3RD INTERNATIONAL MEETING ON HEALTHCARE SYSTEMS DESIGN RESEARCH: TIME FOR ACTION

DATE:

2nd and 3rd of December 2019

VENUE:

Hughes Hall, University of Cambridge, Wollaston Road, Cambridge, United Kingdom, CB1 2EW

ORGANISED BY:

Cambridge Engineering Design Centre, Engineering Systems Group at DTU - Technical University of Denmark, THIS Institute (The Healthcare Improvement Study Institute), University of Cambridge, KTH Royal Institute of Technology, Sweden, Mälardalen University, Sweden, Chalmers University, Sweden and Technology University, Delft, Netherlands

INITIAL REPORT: RAW OUTPUTS

FLASHBACKS


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Engineering Better Kidney Care
Quality Improvement and Physician Motivation
3rd International Meeting on Healthcare
Systems Design Research
2nd December 2019
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UNIVERSITY OF CAMBRIDGE
Engineering Design Centre

DTU

THIS.Institute The Healthcare Improvement Studies Institute

MÄLARDALEN UNIVERSITY SWEDEN

CHALMERS
UNIVERSITY OF TECHNOLOGY

KTH

TU Delft

EXECUTIVE SUMMARY

Aims of the meeting:

At our first meeting in Cambridge UK, in November 2018, we began to lay the foundations of a community of researchers and practitioners from broadly diverse disciplinary backgrounds but with a common interest in Healthcare Systems Design. In April this year, we met again at DTU in Copenhagen and took the next step of continuing to grow this community. Whilst the work of laying the foundation and growing the community are still on going, at this event our aim is to begin putting some of our talk so far into action by working on a project that belongs to us as a community – An edited Book on Healthcare Systems Design Research and Practice.

We will, therefore, focus on two objectives for this event:

1. Developing a detailed structure of an edited book on Healthcare Systems Design Research and Practice
2. Sharing specific projects from research groups represented in our community.

Attendance

Thirty-nine delegates, representing seven countries, seventeen Universities and institutions, attended the event. Below is a full list of delegates and their affiliations.

	Delegate Name	Country	Research group	Institution
1	Alexander Komashie	UK	Engineering Design Centre	University of Cambridge
2	Kathy Kotiadis	UK	Kathy Kotiadis	University of Kent
3	Marie Sjölinder	Sweden	SICS/DNA	Research Institutes of Sweden (RISE)
4	Christina Phillips	UK	Liverpool Business School	Liverpool John Moore University
5	Antuela Tako	UK	Simulation Practice Interest Group	Loughborough University
6	Bertil Lindenfalk	Sweden	Jönköping Academy	Jönköping University
7	Glenn Robert	UK	Glenn Robert	King's College London
8	Oli Williams	UK	THIS Institute	King's College London
9	Valeria Pannunzio	Netherlands	Valeria Pannunzio	Delft University of Technology
10	Nicholas Ciccone	Denmark	Engineering Systems	DTU - Technical University of Denmark
11	James Ward	UK	Engineering Design Centre	University of Cambridge
12	Guillaume Lame	France	Laboratoire de Genie Industriel	CentraleSupelec
13	Yvonne Eriksson	Sweden	Information Design Research Group	Mälardalen University
14	François Patou	Denmark	Engineering System Design	DTU - Technical University of Denmark
15	Michael Kokkolaras	Canada	Systems optimization	McGill University
16	Matt Woodward	UK	THIS Institute	University of Cambridge
17	Anja Maier	Denmark	Engineering Systems Design	DTU - Technical University of Denmark
18	Sebastiaan Meijer	Sweden	Department of Biomedical Engineering and Health Systems	KTH Royal Institute of Technology
19	Mei-Li Komashie	UK	NA	University of Cambridge
20	Adam Darwich	Sweden	Logistics and Informatics in Healthcare	KTH Royal Institute of Technology
21	Juliane Kuhl	Germany	Institute of Product Development and Mechanical Engineering Design	Hamburg University of Technology
22	Ulrika Florin	Sweden	Information Design research group	Mälardalen University
23	Geoff Royston	UK	(former president- operational research society)	Independent
24	Timoleon Kipouros	UK	Change Management / Computational Design	University of Cambridge

25	Olena Sinkevich	Canada	N/A (accompanying person)	N/A (accompanying person)
26	Christine Gustafsson	Sweden	Prolonged independent life	Mälardalen University
27	Katharina Kohler	UK	Engineering Design Centre	University of Cambridge
28	Daniel Stubbs	UK	Engineering Design Centre	University of Cambridge
29	Claudia Eckert	UK	E&I	The Open University
30	Gyuchan Thomas Jun	UK	Human Factors and Complex Systems Research Group	Loughborough University
31	Terry Dickerson	UK	Terry Dickerson	Self
32	John Clarkson	UK	Engineering Design Centre	University of Cambridge
33	Tom Bashford	UK	Engineering Design Centre	University of Cambridge
34	Jos Kraal	Netherlands	Pride & Prejudice @Industrial Design Engineering	Delft University of Technology
35	Maaike Kleinsmann	Netherlands	Industrial Design and Engineering	Delft University of Technology
36	Partha Das	UK	DaVita International	DaVita International Limited
37	Mary Dixon-Woods	UK	THIS Institute (The Healthcare Improvement Studies Institute)	University of Cambridge
38	Darren Jones	UK	The Open University, UK	The Open University
39	Mohammad Hassannezhad	UK	University of Sheffield	University of Sheffield

DAY 1: Co-creation

Objectives:

1. To be inspired and challenged through two specially selected keynotes
2. Co-creating the detailed structure of our edited book on Healthcare Systems Design Research & Practice
3. Get to know each other through specific research presentations

Welcome and background: Professor John Clarkson, Director, Cambridge Engineering Design Centre

3rd International Meeting on Healthcare Systems Design Research,
Hughes Hall, University of Cambridge, United Kingdom.
December, 2-3 2019.

HSDR Meetings: Brief Background

John Clarkson

UNIVERSITY OF CAMBRIDGE
Engineering Design Centre

Conception: Vancouver 2017

Cambridge 2018: Two aims

1. To identify the unique contributions that systems design research can make in achieving sustainable improvements in health and care delivery systems internationally.

2. To lay the foundations for a community of research and practice dedicated to healthcare systems design, across disciplinary boundaries.

INTERNATIONAL MEETING ON HEALTHCARE SYSTEMS DESIGN RESEARCH

DATE HELD:

29th and 30th of November 2018

VENUE:

Seminar Room, James Dyson Building, Engineering Department, University of Cambridge, Trumpington Street, Cambridge, United Kingdom, CB2 1PZ

ORGANISED BY:

Cambridge Engineering Design Centre, Engineering Systems Group at the Technical University of Denmark (DTU) and THIS Institute (The Healthcare Improvement Study Institute), University of Cambridge

34 attendees

UK = 17, Sweden = 7, Denmark = 3, France = 3, and Germany, Switzerland, The Netherlands, Canada = 1

Worked hard

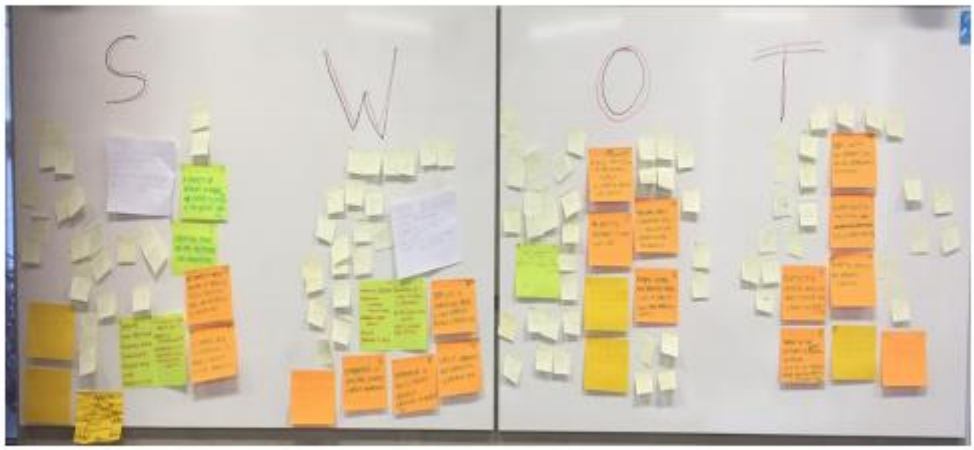
Passionate

Had fun

Discovering ourselves

Discovering ourselves

Diversity = Strength = Weakness



Our healthcare issues

The ultimate question: What one thing …?

A desire to meet again

Copenhagen 2019

Copenhagen 2019

DTU UNIVERSITY OF CAMBRIDGE DEPARTMENT OF ENGINEERING THIS.

Copenhagen 2019

ICED 2019: Paper

EXPLORING HEALTHCARE SYSTEMS DESIGN RESEARCH AND PRACTICE: OUTCOMES OF AN INTERNATIONAL MEETING

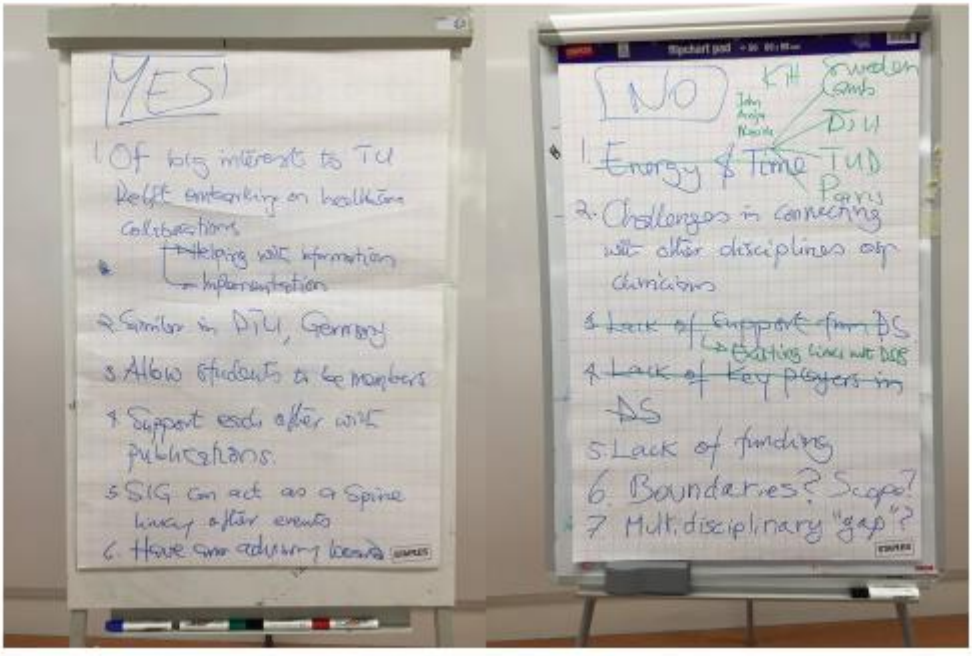
Alexander Komashie[1,2], Guillaume Lame[2], Francois Patou[3], Nicholas Ciccone[3], Anja Maier[1], P. John Clarkson[1]

Organisation(s): 1: Engineering Design Centre, Department of Engineering, University of Cambridge, Cambridge, UK; 2: The Healthcare Improvement Studies Institute, University of Cambridge, Cambridge, UK; 3: Engineering Systems Division, Department of Management Engineering, Technical University of Denmark, Denmark

ABSTRACT

Current healthcare delivery challenges are multi-faceted, requiring multiple perspectives to be addressed using a systems approach. However, a significant amount of healthcare systems design research work is carried out within single disciplines or at best a few disciplines working together. There appears to be little deliberate attempt to draw together a wide range of disciplines committed to working together to

ICED 2019: Healthcare Meeting



Design Society: Special Interest Groups

the Design Society
a worldwide community

Design Society: Special Interest Groups

GOAL: Create a space and build a community for design researchers who specialise in or are interested in the study of health systems design

OBJECTIVE 1: Tackle important questions in the practice and study of health systems design

OBJECTIVE 2: Engage in strategic partnerships with other groups and communities that contribute to improve healthcare design

DELIVERABLE 1: conference series for operational researchers, human factors specialists and ergonomists, health services researchers, clinicians and health policy-makers

DELIVERABLE 2: workshops at design society events

DELIVERABLE 3: a reference book on healthcare systems design

DESIGN 2020: Paper

INTERNATIONAL DESIGN CONFERENCE - DESIGN 2020
https://doi.org/10.21278/idc.2020.0000

A SYSTEMS APPROACH TO HEALTHCARE: THEMES FROM THE SECOND INTERNATIONAL MEETING ON HEALTHCARE SYSTEMS DESIGN RESEARCH

DESIGN 2020: 1st SIG Workshop

Patient Journey

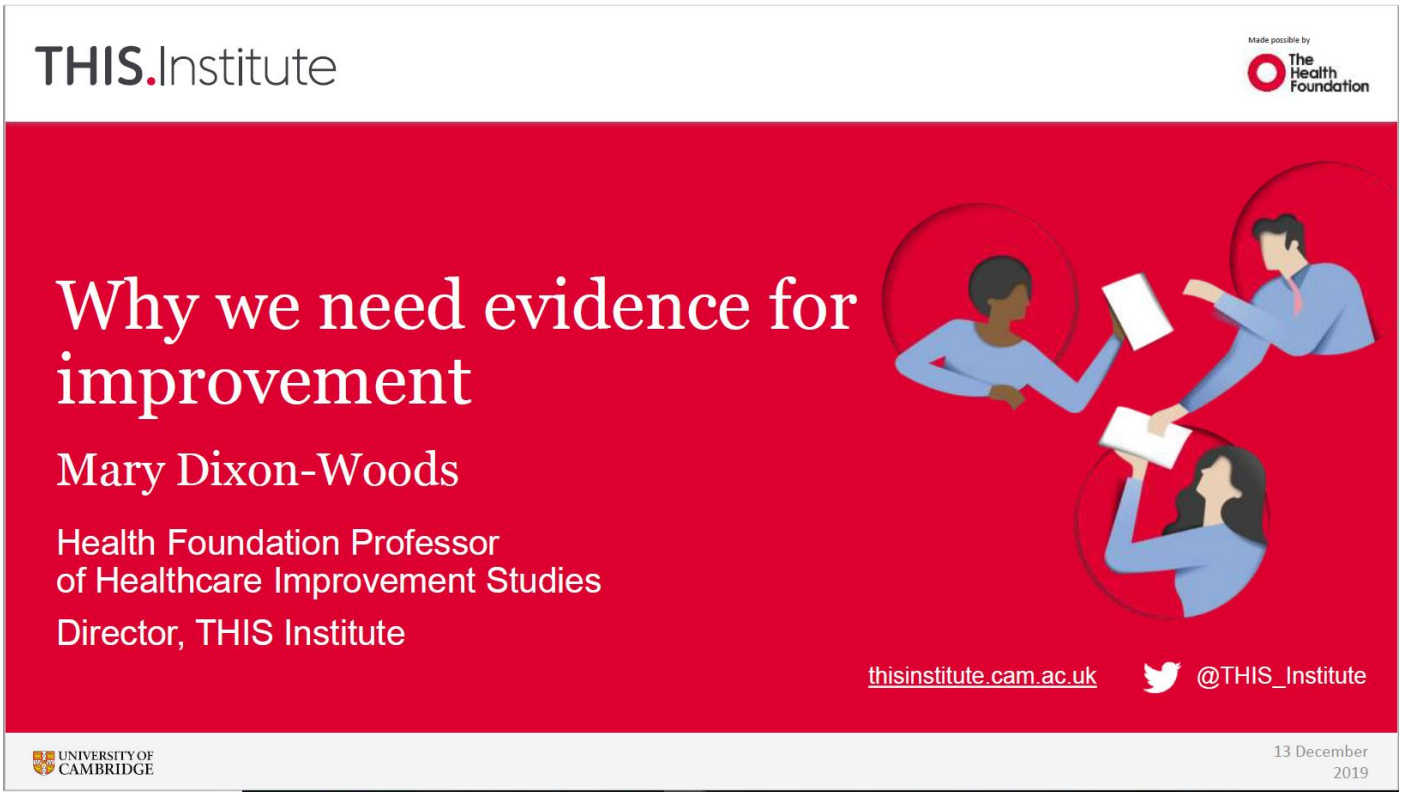
Cambridge 2019

3RD INTERNATIONAL MEETING ON HEALTHCARE SYSTEMS DESIGN

RESEARCH: TIME FOR ACTION

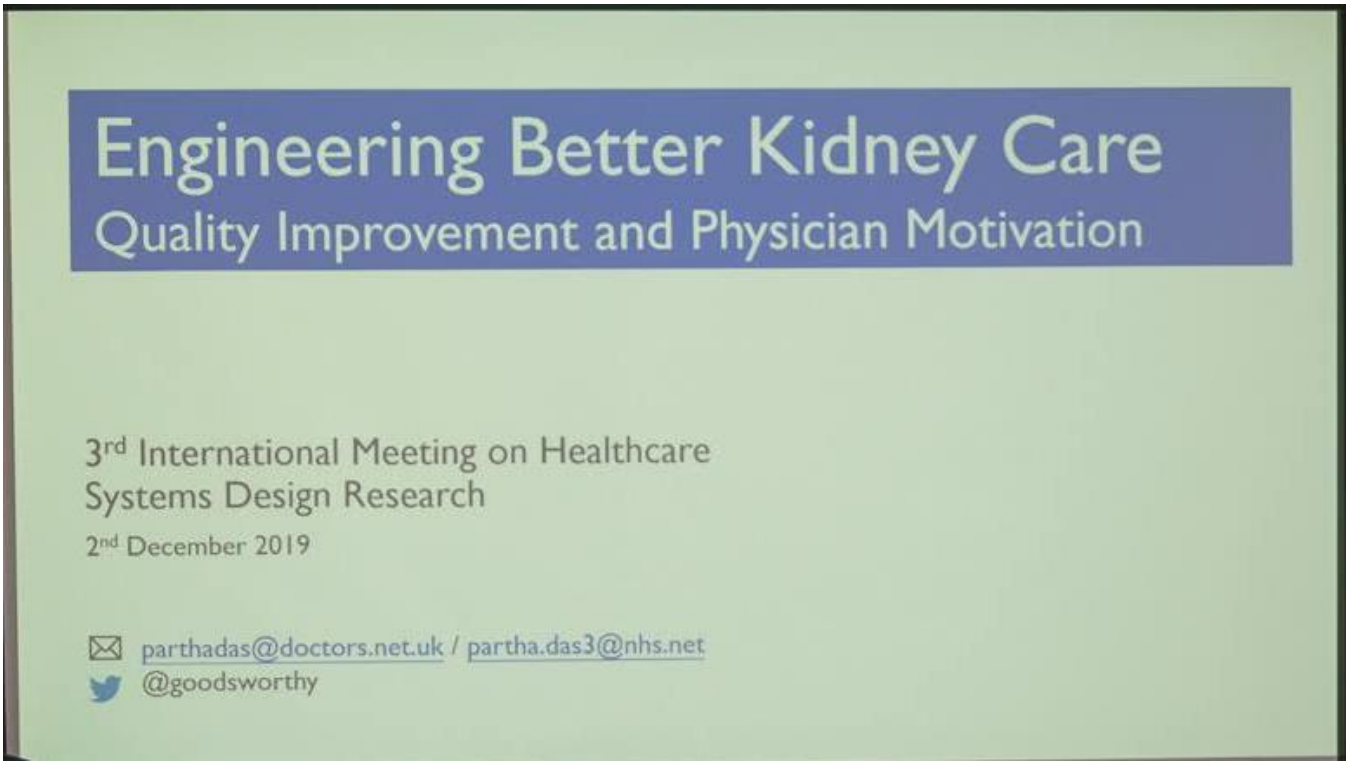
Welcome Back To Cambridge!

Keynote I: Why we need evidence for improvement
Professor Mary Dixon-Woods, Director, THIS Institute, University of Cambridge, UK
Chair: Dr Guillaume Lame, CentraleSupelec, France



FULL SLIDE SET TO BE SHARED SEPARATELY

Keynote II: Engineering better kidney care: an international perspective
Dr Partha Das, Chief Medical Officer for DaVita International, London, UK
Chair: Dr Alexander Komashie, University of Cambridge, UK



FULL SLIDE SET TO BE SHARED SEPARATELY

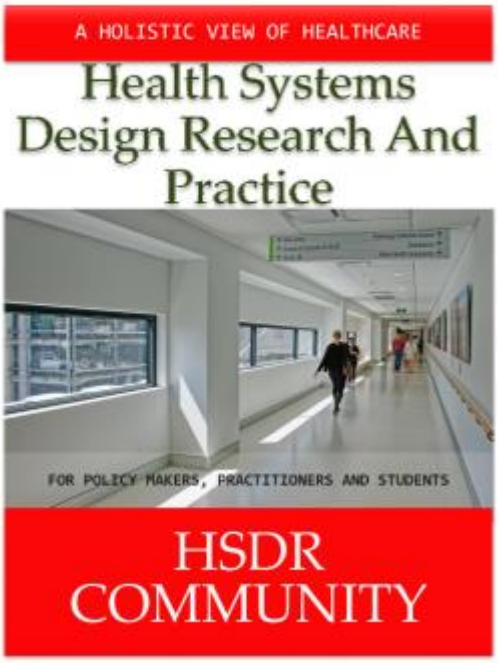
Book session I: Topics and categories
Lead: Dr Alexander Komashie, University of Cambridge, UK

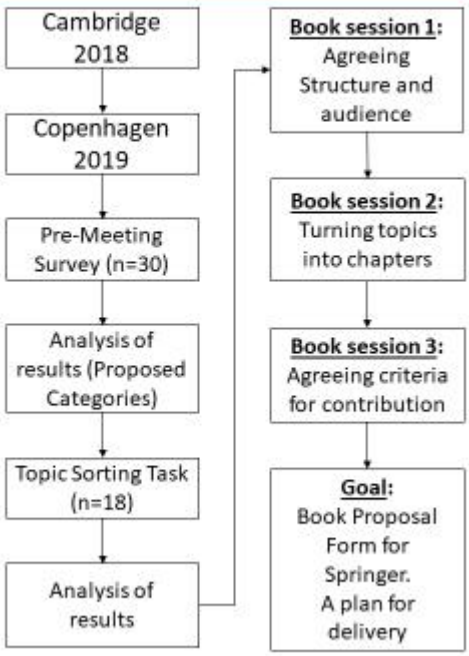
3rd International Meeting on Healthcare Systems Design Research,
Hughes Hall, University of Cambridge, United Kingdom.
December, 2-3 2019.

OptimalSort topic sorting task: Results

Alexander Komashie
Guillaume Lame
John Clarkson

Overview of Book Project





Survey results

Respondent disciplines

Engineering System Design in Healthcare
Engineering design and optimization
Healthcare improvement
Service design
Human centric analytics design
Forecasting
Simulation
Operations Research
Operations Management
Management and organization
Improvement science
Healthcare Logistics
Simulation of Complex Adaptive Systems
Public Health
Health care public health
Sociologist
Health services research
Healthcare systems strengthening
Health policy
Design for Disability
Design of healthcare systems for physiotherapists and occupational therapists,
Design and manufacture of intelligent systems
Engineering design
System Design
Health Technology Management
Global health care improvement
Organisational Sociology
Healthcare Technology
Telemedicine-telehealth
IoT-SmartHomes
Healthcare quality and safety
Methodical Product Development
Dosage form design supported by tools of engineering design
Digital solutions for improving care and health care systems, and for prevention and increasing quality of life
Anaesthesia
Human Factors
Information Design
Engineering design of products and services

Suggested target audience

- Design researchers
- Policy makers (including international bodies like WHO)
- Improvement specialists
- Healthcare managers
- Public/private sectors
- Medical schools
- Service/system design academics
- Improvement practitioners
- Design practitioners
- Improvement researchers
- Hospital non-clinical staff e.g. finance, procurement, clinical biomedical engineers, IT
- Students
- Engineers
- Management consultants
- Insurance companies
- NHS Boards
- Higher education
- All levels in healthcare delivery from government through to suppliers
- Middle managers and clinical staff most important

Slido polling for target audience

- Go to www.sli.do/
- Enter Event code - #HSDR3
- Refer to the full list of suggested target audience on your table
- Type in your top three from the list.
- Then click "Send".

Results: Top three target audience

1. Policy makers
2. Healthcare Practitioners/managers
3. Improvement specialists
4. Students in higher education

Goal –build community, state of the art, practical guide

Suggested topics

1. Business model design
2. Human factors
3. Trends in healthcare (demographic, technological, clinical)
4. Behaviour
5. Technology
6. Interventions
7. Systems perspective / thinking / theory
8. Value (definition, modelling, value-driven healthcare)
9. Modelling
10. Quality
11. Engaging with healthcare professionals and stakeholders
12. Decision support
13. Complexity (theory, complex systems, complex adaptive systems, complexity management)
14. Network/graphs
15. Optimisation
16. Systems engineering
17. Uncertainty
18. International comparisons of healthcare systems
19. Data (including data-driven/data-enabled design)
20. Healthcare infrastructure (including hospital design)
21. Simulation (including system dynamics, discrete event simulation agent-based simulation)
22. Prototyping
23. Human-centred design
24. Co-production (as defined and inspired by Elinor Ostrom)
25. User-Centred Design
26. Organisational design
27. Collaboration
28. Welfare system design
29. Service ecosystems
30. Service approach to healthcare
31. Action research
32. Improvement science
33. Operational research
34. Health economics
35. Examples of design impact taken from other fields
36. Examples of using design in healthcare (good and bad examples)
37. Current issues in healthcare
38. Design thinking
39. Research methods for researching design in healthcare
40. The qualitative/quantitative divide
41. Scenarios
42. The hard/soft divide
43. Performance
44. Ethical challenges
45. Evaluation and evidence-based medicine/management/policy
46. Relationships and links with other disciplines
47. Quadruple aim
48. Transition design
49. Managing risk proactively
50. Management of design requirements in the context of improvement
51. How to release time for clinicians to do QI
52. Comparison of different QI methodologies
53. How to perform system disaggregation/reintegration in healthcare
54. How to manage "system of systems" design
55. Systems thinking
56. Design dialogues as method – using artefacts to support dialogue (visual & tangible)
57. Tools for developing understanding and engagement across knowledge horizons
58. Systems approach to healthcare improvement
59. Architecting healthcare delivery systems
60. Healthcare systems modelling – from mapping to simulation
61. Evidencing the impact of a systems approach
62. Patients and Public involvement in health systems research

Proposed categories

1. Introduction – International perspectives on health systems, issues and trends
2. Engagement
3. Systems
4. Improvement methods
5. Design
6. Case studies
7. Measures
8. Risk management

OptimalSort results

Standardization grid

Total participants 0 — 17

Name	Case stu...	Design	Engagem...	Improve...	Introducti...	Measures	Risk man...	Systems	Not standardized
Action research	2	3	3	5		1			4
Architecting healthcare delive		6		1	1			8	2
Behaviour	1		6		3	2	2	3	1
Business model design	1	9	1	1	1	1	2	1	1
Co-production (as defined an		2	11	4					1
Collaboration		2	13	1					2
Comparison of different qualit	1	1		14	1		1		
Complexity (theory, complex s		1		1	1		1	11	3
Current issues in healthcare					16				2
Data (including data-driven de		2		2		11	1		2
Decision support		4	3	6			2		3
Design dialogues as method -	1	11	1	5					
Design thinking		14	1	1	2				
Engaging with healthcare pro	1		17						
Ethical challenges			4	1	8	1	1	1	2
Evaluation and evidence-base	2		1	1	2	8		1	3
Evidencing the impact of a sy	1		1		1	7		5	3
Examples of design impact ta	12	2	1		1				2

Standardization grid

Total participants 0 — 17

Name	Case stu...	Design	Engagem...	Improve...	Introducti...	Measures	Risk man...	Systems	Not standardized
Examples of using design in h	14	2			1		1		
Health economics			1	2	2	9	3		1
Healthcare infrastructure (incl	4	6			5			1	2
Healthcare systems modelling	1	2		3		1	1	8	2
How to manage "systems of s		2			1			12	3
How to perform system disag	2			1		1		10	4
How to release time for clinici	2		8	4		1	1		2
Human factors		5	1	2	4	2	1	1	2
Human-centred design		15	1	1					1
IHI Quadruple aim			1	5	3	2	1	1	5
Improvement science			1	14	1				2
International comparisons of h	1				14	1		2	
Interventions	5	1	1	3	1	2			5
Management of design requir		8		9				1	
Managing risk proactively							17		1
Modelling	2	3		6		2		1	4
Network/graphs				6		6		5	1
Operational research				9	2	3	1		3

Standardization grid

Total participants 0 — 17

Name	Case stu...	Design	Engagem...	Improve...	Introducti...	Measures	Risk man...	Systems	Not standardized
Optimisation		1		10		2	1	1	3
Organisational design		12	1	1				1	3
Patients and public involveme		1	16	1					
Performance				2		14			2
Prototyping		10		6			1		1
Quality				2		7	4	1	4
Relationships and links with o			3	2	8	2		1	2
Research methods for researc		9		2	2				5
Scenarios	6	5		5		1		1	
Service approach to healthcai		5	1	5	1			2	4
Service ecosystems	1	2		1				13	1
Simulation (including system c	2			9		2	1	2	2
Systems approach to healthca				5	2			9	2
Systems engineering				1				16	1
Systems perspective / thinkin					2			15	1
Systems thinking					1	1		16	
Technology	1	2		2	6		1	1	5
The hard/soft divide	1	1			4	3		3	6
The qualitative/quantitative di				2	3	7			6
Tools for developing understa	1		9	7					1
Transition design		12					1		5
Trends in healthcare (demogr					16				2
Uncertainty						2	10	3	3
User-Centred Design		14	1	2					1
Value (definition, modelling, v				2	3	9		2	2
Welfare system design		11	1	1				3	2

Agreements on proposed categories

1. Introduction:
International perspectives on health systems, issues and trends

- Current issues in healthcare (16)
- International comparisons of healthcare systems (14)
- Trends in healthcare (demographic, technological, clinical) (16)

2. Engagement

- Co-production (as defined and inspired by Elinor Ostrom) (11)
- Collaboration (13)
- Engaging with healthcare professionals and stakeholders (17)
- Patients and public involvement in healthcare systems design research (16)
- Tools for developing understanding and engagement across knowledge horizons (9)

3. Systems

- Complexity (theory, complex systems, complexity management) (11)
- How to manage "Systems of Systems" design (12)
- How to perform system disaggregation/integration in healthcare (10)
- Service ecosystems (13)
- Systems approach to healthcare improvement (9)
- Systems engineering (16)
- Systems perspectives/thinking/theory (15)
- Systems thinking (16)

4. Improvement Methods

- Comparison of different QI methodologies (14)
- Improvement science (14)
- Management of design requirements in the context of improvement (9)
- Operational Research (9)
- Optimisation (10)
- Simulation (including systems dynamics, discrete event and agent-based simulation) (9)

5. Design

- Business model design (9)
- Design dialogue as method using artefacts to support dialogue (visual and tangible) (11)
- Design thinking (14)
- Human-centred design (15)
- Organisational design (12)
- Prototyping (10)
- Research methods for researching design in healthcare (9)
- Transition design (12)
- User-centred design (14)
- Welfare system design (11)

6. Case Studies

- Examples of design impact taken from other fields (12)
- Examples of using design in healthcare (good and bad examples) (14)

7. Measures

- Data (including data-driven design) (11)
- Health economics (9)
- Performance (14)
- Value (definition, modelling, value-driven healthcare) (9)

8. Risk Management

- Managing risk proactively (17)
- Uncertainty (10)

Taking out topics we agree on

1. ~~Business model design~~
2. Human factors
3. ~~Trends in healthcare (demographic, technological, clinical)~~
4. Behaviour
5. Technology
6. Interventions
7. ~~Systems perspective / thinking / theory~~
8. ~~Value (definition, modelling, value driven healthcare)~~
9. Modelling
10. Quality
11. ~~Engaging with healthcare professionals and stakeholders~~
12. Decision support
13. ~~Complexity (theory, complex systems, complex adaptive systems, complexity management)~~
14. Network/graphs
15. ~~Optimisation~~
16. ~~Systems engineering~~
17. ~~Uncertainty~~
18. ~~International comparisons of healthcare systems~~
19. ~~Data (including data driven/data enabled design)~~
20. Healthcare infrastructure (including hospital design)
21. ~~Simulation (including system dynamics, discrete event simulation agent based simulation)~~
22. ~~Prototyping~~
23. ~~Human centred design~~
24. ~~Co production (as defined and inspired by Elinor Ostrom)~~
25. ~~User Centred Design~~
26. ~~Organisational design~~
27. ~~Collaboration~~
28. ~~Welfare system design~~
29. ~~Service ecosystems~~
30. Service approach to healthcare
31. Action research
32. ~~Improvement science~~
33. ~~Operational research~~
34. ~~Health economics~~
35. ~~Examples of design impact taken from other fields~~
36. ~~Examples of using design in healthcare (good and bad examples)~~
37. ~~Current issues in healthcare~~
38. ~~Design thinking~~
39. ~~Research methods for researching design in healthcare~~
40. The qualitative/quantitative divide
41. Scenarios
42. The hard/soft divide
43. ~~Performance~~
44. Ethical challenges
45. Evaluation and evidence-based medicine/management/policy
46. Relationships and links with other disciplines
47. Quadruple aim
48. ~~Transition design~~
49. ~~Managing risk proactively~~
50. ~~Management of design requirements in the context of improvement~~
51. How to release time for clinicians to do QI
52. ~~Comparison of different QI methodologies~~
53. ~~How to perform system disaggregation/reintegration in healthcare~~
54. ~~How to manage "system of systems" design~~
55. ~~Systems thinking~~
56. ~~Design dialogues as method – using artefacts to support dialogue (visual & tangible)~~
57. ~~Tools for developing understanding and engagement across knowledge horizons~~
58. ~~Systems approach to healthcare improvement~~
59. Architecting healthcare delivery systems
60. Healthcare systems modelling – from mapping to simulation
61. Evidencing the impact of a systems approach
62. ~~Patients and Public involvement in health systems research~~

Topics with less agreement

1. Human factors
2. Behaviour
3. Technology
4. Interventions
5. Modelling
6. Quality
7. Decision support
8. Network/graphs
9. Healthcare infrastructure (including hospital design)
10. Service approach to healthcare
11. Action research
12. The qualitative/quantitative divide
13. Scenarios
14. The hard/soft divide
15. Ethical challenges
16. Evaluation and evidence-based medicine/management/policy
17. Relationships and links with other disciplines
18. IHI Quadruple aim
19. How to release time for clinicians to do QI
20. Architecting healthcare delivery systems
21. Healthcare systems modelling – from mapping to simulation
22. Evidencing the impact of a systems approach

Additional categories suggested

1. Approaches to systems design and evaluation
2. Abstract concepts applied to healthcare to the measured, modelled and managed
3. Delivering healthy systems
4. Design solutions
5. Ethics
6. Healthcare systems design research methods
7. Managing improvement
8. Managing systems improvement
9. Modelling
10. Outcomes and measures
11. Research in design sciences
12. Research methods for healthcare
13. Systems design by decision support: forecasting
14. Technology - soft and hard
15. Healthcare context
16. Theory
17. Trends in healthcare

Blank categories for group work

1. Introduction: International perspectives on health systems, issues and trends	2. Engagement	3. Systems	4. Improvement Methods
5. Design	**6. Case Studies**	**7. Measures**	**8. Risk Management**

Slido pub quiz for categorising remaining topics

- You have 20 minutes to discuss the list of topics around each table.
- Each table needs:
  a) Blank categories for group work
  b) List of topics with less agreement
  c) List of additional categories suggested

- As a group decide which category (if any) each of the 22 topics (from b above) fit in and write your choice down on the blank category sheet (a) provided on your tables.

- Then get ready for the pub quiz!
- Go to www.sli.do/
- Enter Event code - #HSDR3
- The question will appear on the screen for 20 seconds
- For each of the 22 questions, select the category you have agreed as a group.
- Then click "Send".

Comments from sorting task

"Some of the items could have been placed in two categories, it would be nice to have the possibility to do this. One item difficult to place as I don't understand what it means."

"A very interesting exercise! I've taken liberties with some title changes, and the order of placement roughly reflects some kind of flow. All the best,"

"sorry, this is just too long a task, sorting this in a way that makes sense would cost me half a day"

*"Many of these subjects are covered elsewhere in a lot of detail, although no necessarily in a systems context. You could end up with a 'standard' text book that may not stand out - which is fine if that is what is needed. I suggest the first half of the book is focused on case studies with reference to later chapters that go into the detail of the methods, theory etc. Alternatively have case study chapters, each of which has one main (and maybe supplementary) learning point. Each case study could then have an addendum to cover the theory, current good practice etc. regarding that learning point. Some thoughts: * what will the book aim to do? * who is the book aimed at? * why would they want to buy/read it? * does the presentation fit with learning styles?"*

*"A few thoughts: * Who or what is the intended audience? * What knowledge do you want to impart to that audience? * What knowledge will the audience have and what will be new to them? * Will this document fit with their learning styles? There is a possibility that the process will end with a 'standard' text book, which is fine if that is what is needed. However is it worth trying to be a bit more innovative or different? For instance basing the learning around case studies with reference to sections on theory, best practice etc. I have tried to put the items and the blocks in order that makes sense to me. I did feel that many if the items fitted into multiple blocks"*

Do you have any comments or ideas?

“ ”

. . . . . .

Slido activity: Comments and ideas

- Finally, we want to hear about any comments or ideas you have.
- So, for the last time, please go to www.sli.do/
- Enter Event code - #HSDR3
- Type in as many comments and ideas as you want
- Then click “Send”.

UNIVERSITY OF CAMBRIDGE Engineering Design Centre

DTU

THIS.Institute The Healthcare Improvement Studies Institute

MÄLARDALEN UNIVERSITY SWEDEN

Any final comments or questions?

