}$
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No Conflict
C. Aligned$_{nw}$
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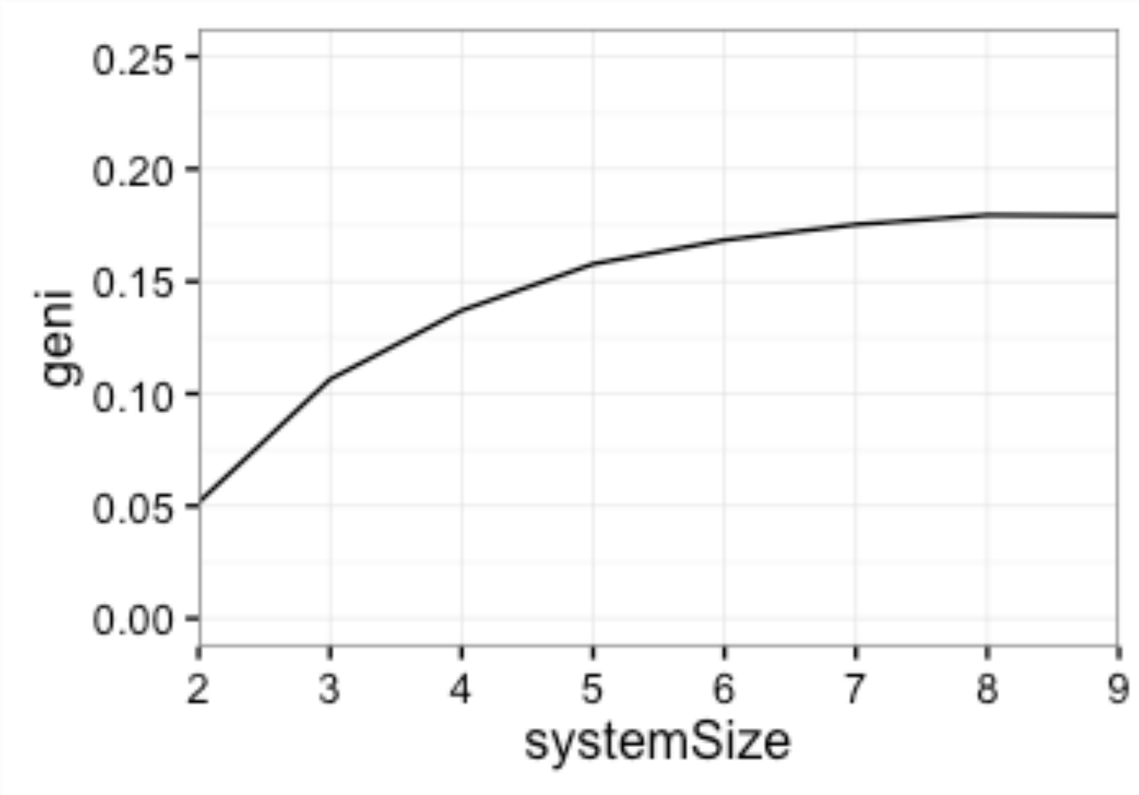
C Assurance$_{nw}$
C Assurance$_{se}$
Win-win
Ideo. Hegm.'
Blackmailer'
Hostage'
Delilah'
Samson'
Hegemon'

