The Way of the Foxy Hedgehog:
Reflections on Medical Education in an Age of Thinking Tools

Ruben R. Puentedura, Ph.D.

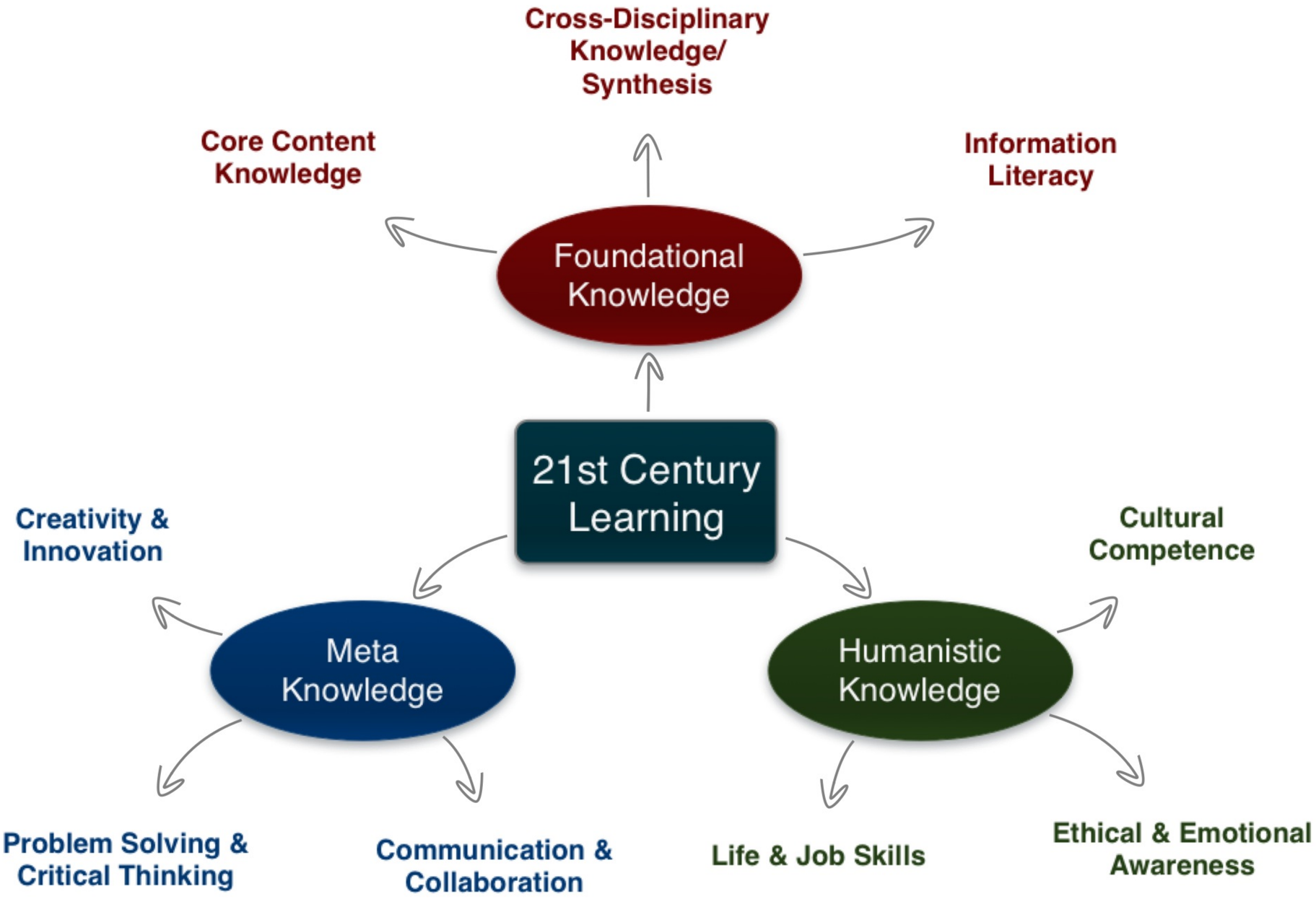
I. A Paradox

“The fox knows many things, but the hedgehog knows one big thing.”

