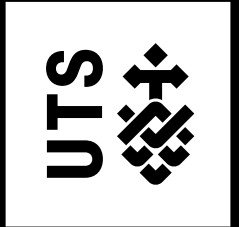


Keynote, 2nd International Conference on Quantitative Ethnography www.icqe20.org



QE Visualizations as Tools for Thinking

Simon Buckingham Shum

Professor of Learning Informatics
Director, Connected Intelligence Centre
University of Technology Sydney

cic.uts.edu.au • Simon.BuckinghamShum.net • [@sbuckshum](https://twitter.com/sbuckshum)

The bring + share meal that is QE!



Overview...

How my academic journey primed me for QE

Confession: I have been a participant observer!

Visualizations as cognitive artifacts

Observations of how QE (ENA) stories are told

The future may be a more participatory QE

→ New kinds of visualizations, interactivity

→ New fluencies to wield participatory visual tools

Visualizing my communities

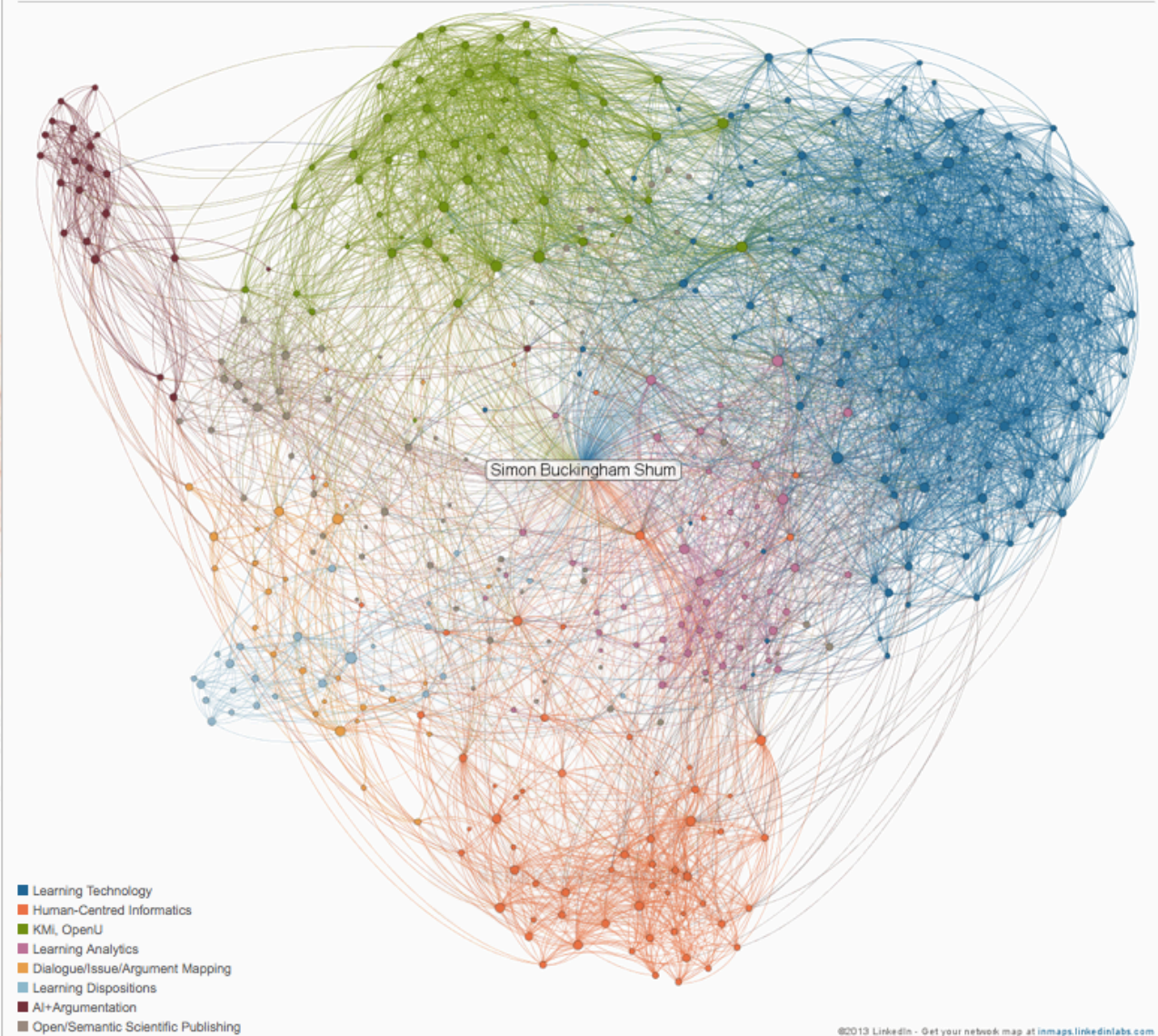
LinkedIn Maps (2013)

Label your

Professional Networks

- Learning Technology
- Human-Centred Informa
- KMi, OpenU
- Learning Analytics
- Dialogue/Issue/Argumen
- Learning Dispositions
- + Add Label
- Open/Semantic Scientifi

LinkedIn Maps Simon Buckingham Shum's Professional Network
as of November 9, 2013



My journey with various research tribes...

B.Sc. Psychology → M.Sc. Ergonomics (→ Cognitive Ergonomics)

Ph.D. Human-Computer Interaction (visual design rationale + cognition)

Hypertext/Semantic Web (spatial metaphors; scholarly hypertexts)

Dialogue & Argument Visualisation (Making deliberation visible, and contestable)

Learning Technology (critical thinking; synchronous groupware; open education)

Data Science/Learning Analytics/AIED (critical reflection; teamwork; dispositions; ethics)

Quantitative Ethnography (beginner; keen observer!)

This journey primed me for QE...

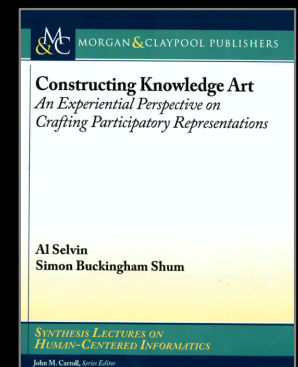
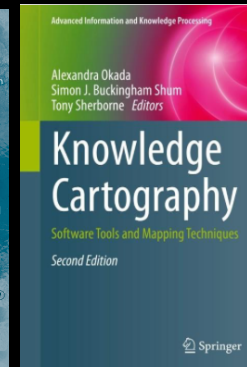
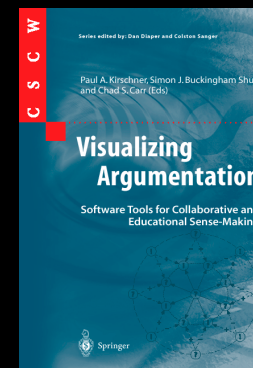
“Augmenting human intellect”
with interactive tools

...Douglas Engelbart's pioneering 1960s
work is my inspiration

→ a fascination with how software
helps make thinking visible
...and how thinking is shaped by
(semi)formal, interactive representations



<http://simon.buckinghamshum.net/2014/07/openu-valedictory-lecture>



This journey primed me for QE...

A passion for research-inspired,
open source tools for researchers,
and other knowledge workers...

...co-building and supporting a
user community for >20 years

...in service of participatory
sensemaking

<http://simon.buckinghamshum.net/tag/compendium>

<http://projects.buckinghamshum.net/compendiuminstitute/community/community.htm>

Simon.BuckinghamShum.net

Tag Archive: compendium

You are browsing the tag archive for compendium.

Compendium Archive & Network 2021

January 3rd, 2021 | Projects, Software | 1 Comment

Quick links: Archived Compendium Institute website Installer recommended: CompendiumNG (next generation) wiki with installer links In case you want the last KMI Open University installer with advanced experimental features (like Maps supporting video annotation): Downloads page | QuickStart Guide for Mac or Windows *follow these instructions* Compendium Mapping Google Group CONTEXT... Those of you who know my R&D will know that I [...]

1 Comment | Read full story »

Previous Stories


- Al Selvin - Memories & Tributes
- Constructing Knowledge Art: new book
- Delta Dialogues: fantastic Dialogue Mapping case study
- New book: Chapter 1 v0.1
- CompendiumDS helps OU win gold
- Making Representations Matter: Al Selvin PhD
- Mapping PhD research in Compendium
- Compendium used for German public debate on synthetic biology
- Working with "Learning Futures" on authentic enquiry
- COMMA 2010: Software Agents in Support of Human Argument Mapping
- Knowledge Art
- Annotating Election Debate replay with Compendium Dialogue Map
- Visualizing UK Election Debate 2
- Election Debate: seeing Nick Clegg's moves
- Real-time mapping Election TV Debates
- Compendium for mapping group dynamics
- Issue mapping for emergency response
- Knowledge mappers empower e-democracy?
- When children learn to map dialogue and argument
- Extending Compendium for choreographic video annotation
- Dancing on the Grid: new article
- Hypermedia Discourse in the "State of the Future" report
- Spatio-temporal video annotation in Compendium
- Evidence-Based Dialogue Mapping for Teenagers
- Dr Anna De Liddo!

Supporting a user community for >20 years

A tool, method + practice for participatory, visual, networked thinking

CompendiumInstitute

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Compendium Institute

[About Compendium](#)

[Associated Institutions](#)

[Acknowledgements](#)



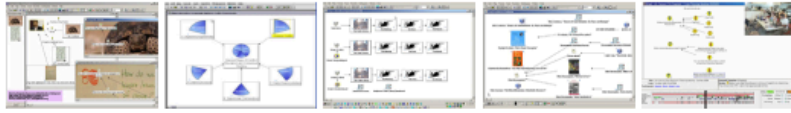


Compendium Institute

Compendium is about sharing ideas and breaking down the boundaries between dialogue, artifacts, knowledge, and data. Please visit the resources on this site to learn more. See [what our users are saying...](#)

The Compendium Institute was the community hub (until 2014) for the ongoing development and dissemination of the **Compendium** methodology and software tools. The software can still be downloaded, and we welcome user endorsements, but the site and code are now archived and not actively maintained.

The Community Showcase



The Compendium Exchange

Compendium has a place where the community can share maps, stencil set, themes and more. Here we are also developing Compendium training materials.

[The Compendium Exchange](#)

Community

The international Compendium community comprises user enthusiasts. We support the community with workshops and showcase of innovative uses of Compendium.

Compendium's R&D has been funded by grants from The Arts and Humanities Research Council, corporate and government research institutes, and we are delighted to acknowledge their support:



TESTIMONIALS - Now Archived

Compendium is used globally across diverse sectors.

Business: 18% (59)	Education: 26% (83)
Government: 2% (5)	Not for Profit: 13% (43)
Personal: 31% (99)	Other: 9% (30)

Compendium as a science sensemaking tool

NASA Field Trials (Mobile Agents Project)

http://projects.buckinghamshum.net/NASA_EPSRC_Mars/

Collaborative
ADVANCED KNOWLEDGE TECHNOLOGIES
CoAKTiNG
in the Grid

bit.ly/MarsFieldTrials

In 2000, the UK's Engineering & Physical Sciences Research Council (EPSRC) funded a 6 year Interdisciplinary Research Collaboration, entitled the Advanced Knowledge Technologies project (AKT). In 2002 a satellite project CoAKTiNG (Collaborative Advanced Knowledge Technologies in the Grid) launched to explore e-Science applications of AKT's new tools. A key demonstrator was a collaboration supporting NASA field trials of their Mobile Agents Architecture for human-robot work systems. . .

**NASA Mobile Agents Field Trials:
Evaluating the CoAKTiNG Project's e-
Science Collaboration Tools**

This website demonstrates the results of a 6 month collaboration between CoAKTiNG and NASA's Mobile Agents Project based in the Human-Centered Computing Group at Ames Research Center, led by William Clancey and Maarten Sierhuis. This culminated in a 2 week field trial in 2004, repeated 2005, at the Mars Desert Research Station, in the Utah desert ("Mars").

Contact: Simon Buckingham Shum
(now @University of Technology Sydney)

A widescreen is recommended for best viewing, or alternately, this contents column can be narrowed by dragging the frame border, or open each link in a fresh browser window/tab.

Human Exploration of Mars: Science Team Scenario

In a future multi-month, manned mission to Mars, the few scientists in the Mars crew will need to work with their Earth colleagues (the Remote Science Team - RST). How will they make joint decisions, share data and conduct analyses when the huge distances prevent synchronous meetings? Meanwhile how will the RST, distributed around the world, work together effectively to analyse data, review plans proposed from the Mars crew, and provide rapid, succinct feedback?

In 2004, the NASA Mobile Agents Project was developing a sophisticated multi-agent infrastructure to support human-robot

EPSRC
Engineering and Physical Sciences
Research Council

NASA

The Open
University

KNOWLEDGE MEDIA
INSTITUTE
KMI

University
of Southampton

[Map]: Poohs Corner DayOneEva Crew Planning Meeting 04/27/04

pooh's corner waypoints.pdf

pooh eva.pdf

Today's EVA Map?

Where should Boudreaux take Panoramas?

Where is Pooh's Corner?

Possible Locations?

Looking at the Aerial photo 1m resolution

How long do we have?

We can do 10 at the entrance,

It takes about an hour for Boudreaux to get to WP 10

We have approx. 3-4 hours of battery

Poohs_Corner_Waypoint_1

Poohs_Corner_Waypoint_13

Poohs_Corner_Waypoint_14

Title: MDRS Day One EVA Debrief Meeting 4/27/2004

Date: Wed Apr 28 01:51:32 2004

Current Speaker: Maarten

Nodes: Go to the panoramas and go over the naming scheme

Participants: Maarten, Brent, Abigail, Richard, John.

Agenda

Compendium

Abigail

Brent

John

Maarten

Richard

Video Paused 00h 01m 15s Play

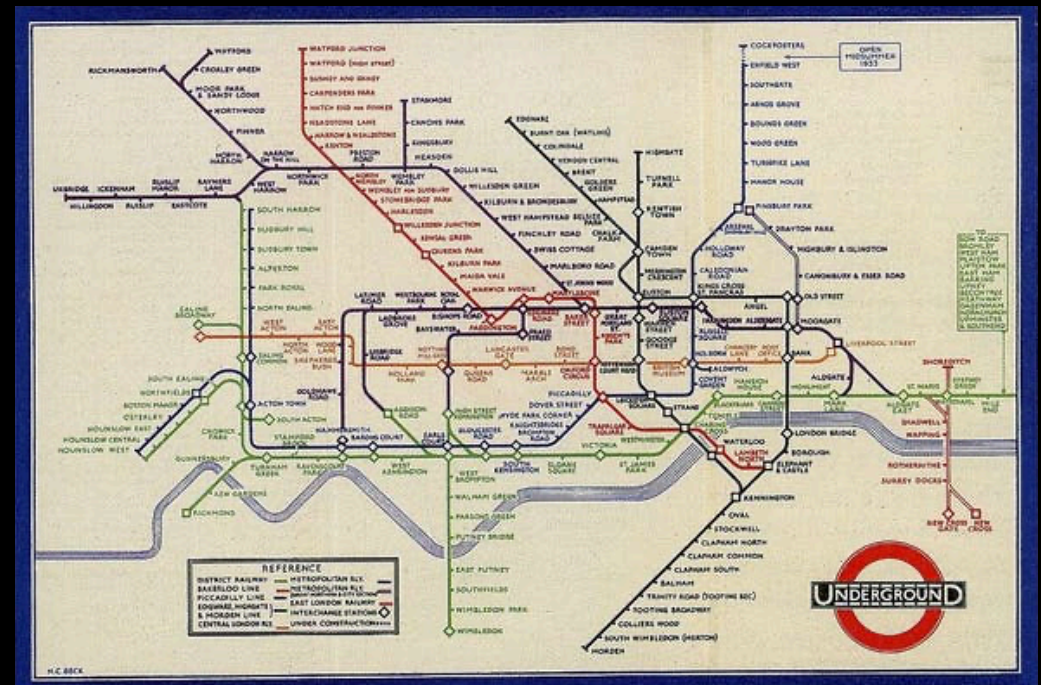
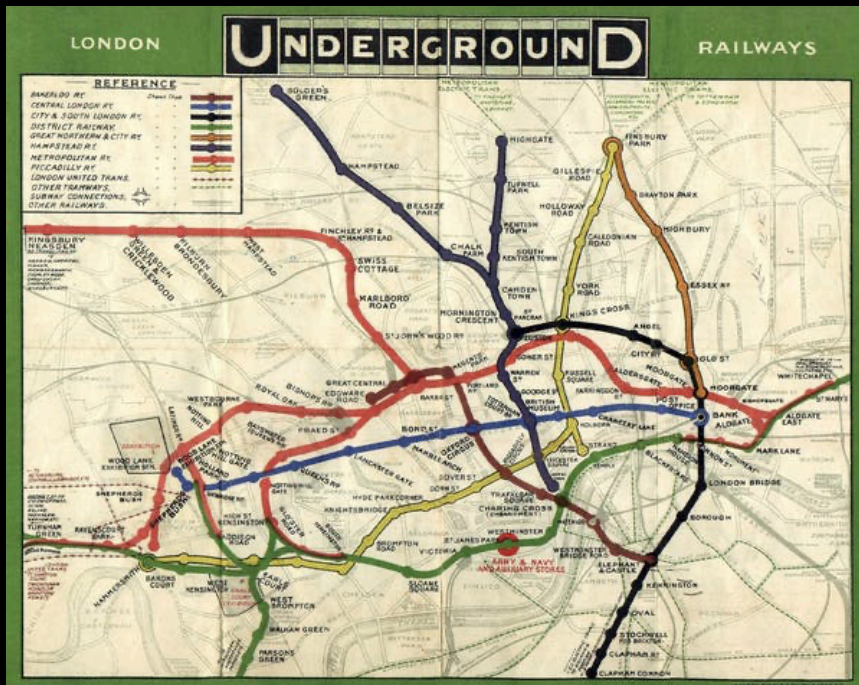
GroupSync Offline Online

Mode Master Slave

Receiving Yes No

Visualizations as Tools for Thinking

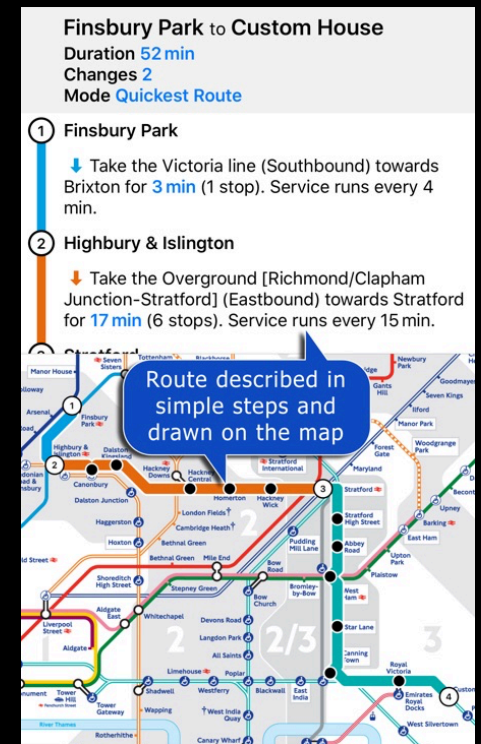
Example visualization: London Underground Map



<https://theconversation.com/sublime-design-the-london-underground-map-26240>

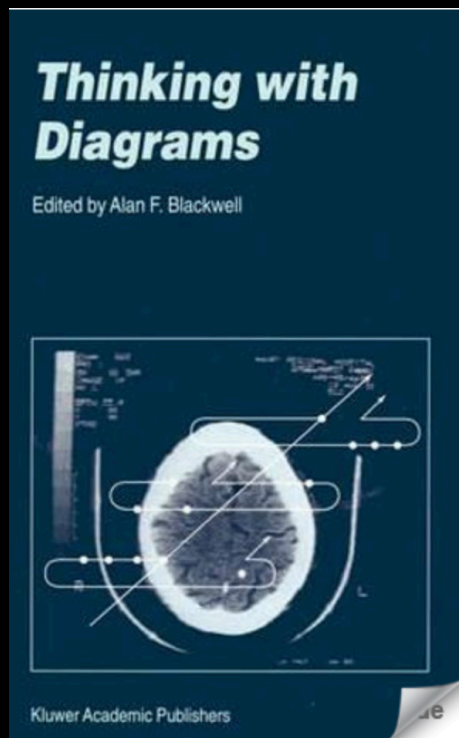
Example visualization: London Underground Map

ontology	typed nodes (stations), typed connections (lines)
data	The Tube; The River Thames!
notation	“wiring diagram” optimized for route-tracing (horiz, vertical, 45deg) at expense of geog. accuracy
interactivity	filtering and route planning apps



**But what are a visualization's
cognitive affordances?**

A visualization's meaning is emergent from its interaction with a given viewer



“Diagrams, in and of themselves, do not ‘contain’ all the information that a viewer needs to use them properly. Rather, the background knowledge that the viewer brings to the diagram plays a critical role in whether or not it can be processed satisfactorily.