Thank You

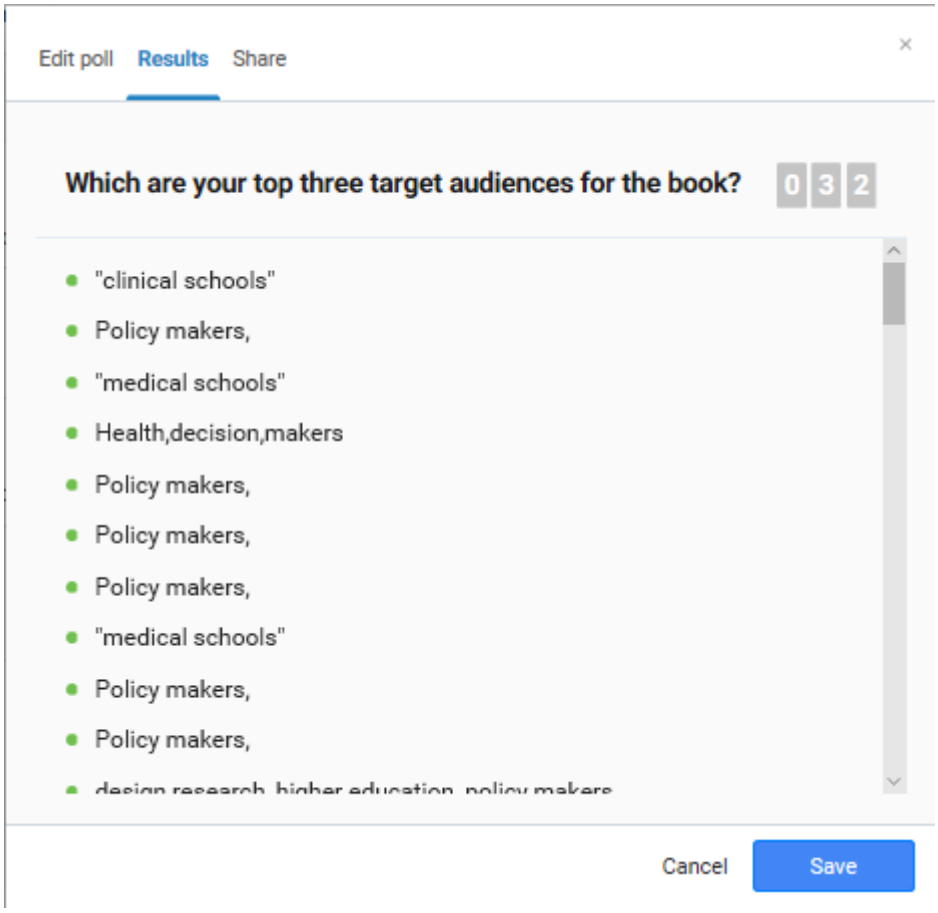
CHALMERS UNIVERSITY OF TECHNOLOGY

KTH

TU Delft

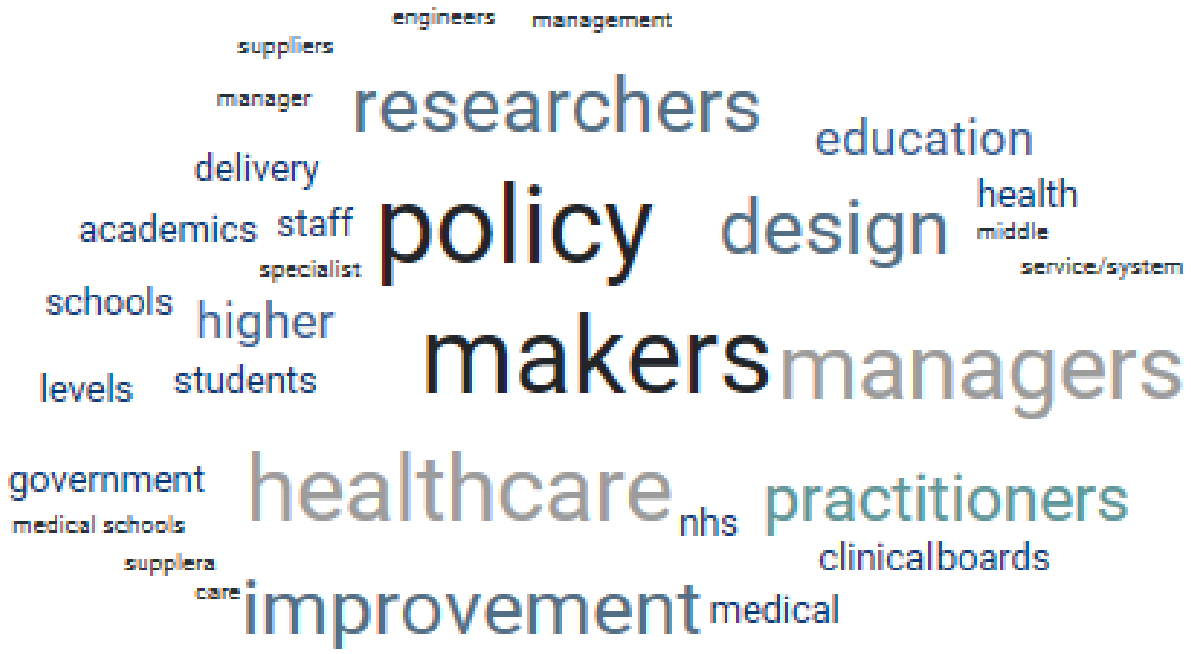
OUTPUTS FROM BOOK SESSION 1

1. TARGET AUDIENCE



- "clinical schools"
- Policy makers,
- "medical schools"
- Health,decision,makers
- Policy makers,
- Policy makers,
- Policy makers,
- "medical schools"
- Policy makers,
- Policy makers,
- design research, higher education, policy makers
- Design/researchers, Improvement/specialists, Policy/makers
- Design research, Design practictioners, policy makers,
- All levers in healthcare delivery from government trolighet to supplera, policy makers, Higher education,
- Clinical staff, Healthcare researchers, Clinical staff
- Health managers, Higher education, policy makers
- Service/system design academics, Policy makers, Healthcare managers,
- Healthcare,managers Students NHS,Boards
- improvement_specialists, medical_schools, healthcare_managers
- Higher education, policy makers, healthcare managers
- ,NHS Boards,

- Healthcare managers, higher education, all levels in healthcare delivery from government to suppliers
- NHS,boards
- Design researchers, engineers, Design practitioners,
- Design researchers, improvement practitioners, hospital researchers
- Healthcare practitioners, improvement practitioners, policy makers.
- Improvement practitioners
- Healthcare managers, medical schools, policy makers,
- Design researchers, policy makers, service/system design academics
- Design researcher, system design academics, students
- Clinical staff, Improvement specialist, Healthcare design researchers
- Improvement practitioners,
- Researchers, students, higher education
- Improvement specialist, Design researcher, Healthcare manager,
- Improvement researchers
- Improvement researchers,
- Design_researchers, Improvement_managers, Policy_makers
- healthcare managers
- Design researchers, Design practitioners, Students
- Design researchers,
- Improvement practitioners, healthcare managers, policy makers,
- Policy makers, improvement specialists
- Improvement,practitioners Management,consultants middle,Managers,and,clinical,staff
- Improvement researchers, policy makers, improvement practitioners
- Clinical staff, healthcare managers, policy makers
- Healthcare manager
- Design academics
- improvement specialist Healthcare managers Design researchers
- Design researchers Improvement researchers Improvement practitioners
- Healthcare managers Higher education All levels of healthcare delivery
- Higher education Policy makers Healthcare managers
- Policy makers Improvement researchers Health care managers
- Improvement practicioners Clinical staff Healthcare service design academics
- Healthcare manager Higher education Policy makers
- Design researcher
- Design researchers, Healthcare managers, Policy makers
- All levers in healthcare delivery from government trolighet to supplera Higher educating Policy makers
- Healthcare managers Improvement specialists Medical schools
- Policy makers Improvement practitioners All levels in healthcare delivery from government through to suppliers
- Design researcher
- Improvement practitioners NHS Boards Medical schools
- Medical schools Higher education Healthcare managers Policy makers Clinicians
- Healthcare managers Students NHS Boards
- Design researchers Engineers Improvement practitoners
- Researchers
- Healthcare managers Design Researchers Improvement specialists
- Improvement practitioners Management consultants middle Managers and clinical staff
- Design researchers Healthcare managers Policy makers
- Improvement practitioners Policy makers Healthcare practitioners
- Researchers Students Higher education
- Improvement practitioners Healthcare managers Improvement researchers
- Service/system design academics Policy makers Healthcare managers
- Policy makers Health care managers Higher education
- Design researchers and practitioners All levels in healthcare delivery... Policy makers
- Design researchers Design practitioners Students



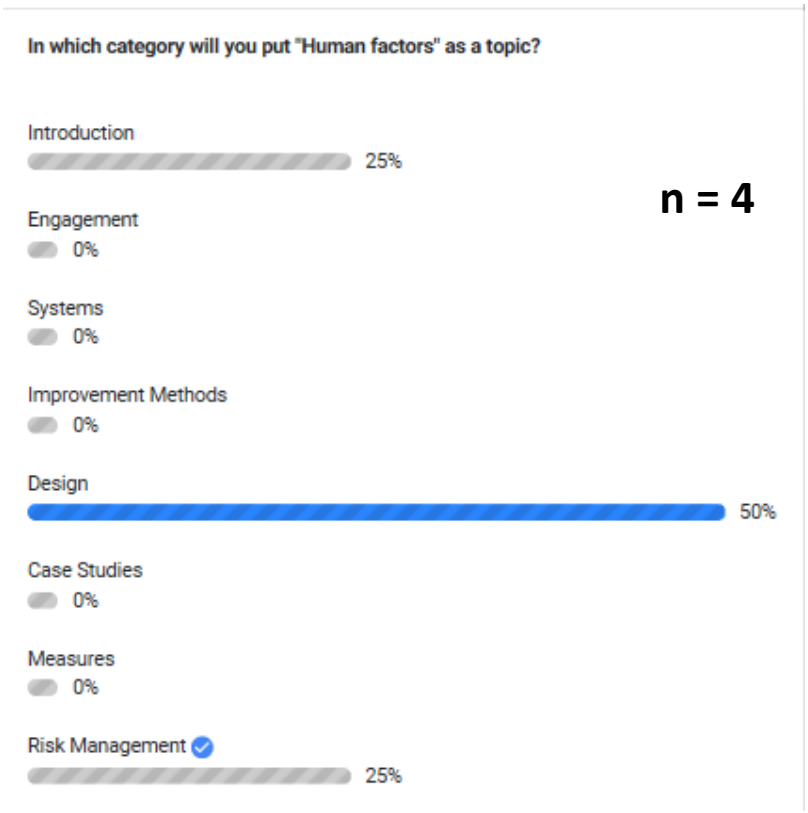
Audiences we agreed to focus on:

1. Policy makers
2. Healthcare Practitioners/managers
3. Improvement specialists
4. Students in higher education

We identified the need to the main goal of the book:

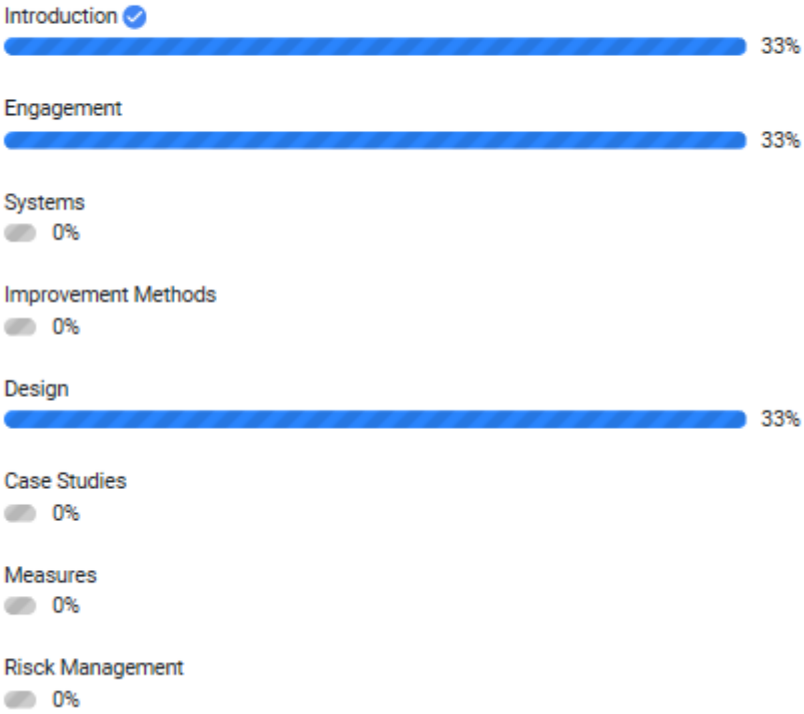
Is it to build community, a state of the art or a practical guide?

2. GROUP DECISIONS ON TOPICS WITH LESS AGREEMENT (N = 6 GROUPS)



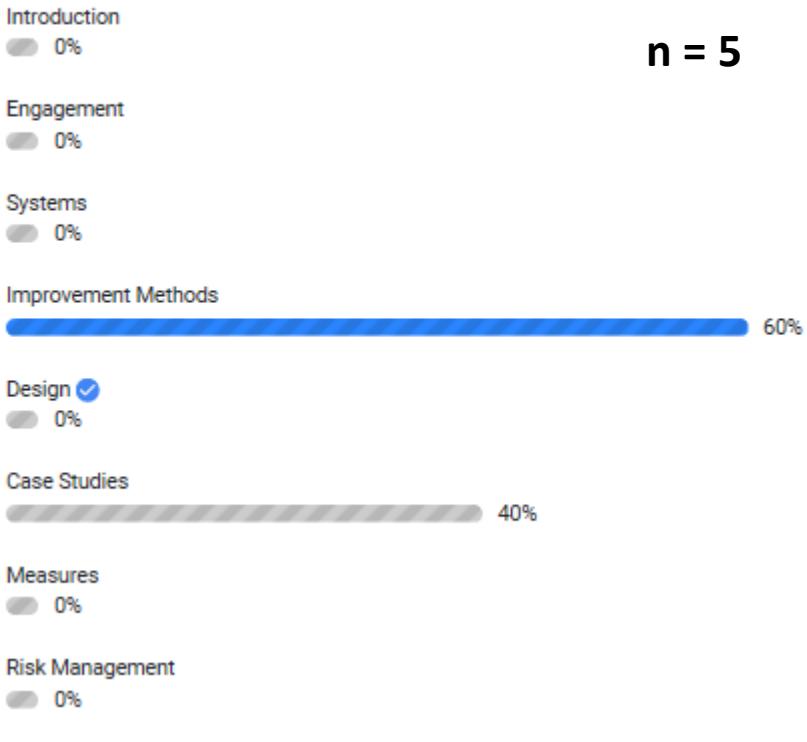
In which category will you put "Technology" as a topic?

n = 3



In which category will you put "Interventions" as a topic?

n = 5



In which category will you put "Modelling" as a topic?

n = 3

- Introduction 0%
- Engagement 0%
- Systems ✓ 67%
- Improvement Methods 33%
- Design 0%
- Case Studies 0%
- Measures 0%
- Risk Management 0%

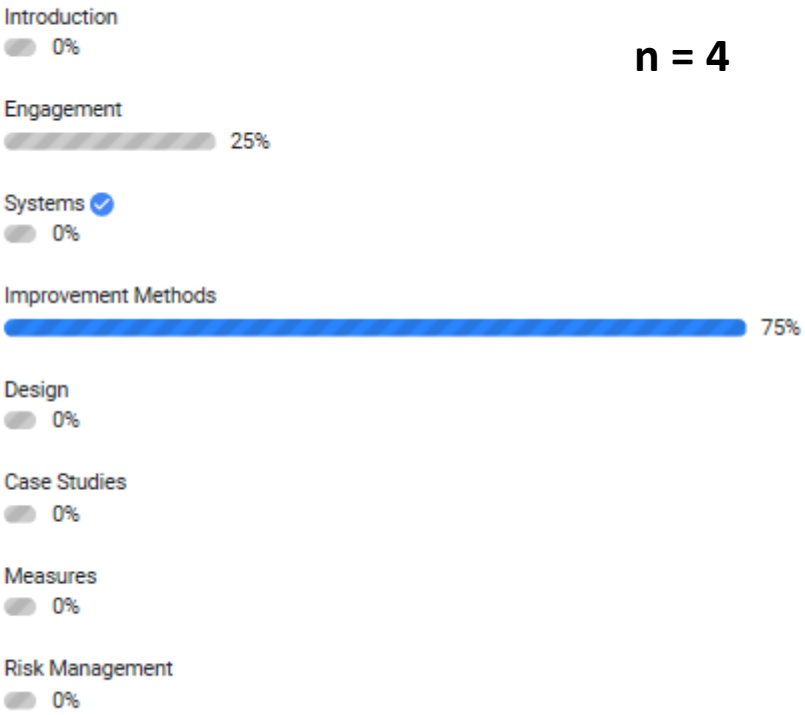
In which category will you put "Quality" as a topic?

n = 5

- Introduction 40%
- Engagement 0%
- Systems 0%
- Improvement Methods 20%
- Design 0%
- Case Studies 0%
- Measures ✓ 40%
- Risk Management 0%

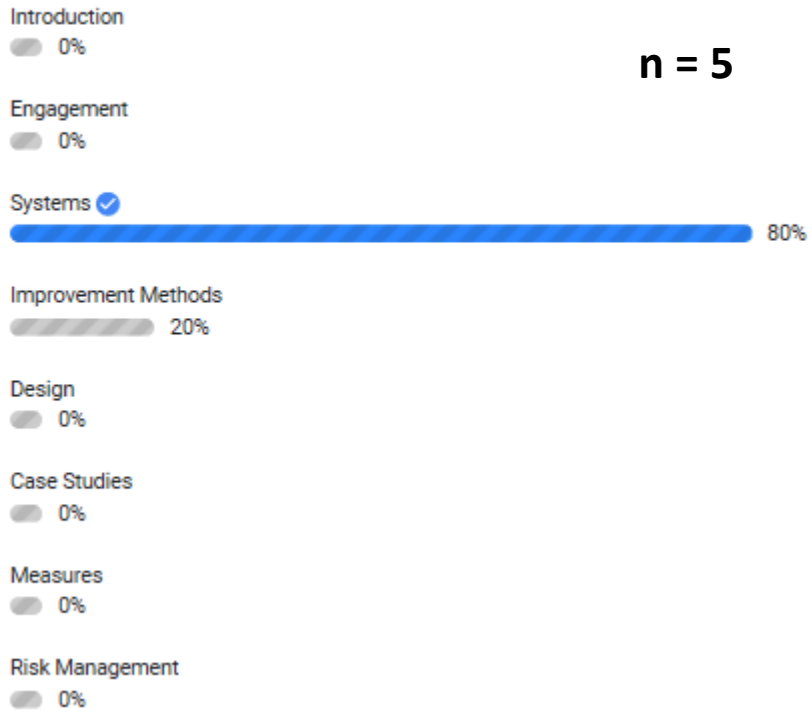
In which category will you put "Decision support" as a topic?

n = 4



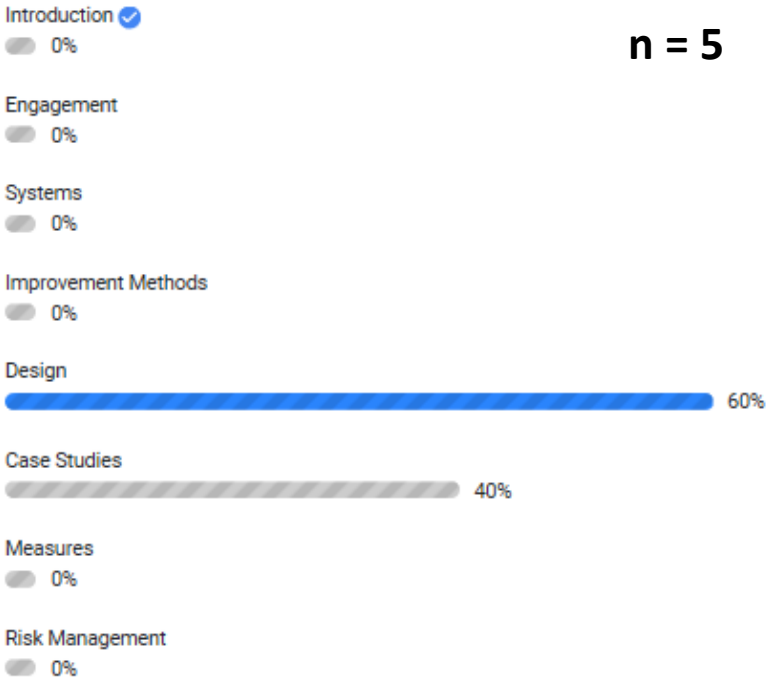
In which category will you put "Network/graphs" as a topic?

n = 5



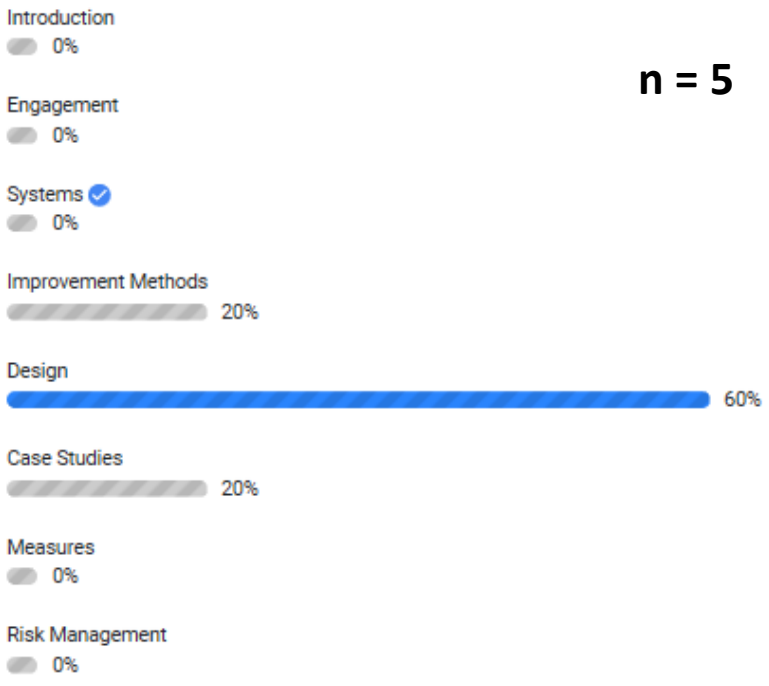
In which category will you put "Healthcare infrastructure (including hospital building)" as a topic?

n = 5



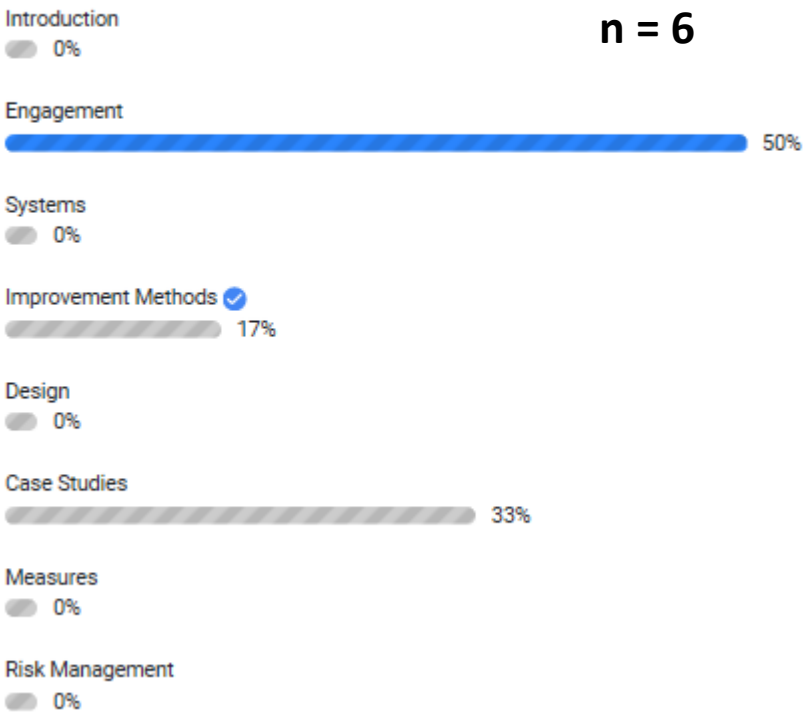
In which category will you put "Service approach to healthcare" as a topic?

n = 5



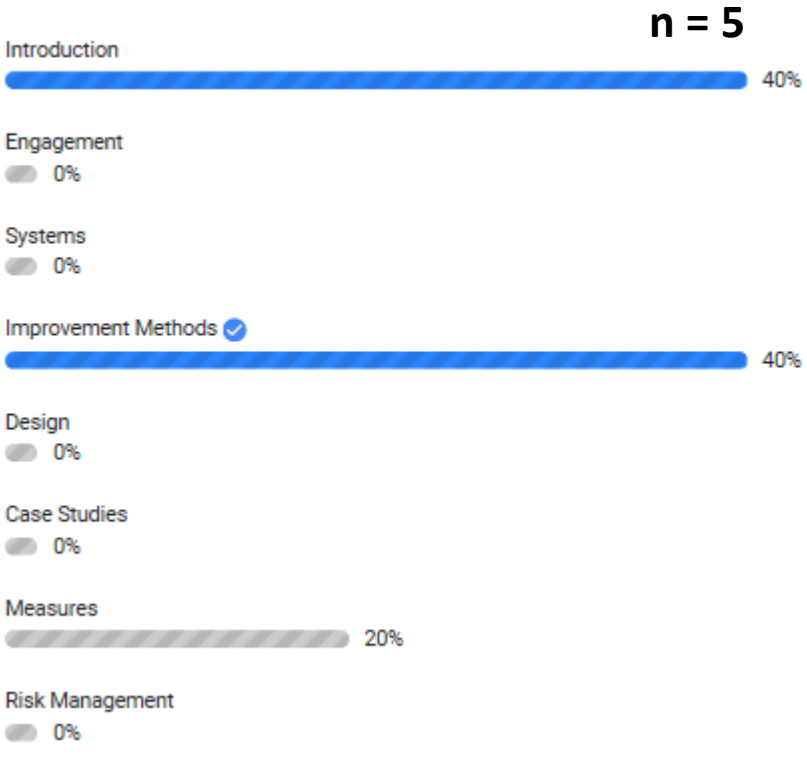
In which category will you put "Action research" as a topic?

n = 6



In which category will you put "The qualitative/quantitative divide" as a topic?

n = 5



In which category will you put "Scenarios" as a topic?

n = 4

- Introduction 0%
- Engagement 25%
- Systems 0%
- Improvement Methods 0%
- Design 25%
- Case Studies ✓ 50%
- Measures 0%
- Risk Management 0%

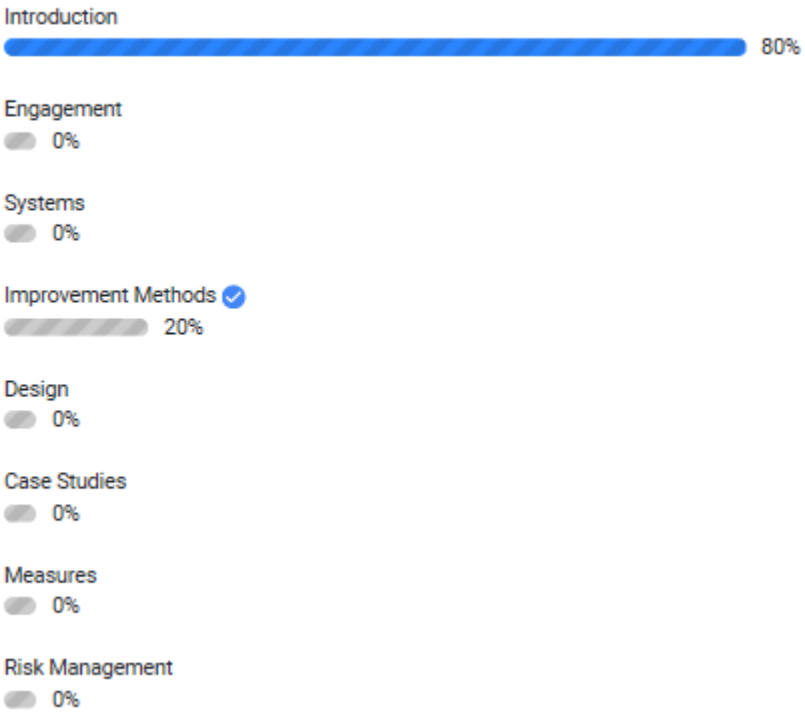
In which category will you put "The hard/soft divide" as a topic?

n = 5

- Introduction 20%
- Engagement 0%
- Systems ✓ 0%
- Improvement Methods 60%
- Design 0%
- Case Studies 0%
- Measures 20%
- Risk Management 0%

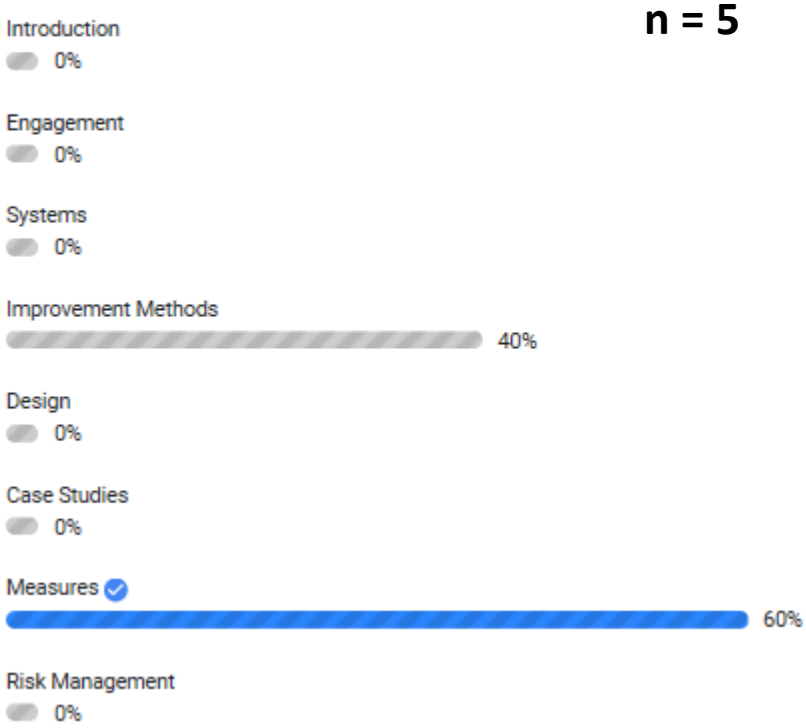
In which category will you put "Ethical challenges" as a topic?

n = 5



In which category will you put "Evaluation and evidence-based medicine/management/policy" as a topic?

n = 5



In which category will you put "Relationships and links with other disciplines" as a topic?

n = 0

Introduction
0%

Engagement
0%

Systems
0%

Improvement Methods
0%

Design
0%

Case Studies
0%

Measures
0%

Risk Management
0%

In which category will you put "IHI Quadruple aim" as a topic?

n = 5

Introduction
40%

Engagement
0%

Systems
0%

Improvement Methods
20%

Design
0%

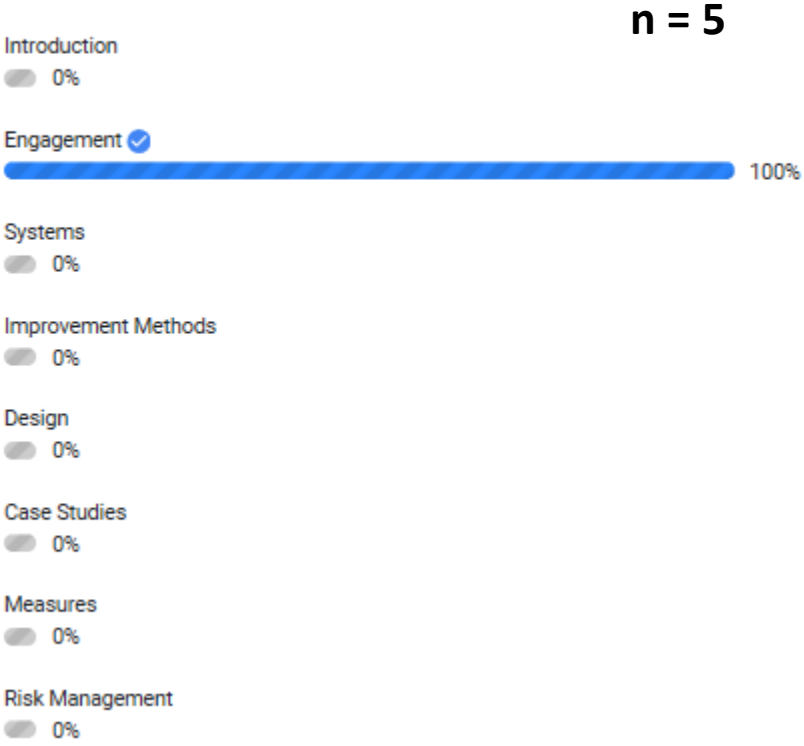
Case Studies
0%

Measures
40%

Risk Management
0%

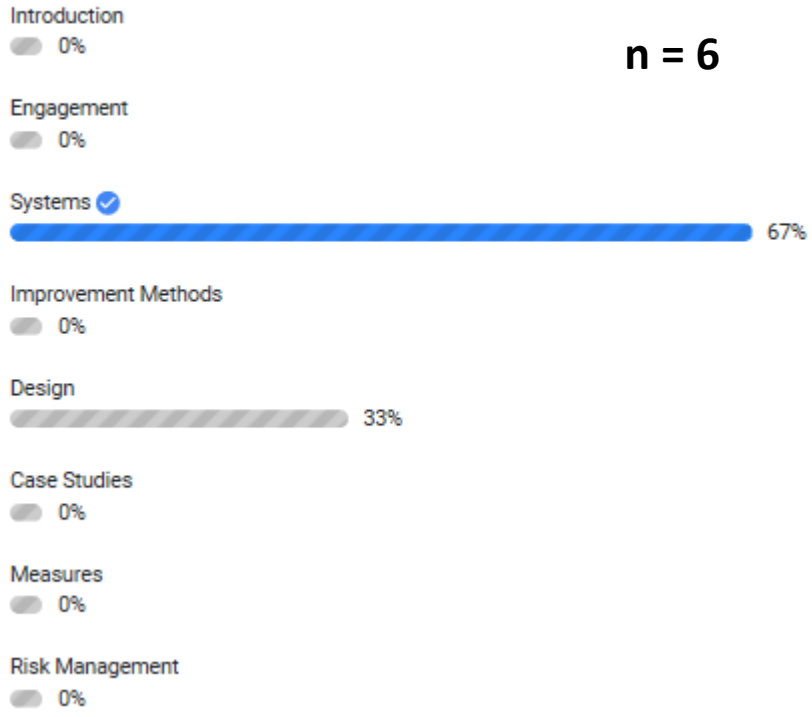
In which category will you put "How to release time for clinicians to do QI" as a topic?

n = 5



In which category will you put "Architecting healthcare delivery systems" as a topic?

n = 6



In which category will you put "Healthcare systems modelling - from mapping to simulations" as a topic?

n = 6

Introduction
0%

Engagement
0%

Systems
50%

Improvement Methods
50%

Design
0%

Case Studies
0%

Measures
0%

Risk Management
0%

In which category will you put "Evidencing the impact of a systms approach" as a topic?

n = 6

Introduction
0%

Engagement
0%

Systems
0%

Improvement Methods
0%

Design
0%

Case Studies
0%

Measures
100%

Risk Management
0%

Topics remaining with no strong agreement:

- Human Factors
- Behaviour
- Technology
- Modelling
- Quality
- The quantitative/qualitative divide
- Relationships and links with other disciplines
- IHI quadruple aim

3. COMMENTS AND IDEAS FOR BOOK PROJECT

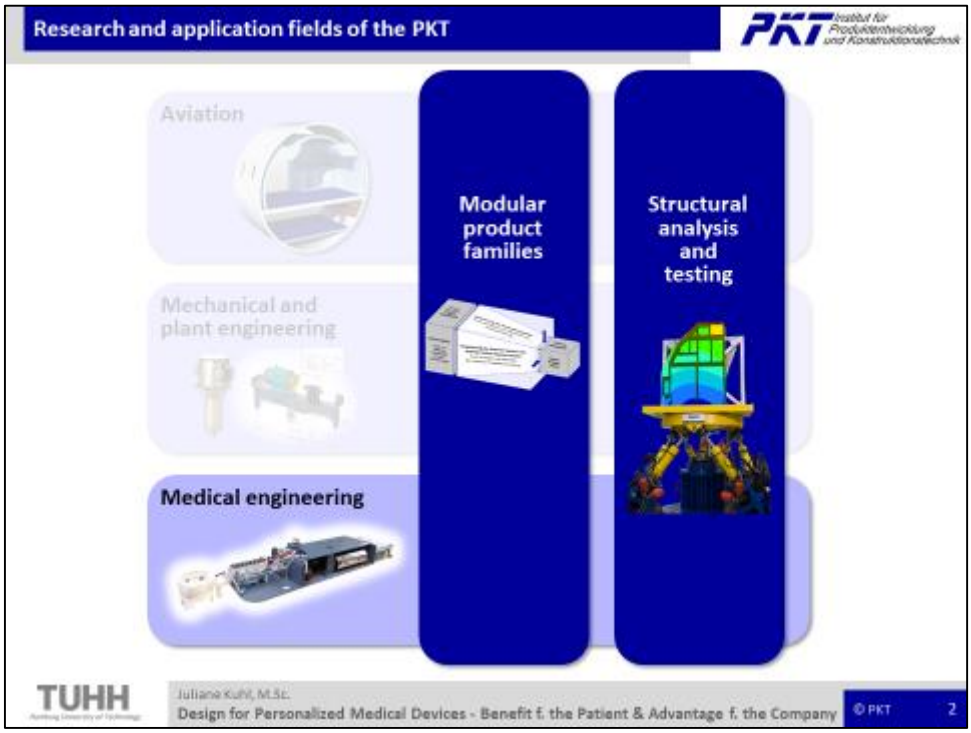
Do you have any comments or ideas about the project, categories, topics etc?

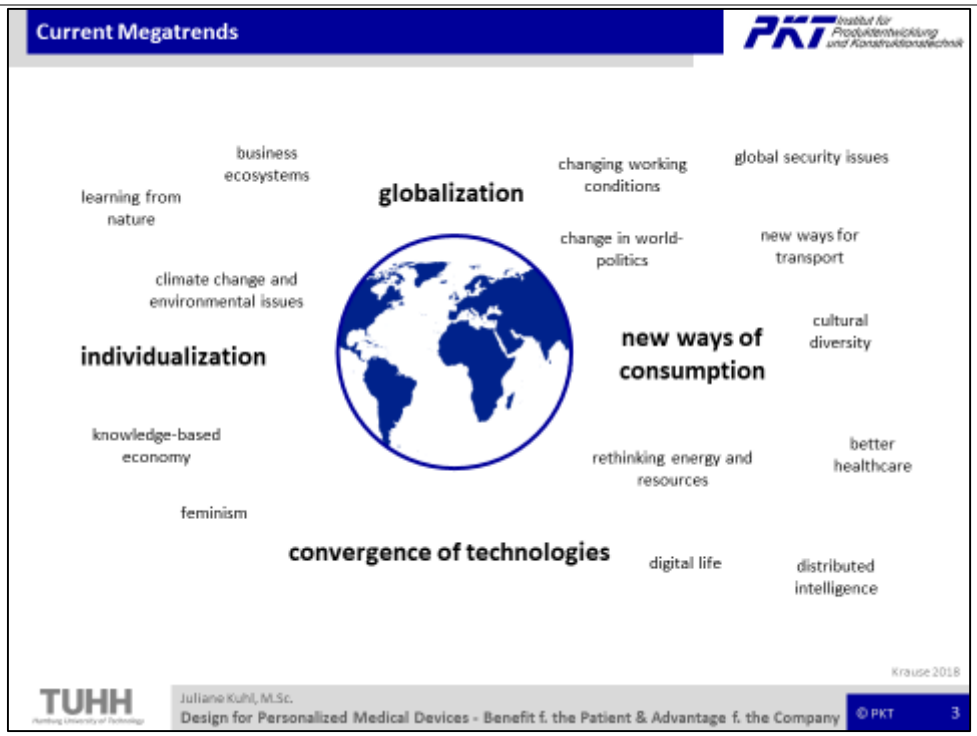
1. The unique contribution is combining/taking a health systems design perspective, emphasis on the framing, integration, knock-on effects.
2. Have a look at existing books from a systems perspective: Jones re-designing care (2013), Cooper healthcare design, Rouse healthcare as complex adaptive system, etc
3. system behaviour (macro-level), individual behaviour monitoring and also behaviour change approaches, patient behaviour - should either underly everything or be its own category
4. To avoid writing two books l, we could structure a book in this way; each chapter has a 'theory' part and a 'case studies' part. The two parts could clarify and complement each other in a nice way.
5. ___ / . . ___ / \ __ \ ‘ ____/ __ __/ ___|___|_____/ \ __/ __/
6. Maybe, a statement paper declaring the aim with the HSDR and what the communityr will do, can be helpful? it is hard to understundom the idea/content of HSDR. I think this should be done before writing a book
7. Slido not best method for these activities (but it was for last part)
8. I think a handbook written in accessible language with two sections (e.g., theory and practice) would be more useful than writing/publishing two books.
9. Three books
10. Future perspectives, change in health delivery
11. It would be good to have some sense of flow/progression through the book.
12. Behaviour should be it's own category
13. Agree to idea of 2 books
14. Technology should be its own category
15. Eat more cake
16. Health and care improvements might attract much broader range of audiences on this state of the art. By the term healthcare we are applying a sort of pre-filtration to the community.
17. Visualizations are necessary in the book
18. Remember that 99% of managers and policy makers will not read a book on state of the art research ; so good arguments for 2 books
19. Several items from the previous round really deserved their own category. For example behaviour runs across all categories. We should avoid the terminology of soft/hard divide as an effective systems approach will employ mixed methods.
20. Some topics were far too broad as they will inevitably appear throughout the sections. In a number of these instances (e.g., ethical challenges) it makes sense to mention them in the introduction and then have them come up at each relevant point in different chapters.
21. It would be great to ask what people would like to write about. Some proposed chapters by individuals might span across a number of categories. However this process was very useful to make us think what we should include!
22. We love you, Alex!
23. I think it’s time to see what is overlapping, many of the concepts could be clustered together or put as under categories.
24. Good efforts engaging all of us in this way. Perhaps It is time for Alex/John to finalise the structure based on our inputs.

