

# › Driving collective change ‹ in a digital world

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## The game has changed. Permanently.

As a generation that is more digitally sophisticated than any previously, students expect to be taught and to learn using methods that suit their **personal preferences** and at a pace that they have chosen, not one that is mandated to them. <sup>1</sup>



The real importance of digital to business is not in the emergence of new technology; the importance is the **shift in customer behaviour.** <sup>2</sup>

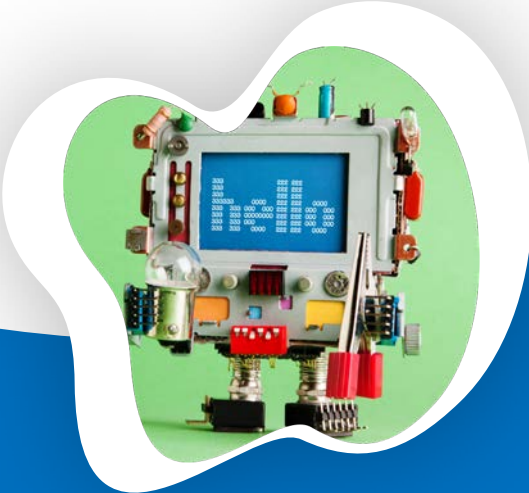




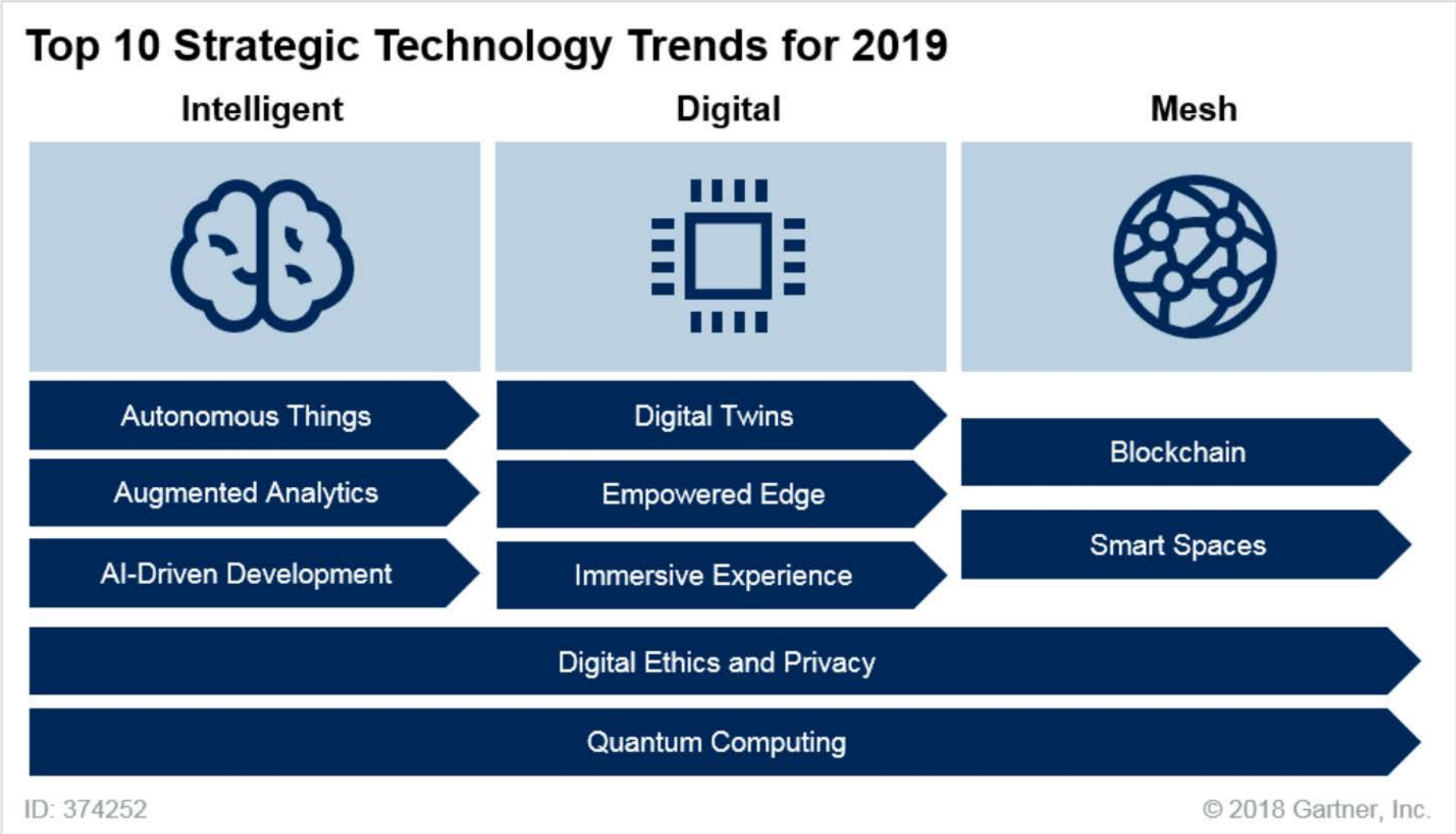
There is no turning back from digital in HE. The digital demand is real, and HE institutions must start making the grade or risk irrelevance in the **digital era**.<sup>3</sup>



The way we experience a digitally enabled world is changing. Through 2024, AI will seep into every software, service and physical asset, driving a new level of automation. That automation will free us for more creative activities – **AI augmented humans**.<sup>4</sup>



# The challenge of digital



# What does higher education research say?

## NMC Horizon Report – Higher Education 2018 <sup>5</sup>

### Important Developments in Technology for Higher Education



**Long-Term** Driving technology adoption in Higher Education for five or more years

Advancing Cultures of Innovation  
Cross-Institution & Cross-Sector Collaboration



- Advancing innovative services and operations requires a **reimagining of organizational structures**
- Artificial intelligence and the Internet of Things are poised to amplify the utility and reach of library services.
- Enabled by **digital scholarship** technologies, the research landscape is evolving



## SCONUL – Mapping the Future of Academic Libraries (1/2) <sup>8</sup>

There is no equivalent venue to the physical library online, only signposting to disparate resources

Digital Equivalence of Experience?