[...]

For this reason, current orthodoxies about the intrinsic benefits of visualization [...] need to be examined far more critically.”

Internal cognition is augmented by external cognition — mediated by representations

Some features include:

Computational offloading Reduce cognitive effort compared to other representations (e.g. text) by enabling the user to read off information rather than infer it and maintain it in memory

Graphical constraining Support specific kinds of reasoning

Continuous internal/external interplay A graphical representation shapes reasoning, which in turn changes what we seek and see in the display

Cognitive affordances may be both individual and shared



Augments personal working memory

persistent display tuned to specific tasks

Shared language and inferences

users can read it with little/no training

agree on what can be inferred (and what can't)

point and plan together: common ground

Epistemic Network Analysis (ENA) diagrams

QE \neq ENA

But for obvious reasons, ENA dominates the QE community at present as the fullest expression of QE principles

ENA is a compelling proof-case: QE principles can be translated into running code \rightarrow powerful analytics

ENA's success is not just due to its modelling and analysis, but the visual networks it generates engage a wider audience

Cognitive affordances of ENA diagrams

Notational features:

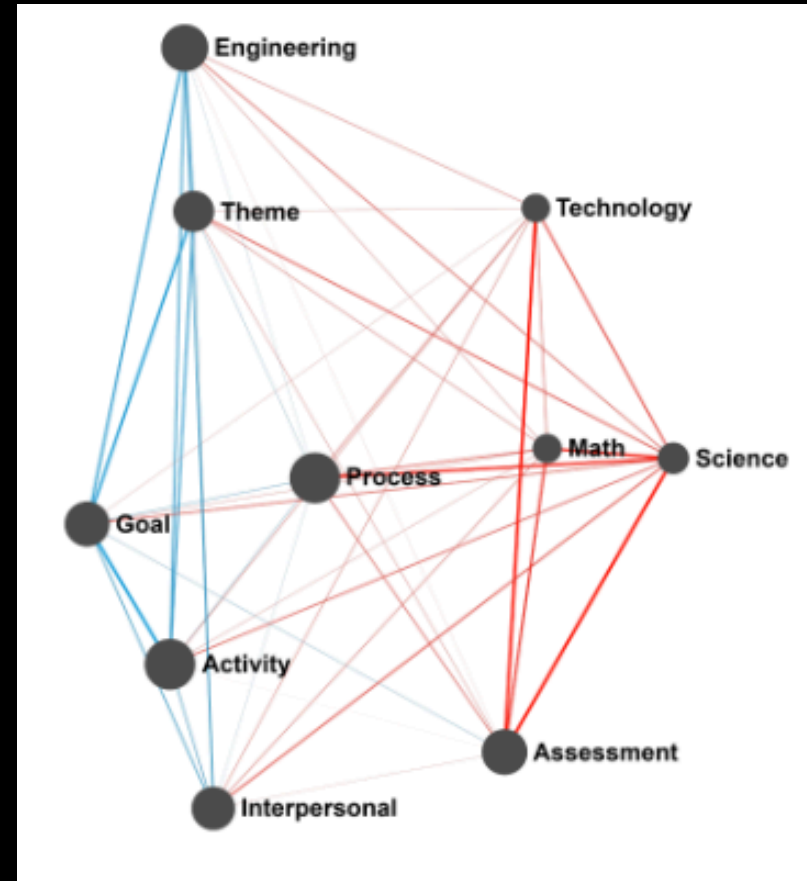
Variable sized nodes

Connections (colour and weight)

Meaning of node positions and the quadrants open to researcher interpretation

Common node positioning enables visual comparison and calculation of subtraction networks

Centroid trajectories, + more...

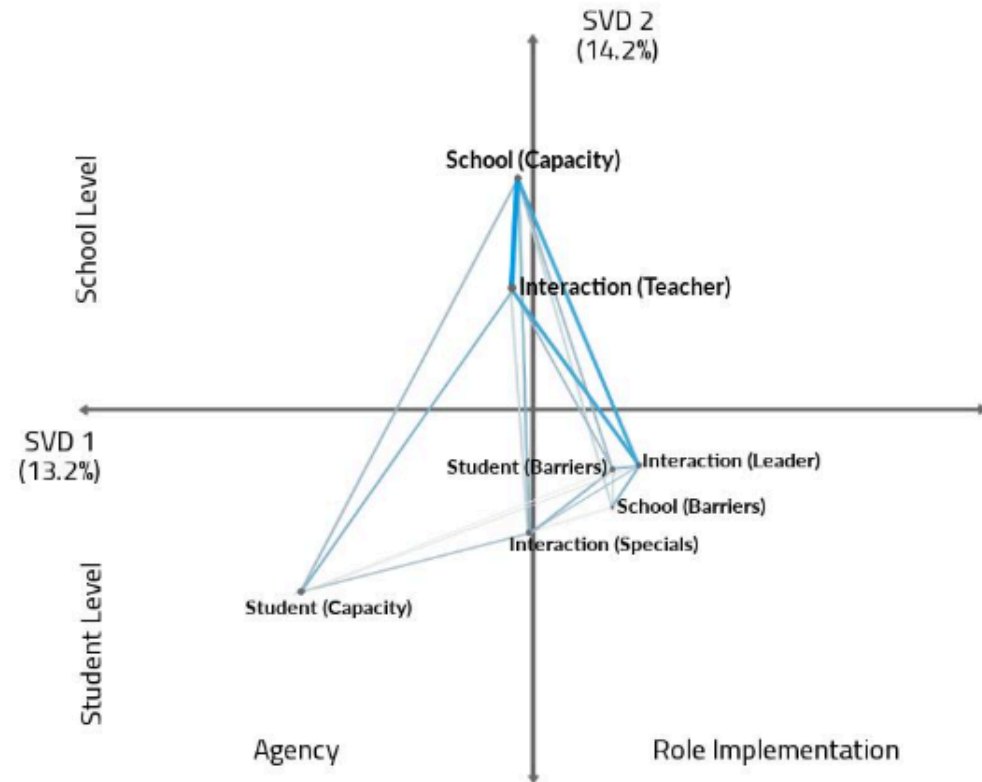


Bian Wu: <https://qesoc.org/webinar-archives/#webinar-7>

Exploiting our ability to detect visual changes

Srecko Joksimovic:

<https://www.qesoc.org/webinar-archives/#webinar-5>

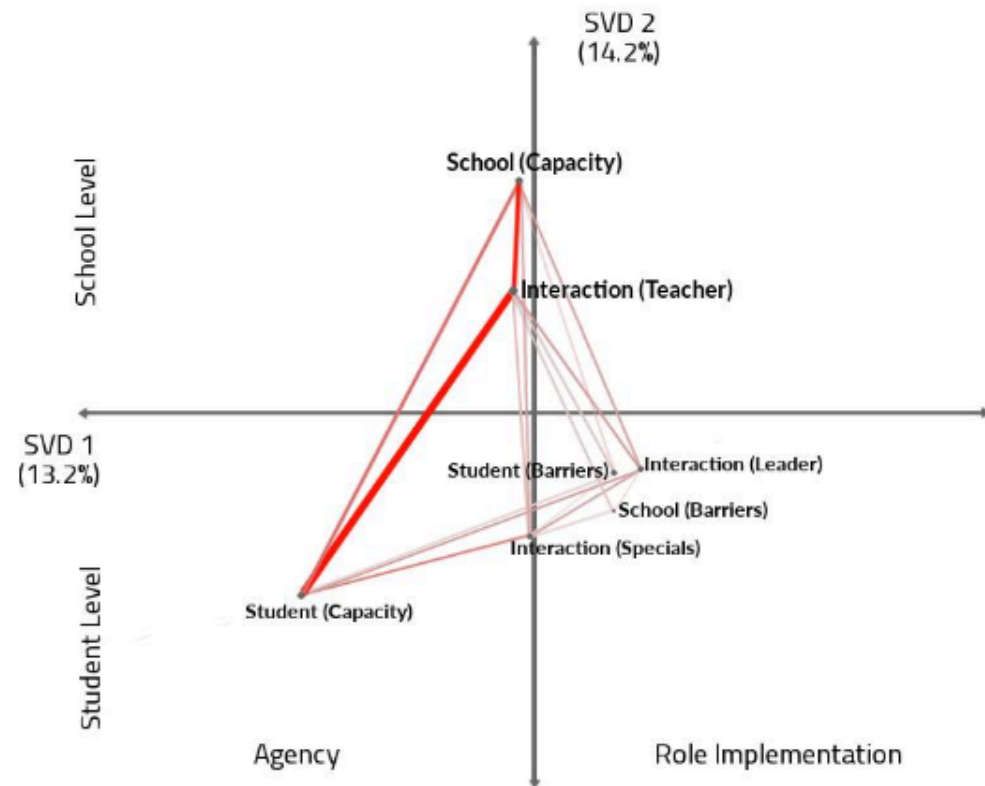


Acting as role implementers

Exploiting our ability to detect visual changes

Srecko Joksimovic:

<https://www.qesoc.org/webinar-archives/#webinar-5>



Acting as agents

dENA extends the ontology and notation with directed edges → greater expressiveness

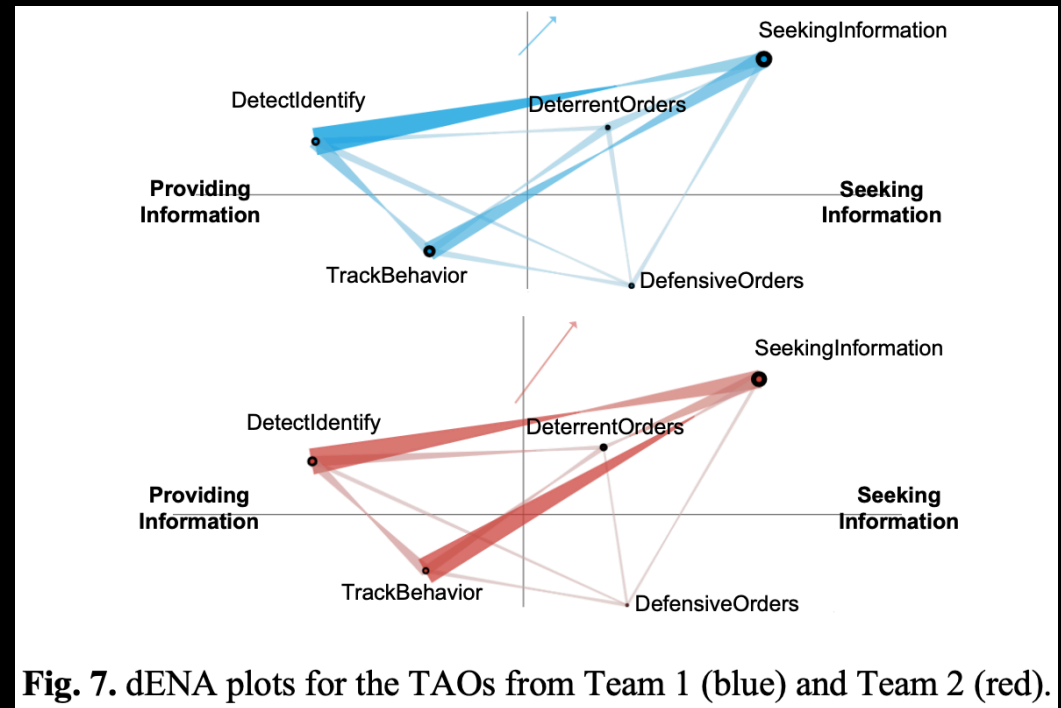
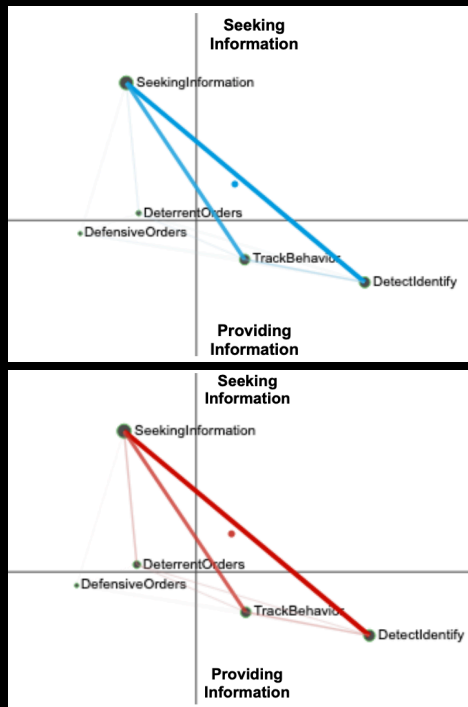


Fig. 7. dENA plots for the TAOs from Team 1 (blue) and Team 2 (red).

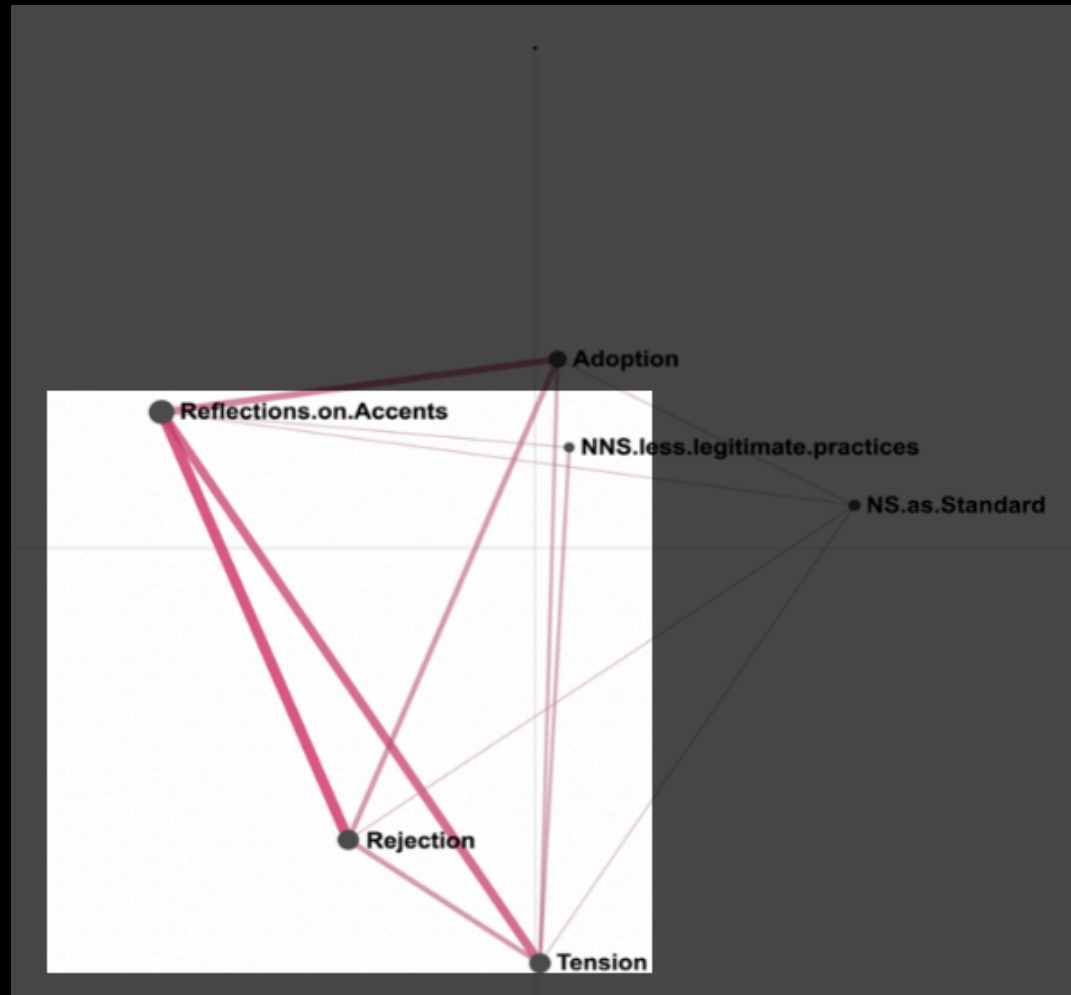
Additional ENA 'narrative techniques'

When people work around, or augment software
with other tools (inc. pen+paper),
they're clues to gaps in cognitive support
→ potential software improvements

Zoom in and reduce visual noise to focus attention

Golnaz Arastoopour Irgens:

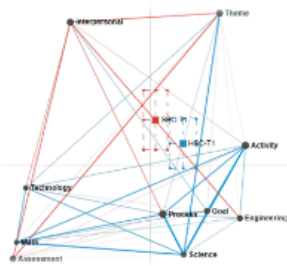
<https://www.qesoc.org/webinar-archives/#webinar-4>



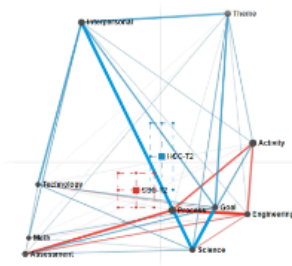
Design a gallery...

