Queen Mary University of London

EPSRC Engineering and Physical Sciences Research Council

University of Glasgow

Understanding the Internet evolution by mining standardisation organisations

Coseners 2023

Ignacio Castro

Why should you care about standards?

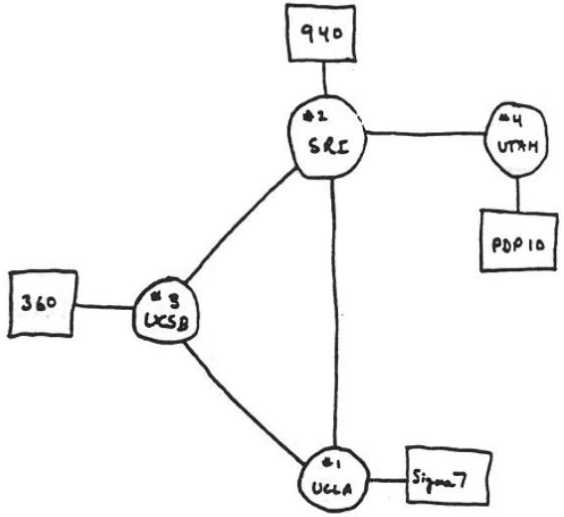
Power the Internet

Social network (of Internet stakeholders)

Internet measurements

Large longitudinal dataset

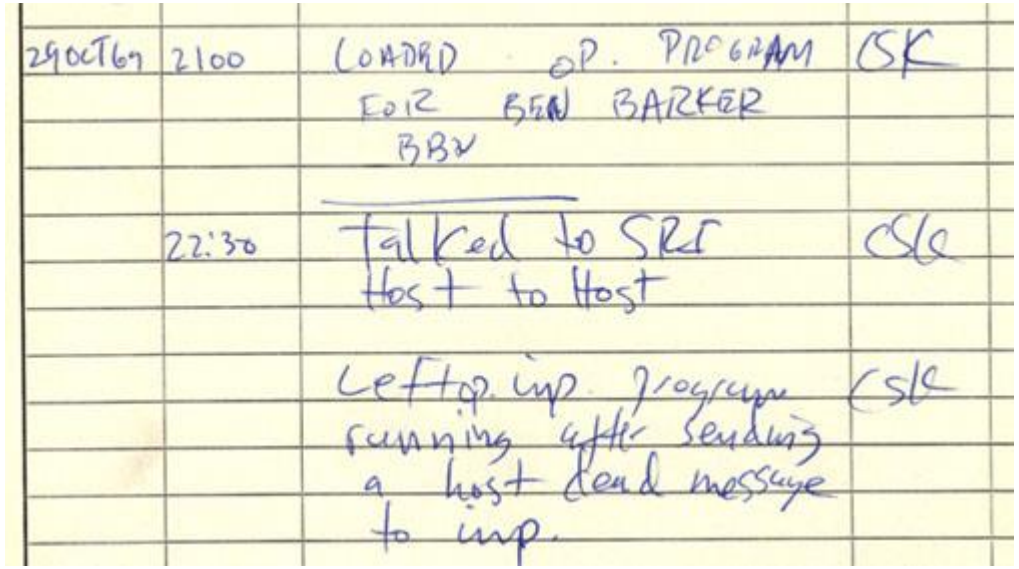
1969: a packet was sent for first time



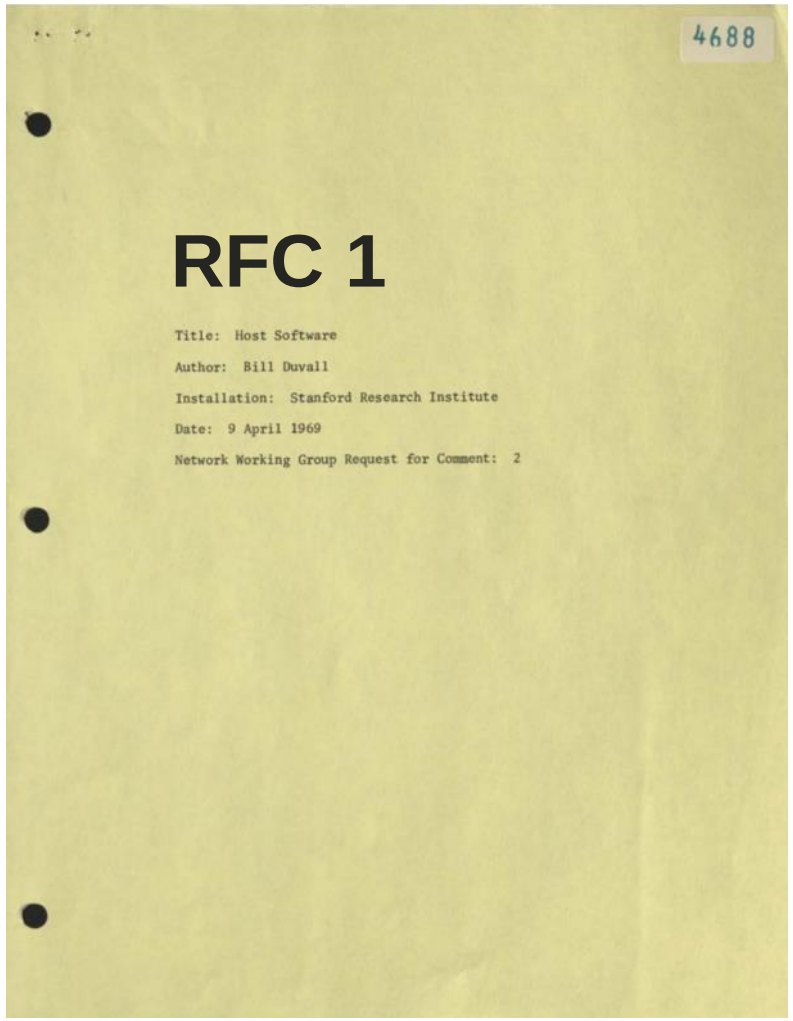
THE ARPA NETWORK

DEC 1969

4 NODES



Before the first packet was sent…

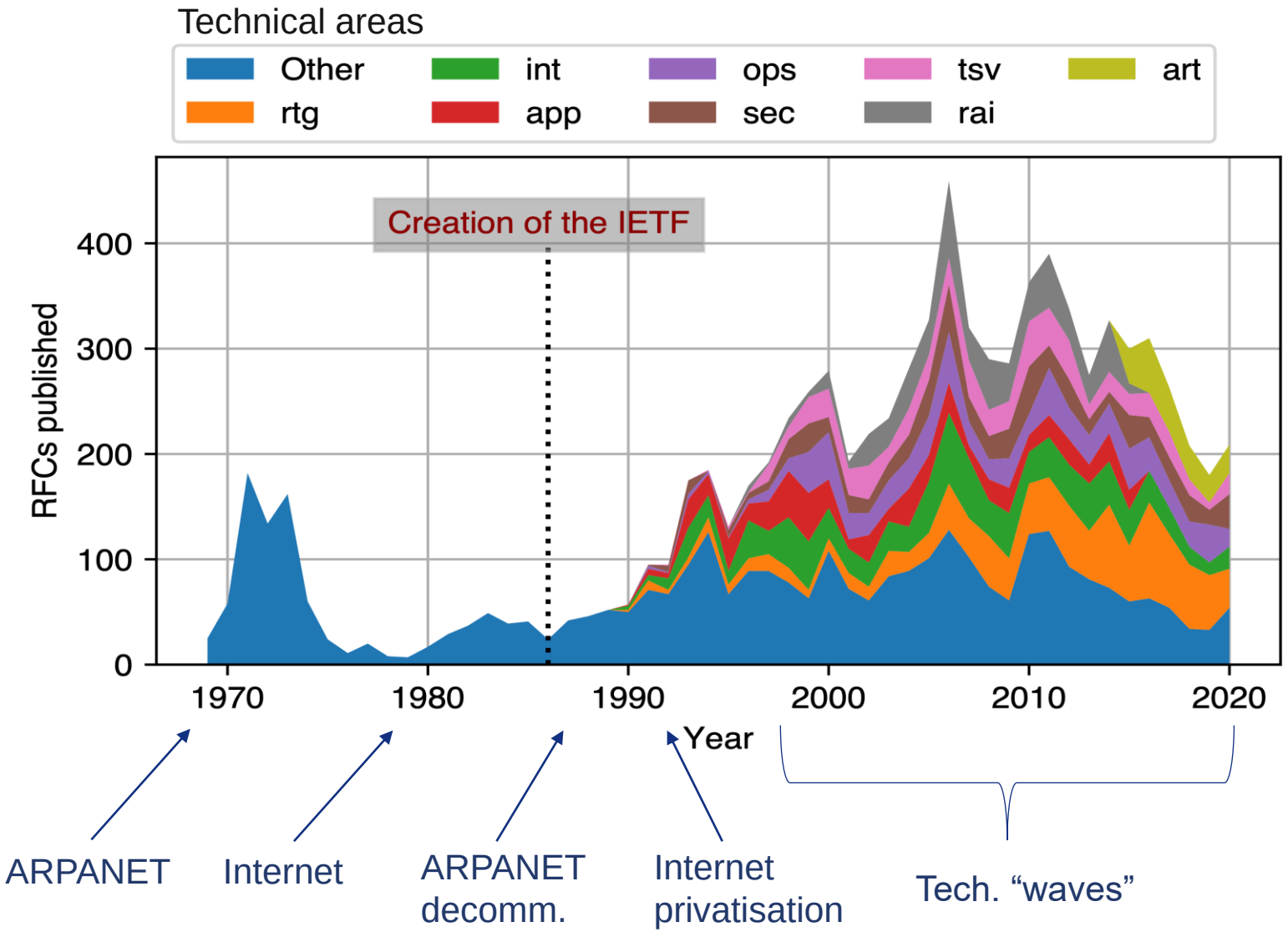


Interoperability: how can different computer systems communicate?