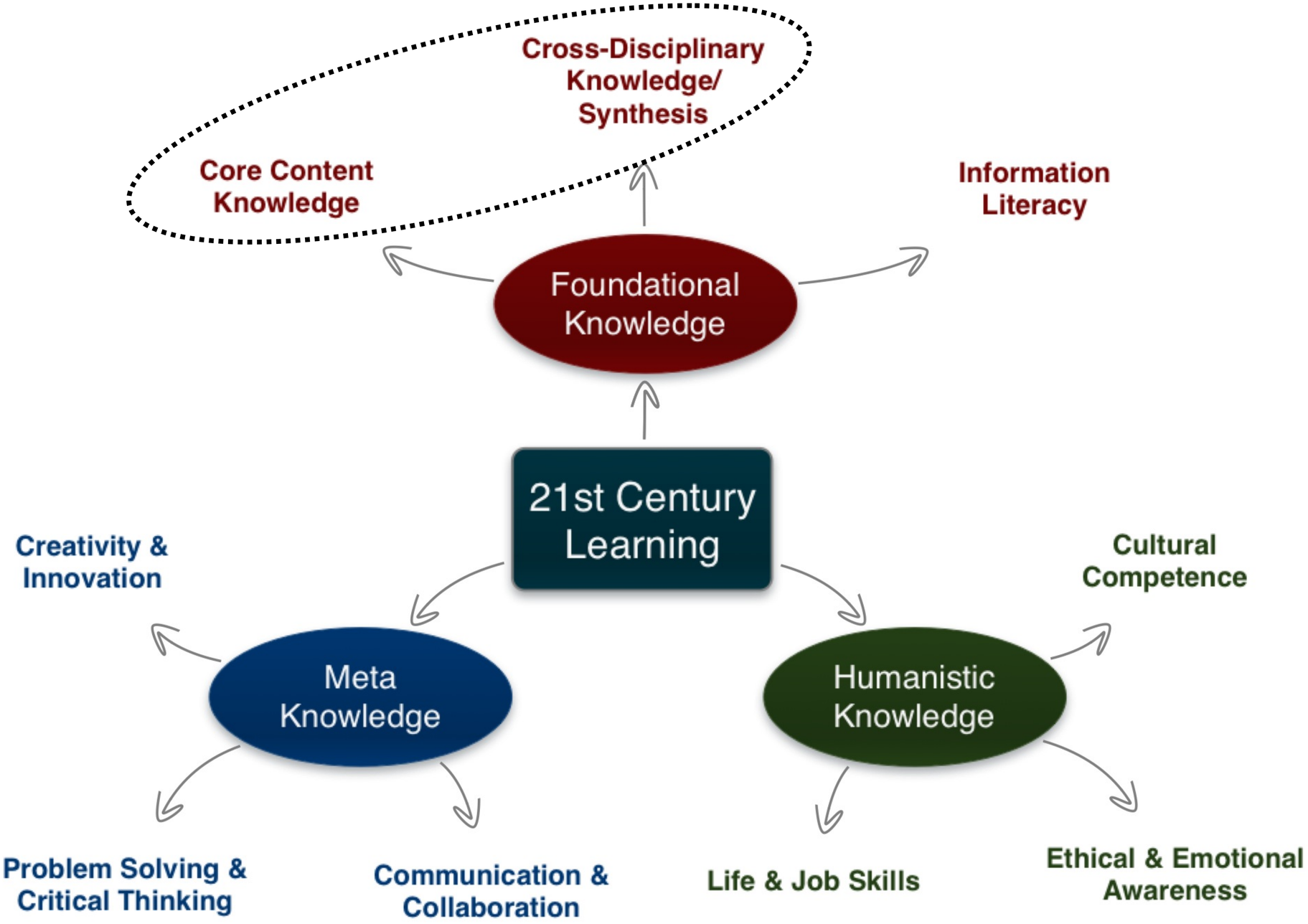
–Archilochus

“For there exists a great chasm between those, on one side, who relate everything to a single central vision, one system, less or more coherent or articulate, in terms of which they understand, think and feel [...] and, on the other side, those who pursue many ends, often unrelated and even contradictory, connected, if at all, only in some de facto way...”

–Isaiah Berlin, *The Hedgehog and the Fox*



Kristen Kereluik, Punya Mishra, Chris Fahnoe, and Laura Terry, "What Knowledge Is of Most Worth: Teacher Knowledge for 21st Century Learning". *Journal of Digital Learning in Teacher Education (29)* 4 (2013)



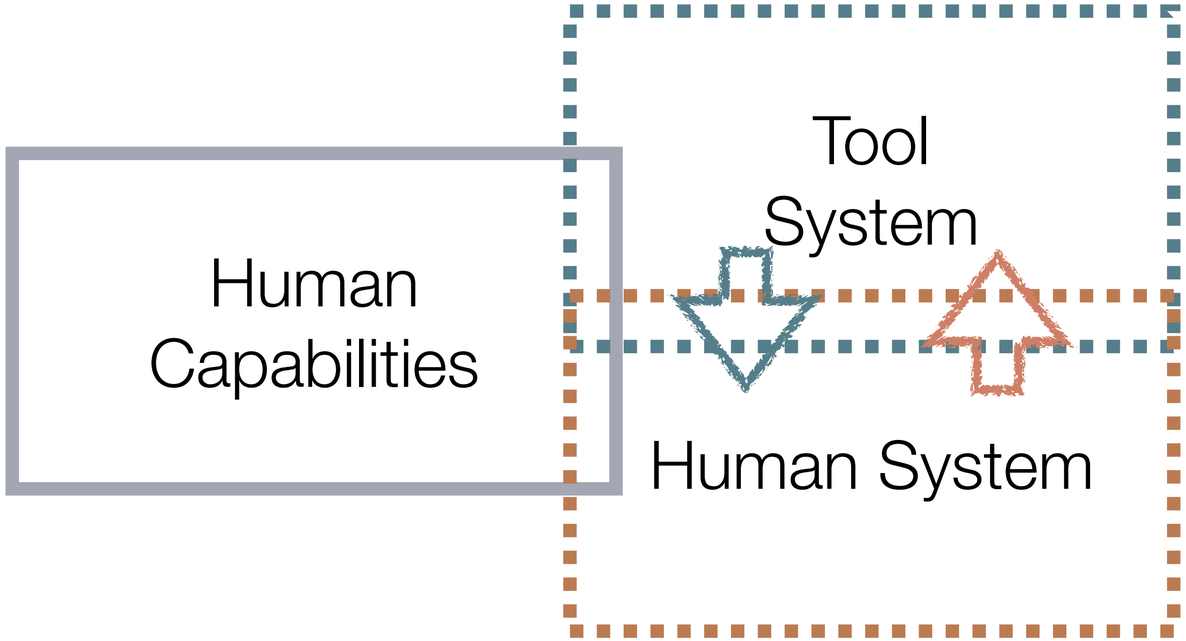
Kristen Kereluik, Punya Mishra, Chris Fahnoe, and Laura Terry, "What Knowledge Is of Most Worth: Teacher Knowledge for 21st Century Learning". *Journal of Digital Learning in Teacher Education (29)* 4 (2013)

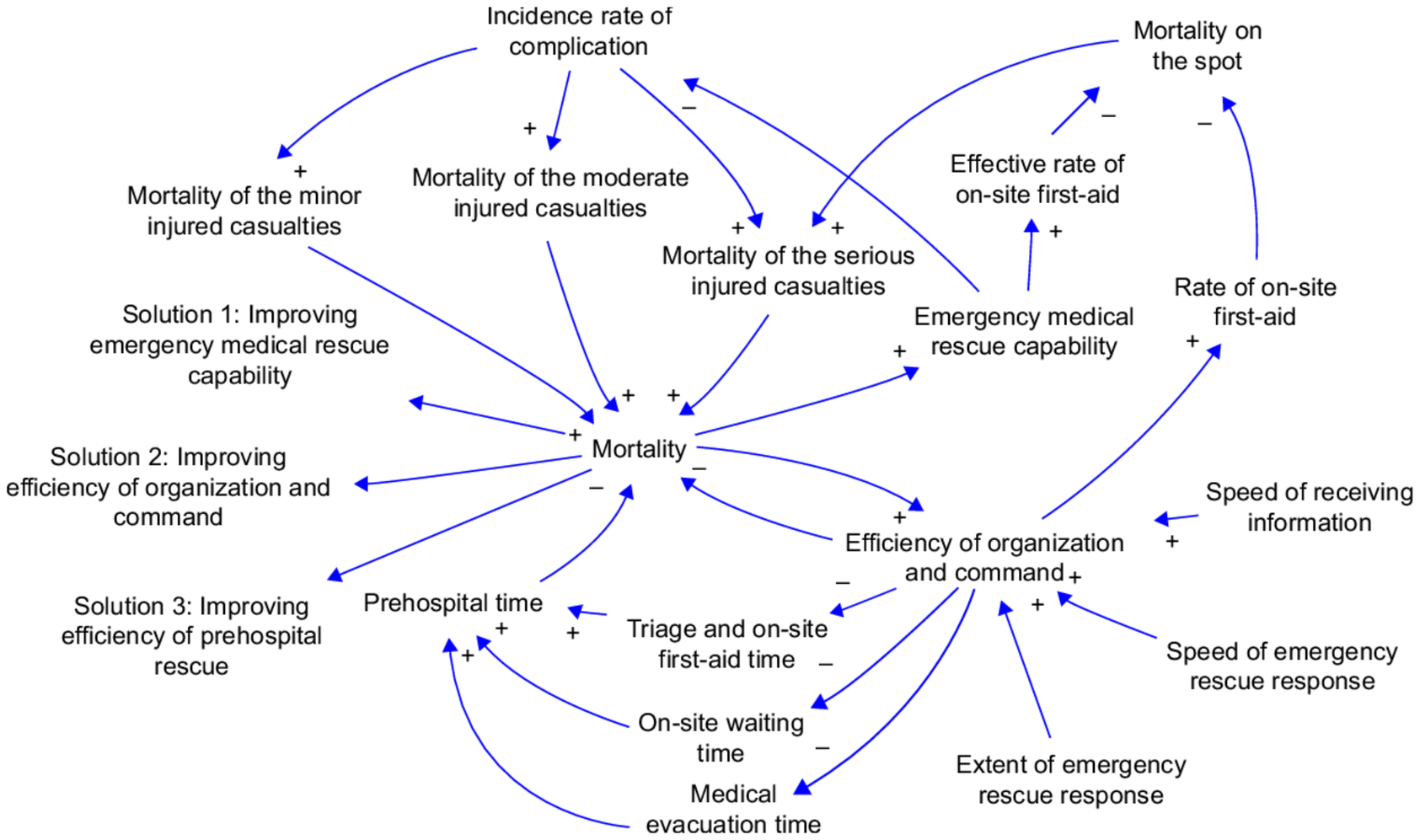
“If we may use a biological analogy, an innovation is like a genetic cross or hybrid; it is totally different from either of its parents, but it resembles both of them in some respects.”