Library as a service-provider, **partner** and **leader**

## SCONUL – Mapping the Future of Academic Libraries (2/2)

Carry out investigation and development of services in the areas of artificial intelligence, machine learning, internet of things, digital humanities, and other areas of **datafied scholarship**

Investigate the possibilities of developing **collaborations** to create **meaningful** online scholarly venues to complement library physical spaces.



**RLUK** Research Libraries UK <sup>9</sup> is a consortium of 37 research intensive libraries. On behalf of its members, it has a clear commitment to transformations in research, innovation in collections, and cultural change in our institutions.

The two strands that I champion are Digital Scholarship and Digital Shift. See the Digital Scholarship report<sup>10</sup> and Digital Shift strand is being revised to reflect technological advances including ML/AI.

## Is AI really the next big thing?

If we go with Gartner Hype cycles <sup>11</sup>, then **may be**, but what kind of AI?

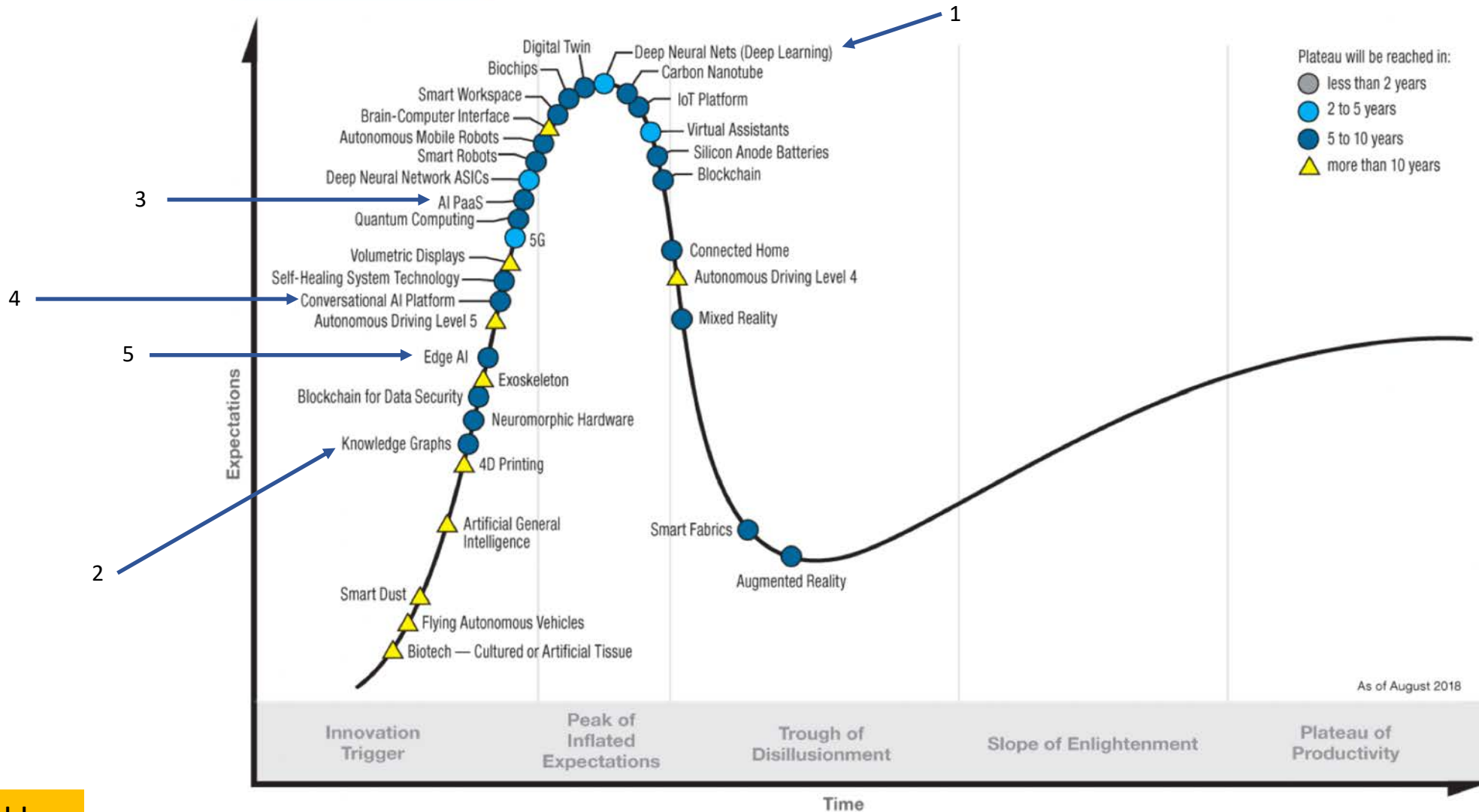
It is possible that in the future, we will have AI machines that are as smart and **adaptable** as humans.

However, many experts believe that this won't be for several decades.