Bian Wu: <https://qesoc.org/webinar-archives/#webinar-7>

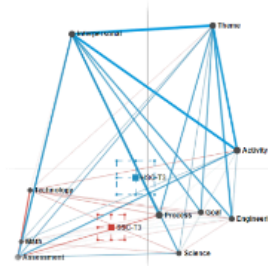
Task1 STEM learning theme



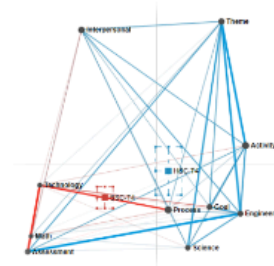
Task2 STEM learning goals



Task3 STEM learning evidence



Task4 STEM learning assessment



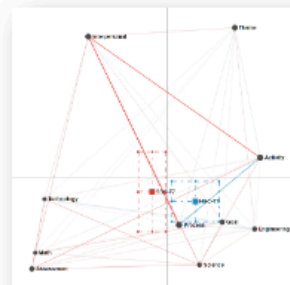
Task5 Refinement of draft design



Task6 STEM learning activity



Task7 STEM learning resources

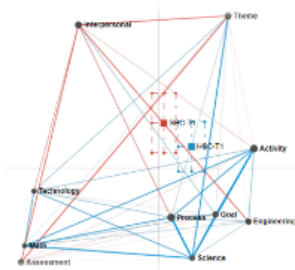


Unit: individual
Stanza window: 6
Conversation: design discussion
of each task
Static scaffold group
Adaptive scaffold group

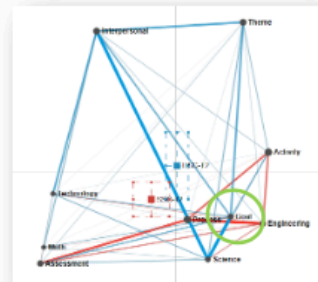
Design a gallery and highlight features to focus attention

Bian Wu: <https://qesoc.org/webinar-archives/#webinar-7>

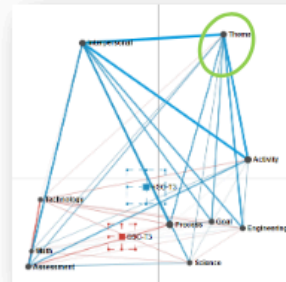
Task1 STEM learning theme



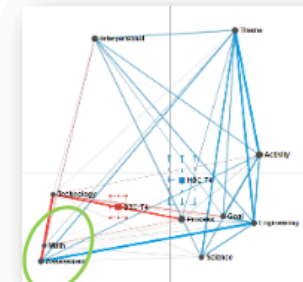
Task2 STEM learning goals



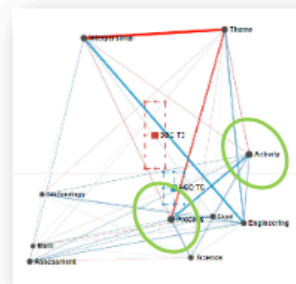
Task3 STEM learning evidence



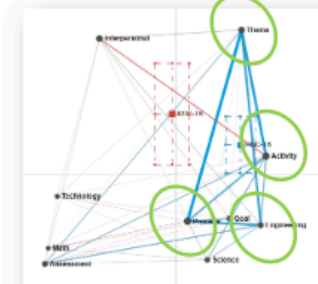
Task4 STEM learning assessment



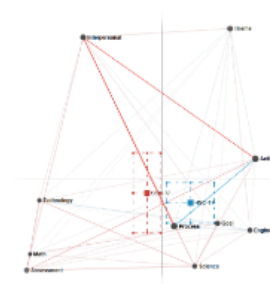
Task5 Refinement of draft design



Task6 STEM learning activity



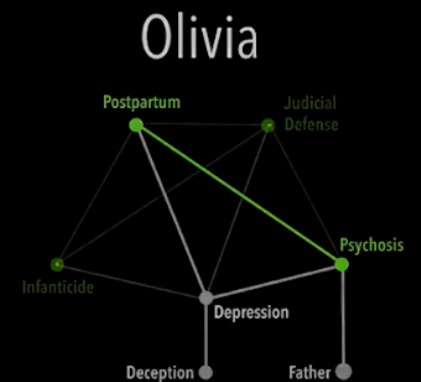
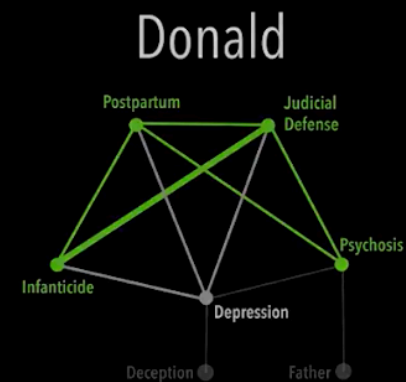
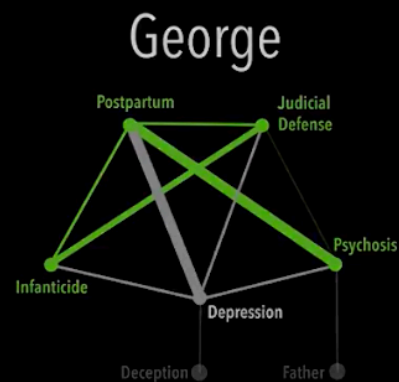
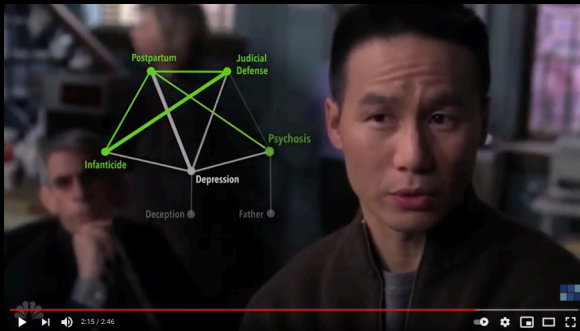
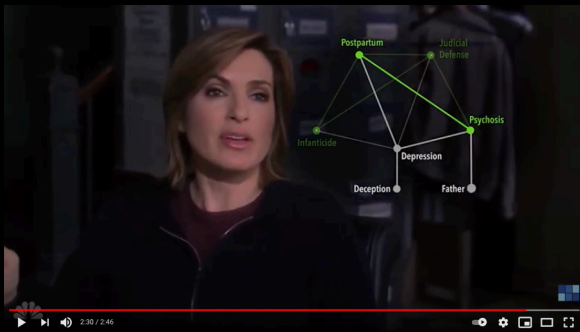
Task7 STEM learning resources



Unit: individual
Stanza window: 6
Conversation: design discussion
of each task
Static scaffold group
Adaptive scaffold group

Animated ENA + synchronized video is compelling

Epistemic Analytics Lab: “Law & Order” ENA-annotated clip

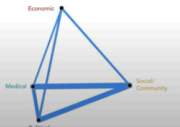



<https://www.youtube.com/watch?v=wrTiXNleHZA>

Animated ENA + synchronized video is compelling



QE Society data challenge: Ardern & Trump COVID-19 policy statements

...in a country where equity ...
Lamin: So please, stay strong, stay home, be kind, and let's finish what we started. I'll now hand over to Dr Bloomfield.
Thank you, Prime Minister. Kia ora koutou katoa. I just want to comment briefly today on the work over recent weeks on testing and contact tracing, given the significance of both of these for supporting our move to level 3. These are two areas of the public health response that we have scaled significantly over the last two months. Early on, we worked hard to ensure New Zealand implemented its own testing capability, and we have

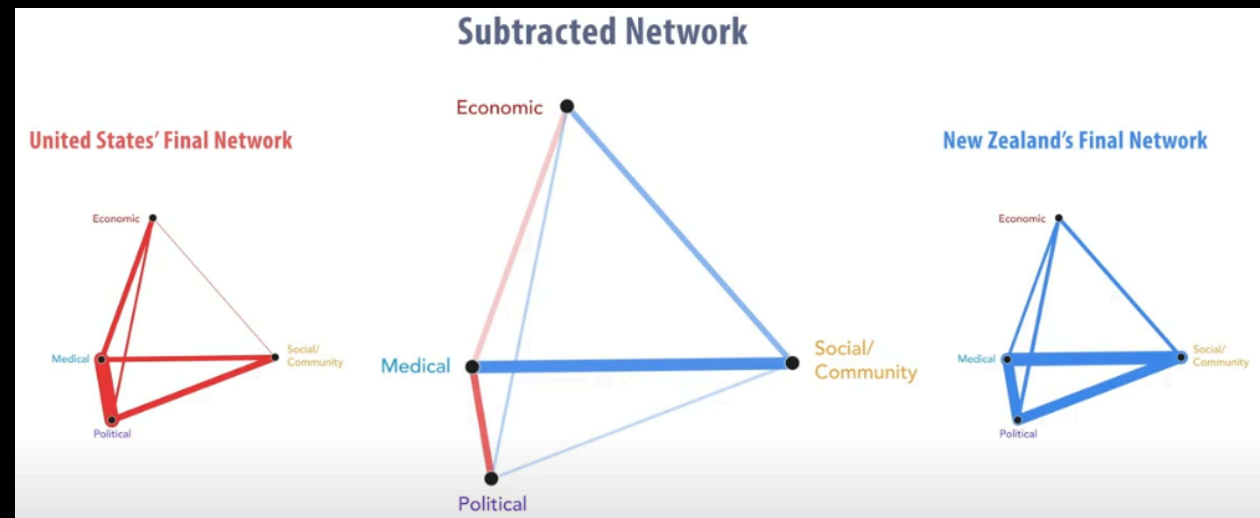


2:35 / 6:09

...Smith, The Ventilator Shortage That Wasn't. The ventilator shortage that wasn't because we got it fixed. And we're also going to help the states, by the way, stockpile ventilators so if a thing like this should happen again they've got them. The stories on testing are all over the place that we're actually in good shape. I'm going to have the vice president and others speak to you about that, but we're in very good shape on testing and we're getting better all the time. You're going to see some interesting things.



4:02 / 6:09



<https://youtu.be/Sy-gwY3SXQ0>

Summary: ENA serves as an aid to shared, external cognition via processes including...

Computational offloading

Graphical constraining

Continuous internal/external cognition interplay

Shared focus of visual and deictic attention

Accessible, shared language for joint sensemaking

Additional narrative to tell the story

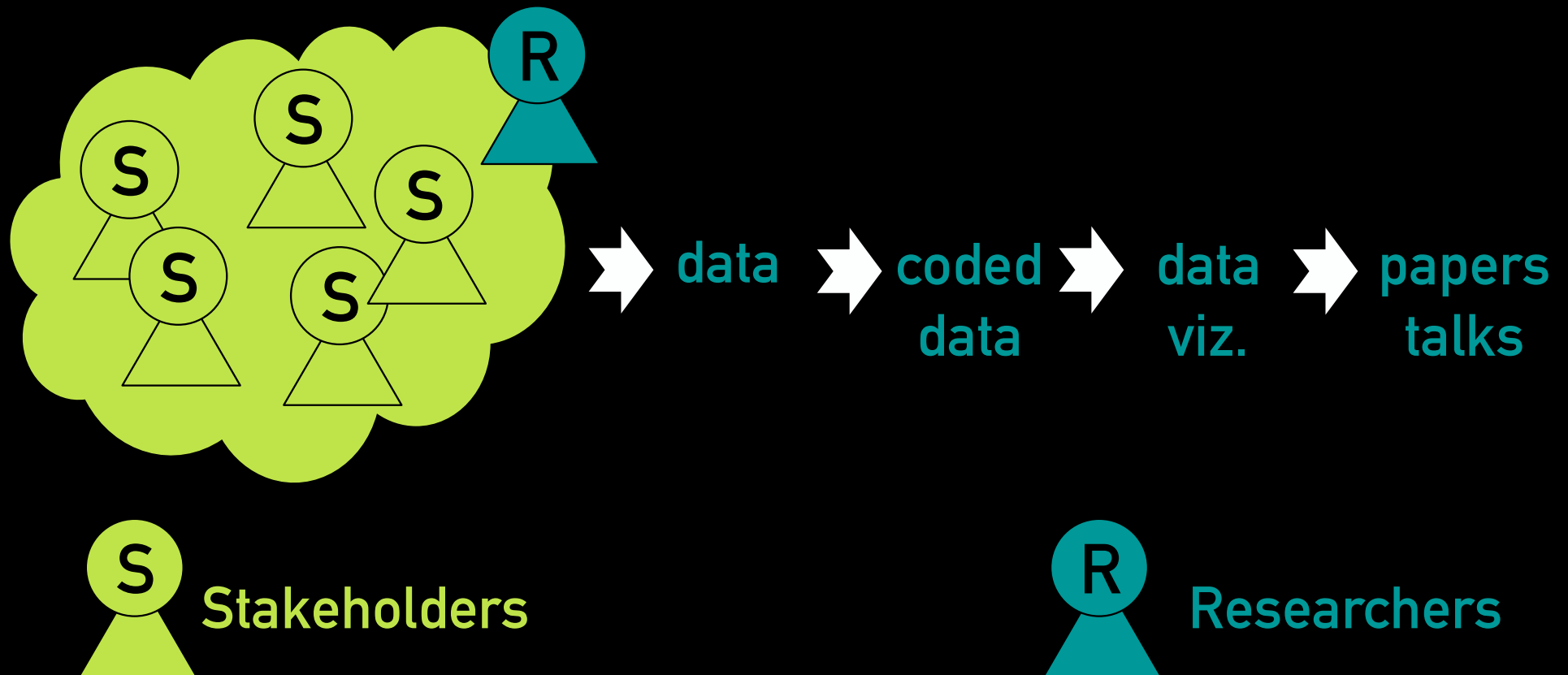
Who are we talking to?

Do they get to interpret?

QE for researchers to tell stories to each other

“emic”

“etic”



"etic"



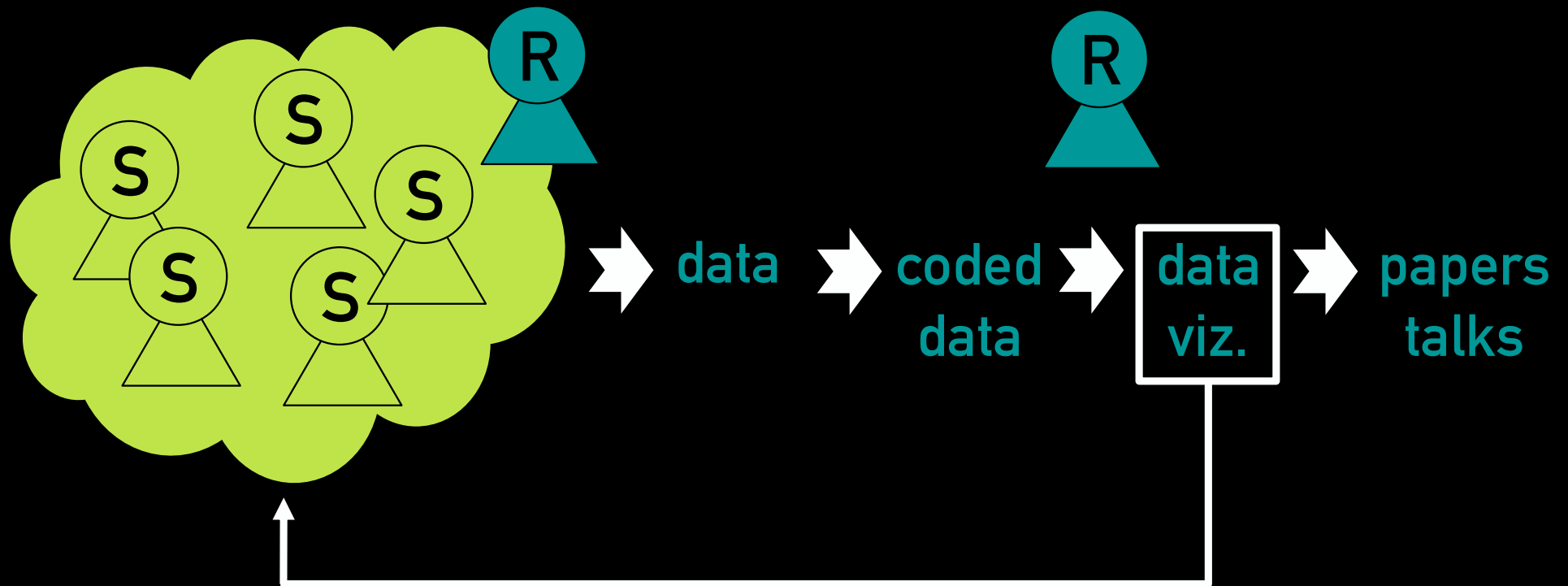
In the 'etic' world...

- Other researchers judge their agreement with our formally submitted papers against scientific criteria
- Establishing scientific credibility has rightly been the first focus of QE as a new field.

QE that validates with stakeholders

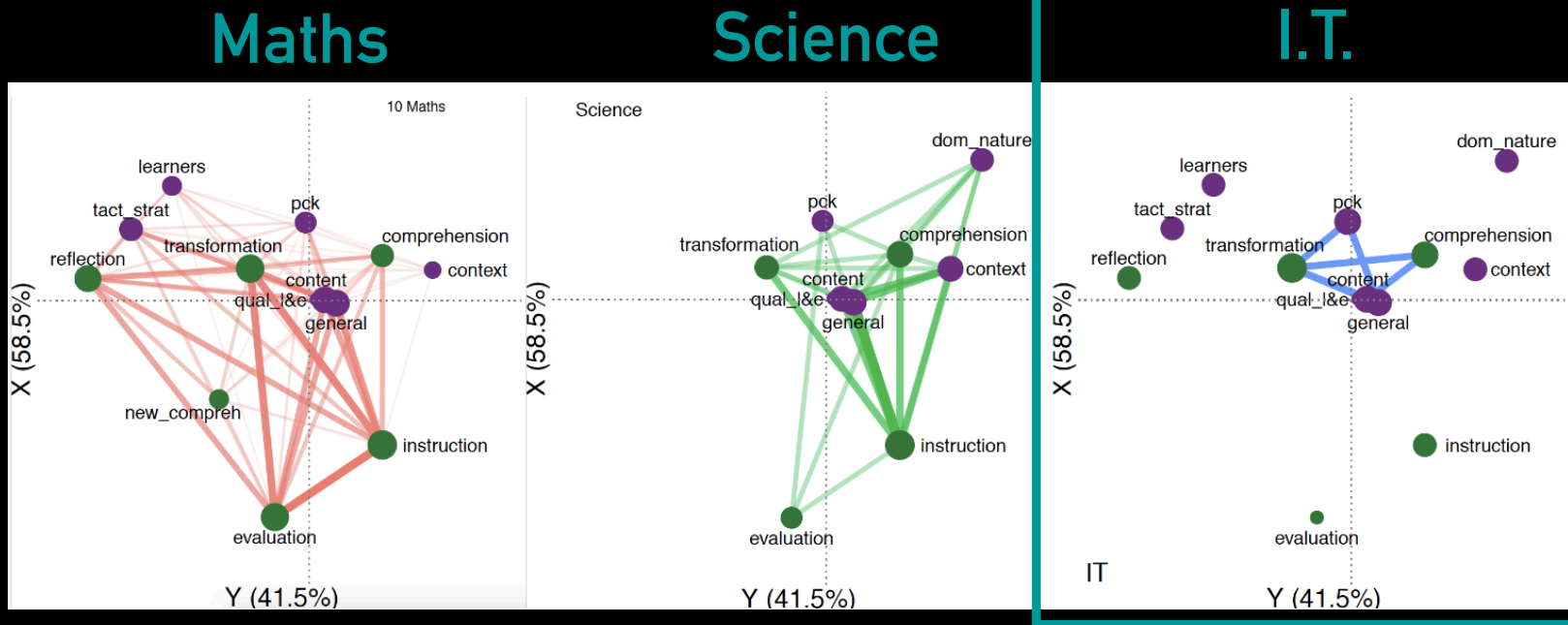
“emic”

“etic”



Making ENA diagrams more participatory (1)

Michael Phillips: ICQE2020 paper and his webinar:
<https://www.qesoc.org/webinar-archives/#webinar-2>



(In)validating the strange ENA for I.T. teachers: “So they were having conversations all the time [...] But that didn't necessarily get translated into the kinds of documentation they had in school. They were doing this on the fly in real time. And so, all of a sudden, I realized that just using one of these data sources didn't necessarily give me the full picture.”