Coordination was required to enable interoperability

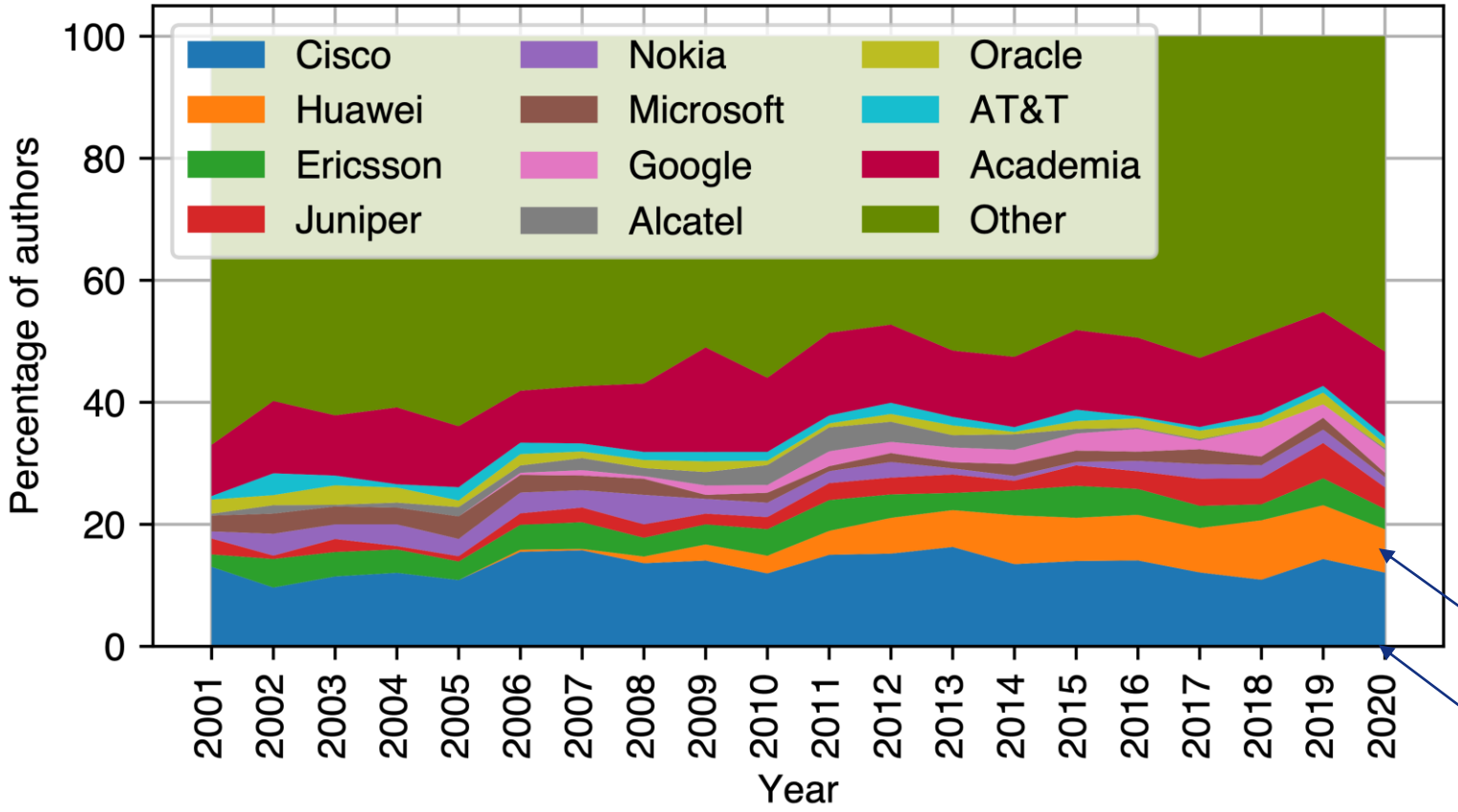
Request For Comments (RFCs): informal documents to discuss “networking ideas” and coordinate the development of the ARPANET