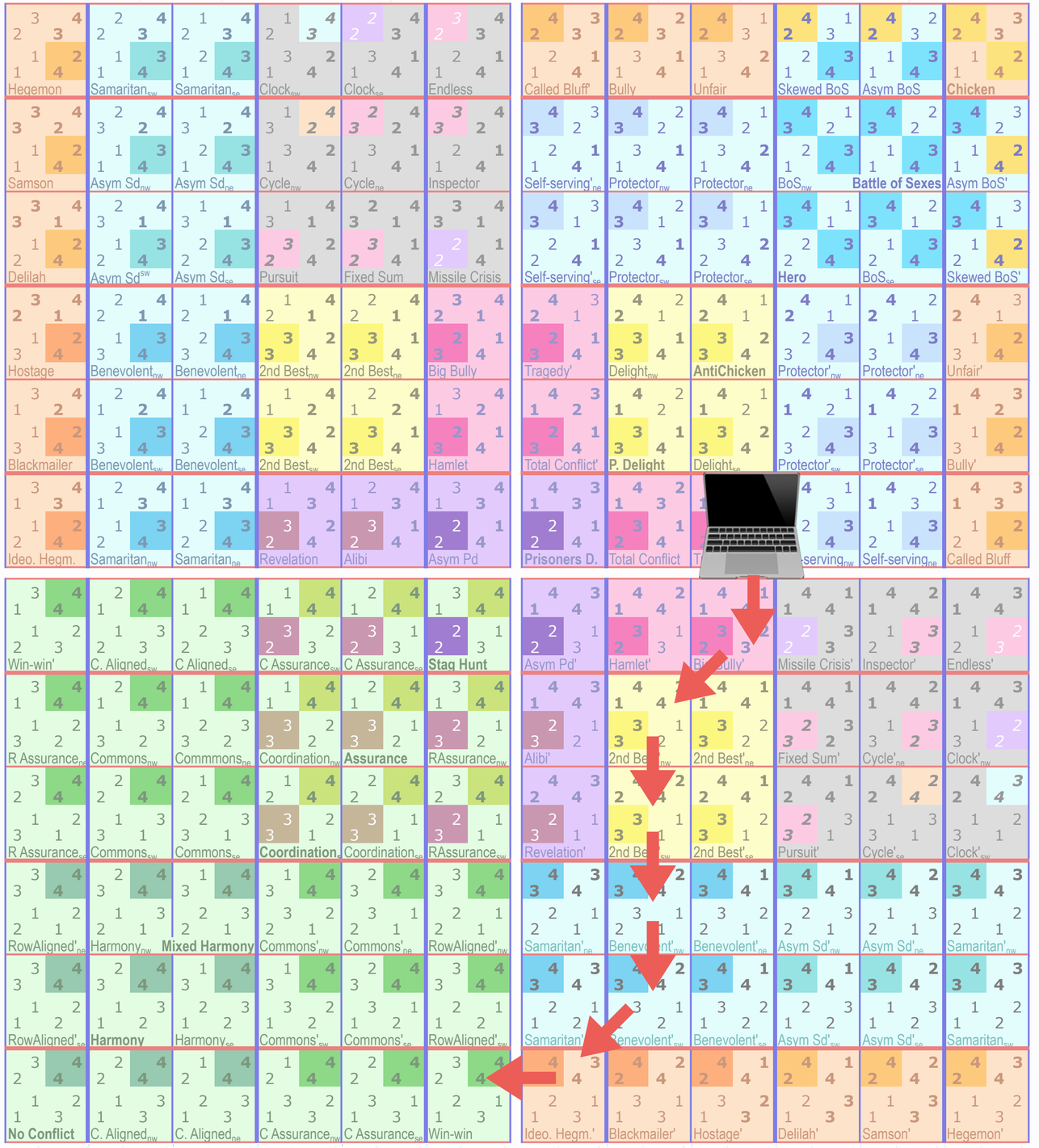
Results

- Half of attractors are win-win
- Despite no sense of fairness
  - … because of the nature of the space
- The attractors form a contiguous basin

Results

How does that scale?




Hegemon
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Samaritan$_{se}$
Clock$_{sw}$
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Protector$_{ne}$
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Asym BoS'
Delilah
Asym Sd^{sw}
Asym Sd$_{se}$
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Fixed Sum
Missile Crisis
Self-serving'$_{se}$
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Protector$_{se}$
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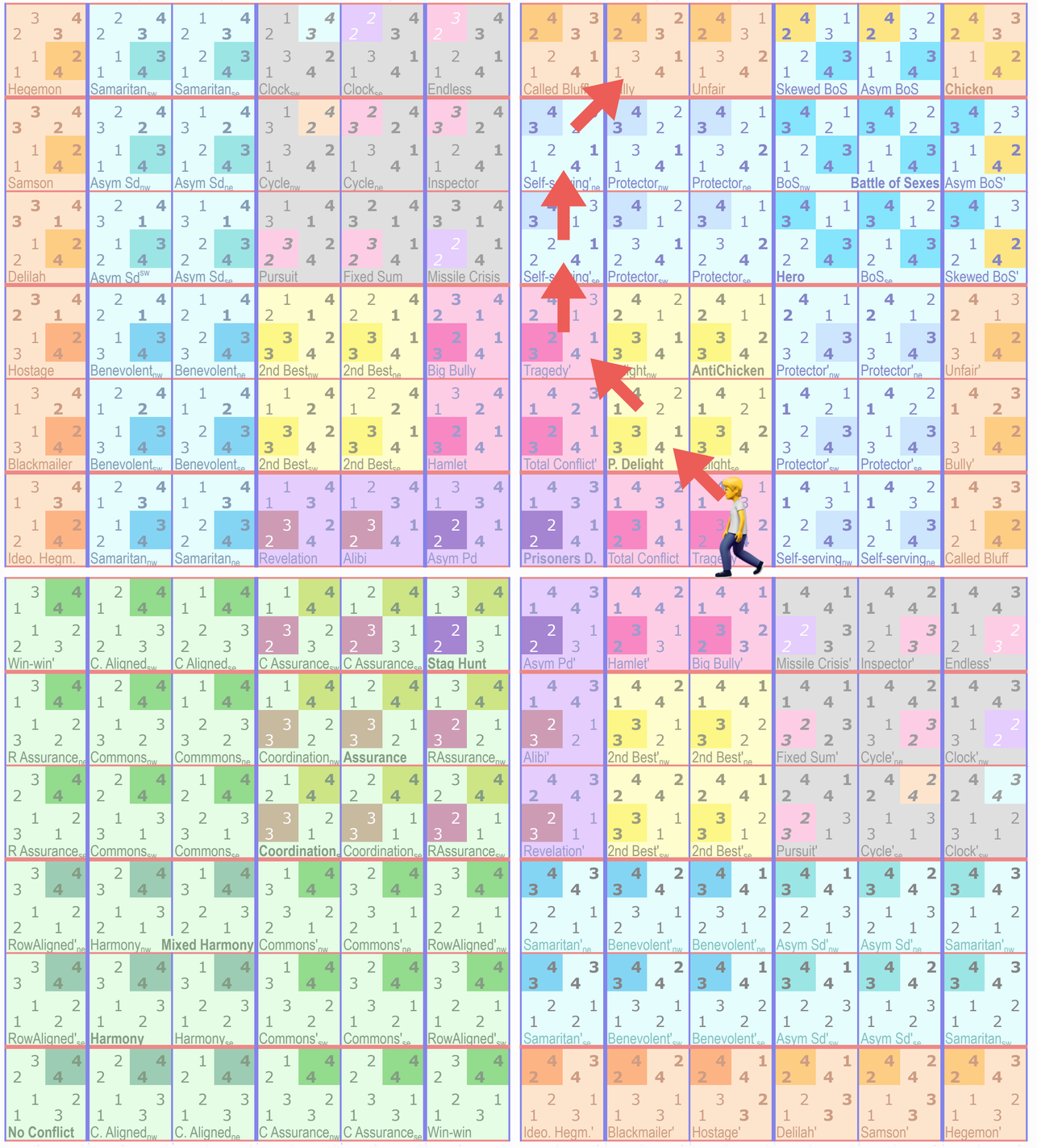
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C Assurance$_{se}$
Win-win
Ideo. Hegm.'
Blackmailer'
Hostage'
Delilah'
Samson'
Hegemon'

HIRING !!!