Making ENA diagrams more participatory (2)

Golnaz Arastoopour Irgens & Hazel Vega:

<https://www.qesoc.org/webinar-archives/#webinar-4>

“We needed to set the stage to co-create meaning together with the teachers, and to ensure that this network is just one interpretation of what they said...”

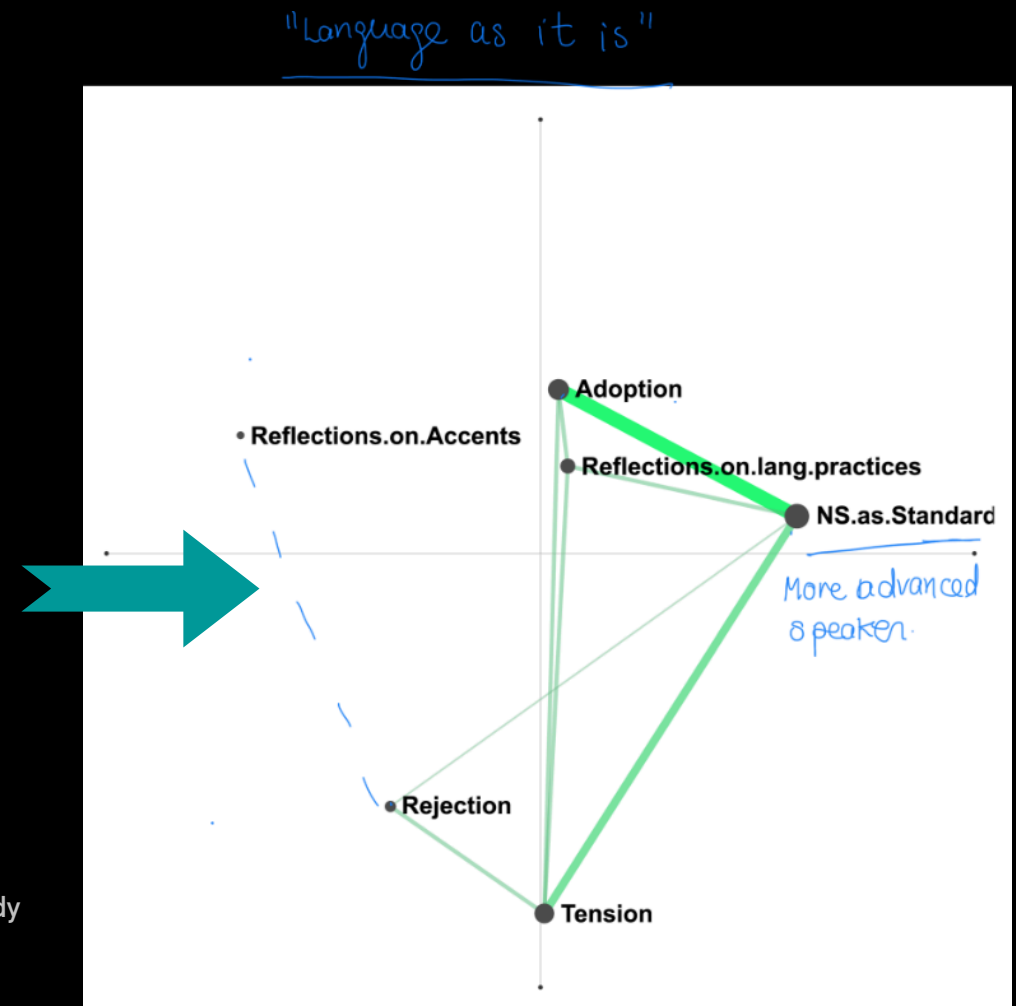
Making ENA diagrams more participatory (2)

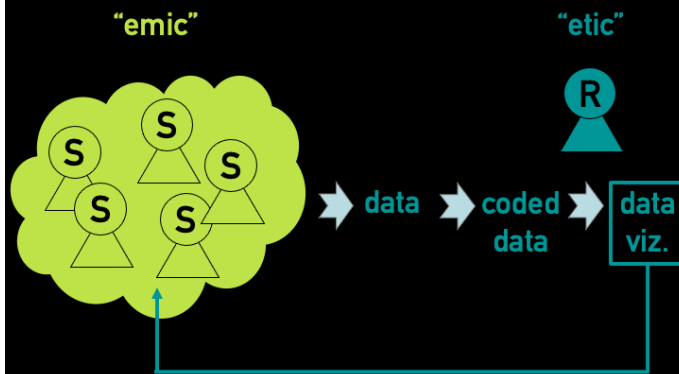
Golnaz Arastoopour Irgens & Hazel Vega:
<https://www.qesoc.org/webinar-archives/#webinar-4>

“[the researcher] annotated the network during the interview [...]

There's a dotted line here between reflection on Accents and Rejection, because [...] the teacher said [...] she felt that there should have been a link between those two things, for her discourse.”

Vega, H., Arastoopour Irgens, G., & Bailey, C. (2020). Negotiating Tensions: A Study of Pre-Service English as Foreign Language Teachers' Sense of Identity within their Community of Practice. In Ruiz, A. & Lee, S. (Eds), *Advances in Quantitative Ethnography: Second International Conference, ICQE 2020*. (pp.) Springer.





When we loop 'etic' back into dialogue with 'emic'

- Stakeholders are given a voice to validate the analysis
- The 'etic' could change the 'emic'
- The 'emic' could change the 'etic'

Expanding the audience has consequences for QE visualizations

Computational offloading

Graphical constraining

Continuous internal/external cognition interplay

Shared focus of attention

Accessible, shared language for joint sensemaking

Additional narrative techniques
+ malleability → new meanings...

ONLY WORKS if the representation is
(i) intuitive and
(ii) editable

Software design implications?



**As QE becomes embedded in interactive tools
to support work systems, we have to
think differently about QE visualizations**



Now we're designing work systems

"emic"

"etic"



Work System

with a new Tool

and Users who may be different from the Stakeholders being analysed

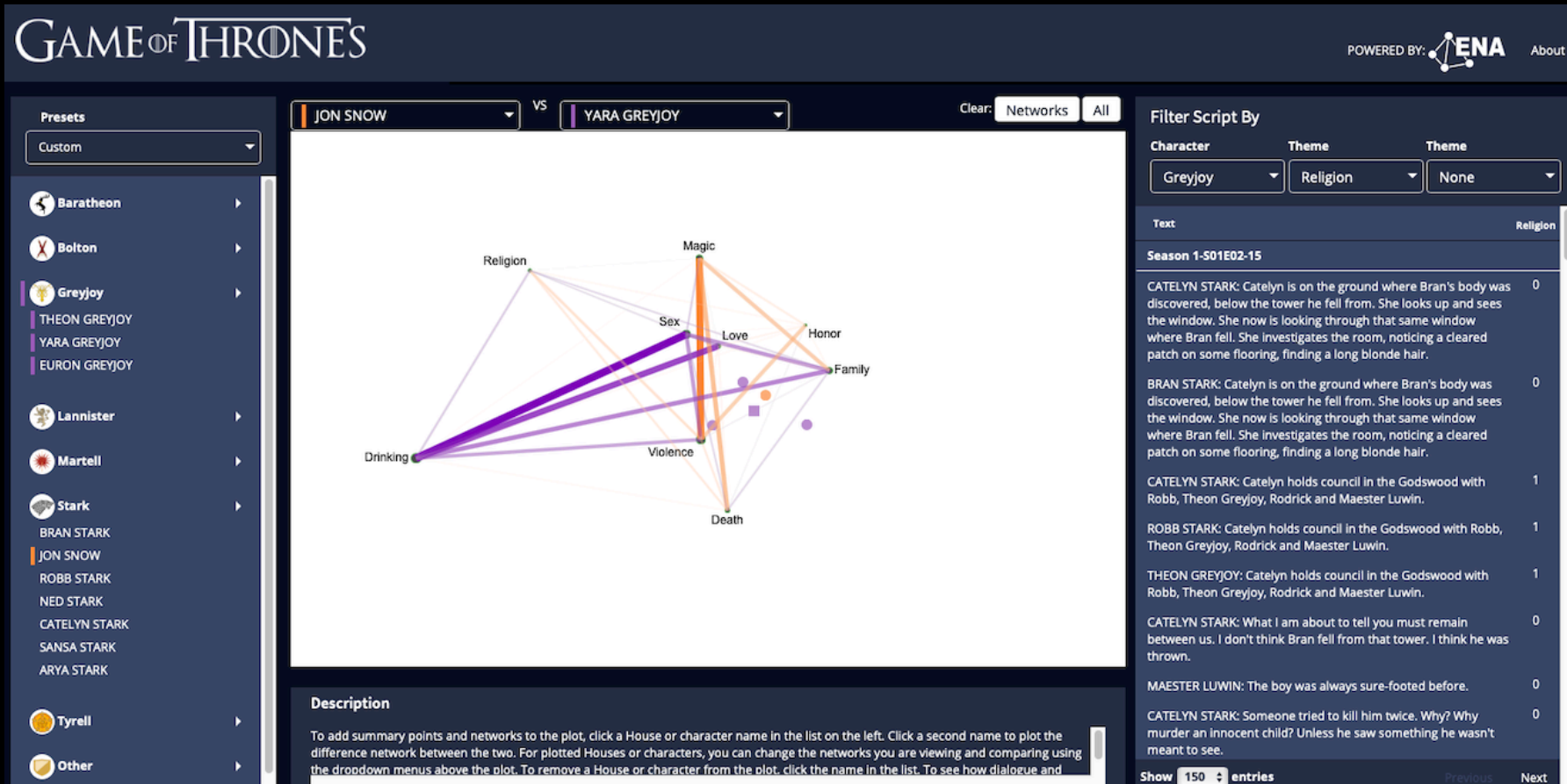


Implications now we're designing work systems

QE is now part of a (hopefully) human-centred design process

- increasing the diversity of voices in system design
- changing the viz. design process (affordances vary with user expertise)
- and the designed product (what Stakeholders/Users want to see and do in the tool)
- ...which will differ from QE researchers' viz. requirements
- there is now no expert to provide additional narrative: it has to be in the tool

Scaffolding interpretation for non-experts in QE



Swiecki, Z., Marquart, C., Sachar, A., Hinojosa, C., Ruis, A.R., Shaffer, D.W. (2019). Designing an interface for sharing quantitative ethnographic research data. In Eagan, B., Misfeldt, M., & Siebart-Evenstone, A.L. (Eds.) *Advances in Quantitative Ethnography: ICQE 2019*.

Embedding QE in a real-time dashboard (1)

Summary

Notebook

Standards

Stats

Process

Group: L-NPO

Group: L-EDC

Group: LC-RWC

Group: L-CAG

Bel

Izzy

Justine

Nic

Ryan

Link

Zelda

Ganon

Vaati

Majora

Ross

Joey

Monica

Rachel

Phoebe

Mario

Yoshi

Luigi

Peach

Daisy

Entrance Interview and Workflow Tutorial

Customer Input Map

Customer Input Map Reflection

Request for Proposals

Preference Survey

Preference Survey Reflection

Revised Preference Survey

Revised Preference Survey Reflection

Combined Preference Survey

Final Plan Discussion

Final Proposal

Exit Interview

Individual

Group

Justine

Made at least one critical connection

Indicator Based Justifications

Model Relationships

Stakeholder Based Justifications

Balance

Location

Valuing Indicators

Trade-offs

Intervention

Justine is:

- balancing issues stakeholders care about

You might suggest that Justin thinks about:

- how land use changes affect indicators in the model, and how that can help balance issues stakeholders care about

Chat

know how to balance that out.

Bel:

6/29/16 02:45 PM

as we change things the indicator graphs would change things, like more commercial zones increased sales and more industrial zones increased the Carbon monoxide and job

Bel:

6/29/16 02:45 PM

good

Justine:

6/29/16 02:45 PM

That sounds right

Justine:

6/29/16 02:45 PM

I feel I need to know more about zoning and its implications.

Ryan:

6/29/16 02:45 PM

I think it was very hard to change anything without having repercussions in a different category. It was definitely challenging to try and satisfy all of the different demands of the stakeholders.

Ryan:

6/29/16 02:45 PM

Several

Justine:

6/29/16 02:45 PM

I tried to change carbon monoxide but clearly it didn't work.

Nic:

6/29/16 02:45 PM

I feel like I was just randomly changing industrial plots to open space/wetlands for more nesting sites and less carbon emissions but I feel like if I really knew how to successfully zone, the outcome would be better.

Nic:

6/29/16 02:45 PM

Also several indicators

Justine:

6/29/16 02:45 PM

It seems almost impossible to please every stakeholder because you have to sacrifice jobs and sales to reduce carbon emissions and increase nesting sites, so we will have to compromise.

Scripts

Room Guides

Groups

L-CAG

34

Hide

L-EDC

0

Hide

L-NPO

0

Hide

LC-RWC

0

Hide

Mentor Chat

Support

7/12/16 AM

Kira Valmansi

7/12/16 AM

Just let me know if you get my notes on here as I'm at the school, where we've had tech issues in the past

Kira Valmansi

7/14/17 AM

ok will do.

Kira Valmansi

7/14/17 AM

The fact that you even got this out of tech is a good sign!

Kira Valmansi

7/15/17 AM

tee hee

Kira Valmansi

7/22/17 AM

Looks like everything is A-OK here today

Support

7/27/16 AM

Hi All, I was a little late logging on, but I'm available if you have any questions! Looks like everything is going well though :)

Kira Valmansi

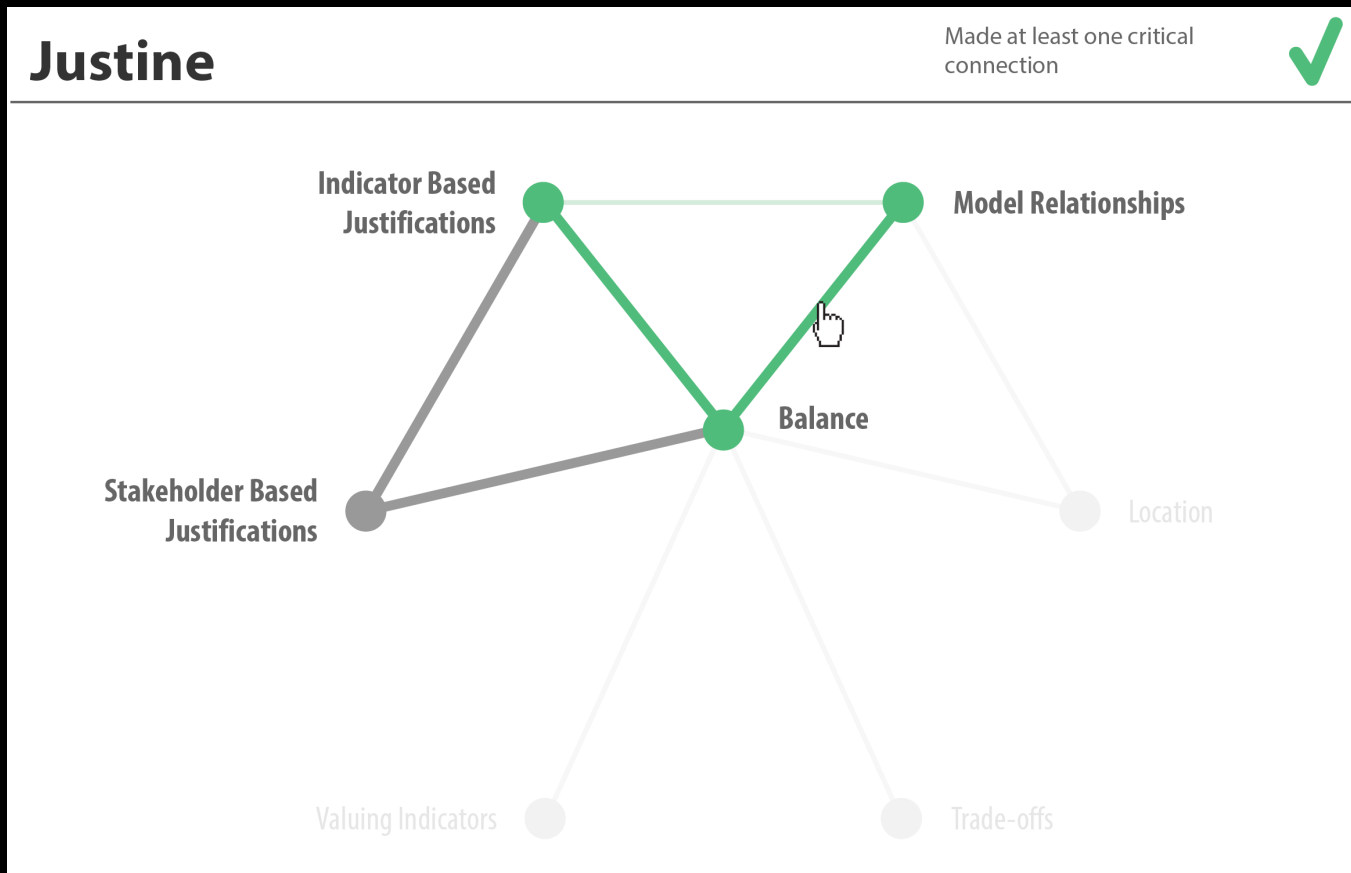
7/27/16 AM

@Support: thank you! It's going well today. No issues so far

Type chat here, [Enter] to send.