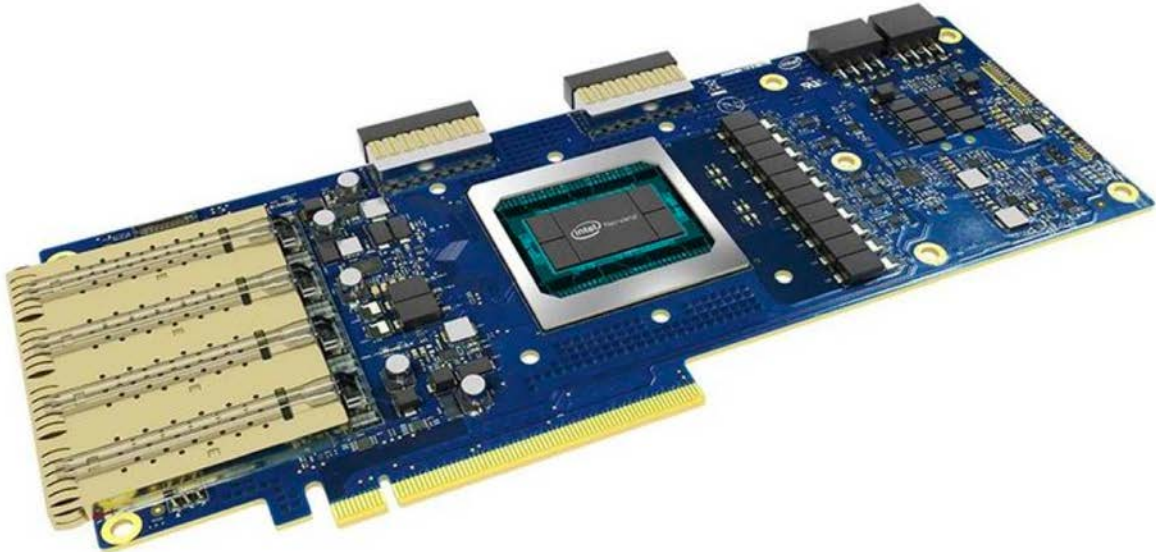


## Hype Cycle for Emerging Technologies, 2018

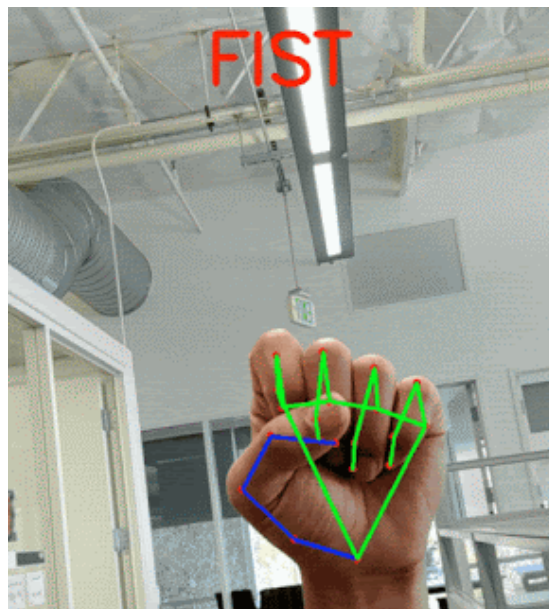
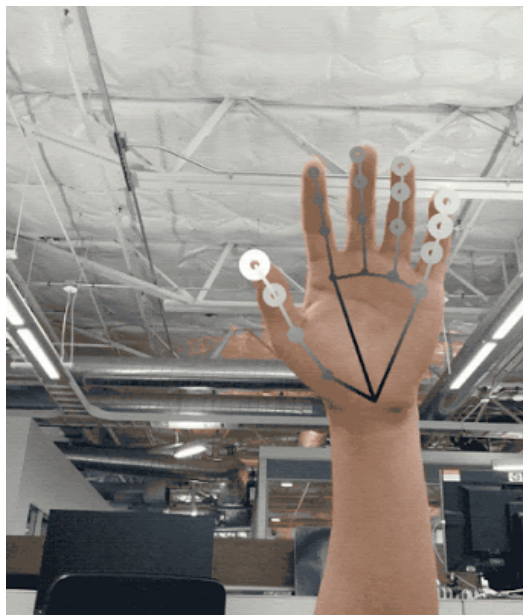


## Deep Neural Network ASICs

Built from the ground up to train deep learning models at scale, Intel Nervana NNP-T (Neural Network Processor)<sup>12</sup> pushes the boundaries of deep learning training.



# On-Device, Real-Time Hand Tracking <sup>13</sup>





## Adaptive teaching/learning

Predicted in Innovating Pedagogy<sup>14</sup> series in 2015 with an implementation time frame of 4+ years. McGraw-Hill ALEKS<sup>15</sup> and Squirrel<sup>16</sup> are two big examples.





## Innovating Pedagogy 2019 <sup>17</sup>.

### Technical

Learning with Robots, Drone-based learning, Virtual studios

### Emotional and practical

Playful Learning, Learning through wonder, Place based learning, Action Learning, Making thinking visible, Roots of empathy



## Specialised Intelligence

The ability to achieve specific goals effectively in a given environment.

## General Intelligence

The ability to achieve a wide range of different goals effectively in different environments.

## Super Intelligence

The ability to greatly exceed the cognitive performance of humans in virtually all domains of interest.



## General Collective Intelligence <sup>18</sup>

Group versatility or group adaptability

The concept of perceptiveness, regardless of whether it is in person or online along with individual intelligence.



## Can machines have perceptiveness? Strategic thinking? Long-term planning?

Basically General Artificial Intelligence.

Over time, the boundaries between what people do and what machines do will keep changing, but at any given time, humans will do the things the machine can't. <sup>18</sup>

A study also looked at 95 predictions about when general AI would be achieved between 1950 and 2012. A strong tendency was found that the prediction has always been between 15 and 25 years. <sup>18</sup>

## Pathways to General Artificial Intelligence

Develop common sense through defining rules for everything. See Cyc<sup>19</sup> for an example

Develop common sense through [big data analysis](#).

Big Data analysis often requires machine learning – supervised and unsupervised.