email
sethfrey@ucdavis.edu
and
kj338@cornell.edu

https://
psynet.dev

Question

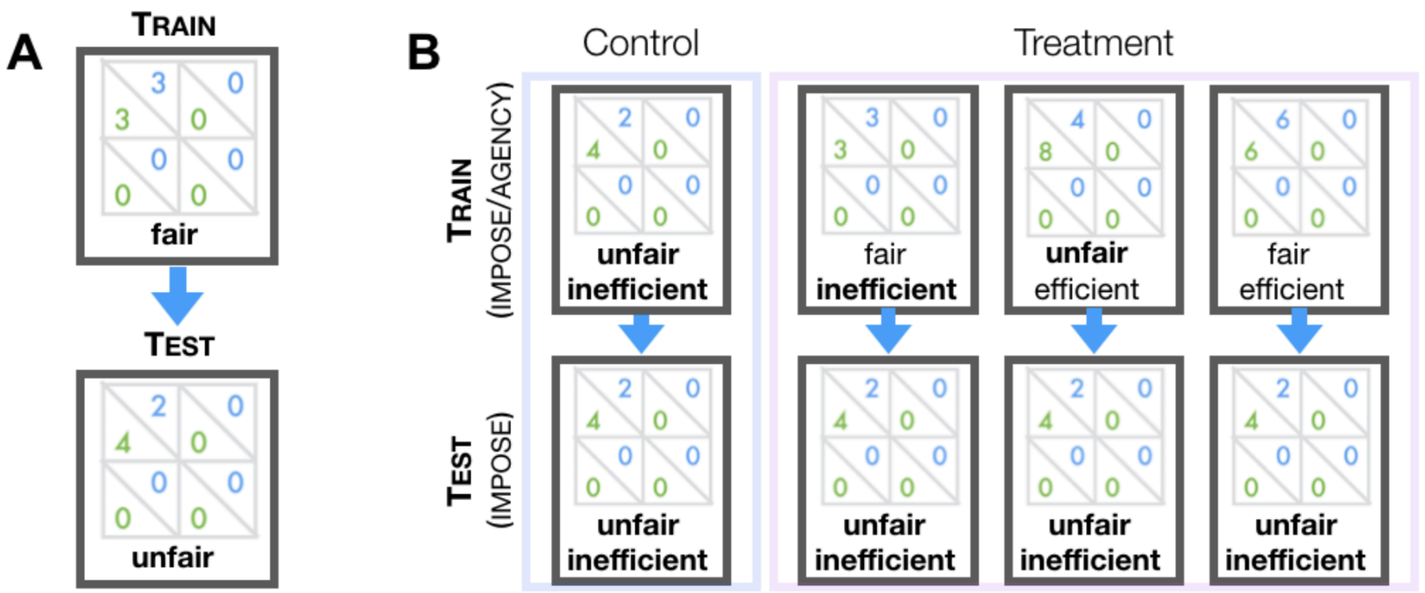
- What features do actual human beings favor in selecting between institutions?

Prediction

- In *Natural Justice* (2005), Ken Binmore distinguishes """"
  ... three levels of priority made necessary by an evolutionary approach to social contract theory. The three levels of priority are
  - *Stability*
  - *Efficiency*
  - *Fairness*

  """"(p.5)

Design


A
TRAIN
3 0
3 0
0 0
0 0
fair
TEST
2 0
4 0
0 0
0 0
unfair
B
Control
Treatment
TRAIN
(IMPOSE/AGENCY)
TEST
(IMPOSE)
2 0
4 0
0 0
0 0
unfair
inefficient
3 0
3 0
0 0
0 0
fair
inefficient
4 0
8 0
0 0
0 0
unfair
efficient
6 0
6 0
0 0
0 0
fair
efficient
unfair
inefficient
unfair
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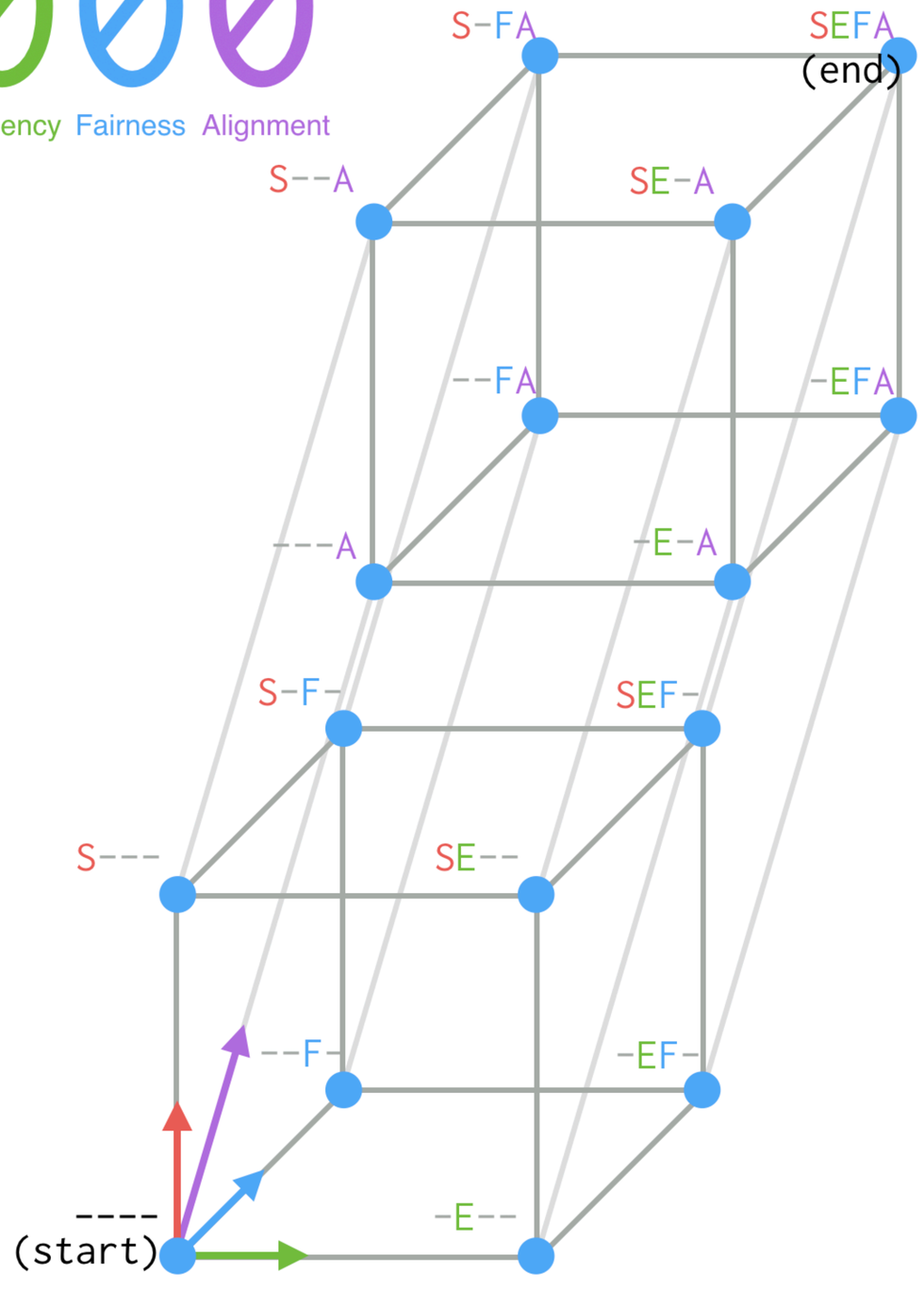
unfair
inefficient
unfair
inefficient