Herder, T., Z. Swiecki, S. S. Fougat, A. L. Tamborg, B. B. Allsopp, D. W. Shaffer and M. Misfeldt (2018). Supporting teachers' intervention in students' virtual collaboration using a network based model. *Proc. 8th International Conf. Learning Analytics and Knowledge*. Pp.21–25. <https://doi.org/10.1145/3170358.3170394>

Embedding QE in a real-time dashboard (1)
































Headline summarises key point

Nodes positioned for visual clarity, no semantics as in normal ENA

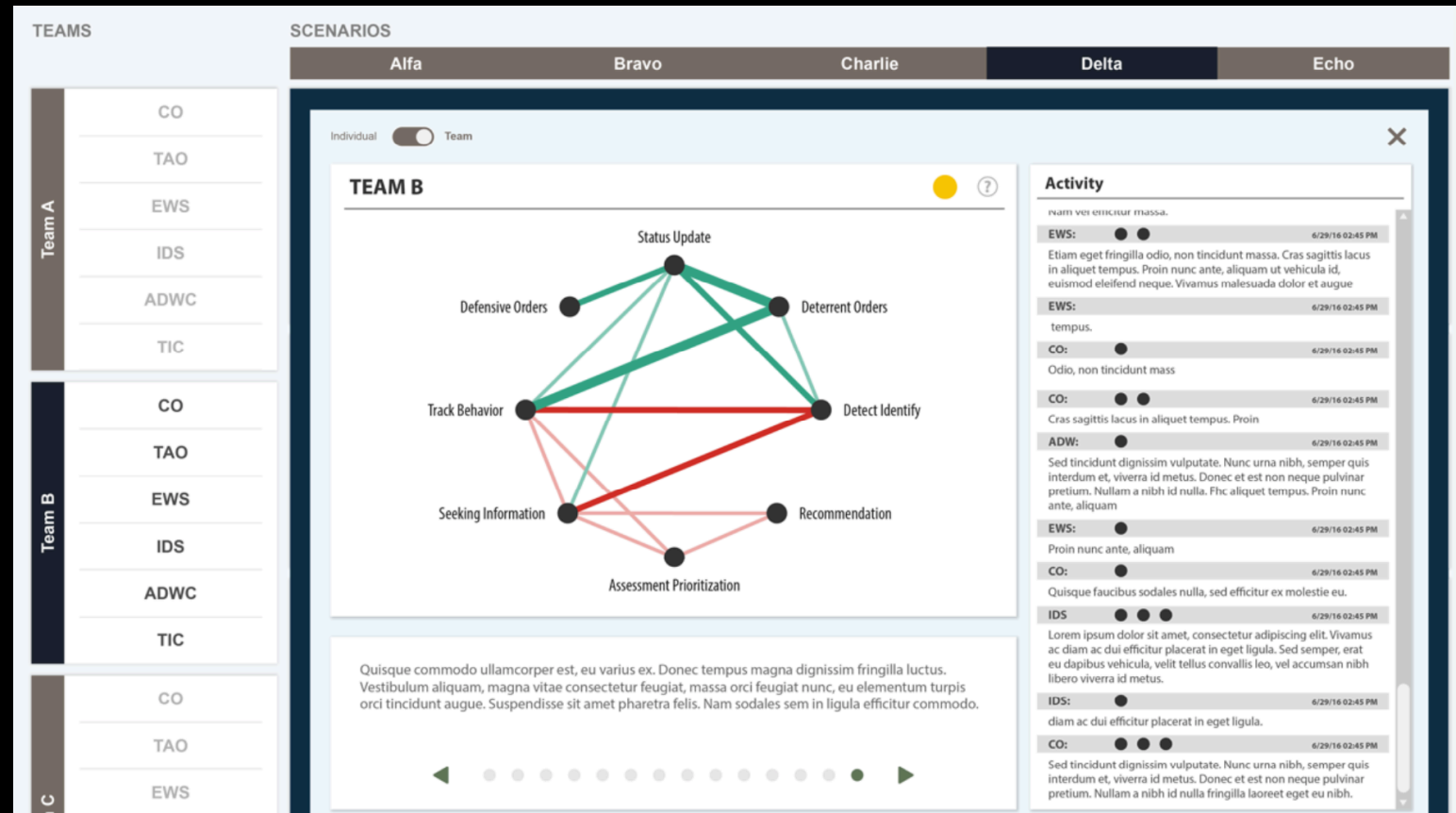
Embedding QE in a real-time dashboard (2)

Overall status indicator
re. the 'health' of a
team's ENA network

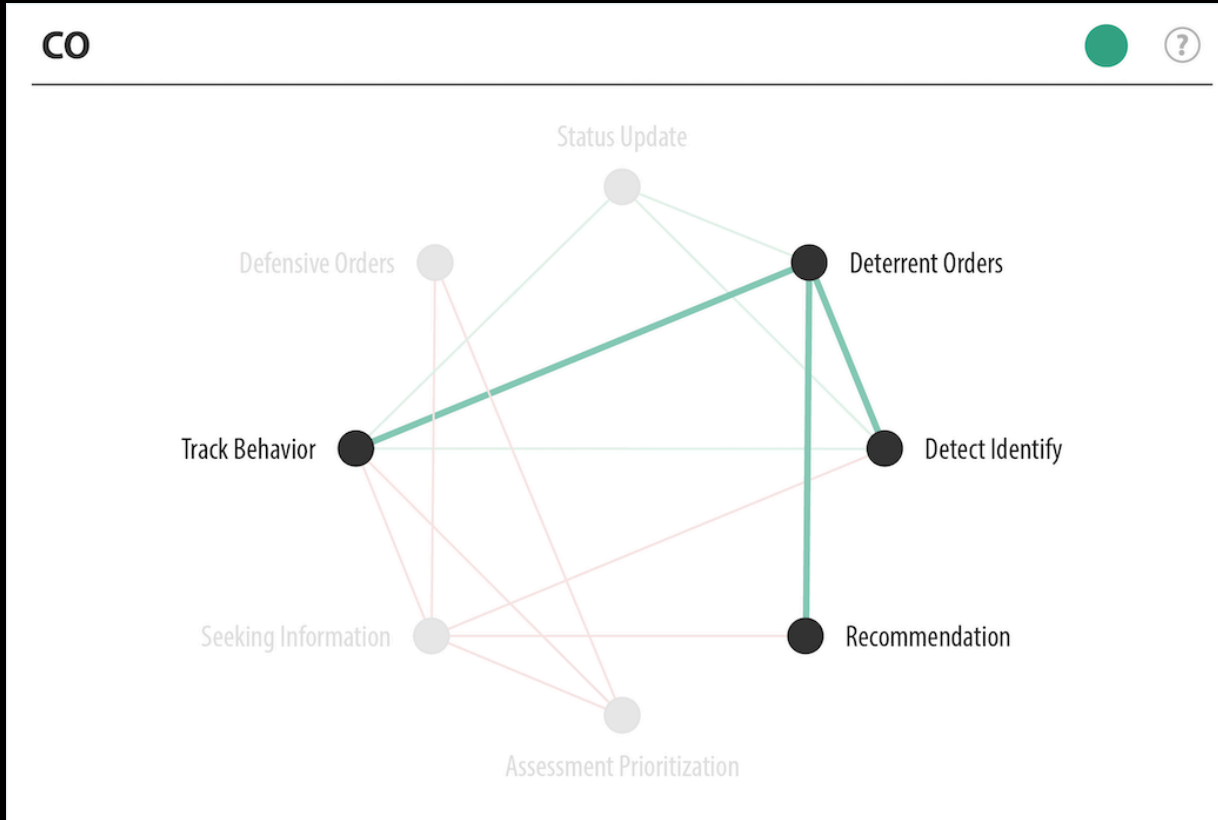
TEAMS		SCENARIOS		
		Alfa	Bravo	Charlie
Team A	CO			
	TAO			
	EWS			
	IDS			
	ADWC			
	TIC			
Team B	CO			
	TAO			
	EWS			
	IDS			
	ADWC			
	TIC			

Embedding QE in a real-time dashboard (2)

Drill down for detail displays an interactive ENA linked to the transcript



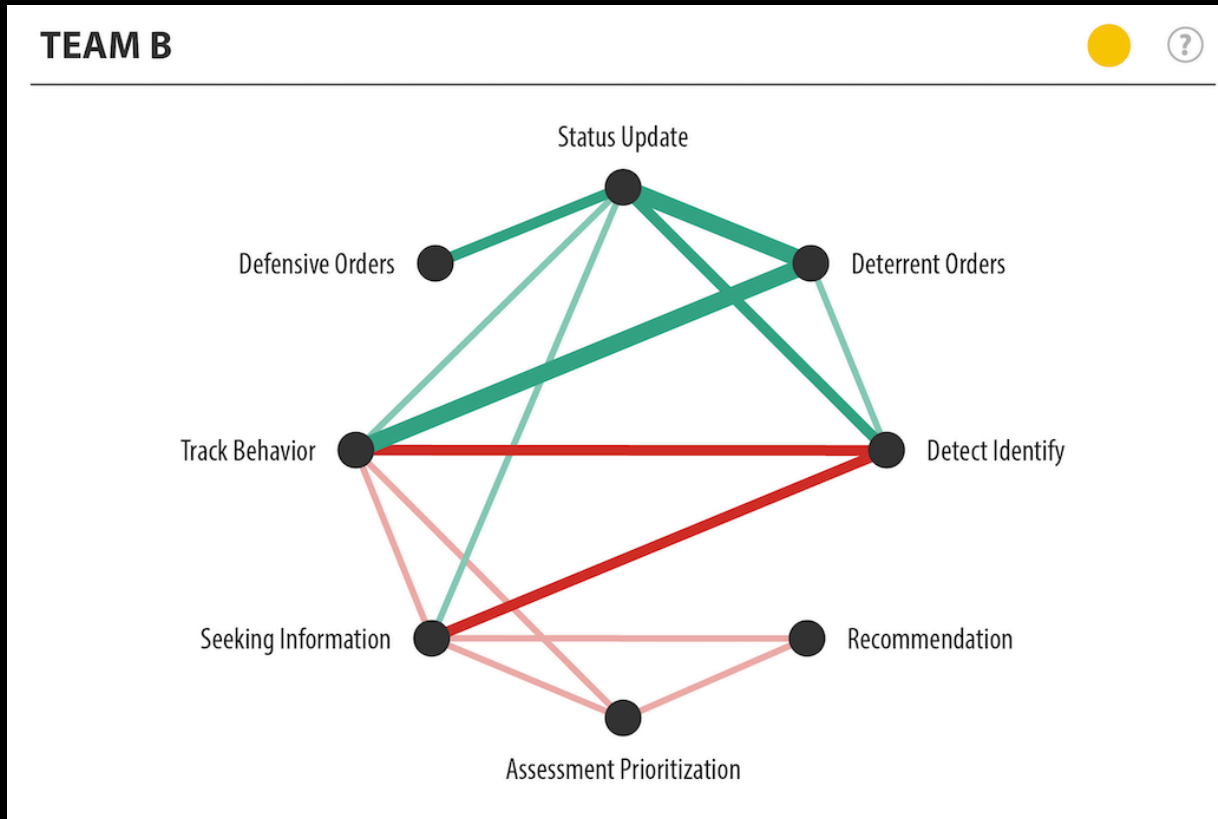
Embedding QE in a real-time dashboard (2)



Headline icon summarises overall status of network

Nodes positioned for visual clarity, no semantics as in normal ENA

Embedding QE in a real-time dashboard (2)



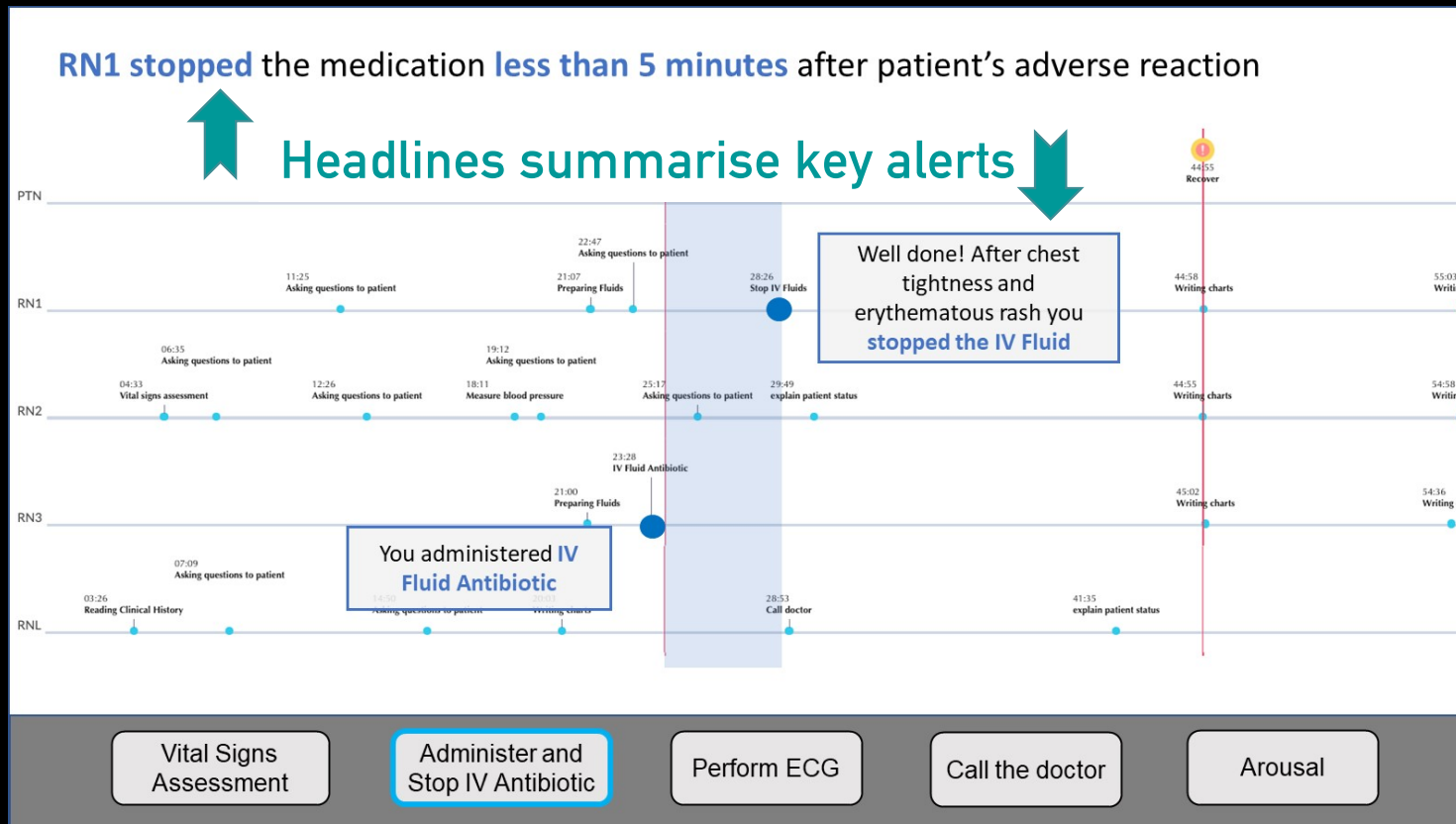
Headline icon
summarises overall
status of network

Nodes positioned for
visual clarity, no
semantics as in
normal ENA

Embedding QE in a post-hoc dashboard (1)

Roberto Martinez-Maldonado et al: <https://www.qesoc.org/webinar-archives/#webinar-8>

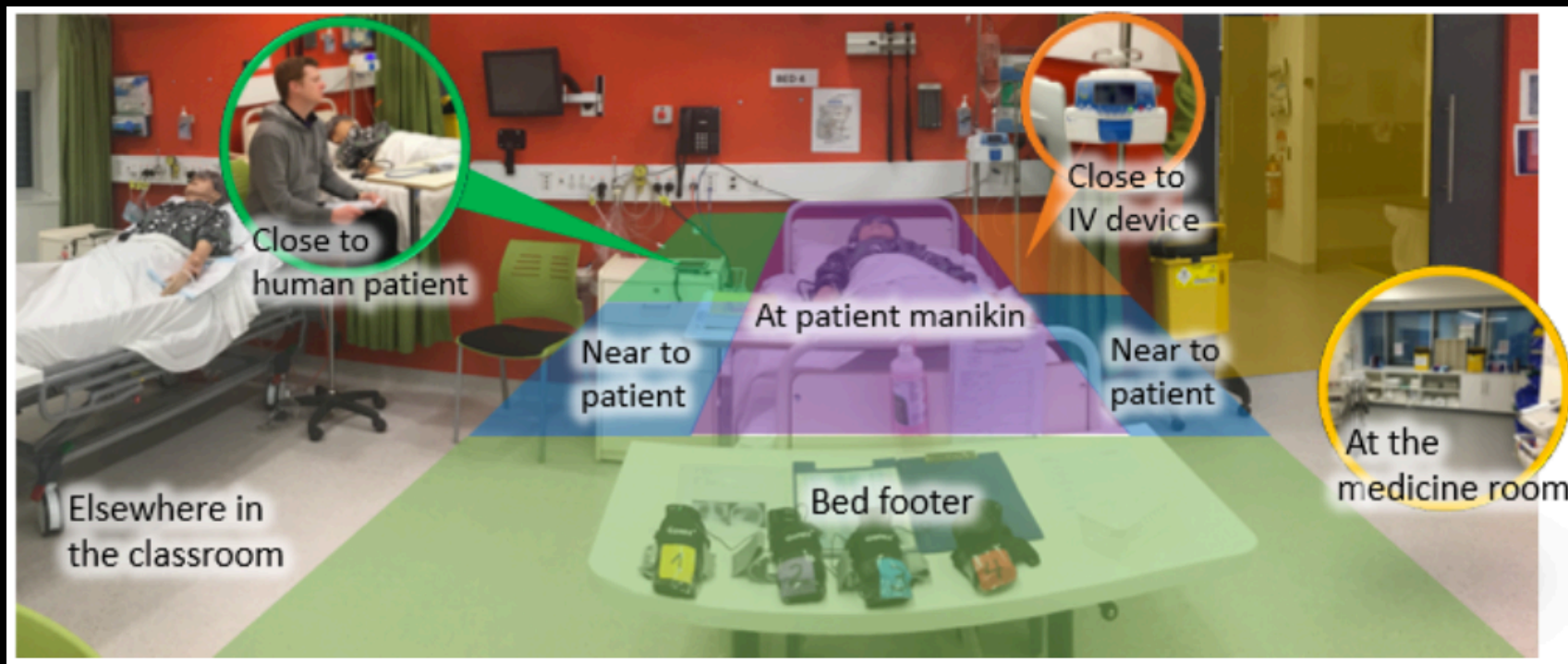
Headlines
summarise
key alerts



Martinez-Maldonado, R., Echeverria, V., Fernandez-Nieto, G. & Buckingham Shum, S. (2020). From Data to Insights: A Layered Storytelling Approach for Multimodal Learning Analytics. *Proc. ACM CHI 2020: Human Factors in Computing Systems*, Paper 21, pp.1-15. <https://doi.org/10.1145/3313831.3376148>

Embedding QE in a post-hoc dashboard (2)