IETF: Mails, drafts, RFCs



Longitudinal dataset

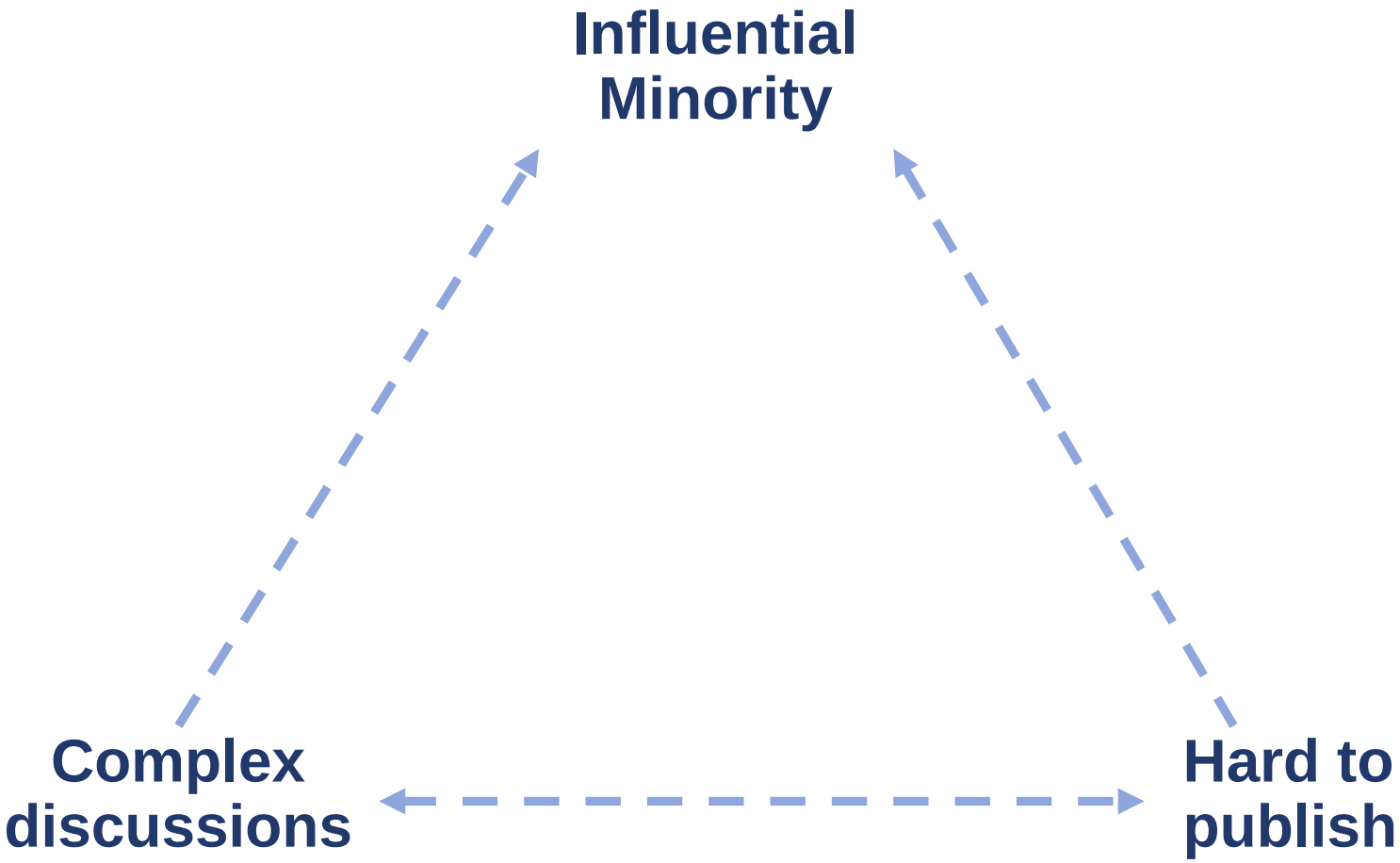
Internet evolution

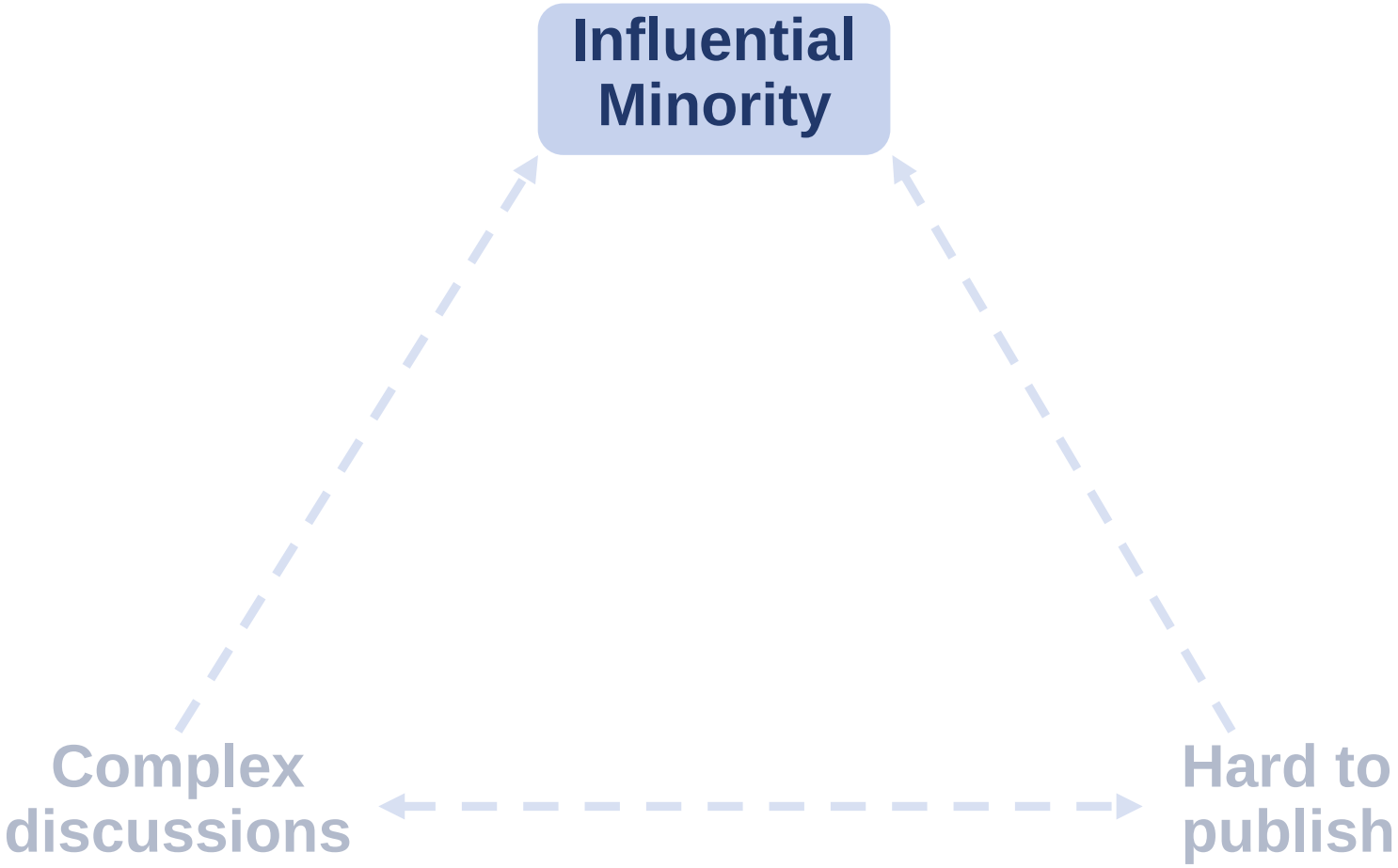


Increasing number of Internet stakeholders

Huawei is upcoming

Cisco is still large


Influential Minority