The space

S-FA	3 3 0 0 0 0 0 0	SEFA	6 6 0 0 0 0 0 0
S-F-	3 3 6 0 0 6 0 0	SEF-	6 6 12 0 0 12 0 0
SE-A	4 8 0 0 0 0 0 0	-EFA	6 6 0 0 0 0 6 6
SE--	4 8 12 0 0 12 0 0	-EF-	4 8 0 0 0 0 8 4
S--A	2 4 0 0 0 0 0 0	--FA	3 3 0 0 0 0 3 3
S---	2 4 6 0 0 6 0 0	--F-	2 4 0 0 0 0 4 2
---A	2 4 0 0 0 0 2 4	-E-A	4 8 0 0 0 0 4 8
----	2 4 0 0 0 0 1 5	-E--	4 8 0 0 0 0 2 10

0 0 0 0

Stability Efficiency Fairness Alignment

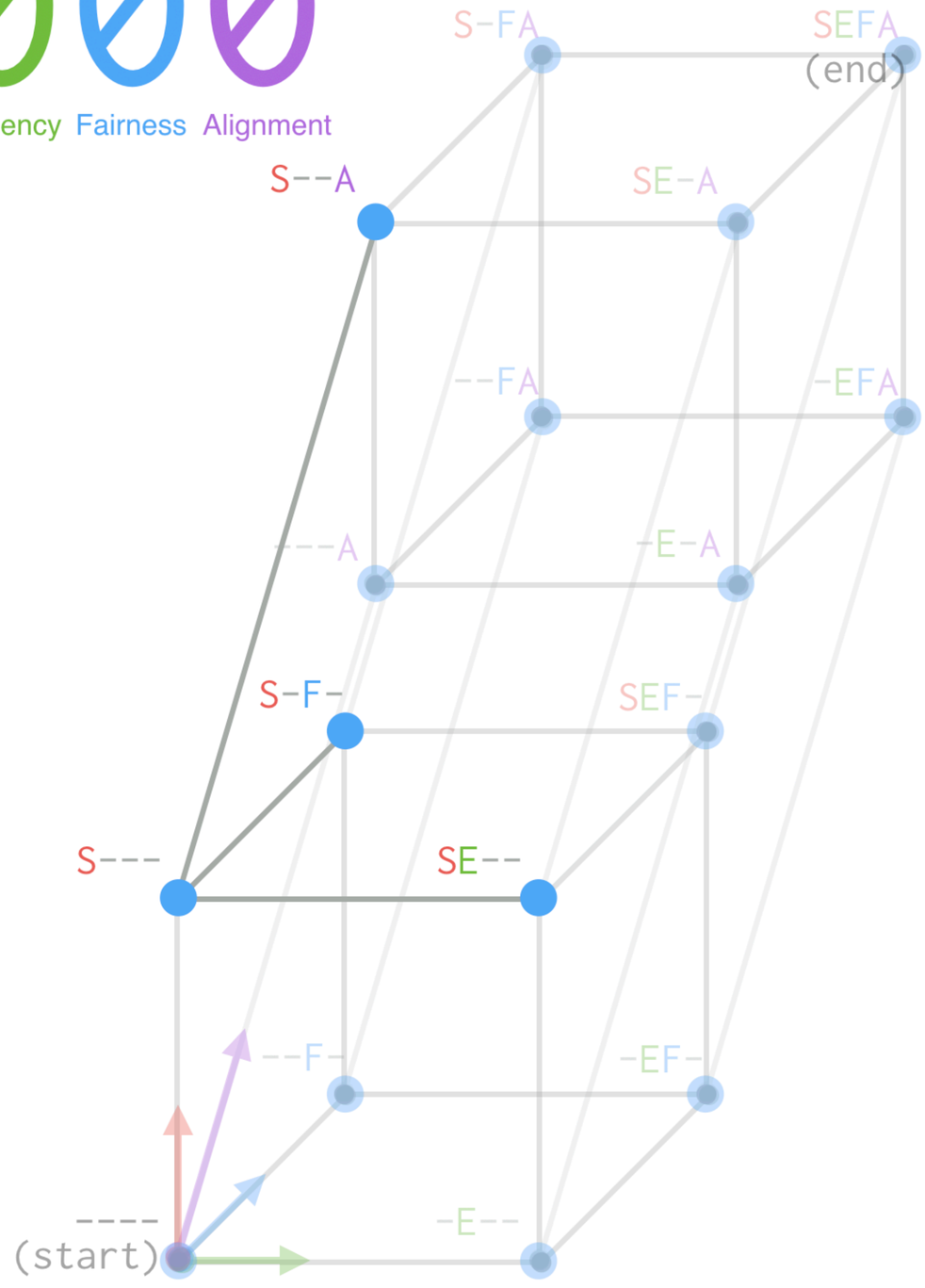


The space

S-FA	3 3 / 0 0 / 0 0	0 0 / 0 0 / 0 0
SEFA	6 6 / 0 0 / 0 0	0 0 / 0 0 / 0 0
S-F-	3 3 / 6 0 / 0 6	0 0 / 0 0 / 0 0
SEF-	6 6 / 12 0 / 0 12	0 0 / 0 0 / 0 0
SE-A	4 8 / 0 0 / 0 0	0 0 / 0 0 / 0 0
-EFA	6 6 / 0 0 / 0 0	0 6 / 0 0 / 6 0
SE--	4 8 / 12 0 / 0 12	0 0 / 0 0 / 0 0
-EF-	4 8 / 0 0 / 0 0	0 8 / 0 4 / 0 0
S--A	2 4 / 0 0 / 0 0	0 0 / 0 0 / 0 0
--FA	3 3 / 0 0 / 0 0	0 3 / 0 3 / 0 0
S---	2 4 / 6 0 / 0 6	0 0 / 0 0 / 0 0
--F-	2 4 / 0 0 / 0 0	0 4 / 0 2 / 0 0
---A	2 4 / 0 0 / 0 0	0 2 / 0 4 / 0 0
-E-A	4 8 / 0 0 / 0 0	0 4 / 0 8 / 0 0
----	2 4 / 0 0 / 0 0	0 1 / 0 5 / 0 0
-E--	4 8 / 0 0 / 0 0	0 2 / 0 10 / 0 0