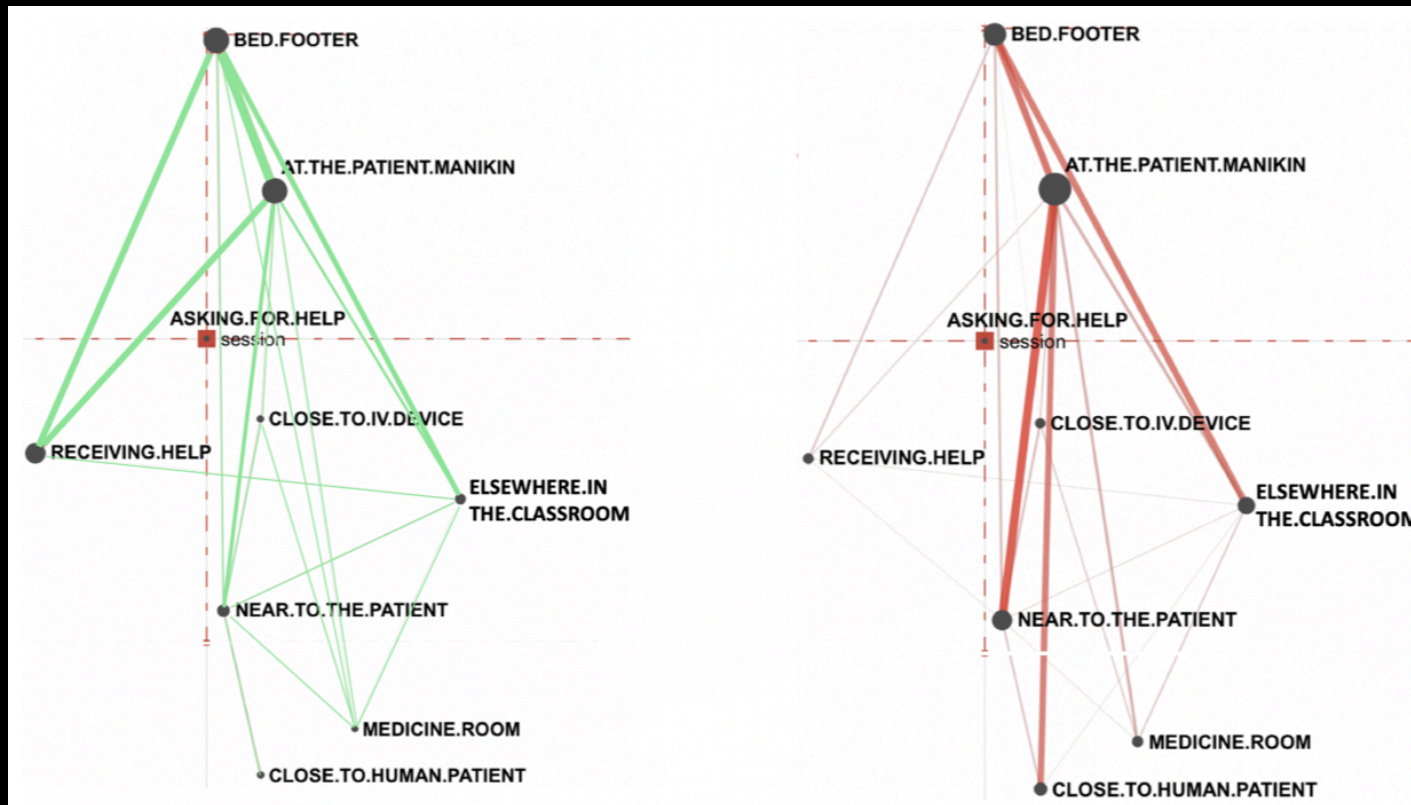
ENA annotation of Spaces of Interest in the Simulation Ward



Fernandez-Nieto, G., Martinez-Maldonado, R., Kitto, K. & Buckingham Shum, S. (2021). Modelling Spatial Behaviours in Clinical Team Simulations using Epistemic Network Analysis: Methodology and Teacher Evaluation. *Proc. 11th International Conference on Learning Analytics & Knowledge*. <https://doi.org/10.1145/3448139.344817>

Embedding QE in a post-hoc dashboard (2)

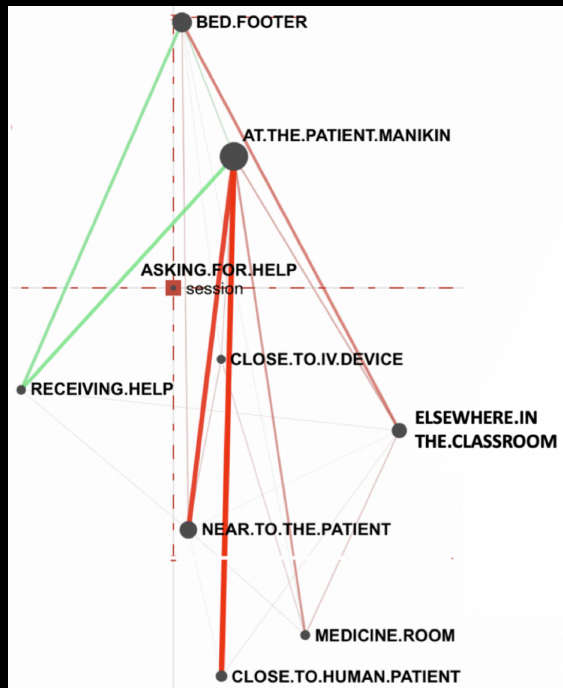
Default ENA network: can nursing teachers interpret this?



Fernandez-Nieto, G., Martinez-Maldonado, R., Kitto, K. & Buckingham Shum, S. (2021). Modelling Spatial Behaviours in Clinical Team Simulations using Epistemic Network Analysis: Methodology and Teacher Evaluation. *Proc. 11th International Conference on Learning Analytics & Knowledge*. <https://doi.org/10.1145/3448139.344817>

Embedding QE in a post-hoc dashboard (2)

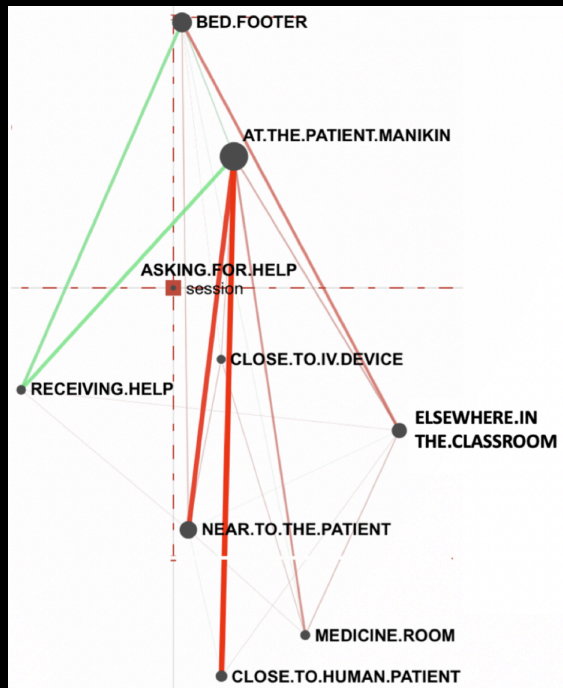
Default ENA network: can nursing teachers interpret this?



- Nodes, links, colours, thickness: intuitive after a brief introduction
- Team differences were 'read off' correctly, and validated against knowledge of the students
- Node names could be corrected
- 2 nodes should be combined
- A node needed to be split into 2 distinctive ones
- Clear incongruence between spatial location on the ward, and ENA node position

Embedding QE in a post-hoc dashboard (2)

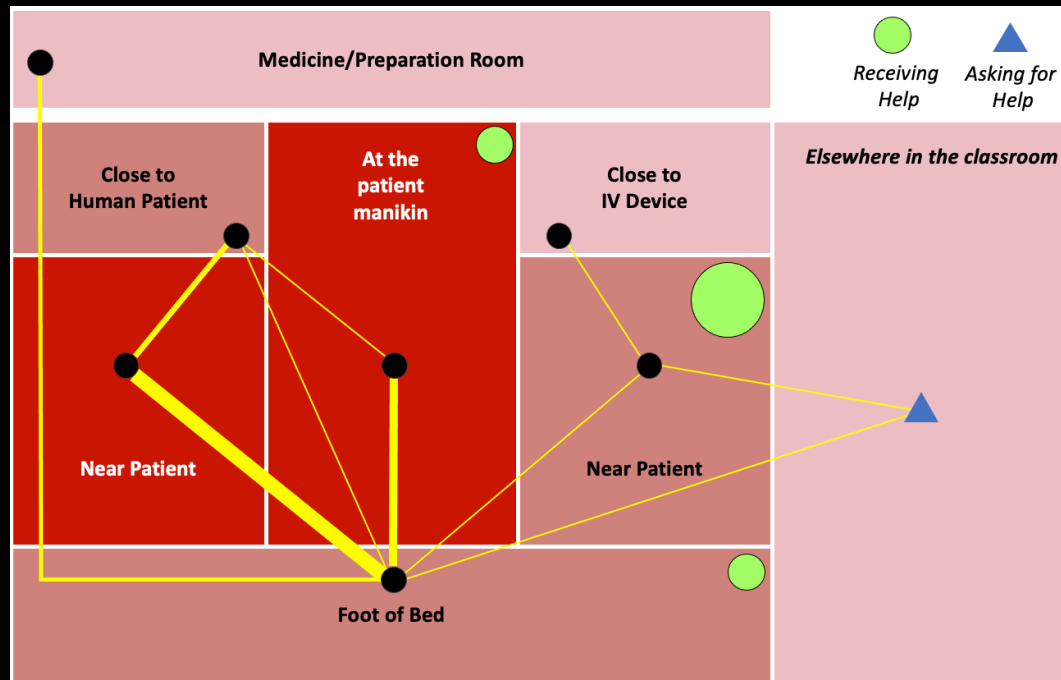
Incongruence between spatial location on the ward, and ENA node position



- Repeated reminders required emphasizing that node positions \neq floorplan position
- One teacher thought the ENA seemed upside-down (medicine room is at the bottom)
- An edge passing close to a node was read as the student passed close to that location
- ENA node for the manikin patient was distant from the node for the human role-playing the patient's voice: nodes to be merged

Embedding QE in a post-hoc dashboard (2)

In the context of the nursing work system, switch to ENA-based annotation of a more intuitive visualization: the ward floorplan



Mapping from ENA to new visual language:

ENA node size → colour saturation
→ a heatmap of spaces

ENA edge size → edges overlayed directly
onto a floorplan → direct representation of
nursing movements

Asking/Receiving Help nodes → *activity
icons* in the relevant locations

Beyond networks

**Interactively linked
complementary representations**

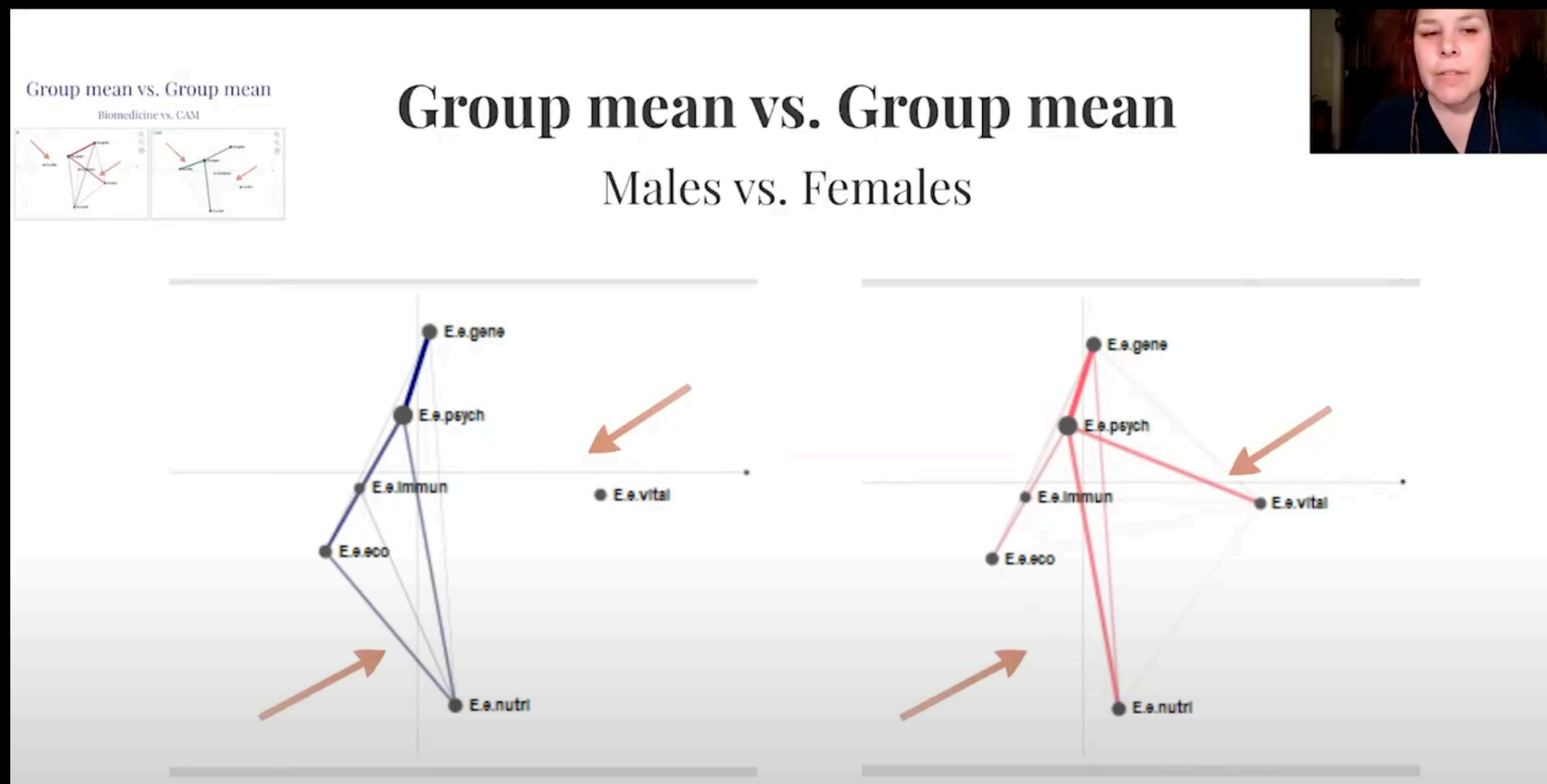
Might a heatmap of the underlying matrix add complementary value to what a network shows?

-8.3543	-12.213	-6.2443	0.54762	6.49059	12.1791	17.1265	13.3147	8.72477	5.57454	-5.419	-11.056
-9.1357	-10.364	-7.9723	-2.0709	3.25752	9.25487	10.5047	10.0693	5.93842	0.10855	-4.2426	-8.9772
-10.03	-4.3994	-1.5381	-0.9917	5.50332	10.2183	12.0818	10.9852	7.78772	-0.9624	-4.565	-5.9784
-5.8522	-12.397	-6.4213	0.71863	4.45775	10.1257	12.3534	11.153	7.7367	2.67381	-6.36	-10.344
-10.516	-7.2414	-4.5504	-1.9349	6.1935	12.8053	13.4849	11.15	7.12994	-1.5638	-4.2637	-5.0698
-7.1403	-7.5811	-7.0634	1.39558	6.27321	11.5314	13.6839	11.0818	7.46333	2.59721	-2.1433	-8.3837
-10.102	-7.1038	-2.8856	0.41319	3.97617	10.7921	11.9424	9.60489	6.76179	4.90051	-1.9044	-9.3386
-7.6858	-7.2163	-6.6125	-0.0338	4.66616	9.93005	13.4693	12.4432	7.07872	3.98231	-6.5729	-6.09
-5.7249	-9.7196	-7.8271	-2.173	2.82495	10.6924	12.7172	11.3539	7.49738	4.46687	-7.5825	-7.8804
-8.8359	-4.1731	-3.0441	0.69943	6.55223	11.2132	12.8189	11.7673	7.89824	2.02551	-5.1296	-7.3773
-7.5601	-7.6682	-4.4109	0.14203	7.39306	10.2342	12.8152	13.4854	8.24471	0.62016	-4.5175	-4.3867
-13.274	-11.335	-3.3422	-0.7771	5.27991	11.6112	14.8408	12.2349	6.2614	0.37632	-4.4787	-6.1484
-11.695	-6.4603	-3.6239	1.0698	6.31972	10.9803	14.0629	11.9099	7.75803	1.77744	-0.9825	-9.308
-8.6275	-5.2532	-5.2891	1.93473	5.36766	11.7437	16.6909	12.2624	7.85701	1.43301	-4.1818	-5.5088
-11.904	-8.4983	-8.3857	0.03352	4.15879	9.09481	13.5183	11.4789	6.23943	0.24375	-6.2976	-15.672
-8.2113	-7.8551	-7.789	0.2695	4.56149	10.2042	15.1734	10.6485	6.29317	-0.2718	-1.6583	-7.4736
-14.062	-10.974	-9.5847	-2.6376	4.58236	13.2043	12.6525	14.6893	7.56509	2.43389	-3.7641	-9.2942
-13.532	-7.3955	-3.9794	0.74686	6.37134	9.90527	14.4321	11.3667	6.61188	3.48346	-0.5722	-7.9366

ENA Data-to-Text?