Complex discussions
Hard to publish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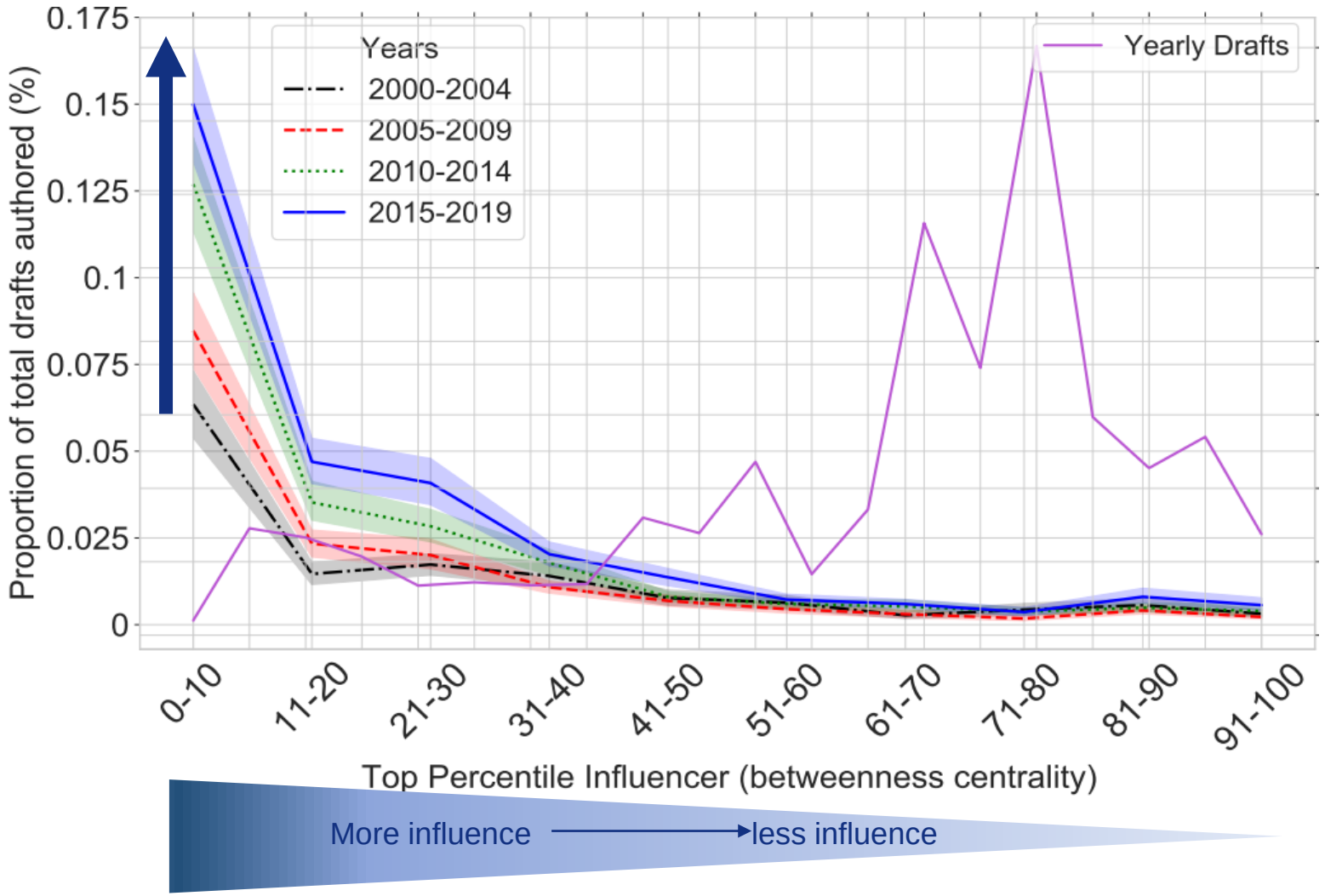
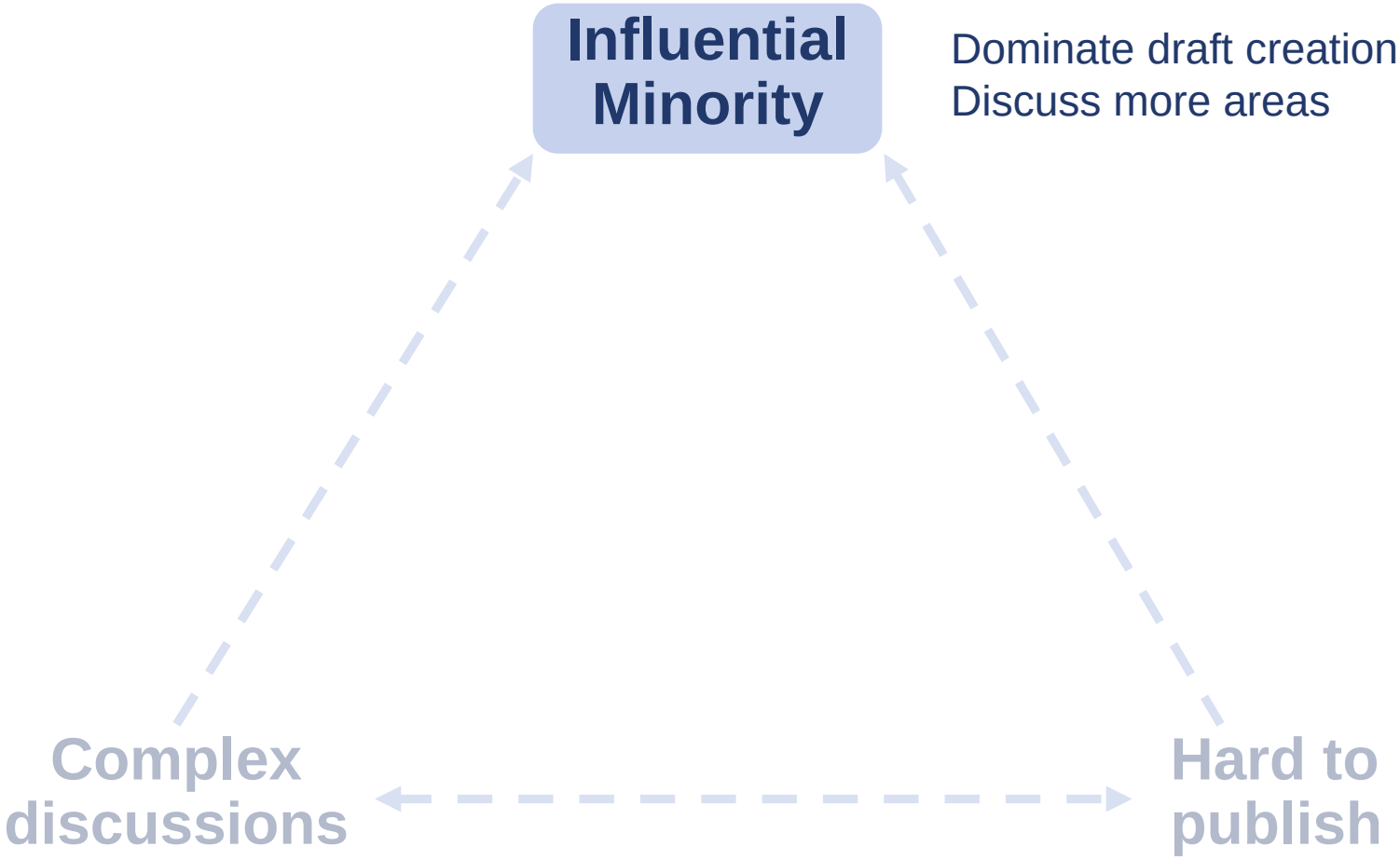
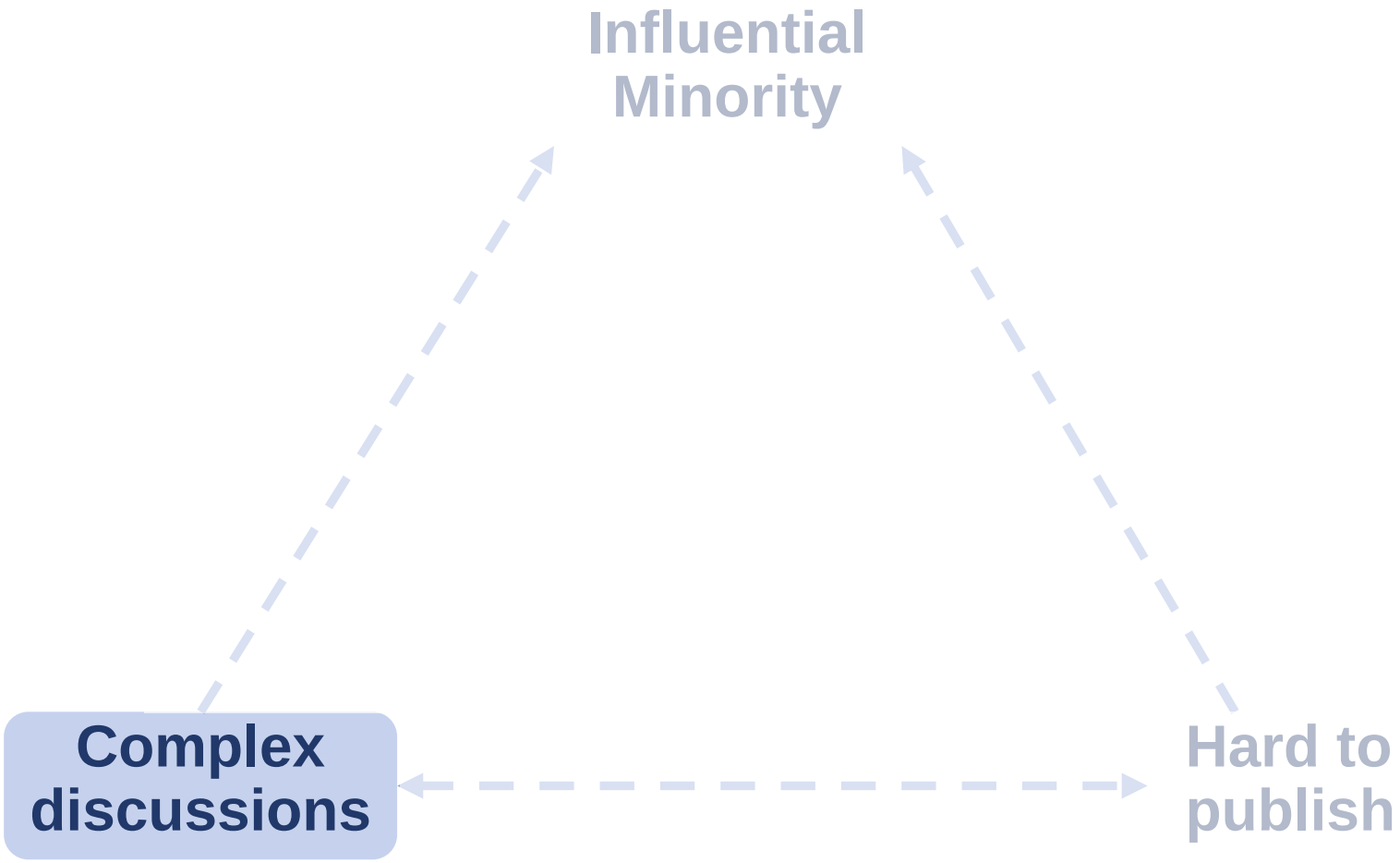
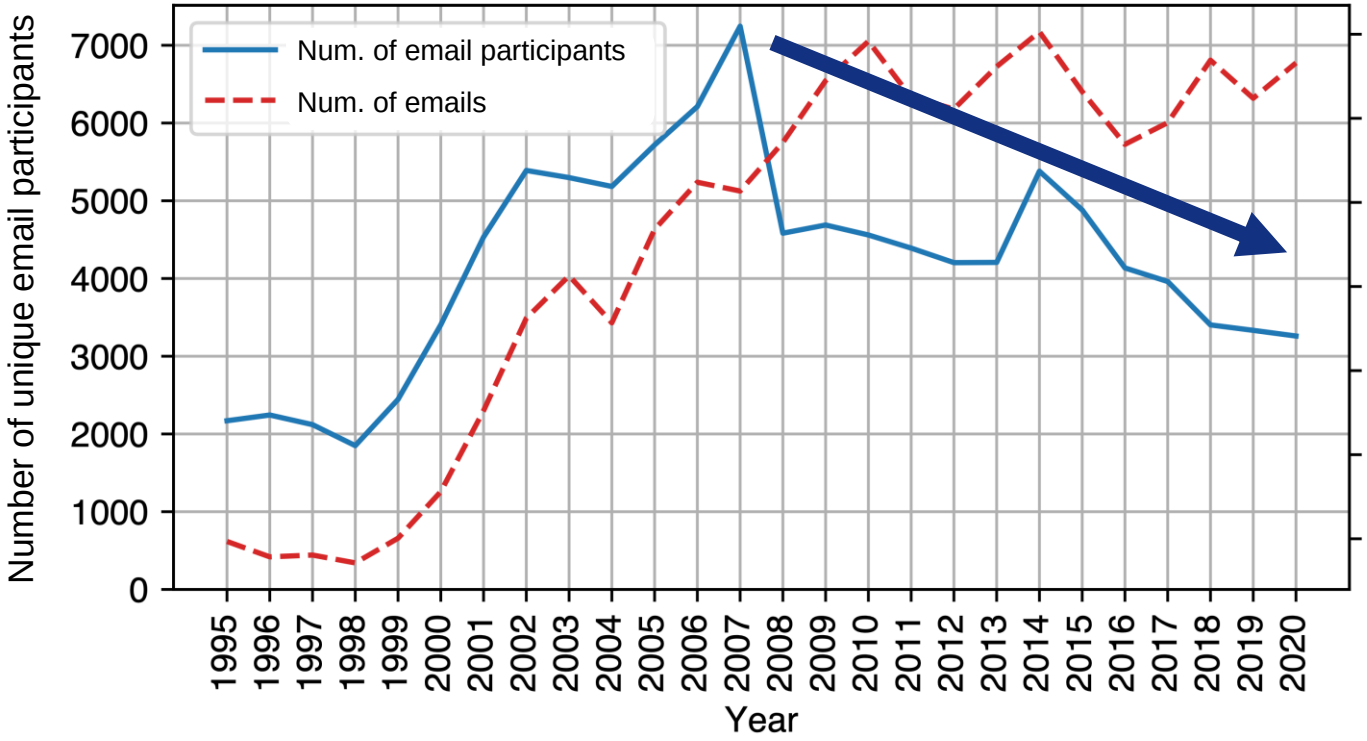