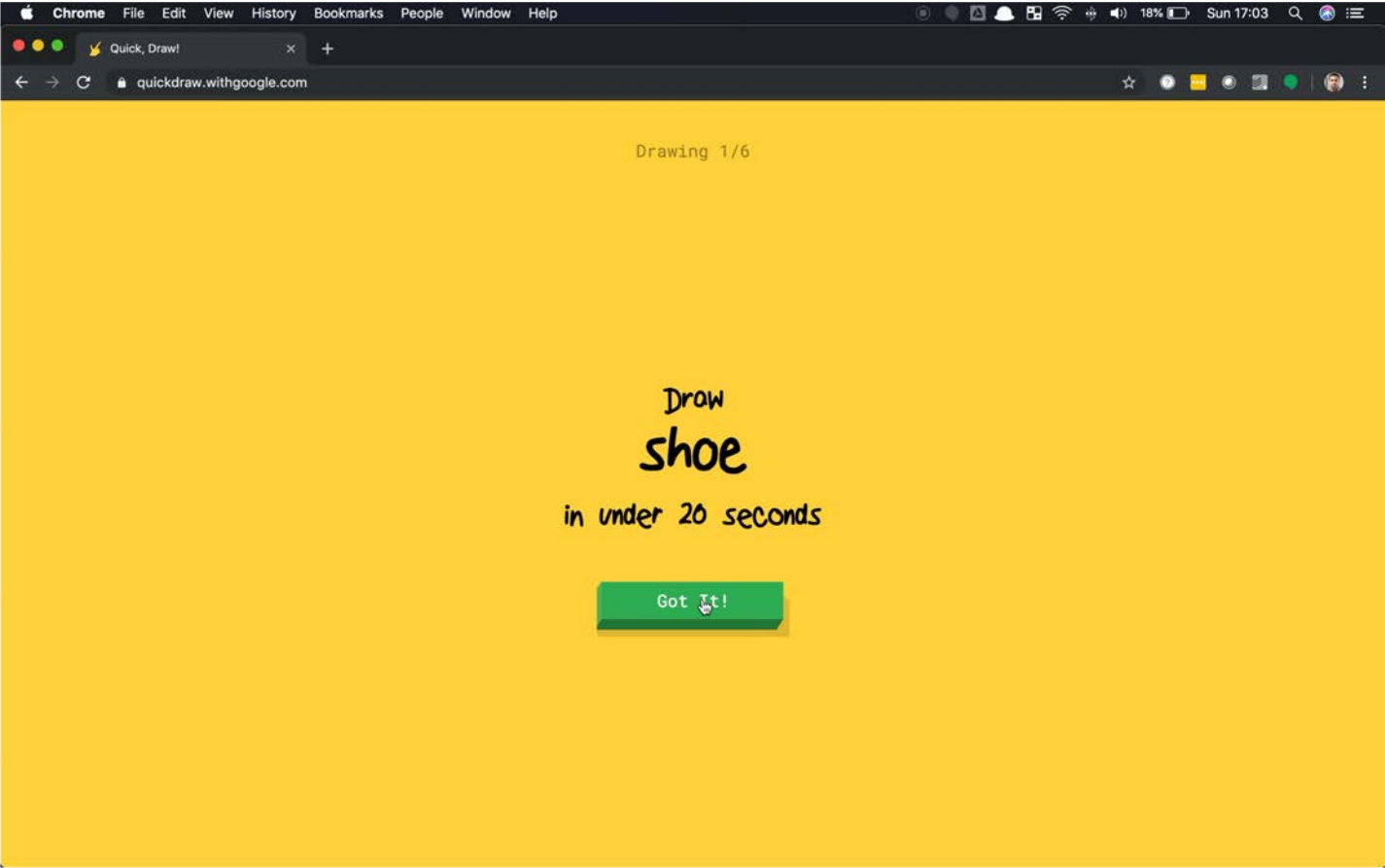
Neuromorphic computing – billions of computers simulating neurons in a human brain.

# Machine Learning examples

Google Draw

supervised learning

Autonomous vehicles,  
image classification,  
customer experience,  
etc – deep learning





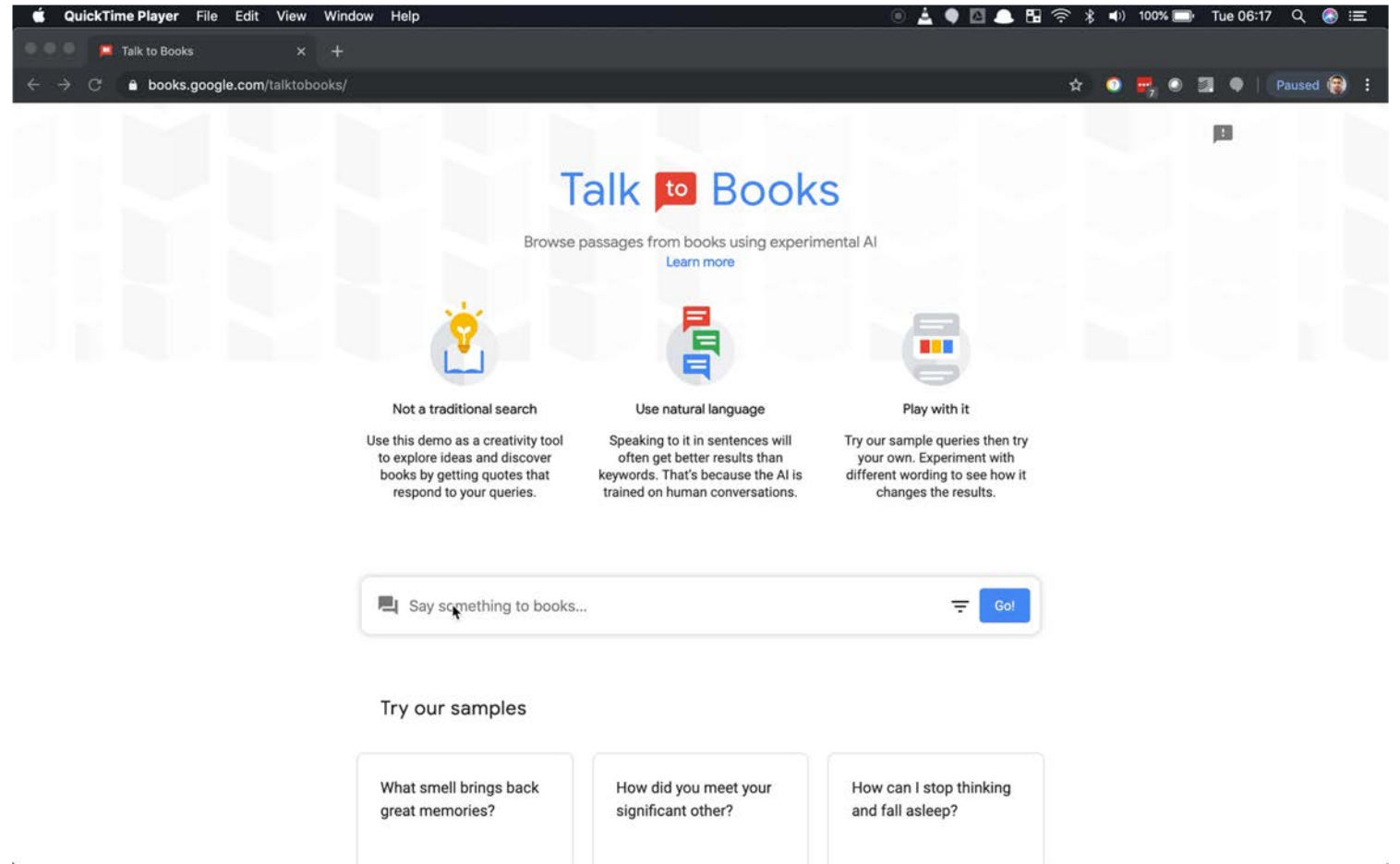
## Talk to Books

## Google Semantic Experiences

## Experiments in understanding

## Language <sup>6</sup>

## New Primo search algorithm?



Specialised AI is here and  
General AI **might be** decades  
away.