Szilvia Zörgő & Gjalt-Jorn Peters:

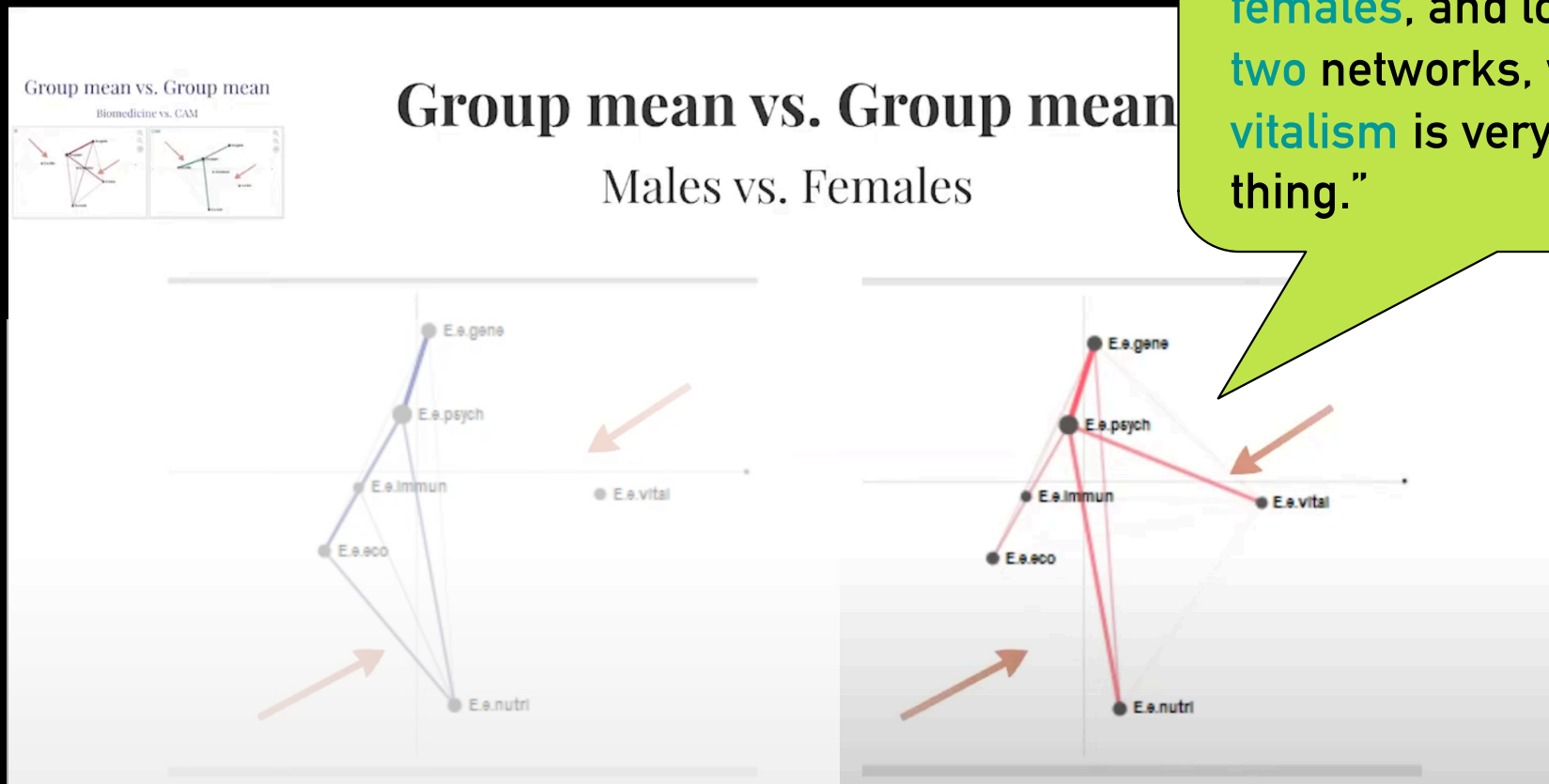
<https://www.qesoc.org/webinar-archives/#webinar-1>



ENA Data-to-Text → prose summaries?

Szilvia Zörgő & Gjalt-Jorn Peters:

<https://www.qesoc.org/webinar-archives/#webinar-1>



ENA Data-to-Text → prose summaries?

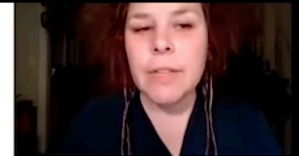
Szilvia Zörgő & Gjalt-Jorn Peters:

<https://www.qesoc.org/webinar-archives/#webinar-1>

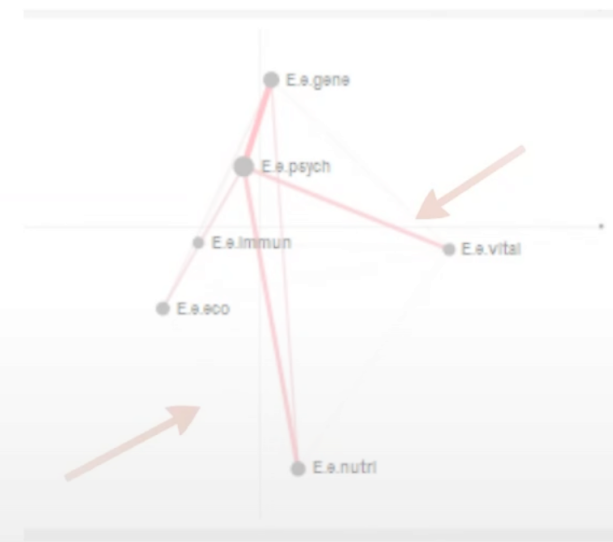
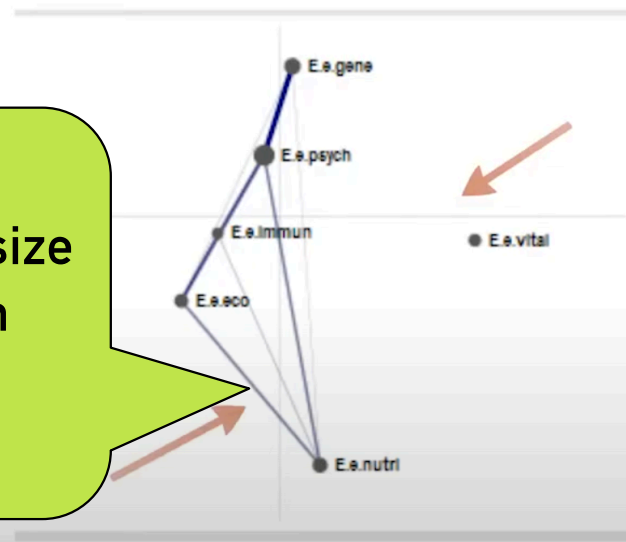
Group mean vs. Group mean
Biomedicine vs. CAM



Group mean vs. Group mean Males vs. Females



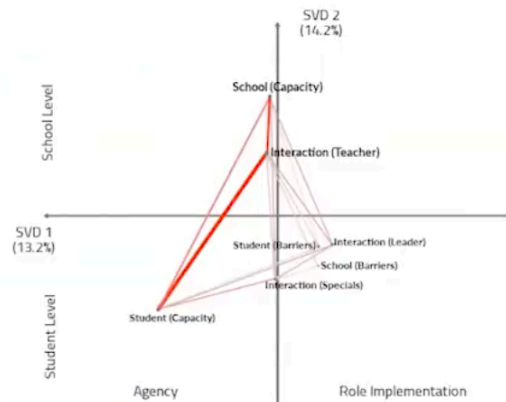
“And we can see that in contrast **males** emphasize the connection between **ecological** factors and **nutritional** factors.”



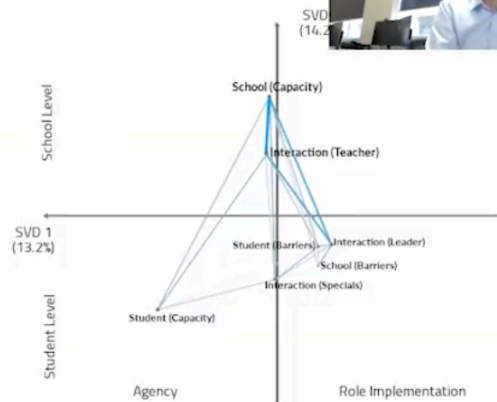
ENA Data-to-Text → prose summaries?

Srecko Joksimovic:

<https://www.qesoc.org/webinar-archives/#webinar-5>



Acting as agents



Acting as role implementers

**Teacher agency
is situational**

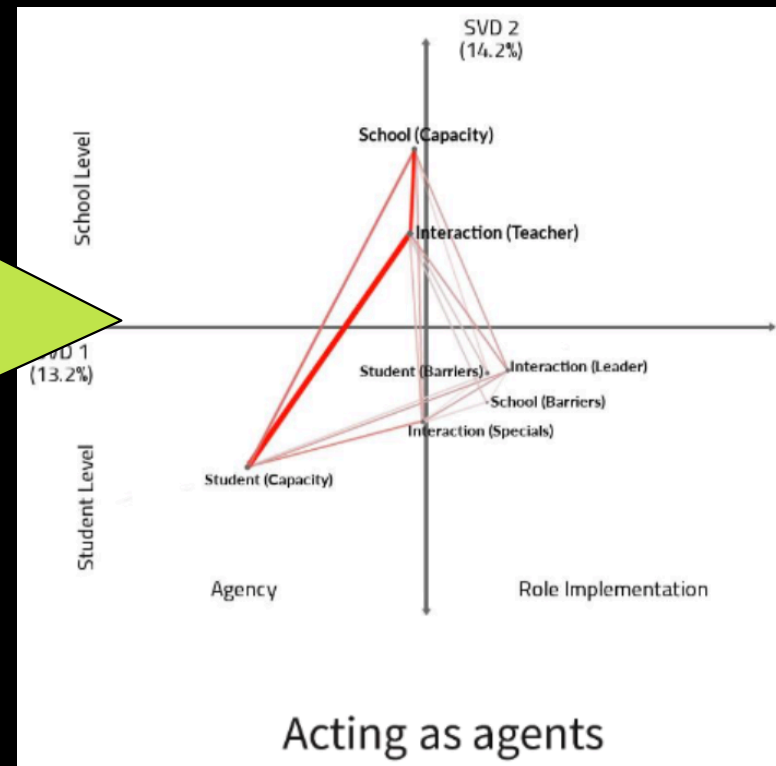
“The results show significant differences between teachers, when acting as agents, compared to acting as role implementers.”

ENA Data-to-Text → prose summaries?

Srecko Joksimovic:

<https://www.qesoc.org/webinar-archives/#webinar-5>

“The epistemic frame for **agency** indicates a **strong connection** between **Inclusive Pedagogy** and **Interactions with Teachers**, evidenced with those **thicker lines** between **School Capacity**, **Student Capacity** and **Teacher Interaction**.”



In a future ENA tool...?

**We don't have to choose
between representations**

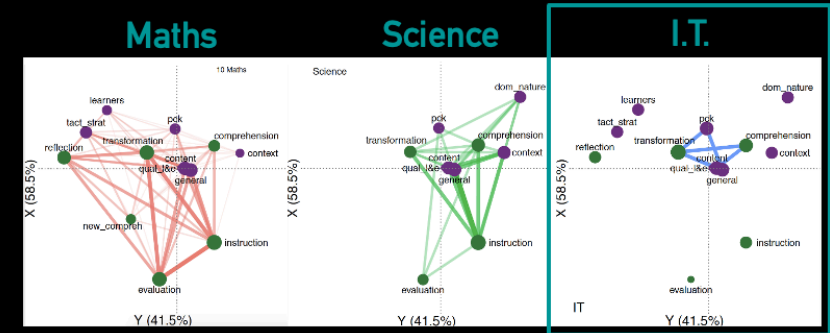
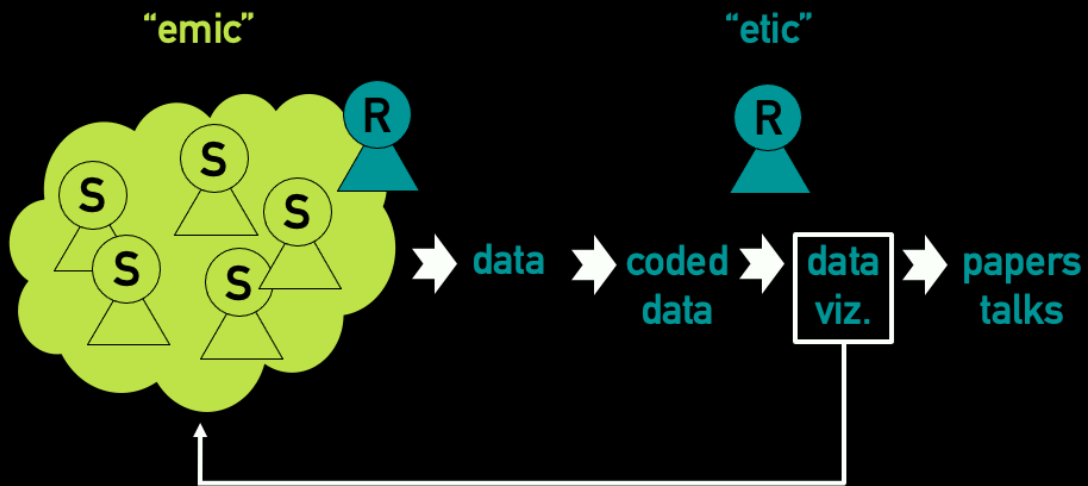
**We can offer them all,
and link them interactively**

More participatory QE, and HCD of “QE Inside” tools,
requires a new skillset

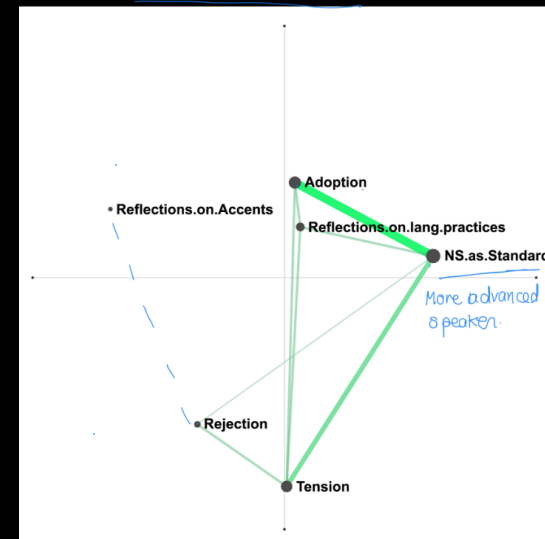
**Fluency using QE visualizations
for participatory sensemaking**

...clues from the Knowledge Art framework

Let's revisit the earlier examples



"Language as it is"



Should QE researchers be encouraging this sort of conversation? Should our tools support it?

That node name isn't quite right, we'd normally refer to...

Why isn't there a link there? Can I just add that now?

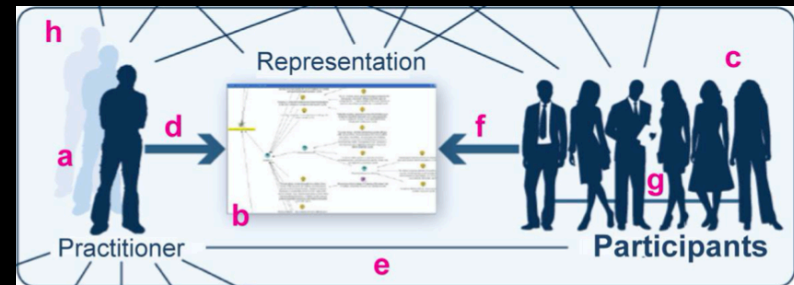
These 2 nodes are really the same thing, let's merge them, and then we can see much more clearly...

Let's make that green link much thicker, so we can see the contrast with red clearly

This node is confusing two things, it's best split up. Now we can discuss their different links

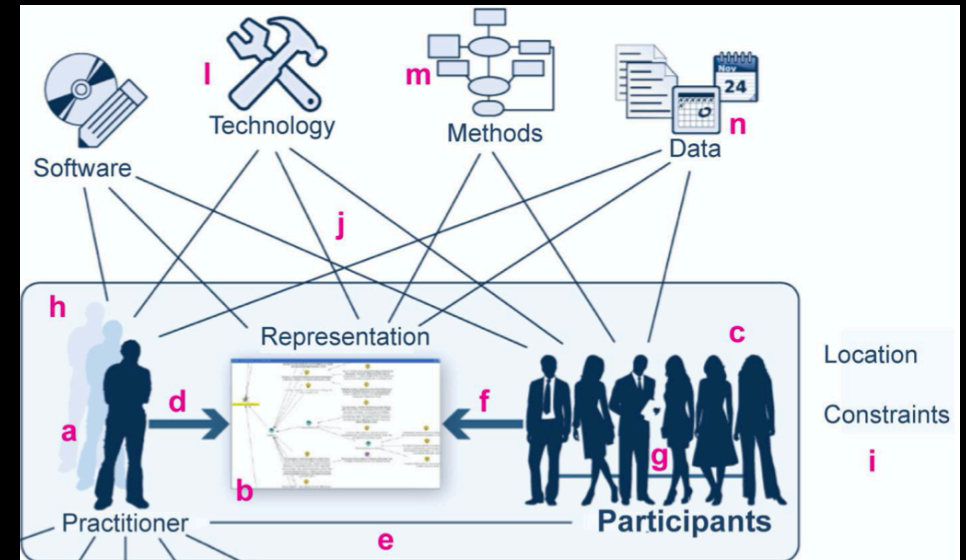
Knowledge Art framework: the focal activity

The facilitation skillset
of crafting participatory
visual representations
to facilitate joint sensemaking



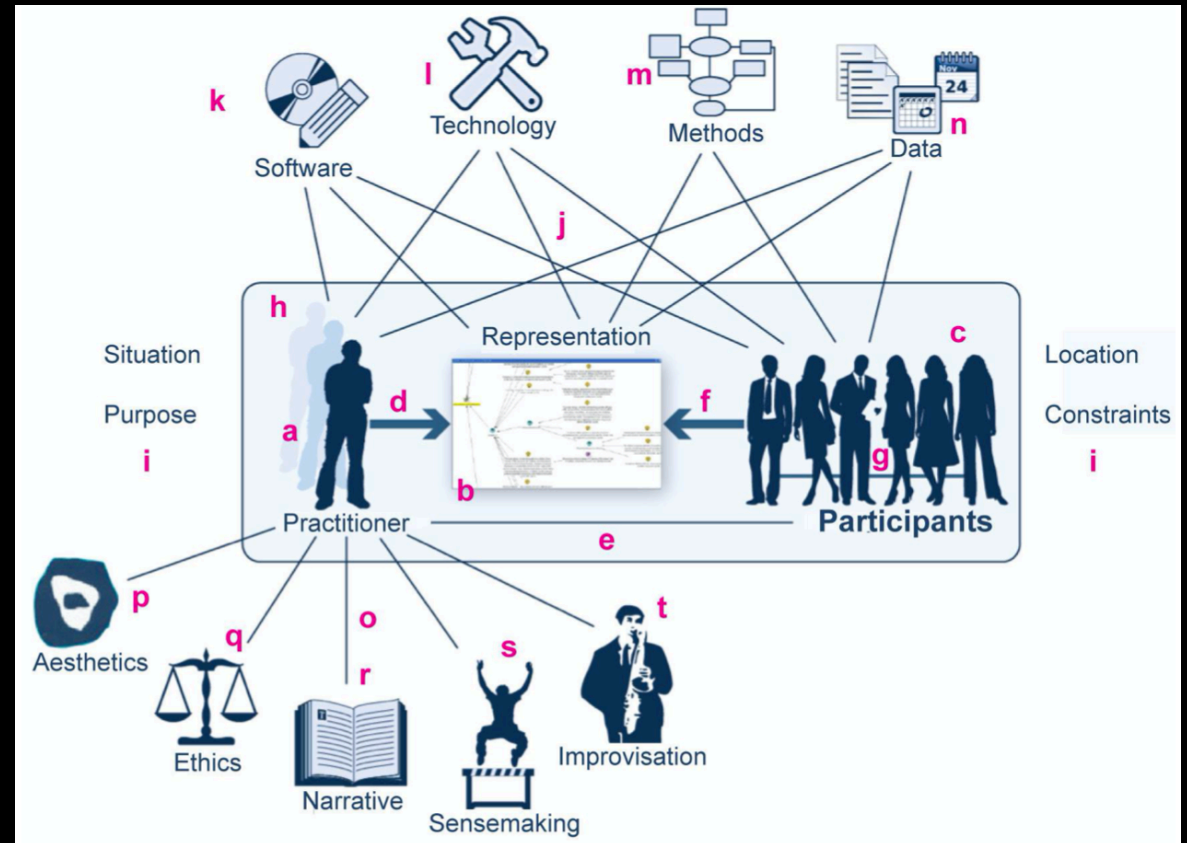
Knowledge Art framework: work system tools