–H.G. Barnett, *Innovation: The Basis of Cultural Change*


ROUTE SEE (ALPHA)
WORK
DRUGS
SHOES
LIBRARY

Bootstrapping the Augmentation System (Engelbart, 1968)





Yu, Wenya, et al. "Research of an emergency medical system for mass casualty incidents in Shanghai, China: a system dynamics model." *Patient preference and adherence* 12 (2018).

Use of System Dynamics Modeling in Medical Education and Research Projects

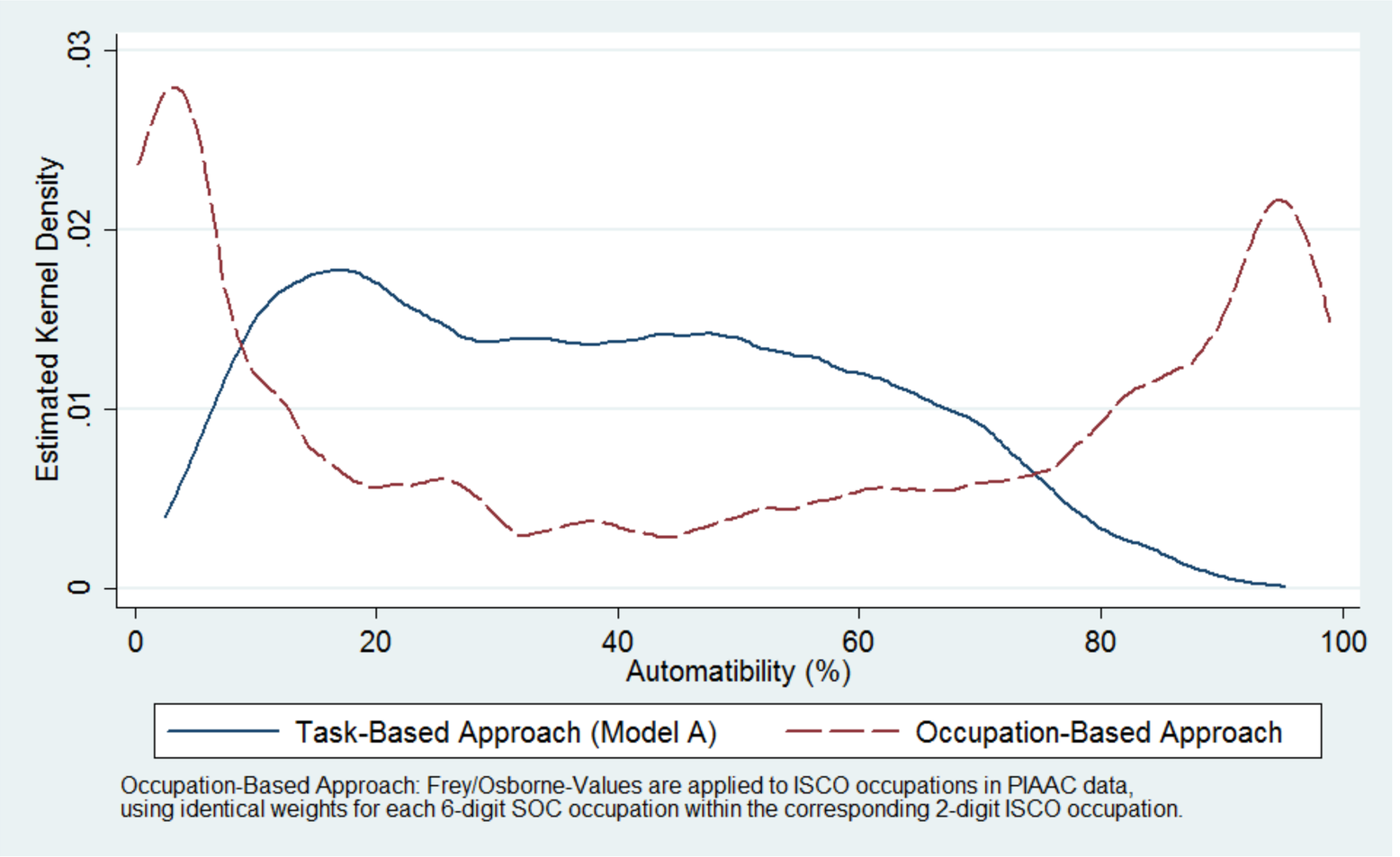
Jadranka BOZIKOV[a,1] , Danko RELIC[a] and Gjuro DEZELIC[a]
[a] *Andrija Stampar School of Public Health, School of Medicine, University of Zagreb, Zagreb, Croatia*

Abstract. The paper reviews experiences and accomplishments in application of system dynamics modeling in education, training and research projects at the Andrija Stampar School of Public Health, a branch of the Zagreb University School of Medicine, Croatia. A number of simulation models developed over the past 40 years are briefly described with regard to real problems concerned, objectives and modeling methods and techniques used. Many of them have been developed as the individual students' projects as a part of their graduation, MSc or PhD theses and subsequently published in journals or conference proceedings. Some of them were later used in teaching and simulation training. System dynamics modeling proved to be not only powerful method for research and decision making but also a useful tool in medical and nursing education enabling better understanding of dynamic systems' behavior.