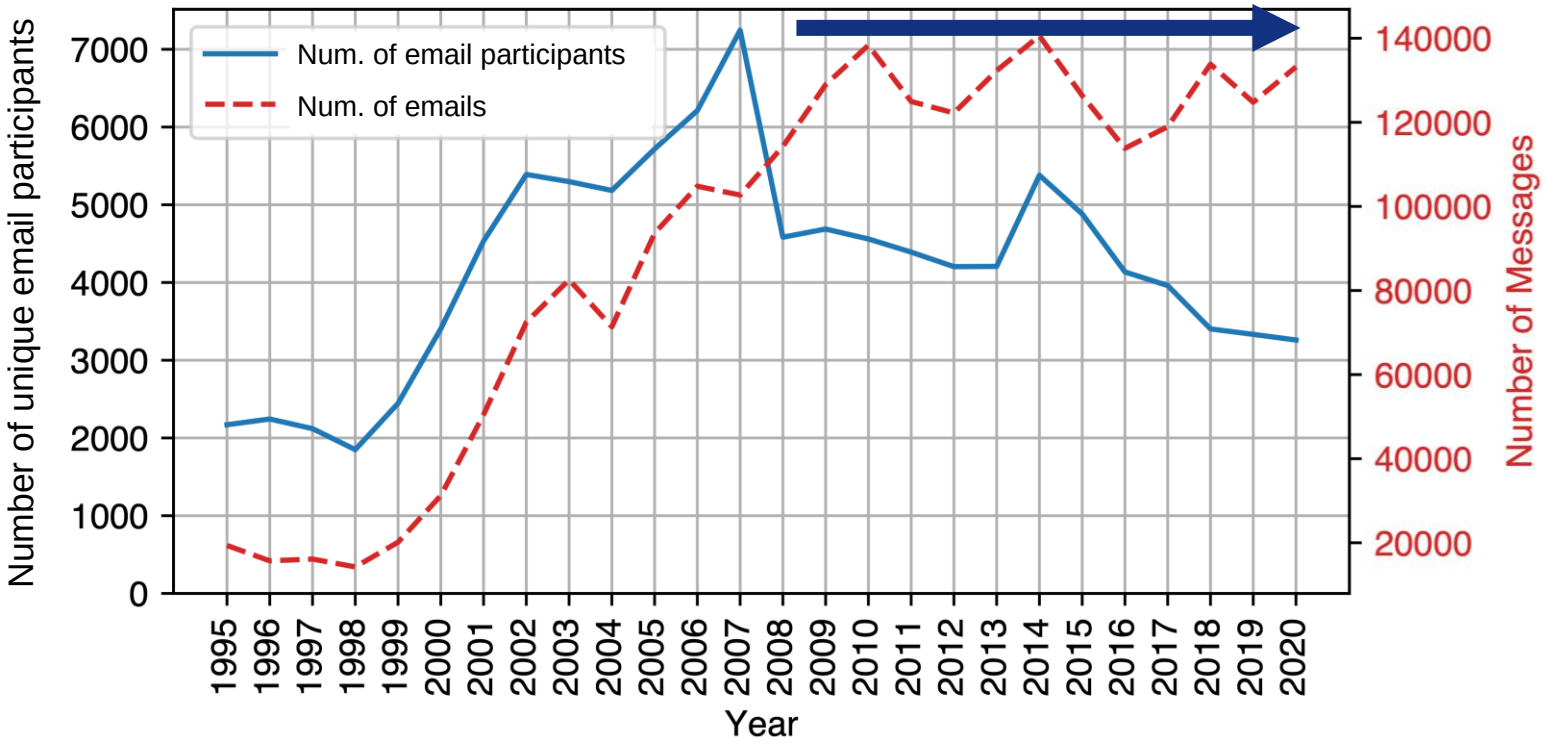
Influential participants increasingly dominate draft creation


Influential Minority
Dominate draft creation
Discuss more areas
Complex discussions
Hard to publish