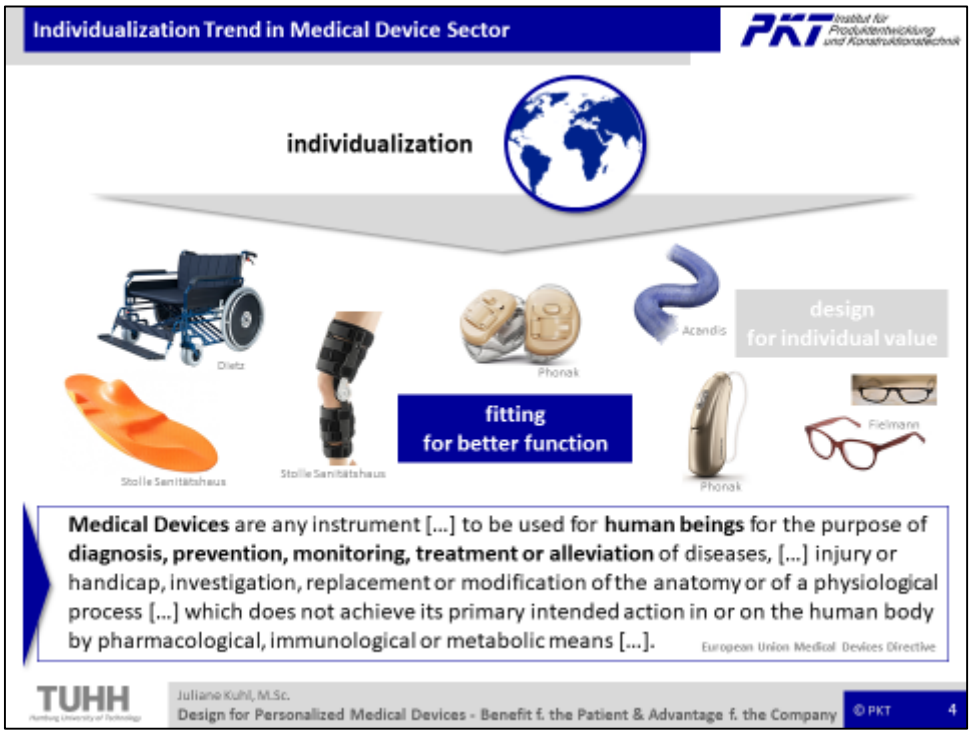
25. Separate the theorical issues into an underlying theory part. Abstract some of the very specific one. Specify the generic po nea like behaviour. Behaviour of what?
26. A book is essentially linear to get over a non- linear 'subject' set.
27. Some topics go across the board, great approach to make sure we don't miss key topics, we need to be clear of the aims and what we want to achieve!
28. Some keywords/categories are subwords/-categories of others
29. Topics depend on aim of the book
30. May need a chapter explaining some concepts if aiming at a broad audience
31. I think we should consider the value of some of the suggested topics . While many of them are obviously important, many also seem less relevant to a book on systems thinking. When deciding on chapters, let's not try to reinvent the wheel, but consider our USP.
32. Some topics would be better as categories
33. Would be nice to have a separate category for behaviour, human factors and ethics. Also, the 'measures' category could be rephrased as 'evidence', 'evaluation', or 'impact'
34. Some topics (eg. Behaviour, ethical challenges) could run across all chapters
35. Have people write a title and and abstract and group afterwards
36. Many categories, I.e. technology, modelling are so generic they could be expected to thread through every other category.
37. Same words can mean different things in different communities,
38. Divide design category in process, product and systems design (methodology)
39. Some topic are core principles and could therefore be in all chapters. (E.g., Topics 2,3,5,6,7,9,13)
40. Is à 'static' book the best way of delivering this knowledge?
41. Some topics too general
42. Focus on design and systems
43. Some topics were very broad ("technology" "behaviour"...),
44. Time for tea?

Presentations session I
Chair: Professor John Clarkson, University of Cambridge, UK

1. ***Design for Personalized Medical Devices – Benefit for the patient as well as advantage for the company***
   Juliane Kuhl and Dieter Krause, Hamburg University of Technology, Germany




Current Megatrends
PKT
business ecosystems
learning from nature
globalization
changing working conditions
global security issues
change in world-politics
new ways for transport
climate change and environmental issues
individualization
new ways of consumption
cultural diversity
knowledge-based economy
rethinking energy and resources
better healthcare
feminism
convergence of technologies
digital life
distributed intelligence
Krause 2018
TUHH
Juliane Kuhl, M.Sc.
Design for Personalized Medical Devices - Benefit f. the Patient & Advantage f. the Company
© PKT
3


Individualization Trend in Medical Device Sector
PKT
individualization
Dietz
Phonak
Acandis
design for individual value
Stolle Sanitätshaus
Stolle Sanitätshaus
fitting for better function
Phonak
Fielmann
Medical Devices are any instrument [...] to be used for human beings for the purpose of diagnosis, prevention, monitoring, treatment or alleviation of diseases, [...] injury or handicap, investigation, replacement or modification of the anatomy or of a physiological process [...] which does not achieve its primary intended action in or on the human body by pharmacological, immunological or metabolic means [...].
European Union Medical Devices Directive
TUHH
Juliane Kuhl, M.Sc.
Design for Personalized Medical Devices - Benefit f. the Patient & Advantage f. the Company
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Outline
PKT Institut für Produktentwicklung und Konstruktionstechnik
Individualization Trend in Medical Device Sector
Challenges for Personalized Medical Devices
Conclusion and Outlook
TUHH
Juliane Kuhl, M.Sc.
Design for Personalized Medical Devices - Benefit f. the Patient & Advantage f. the Company
© PKT
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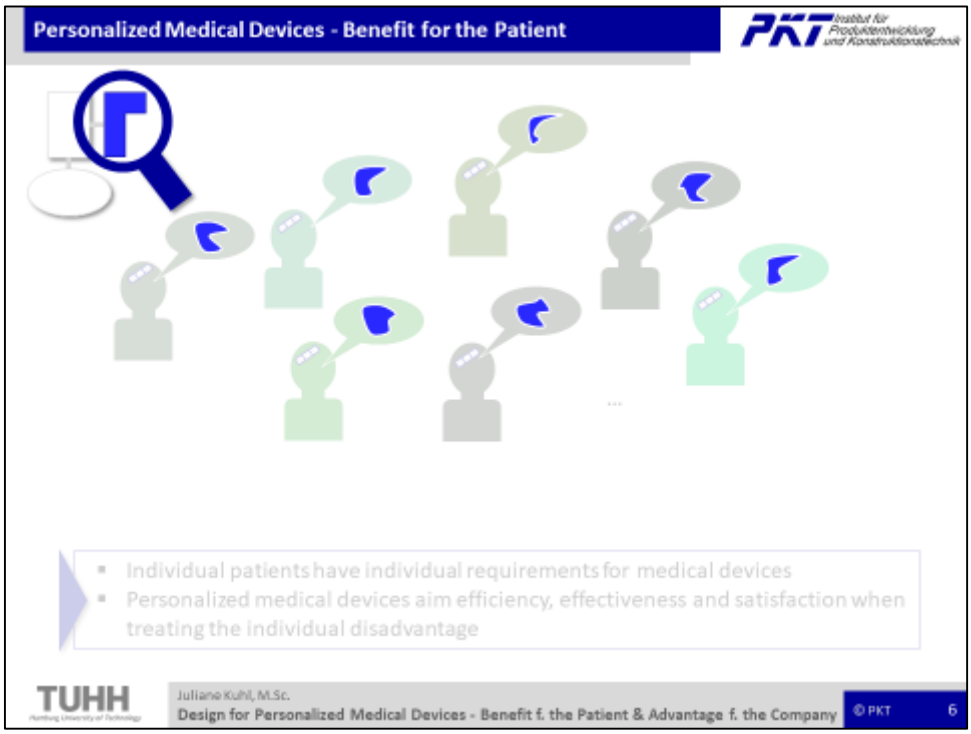
Personalized Medical Devices - Benefit for the Patient
PKT Institut für Produktentwicklung und Konstruktionstechnik
Individual patients have individual requirements for medical devices
Personalized medical devices aim efficiency, effectiveness and satisfaction when treating the individual disadvantage
TUHH
Juliane Kuhl, M.Sc.
Design for Personalized Medical Devices - Benefit f. the Patient & Advantage f. the Company
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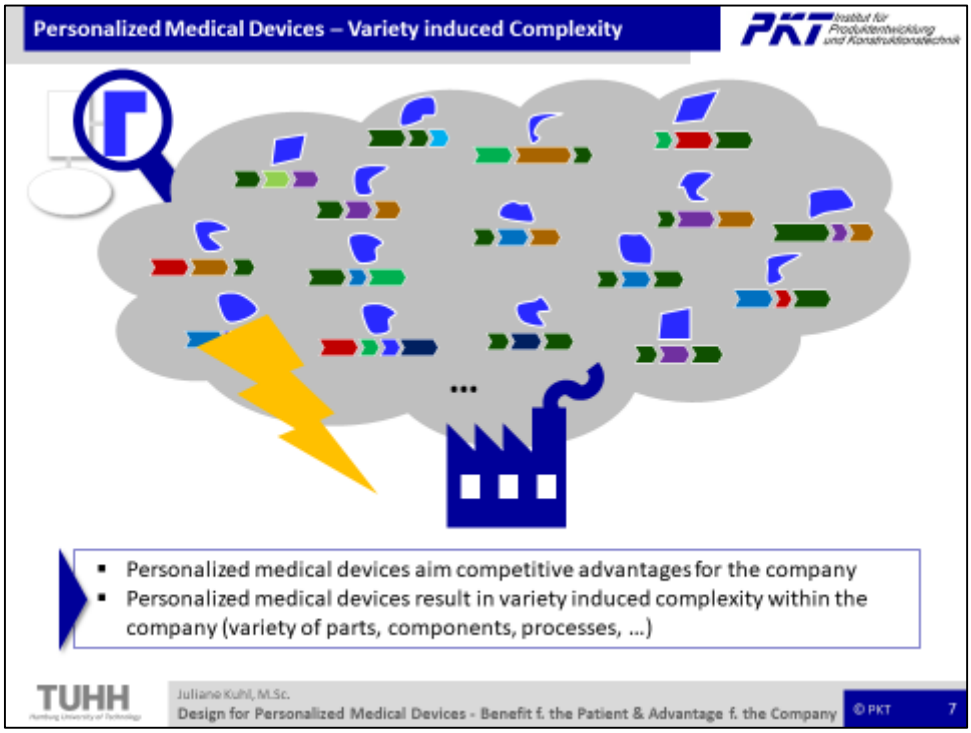
Personalized Medical Devices – Variety induced Complexity
PKT Institut für Produktentwicklung und Konstruktionstechnik
...
Personalized medical devices aim competitive advantages for the company
Personalized medical devices result in variety induced complexity within the company (variety of parts, components, processes, ...)
TUHH
Juliane Kuhl, M.Sc.
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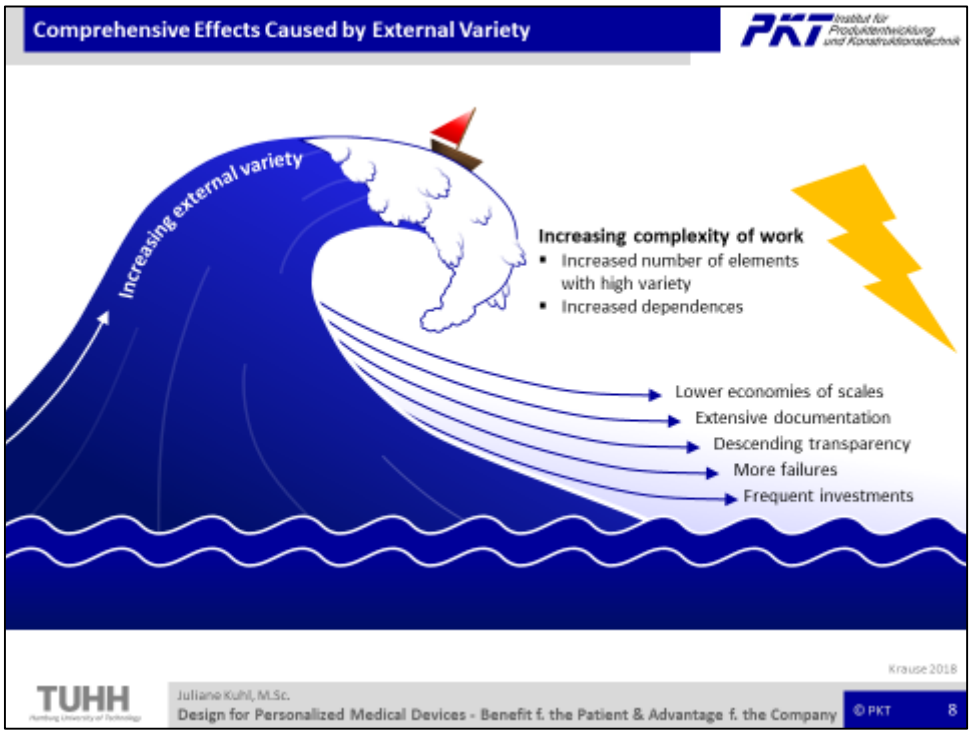
Comprehensive Effects Caused by External Variety
PKT Institut für Produktentwicklung und Konstruktionstechnik
Increasing external variety
Increasing complexity of work
Increased number of elements with high variety
Increased dependences
Lower economies of scales
Extensive documentation
Descending transparency
More failures
Frequent investments
Krause 2018
TUHH
Juliane Kuhl, M.Sc.
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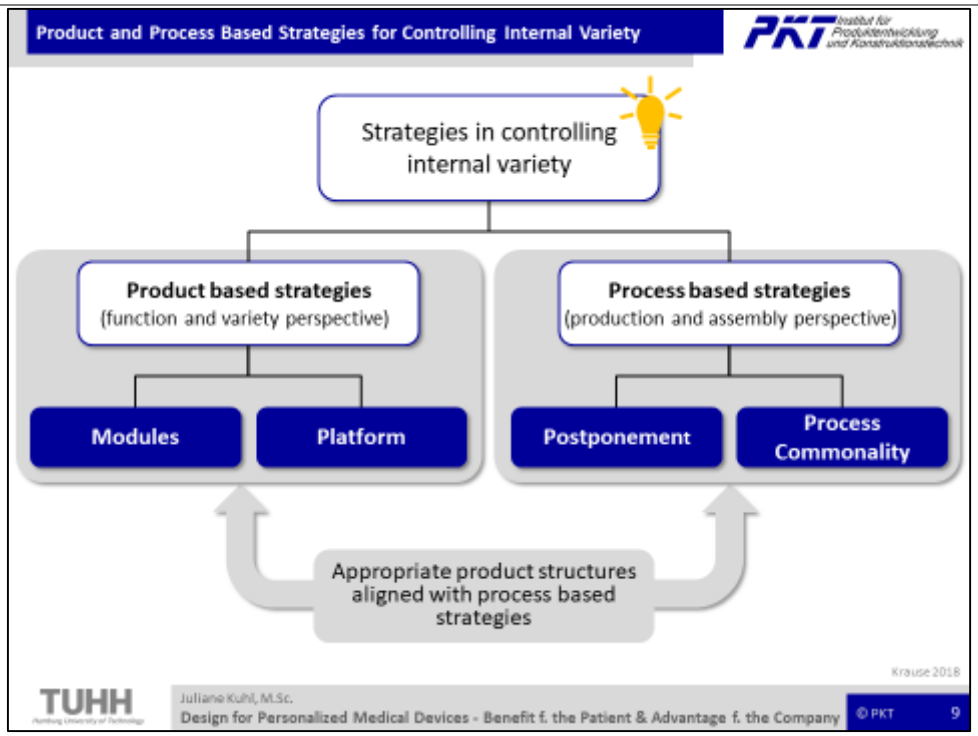
Product and Process Based Strategies for Controlling Internal Variety
PKT
Strategies in controlling internal variety
Product based strategies
(function and variety perspective)
Process based strategies
(production and assembly perspective)
Modules
Platform
Postponement
Process Commonality
Appropriate product structures aligned with process based strategies
Krause 2018
TUHH
Juliane Kuhl, M.Sc.
Design for Personalized Medical Devices - Benefit f. the Patient & Advantage f. the Company
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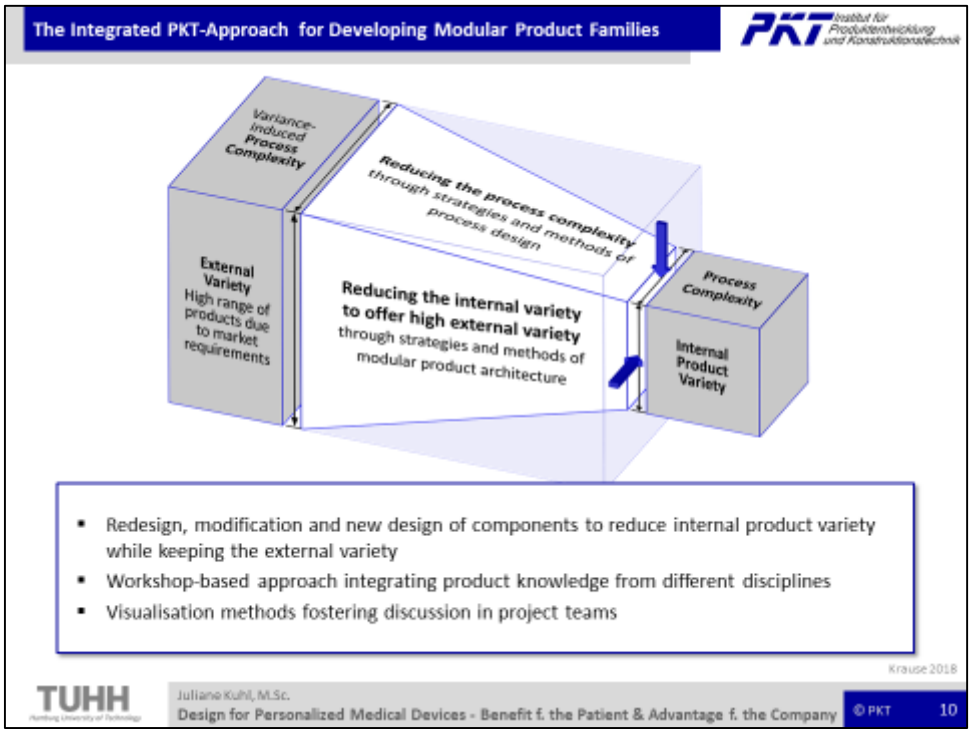
The Integrated PKT-Approach for Developing Modular Product Families
PKT
Variance-induced Process Complexity
Reducing the process complexity through strategies and methods of process design
External Variety
High range of products due to market requirements
Reducing the internal variety to offer high external variety
through strategies and methods of modular product architecture
Process Complexity
Internal Product Variety
Redesign, modification and new design of components to reduce internal product variety while keeping the external variety
Workshop-based approach integrating product knowledge from different disciplines
Visualisation methods fostering discussion in project teams
Krause 2018
TUHH
Juliane Kuhl, M.Sc.
Design for Personalized Medical Devices - Benefit f. the Patient & Advantage f. the Company
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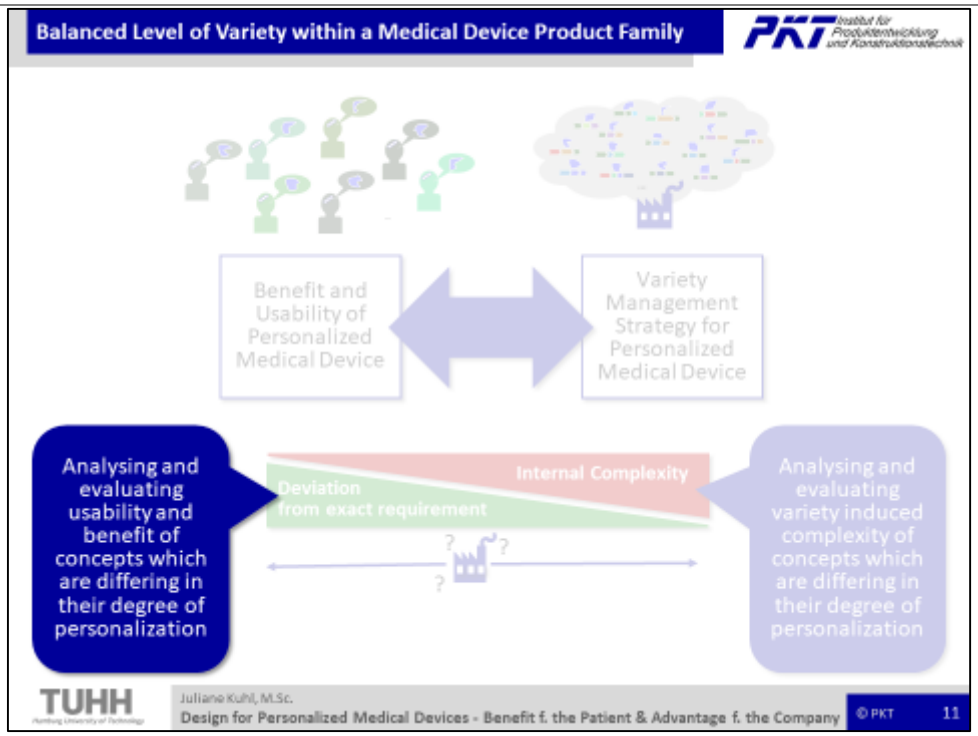
Balanced Level of Variety within a Medical Device Product Family
PKT Institut für Produktentwicklung und Konstruktionstechnik
Benefit and Usability of Personalized Medical Device
Variety Management Strategy for Personalized Medical Device
Analysing and evaluating usability and benefit of concepts which are differing in their degree of personalization
Deviation from exact requirement
Internal Complexity
Analysing and evaluating variety induced complexity of concepts which are differing in their degree of personalization
TUHH
Juliane Kuhl, M.Sc.
Design for Personalized Medical Devices - Benefit f. the Patient & Advantage f. the Company
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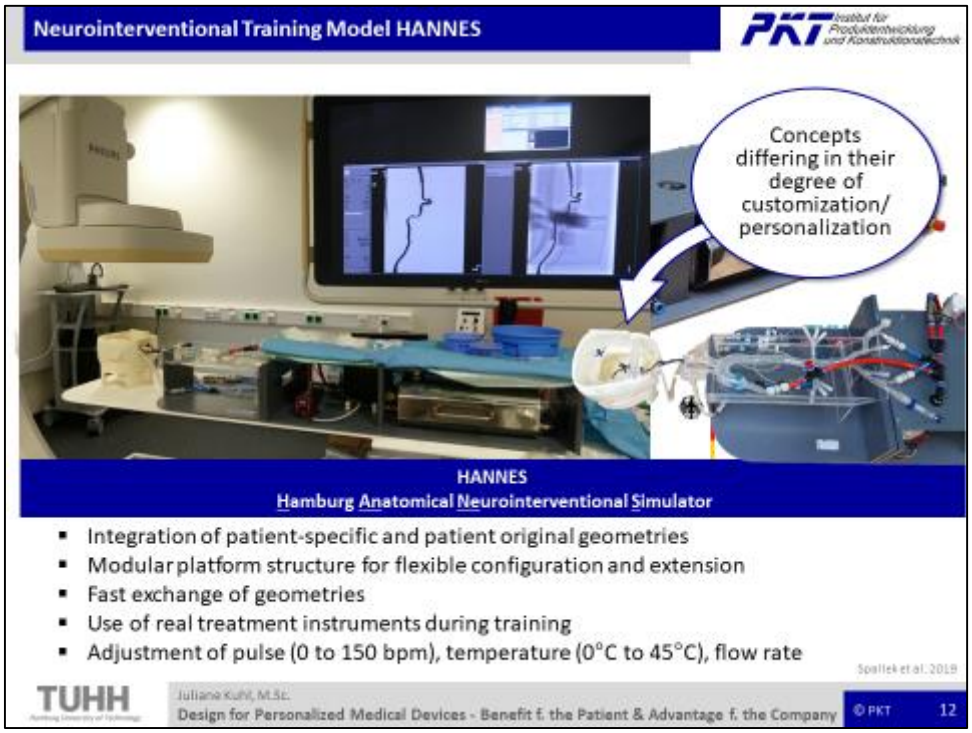
11


Neurointerventional Training Model HANNES
PKT Institut für Produktentwicklung und Konstruktionstechnik
Concepts differing in their degree of customization/ personalization
HANNES
Hamburg Anatomical Neurointerventional Simulator
Integration of patient-specific and patient original geometries
Modular platform structure for flexible configuration and extension
Fast exchange of geometries
Use of real treatment instruments during training
Adjustment of pulse (0 to 150 bpm), temperature (0°C to 45°C), flow rate
Spallek et al. 2019
TUHH
Juliane Kuhl, M.Sc.
Design for Personalized Medical Devices - Benefit f. the Patient & Advantage f. the Company
© PKT
12

Outline

PKT Institut für Produktentwicklung und Konstruktionstechnik

- Individualization Trend in Medical Device Sector
- Challenges for Personalized Medical Devices
- **Conclusion and Outlook**

Outlook and Conclusion

PKT Institut für Produktentwicklung und Konstruktionstechnik

Conclusion

- Personalized medical devices satisfy individual requirements and aim efficiency, effectiveness and satisfaction while treating individual disadvantages
- Personalized medical devices induce complexity within the company which need to be managed by an adequate variety management

Outlook

- Need for variety management for personalized medical devices facing internal complexity and product benefit
  - How to measure benefit and usability for medical device concepts with different customization / personalization degree?
  - How to evaluate variety induced complexity for medical device concepts with different customization / personalization degree in advance?

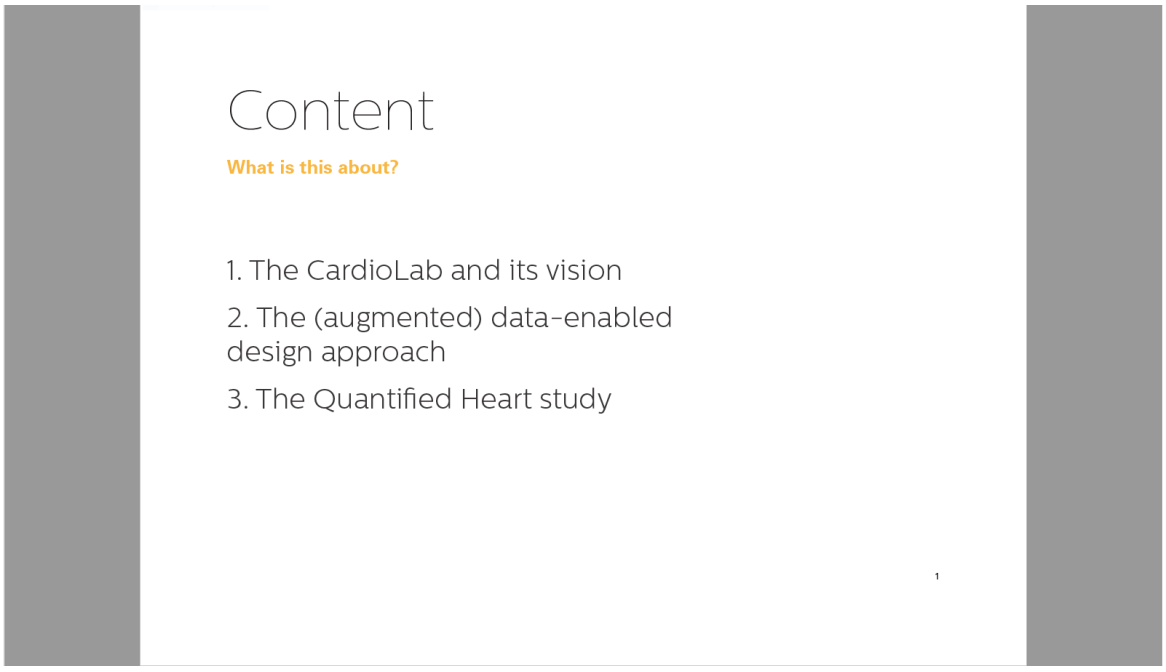
Juliane Kuhl, M.Sc.
Hamburg University of Technology,
Institute of Product Development and Mechanical Engineering Design (PKT)
juliane.kuhl@tuhh.de

Federal Ministry of Education and Research

The authors would like to thank the German Federal Ministry of Education and Research for founding this work within the project BELUCCI (13GW0274D).

2. *Convergent design integration for cardiovascular prevention: The Quantified Heart example*

Valeria Pannunzio and Maaike Kleinsmann, TU Delft, The Netherlands



The CardioLab

Industry + university + public health

CardioLab · TU Delft · PHILIPS · Hartstichting · NeLL National eHealth Living Lab · LUMC · Erasmus MC Universitair Medisch Centrum Rotterdam

3

The CardioLab vision

designing for health systems' contemporary needs

The CardioLab vision towards designing smart technologies in the health domain embraces a:

- life-course
- community-level
- evidence-based

approach towards health innovation.

3

2.63 x 1.97 in

The CardioLab vision

designing for health systems' contemporary needs

The CardioLab vision towards designing smart technologies in the health domain embraces a:

- life-course
- community-level
- **evidence-based**

approach towards health innovation.

4

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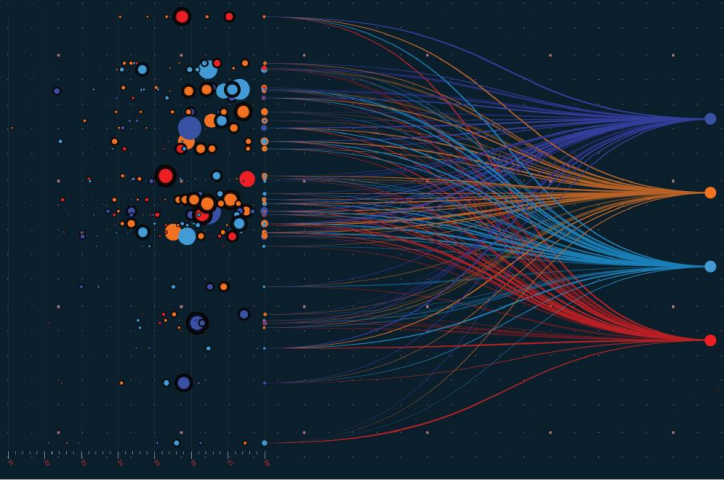
Data-enabled design

designing intelligent ecosystems using digital data as creative material



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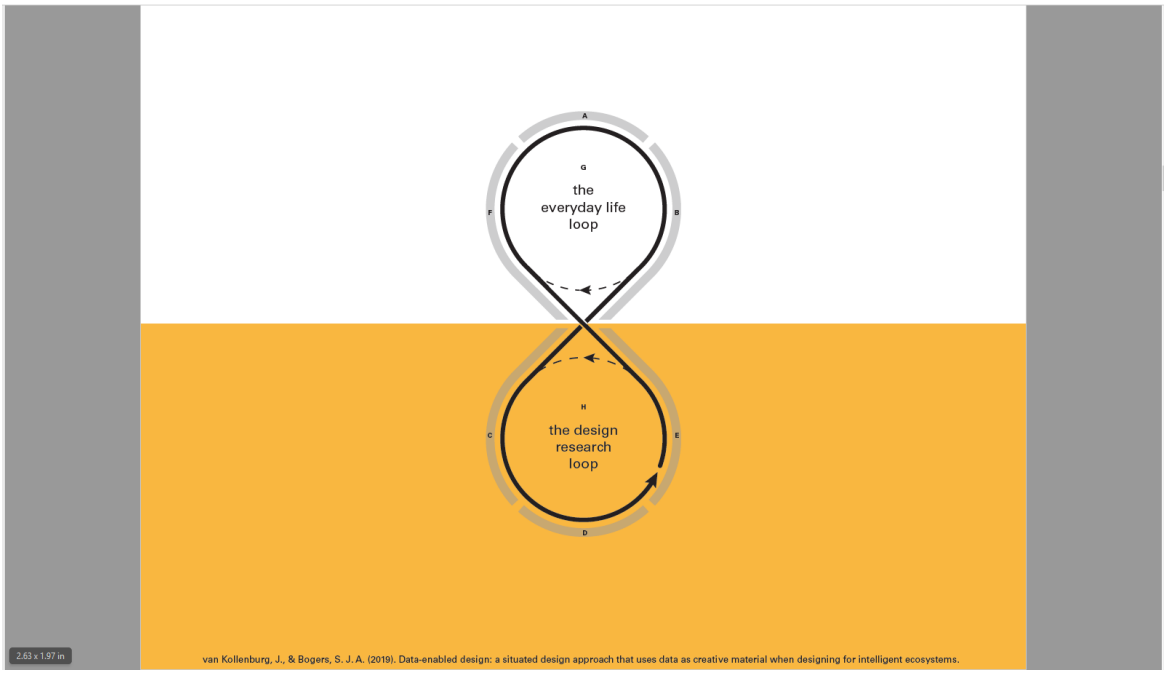
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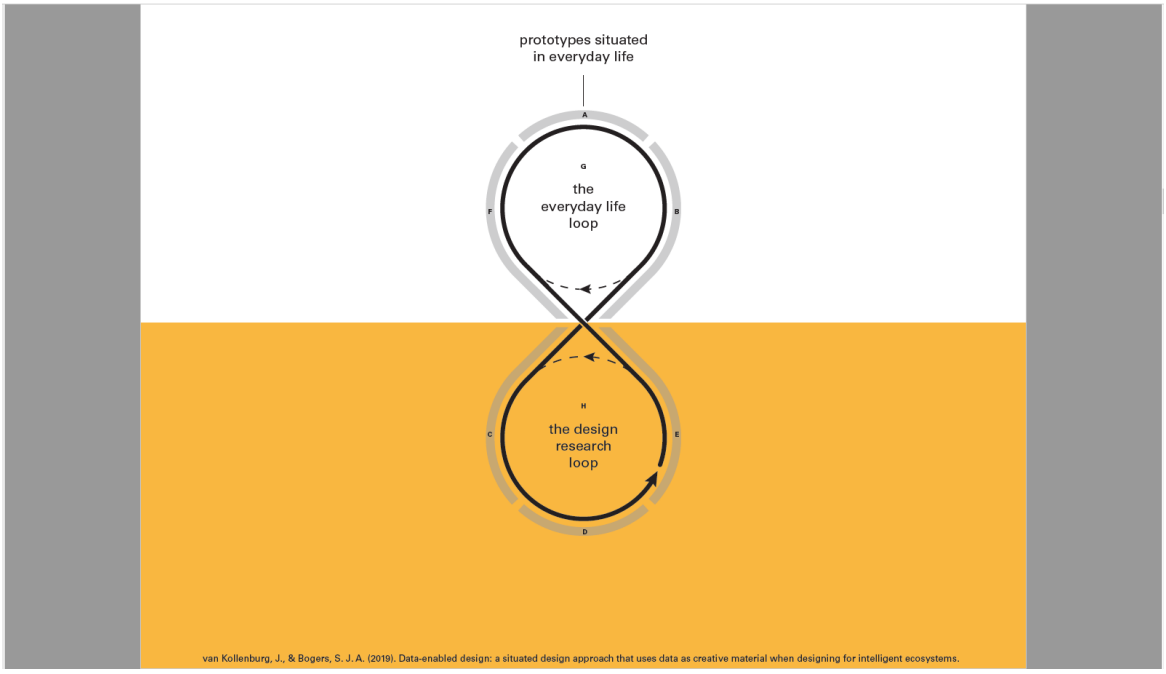
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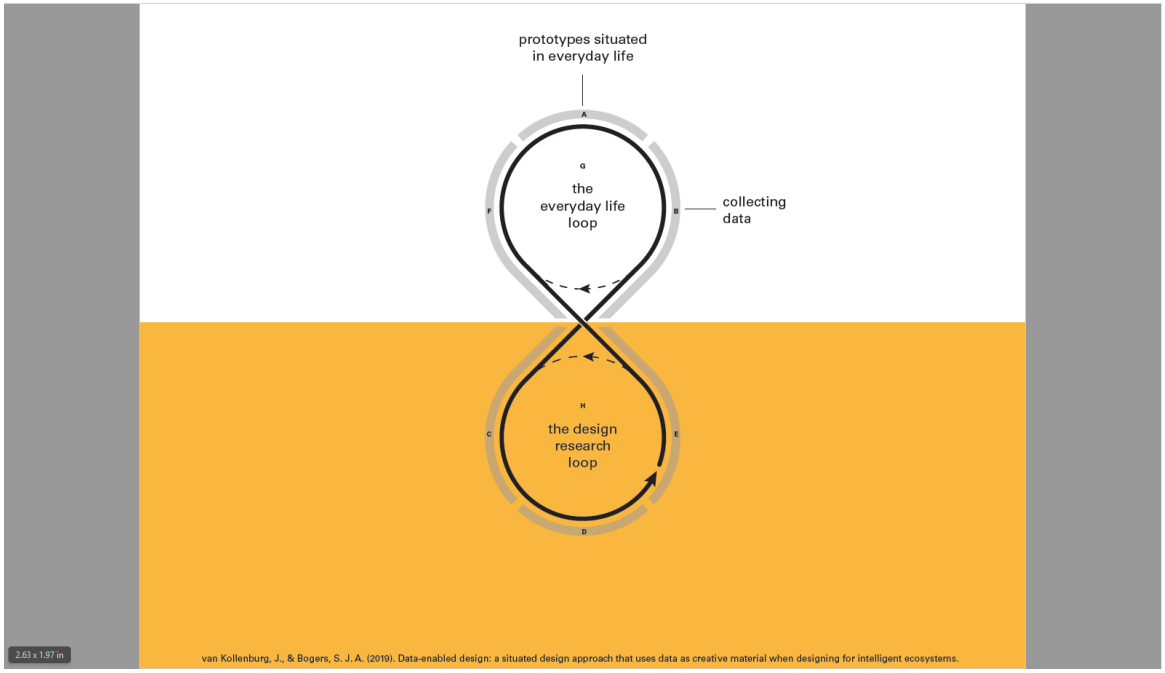
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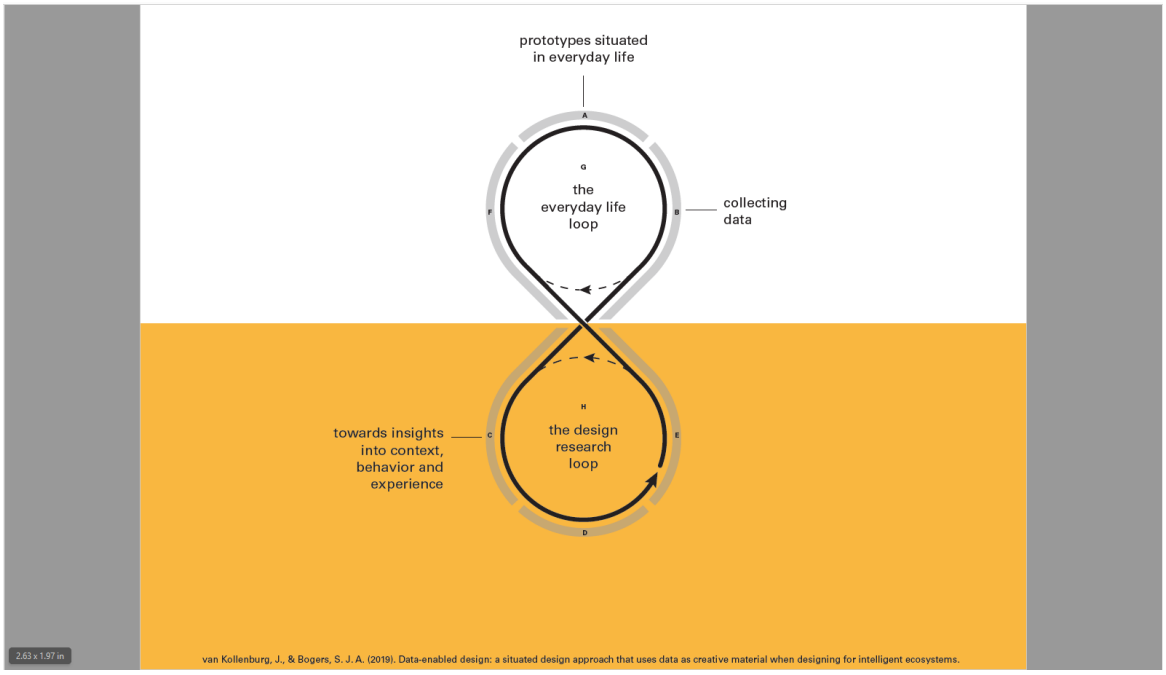
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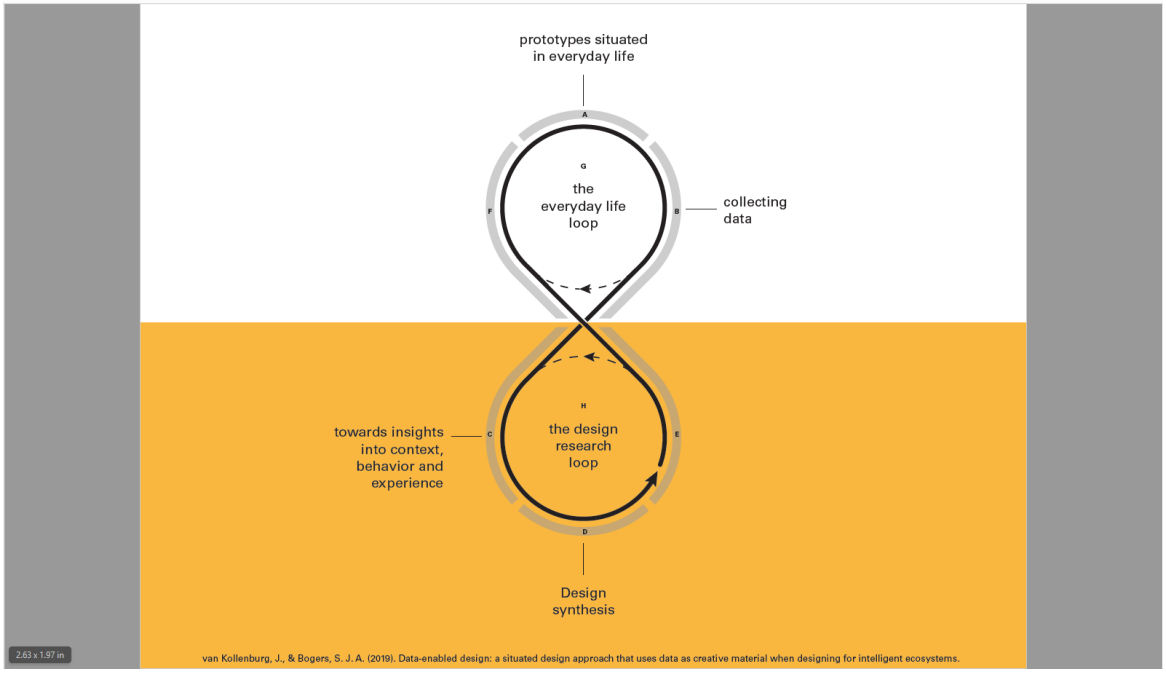
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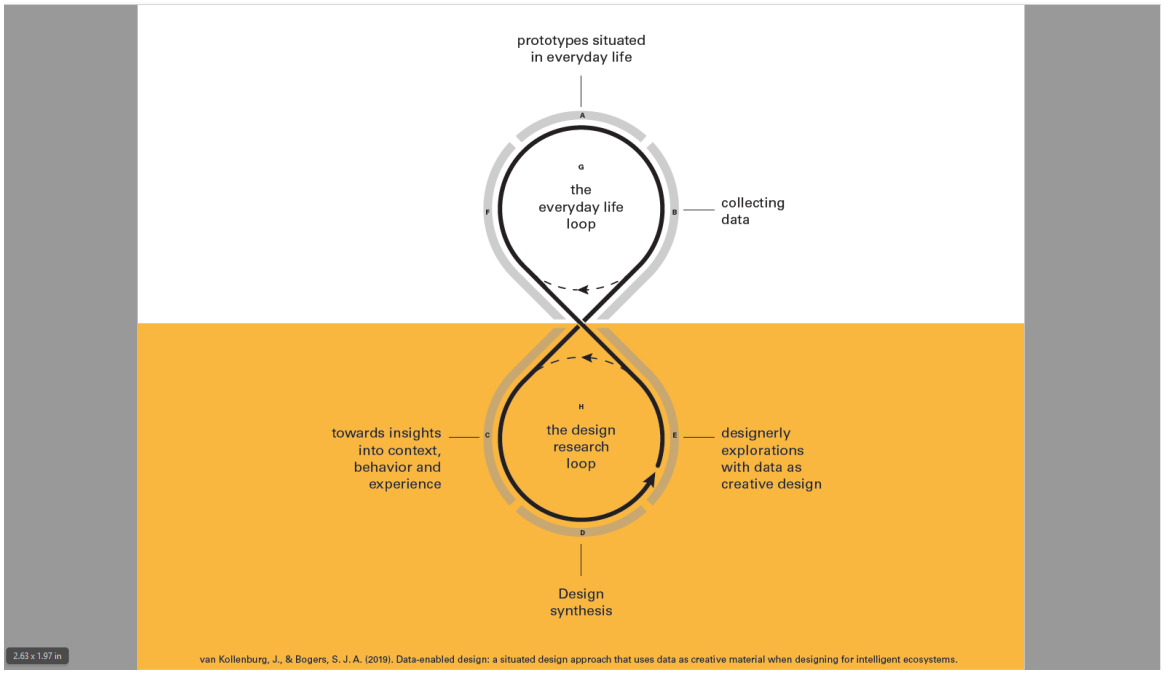
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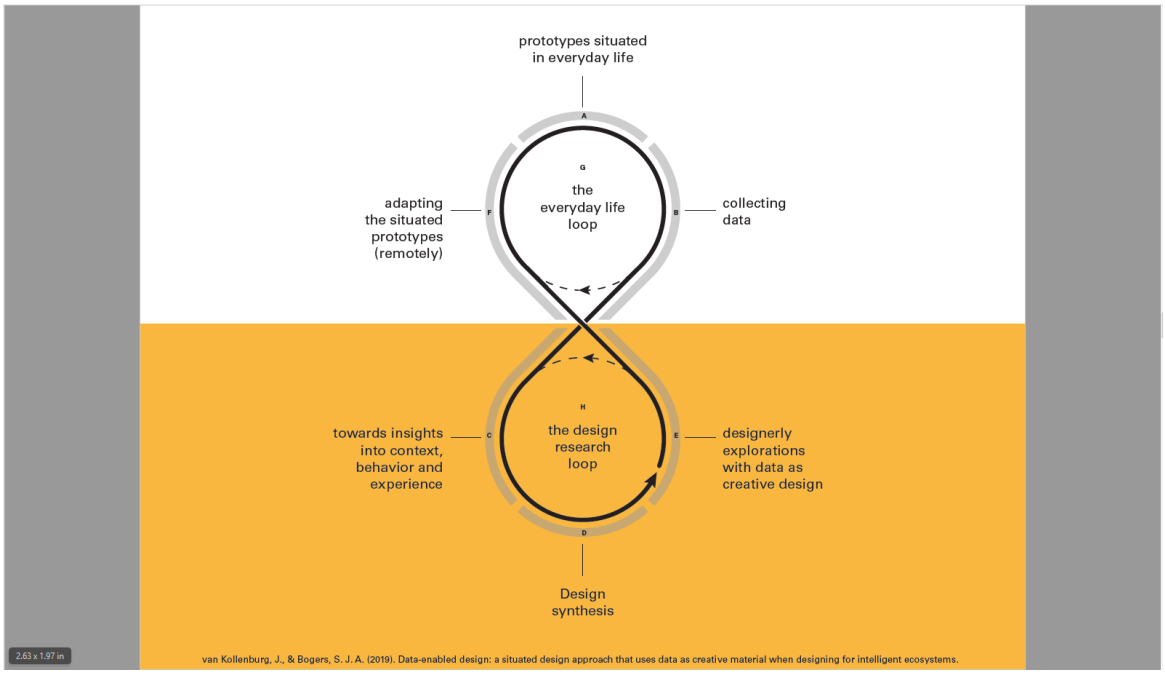