Božikov, Jadranka, Danko Relić, and Gjuro Deželić. "Use of System Dynamics Modeling in Medical Education and Research Projects." *Studies in health technology and informatics* 247 (2018)

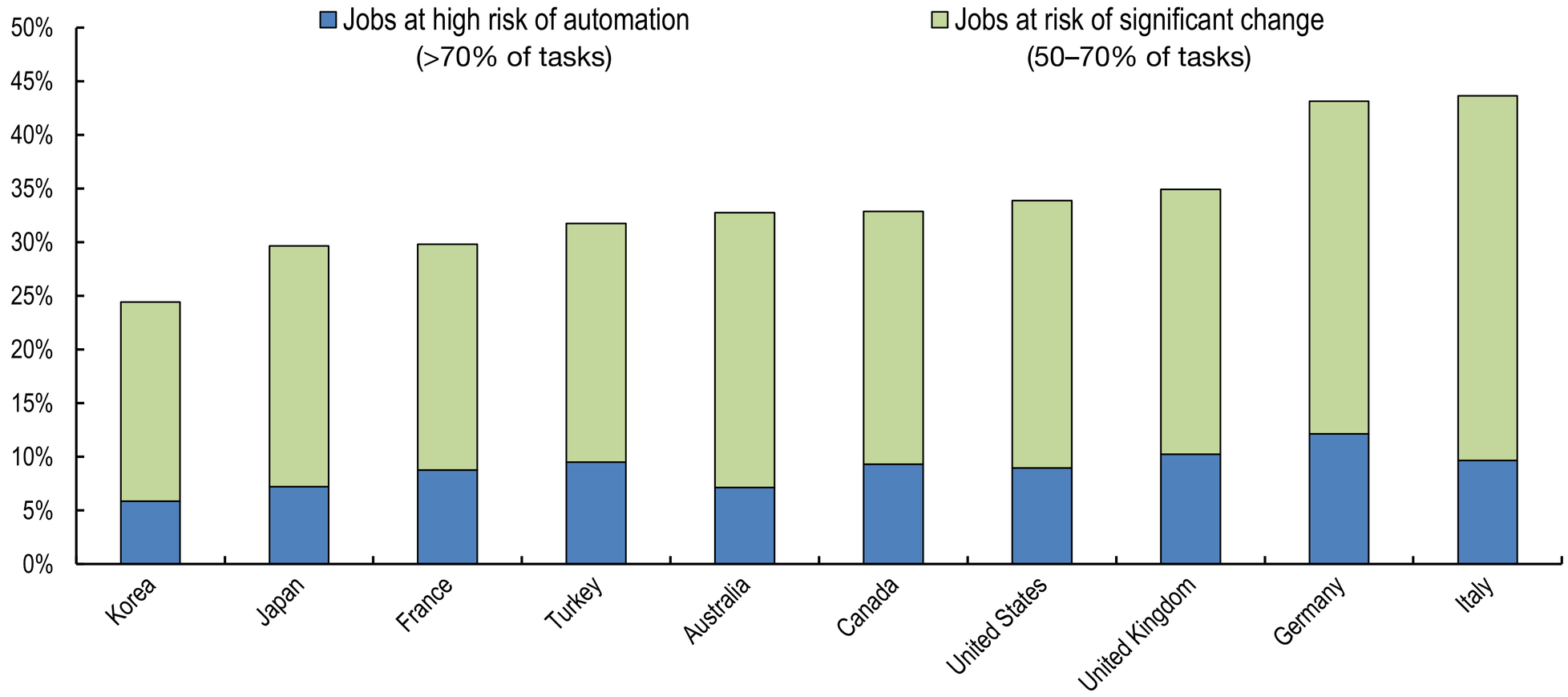
II. Enter AI

Distribution of Automatibility in the US (Task-Based vs. Occupation-Based Approach)