## DOTA2


DOTA 2 - It is an extremely complex, high strategy, high coordination game.

Remember when an AI won Jeopardy or when an AI beat world-class Chess or Go players. (Chess = 8x8, Go=19x19, DOTA2=15000x15000)

We have coached the AI to learn just by playing against itself. No strategy was given, no human training was given, starts from complete randomness, makes small adjustments and eventually reaches professional level.

## DOTA2 – OG vs OpenAI

### Human View



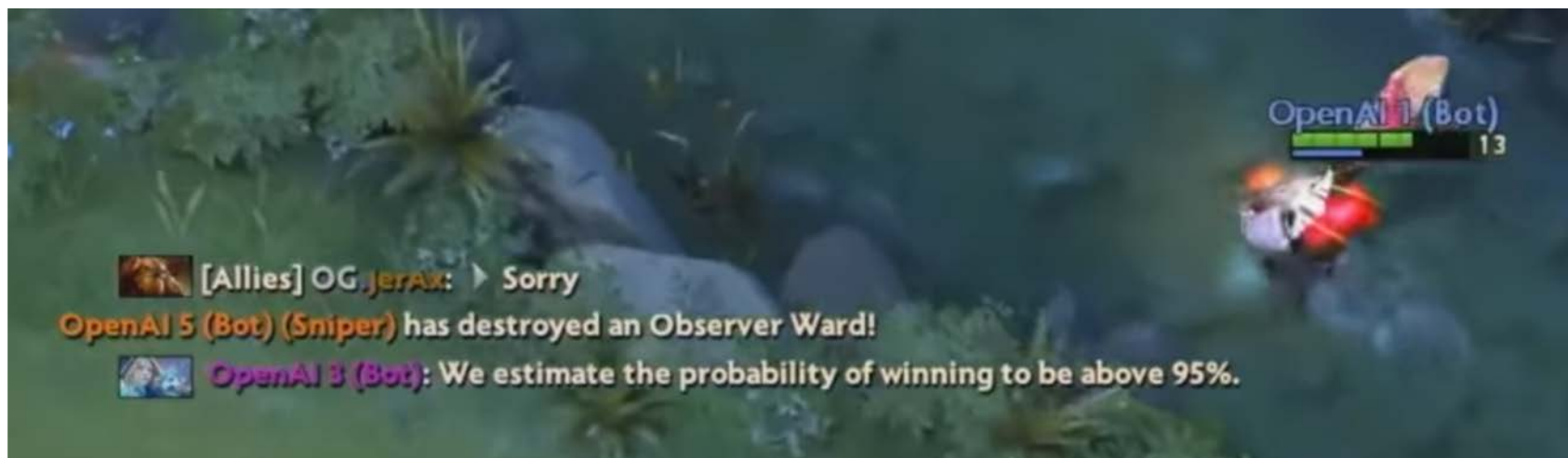
### AI View

3.006	-1.386	-0.4695	0.883	1	0.84
-0.3154	-0.5425	-0.5	0.866	0	0.82
3.11	-1.36	-0.9336	0.3584	1	0.78
-2.324	2.863	0.9746	0.225	0	0.86
3.037	-1.361	-0.7773	0.6294	1	0.82
-1.387	2.951	0.988	0.1565	0	0.74
3.023	-0.9395	0.05234	-0.9985	0	0.66
2.951	-0.5747	0.01746	1	0	0.72
2.963	-1.303	0.3906	0.9204	0	0.68
2.834	-3.164	0.01746	-1	0	0.68
3.127	-1.368	0.6562	0.755	1	0.55
3.088	-1.366	0.4695	0.883	0	0.55
2.984	-1.398	-0.225	0.9746	1	0.55
3.037	-1.391	0.788	0.6157	0	0.55
3.076	-1.438	0.883	0.4695	0	0.55
-2.412	2.846	0.996	0.08716	1	0.3

## DOTA2 – OG vs OpenAI

Game 1 – Open AI win probability at Roster selection – 67.6%

Game 1 – 20 minutes in – when humans seem to be winning by a small margin





## Other things you may want to read

Toward Grand Unified AGI – SingularityNET (the global AI network) <sup>21</sup>

Deep Neural Networks can detect sexual orientation from faces <sup>22</sup>

Open AI has a billion dollar investment by Microsoft <sup>23</sup>

The question is what can we do now, do we have the right skills, and how do we prepare for the near future?