0 0 0 0

Stability Efficiency Fairness Alignment



S---

2 / 4	6 / 0
0 / 6	0 / 0

S-F-

3 / 3	6 / 0
0 / 6	0 / 0

SE--

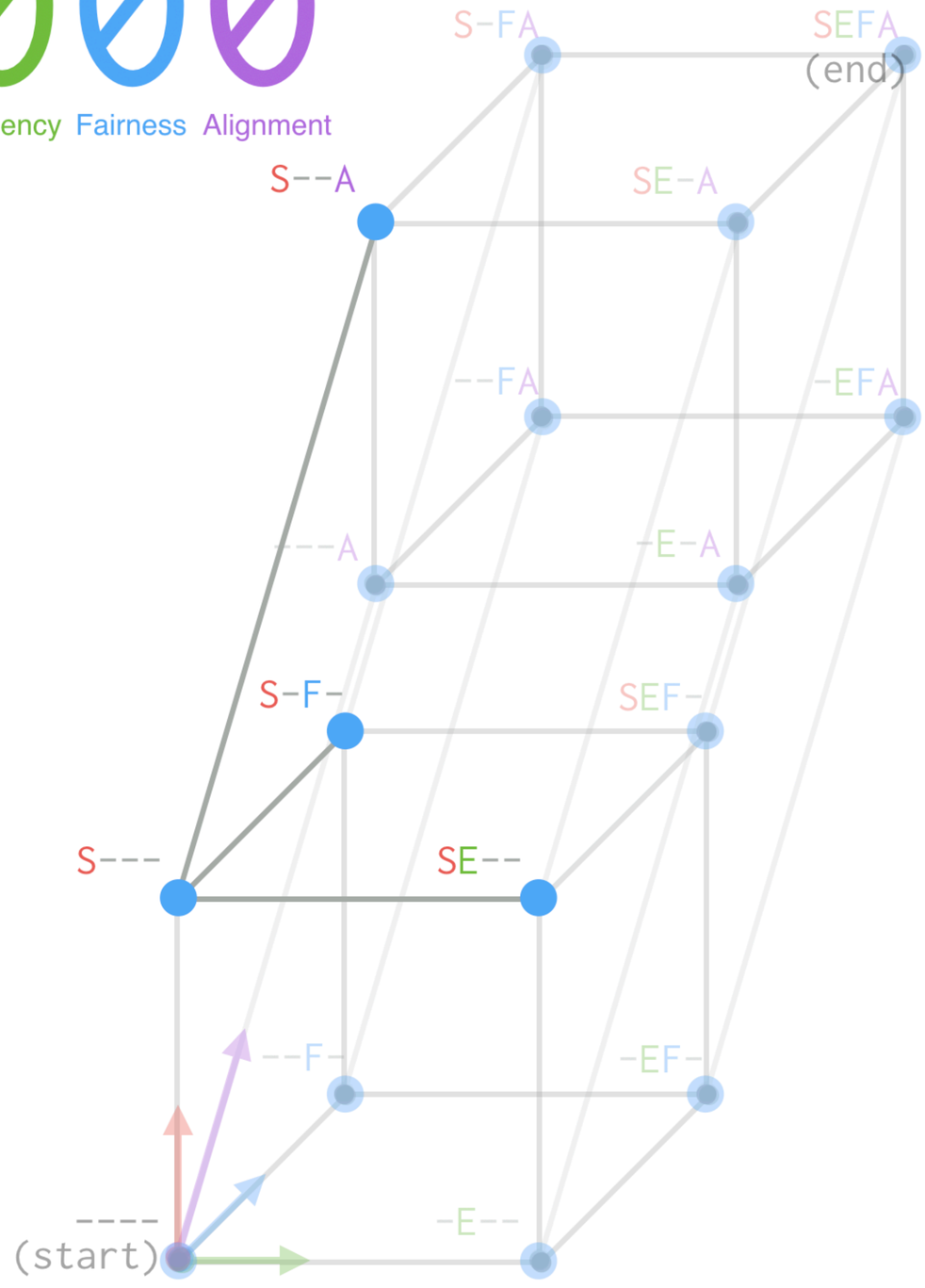
4 / 8	12 / 0
0 / 12	0 / 0

S--A

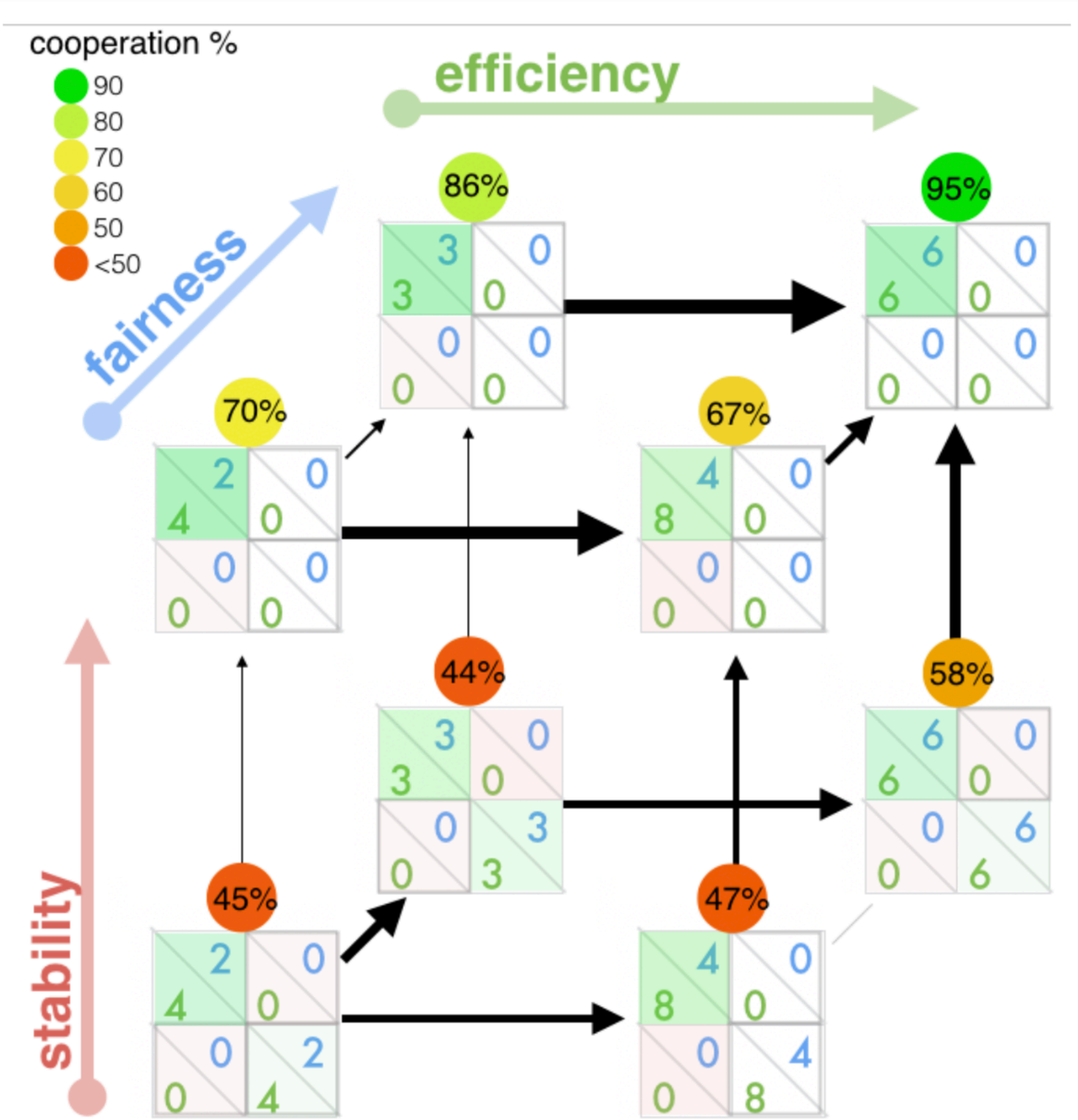
2 / 4	0 / 0
0 / 0	0 / 0

0000

Stability Efficiency Fairness Alignment



Preliminary results



Directions

- **Among** self-governing institutions, how should governance style change with the size?
- **How** do we model the effects of individuals on the cultural evolution of institutions?
- **What** do people look for when they browse for social systems for participate in?

Example motivation: **Institutional layering**

- Institutions grow by incremental accretion
  - Deletions are rare
  - "Edits" are rare
  - Big changes are rare
- This "algorithm" will find optimal rule configurations if rules don't interact
- Our evidence for interactions suggests that layering is vulnerable to local minima

Takeaway

Understanding institutional change as a dynamic ***over*** systems offers a powerful, general, and empirically testable framework for the study of cultural evolution.

Composing games into complex institutions

Seth Frey
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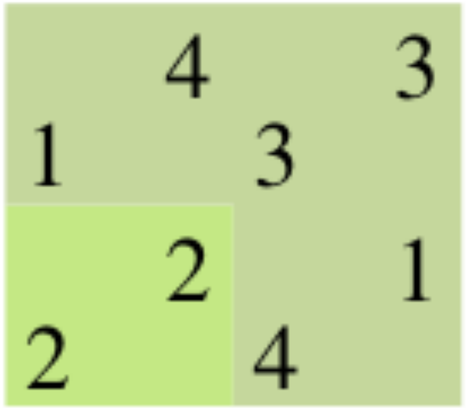
with
Jules Hedges, Strathclyde University
Joshua Tan, Oxford University
Philipp Zahn, 20Squares

Frey, S., Hedges, J., Tan, J., Zahn, P. (2023) "Composing games into complex institutions" PLOS ONE https://doi.org/j3vs