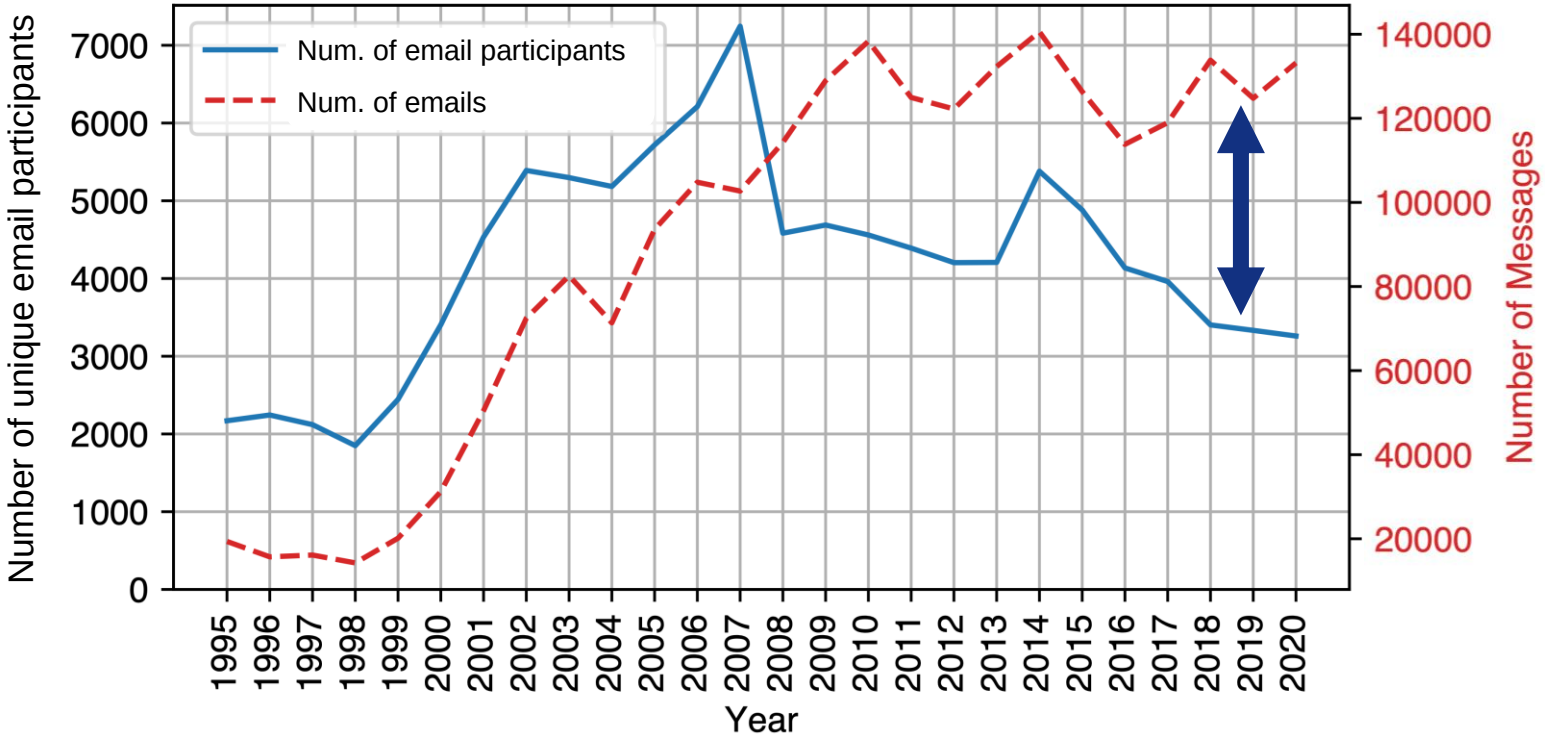

Influential Minority
Complex discussions
Hard to publish



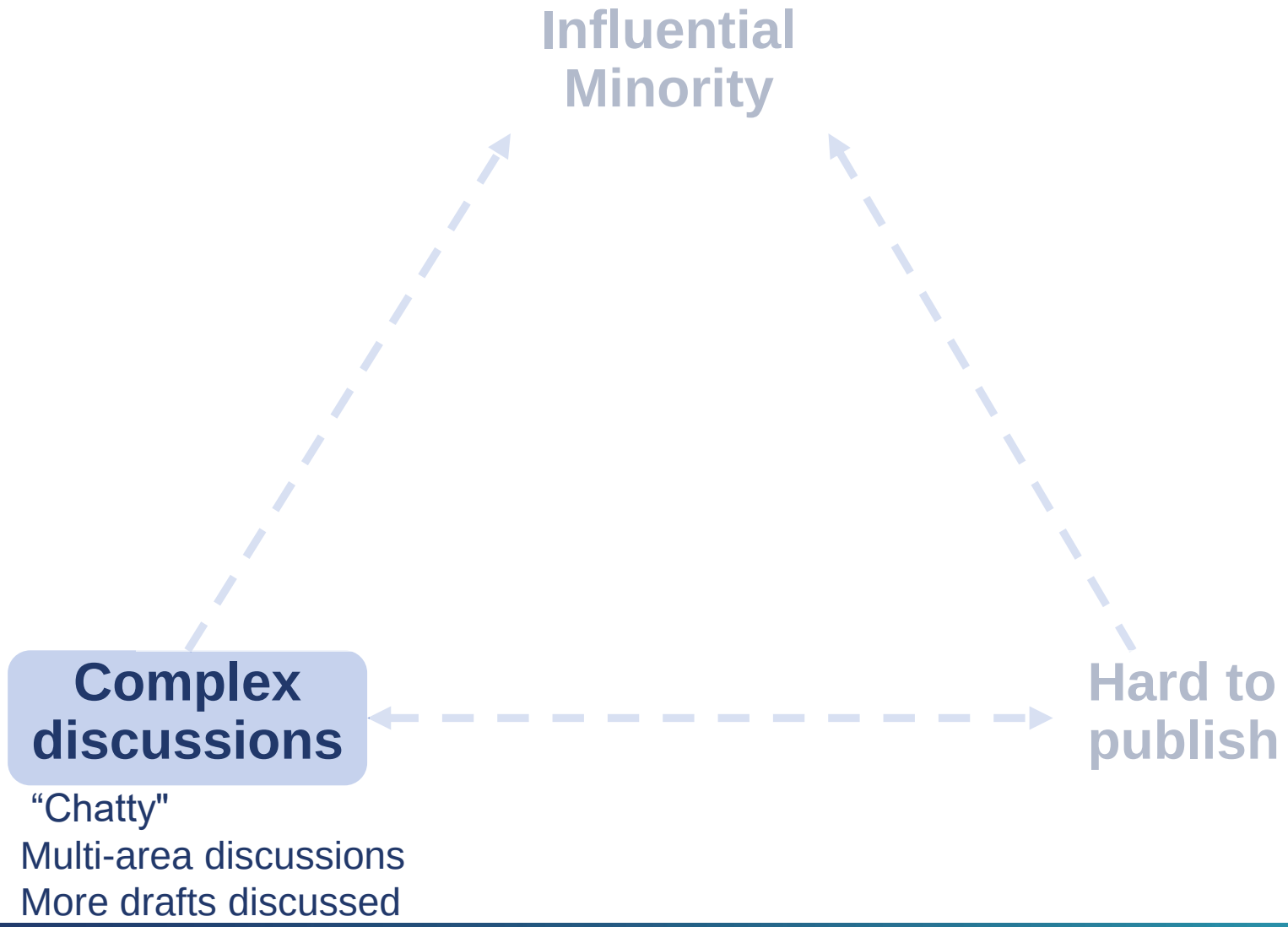
Decreasing number of email participants

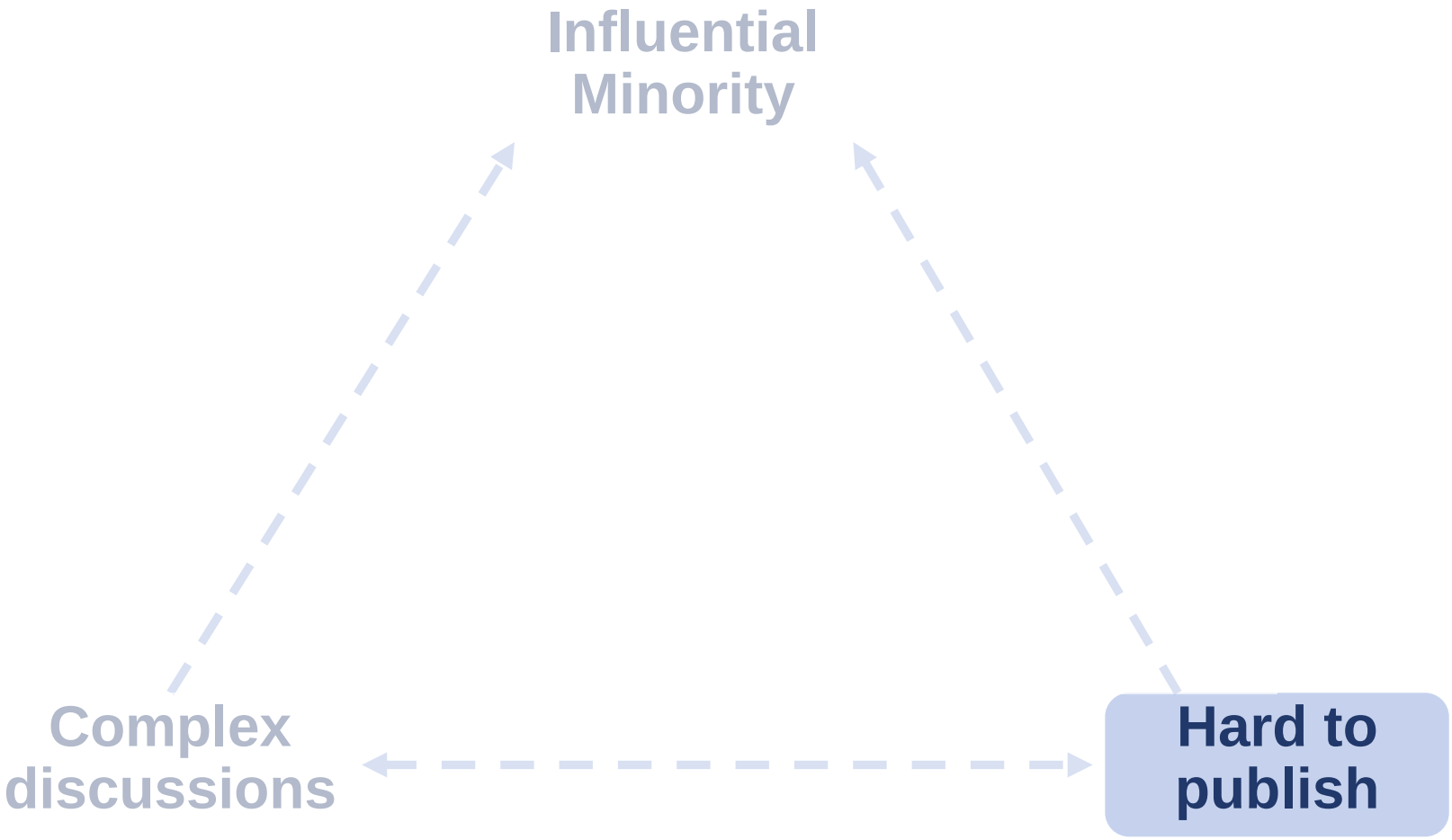


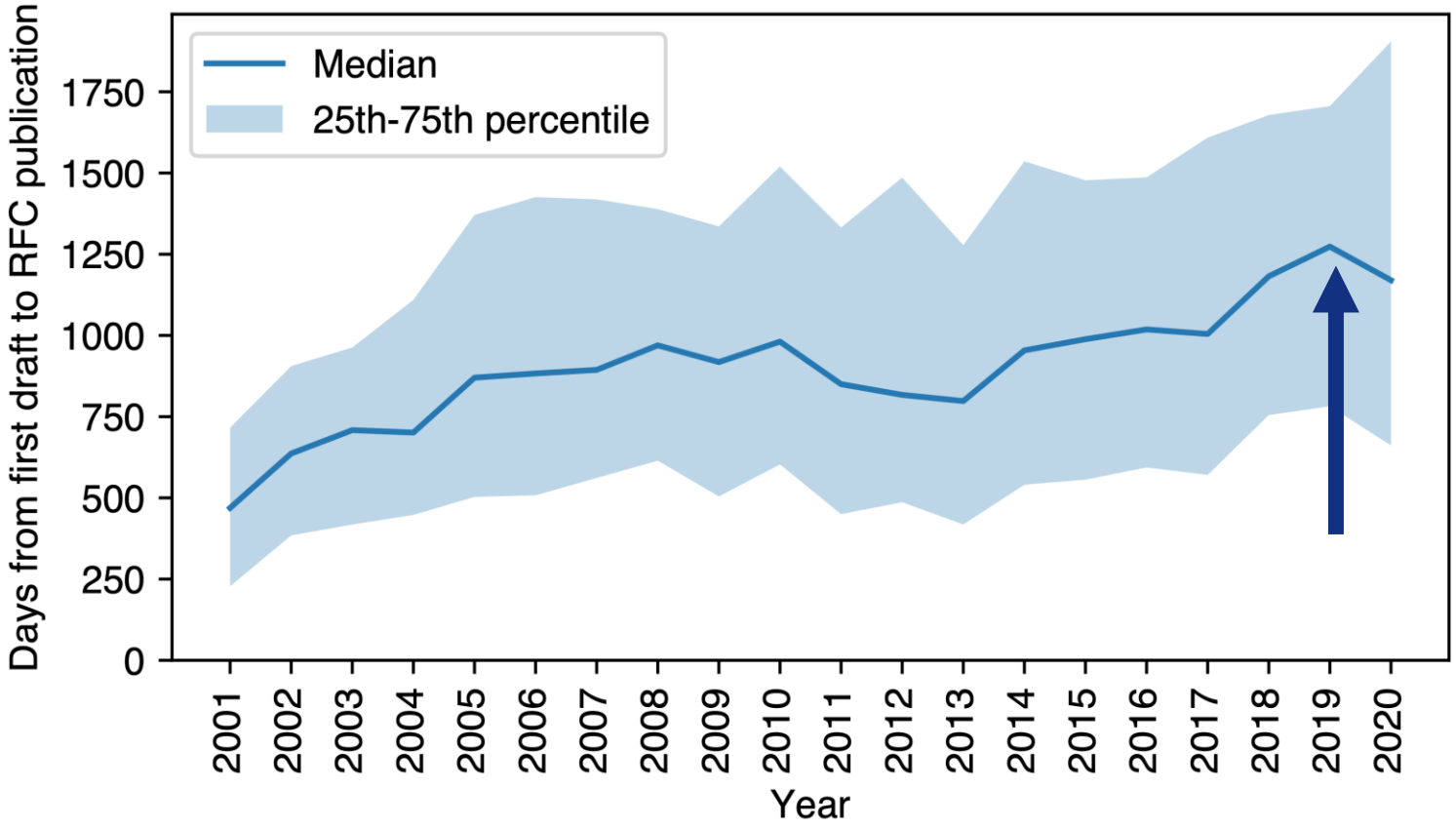
Stable number of emails



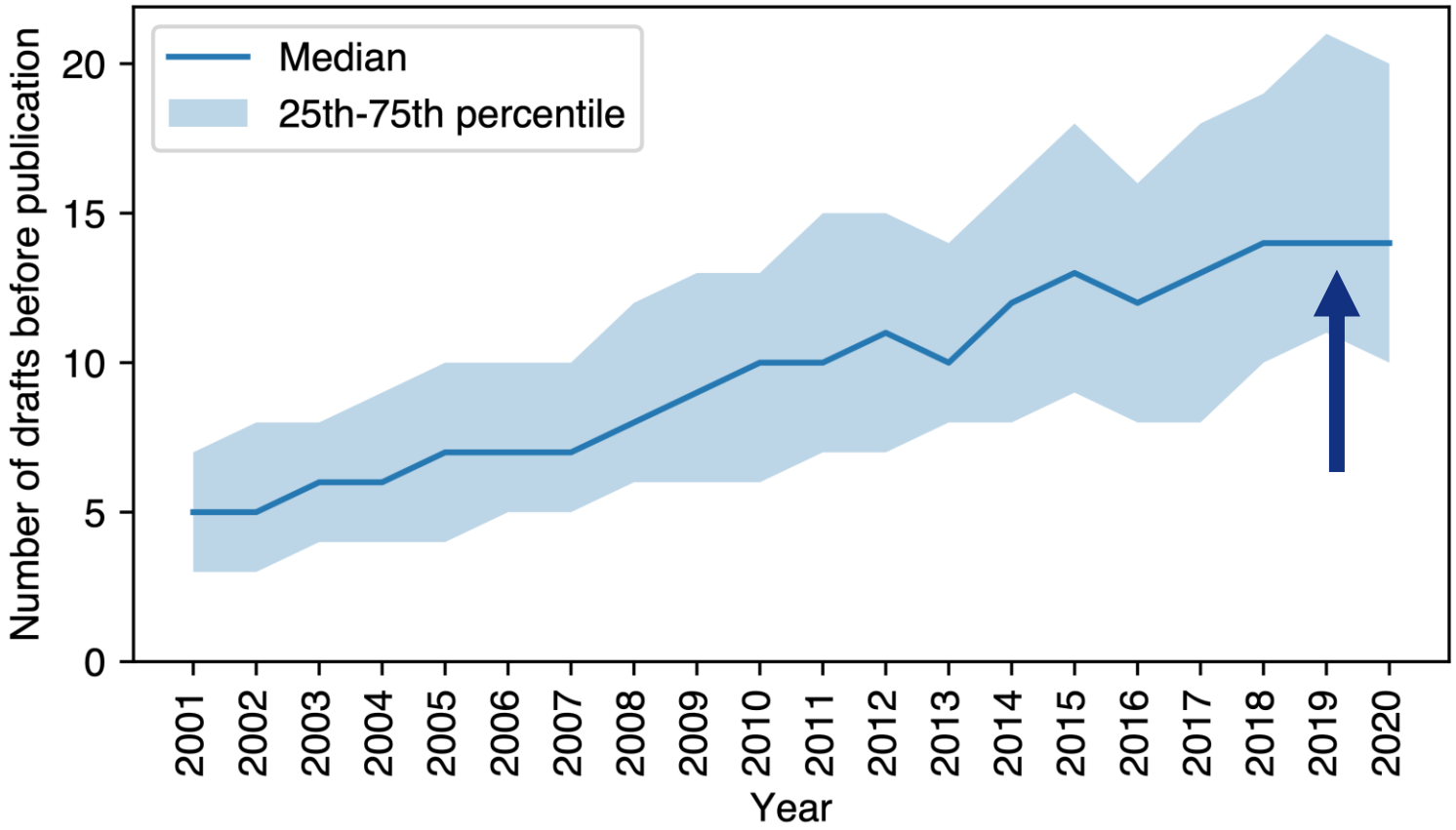
Increasingly “chatty”


Influential Minority
Complex discussions
Hard to publish
“Chatty"
Multi-area discussions
More drafts discussed