**“Without libraries what have we? We have no past and no future.”**

**Ray Bradbury**

## Customer Layer

Personal preferences

Shift in customer behaviour

AI augmented Humans

## Data Layer

Datified Scholarship

Digital Scholarship

Big Data Analysis

## Organisational Layer

Digital era

Reimagining of structures

Partner

Collaborations

Adaptability

Meaningful venues

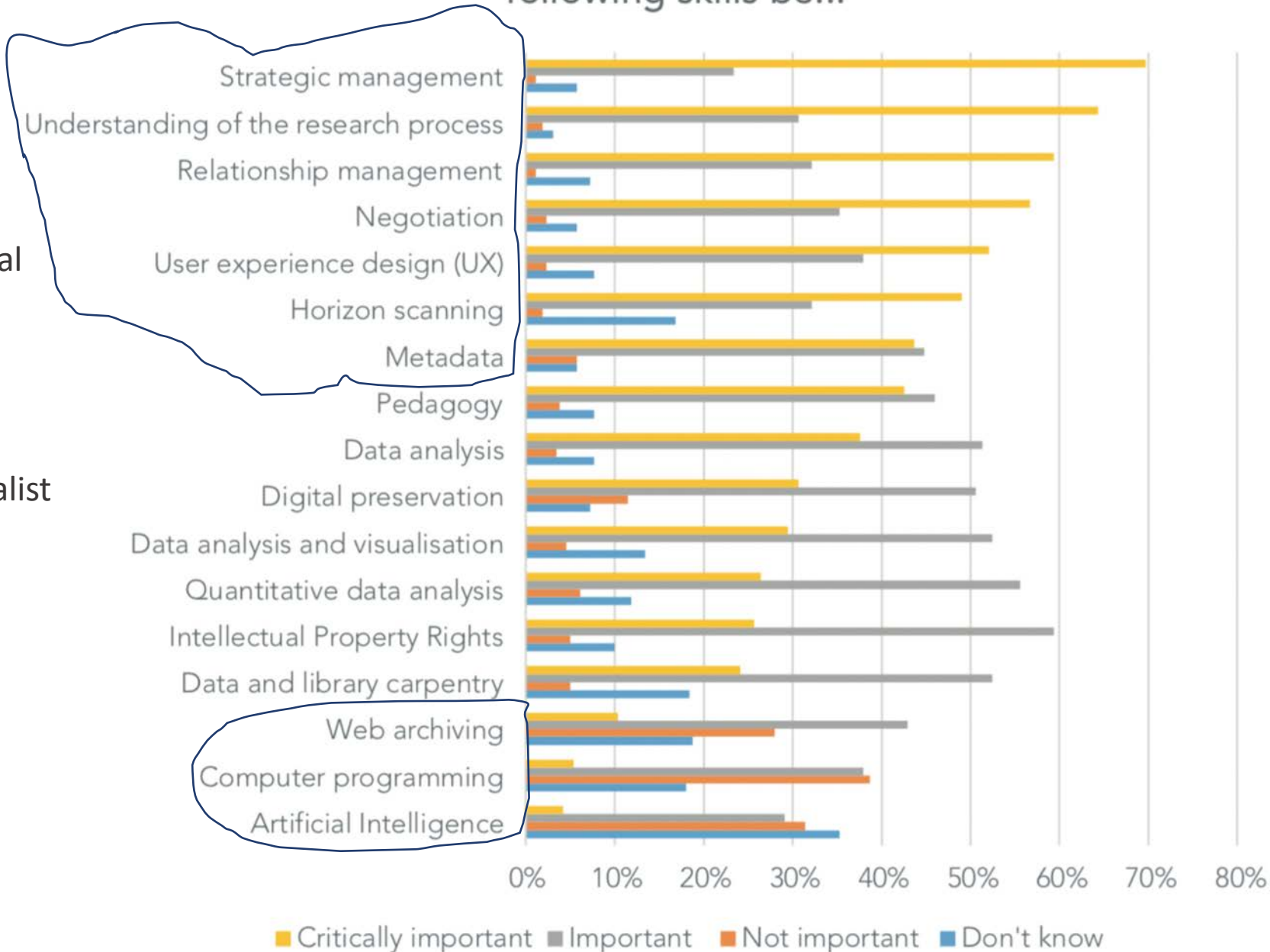
Leader

# Library skills: In your library how important will the following skills be...

Human / organisational

Data / Specialist

Digital



## Demographics

- 18-25 - 1%
- 26-35 - 14%
- 36-45 - 26%
- 46-55 - 38%
- 55-65 - 19%
- 65+ - 0%
- Prefer not to say - 1%

From Mapping the Future of Academic Libraries report by SCONUL<sup>8</sup>

# Skills required in Libraries

Our success requires our staff to develop expertise in one or more of these areas, and for us to champion organisational structures that harnesses their expertise and potential.