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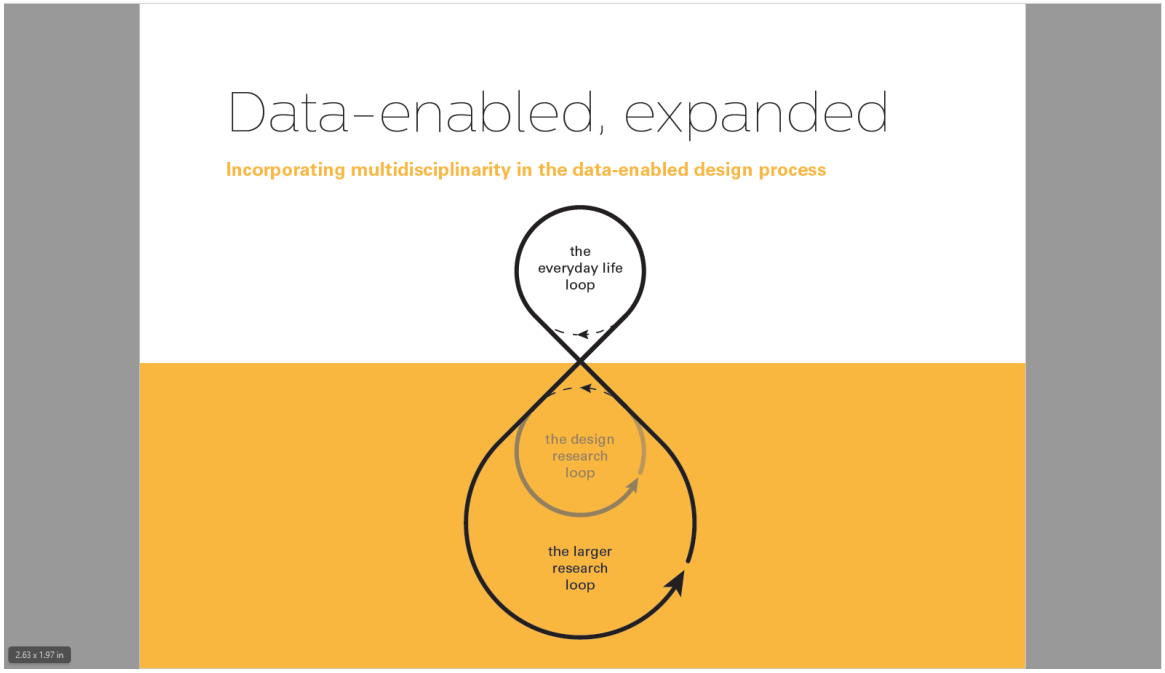
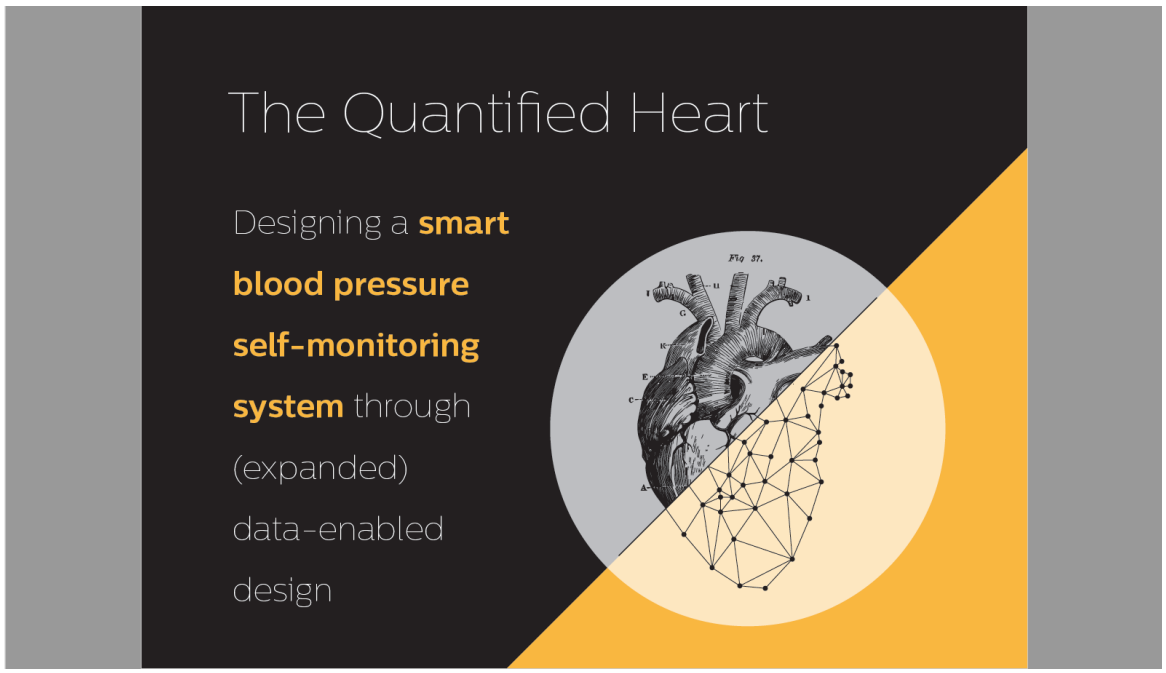
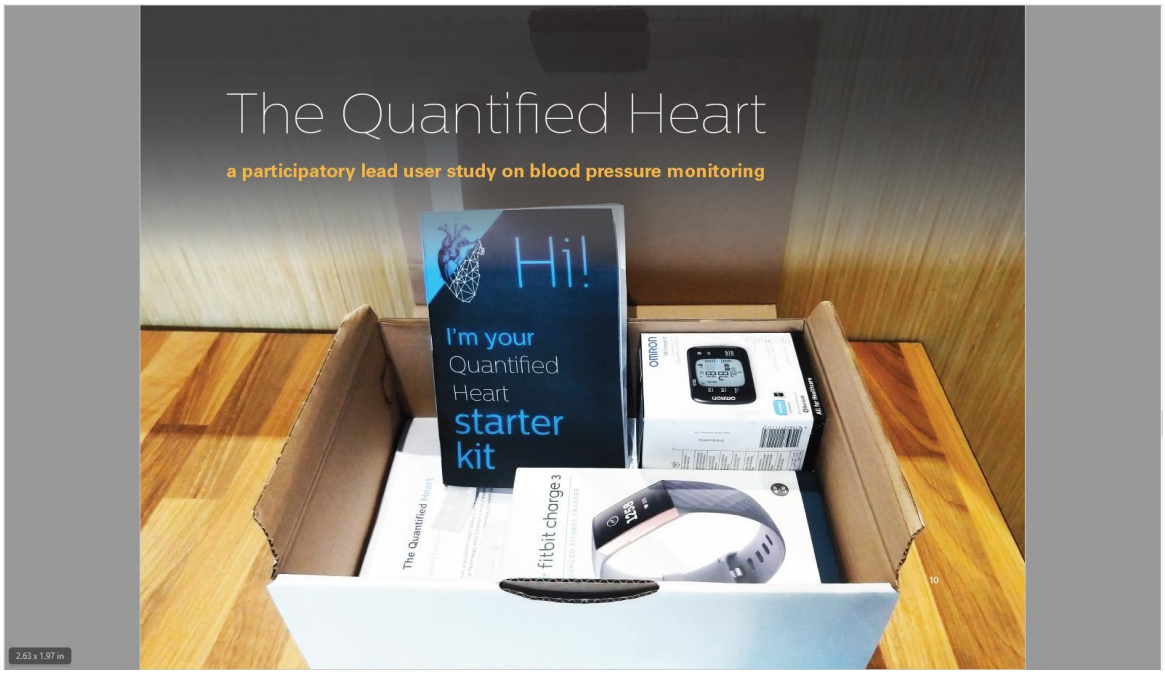
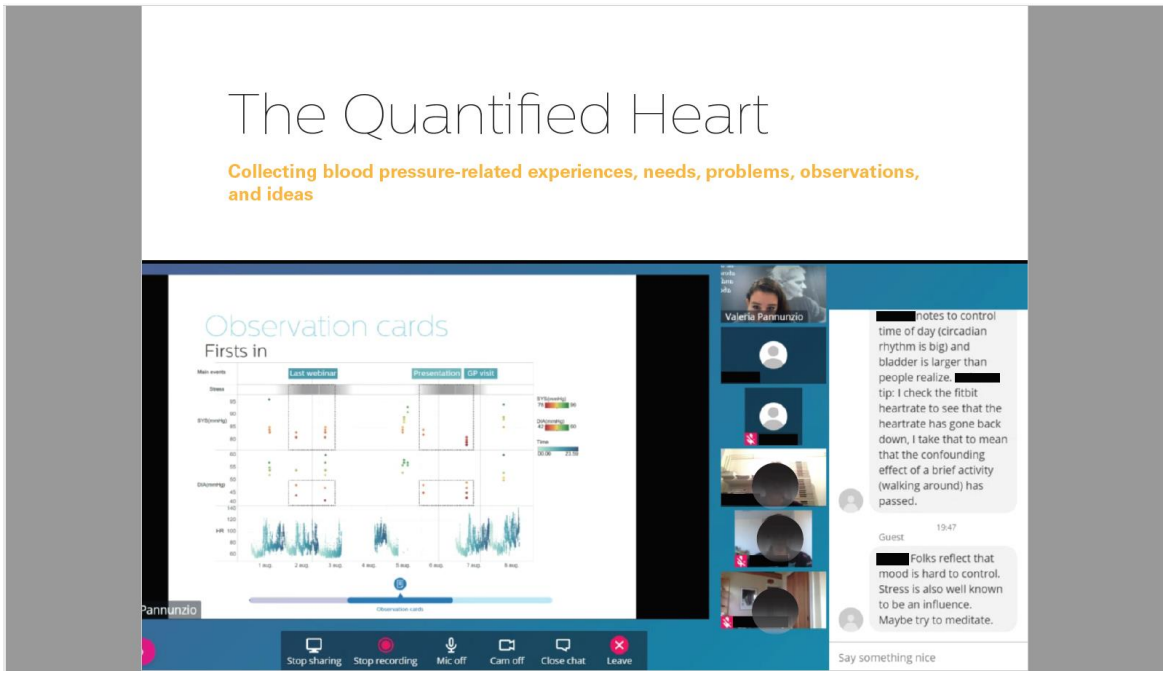
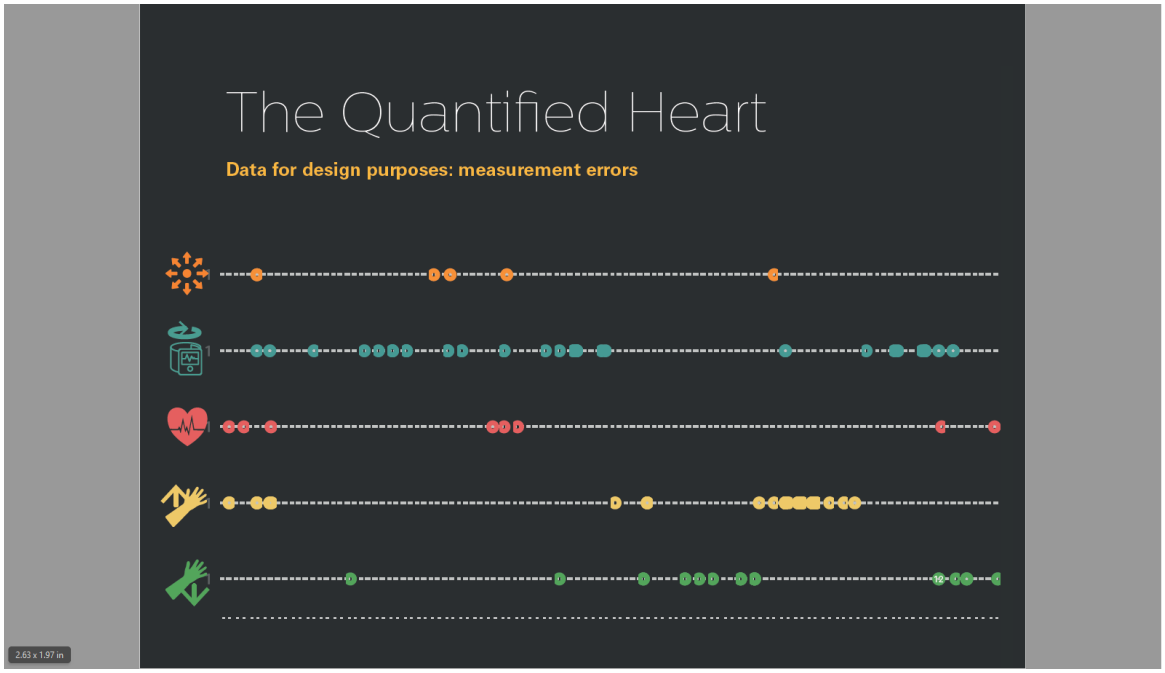
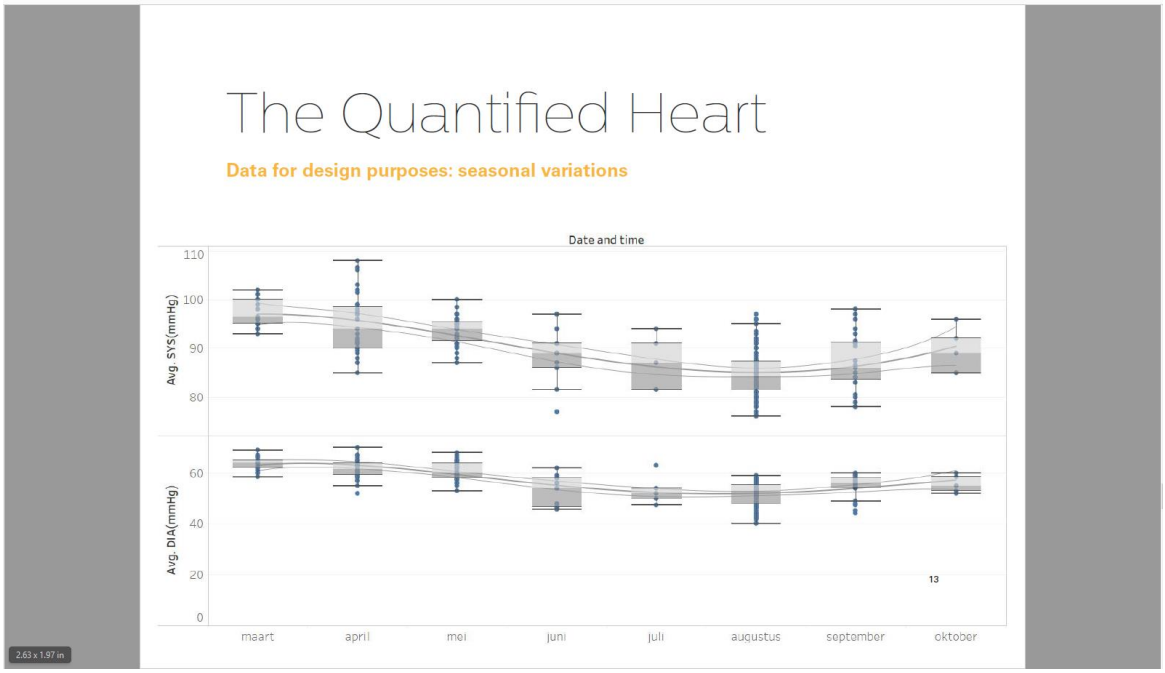

Data-enabled, expanded
Incorporating multidisciplinarity in the data-enabled design process
the everyday life loop
the design research loop
the larger research loop
2.63 x 1.97 in


The Quantified Heart
Designing a smart blood pressure self-monitoring system through (expanded) data-enabled design


The Quantified Heart
a participatory lead user study on blood pressure monitoring
Hi!
I'm your Quantified Heart starter kit
omron
fitbit charge 3
2.63 x 1.97 in


The Quantified Heart
Collecting blood pressure-related experiences, needs, problems, observations, and ideas
Observation cards
Firsts in
Last webinar
Presentation
GP visit
Valeria Pannunzio
notes to control time of day (circadian rhythm is big) and bladder is larger than people realize. tip: I check the fitbit heartrate to see that the heartrate has gone back down, I take that to mean that the confounding effect of a brief activity (walking around) has passed.
19:47
Guest
Folks reflect that mood is hard to control. Stress is also well known to be an influence. Maybe try to meditate.
Say something nice
Stop sharing
Stop recording
Mic off
Cam off
Close chat
Leave


The Quantified Heart
Data for design purposes: measurement errors
2.63 x 1.97 in


The Quantified Heart
Data for design purposes: seasonal variations
Date and time
Avg. SYS(mmHg)
Avg. DIA(mmHg)
110
100
90
80
60
40
20
0
maart
april
mei
juni
juli
augustus
september
oktober
13
2.63 x 1.97 in

How is this useful?

Applying the expanded data-enabled insights

The insights collected through the expanded data-enabled design study appear to be relevant input for:

- designing smart blood pressure monitoring systems (e.g. personalized monitoring coaching based on error patterns)
- fostering 'user-centered clinical research' (e.g. clinical investigation into seasonal blood pressure variations)

14

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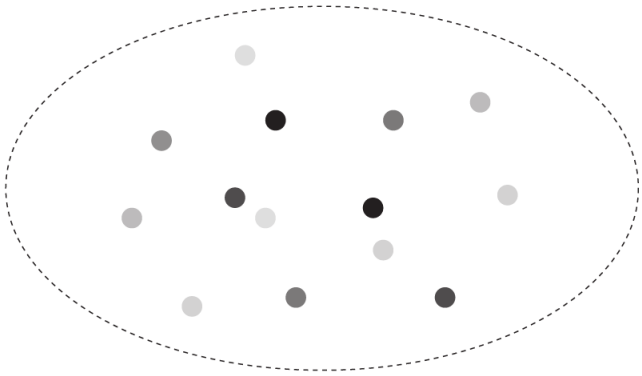
The solution space

Applying the expanded data-enabled insights



15

CardioLab vision

The evidence-based component

Towards a design process which:

- Embeds relevant evidence
- Fosters the collection of new relevant evidence

16

2.63 x 1.97 in

Healthcare system design

The systemic component

Towards a design process which:

- Embeds relevant evidence
- Fosters the collection of new relevant evidence

↓

- Fulfills a systemic role in (digital) health innovation

17

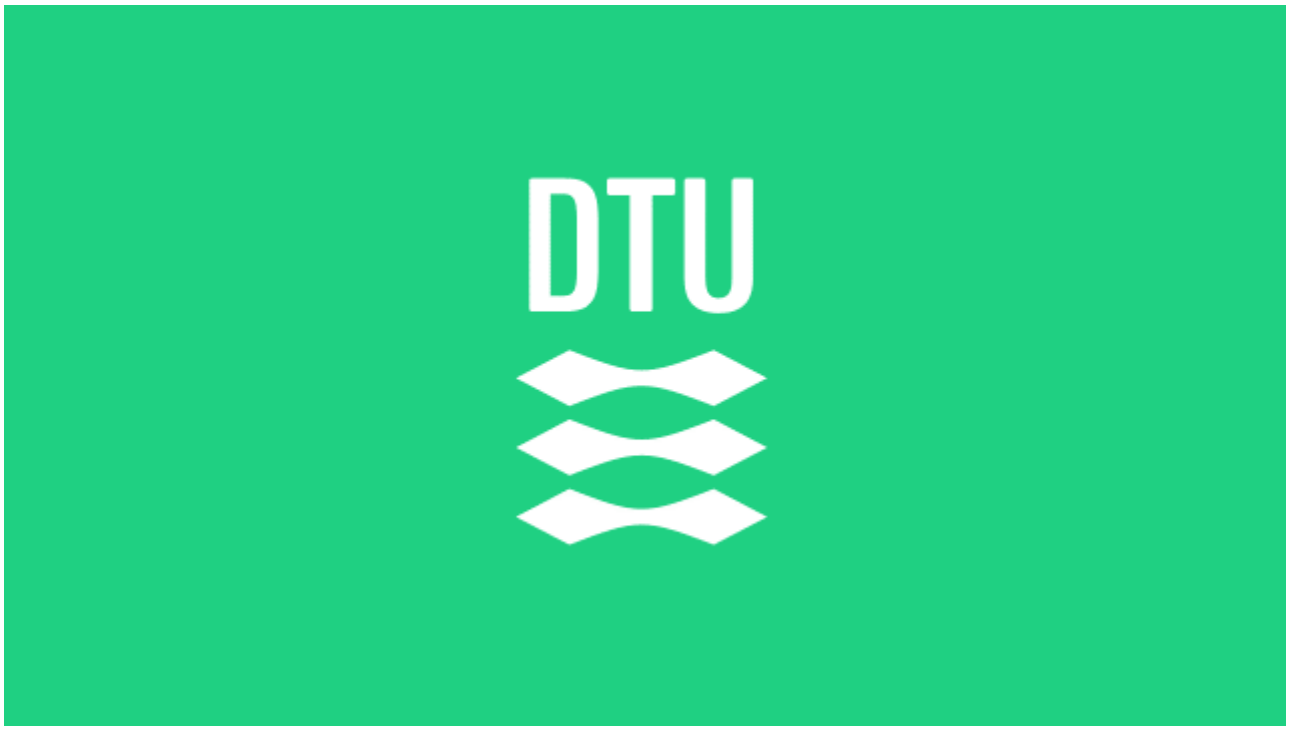
2.63 x 1.97 in

Thank you!

contacts:
v.pannunzio@tudelft.nl
https://delftdesignlabs.org/cardiolab/

3. ***Healthcare systems design: Using technology to realise human behaviour***

Nicholas Ciccone, François Patou and Anja Maier, DTU – Technical University of Denmark, Denmark



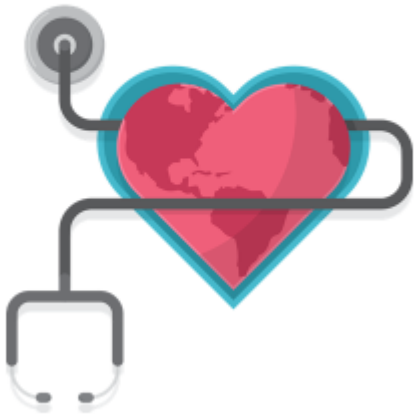
DTU

Content

1. State of current Healthcare
2. Engineering Systems Design framework
3. Promising technology & trends
4. Technology research examples
5. Clinical and technology partners

DTU

Healthcare systems under strain



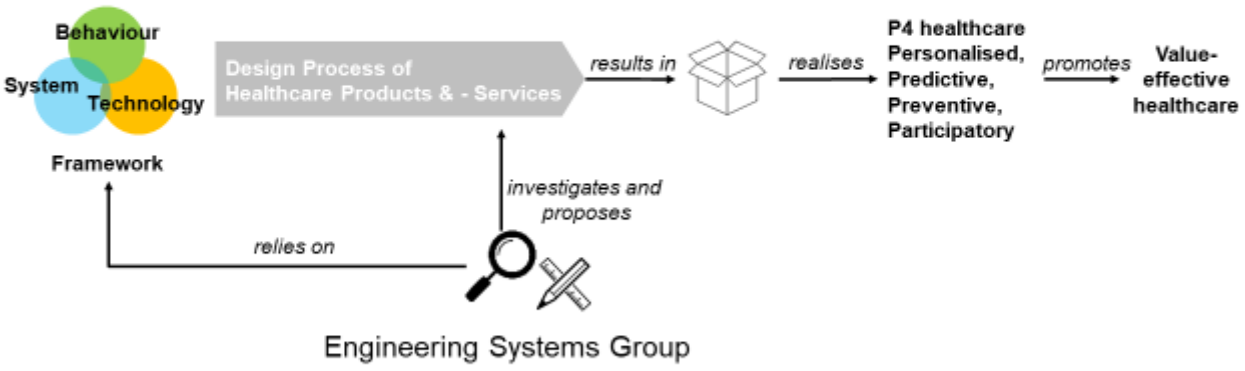
Western world

- **Cancer, heart disease, neurodegenerative disease** are predominant causes of death or reduction in quality of life in adults
- **Chronic disease** accounts for € trillion's in spending.
- **Aging population**: Europeans % aged 65 and over rising from 9.8% in 1960 to 19.8% in 2017.

Age is a risk factor in many morbidities and therefore an ageing population with greater access to healthcare is a higher cost on economies with higher GDP spending being needed to maintain care (WHO European Health Information Gateway, 2018).

DTU

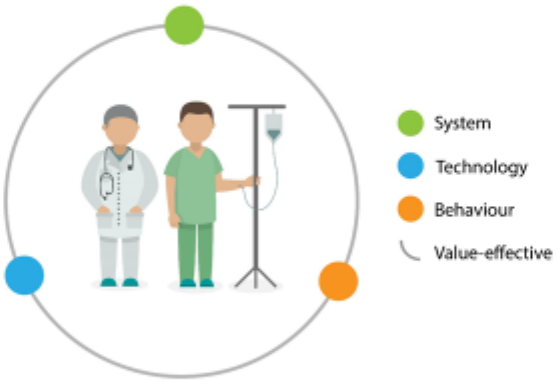
Designing value-effective healthcare solutions



Engineering Systems Group

DTU

A Human Centred Techno-Behavioural approach



Ciccone, N., Patou, F., & Maier, A. (2019).
Designing for better healthcare: A systemic approach utilising behavioural theory, technology and an understanding of healthcare delivery systems. *22nd International Conference on Engineering Design (ICED19)*, Design Society.

DTU

Balancing the Angles

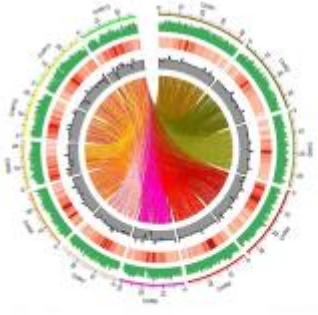
These entry angles need to be considered together for healthcare improvement initiatives.

- The current Healthcare Delivery System
- Technology
- Human Behaviour

To create a value effective solution

DTU

Technological promises for healthcare



Credit: Guobian Li and Rashmi Jain/Berkeley Lab

Credit: Bio-Robotics Institute Pisa / Microsoft

DTU

Technology-development trends in healthcare

- Macro Trends

Decentralisation, personalisation, connectivity, pervasiveness, and stratification (Patou & Maier, 2017).

- P4 Medicine

Predictive, Preventative, Personalised and Participative healthcare and medicine (Hood, Balling & Auffray, 2012).

(Credit: Alphagenomix)

DTU

Pervasive Assistive Technology For People with Dementia: A UCD Case

Thorpe, J., Forchhammer, B. H., & Maier, A. M. (2019). Adapting Mobile and Wearable Technology to Provide Support and Monitoring in Rehabilitation for Dementia: Feasibility Case Series. *JMIR Formative Research*, *3*(4), e12346.

Can smart wearables both support people with dementia and generate data about their behaviour?

- A user-centred approach developing and testing AT based on off-the-shelf pervasive technologies.
- A prototype is tested among end-users and their caregivers. combining a smartphone, smartwatch and various applications to offer six support features.
- Provides a set of recommendations for future technology designs and UCD practices

DTU

Listen Care-Fully: Healthcare Design on Listening Effort and Cognitive Functioning

Is increased listening effort associated with cognitive function?

- Using pupillometry, in the healthy and mildly cognitive impaired to determine listening effort.
- Designing a hearing aid intervention to explore potential improvements.
- Investigate how to integrate this test into current dementia and hearing care management.

From Evidence to Implementation: How Systems Design can Foresee Complex Healthcare Interventions. Feldman, A. Patou, & Maier, A. Design2020 (Submitted).

DTU

Using Gaze Tracking to Enhance Traditional Tests of Visual Field Damage in Stroke Patients.

Can gaze tracking and pupillometry be used to make more accurate diagnosis of visual field damage in stroke patients?

- An exploratory hospital based study using in-patients.
- As part of the standardised pen and paper tasks patients will wear an eye tracker to collect additional data.
- Post-processing will identify any differences between types of visual field damage.
- Next steps are to investigate how this could be used to inform clinicians and improve current work-flow.

DTU

Partnership

The Capital Region of Denmark · SIEMENS medical · oticon MEDICAL · Rigshospitalet · nne Focused pharma engineering · NATIONALT VIDENSCENTER FOR DEMENS · Frederiksberg Hospital · Glostrup Hospital · novo nordisk · Coloplast · CITY OF COPENHAGEN · Bispebjerg Hospital · Ferrosan Medical Devices · cachet · Copenhagen Center for Health Technology · Coloplast · Region Hovedstaden · VihTek Videncenter for velfærdsteknologi · EAR SCIENCE

DTU

Thank you

Engineering Systems Design

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François Patou, PhD
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E-mail frpato@dtu.dk

Professor Anja Maier, PhD, Head of Group
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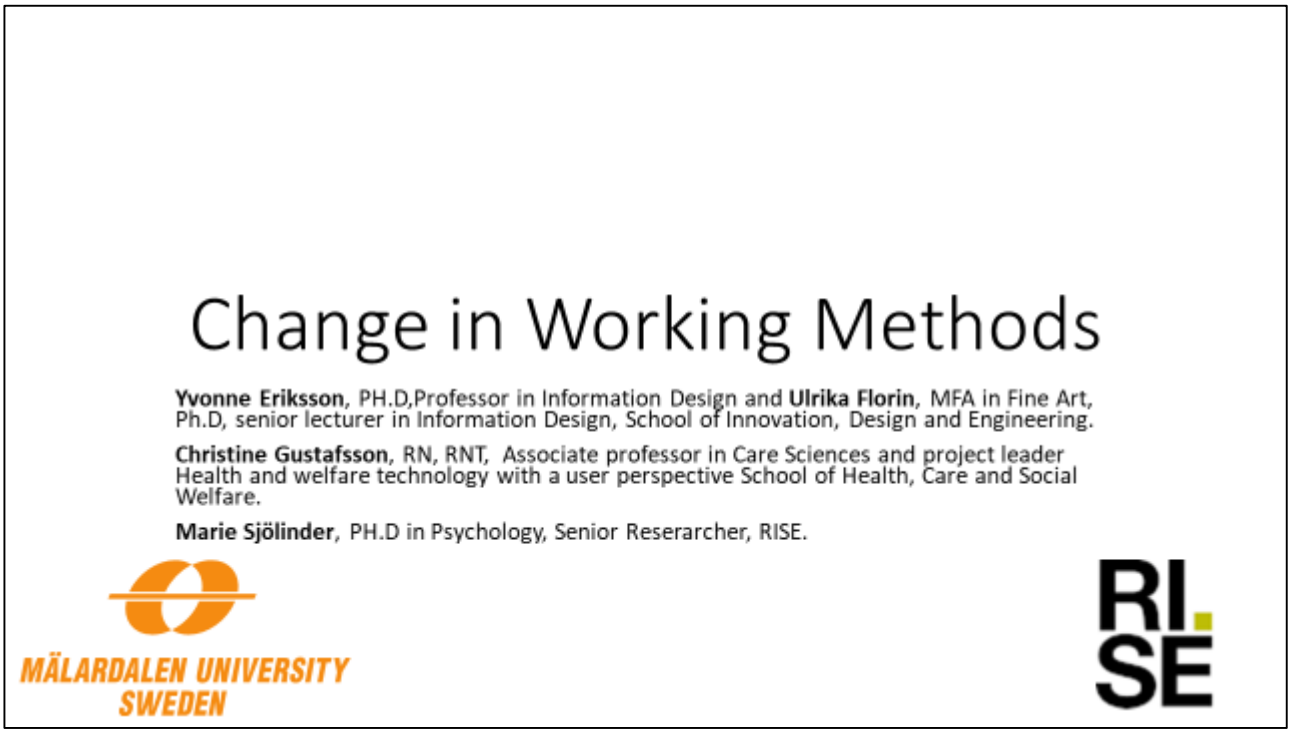
E-mail amai@dtu.dk

4. ***Change in working methods***

Yvonne Eriksson, Ulrika Florin, Christine Gustafsson, Mälardalen University, Sweden and Marie Sjölinder, RISE, Sweden



The shift to welfare technology

- Globally, healthcare and social care are facing a shift in which digitalization and welfare technology already plays an important role, in both healthcare and welfare.
- It includes such as social care and home care solutions to obtain more efficient patient-client focused processes and facilitate prolonged independent life.
- Important is also to include relatives and staff as welfare technology users in this context.

Two examples

- Insights from developing new technology together with the care personnel
- A research project example: HV3D (ongoing)

Involving the care personnel in the design process

- In many situations older adults have difficulties in participating in the design process - cognitive decline and/or physical decline
- Mediators have their own needs and perspectives – not always in line with the older adult's perspective
- Relationship between the older adult and the mediator is important
- The closer the relationship is - suggestions more in line with the older adult´s view
- Understanding of previous history and relationship to technology

Insights from developing new technology together with the care personnel

- Communication device that were not used – too small social networks
- Assumptions about older people's technology experience could be misleading
- Personas together with the personnel – starts to realize that the older adults have experience from using technology
- From technology experience to addressing needs - moved the devices into the dining areas
- When personnel become engaged they start to think about how the technology could be beneficial – they contribute in taking control over the technology and suggest new ways of usage

Insights from developing new technology together with the care personnel

- Positive effects of personnel and elderly sharing the experience of trying new technology
- Common understanding of possibilities and limitations
- Feedback on the usage from different perspectives
- The care professionals could see problems and suggest solutions - a deeper understanding of the usage

A research Project example: HV3D

Assistive technology and welfare technology in 3 dimensions

- The overarching aim of the project is to work out a model/structure for decision support for health and welfare organizations when planning to implement new assistive technology and welfare technology.

A research project example: HV3D

Simply HV3D will answer the following three questions:

1. What are the values of assistive technology and welfare technology for the users (patients/clients, relatives and staffs and health and care providers) ?

In terms of:

- safety
- security
- activity
- independence,
- function
- participation
- quality of life
- well-being

2. What is the cost of implementing new tools and welfare technology in health care and how these can be calculated? (including decision support models)

3. How should organizations structures be constructed for the best results in the introduction/implementation of new assistive technology and welfare technology?

Interdisciplinary research team: including care sciences, physiotherapy, sociology and organisational/business/economy.