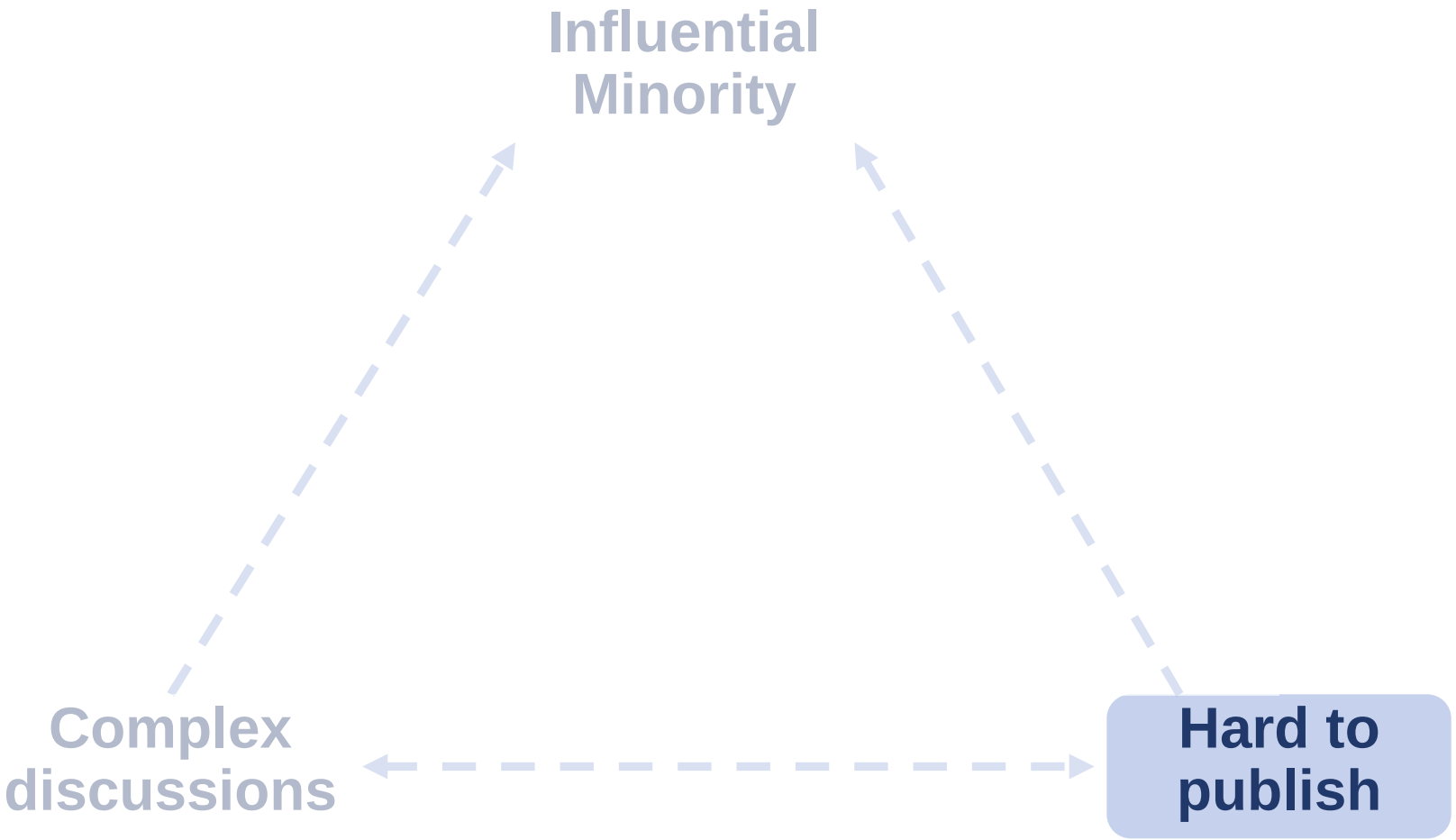

Influential Minority
Complex discussions
Hard to publish



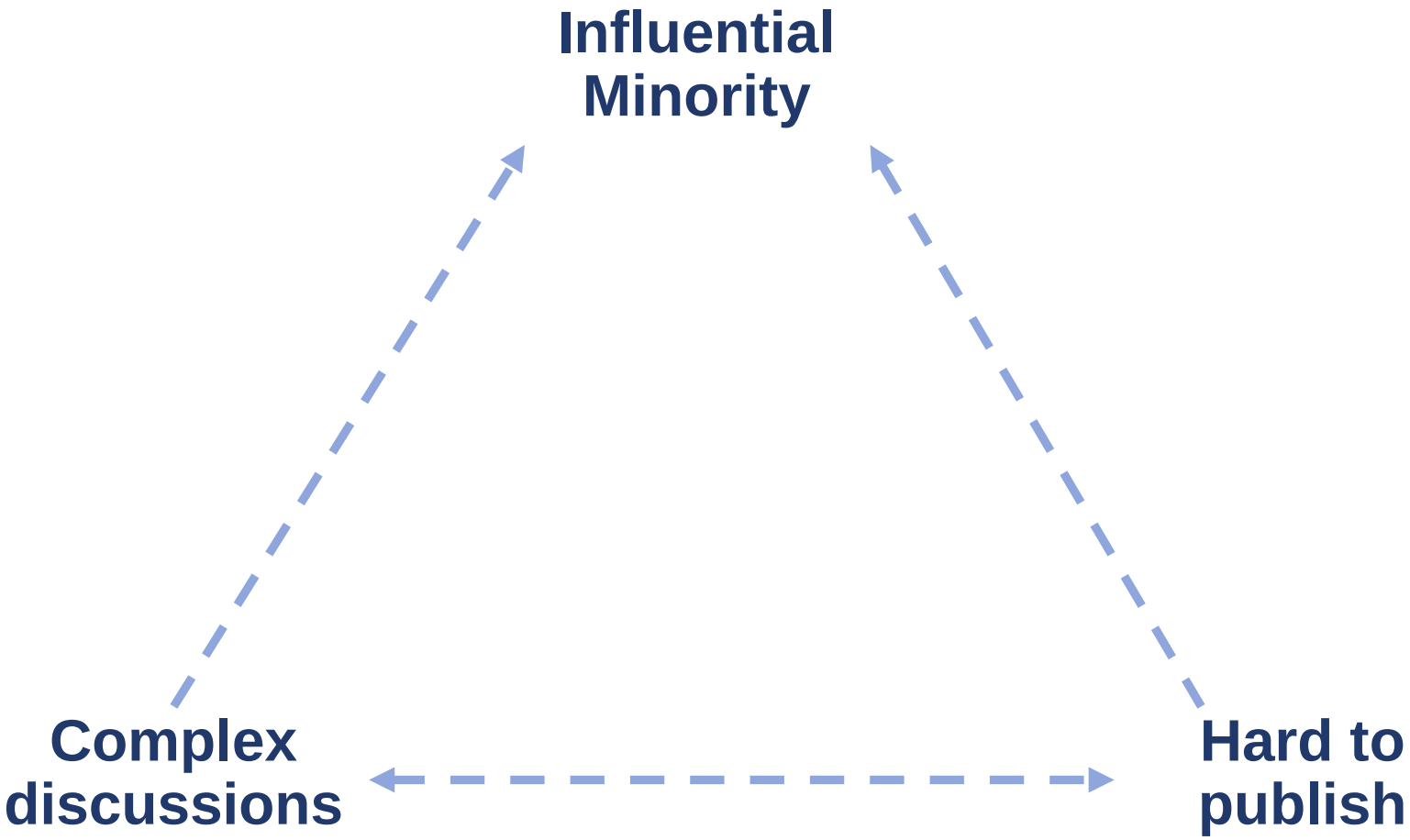
3x increase in time to publish

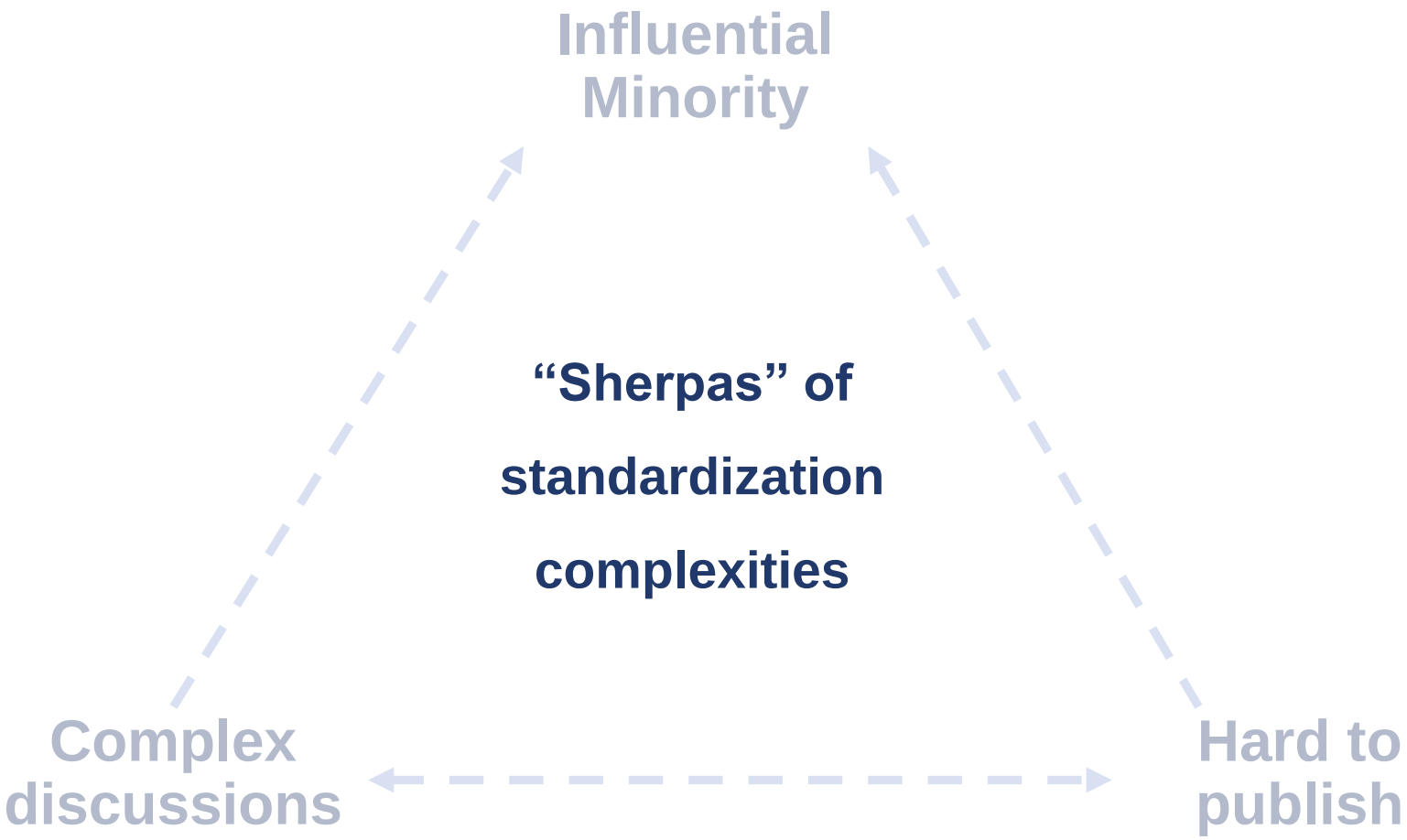


2x drafts pre-RFC publication

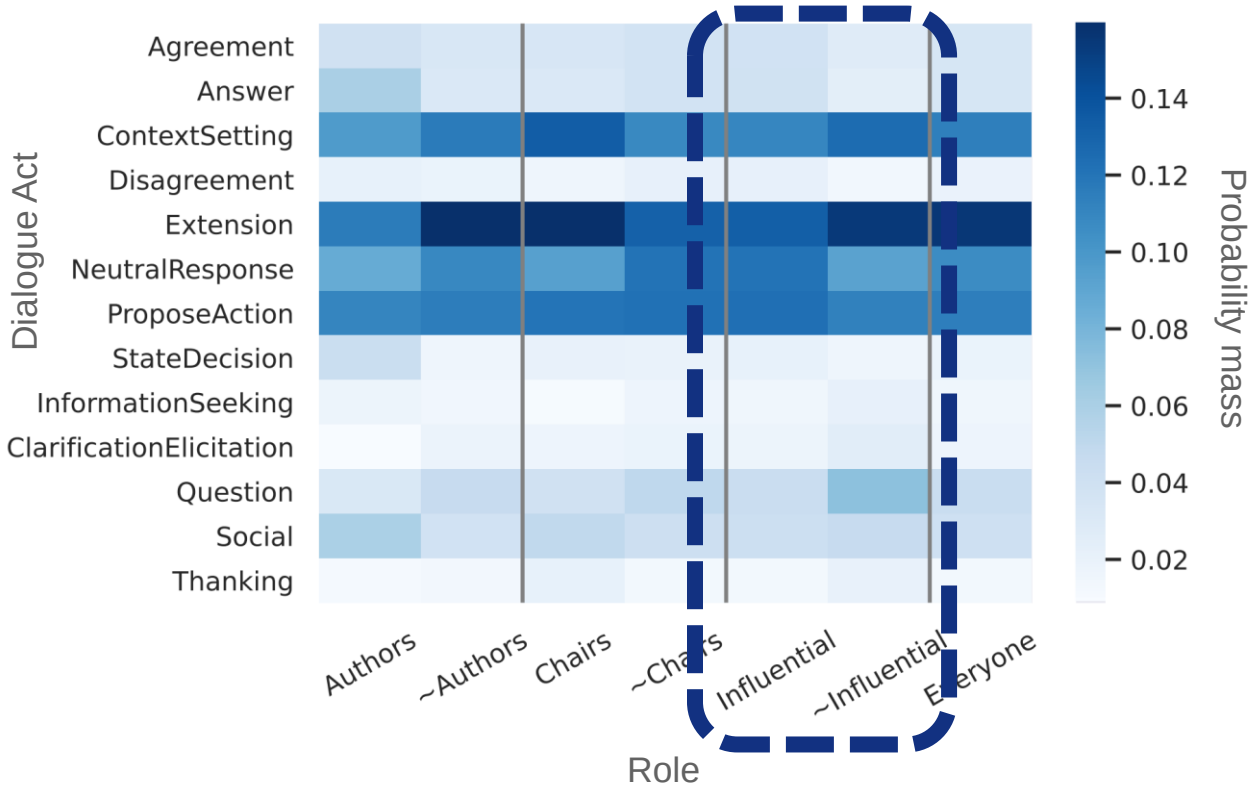


Longer time, more drafts
More affiliations, areas, authors


Influential Minority
Complex discussions
Hard to publish


Influential Minority
“Sherpas” of standardization complexities
Complex discussions
Hard to publish

Influential participants have distinct conversations



Responsive

Concise communication style

Make decisions

Propose more actions

EPSRC
Engineering and Physical Sciences Research Council

Sodestream project: sodestream.github.io

Code: Social network of Internet stakeholders

Data: Annotated dataset for decision making

Papers: ACL'23, TMA'23, ICWSM'22, IMC'21

RASP RG: datatracker.ietf.org/rg/rasprg/

Welcoming members/presentations

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i.castro@qmul.ac.uk

University of Glasgow

EPSRC
Engineering and Physical Sciences Research Council

Papers:

- P. Khare, R. Shekhar, M. Karan, S. McQuistin, C. Perkins, I. Castro, G. Tyson, P. GT Healey, and M. Purver. *"Tracing Linguistic Markers of Influence in a Large Online Organisation".* ACL, 2023.
- M. Karan, P. Khare, R. Shekhar, S. McQuistin, I. Castro, G. Tyson, C. Perkins, P. GT Healey, and M. Purver. *"An Email Dataset for Analyzing Large-Group Decision-Making".* ACL Findings, 2023.
- P. Khare, M. Karan, S. McQuistin, C. Perkins, G. Tyson, M. Purver, P. Healey, I. Castro. *"The Web We Weave: Untangling the Social Graph of the IETF".* AAAI ICWSM, 2022. [PDF]
- S. McQuistin, M. Karan, P. Khare, C. Perkins, G. Tyson, M. Purver, P. Healey, W. Iqbal, J. Qadir, I. Castro. *"Characterising the IETF Through the Lens of RFC Deployment"*. ACM IMC 2021 [PDF]

Sodestream project: sodestream.github.io
RASP RG: datatracker.ietf.org/rg/rasprg/
More: icastro.info

Decision-making annotated

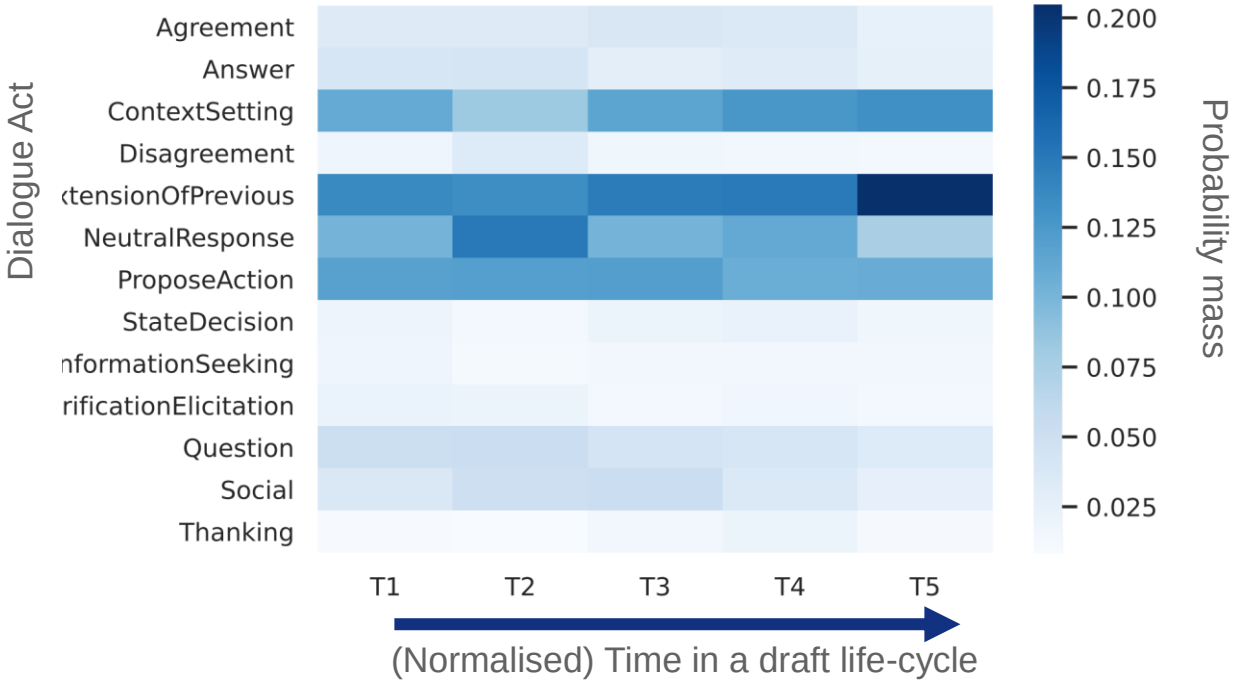
Based on ISO 24617-2 standard for Dialogue Act (DA) labeling

Each e-mail segment is labeled by at least two annotators (trained linguists)

One or more DA labels per segment

Label	Description	Example	Count	IAA
InformationProviding	Any type of providing information	-	7643	.86
Agreement	Agreeing with opinion or accepting a task	That's a good idea.	651	.74
Answer	Answering a question	It is 42 bytes.	655	.73
ContextSetting	Providing context before other DAs	Imagine the case when ...	2212	.25
Disagreement	Disagreeing with opinion on rejecting a task	I don't think so.	365	.68
Extension	Natural continuation of the previous one.	Moreover, it's faster.	3007	.65
NeutralResponse	Response without clear (dis)agreement	Your idea seems interesting.	2066	.71
ProposeAction	Propose an actionable activity	We should update the text.	2225	.65
StateDecision	Explicitly express a decision	We will incorporate this.	359	.63
InformationSeeking	Any type of seeking information	-	1146	.84
ClarificationElicitation	Expresses need for further elaboration.	Could you explain again ...	326	.29
Question	Any type of question.	How big is the header?	865	.86
Social	Social acts (thanking, apologizing etc.)	-	1040	.67
Thanking	Conveying thanks.	Thanks for the comment.	249	.98