## Challenges

Space

Scholarship

Skills

Customer Experience

Data & Intelligence

Staffing and Culture

## Organisation

Portfolios

Programmes

Projects

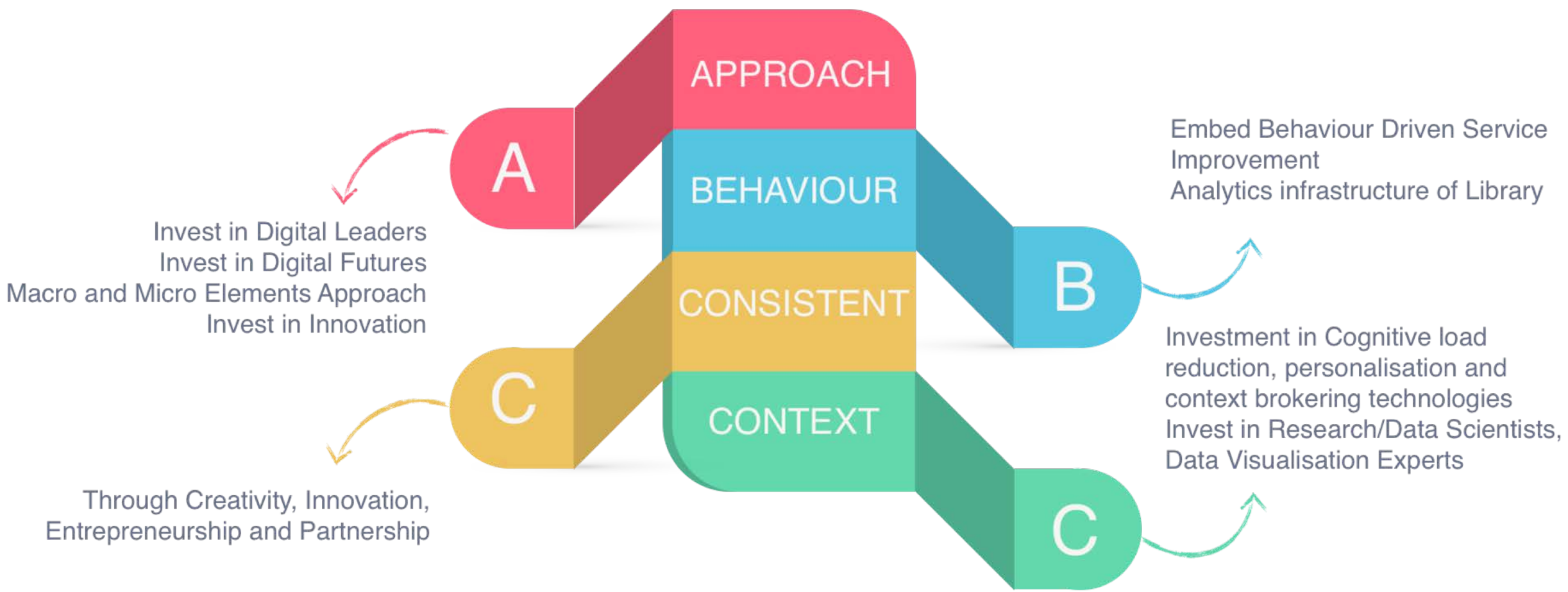
## Values

Customer Focus

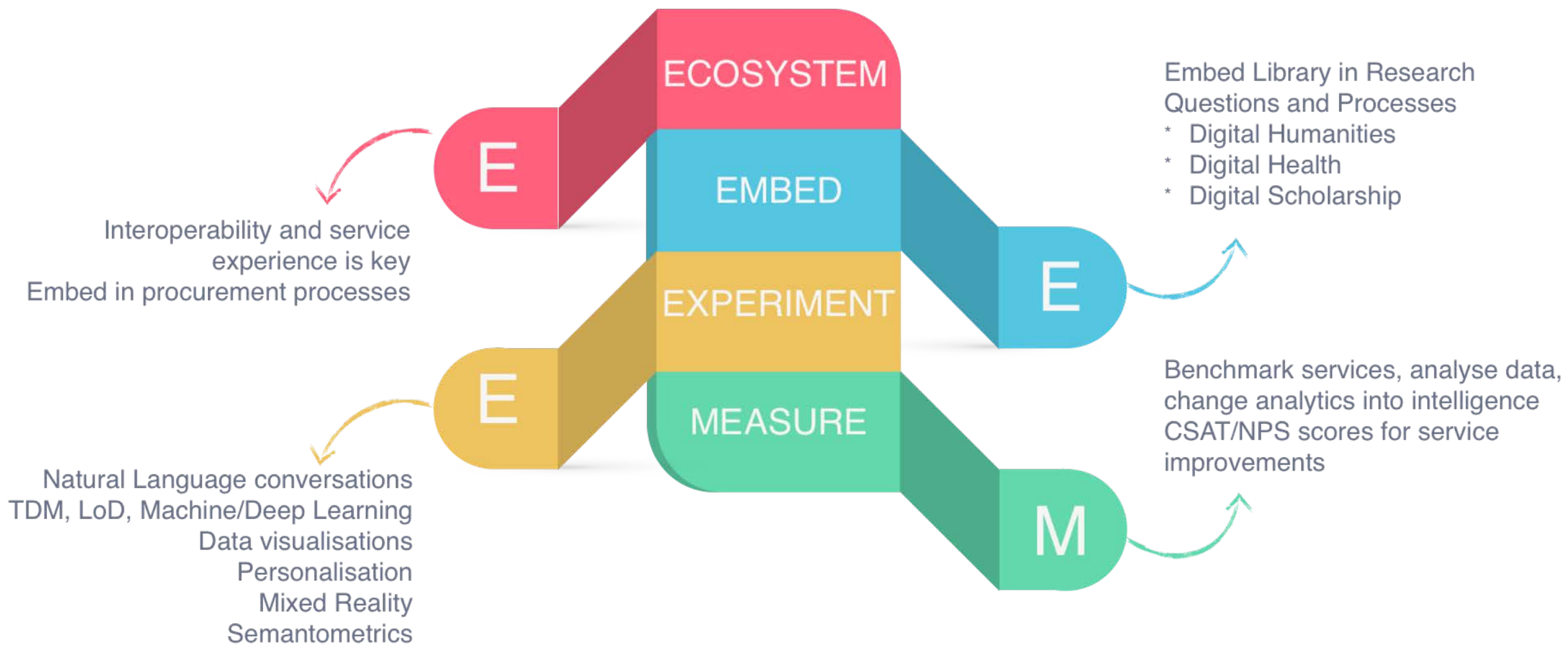
Continuous Improvement

Collaboration

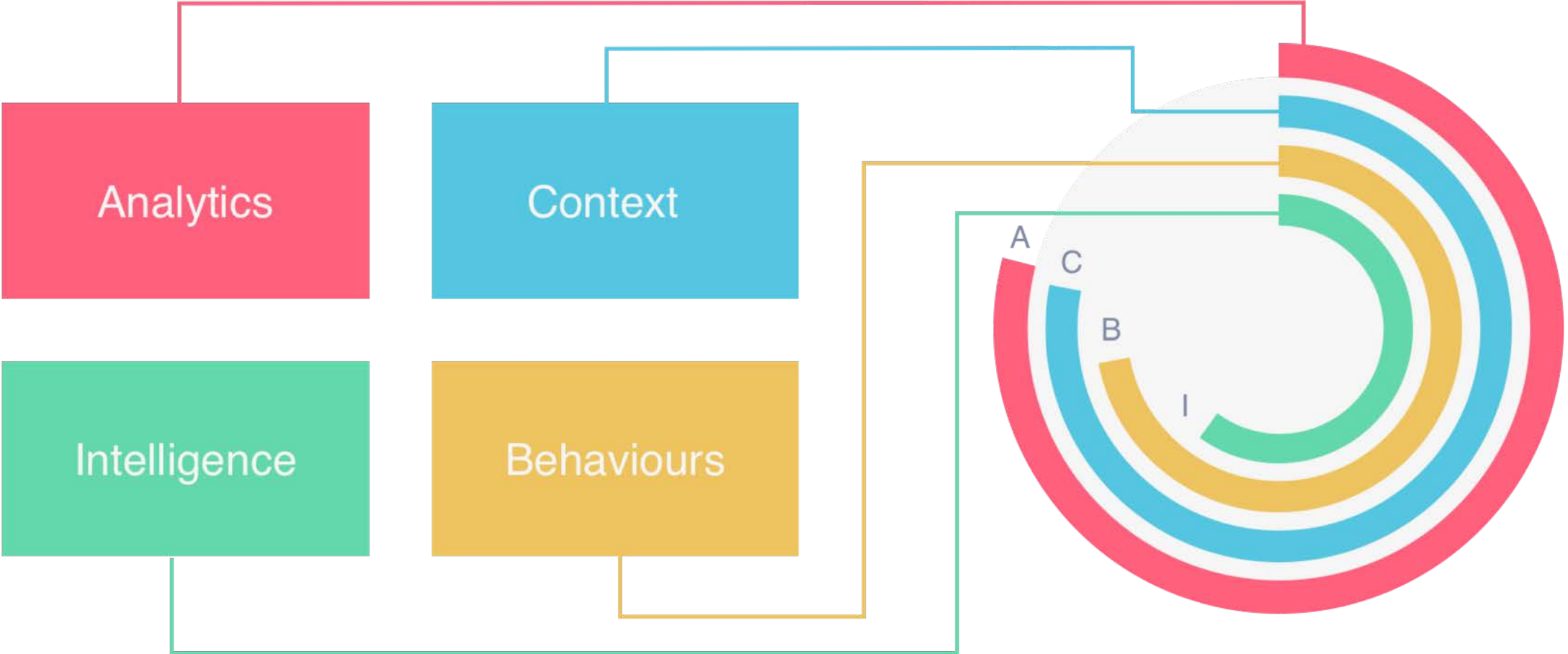
# Where next? Tackling Challenges (1/2)