Conclusion

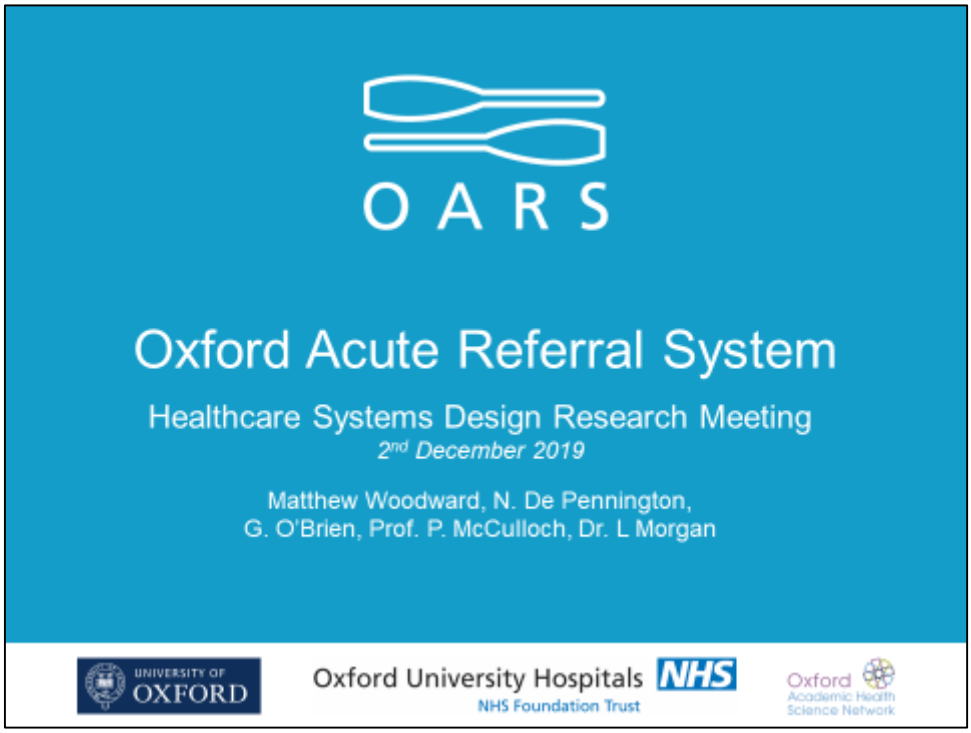
- This two examples shows the necessity to work with multi perspectives.
- To understand that it is a complex system
- To listen to **all** voices
- The ultimate value is to provide good healthcare and wellbeing

Thank you!

- **Yvonne Eriksson**, PH.D,Professor in Information Design and **Ulrika Florin**, Ma in Fine Art, Ph.D, senior lecturer in Information Design, School of Innovation, Design and Engineering.
- **Christine Gustafsson**, RN, RNT, Associate professor in Care Sciences and project leader Health and welfare technology with a user perspectiveSchool of Health, Care and Social Welfare.
- **Marie Sjölinder**, PH.D in Psychology, RISE.

5. ***Development of a regional electronic referral system with user-centred design***

Matthew Woodward, Nick de Pennington, Georgina O-Brien, Peter McCulloch and Lauren Morgan, University of Oxford, UK



FULL SLIDE SET CANNOT BE SHAIRED

6. ***Over design of building services as a financial drain for hospitals***
Claudia Eckert, The Open University, UK

Overdesign of building services as a financial drain on hospitals

The Open University

Prof Claudia Eckert, The Open University
Dr Pam Garthwaite, The Open University
Dr Martin Stacey, De Montfort University
Darren Jones, The Open University and Low Carbon Europe

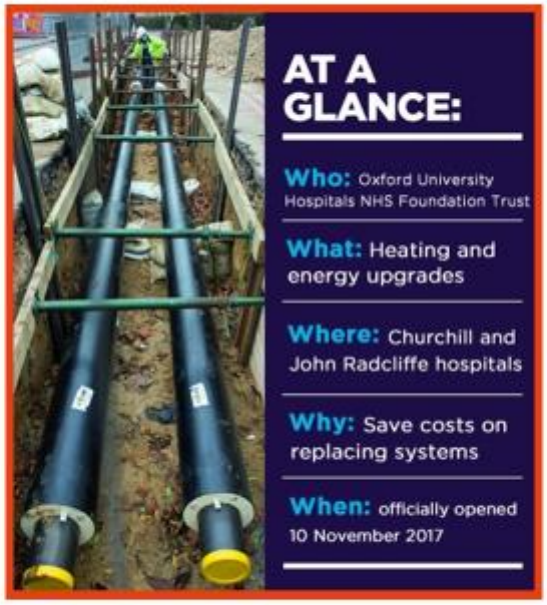
This project was funded by the Centre for Digital Built Britain

Cash strapped NHS hospitals have oversized building service systems

Oxford John Radcliff – Case Study

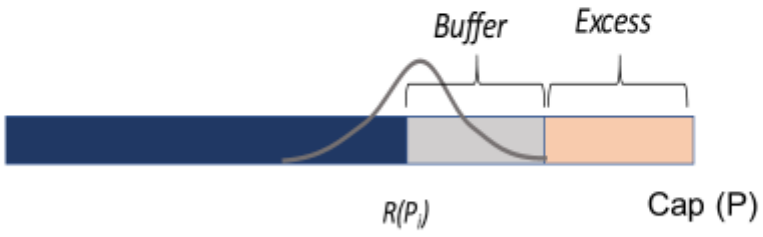
This wastes money and is not sustainable

What is going on here?



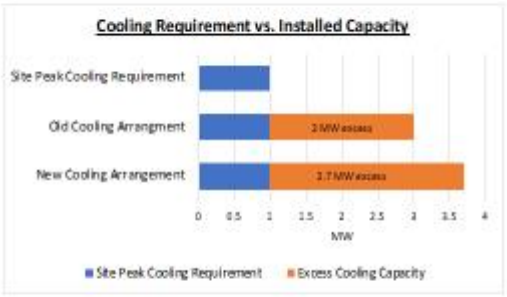
Our lens: Margins

- Margin = capability – requirement
- Margin = buffer + excess



Eckert, C., Isaksson, O., & Earl, C. (2019).
Design margins: a hidden issue in industry. *Design Science*, 5.

The capacity of the building service systems exceed the actual maximal need by hundreds of percent

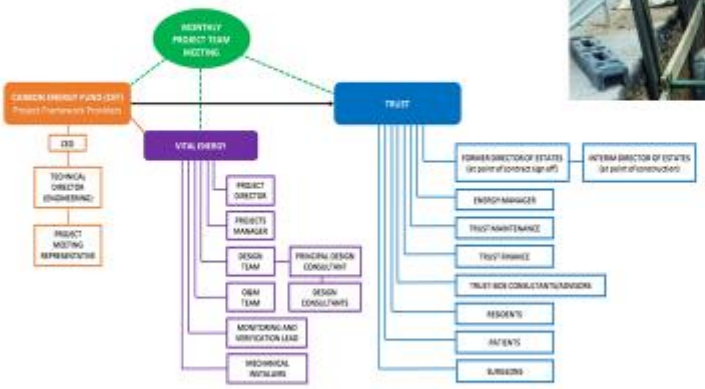


Cooling Systems – Over Capacity
1 MW site peak requirement
Old arrangement – **3 MW** total capacity
New arrangement – **3.7 MW** total capacity
New arrangement provides an **£8k** energy saving p.a. for a capital expenditure of **£2.6m**

Heating Systems – Standing Losses
Input thermal capacity = 4,323 x 2 = 8,646kW
Estimated output capacity (input less 20%) = 6,917kW
Standing losses at 3% of boiler output capacity = 208kW
Annual losses = 208kW x 8,760Hrs = **1,822,080kWh**
Cost of annual losses (based on gas cost of 3p/kWh) = **£54,600**

Higher capital cost, higher running cost, oversized sub systems

We carried out a case study to piece together the decisions that led to the system being oversized

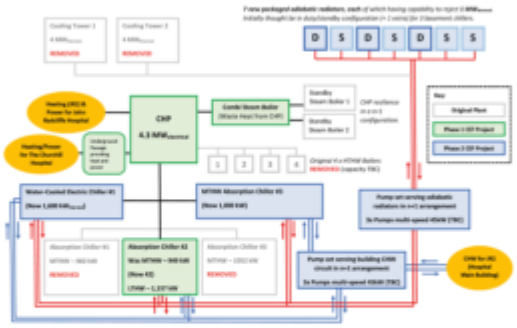


The system makes huge savings but is also hugely oversized

Reasons for overdesign

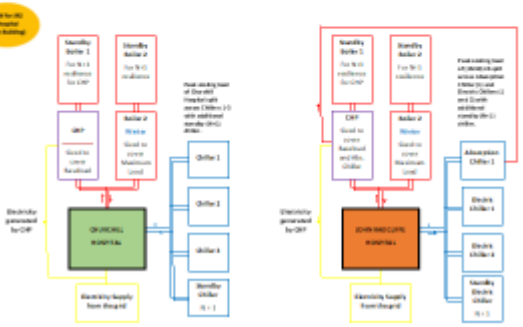
- The old system was unreliable
- Hospitals need to be resilient
- The opportunity to invest existed
- The hospital might grow and expand
- The most interesting design tendered links two sites

Overdesign can be reduced through modular design



Actual integrated system

Alternative designs



Language of saving hides waste

- Energy saving targets are compared to usage of often old inefficient systems
- Missing data: no clear base line no clear predictions
- Requirements can go up, but also can go down
- Systems need to be optimised for required use

Chillers

CHP

Boilers

Implication for Patient care

- The capital expenditure budgets for medical care and building services are linked
- The increase running costs takes money away from other patient facing services
- Since the systems have margins, the hospitals don't think about "natural" ways of heating and cooling hospitals
- Hospital are too hot

Next steps

Put in grand application

- Model and track the margins
- Gain data of actual and predictable margins
- Improve the NHS decision making process

LCE

UNIVERSITY OF CAMBRIDGE

CEF · Dartford and Gravesham NHS Trust · Homerton University Hospital NHS Foundation Trust · London North West University Healthcare NHS Trust · VITAL ENERGI · CIBSE · NHS Improvement · North West Anglia NHS Foundation Trust · Oxford University Hospitals NHS Foundation Trust

cdbb Centre for Digital Built Britain

LCE

The Open University

Overdesign of building services as financial drain on hosptials

Prof Claudia Eckert, The Open University
Dr Pam Garthwaite, The Open University
Dr Martin Stacey, De Montfort University
Darren Jones, The Open University and Low Carbon Europe

This project is funded by the Centre for Digital Built Britain

Immediate
(Integrated **M**anagement of **M**argins through
Evaluation, **Des**Ign, **A**nalysis, **T**racking and n**E**gotiation)

The Open University

Please get in touch with any questions

Prof Claudia Eckert - claudia.eckert@open.ac.uk
Darren Jones - darren.jones@lowco2.eu

cdbb
Centre for Digital Built Britain

Day 2: Planning delivery

Objectives:

1. Finalising book structure and planning for delivery
2. Further opportunity to get to know each other through research presentations

Book session II
Lead: Professor Anja Maier, DTU - Technical University of Denmark, Denmark

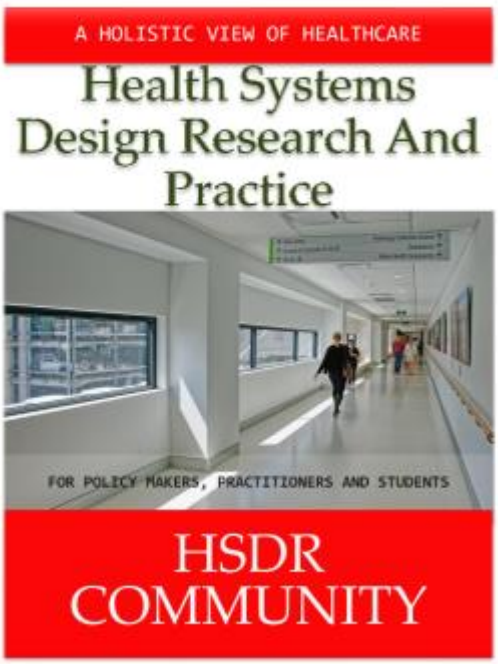
3rd International Meeting on Healthcare Systems Design Research,
Hughes Hall, University of Cambridge, United Kingdom.
December, 2-3 2019.

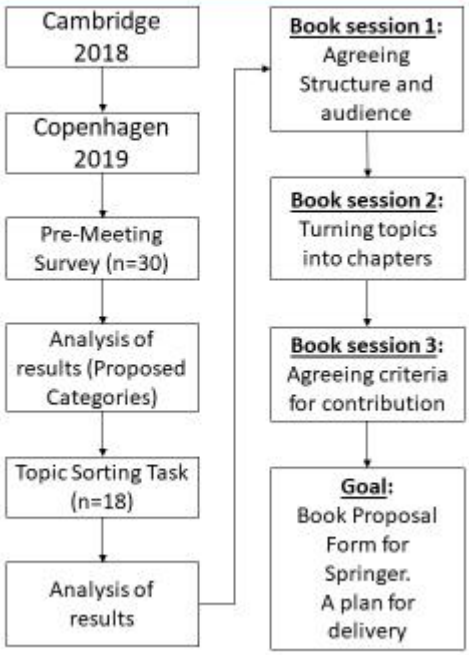
Book session 2: Turning topics into chapters

Anja Maier

UNIVERSITY OF CAMBRIDGE
Engineering Design Centre

Overview of Book Project





Agreements on proposed categories: Updated

1. Introduction: International perspectives on health systems, issues and trends

- Current issues in healthcare (16)
- International comparisons of healthcare systems (14)
- Trends in healthcare (demographic, technological, clinical) (16)
- Ethical challenges (80%, n=5)

2. Engagement

- Co-production (as defined and inspired by Elinor Ostrom) (11)
- Collaboration (13)
- Engaging with healthcare professionals and stakeholders (17)
- Patients and public involvement in healthcare systems design research (16)
- Tools for developing understanding and engagement across knowledge horizons (9)
- How to release time for clinicians to do QI (100%, n=5)
- Action research (50%, n=6

3. Systems

- Complexity (theory, complex systems, complexity management) (11)
- How to manage "Systems of Systems" design (12)
- How to perform system disaggregation/integration in healthcare (10)
- Service ecosystems (13)
- Systems approach to healthcare improvement (9)
- Systems engineering (16)
- Systems perspectives/thinking/theory (15)
- Systems thinking (16)
- Healthcare systems modelling – from mapping to simulations (58%, n=6)
- Architecting healthcare delivery systems (67%, n=6)
- Network/graphs (80%, n=5)

4. Improvement Methods

- Comparison of different QI methodologies (14)
- Improvement science (14)
- Management of design requirements in the context of improvement (9)
- Operational Research (9)
- Optimisation (10)
- Simulation (including systems dynamics, discrete event and agent-based simulation) (9)
- The hard/soft divide (60%, n=5)
- Decision support (75%, n=4)
- Interventions (60%, n=5)

5. Design

- Business model design (9)
- Design dialogue as method using artefacts to support dialogue (visual and tangible) (11)
- Design thinking (14)
- Human-centred design (15)
- Organisational design (12)
- Prototyping (10)
- Research methods for researching design in healthcare (9)
- Transition design (12)
- User-centred design (14)
- Welfare system design (11)
- Service approach to healthcare (60%, n=5)
- Healthcare infrastructure (including hospital building) (60%, n=5)

6. Case Studies

- Examples of design impact taken from other fields (12)
- Examples of using design in healthcare (good and bad examples) (14)

7. Measures

- Data (including data-driven design) (11)
- Health economics (9)
- Performance (14)
- Value (definition, modelling, value-driven healthcare) (9)
- Evidencing the impact of a systems approach (100%, n=6)
- Evaluation and evidence-based medicine/management/policy (60%, n=5)

8. Risk Management

- Managing risk proactively (17)
- Uncertainty (10)

Requirements from springer

1. Completed book proposal form
2. Draft table of content
3. List of possible reviewers
4. Exact choice of subject is up to us but Springer will conduct their own peer review on submission
5. We may propose submission date but Springer production times are 4-5 months from editorial approval
6. A book generally takes 1 – 1.5 years from their experience.
7. But they are keen:

"*Springer's existing production and systems engineering book lists have already begun to explore some topics related to your proposed book. As you know the importance of healthcare and the increasing complexity of providing advanced treatments and care programmes to patients efficiently draws on many of the results of research into systems design and systems engineering.*"

Anthony Doyle, Executive Editor, Engineering, Springer Publishers

Plan for session

1. Introduction to session (5min)

2. Each table works on a category (part of book) – Tables should be based on expertise for meaningful contribution. Participants decide which table to join.

   a) Table 1 - Introduction - International perspectives on health systems, issues and trends
   b) Table 2 - Engagement
   c) Table 3 - Systems
   d) Table 4 - Design
   e) Table 5 - Risk management/Measures
   f) Table 6 - Case studies/Improvement methods

3. Task (20min)

   a) Review the concepts or topics
   b) Identify possible missing topics
   c) Propose a list of chapters with the associated topics on a flipchart
   d) If possible, suggest a format for your chapters

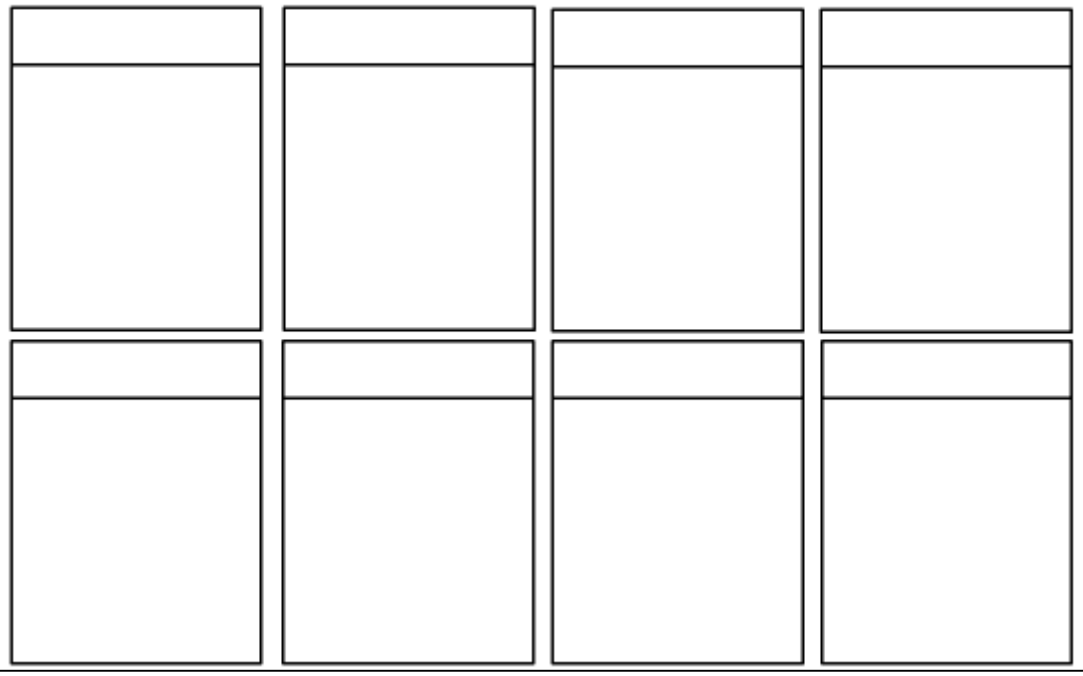
4. Each group presents its results and receives feedback from the room (45min)
   a) 3 min reporting plus 3 min questions and feedback per group

5. Group reconvenes to integrate feedback and improve the proposed chapter list (20min)

Chapters: Blank categories for group work

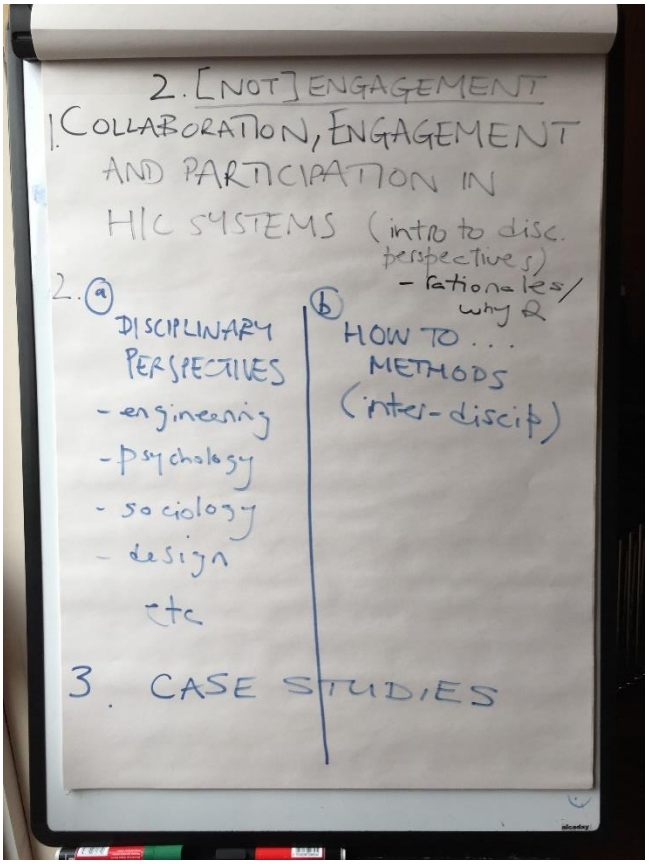
1. Introduction: International perspectives on health systems, issues and trends	2. Engagement	3. Systems	4. Improvement Methods
5. Design	**6. Case Studies**	**7. Measures**	**8. Risk Management**

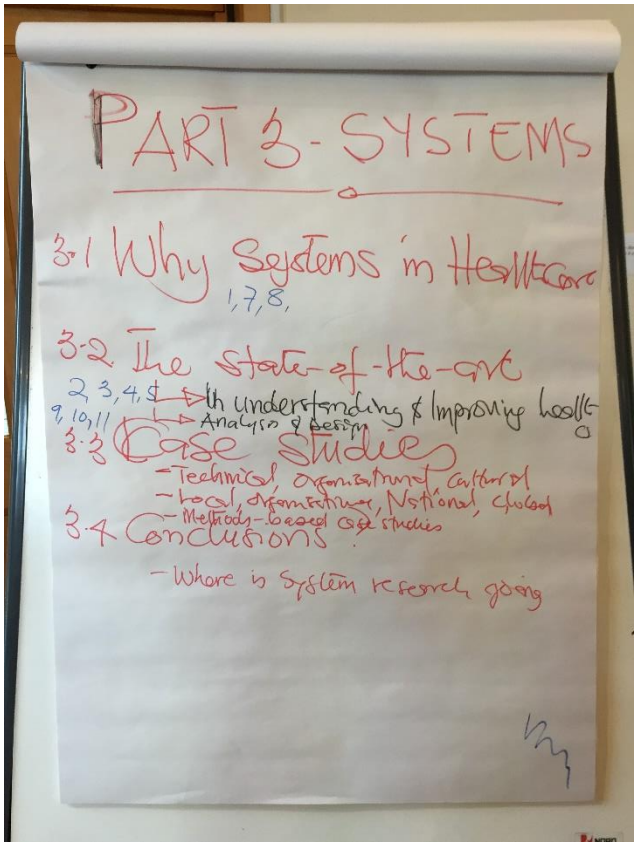
Chapters: New categories if needed

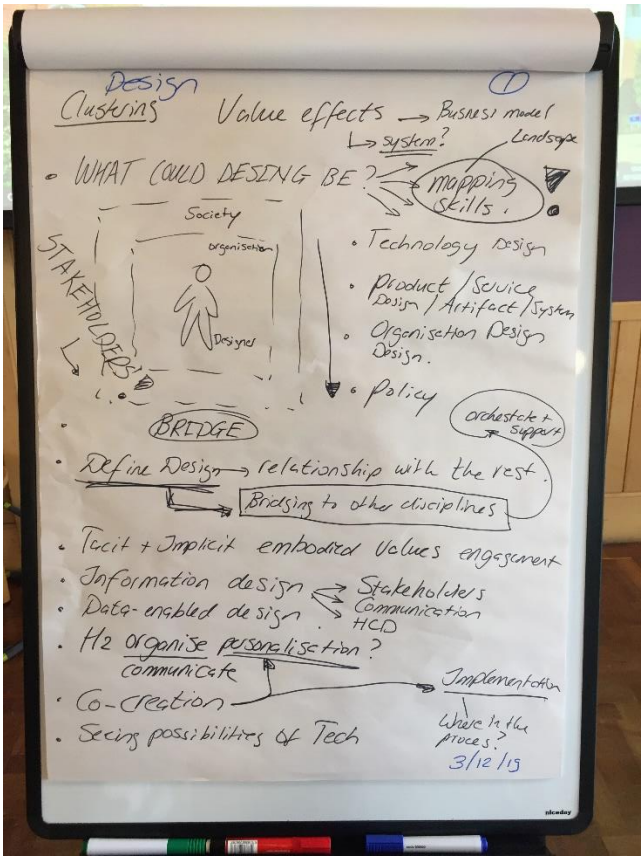


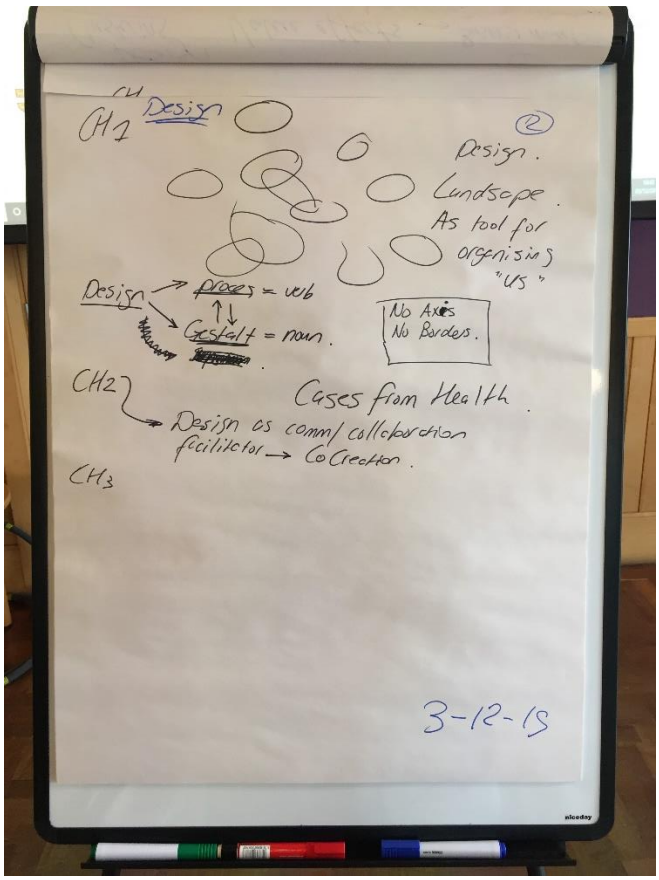
Any questions or comments?

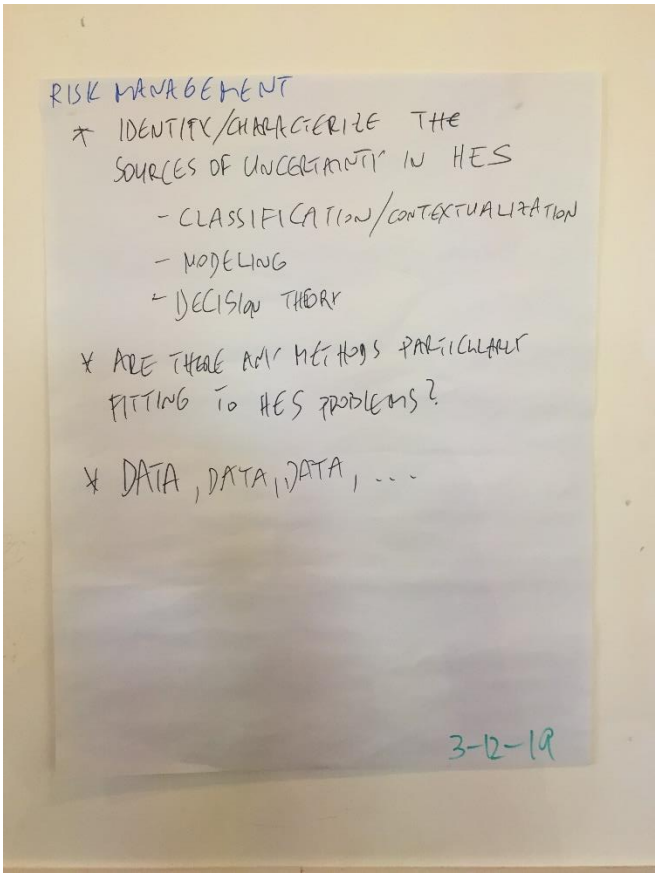
OUTPUTS FROM BOOK SESSION 2: TURNING TOPICS INTO CHAPTERS

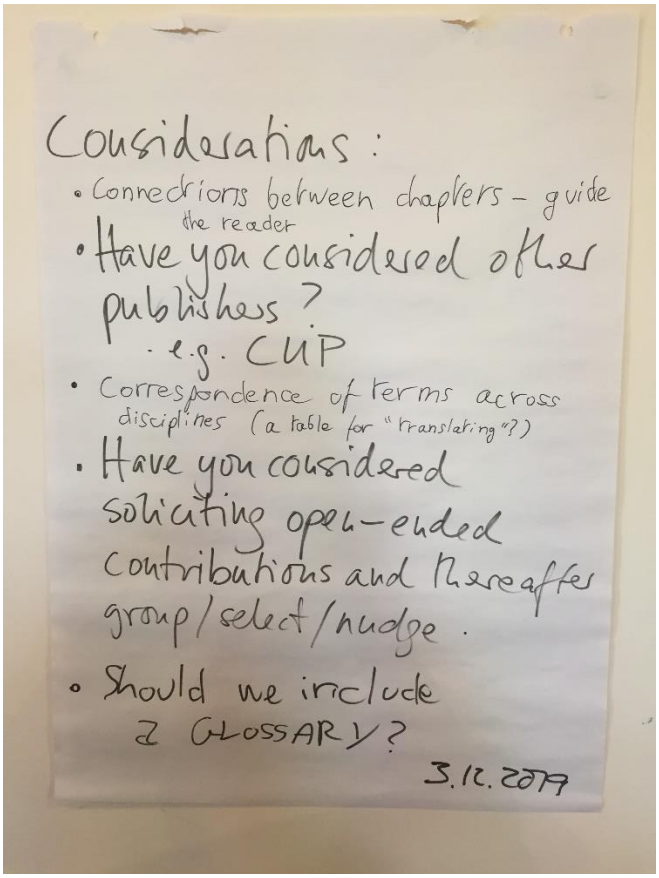


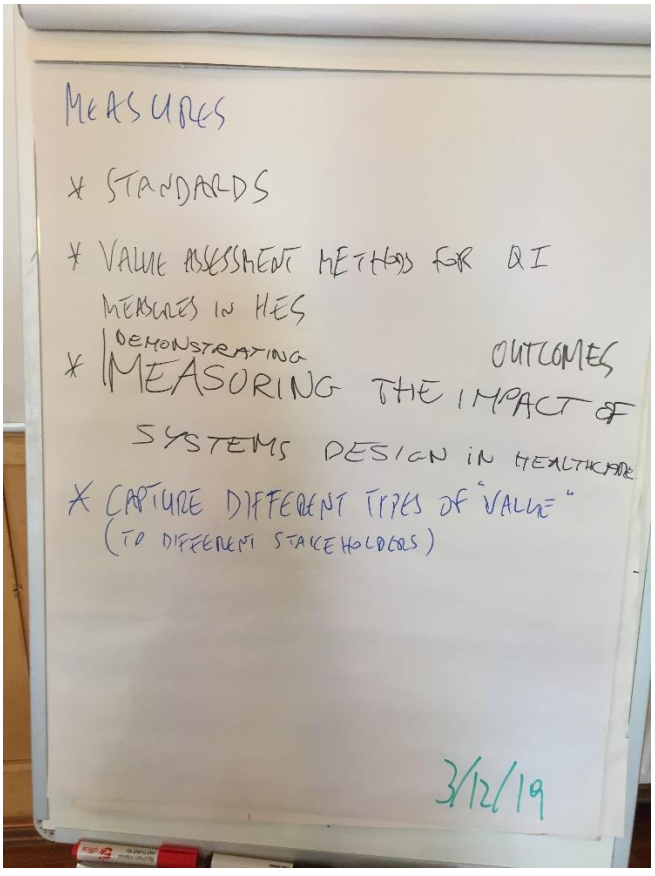


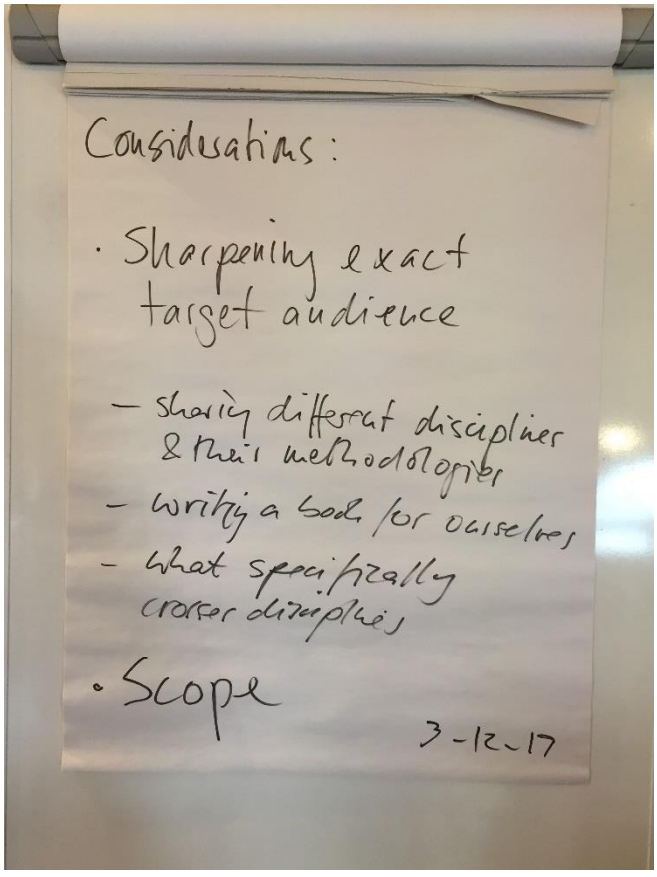


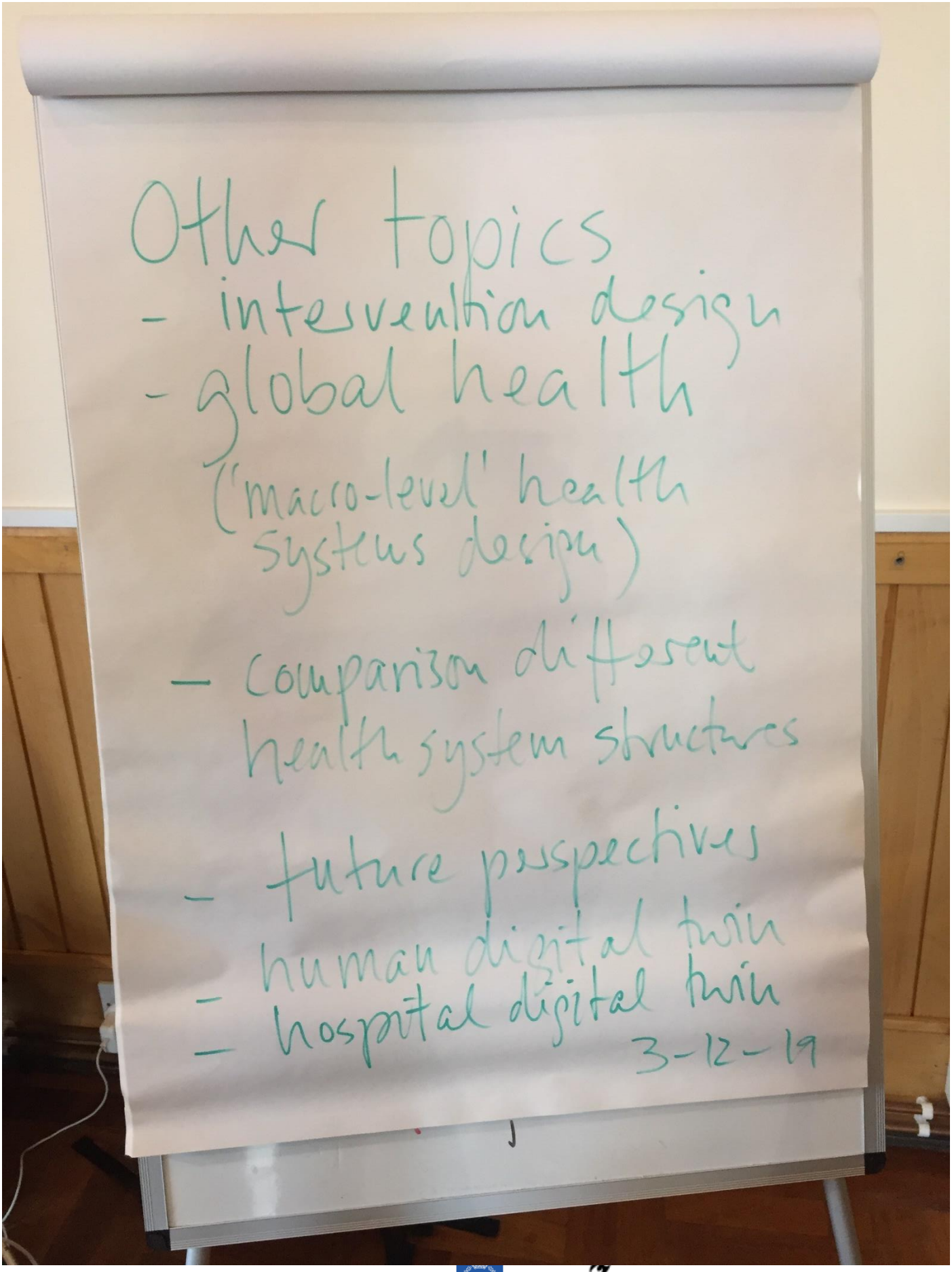



RISK MANAGEMENT
* IDENTIFY/CHARACTERIZE THE SOURCES OF UNCERTAINTY IN HES
- CLASSIFICATION/CONTEXTUALIZATION
- MODELING
- DECISION THEORY
* ARE THERE ANY METHODS PARTICULARLY FITTING TO HES PROBLEMS?
* DATA, DATA, DATA, ...
3-12-19


Considerations:
• Connections between chapters – guide the reader
• Have you considered other publishers? e.g. CUP
• Correspondence of terms across disciplines (a table for "translating"?)
• Have you considered soliciting open-ended contributions and thereafter group/select/nudge.
• Should we include a GLOSSARY?
3.12.2019


MEASURES
* STANDARDS
* VALUE ASSESSMENT METHODS FOR QI MEASURES IN HES
* DEMONSTRATING MEASURING OUTCOMES THE IMPACT OF SYSTEMS DESIGN IN HEALTHCARE
* CAPTURE DIFFERENT TYPES OF "VALUE" (TO DIFFERENT STAKEHOLDERS)
3/12/19


Considerations:
• Sharpening exact target audience
– sharing different disciplines & their methodologies
– writing a book for ourselves
– what specifically cross disciplines
• Scope
3-12-17


Other topics
- intervention design
- global health
('macro-level' health
systems design)
- comparison different
health system structures
- future perspectives
- human digital twin
- hospital digital twin
3-12-19

NOTES TAKEN DURING BOOK SESSION2

Risk and Measures sections

Are we designing a book for other designers or for policy-makers? This affects the vocabulary and the way we approach topics.

A chapter on defining and evaluating value can bring together these different perspectives (designers, policy-makers, clinicians, etc.)

Have sections that give the essential first for readers who want a general idea, and then give pointers to readers "if you want to learn more about X, go to chapter Y".