CAD for governance

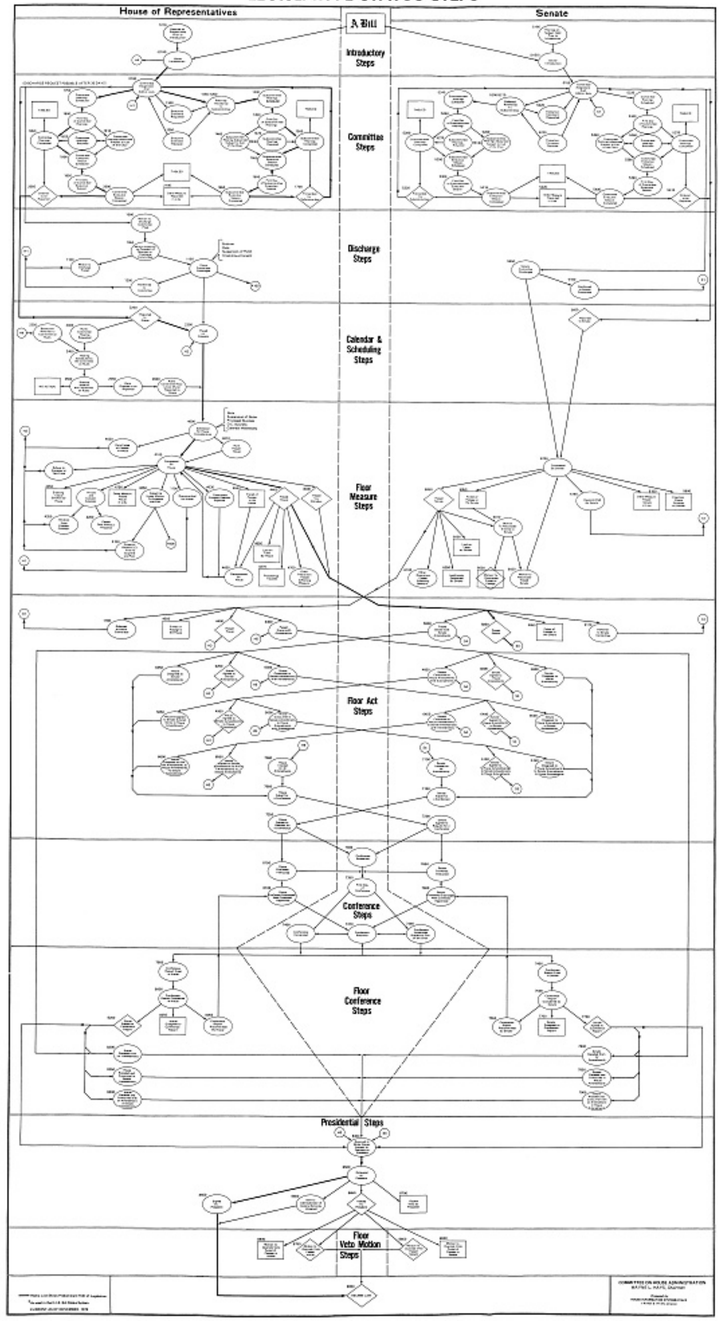
- We can't yet formally represent real-world institutional complexity.
- We need it.
- Existing options fall short, including game theory.
- *What does an extended game theory look like?*