The facilitation skillset
of crafting participatory
visual representations
to facilitate joint sensemaking



Knowledge Art framework: critical fluencies

The facilitation skillset
of crafting participatory
visual representations
to facilitate joint sensemaking



Knowledge Art framework: critical fluencies

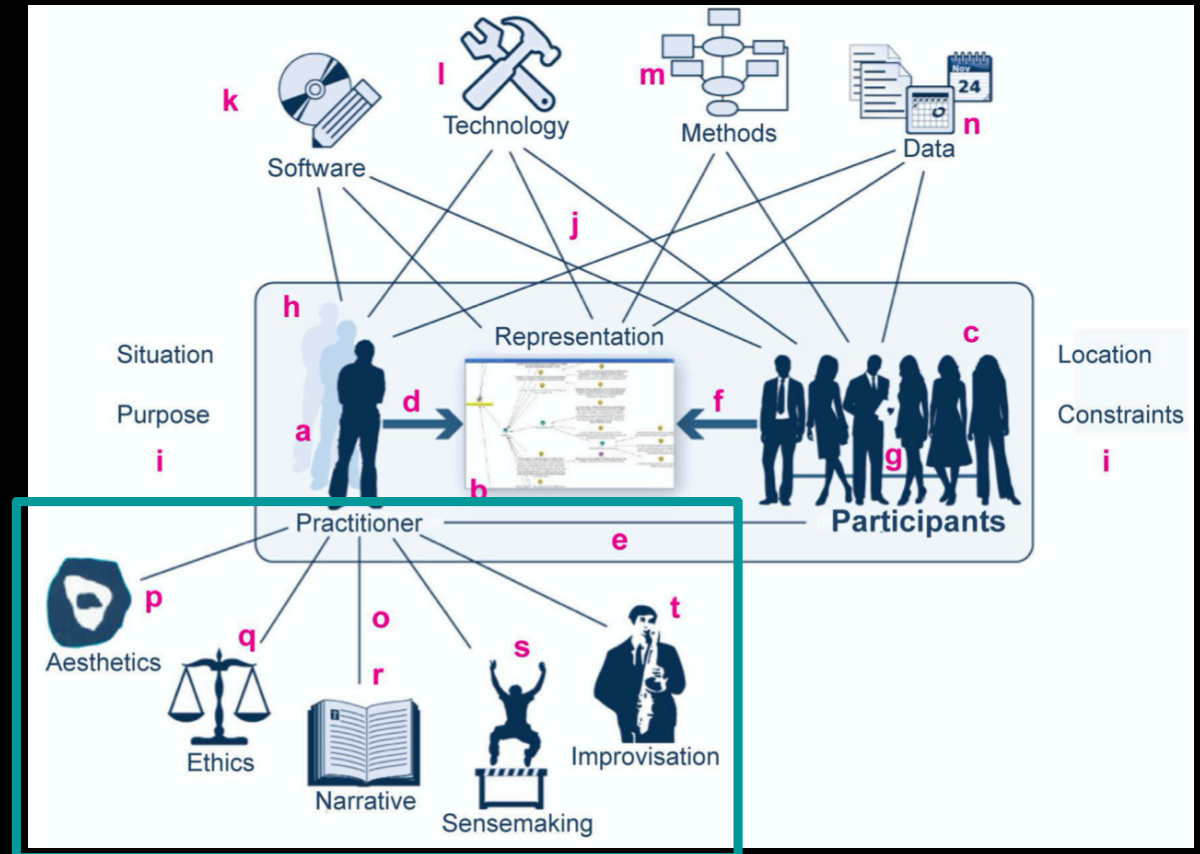
Aesthetics. The choices we make for shaping a visualisation – what's foregrounded, excluded, how polished, how editable...

Ethics. How our moves affect the other stakeholders: recognise/ignore their contribution, change meaning, shift topic...

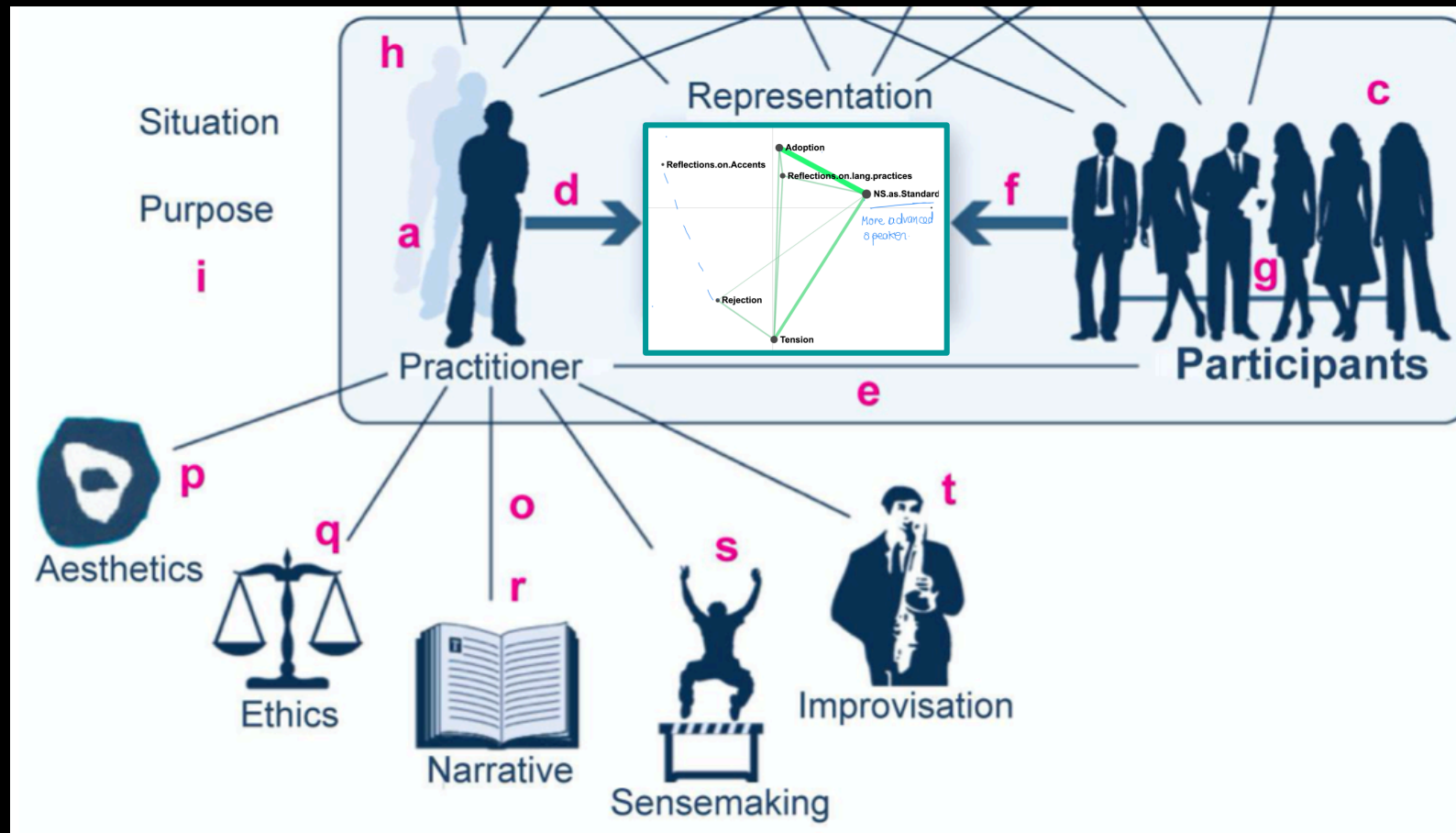
Narrative. The context for a session: spoken/unspoken expectations of why we're here, how we should proceed, what kinds of meanings will be made, or outputs produced...

Sensemaking. How we interpret unexpected events or anomalies

Improvisation. How well we make spontaneous, unplanned moves with the visualisation when breakdowns occur



Knowledge Artistry for more participatory QE?



Knowledge Artistry for more participatory QE?

Aesthetics. The choices we make for shaping a visualisation – what's foregrounded, excluded, how polished, how editable...

Ethics. How our moves affect the other stakeholders: recognise/ignore their contribution, change meaning, shift topic...

Narrative. The context for a session: spoken/unspoken expectations of why we're here, how we should proceed, what kinds of meanings will be made, or outputs produced...

Sensemaking. How we interpret unexpected events or anomalies

Improvisation. How well we make spontaneous, unplanned moves with the visualisation when breakdowns occur

- “Raw viz” (direct from the tool, as used by QE researchers) or a simplified version, more accessible to lay people?
- Does a fixed or malleable viz open up more productive conversations? What's editable?

Knowledge Artistry for more participatory QE?

Aesthetics. The choices we make for shaping a visualisation – what's foregrounded, excluded, how polished, how editable...

Ethics. How our moves affect the other stakeholders: recognise/ignore their contribution, change meaning, shift topic...

Narrative. The context for a session: spoken/unspoken expectations of why we're here, how we should proceed, what kinds of meanings will be made, or outputs produced...

Sensemaking. How we interpret unexpected events or anomalies

Improvisation. How well we make spontaneous, unplanned moves with the visualisation when breakdowns occur

- Does a visualization empower or disempower stakeholders? Amplify or muffle their voices?
- If the viz tool can't reflect someone's feedback, what are we saying to them?
- When does the QE researcher change the topic of conversation in order to focus on un-explored parts of the viz?

Knowledge Artistry for more participatory QE?

Aesthetics. The choices we make for shaping a visualisation – what's foregrounded, excluded, how polished, how editable...

Ethics. How our moves affect the other stakeholders: recognise/ignore their contribution, change meaning, shift topic...

Narrative. The context for a session: spoken/unspoken expectations of why we're here, how we should proceed, what kinds of meanings will be made, or outputs produced...

Sensemaking. How we interpret unexpected events or anomalies

Improvisation. How well we make spontaneous, unplanned moves with the visualisation when breakdowns occur

- What are the power dynamics and trust levels?
- Are we here only to validate the QE researchers' story, or to elicit new stories?
- Are the stakes high? Will this viz shape future narratives? (e.g. impact people, agendas, arguments...?)

Knowledge Artistry for more participatory QE?

Aesthetics. The choices we make for shaping a visualisation – what's foregrounded, excluded, how polished, how editable...

Ethics. How our moves affect the other stakeholders: recognise/ignore their contribution, change meaning, shift topic...

Narrative. The context for a session: spoken/unspoken expectations of why we're here, how we should proceed, what kinds of meanings will be made, or outputs produced...

Sensemaking. How we interpret unexpected events or anomalies

Improvisation. How well we make spontaneous, unplanned moves with the visualisation when breakdowns occur

- “This is the wrong ENA: can you display the ENA for teams 1-3 + 23, masking dimensions D1+D2, with comparable link weights”
- How do we handle surprise and discontinuity: what do we do if the viz conflicts with their understanding?
- Sketching and tinkering are ways to articulate and sharpen emerging thoughts: is this representationally possible, and encouraged?

Knowledge Artistry for more participatory QE?

Aesthetics. The choices we make for shaping a visualisation – what's foregrounded, excluded, how polished, how editable...

Ethics. How our moves affect the other stakeholders: recognise/ignore their contribution, change meaning, shift topic...

Narrative. The context for a session: spoken/unspoken expectations of why we're here, how we should proceed, what kinds of meanings will be made, or outputs produced...

Sensemaking. How we interpret unexpected events or anomalies

Improvisation. How well we make spontaneous, unplanned moves with the visualisation when breakdowns occur

- “Disciplined improvisation” combines pre-defined, structured methods with creative, spontaneous ones: our software toolkits need to facilitate this...
- What is our improvisational repertoire with the representations?
- What's the learning curve?

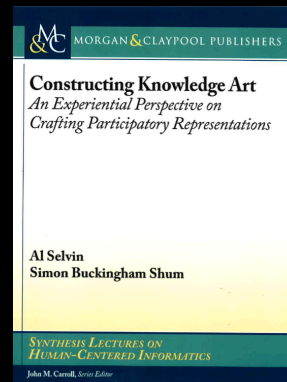
Knowledge Art: learn more...



Al Selvin: Open University 2011 PhD seminar:
<http://simon.buckinghamshum.net/2011/12/making-representations-matter-al-selvin-phd>

Knowledge Art blog:
<http://knowledgeart.blogspot.com>

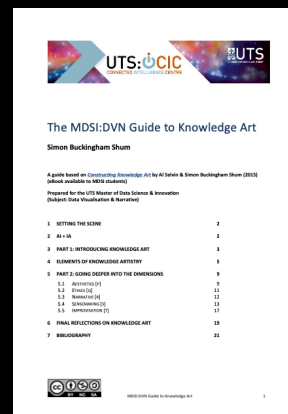
Selvin, A., Buckingham Shum, S.J. & Aakhus, M. (2010). The Practice Level in Participatory Design Rationale: Studying Practitioner Moves and Choices. *Human Technology* (Special Issue on Creativity and Rationale, Ed. John Carroll), 6, (1), pp. 71–105.
<http://humantechnology.jyu.fi/archive/vol-6/issue-1>



Selvin, A. & Buckingham Shum, S. (2015). *Constructing Knowledge Art: An Experiential Perspective on Crafting Participatory Representations*. Morgan Claypool (Synthesis Lectures on Human-Centered Informatics).

<https://doi.org/10.2200/S00593ED1V01Y201408HCI023>

Selvin, A. (2011). *Making Representations Matter: Understanding Practitioner Experience in Participatory Sensemaking*. Doctoral Dissertation, Knowledge Media Institute, The Open University, Milton Keynes, UK. <http://oro.open.ac.uk/30834>



Open Educational Resources

UTS Master of Data Science & Innovation:
“Data, Narrative & Visualization” course: 2016, 2019

<http://simon.buckinghamshum.net/2019/05/knowledge-art-learning-resources>

To wrap up...

Sneak preview of the ICQE 2022 program?...

“Is a picture worth a thousand words? Teacher’s preferences for ENA-generated prose versus networks”

“QEviz 2.0: Video plus linked, interactive QE visualizations”

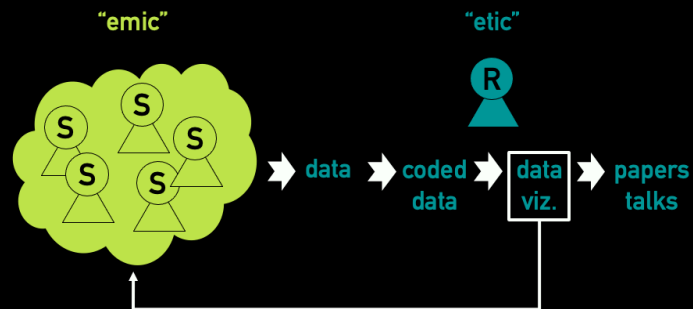
“‘Sorry, but that’s not how we do things...’ The politics of adapting QE visualizations in response to stakeholder feedback”

“Integrating QE analytics into an ER-Nursing handover support tool: design challenges and empirical evaluation”

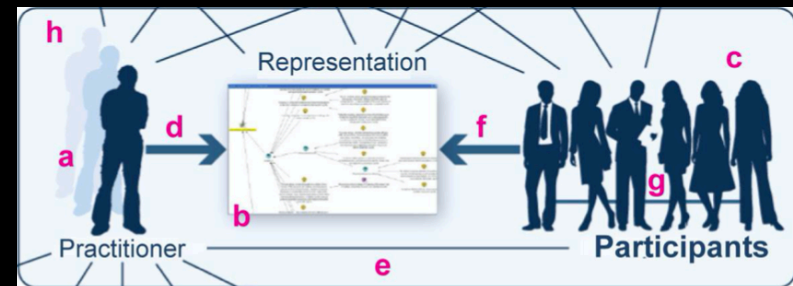
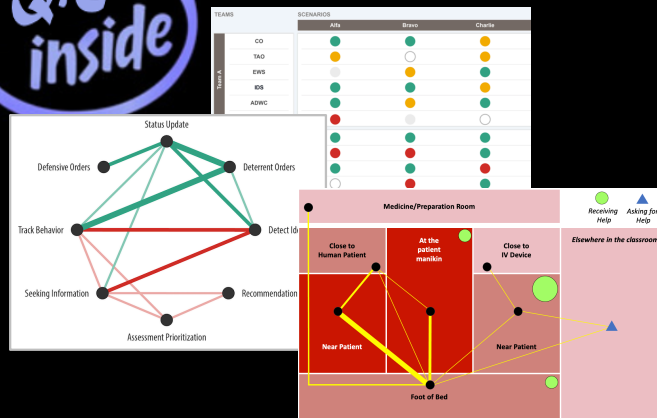
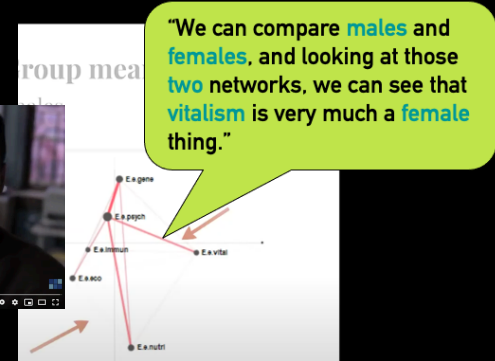
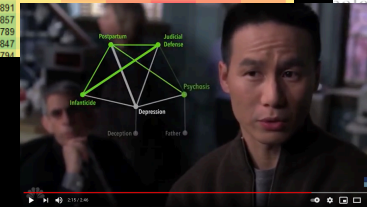
I hope my dishes didn't give you indigestion

Perhaps they'll go well with one you brought

To summarise...



6.2443	0.54762	6.49059	12.1791	17.1265	13.3147	8.72477
7.9723	-2.0709	3.25752	9.25487	10.5047	10.0693	5.93842
1.5381	-0.9917	5.50332	10.2183	12.0818	10.9852	7.78772
6.4213	0.71863	4.45775	10.1257	12.3534	11.153	7.7367
4.5504	-1.9349	6.1935	12.8053	13.4049	11.15	7.12994
7.0634	1.39558	6.27321	11.5314	13.6839	11.0818	7.45333
2.8856	0.41319	3.97617	10.7921	11.9424	9.60489	6.76179
6.6125	-0.0338	4.66616	9.93005	13.4693	12.4432	7.07872
7.8271	-2.173	2.82495	10.6924	12.7172	11.3539	7.49738
3.0441	0.69943	6.65223	11.2132	12.8109	11.7873	7.89624
4.4109	0.14203	7.39306	10.2342	12.8152	13.4854	8.24471
3.3422	-0.7771	5.27991	11.6112	14.8408	12.2349	6.2614
3.8239	1.0598	6.31972	10.9803	14.0629	11.9099	7.75803
5.2991						
8.3857						
-7.789						
9.5847						
6.4094						



Thank You... Discussion!...