Design section

First chapter: the landscape of design

- Various ways of approaching health through design
- Take the example of the co-design landscape figure (Elizabeth B.-N. Sanders & Pieter Jan Stappers (2008) Co-creation and the new landscapes of design, Co-Design, 4:1, 5-18, DOI: 10.1080/15710880701875068)
- Show the breadth of design streams and what each can bring to health and healthcare
- Design as process and gestalt
- Design as communication and facilitation
- Careful to manage the overlap with other recent books

Engagement section

- Do NOT call it "engagement"
- Two different options:
    - What different disciplines (sociology, engineering, industrial design, OR…) can bring to design and engagement, what exists in each discipline and how people do it
        - Interesting because we ourselves do not know what others in our own HSDR group do
        - Precious for clinicians and junior researchers who want to enter the field and do not know where to start
    - What crosses discipline, what's common to all: the rationales, the purpose of using these methods
        - Policy-makers do not want to hear about disciplines
    - The choice depends on the audience we want to target
- Could we have a case-based structure, driven by case studies, challenges, examples?
- Do we need to talk about disciplines, or can we show the diversity by illustrating with examples?
- Importance of case studies throughout the book rather than as a separate section

Systems

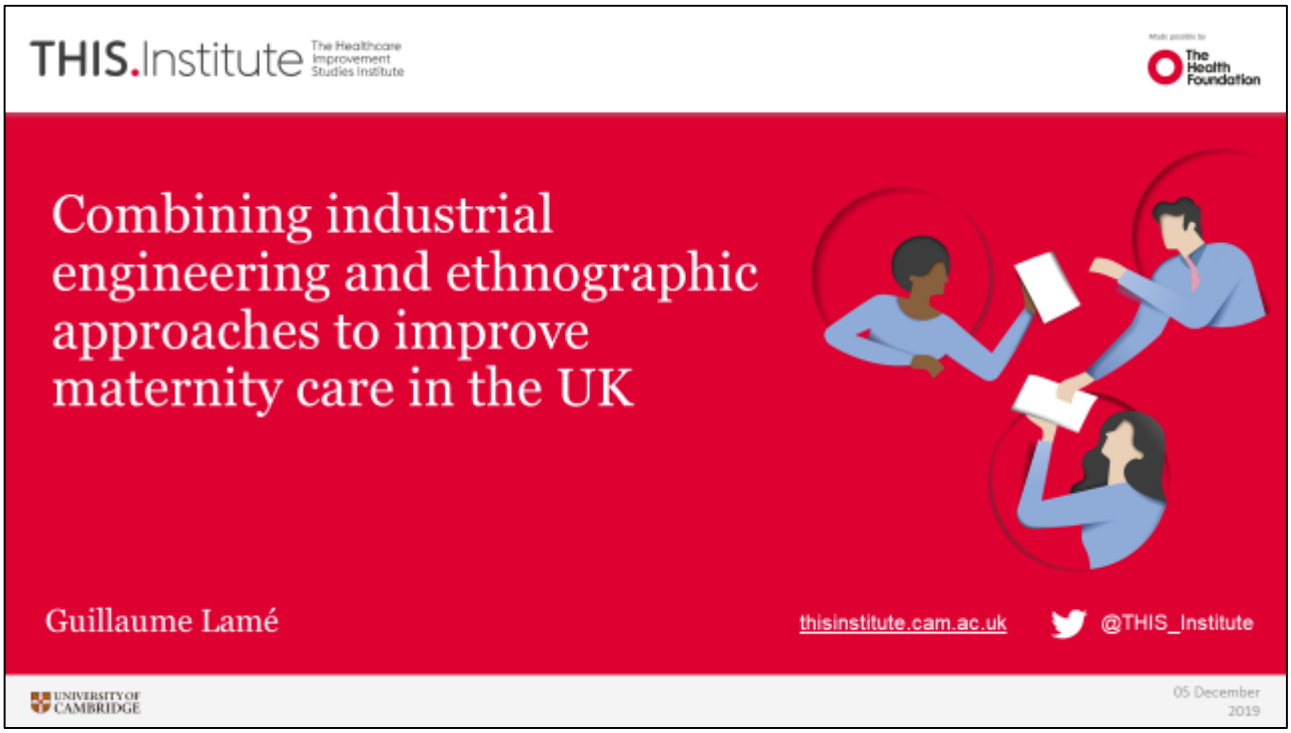
- Pointers to other books throughout the chapter
    - Especially useful in an e-book/online version
- Mention system levels
- Have a chapter with conclusions and perspectives for further developments
- State-of-the art for us, as a community, but also "how to" and methods
- Discussion of sections shows recurring structure:
    - State of the art and theory
    - "How to" and case studies
    - Conclusion and perspectives

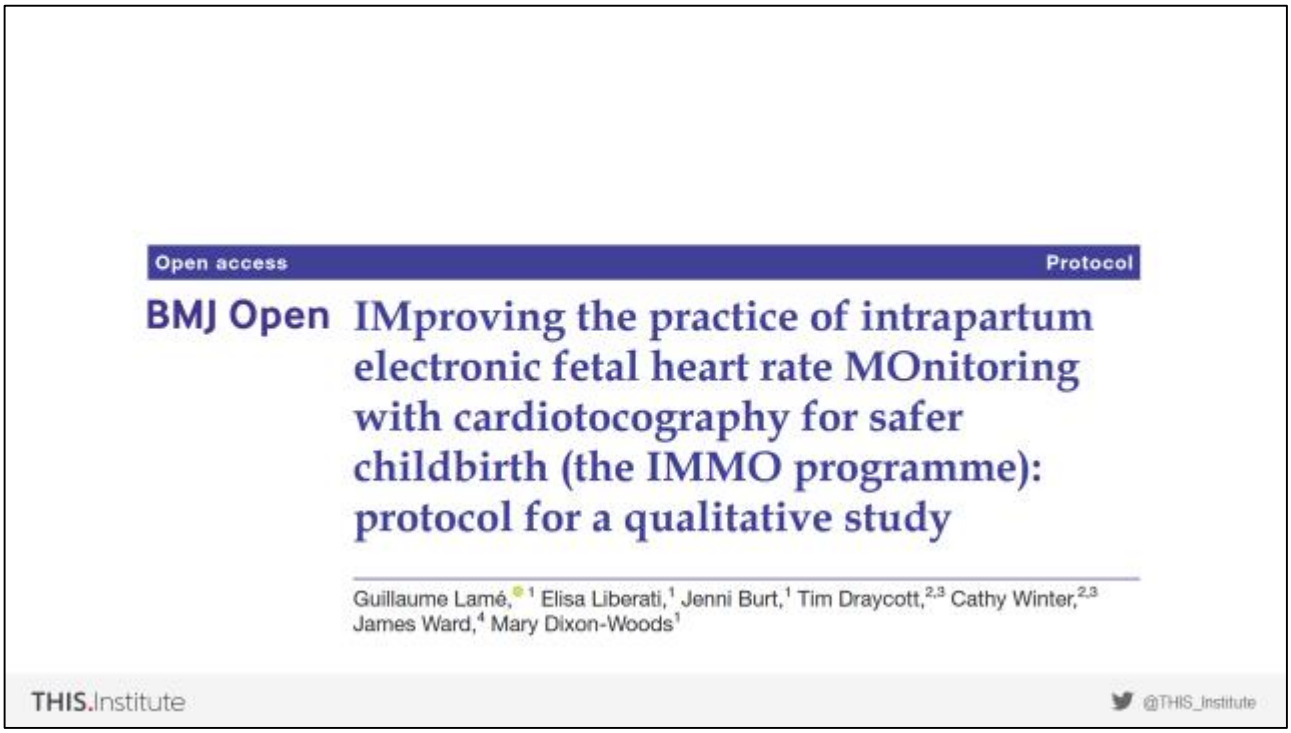
Other considerations

- Something around specific health domains? Primary care, kidney care, home care…?
- How much can we stuff into this book?
- Danger of producing something for us and stuffing everything we want in it, without bringing much value to our audience

Presentations session II
Chair: Professor Maaike Kleinsmann, Technology University of Delft, The Netherlands

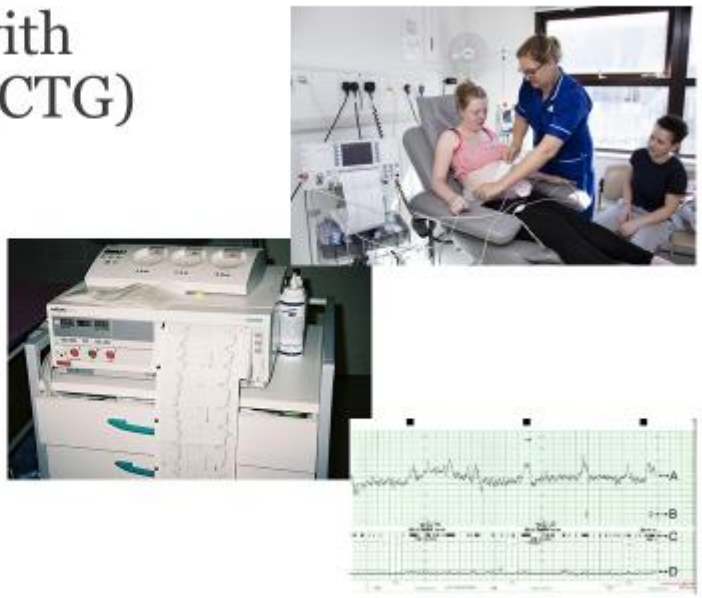
1. ***Combining industrial engineering and ethnographic approaches to improve maternity care in the UK***
   Guillaume Lame, CentraleSupelec, France





Fetal monitoring with cardiotocography (CTG)

- Screening tool for fetal wellbeing
- Used during labour for high-risk pregnancies
- Trace analysed based on its features
- Trace classified as "normal", "suspicious", "pathological" or "need for urgent intervention" (NICE 2014)



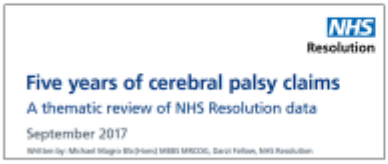
A long-standing issue


Obstetric accidents: a review of 64 cases

M Ennis, C A Vincent BMJ VOLUME 300 26 MAY 1990


NHS Litigation Authority

Ten Years of Maternity Claims
An Analysis of NHS Litigation Authority Data


NHS Resolution

Five years of cerebral palsy claims
A thematic review of NHS Resolution data
September 2017

1982-6: 14 of 34 abnormal traces not identified by junior doctors.

2000-10: 6% of maternity claims linked to CTG, but 15% of claims value.

148/170 CTG claims attributed to misinterpretation of a CTG.

2012-16: 29 cerebral palsy claims out of 50 (64%) linked to CTG

Solutions so far

Computerised interpretation of fetal heart rate during labour (INFANT): a randomised controlled trial

The INFANT Collaborative Group*

Interpretation Use of computerised interpretation of cardiotocographs in women who have continuous electronic fetal monitoring in labour does not improve clinical outcomes for mothers or babies.

Mandatory yearly training, but no agreement on methods and weak evidence on impact

Computer-assisted CTG interpretation has no demonstrable impact

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How the topic has been researched

- A lot of studies based on litigation claims and/or incident reviews
  - « What you look for is what you find » (Lundberg et al 2009)
- Very little published information on everyday practice
  - Work-as-imagined versus work-as-done

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Objective and methods

Mixed methods

Develop an intervention to improve the safety of fetal heart rate monitoring,

… advancing current **knowledge of the types of errors, hazards and failure modes**.

Cross-disciplinary team

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The team

- Social scientists
- Obstetrician
- Midwife
- Evidence synthesis specialist
- Medical librarian
- Engineers
- Human factors/ergonomics specialist

Patiloika, CC-BY 2.0, https://flickr.com/photos/25569106@N00/3684998951

- … and support from research coordinator, communication team, patient and public involvement lead

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Methods

- Two systematic literature reviews
  - Impact of fetal monitoring training
  - Factors affecting patient safety in the fetal monitoring process in routine practice
- Ethnographic observations in three maternity units
  - Seven days by engineer, seven days by social scientist in each site
  - Twelve interviews per site
- Risk analysis workshops
  - To design a framework of risk, hazards and failure modes in the fetal monitoring process
- Online consultation on the framework
- Design of an intervention to improve fetal monitoring

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Methods

- Two systematic literature reviews
  - Impact of fetal monitoring training — Writing the paper
  - Factors affecting patient safety in the fetal monitoring process in routine practice — Screening abstracts
- Ethnographic observations in three maternity units
  - Seven days by engineer, seven days by social scientist in each site — Collecting data
  - Twelve interviews per site
- Risk analysis workshops
  - To design a framework of risk, hazards and failure modes in the fetal monitoring process
- Online consultation on the framework
- Design of an intervention to improve fetal monitoring

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Interesting aspects and challenges

- Combining social scientist and engineering perspectives in observations
  - Will the data reveal different sensitivities in the observations?
- Combining data from systematic literature reviews, ethnographic observations and expert opinion into a national-level framework
- Finding space in the very crowded area of maternity safet
  - Dozens of programmes and initiatives
  - « Improvement fatigue »
  - Engaging with stakeholders at national level

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Thank you.

Questions?

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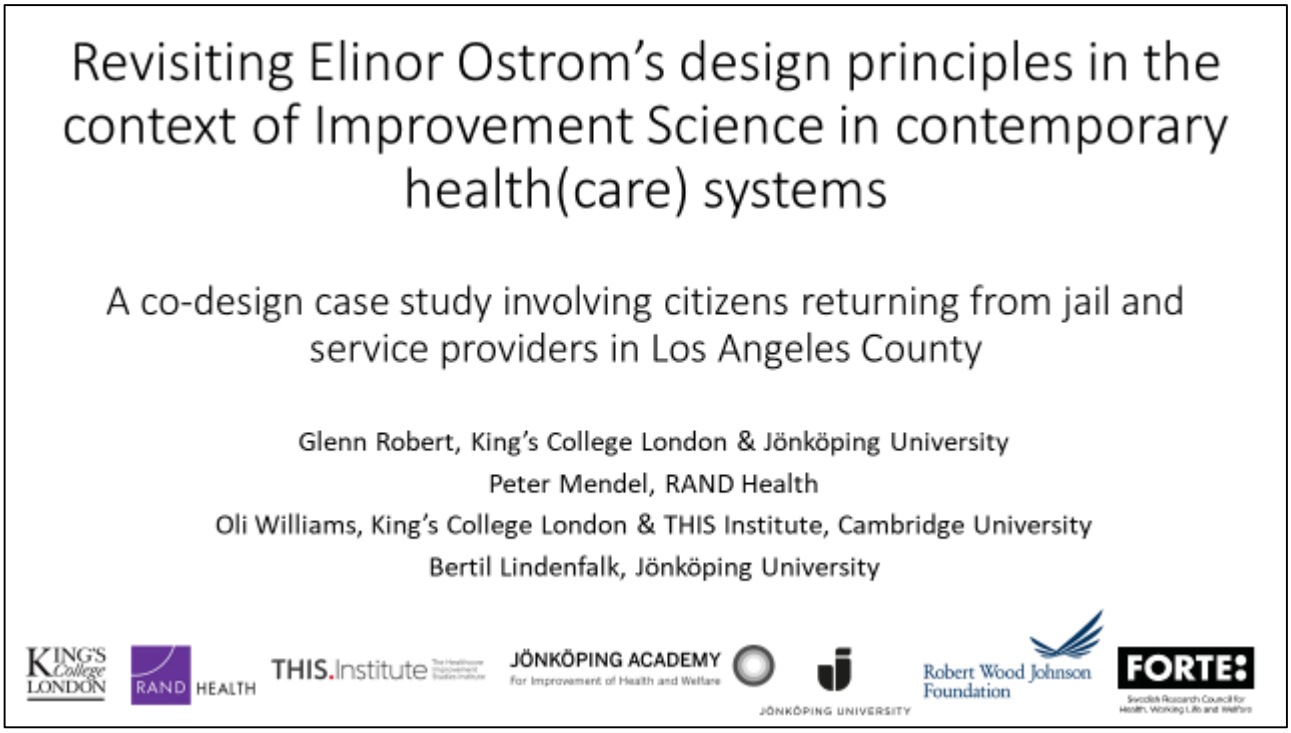
2. ***Revisiting Elinor Ostrom's design principles for contemporary health (care) systems: a co-design case study involving citizens returning from jail and service providers in Los Angeles County***
Glenn Robert, King's College London, UK, Peter Mendel, RAND UK, Oli Williams, King's College London, UK, and Bertil Lindenfalk, Jönköping University, Sweden



Quality 3.0

Quality 1.0	Quality 2.0	Quality 3.0
Professional societies	System/process	Ownership of "health"
Accreditation	Variation & "statistical thinking"	**Service/product logic**
"Be at least this good…" Floor	Intrinsic motivation	**Service co-production**
Standards	Learning from testing change	**Relationship + Action**
Discipline focused	"Customer" mindedness	Lived reality of TIFKAP, TIFKAPro
Audits/inspections	"Improvement & Implementation"	"As is" system journey
Indicators	"Be as good as possible" Ceiling	Science-informed practice
Guidelines	Outcomes focus, measurement	Integrative thinking
	Quality "in"	Prototyping
		Value-creating system architectures
		Quality "of"…

As presented by Paul Batalden at ISQua2019 – Cape Town, South Africa

Eight design principles that enable common pool resource groups to effectively manage their resources

1. Clearly defined boundaries
2. Proportional equivalence between benefits and costs
3. Collective-choice arrangements
4. Monitoring
5. Graduated sanctions
6. Conflict resolution mechanisms
7. Minimal recognition of rights to organize
8. For groups that are part of larger social systems, there must be appropriate coordination among relevant groups. Every sphere of activity has an optimal scale

Ostrom, E., 1990. Governing the Commons: The Evolution of Institutions for Collective Action. Cambridge University Press, Cambridge, UK

Design principles for groups?

- review of 91 empirical studies accumulated since the original study provides strong empirical support for the efficacy of the core design principles (Cox et al., 2010)
- because of their theoretical generality, the principles have wider range of application than CPR groups and are relevant to nearly any situation where people must cooperate and coordinate to achieve shared goals (Wilson et al., 2013)
- the principles can be used as a practical guide for increasing the efficacy of groups, although local tailoring is usually required for their implementation (Wilson et al., 2013)

Synthesis

A Review of Design Principles for Community-based Natural Resource Management

ABSTRACT. In 1990, Elinor Ostrom proposed eight design principles, positing them to characterize robust institutions for managing common-pool resources such as forests or fisheries. Since then, many studies have explicitly or implicitly evaluated these design principles. We analyzed 91 such studies to evaluate the principles empirically and to consider what theoretical issues have arisen since their introduction. We found that the principles are well supported empirically and that several important theoretical issues warrant discussion. We provide a reformulation of the design principles, drawing from commonalities found in the studies.

Key Words: *common-pool resources; design principles; diagnostics; institutions*

INTRODUCTION

The challenge of complexity

Scholars in the social sciences have only recently begun to deal with the challenges involved in analyzing complex systems. The central problem is the large number of relevant variables and their interactions that affect how human systems operate at multiple levels. This complexity increases when social systems interact with natural systems that present similar analytical difficulties. Communities of users managing common-pool resources (CPRs) such as forests or fisheries are excellent examples of this complexity. Understanding these situations is important given the increasing impact humans are having on the environment and the important role that communities often play in natural resource management in diverse settings worldwide.

Until the 1980s, many scholars had presumed that the users of such resources could not self-organize to manage them. Then, scholars often recommended the imposition of government or private ownership based on the theorem of Gordon (1954), Demsetz (1967), and Hardin (1968). Scholarly reports during

In 1985, the National Research Council established a research committee to examine the problems facing the users of CPRs, bringing together scholars from a wide diversity of disciplines to review the existing empirical evidence about CPRs and the impacts of diverse governance arrangements. A report was published in 1986 that criticized the conclusions related to property regimes for CPRs and recommended the need for further research on how diversely structured systems for governing and managing CPRs perform in the field (National Research Council 1986). The report argued that the complexity of the systems used to manage CPRs in the field had confused scholars into thinking that chaos pervaded unless simple governmental or private property systems were imposed.

Previous analyses of common-pool resources

Concurrently with these events, colleagues at the Workshop in Political Theory and Policy Analysis at Indiana University in Bloomington, Indiana, USA, created a database to record key information from the growing number of case studies found in the literature related to how self-organized regimes

Cox, M., et al. (2010). A review of design principles for community-based natural resource management. Ecology and Society
Wilson, D.S., et al. (2013) Generalizing the core design principles for the efficacy of groups. J. Econ. Behav. Organ.

Testing the principles

3 case studies in education & 2 in urban neighbourhoods

*'Given such a strong foundation of theoretical and empirical support, the core design principles can potentially serve as a practical guide for increasing the efficacy of groups in real-world settings … **We encourage others to use the principles … as a practical guide for improving the efficacy of groups**, as we are starting to do for schools and neighbourhoods.' (p11)*

Journal of Economic Behavior & Organization

journal homepage: www.elsevier.com/locate/jebo

Generalizing the core design principles for the efficacy of groups

David Sloan Wilson[a,b,*], Elinor Ostrom[c], Michael E. Cox[d]

ARTICLE INFO

ABSTRACT

This article generalizes a set of core design principles for the efficacy of groups that was originally derived for groups attempting to manage common-pool resources (CPRs) such as irrigation systems, forests, and fisheries. The dominant way of thinking until recently was that common situations invariably result in the tragedy of overuse, requiring either privatization (when possible) or top-down regulation. Based on a worldwide database of CPR groups, Ostrom proposed a set of principles that broadly captured the essential aspects of the institutional arrangements that succeeded, as contrasted to groups whose efforts failed. These principles can be generalized in two respects. First, by showing how they follow from foundational evolutionary principles, and second, by showing how they apply to a wider range of groups. The generality of the core design principles enables them to be used as a practical guide for improving the efficacy of many kinds of groups.

© 2011 Published by Elsevier B.V.

Wilson, D.S., et al. (2013) Generalizing the core design principles for the efficacy of groups. J. Econ. Behav. Organ.

A health systems case study

- LA County largest jail system in world; 16,000 inmates any one evening
- Located in area of 4,000 miles^2 experiencing acute homelessness problem
- Recidivism rate estimated at around 70%

https://www.rand.org/blog/rand-review/2019/10/a-novel-approach-to-helping-people-returning-from-prison.html

CO-SHARE: Co-Design of Services for Health and Re-entry

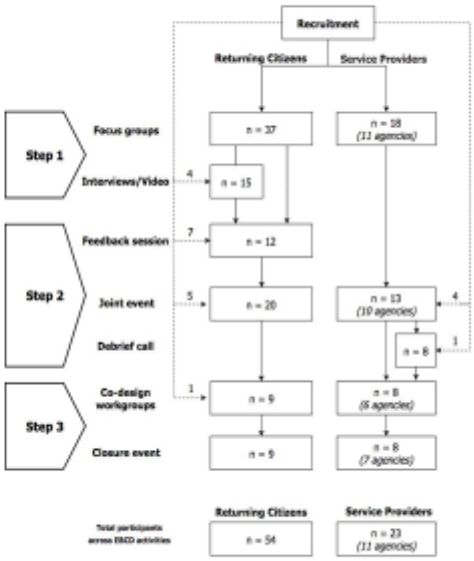
- a project of *RAND Health* in collaboration with *Los Angeles Metropolitan Churches (LAM)*
- goal of the project was to pilot Experience-Based Co-Design (EBCD) as a systematic method for:
  - bringing 'returning citizens' released from jail together with Service Providers of different agencies in LA County
  - to co-ordinate (notoriously) fragmented health, social and other community services critical to health and well-being of returning citizens
  - how to meaningfully engage users of these services in quality and service improvement (given often fraught relationship between returning citizens and service providers)

Non-profit organization of 25 African-American churches that address poverty, education and health concerns including an Ex-Offender Action Network which hosts weekly and monthly meetings

Mendel P, Davis LM, Turner S et al. (2019). 'Co-Design of Services for Health and Reentry (CO-SHARE). An Experience-Based Co-Design (EBCD) Pilot Study with Returning Citizens and Service Providers in Los Angeles County'. RAND Health Care Program

Who participated in the 'returning citizen' gathering of experiences?

- total of 48 returning citizen participants (in focus groups & interviews)
- all participants had experiences with county jail and at least one physical health, mental health, or substance abuse issue
- diversity of race/ethnicity and sex:
  - men (37) women (11)
  - African American (29) Latino (12) White (6) Asian (1)



Mendel P, Davis LM, Turner S et al. (2019). 'Co-Design of Services for Health and Reentry (CO-SHARE). An Experience-Based Co-Design (EBCD) Pilot Study with Returning Citizens and Service Providers in Los Angeles County'. RAND Health Care Program

Who participated as service providers?

- Two county government agencies:
  - Los Angeles County Probation Department,
  - Los Angeles County Sheriff's Department – Community Transition Unit
- Los Angeles Regional Re-entry Partnership
- Seven community-based organizations:
  - A New Way of Life Re-Entry Project, Brilliant Corners, Chrysalis, healthRIGHT 360, Homeless Outreach Program Integrated Care System (HOPICS), Shields for Families, and Telecare Corporation's TABS 109 Program

Figure 2.1. Building Blocks of Community Support for Returning Citizens

Mendel P, Davis LM, Turner S et al. (2019). 'Co-Design of Services for Health and Reentry (CO-SHARE). An Experience-Based Co-Design (EBCD) Pilot Study with Returning Citizens and Service Providers in Los Angeles County'. RAND Health Care Program

Can we apply the principles (and do they help)?

1a. User boundaries
1b. Resource boundaries
2a. Congruence with local conditions
2b. Appropriation and provision
3. Collective choice arrangements
4a. Monitoring users
4b. Monitoring the resource
5. Graduated sanctions
6. Conflict resolution mechanisms
7. Minimal recognition of rights to organize
8. Nested enterprises

- value co-creation at group/collective levels is a gap in current Quality 3.0 discussions
- the EBCD process enabled the formation of a group that worked in a complex system; part of a (new) value-creating system architecture?
- applying the principles could help maintain focus on user centredness in a complex design space
- applying the principles also invites consideration of all agents in a system simultaneously, and about the relational aspects of that system
- legal/monitoring aspects problematic?
- adapt and design these principles into future system-level QI programmes (rather than designing solutions to specific problems) and test them in terms of relational aspects (which are most important and why?)
- but - as Quality 3.0 highlights - still need to understand more about the human and social experience of establishing collective choice arrangements (nature of interactivity and reciprocity)

Insights and reflections from the case study

- empowerment & validation

'The first service provider to speak after showing of the film at the joint event told returning citizens how courageous he thought they were to go on film and candidly share their experiences, including those that did not go well with service providers. The service providers in attendance then applauded the returning citizens, which set the tone for a rich and lengthy whole-group discussion with alternate sharing by both groups.'

Mendel et al, 2019: 58

- trust & working together

'engagement and empowerment strategies may have laid a foundation for collaboration and collective decision-making among returning citizens and services providers. But trust between the two groups was not immediate; it was first necessary to overcome initial scepticism about working together … levels of trust grew over time through respectful interactions.'

Mendel et al, 2019: 58

FEATURE

QUALITY IMPROVEMENT

Getting more health from healthcare: quality improvement must acknowledge patient coproduction—an essay by Paul Batalden

OPEN ACCESS

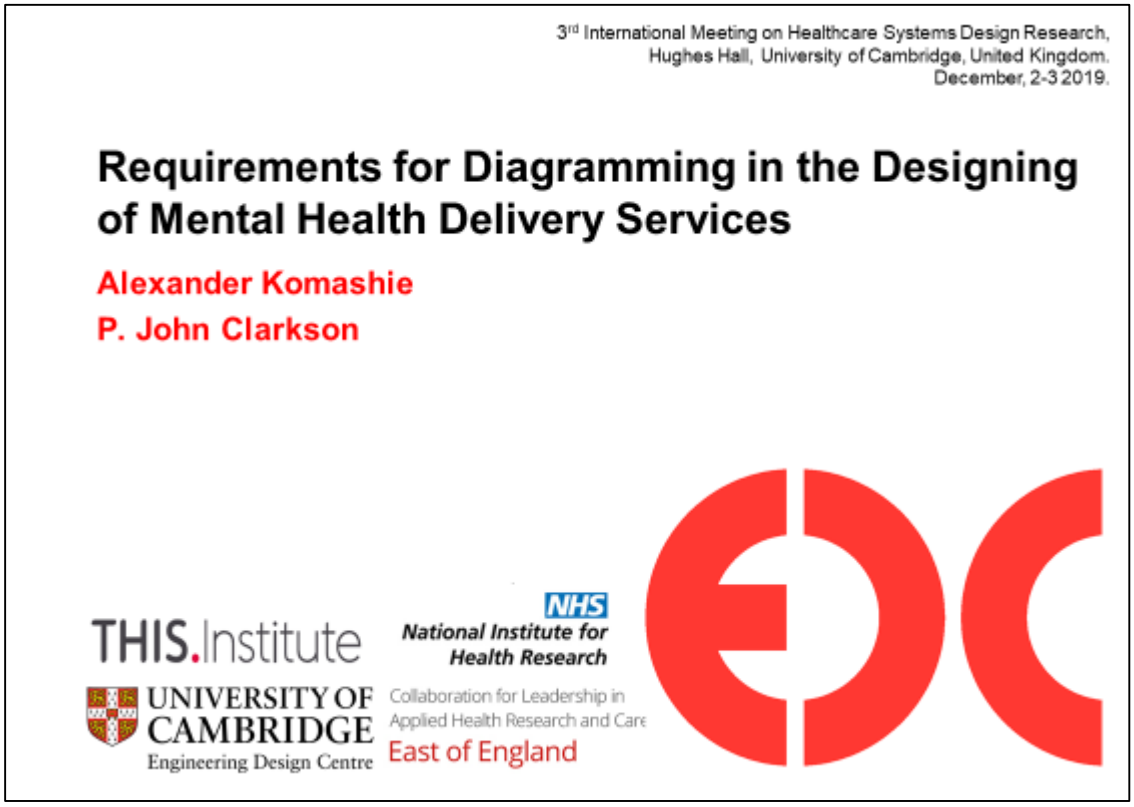
Modelling healthcare as either a product or a service neglects essential aspects of coproduction between doctors and patients. **Paul Batalden** shares his learning from 10 years of studying change

Paul Batalden professor emeritus, paediatrics, community, and family medicine

'Co-production is not, of course, universally advantageous. Nor is it a process that will occur spontaneously simply because substantial benefits could be achieved.'

Ostrom E. Crossing the Great Divide: Coproduction, Synergy, and Development. World Development, 1996; 24(6): 1073-1087

3. ***Requirements for diagramming in the design of mental health delivery services***
Alexander Komashie and P. John Clarkson, University of Cambridge UK



An illustration of the challenge: Mr C

- Had a complex history of mental health problems:
  - Bipolar Disorder
  - Emotionally unstable personality disorder
  - Attention Deficit Hyperactivity Disorder (ADHD)
  - Special education as a child
  - Dyslexia and Dyspraxia.

An illustration of the challenge: Mr C

- Had difficulties engaging mental health services:
  - Sectioned several times under MH Act 1983
  - A voluntary inpatient
  - On waiting list for a care co-ordinator but never allocated one.

An illustration of the challenge: Mr C

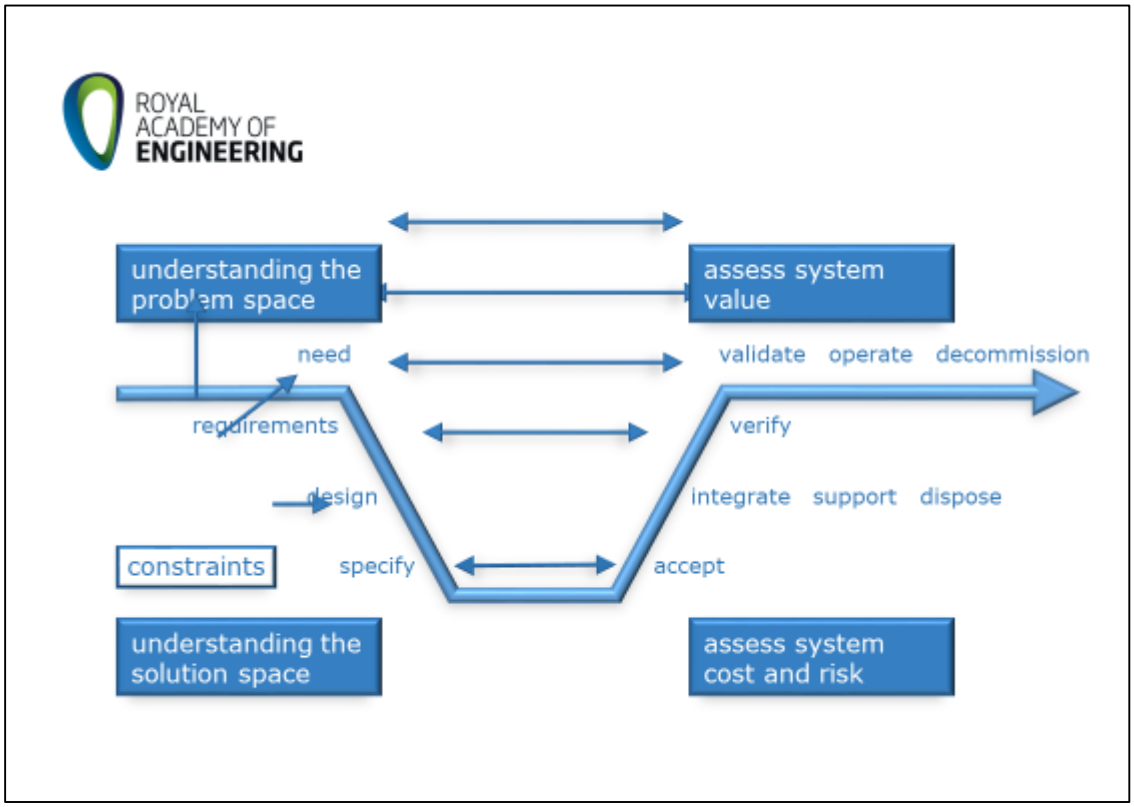
- Sectioned again under the MH Act 1983
- Discharged with support from the Community Treatment Team (CTT)
- He was discharged from the CTT after missing an appointment.
- He died shortly after from drug overdose.

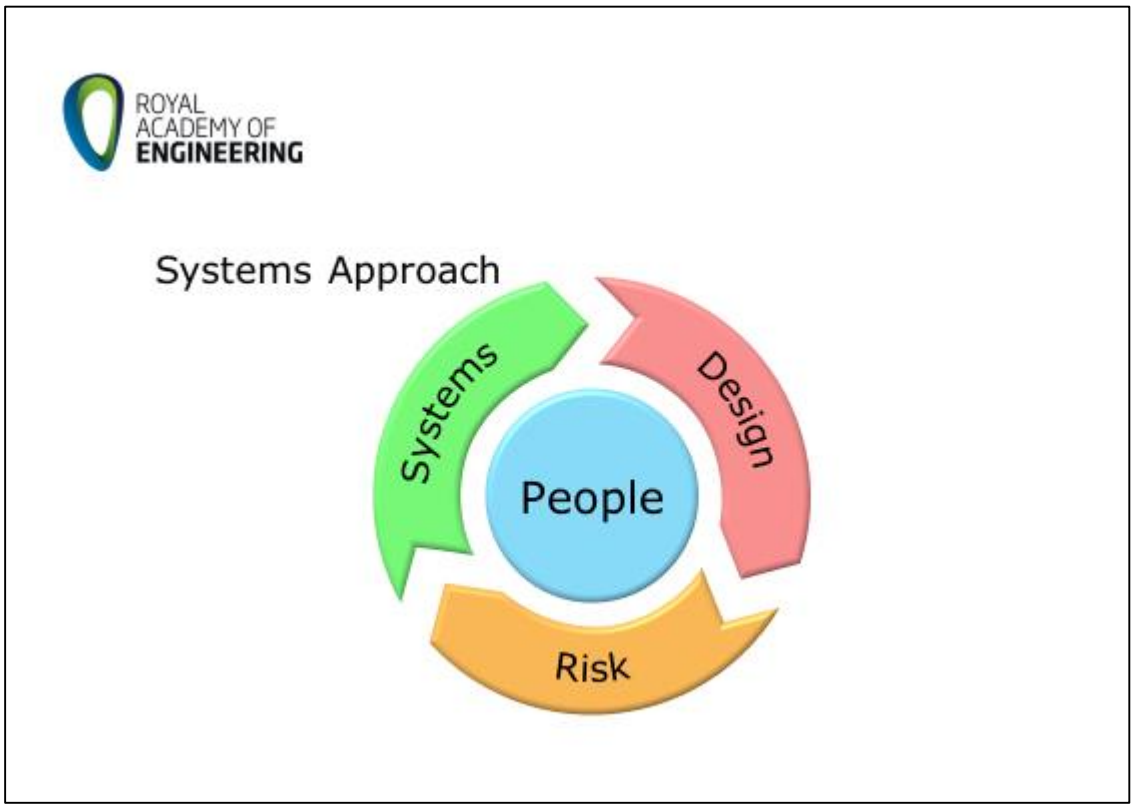
So, what is the answer?

- Well, there is no easy answer
- BUT ….
- Design and Systems Engineering
- System mapping
- CO-DESIGNED

"We are all passengers on an aircraft we must not only fly but redesign in flight."

John Sterman, MIT


ROYAL ACADEMY OF ENGINEERING
understanding the problem space
assess system value
need
validate
operate
decommission
requirements
verify
design
integrate
support
dispose
constraints
specify
accept
understanding the solution space
assess system cost and risk

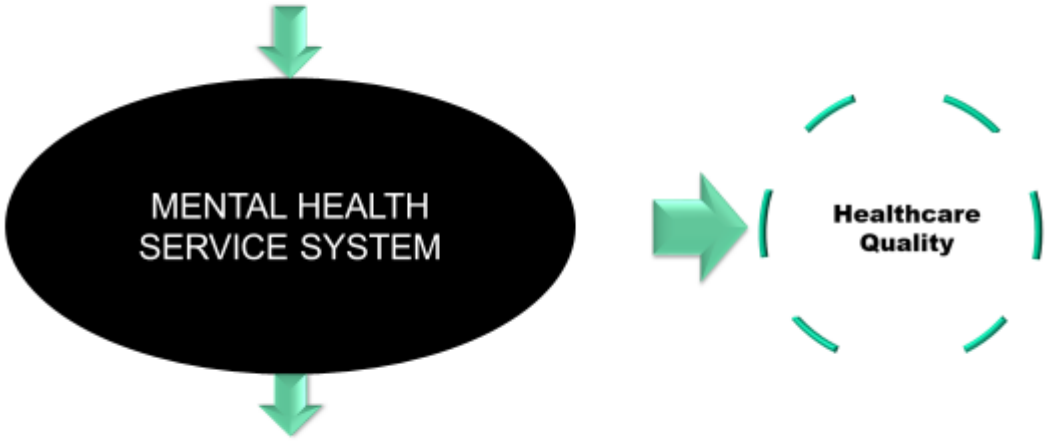

ROYAL ACADEMY OF ENGINEERING
Systems Approach
Systems
Design
People
Risk

ROYAL ACADEMY OF ENGINEERING

Systems

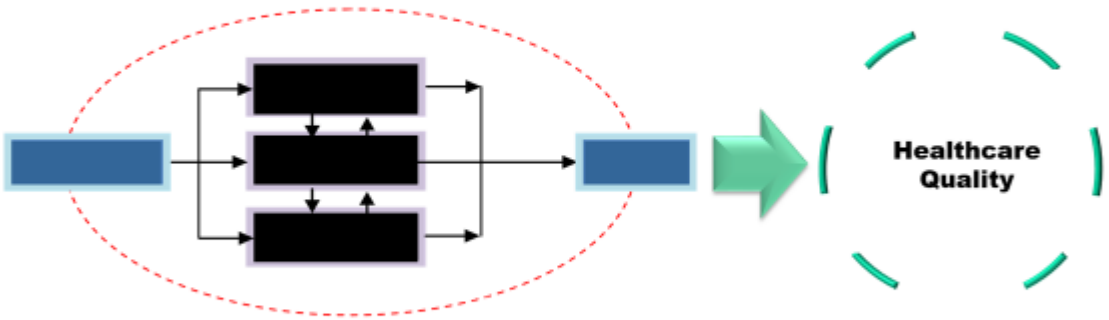
Motivation for the research

Motivation for the research



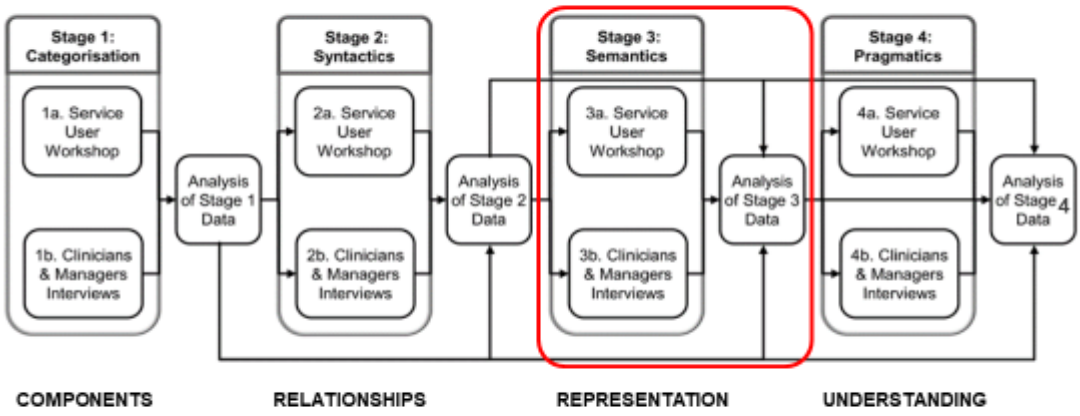
"Systems that work do not just happen – they have to be planned, designed and built."