DAs show the life-cycle of a draft



Questions

common in early phases

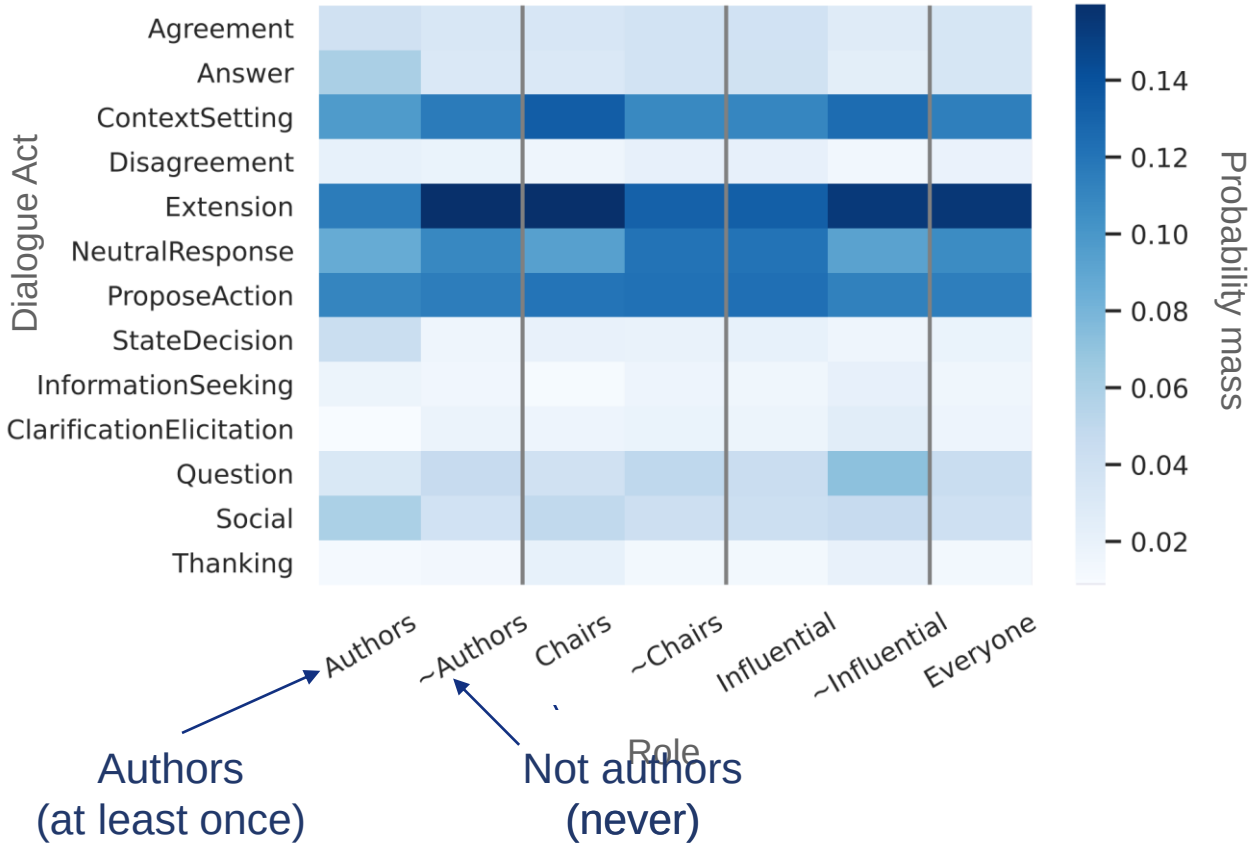
ContextSetting and Extension

common towards the end (complex discussions)

ProposeAction

consistently more frequent than StateDecision: participants prefer to discuss options rather than commit to a single one

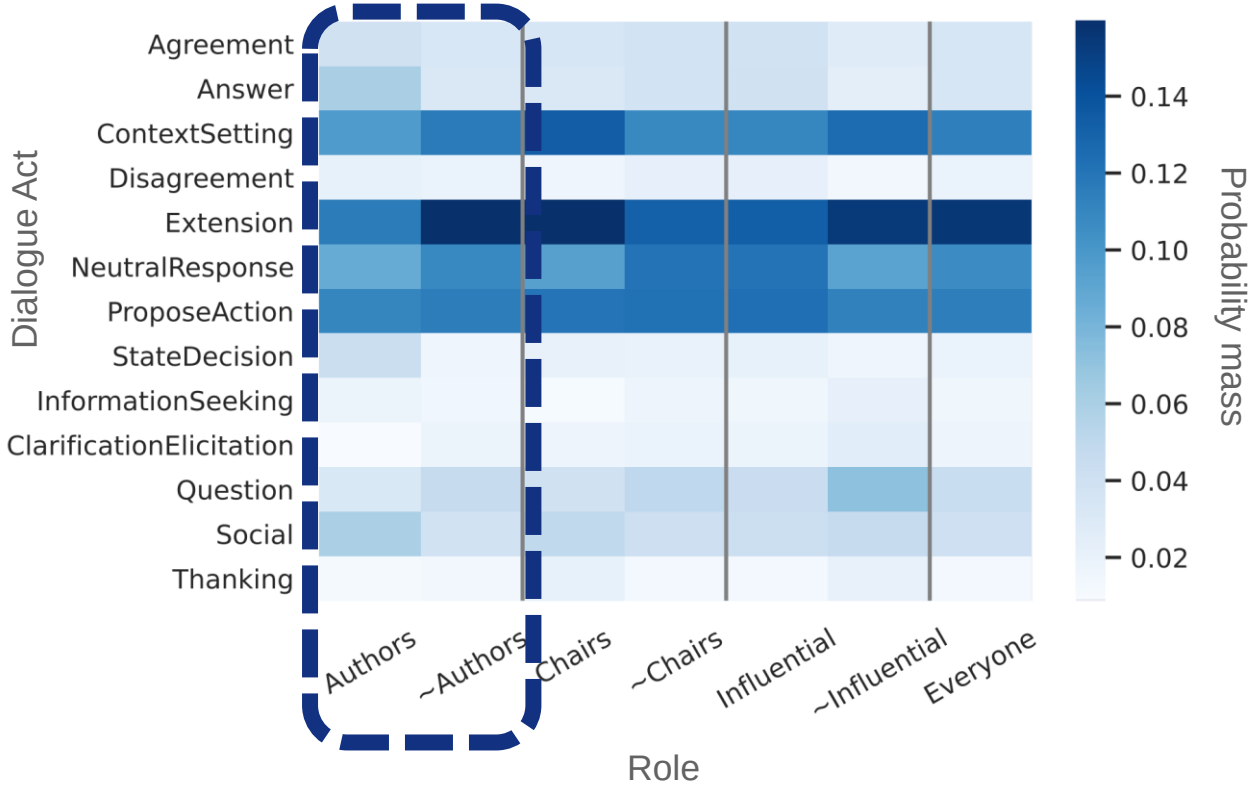
DA show the role of a participant



Authors
(at least once)

Not authors
(never)

Authors have distinct DAs

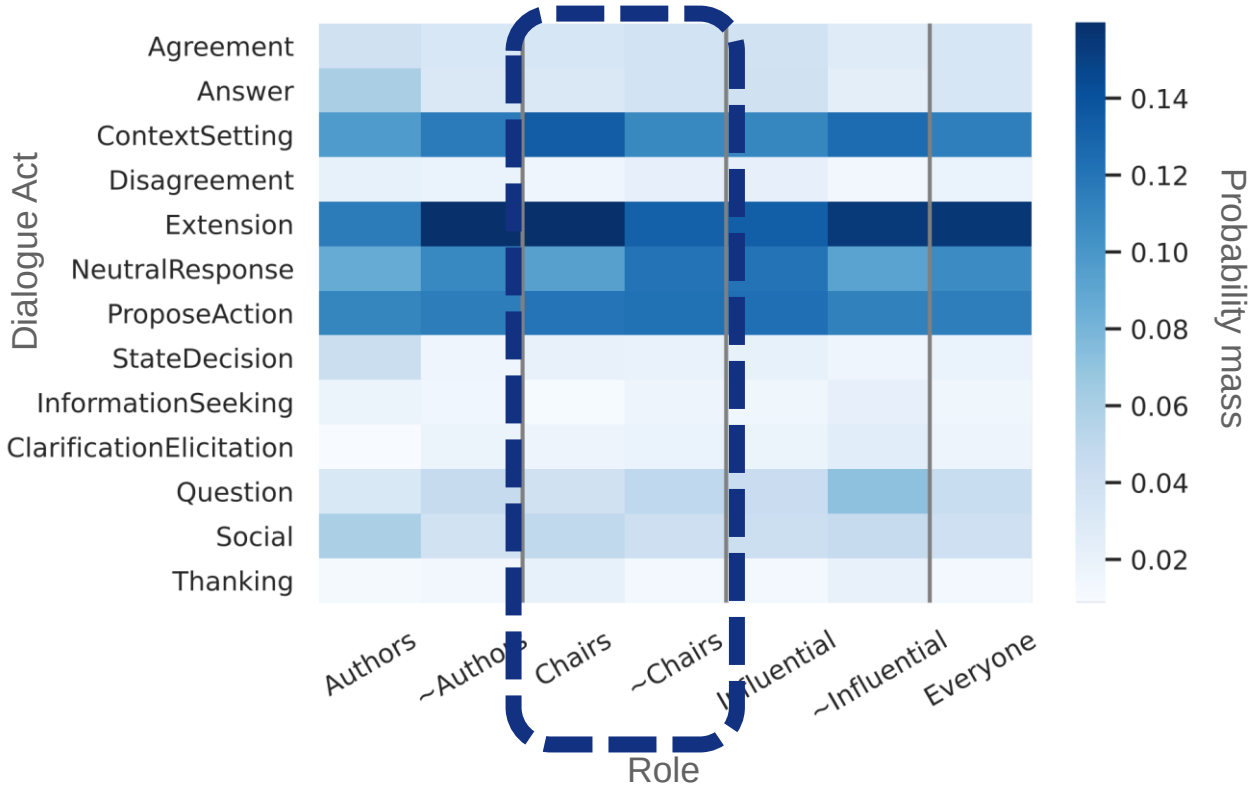


More social, answer more, ask less

Short focused messages

Reactive role and make most decisions

Working Group Chairs have distinct DAs



More responsive

More verbose

- Discussions management
- Review assignment

BERT-based baseline model

	bert-base			bert-base-ietf		
Label	P	R	F_1	P	R	F_1
InfProviding	.89	.96	.93	.88	.97	.93
Agreement	.67	.72	.69	.47	.67	.55
Answer	.44	.40	.41	.35	.49	.41
ContextSetting	.38	.67	.49	.36	.67	.47
Disagreement	.14	.24	.17	.10	.29	.15
Extension	.64	.72	.67	.66	.62	.64
NeutralResponse	.45	.52	.48	.43	.52	.47
ProposeAction	.47	.72	.57	.44	.67	.53
StateDecision	.39	.28	.47	.19	.30	.23
InfSeeking	.85	.87	.86	.78	.84	.81
ClarificationEl.	.25	.46	.33	.21	.51	.30
Question	.78	.98	.87	.84	.88	.86
Social	.33	.67	.44	.45	.52	.48
Thanking	.75	.99	.86	.33	.92	.48
Macro-average	.53	. 66	.59	.46	63	.52

Hierarchical sequence model

14-dimensional vector prediction for each input segment

Predicting higher-level labels is easy

Conceptually more subjective labels is hard