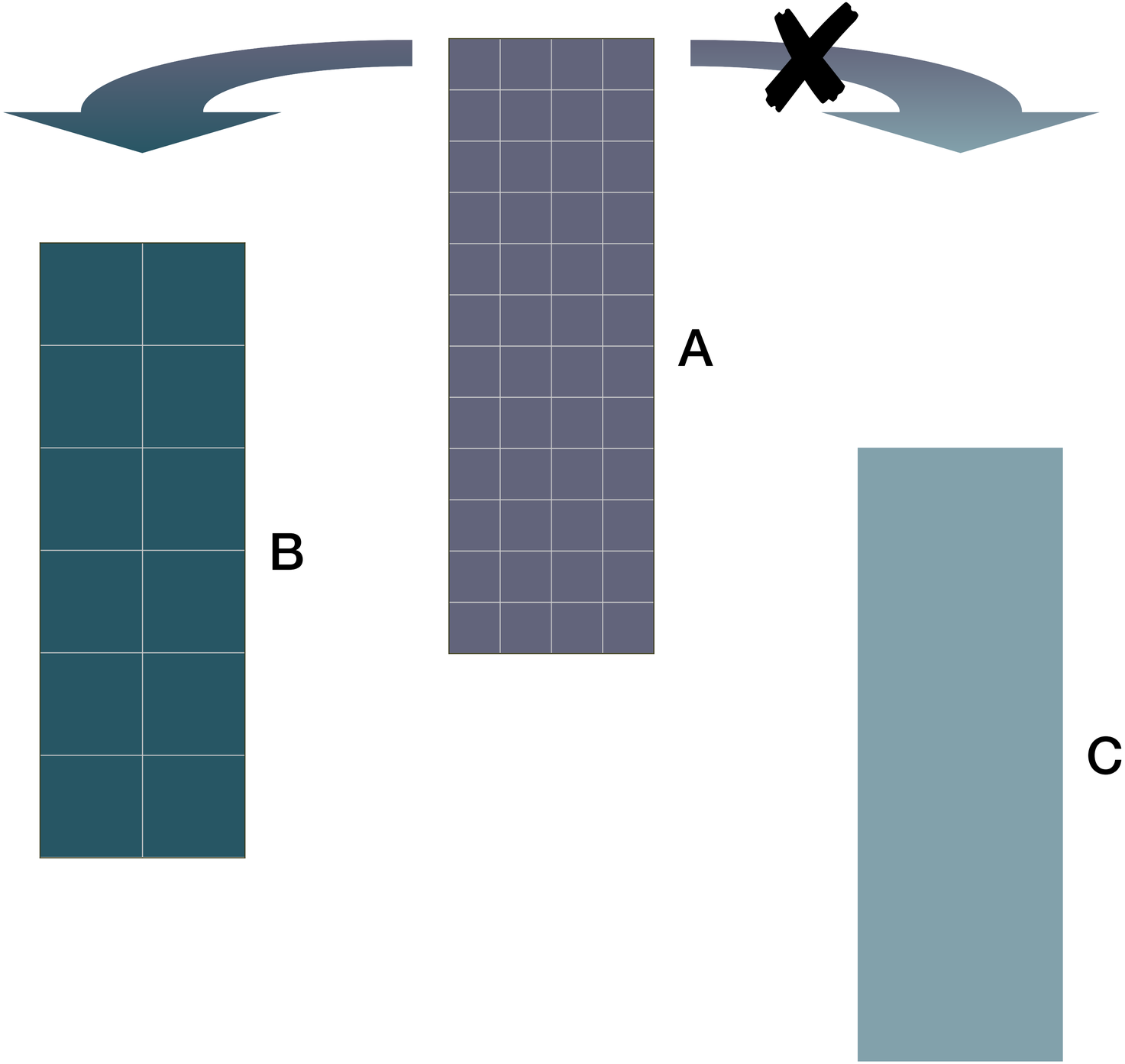


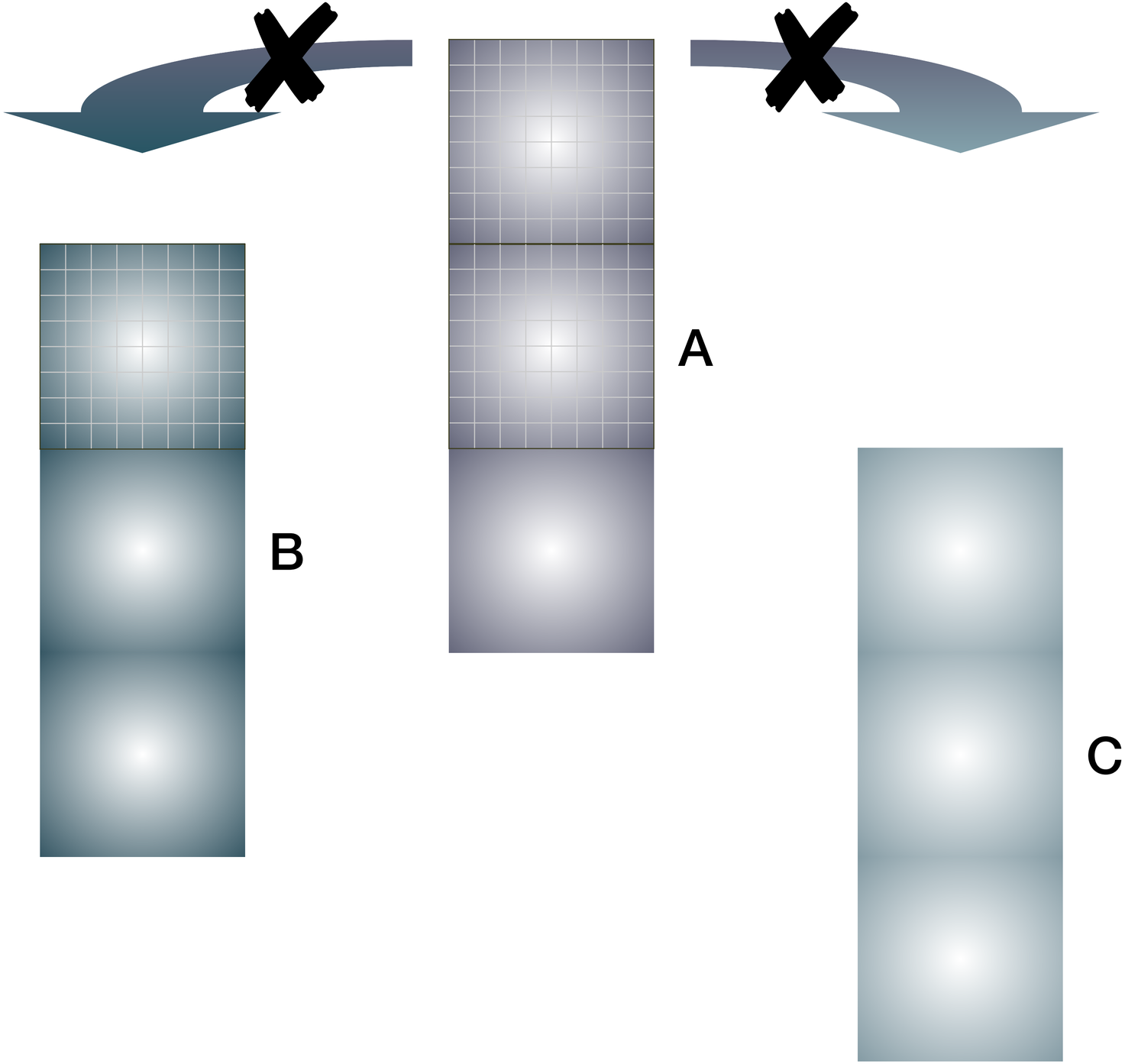
Arntz, M., T. Gregory and U. Zierahn (2016), "The Risk of Automation for Jobs in OECD Countries: A Comparative Analysis", *OECD Social, Employment and Migration Working Papers*, No. 189, OECD Publishing, Paris.

Advanced G20 Countries: Jobs at High Risk of Automation



Organisation for Economic Co-operation and Development (OECD), *Future of Work and Skills*. Paper presented at the 2nd Meeting of the G20 Employment Working Group, Hamburg, Germany. (2017)


A
B
C


A
B
C

For the first time ever there are more people over 65 than under 5

Generally, fertility rates around the world have fallen

Image: REUTERS/Ina Fassbender

This article is published in collaboration with
Business Insider

19 Mar 2019

Rebecca Ungarino

The world's population is aging while many countries' birth rates fail to keep up.

There are now more people over the age of 65 than there are under the age of five - a dispersion that's never occurred before, according to Deutsche Bank.

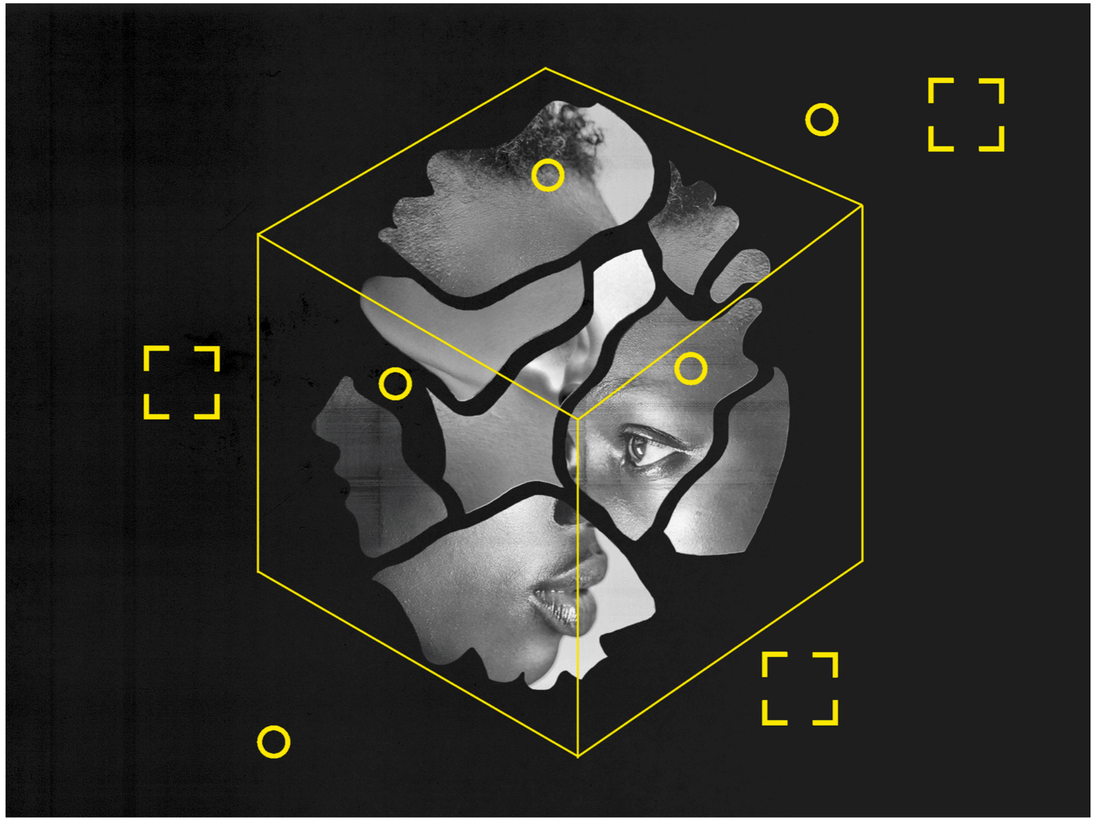
The data point is part of a broader trend with widespread consequences for productivity, inflation, and global growth, economists say.