Prisoner's Dilemma

U. S. Congress

LEGISLATIVE STATUS STEPS*



Frey, S., Hedges, J., Tan, J., Zahn, P. "Composing games into complex institutions" https://arxiv.org/abs/2108.05318

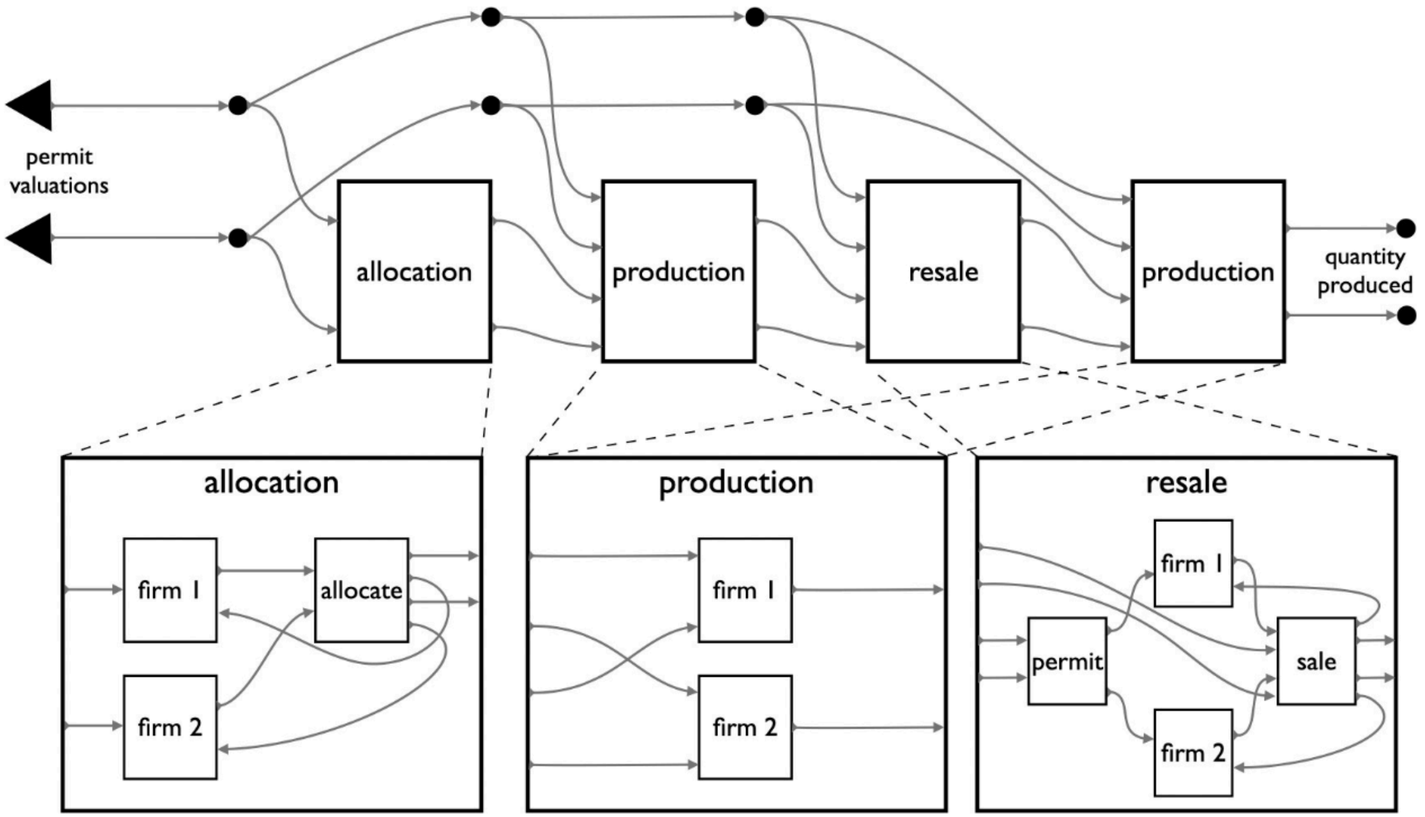
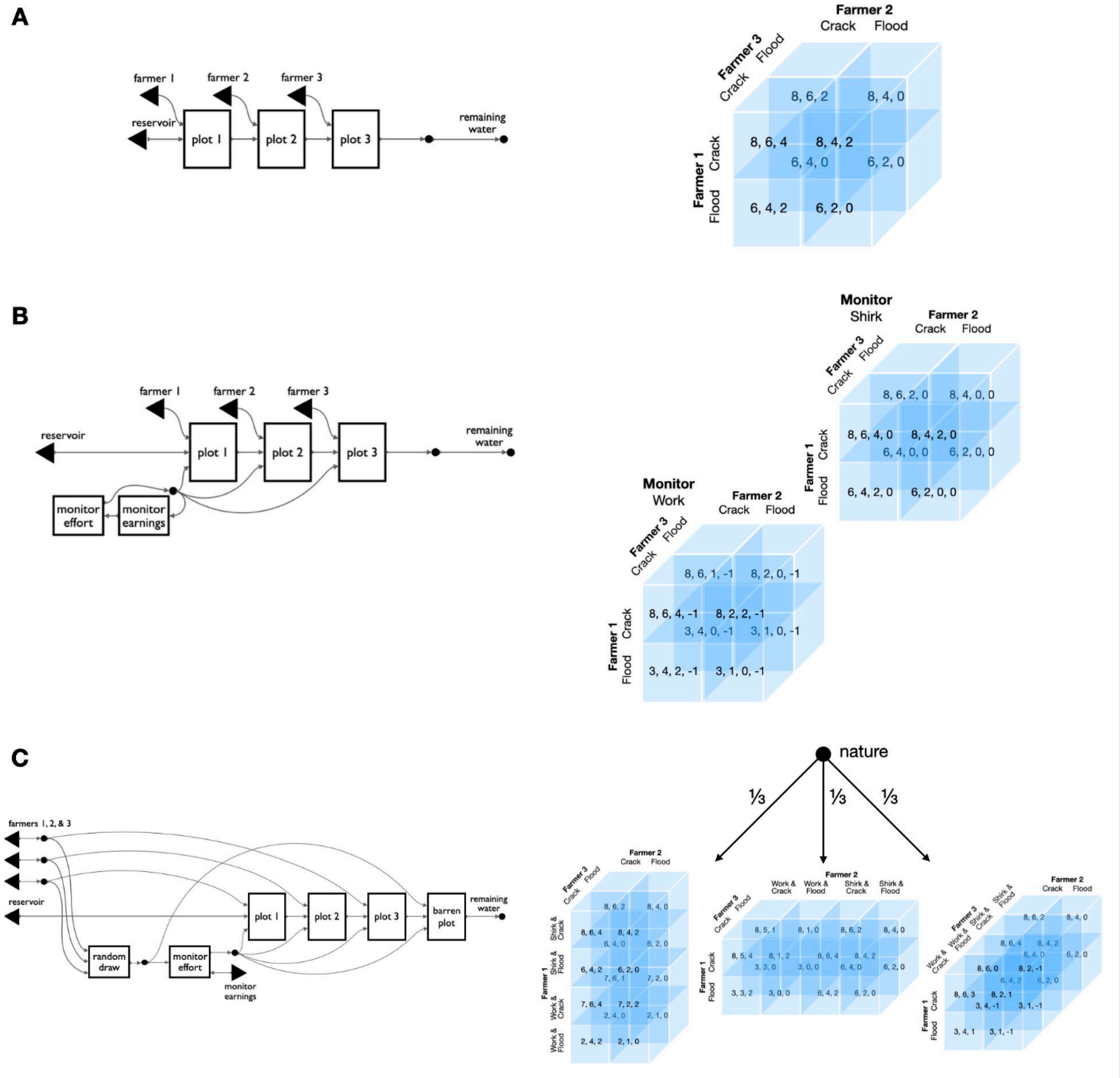