Motivation for the research



"Systems that work do not just happen – they have to be planned, designed and built."

Methodology



Basic principle

- User experience (Stories):
  - –Patients' stories
  - –Clinicians' (and managers') stories

The case for Diagramming

INTERNATIONAL DESIGN CONFERENCE - DESIGN 2016
Dubrovnik • Croatia, May 16 - 19, 2016.

CAN DIAGRAMS HELP IMPROVE HEALTHCARE SYSTEMS DESIGN AND CARE DELIVERY?

A. Komashie and P. J. Clarkson

Keywords: systems engineering (SE), healthcare, design

1. Introduction

"Systems that work do not just happen - they have to be planned, designed and built" [Elliot and Deasley 2007].
In healthcare, the ultimate goal of every system is rather simple - better health for all [WHO 2008]. However, consistently translating this goal into actual experience for patients continues to be a challenge in most countries. In the English National Health Service (NHS), tremendous progress has been made over the past 68 years of its existence but there remain significant challenges to providing care that is consistently safe and of acceptable quality. Munkombwe, in a review, reports that Adverse Events (AEs) have been linked to direct medical costs and lead to an average of 6 to 8.5 extra days of stay in hospital which translate into additional cost of about £2 billion a year for the NHS. Hospital Associated Infections (HAI) occuring to surgery patients alone have also been estimated to cost the NHS £363 million annually, not to mention the harm and loss to patients and their families. [Munkombwe 2010]. More recently, the discovery of systematic failures in some parts of the system [Francis 2013], [Department of Health 2014] has raised serious concerns for all stakeholders. These challenges, however, are not unique to the NHS.

What to describe: System Components

21ST INTERNATIONAL CONFERENCE ON ENGINEERING DESIGN, ICED17
21-25 AUGUST 2017, THE UNIVERSITY OF BRITISH COLUMBIA, VANCOUVER, CANADA

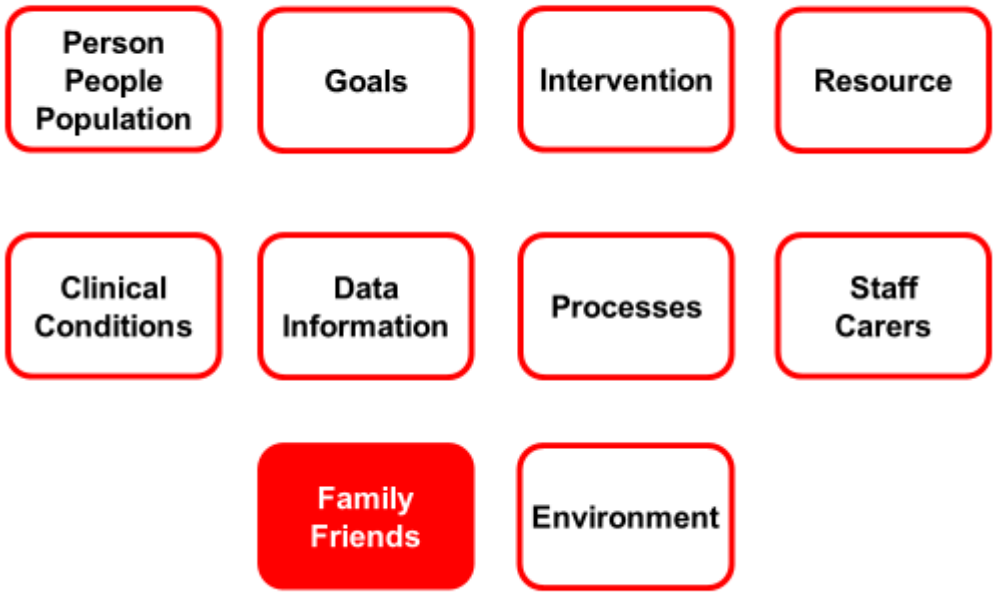
DESIGNING MENTAL HEALTH DELIVERY SYSTEMS: WHERE DO WE START?

Komashie, Alexander (1); Ray, Sarah (2); Kar Ray, Manaan (3); Clarkson, P. John (1)
1: University of Cambridge, United Kingdom; 2: Cambridgeshire and Peterborough NHS Foundation Trust, NIHR CLAHRC for the East of England, United Kingdom; 3: Cambridgeshire and Peterborough NHS Foundation Trust, United Kingdom

Abstract

Healthcare services that consistently meet the needs of service users have to be designed. The growing demand for better quality of care, together with an increasing awareness of limited resources, are bringing attention to the need for design in healthcare. In mental health, considered the largest cause of disability in the UK, the need is great. Existing services often fail to meet demands and do not consistently deliver good quality care for all service users. The design of better delivery systems has the potential to improve service user experience and care outcome. But, where do we start? This paper reports the first stage of an ongoing research to co-design a language for designing mental health services. This stage of the research identified, through focus groups and interviews with service users and clinicians, the key components of a mental health service. This paper argues that an appropriate concept of a mental health delivery service as a system, the identification of its key components and an

Results: System components



What to describe: Component relationships 1

INTERNATIONAL DESIGN CONFERENCE - DESIGN 2018
https://doi.org/10.21278/idc.2018.0413

DESIGN 2018

DESIGNING MENTAL HEALTH DELIVERY SYSTEMS: DESCRIBING THE RELATIONSHIP BETWEEN SYSTEM COMPONENTS

A. Komashie and P. J. Clarkson

Abstract

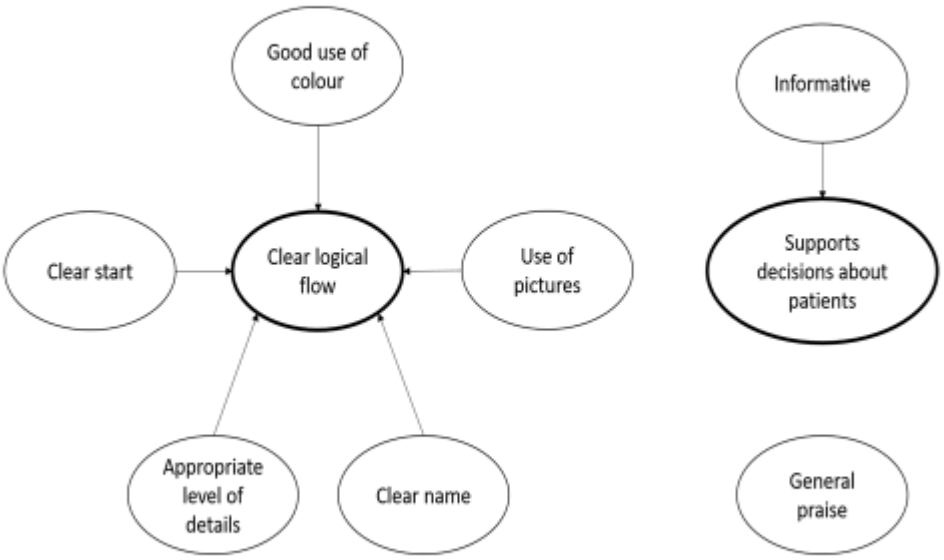
A challenging area of healthcare delivery in the UK is mental health. There is a growing need to improve outcomes of care. This research is part of an ongoing study that brings Design and Systems Engineering approaches into mental health service design. The focus is on how to understand and describe the architecture of delivery systems. Results from earlier stages of the work, looking at the identification of system components, have been reported previously. In this paper, we report the findings from empirical work on understanding the nature of the relationships between system components.

Keywords: healthcare design, systems engineering (SE), service oriented design, mental health

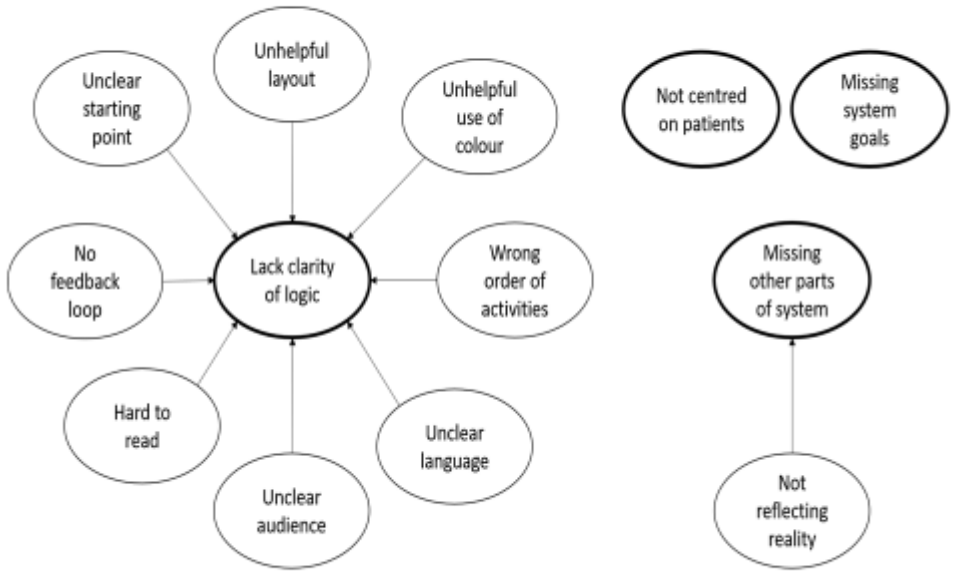
Results: Key words relating components

	Person/ People	Conditions	Interventions	Processes
Person/ People		• Could have • Can be defined by • Can develop • Has	• Can benefit from • Can rarely access • May wish to use • Will resist	• Wait for • Require treatment in • Can be referred to • May need a
Conditions	• Can affect • Is a diagnosis for • Should not define • To be explained to			• Eligible criteria for • Is common in • Is seen in
Interventions	• Can benefit • Helps • Is recommended for • Is demanded by			
Processes	• May be suitable for • Be appropriate for • May benefit • Is inaccessible for	• Supports people with • Treats people with • Understands		

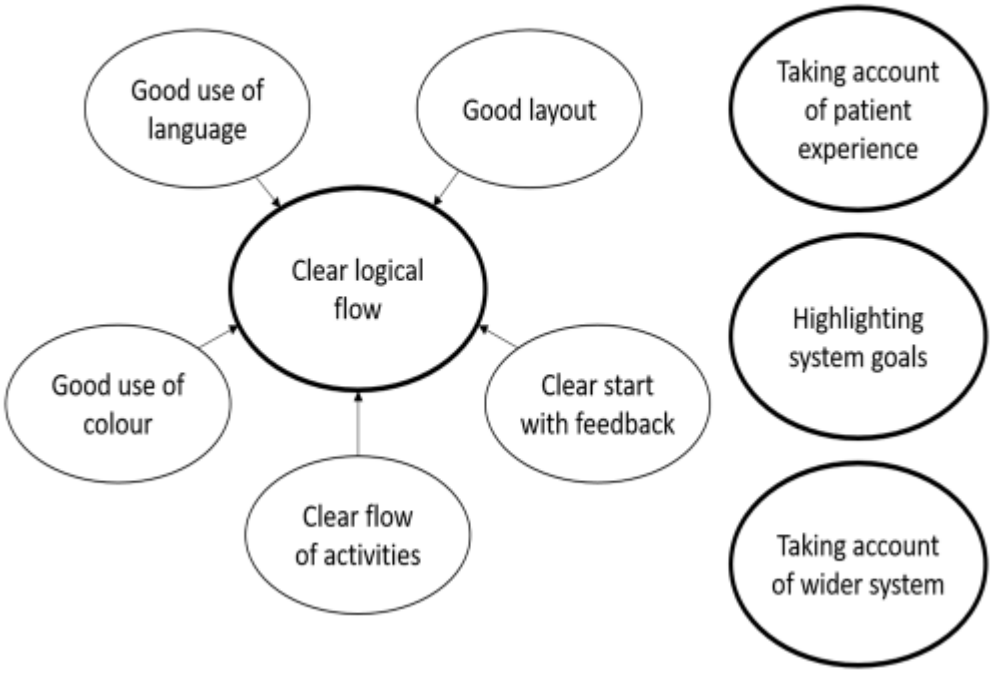
Thematic map of what participants liked



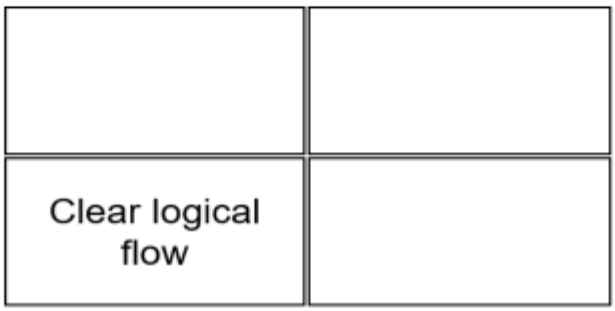
Thematic map of what participants did not like



Thematic map showing final four main themes



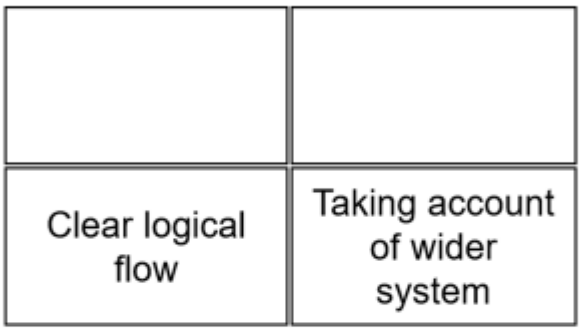
Quality and relevance of diagrams



1

Good quality, low relevance

Quality and relevance of diagrams



2

High quality low relevance

Quality and relevance of diagrams

Highlighting system goals	
Clear logical flow	Taking account of wider system

3

High quality, moderate relevance

Quality and relevance of diagrams

Highlighting system goals	Taking account of patient experience
Clear logical flow	Taking account of wider system

4

High quality, high relevance

A framework for assessing diagrams

Clear logical flow	

1

Clear logical flow	Taking account of wider system

2

Highlighting system goals	
Clear logical flow	Taking account of wider system

3

Highlighting system goals	Taking account of patient experience
Clear logical flow	Taking account of wider system

4

How do we now describe the system?

INTERNATIONAL DESIGN CONFERENCE - DESIGN 2020
https://doi.org/10.21278/idc.2020.0000

REQUIREMENTS FOR DIAGRAMING IN THE DESIGN OF MENTAL HEALTH DELIVERY SERVICES

Komashie A and Clarkson P. J.
Engineering Department, University of Cambridge
THIS Institute (The Healthcare Improvement Studies Institute)
Corresponding author:
A.Komashie@eng.cam.ac.uk

Abstract
[Delivering good quality mental health services remains a top priority in the English National Health Service (NHS). An approach to designing better delivery systems that considers the complexities of mental health services is highly desirable. This paper follows previous work that have sought to identify the key components of mental health delivery systems and explored the nature of the relationships between them. The paper presents the results of a qualitative thematic analysis of the requirements for diagrams as tools for describing and representing delivery systems in mental health.

[Systems mapping, Diagramming, Healthcare Design, Mental Health]

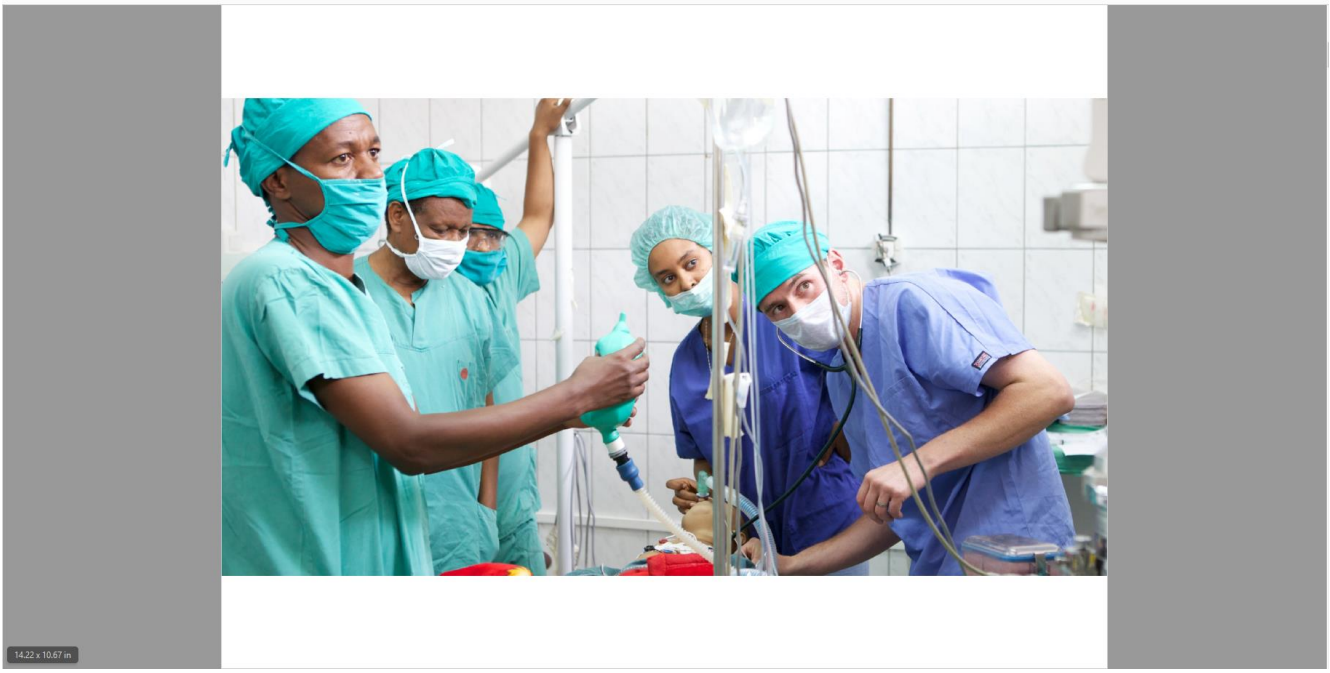
Conclusions

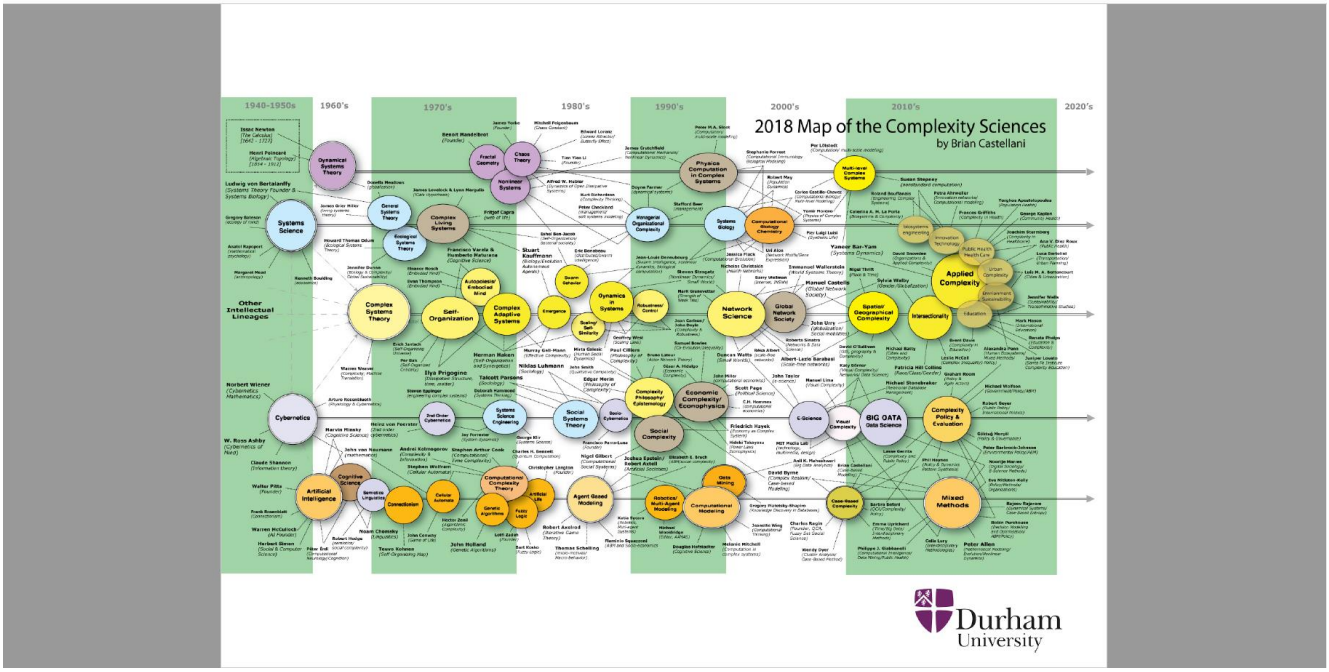
- We have identified four key requirements for diagrammatic representation in mental health.
- Suggested a potential framework for assessing diagrams in the context of metal health and possibly in other parts of healthcare
- Identified opportunity for further work in testing the proposed framework and also developing better diagramming methods for mental health and healthcare in general.

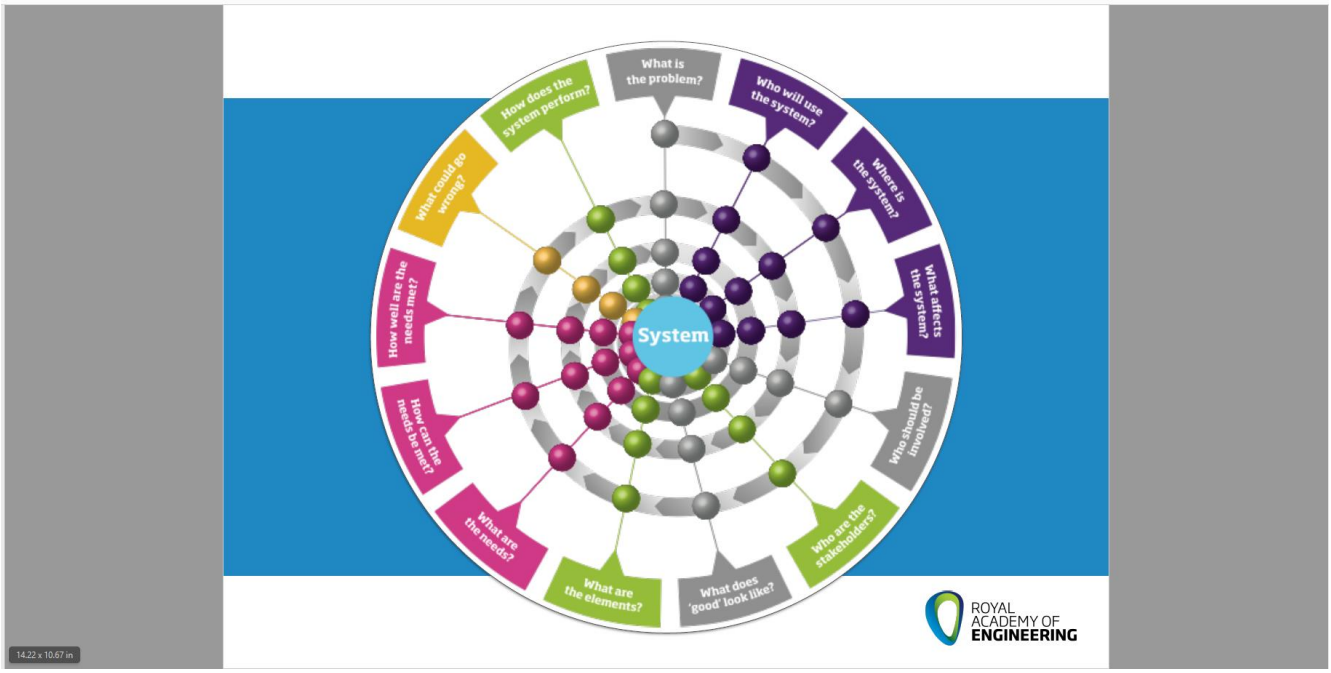
THANK YOU!

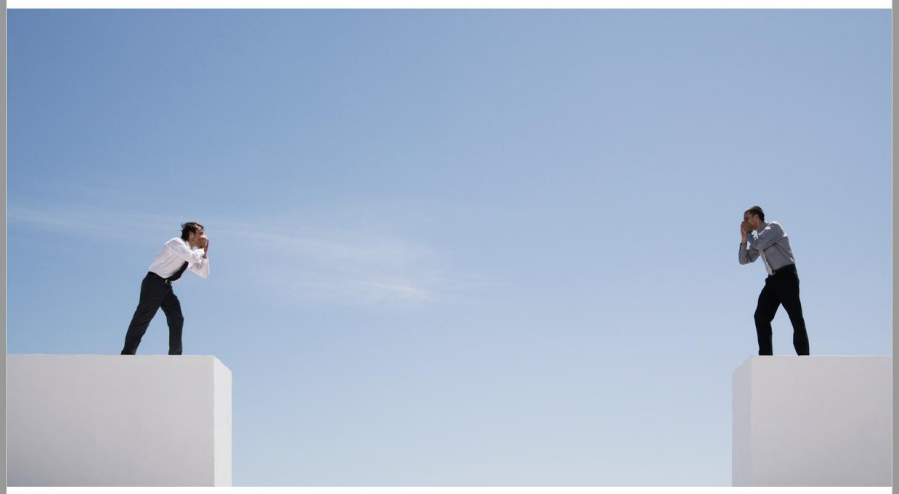
4. ***From stories to systems: the use of narrative in understanding complexity***

Tom Bashford and P. John Clarkson, University of Cambridge UK




2018 Map of the Complexity Sciences
by Brian Castellani
1940-1950s
1960's
1970's
1980's
1990's
2000's
2010's
2020's
Other Intellectual Lineages
Durham University


System
What is the problem?
Who will use the system?
Where is the system?
What affects the system?
Who should be involved?
Who are the stakeholders?
What does 'good' look like?
What are the elements?
What are the needs?
How can the needs be met?
How well are the needs met?
What could go wrong?
How does the system perform?
ROYAL ACADEMY OF ENGINEERING



NARRATIVE & STORYTELLING

NARRATIVE & STORYTELLING

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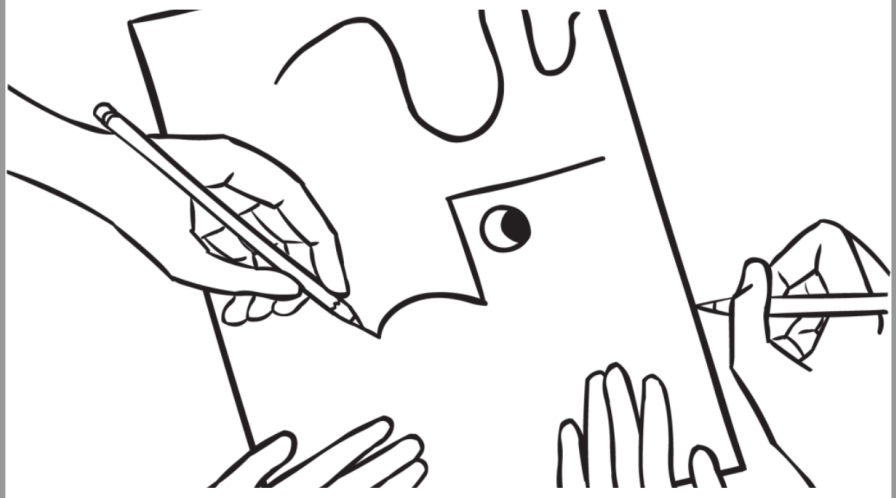

NARRATIVE & STORYTELLING

14.22 x 10.67 in

YGH SINCE 1899

14.22 x 10.67 in

ASIA-TBI, Myanmar

"A Systems Improvement Approach to Traumatic Brain Injury in Myanmar"

Global Health Research Group on Neurotrauma
Cambridge Global Health Partnerships
THET PARTNERSHIPS FOR GLOBAL HEALTH
YGH SINCE 1899
FUNDED BY NIHR | National Institute for Health Research

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ASIA-TBI

ASIA-TBI

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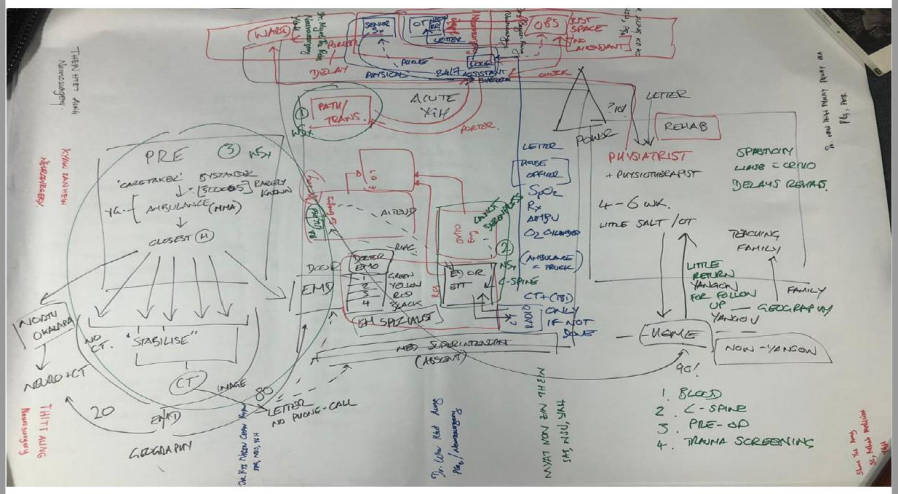

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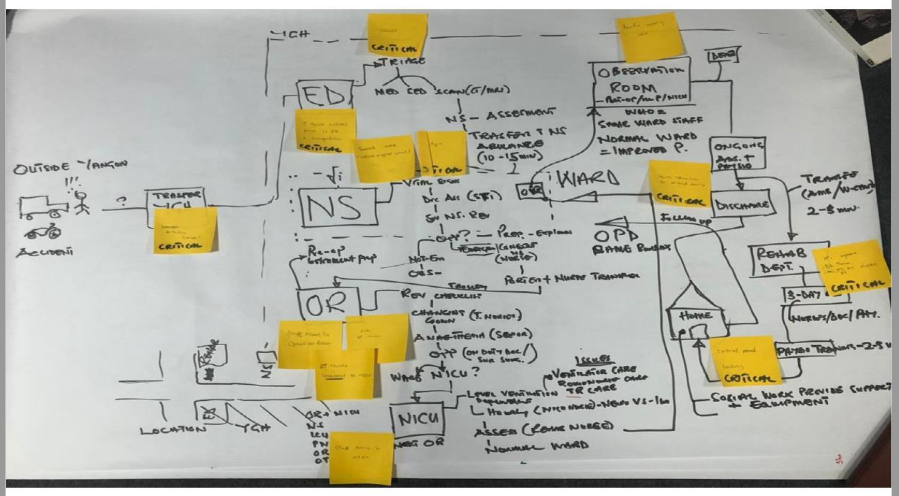

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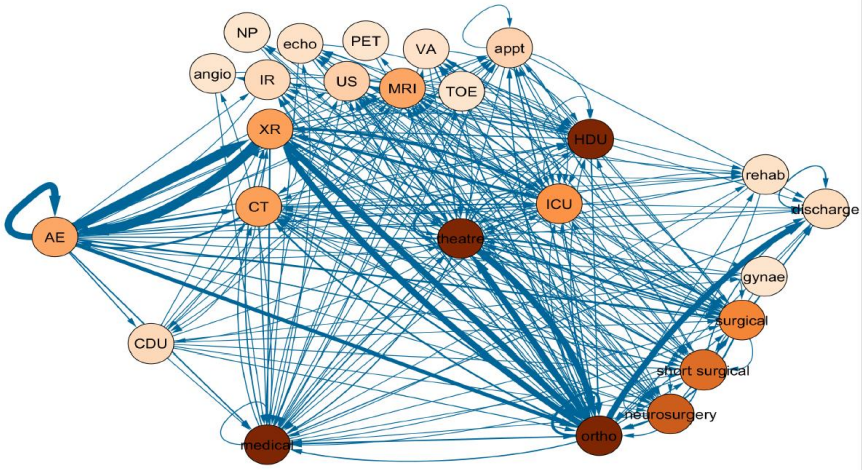

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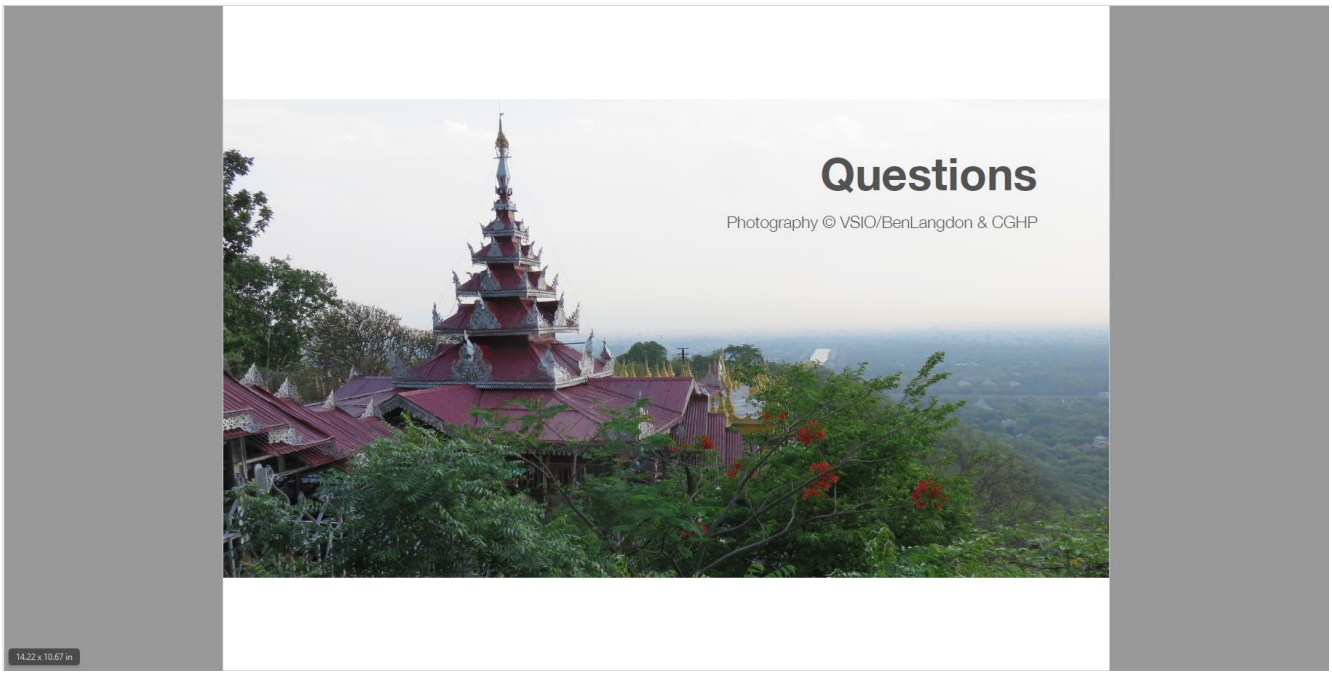
Questions
Photography © VSIO/BenLangdon & CGHP
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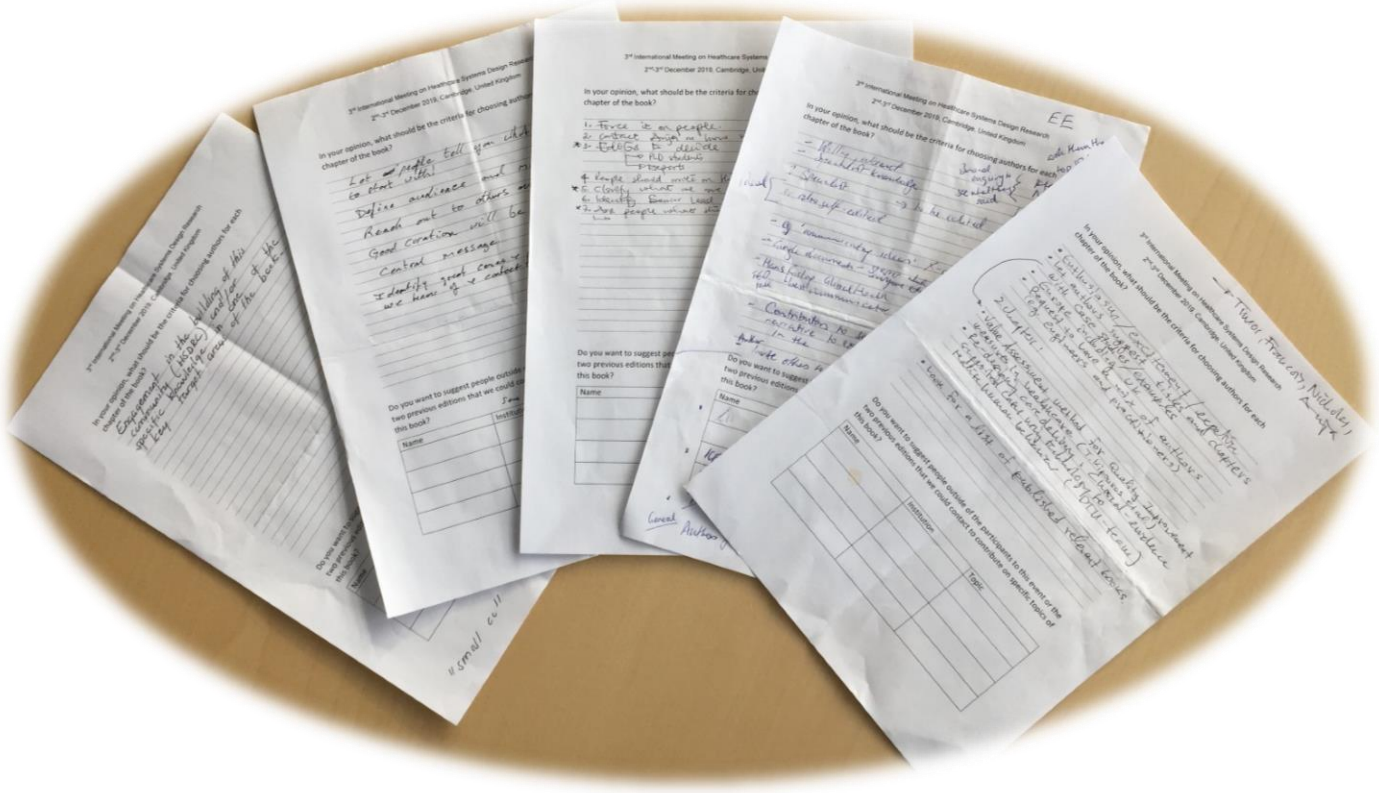
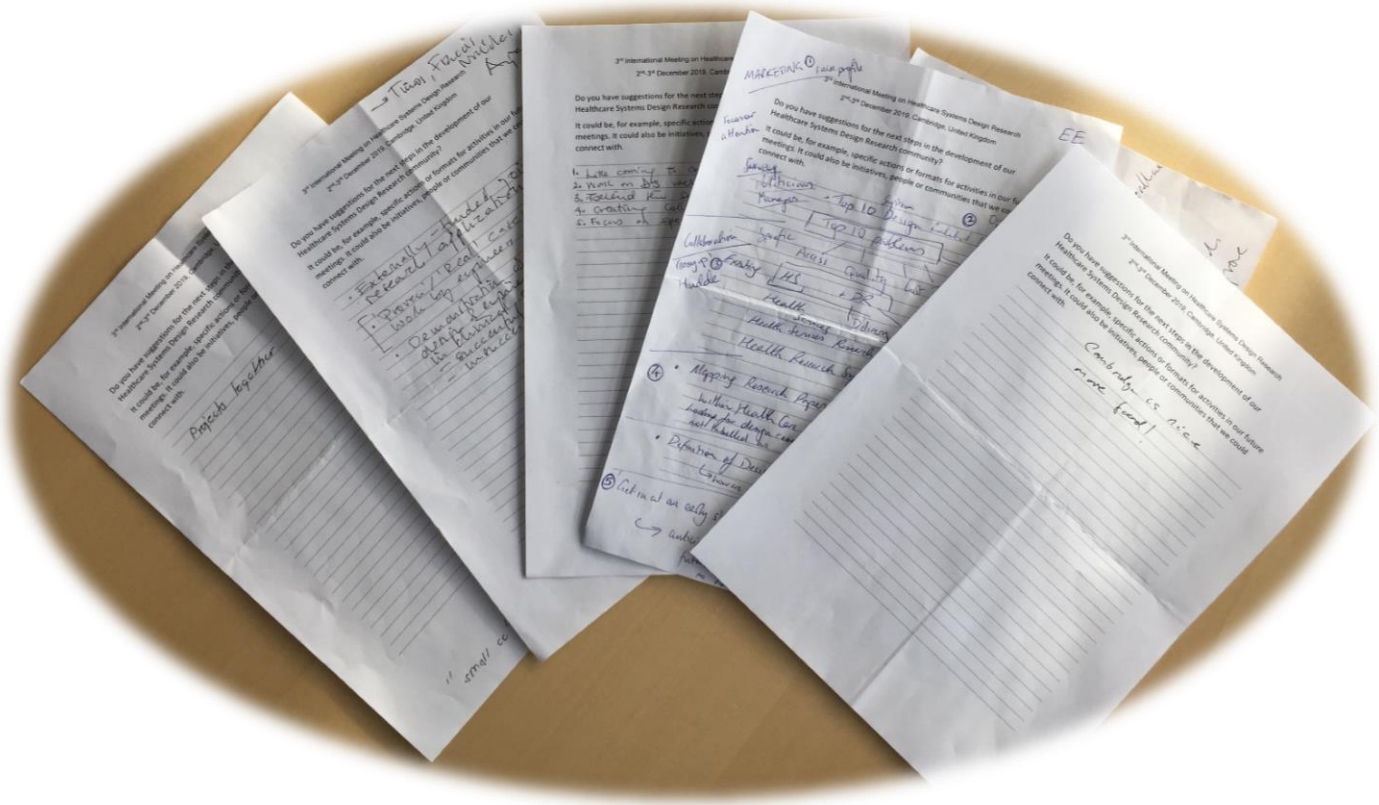
Book session III [Walk and Talk]: Criteria for selecting contributors and next steps
Lead: Dr Guillaume Lame, CentraleSupelec, France



- Enthusiasm/excitement/Expertise
- Let authors suggest titles and chapters with case studies/examples
- Europe including UK
- Request to have a mix of authors (e.g. engineers and practitioners)
- 2 chapters:
    - Value assessment method for quality improvement measures in healthcare (T. Kipouros et al.)
    - Re-designing care delivery, clinical evidence supported care using technology to realise human behaviour (DTU –team)
- Look for a list of published relevant books.
- Willing, interest
- Specialist knowledge
- Communicating ideas cross-disciplinary
- Google documents – starter which everyone edits
- Hans Rosling – Global health – best communicator, TED talk
- Contributors to send in narrative to explain what they would write in the book
- Author invite others to be co-authors
- Contact Health Foundation, Nuffield, King's Fund
    - Ask them the top 10 systems design issues for NHS
    - Broad enquiry to see what they said

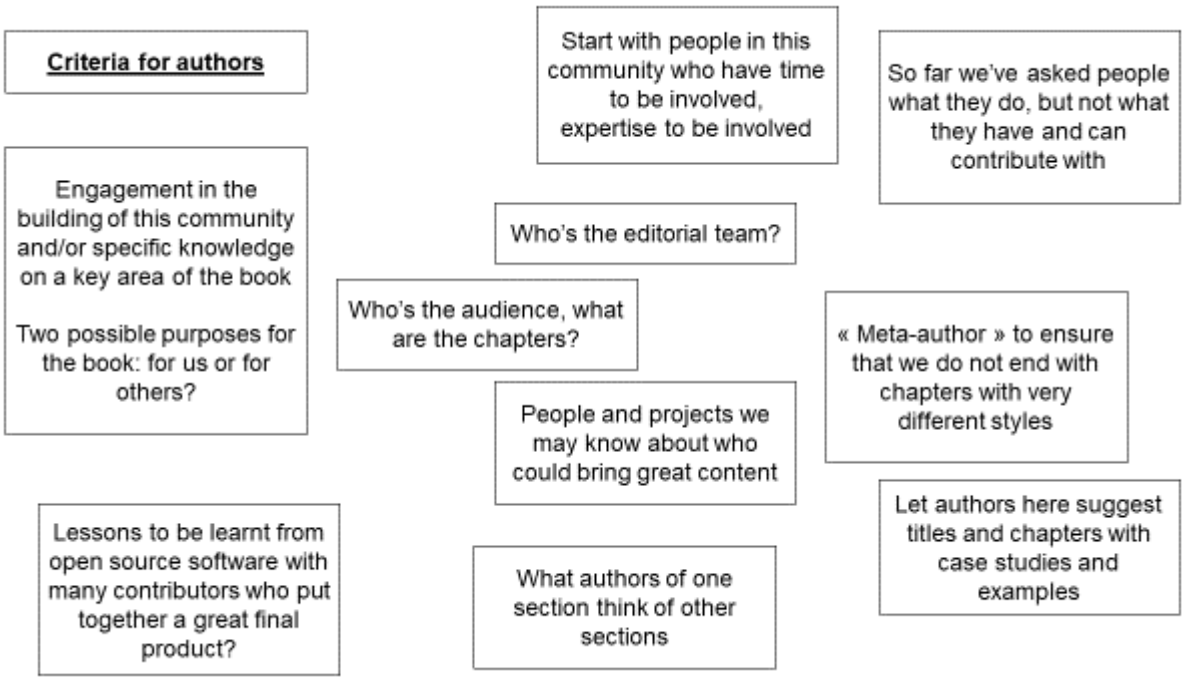
    - Contact their graphic artists
- Kathy – editor of Health Systems Research Journal
- ICED 2019 – Healthcare introduced as topic – authors who presented
- Don Berwick
- Authors from different countries – in general not necessary within a chapter.
- Force it on people who can contribute
- Contact Anja to ask how she found contributors
- Editors to decide – consider PhD students and experts
- People should write on their expertise
- Clarify what we are looking for
- Identify senior lead authors and their teams
- Ask people what they will be happy to write about
- Let people tell you what they can do to start with!
- Define audience and most likely chapters
- Reach out to others outside of this group. Expert contacts – leave this to topic experts to curate and organise.
- Good curation will be key
- Central message
- Identify great cases and projects we know of and contact them/contribution
- Engagement in the building of this community (HSDRC) and/or specific knowledge in one of the key target areas of the book.