“*Gakushiryoku* - ability required for university graduates for an unpredictable era including the education, knowledge and experience to make correct decisions in the face of unexpected difficulties.”

MEXT - *Summary of Report: Towards a Qualitative Transformation of University Education for Building a New Future - Universities Fostering Lifelong Learning and the Ability to Think Independently* (2012)

TOM SIMONITE BUSINESS 07.22.19 07:00 AM

THE BEST ALGORITHMS STRUGGLE TO RECOGNIZE BLACK FACES EQUALLY



BETH HOLZER/GETTY IMAGES

Live View 〉 ImageClassifierPG.playground (Live View)

ImageClassifier

Model accuracy

83%	79%	79%
Training	Validation	Evaluation

Predicted	True
Positive	Positive

Predictions	Confidence
Positive	85%
Negative	15%

Predicted	True
Positive	Positive

III. Remixing the EdTech Quintet

Social	Mobility	Visualization	Storytelling	Gaming
200,000 years	70,000 years	40,000 years	17,000 years	8,000 years

Ruben R. Puentedura, “Technology In Education: The First 200,000 Years” *The NMC Perspective Series: Ideas that Matter*. NMC Summer Conference, 2012.

Social

Bookmarks

RSS Feeds

Discussions

Microblogging

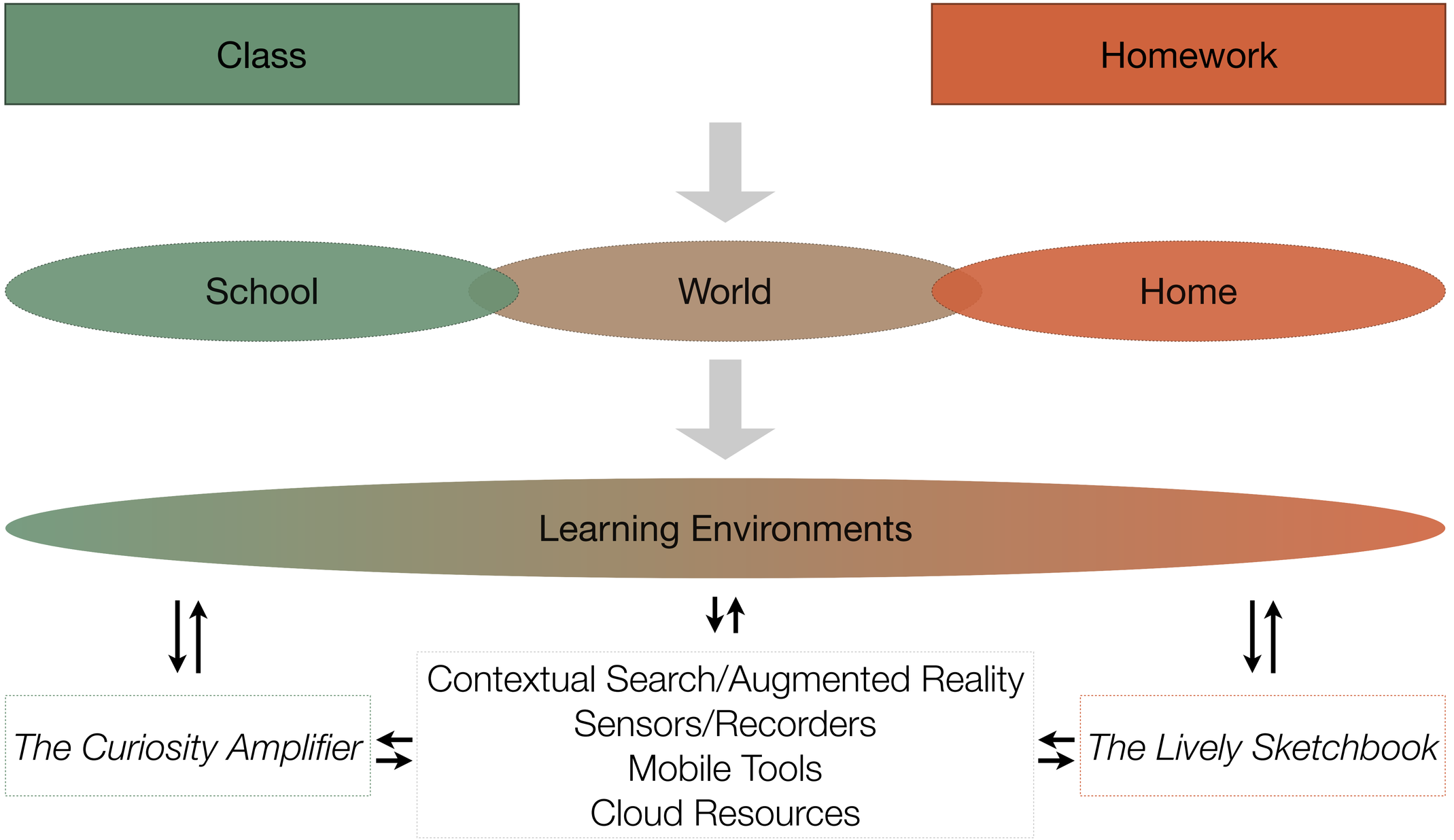
Blogging

Wikis

Telepresence

File Sharing

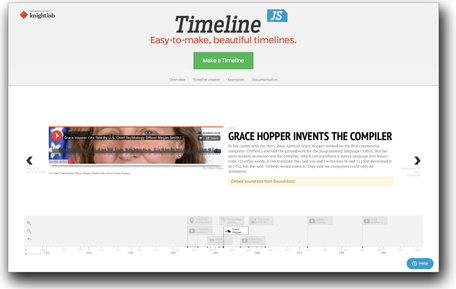
Mobility

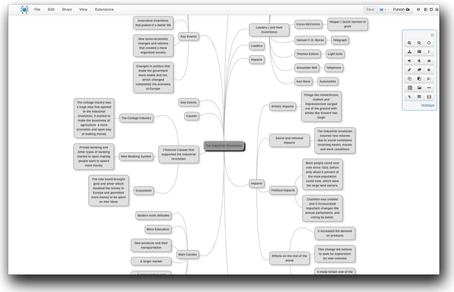


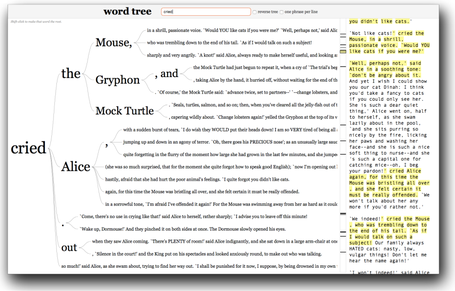