Fig 3. A four stage CO_2 market game. This multi-stage game proceeds through an initial allocation stage, a production stage, a resale stage, and a second production stage. The first models the primary allocation of CO_2 certificates to producers. Producers who received permits then decide how to use them in production. Afterwards, they either have unused permits left or are seeking further permits, and so participate in a resale market that is then followed by a final production phase. Producers operate under incomplete information: they do not know how highly others value their permits. With each stage represented as modules, stages like the production stage can be reused. The explicitly typed incoming (large left-pointing triangles) and outgoing arrows (terminating in circular nodes that represent the game's composability) make this complex of open games itself a game that could be opened and embedded within a larger game.

Frey, S., Hedges, J., Tan, J., Zahn, P. "Composing games into complex institutions" https://arxiv.org/abs/2108.05318



Projects

Minecraft — **What governance systems do communities design for themselves and what works** *with Bob Sumner*

Minecraft — Is governance change due to selection or drift? *with Qiankun Zhong and Martin Hilbert*

Apache Software Foundation — "Do we run how we say we run" *with Mahasweta Chakraborti*

12 platforms — What are the varieties of polycentricity? *with Shagun Jhaver and Amy Zhang*

Model and experiments — **Institutional preferences** *with Ofer, Nori, Dalton, and Qiankun Zhong*

ABM — The psychological mechanisms of the tragedy of the commons *with Christopher Frantz*

Formal framework — **Composing games into complex institutions** *with Hedges, Tan, Zahn*

Toolkit — NLP4GOV *with Mahasweta Chakraborti*

WITH ONLINE COMMUNITIES COMPUTATIONAL SOCIAL SCIENTISTS CAN TEST GENERAL PRINCIPLES OF INSTITUTION DESIGN AND PERFORMANCE

Institutional Grammar Research Initiative

https://institutionalgrammar.org/
https://cisl.info

Rice D, Siddiki S, Frey S, Kwon HK, Sawyer A. Machine coding of policy texts with the Institutional Grammar. Public Admin. 2020;1–15. https://doi.org/ghzpst

Chakraborti, M., Bonagiri, S. A., Virgüez-Ruiz, S., & Frey, S. (2024, May). NLP4Gov: A Comprehensive Library for Computational Policy Analysis. In Extended Abstracts of the CHI Conference on Human Factors in Computing Systems (pp. 1-8). https://doi.org/mxqb

The Metagovernance Project

https://metagov.org/

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Frey, S., Hedges, J., Tan, J., Zahn, P. "Composing games into complex institutions" https://arxiv.org/abs/2108.05318

Thank you

Online communities as model systems for commons governance

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