# Where next? Tackling Challenges (2/2)



# Where next? – (Collaborative?) Intelligent personalisation



Develop a collective list of high quality machine learning datasets -

<https://guides.library.cmu.edu/machine-learning/datasets>

A common registry of all research datasets from across the world?

Global Digitised Dataset (GDD) Network<sup>24</sup> aims to develop a new collaboration between organisations with an interest in supporting the discovery of digitised materials

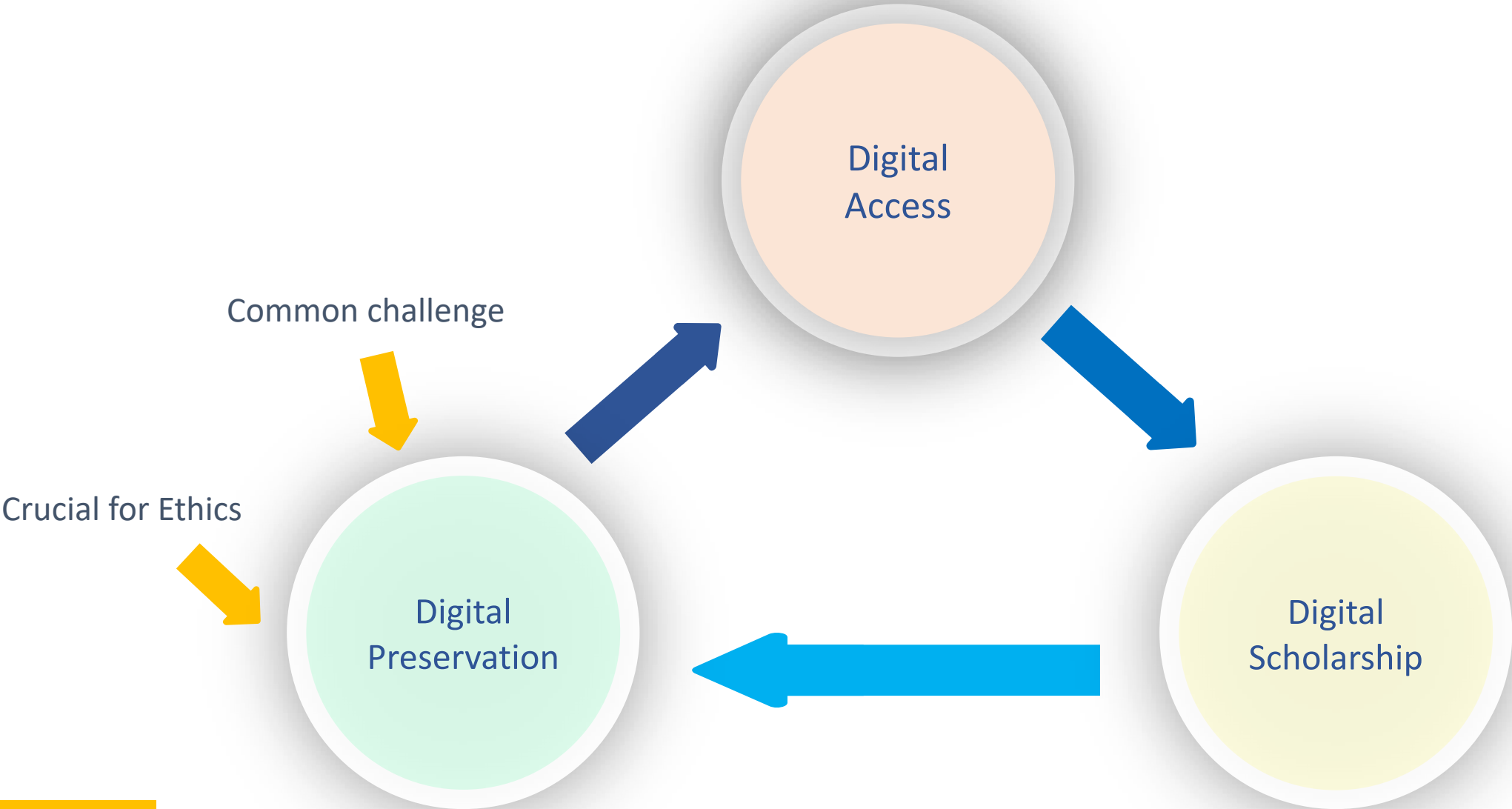
A common challenge that we can invest in solving? Special Collection images, personalised services for cognitive load reduction, the dark side of data and analytics, copyright and ethics

Exchange programmes for new skills development – both within and outside libraries?

Collaborative resolution to digital scholarship challenges, particularly in Arts and Humanities (TDM, Visualisations, Wrangling, Scripting, Computational thinking, etc).



# Where next? – Solving the digital triangle



... based in the MIT Libraries, to **enable bold experimentation** and to serve as a hub for best-in-class research on the great challenges in information science and scholarly communication.<sup>25</sup>

...the Libraries should generate open, interoperable content platforms that explore **new ways** of producing, using, sharing, and preserving knowledge and that promote **revolutionary new methodologies** for the discovery and organization of information, people, ideas, and networks.

## My concluding plea!

To convince your institutional/Library leaders to invest in data scientists and data wranglers.

To build a sense of urgency and importance behind this. Look at Collections as Data<sup>26</sup>, Digging into Data<sup>27</sup>, Library in the Life of the User<sup>28</sup>.

To put real staffing and money behind innovation and experimentation.

To empower and develop a culture of risk taking and an acceptance of failure.



# THANK'S



Questions?

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