John Seely Brown. “A New Culture of Learning”. *NMC Summer Conference, Closing Keynote*. (2010)

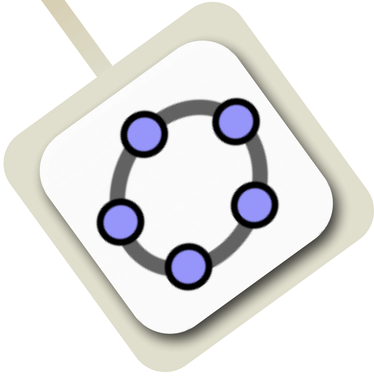
Ruben R. Puentedura, “The Lively Sketchbook”. *Hippasus Blog*. (2010)

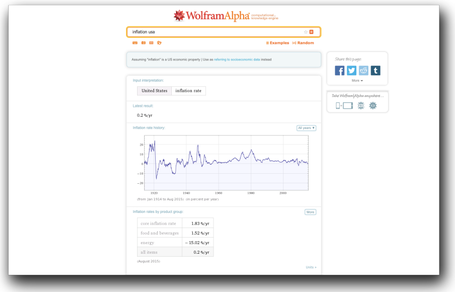
Visualization











Storytelling

Narrative sources;
Narrative constraints

Pictorial vocabulary;
Narrative transitions;
Text/image integration

CDS Seven Elements;
Montage structures

Narrative structures;
Narrative flows

Ludic elements

Image Assembly → Sequential Art → Moving Image → Interactive Media → Interactive Fiction

TIME

PLACE

Infinite Canvas

CONNECTION

SOCIAL

Formal Definition of **Game** (Salen & Zimmerman)

"A game is a system in which players engage in an artificial conflict, defined by rules, that results in a quantifiable outcome."

Katie Salen and Eric Zimmerman. *Rules of Play: Game Design Fundamentals*. The MIT Press, 2003.

The EdTech Quintet – Associated Practices	
Social	Communication, Collaboration, Sharing
Mobility	Anytime, Anyplace Learning and Creation
Visualization	Making Abstract Concepts Tangible
Storytelling	Knowledge Integration and Transmission
Gaming	Feedback Loops and Formative Assessment

Social

Mobility

Localization

Visualization

AI + XR

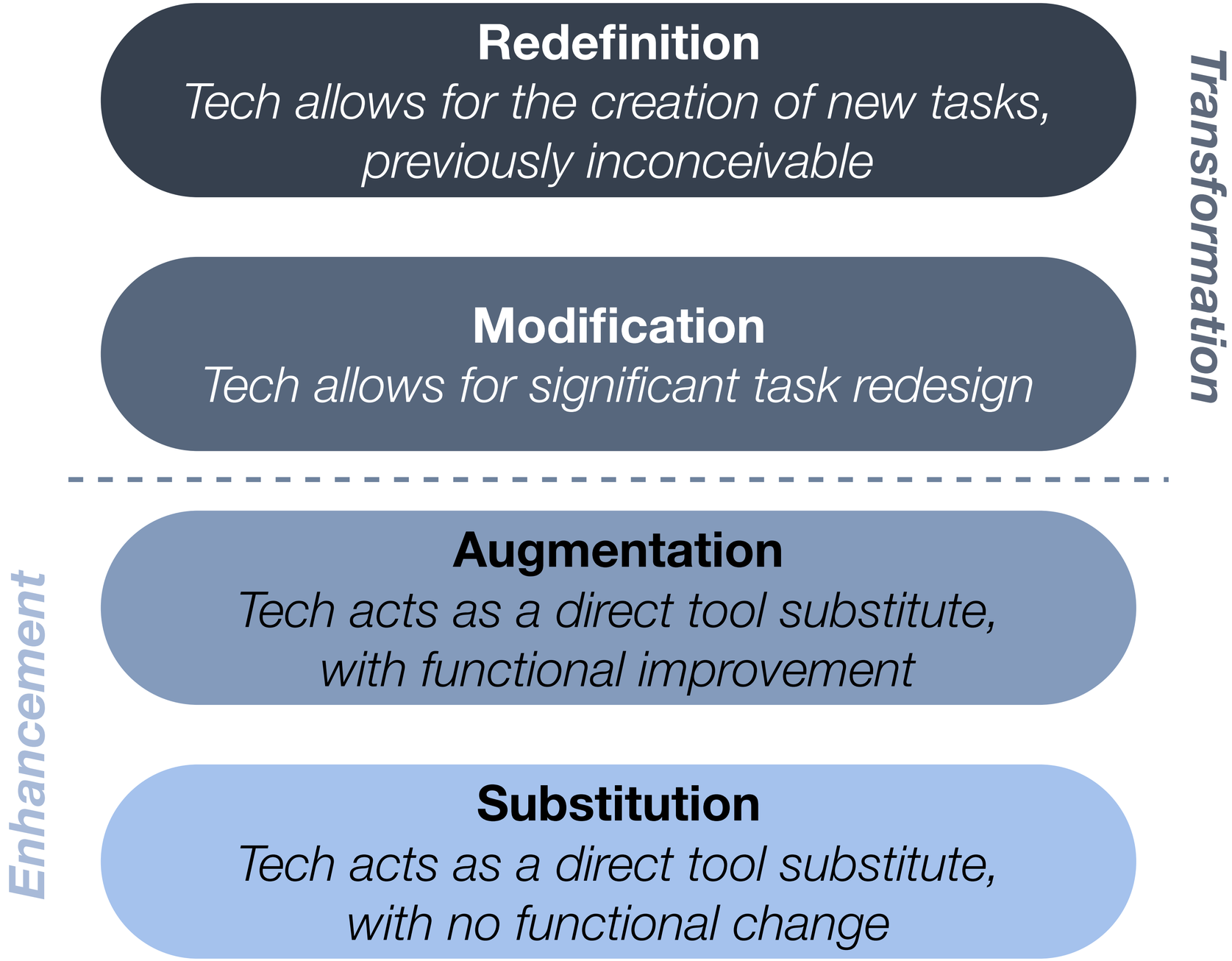
Analysis

Social

Storytelling

Communication

IV. SAMR and Agency



Ruben R. Puentedura, *As We May Teach: Educational Technology, From Theory Into Practice*. (2009)