- Cambridge is nice. More food!
- Marketing. Raise profile
- Focus our attention

- Survey politicians/managers
- Top 10 systems design related issues
- Top 10 problems – specific, access, quality, cost, timeliness
- Opinion from healthcare think tanks (King's Fund, Nuffield, Health Foundation)
- Collaboration
    - Existing HS & DR communities, section of NHIR
    - Subset of this to be design group
    - Health Research Systems Group
- Mapping research papers.
    - Within healthcare research, looking for design research not labelled as.
    - E.g. papers which has won prize, OR group. President's Med. Adelman Award
- Definition of Design – how are we using it here?
- Past 15 years Designing a system (not. Nec. In the title), e.g. designed the auction arrangements for settling radio frequencies.
- Get in at an early stage – anticipate what 10-20 years future issues to understand how to address now.
- Like coming to Cambridge
- Work on DS website
- Extend the scope
- Creating collaborations
- Focus on specific questions or methods.
- Externally – funded joint research applications
- Proven/real cases on joint work by engineers and clinicians.
- Demonstration of design and engineering methods in clinical applications – successful and unsuccessful.
- Projects together – EU.

NOTES DURING WALK AND TALK FEEDBACK



Next events

Define together some key challenges to address (and look at similarities/differences across countries?)

Structure the next meeting around the book (around the themes, around reviewing chapters, …)

Try to cluster presentations around a topic, a method…

Solidify the framing of our group: where do the boundaries lie? Needed to apply for funding

Identify 1 or 2 calls that we can apply to to get funding

Real cases of joint work between members of this community and clinicians (or other disciplines)

Apply Ostrom's principles/framework to define boundaries of the group?

Do we communicate more broadly? Or is this a « secret society »? Liaise with HS&DR conference (UK)?

Presentations session III
Chair: Professor Yvonne Eriksson, Malardalen University, Sweden

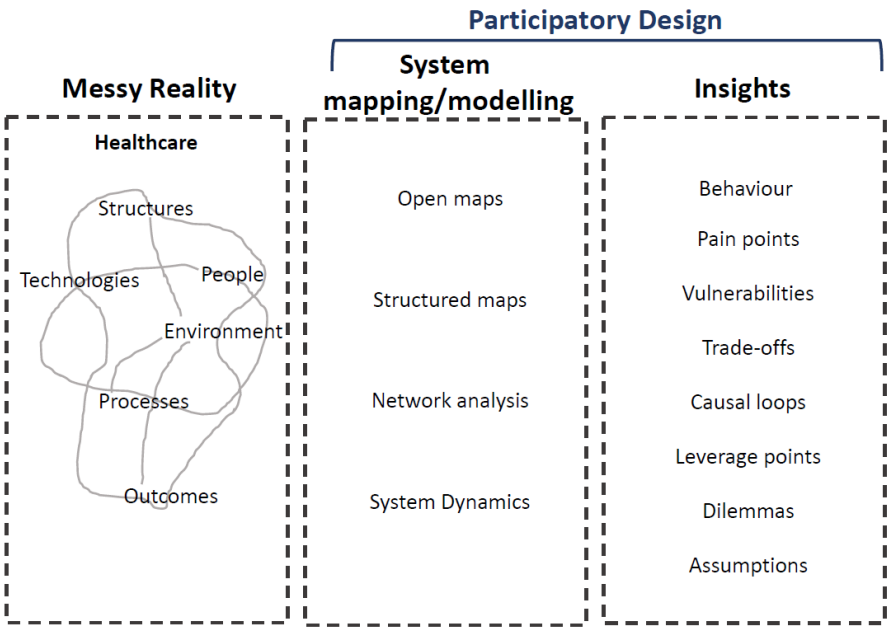
1. ***Participatory systems approach to healthcare system design***
   Thomas Jun, Loughborough University, UK

Participatory Systems Approach to Healthcare System Change

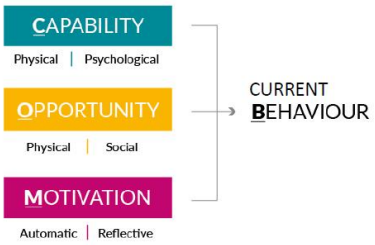
Gyuchan Thomas Jun (g.jun@lboro.ac.uk)
Fernando Carvalho, Nye Canham, Cecilia Landa-Avila, Alison Watt and Marije De-Haas
Human Factors and Complex Systems Research Group
Loughborough University, UK

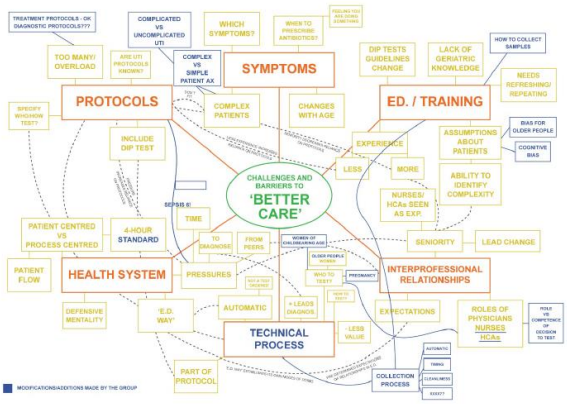
SystemSafetyLab.Com

Loughborough University



Behaviour insights - Why are ED doctors misdiagnosing Urinary Tract Infection in Older Patients?

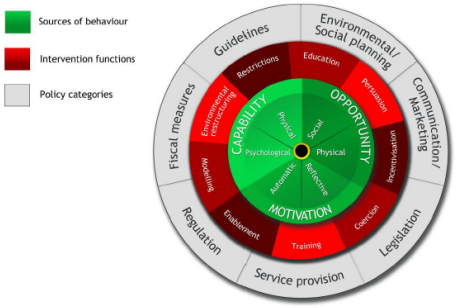




Thematic Network Map

[O'Keily, K., Carvalho, F., Jun, GT, et al , 2019, Why are we misdiagnosing urinary tract infection in older patients? A qualitative inquiry and roadmap for staff behaviour change in the emergency department, European Geriatric Medicine]

Behaviour insights – How can ED doctors better diagnose Urinary Tract Infection in Older Patients?



1. **Individualised feedback** to gradually raise awareness
2. **Restrictive use of dip stick urine tests** in the emergency department

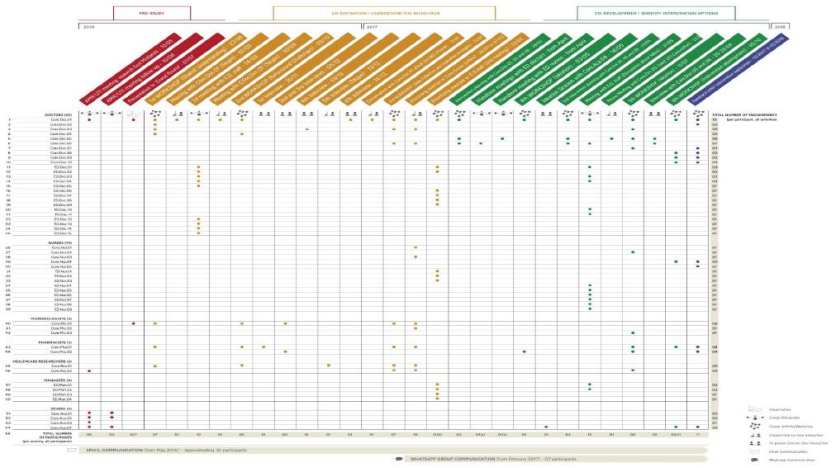
[O'Keily, K., Carvalho, F., Jun, GT, et al , 2019, Why are we misdiagnosing urinary tract infection in older patients? A qualitative inquiry and roadmap for staff behaviour change in the emergency department, European Geriatric Medicine]

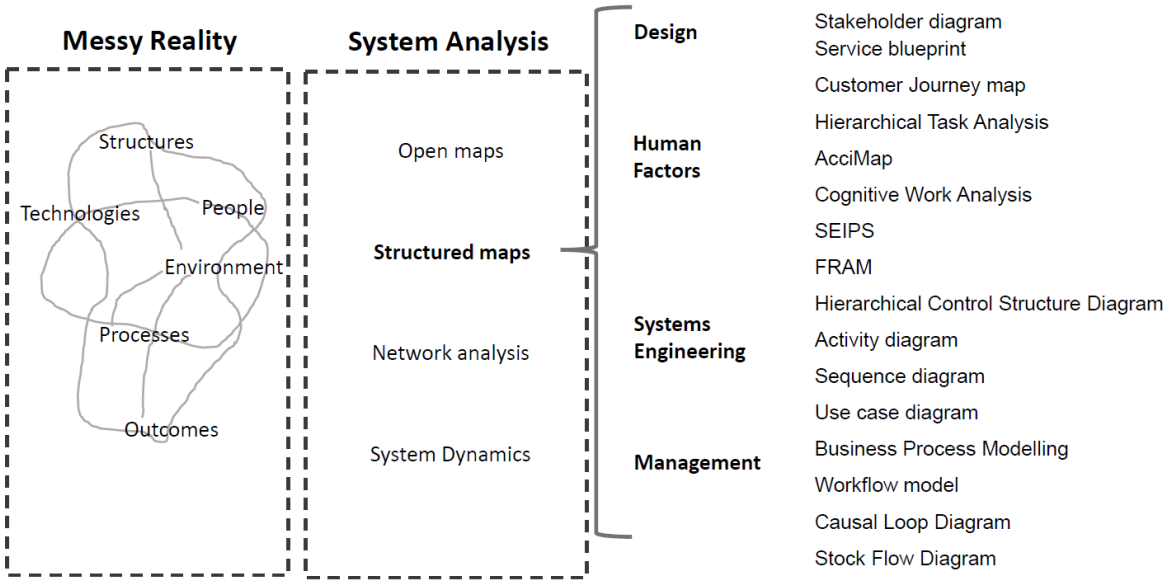
50 Participants

25 doctors

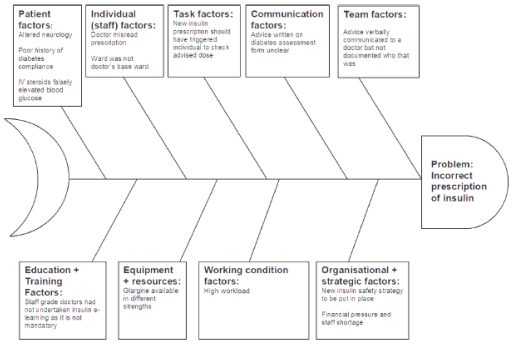
14 nurses

3 microbiologists
2 pharmacists
2 healthcare researchers
4 managers

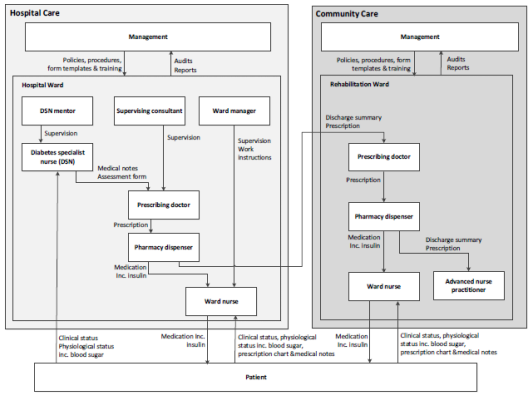




System Vulnerability – Medication error (insulin over-prescription)



Fish Bone Diagram



Hierarchical Control Structure Diagram

[Canham, N, , Jun, GT, et al , 2018, Integrating systemic accident analysis into patient safety incident investigation practices, Applied Ergonomics]

System Vulnerability – How to reduce Medication error?

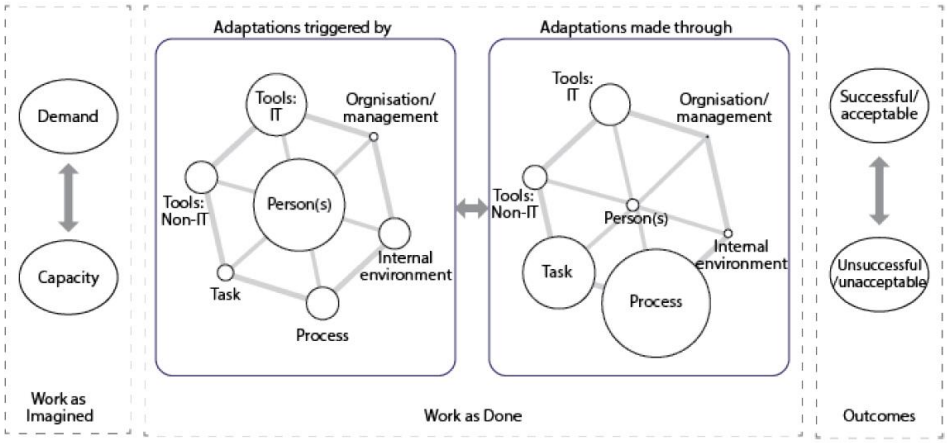
Category of countermeasure	RCA-based recommendations	STAMP-based recommendations
Individual behaviour	1. Personal reflection to be undertaken 2. Roll out and ensure compliance to insulin safety e- learning for all medical and nursing staff	1. Ensure doctors, nurses and pharmacists are given clear safety responsibilities (check and query) and understand these responsibilities
Tools, technology and physical environment	1. Review and implement new diabetes assessment form	1. Review and implement new diabetes assessment form 2. Review electronic information system for potential inclusion of DSN treatment recommendation 3. Feedback to pharmaceutical company about name of medication
Tasks and organisation		1. Ward management to regularly reinforce to nurses the expectation to query prescriptions where there is a concern regarding dose or administration instructions 2. Ensure channels of enquiry to ward leadership or original treatment team are available 3. Ensure prescribers, dispensers and administrators of medication have comprehensive and clear information of patient status and treatment plan 4. Train DSN's as prescribers to enable them to prescribe insulin at time of patient assessment 5. Design process to include DSN check with patient after administration of medication
Change management		1. Revise the design process (specification and testing) for form templates and other electronic and paper based information systems. 2. Revise the documentation review process. The review process needs to be able to efficiently manage change, with timely review and implementation of new documentation 3. Ensure future design of software includes specification and assessment of user needs

New diabetes assessment form

Form design process (specification and testing)

[Canham, N, , Jun, GT, et al , 2018, Integrating systemic accident analysis into patient safety incident investigation practices, Applied Ergonomics]

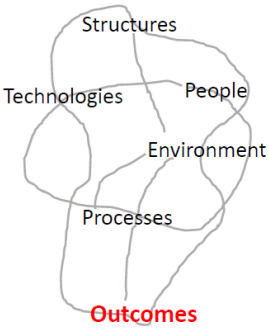
Resilient adaptations in blood transfusion process



Concept for Applying Resilience Engineering (CARE model)
Systems Engineering Initiative for Patient Safety (SEIPS)

[Watt, A, , Jun, GT, et al , 2019, Resilience in the blood transfusion process: Everyday and long-term adaptations to 'normal' work, Safety Science]

Messy Reality



System Analysis

Open maps

Structured maps

Network analysis

System Dynamics

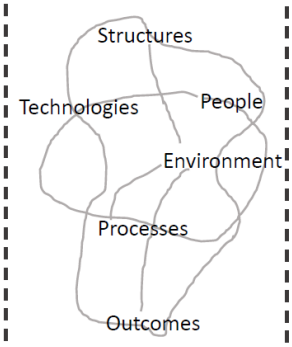
Outcome interactions and prioritisation

10 patients with long term conditions

10 providers

[Landa-Avila, C., Jun, GT, et al , 2019, RSD8, IIT, Chicago]

Messy Reality



System Analysis

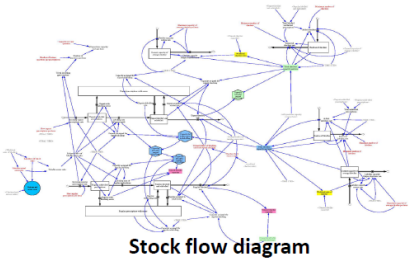
Open maps

Structured maps

Network analysis

System Dynamics

Staffing management in hospital pharmacy – Efficiency and Safety



Stock flow diagram

Scenario 1: Effect of staff ratio and skill-mix on workload and errors

Examine the trade off between efficiency (production) and thoroughness (safety) by analysing staff levels (resources) and their impact on performance. Analyse how number of labellers and checkers can have impact on production and errors (safety)

Scenario 2: Effect of interruptions on performance and errors

Achieve a balance by examining the effect interruptions (questions from coworkers and trainees) can have effect on efficiency.

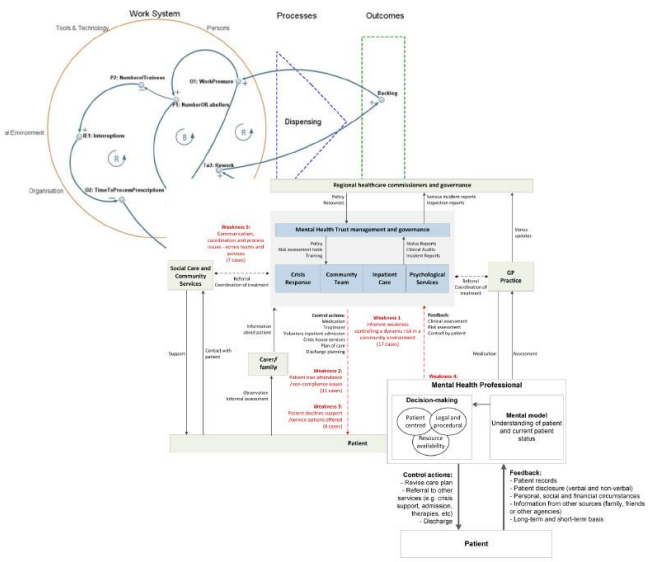
Scenario 3: Effect of high workload on fatigue and errors

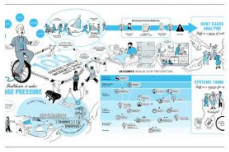
Examine and analyse how the level of workload has effect on fatigue and eventual burnout and subsequent on impact on capacity and errors.

Interactive Scenario Testing Dashboard

[Ibrahim, M, , Jun, GT, et al , 2019, A system dynamics approach to workload management of hospital pharmacy staff: modelling the trade-off between dispensing backlog and dispensing errors, IISE Transactions on Occupational Ergonomics and Human Factors]

System Analysis ➔ **Narratives (animations/films)**





Medication Error – Systems Thinking

Dilemmas in Suicide Prevention - Adaptations

Euthanasia implant – Speculative Design

Participatory Systems Approach to Healthcare System Change

Gyuchan Thomas Jun (g.jun@lboro.ac.uk)
Fernando Carvalho, Nye Canham, Cecilia Landa-Avila, Alison Watt and Marije De-Haas
Human Factors and Complex Systems Research Group
Loughborough University, UK

SystemSafetyLab.Com

2. *Evaluating the impact of new models of care on the performance of an ambulance service through facilitated simulation*

Antuela Tako, Loughborough University, UK

Loughborough University

Evaluating the impact of new models of care on the performance of an ambulance service through facilitated simulation

Dr. Antuela Tako, Loughborough University
@AntuelaTako
a.takou@lboro.ac.uk

3rd International Meeting on Healthcare Systems Design Research, 2-3 December 2019

The problem

- **Ambulance services faced with:**
  - High volume of emergency 999 calls
  - Breaching targets to respond to patient calls
  - High attendance rates to hospital emergency departments

3rd International Meeting on Healthcare Systems Design Research, 2-3 December 2019

Recommended solution

- New recommended models of care aimed at reducing unnecessary attendances at hospital emergency departments:
  - Hear and Treat (H&T) – advice service offered by specialised nurse practitioners over the phone;
  - Sea and Treat (S&T) service - paramedics treat patients at the scene;
  - Alternative Pathways (ALT) – patients are taken to non-hospital destinations, such as dedicated respiratory centres or community urgent care services.

Based on Urgent and Emergency care review, 2013

Overall project aims

Undertaken in close collaboration with the ambulance service staff to:

- Analyse existing data and understand the ambulance call cycle.
- Identify efficiency gains in the call cycle to reduce unnecessary attendances at hospital emergency departments.

Loughborough University

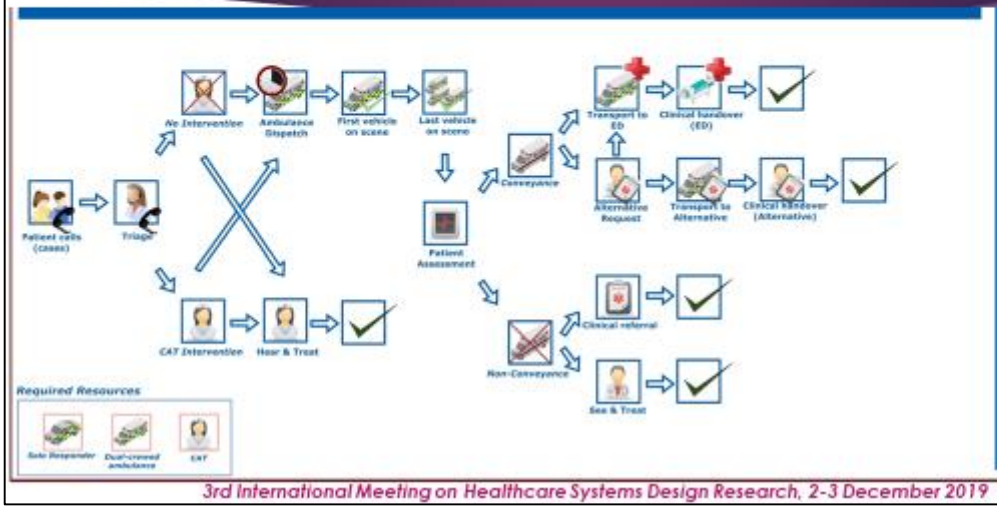
The Facilitated Approach

The PartiSim framework was adopted (Tako and Kotiadis, 2015), through four facilitated workshops to:

- Ensure stakeholder engagement & take ownership of study findings
- Gain a deeper understanding of ambulance call cycle and problems faced through discussions and interactive activities

3rd International Meeting on Healthcare Systems Design Research, 2-3 December 2019

The Ambulance Model



Results

Cases resulting in:

Alter. care attendance	12%
Hear & Treat	24%
See & Treat	10%
ED attendance	40%
Clinical referral	14%

Cases meeting conveyance targets

Red 8	73%
Red 19	87%
Green 30	93%

Non-conveyance vs Conveyance

% comparison	32% : 68%

3rd International Meeting on Healthcare Systems Design Research, 2-3 December 2019

Study findings

- Using the hear and treat (H&T) service offered by clinical assessment team (CAT) over the phone **found to have overall the highest impact on:**
  - Time targets (Red8 **75%**, Red18 **87%**& Green30 **96%**);
  - Decrease in ambulance delays;
- Increase of Sea & Treat (to increase non-conveyance) did NOT achieve time targets, while it achieved lowest number of Emergency room visits.

Loughborough University

Study findings

- Increase of H&T service identified as ***most preferred*** option by stakeholders.
- **Required changes**: increase CAT staff, their training, increased scope of practice and autonomy.
- **Risks**: available finance/funding, legal protection, commissioner approval, organisational resistance to change, lack of support to CAT members.
- Devised an **action plan** for the team to take further within the organisation.

Loughborough University

Loughborough University

Thank you!

3. The Cybernetic view of healthcare systems design by Stafford Beer

Christina Philips, Liverpool John Moore University, UK

SORRY, SLIDES CANNOT BE SHARED

4. ***The Global Sustainable Development Health Goals: a missed opportunity for systems design or a continuing design challenge?***

Geoff Royston, Independent OR Consultant, UK

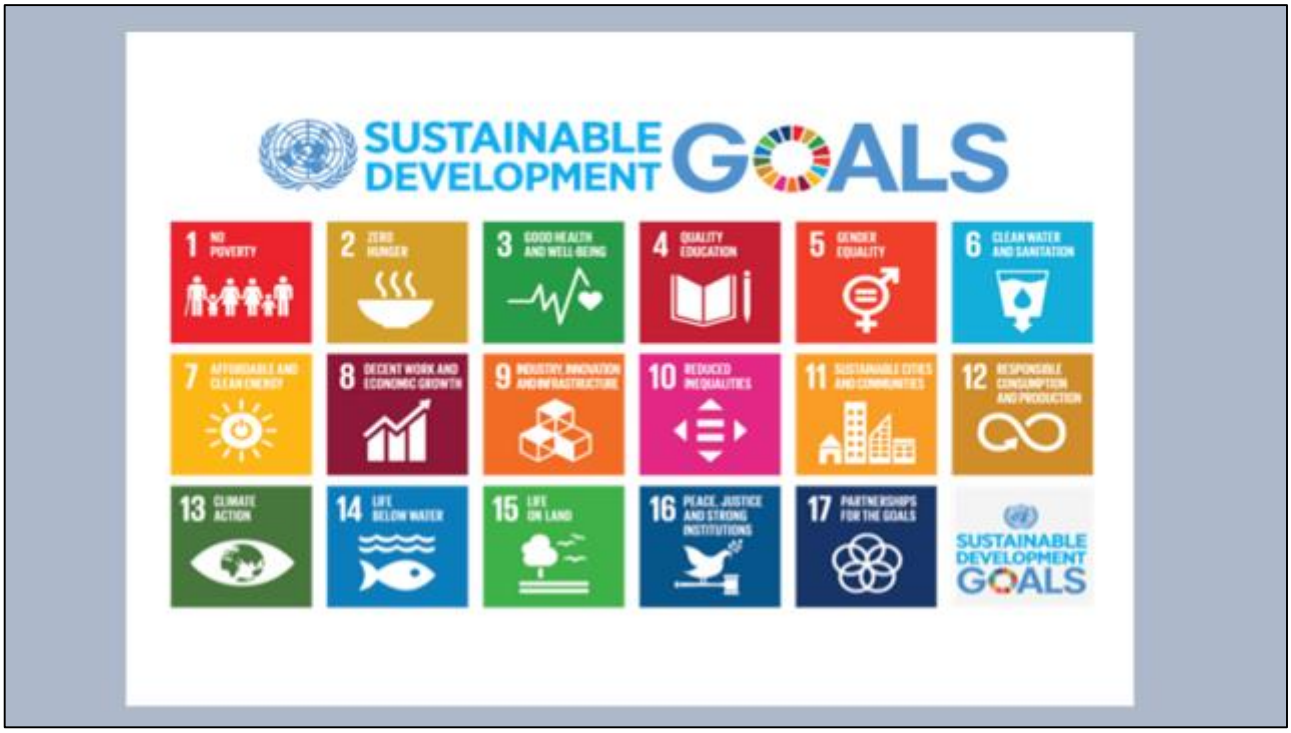
3rd International Meeting on Healthcare Systems Design Research
Cambridge Dec 2-3 2019

The Global Sustainable Development Health Goals: a missed opportunity for design - or a continuing design challenge?

Geoff Royston, Independent

In 2015 seventeen global Sustainable Development Goals were agreed by *all* 193 member states of the UN

- WHAT – an ambitious and universal set of 17 goals and 169 targets, with associated indicators, applicable to *all* countries, for the period 2015-2030
- WHY – to build on the Millennium Development Goals but to be:
  - *more comprehensive* - "balancing the three dimensions of sustainable development : the economic, social and environmental"
  - *more interconnected* - "integrated and indivisible goals and targets"
  - *more inclusive* - "leaving no one behind"
- HOW – a 3 year inter-governmental negotiation process


SUSTAINABLE DEVELOPMENT GOALS
1 NO POVERTY
2 ZERO HUNGER
3 GOOD HEALTH AND WELL-BEING
4 QUALITY EDUCATION
5 GENDER EQUALITY
6 CLEAN WATER AND SANITATION
7 AFFORDABLE AND CLEAN ENERGY
8 DECENT WORK AND ECONOMIC GROWTH
9 INDUSTRY, INNOVATION AND INFRASTRUCTURE
10 REDUCED INEQUALITIES
11 SUSTAINABLE CITIES AND COMMUNITIES
12 RESPONSIBLE CONSUMPTION AND PRODUCTION
13 CLIMATE ACTION
14 LIFE BELOW WATER
15 LIFE ON LAND
16 PEACE, JUSTICE AND STRONG INSTITUTIONS
17 PARTNERSHIPS FOR THE GOALS
SUSTAINABLE DEVELOPMENT GOALS


#1: End poverty in all its forms everywhere
#3: Ensure healthy lives and promote well-being for all at all ages
#5: Achieve gender equality and empower women and girls
#10: Reduce inequality within and among countries
#13: Take urgent action to combat climate change and its impacts*
#17: Revitalize the global partnership for sustainable development

There is a specific SDG on health

As for other SDGs, the health *goal* is broad, the associated *targets* are more specific

e.g

- *Goal* SDG3 " Ensure healthy lives and promote well being for all ages "
- *Target* SDG 3.1 " By 2030, reduce global maternal mortality ratio to less than 70 per 100,000 live births "

The goals within a goal: Health targets for SDG 3

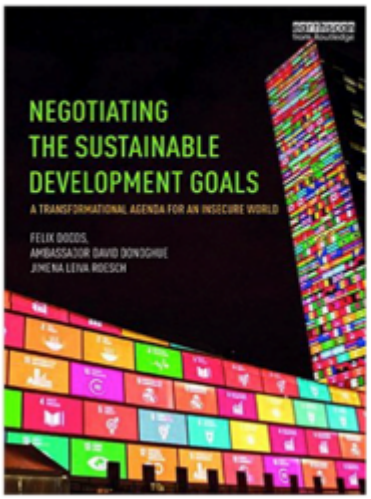
3.1 By 2030, reduce the global maternal mortality ratio to less than 70 per 100 000 live births.
3.2 By 2030, end preventable deaths of newborns and children under 5 years of age, with all countries aiming to reduce neonatal mortality to at least as low as 12 per 1000 live births and under-5 mortality to at least as low as 25 per 1000 live births.
3.3 By 2030, end the epidemics of AIDS, tuberculosis, malaria and neglected tropical diseases and combat hepatitis, water-borne diseases and other communicable diseases.
3.4 By 2030, reduce by one third premature mortality from non-communicable diseases through prevention and treatment and promote mental health and well-being.
3.5 Strengthen the prevention and treatment of substance abuse, including narcotic drug abuse and harmful use of alcohol.
3.6 By 2020, halve the number of global deaths and injuries from road traffic accidents.
3.7 By 2030, ensure universal access to sexual and reproductive health-care services, including for family planning, information and education, and the integration of reproductive health into national strategies and programmes.
3.8 Achieve universal health coverage, including financial risk protection, access to quality essential health-care services and access to safe, effective, quality and affordable essential medicines and vaccines for all.
3.9 By 2030, substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination.
3.a Strengthen the implementation of the WHO Framework Convention on Tobacco Control in all countries, as appropriate.
3.b Support the research and development of vaccines and medicines for the communicable and non-communicable diseases that primarily affect developing countries, provide access to affordable essential medicines and vaccines, in accordance with the Doha Declaration on the TRIPS Agreement and Public Health, which affirms the right of developing countries to use to the full the provisions in the Agreement on Trade-Related Aspects of Intellectual Property Rights regarding flexibilities to protect public health, and, in particular, provide access to medicines for all.
3.c Substantially increase health financing and the recruitment, development, training and retention of the health workforce in developing countries, especially in least developed countries and small island developing States.
3.d Strengthen the capacity of all countries, in particular developing countries, for early warning, risk reduction and management of national and global health risks.

The importance of system interconnections - not least for health - was recognised – in principle….

"there are deep interconnections and many cross-cutting elements across the new Goals and targets"
(UN; The 2030 Agenda for Sustainable Development)

There is even a specific target on coherence - SDG 17.14 is "*Enhance policy coherence for sustainable development*".

…. but the SDG development process gave little opportunity to analyse interconnections



- Fundamentally an (arduous) inter-governmental *negotiated* process
- There is a whole book about the negotiation process itself!

- Limited analysis in formulation of goals or targets
- Such analysis of SDG interdependencies as has been carried out has been *after* their design

Little attempt at designing for systemic coherence of goals or targets

Sustainable development (and hence progressing the SDGs) has the makings of a "wicked" problem

e.g.

- No definitive formulation or permanent solution
- Problem is connected to other problems
- Unbounded set of potential interventions
- Considerable uncertainty and ambiguity
- Little opportunity to learn by trial and error
- Multiple trade-offs and value conflicts
- Cultural, political and economic constraints

Tackling wicked problems calls for a *design* approach

So *systems design support is needed for progressing the SDGs*

And it's not too late - *there is still design work to be done* - implementing, monitoring and evaluating progress on the SDGs is itself a major design challenge

The Sustainable Development Goals Report 2019

"It is abundantly clear that a much deeper, faster and more ambitious response is needed to unleash the social and economic transformation needed to achieve our 2030 goals"

António Guterres
Secretary-General of the United Nations

There are some emerging signs of recognition of the need for a design approach for the SDGs

Implementing the health SDG could be a good place to develop design contributions

- It has more connections to other SDGs than most
- It is generally regarded as a key SDG to progress rapidly
- The preceding Millennium Development Goals were mostly about health, so there is some experience to build on

Possible channels for engagement

E.g.

- Nationally - helping with government, business and community efforts on implementing the health SDGs for the UK

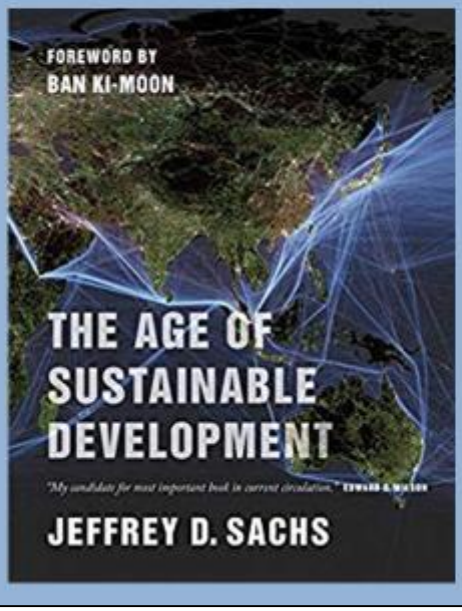
- Internationally - working with countries around the world and on health SDG implementation

- Globally – working with international organisations e.g. the WHO, UNESCO with global responsibilities for aspects of health SDG implementation, monitoring and evaluation

Discussion points

- Key systemic health SDG issues where design, systems and operational research approaches could help? ?
- Key types of contributions the design, systems and operational research communities could make?
- Key channels for engagement?

Further reading



Wrap-up and next steps
Lead: Professor Maaike Kleinsmann, Technology University of Delft, The Netherlands

Preliminary arrangements for HSDR 4

Date: November/December 2020

Location: – Delft University of Technology (TU Delft), The Netherlands