Redefinition

Tech allows for the creation of new tasks, previously inconceivable

Modification

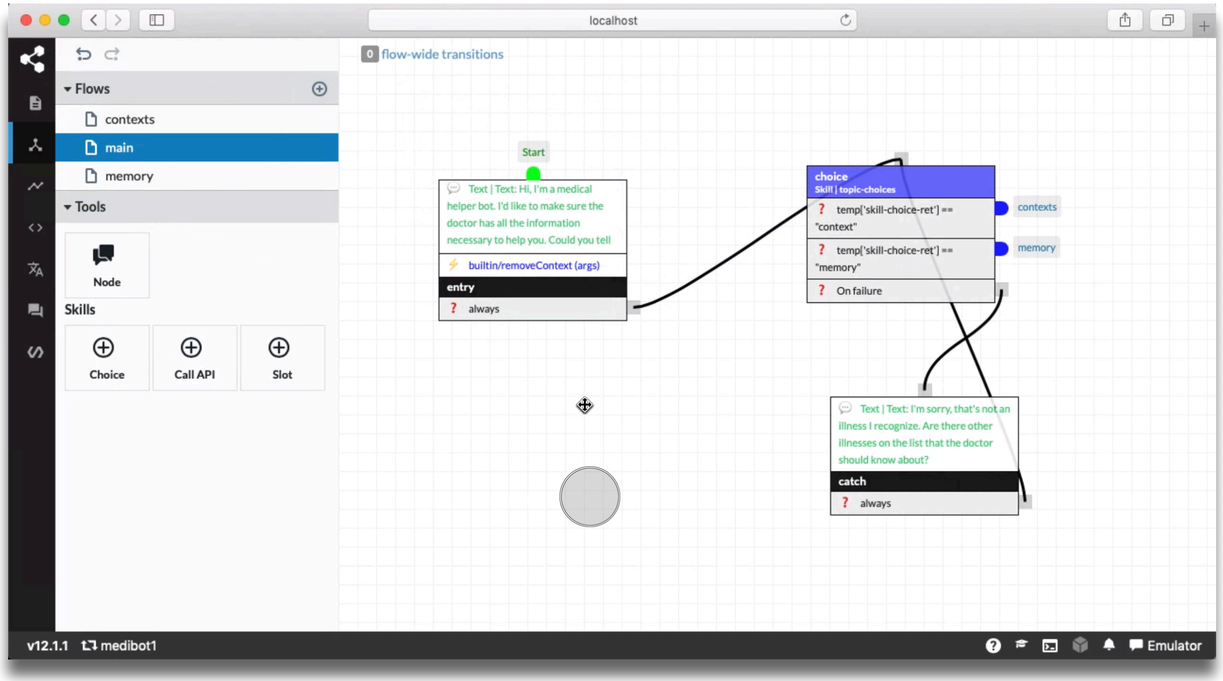
Tech allows for significant task redesign

Augmentation

Tech acts as a direct tool substitute, with functional improvement

Substitution

Tech acts as a direct tool substitute, with no functional change



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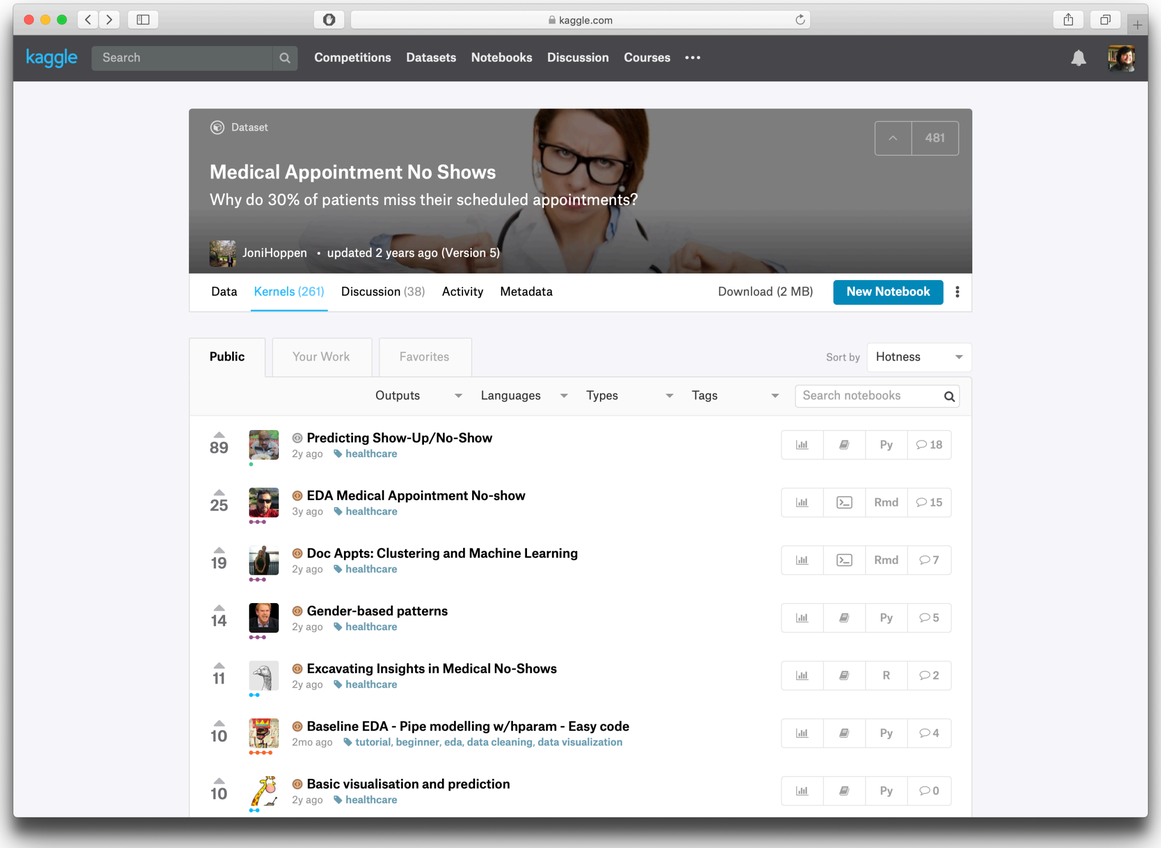

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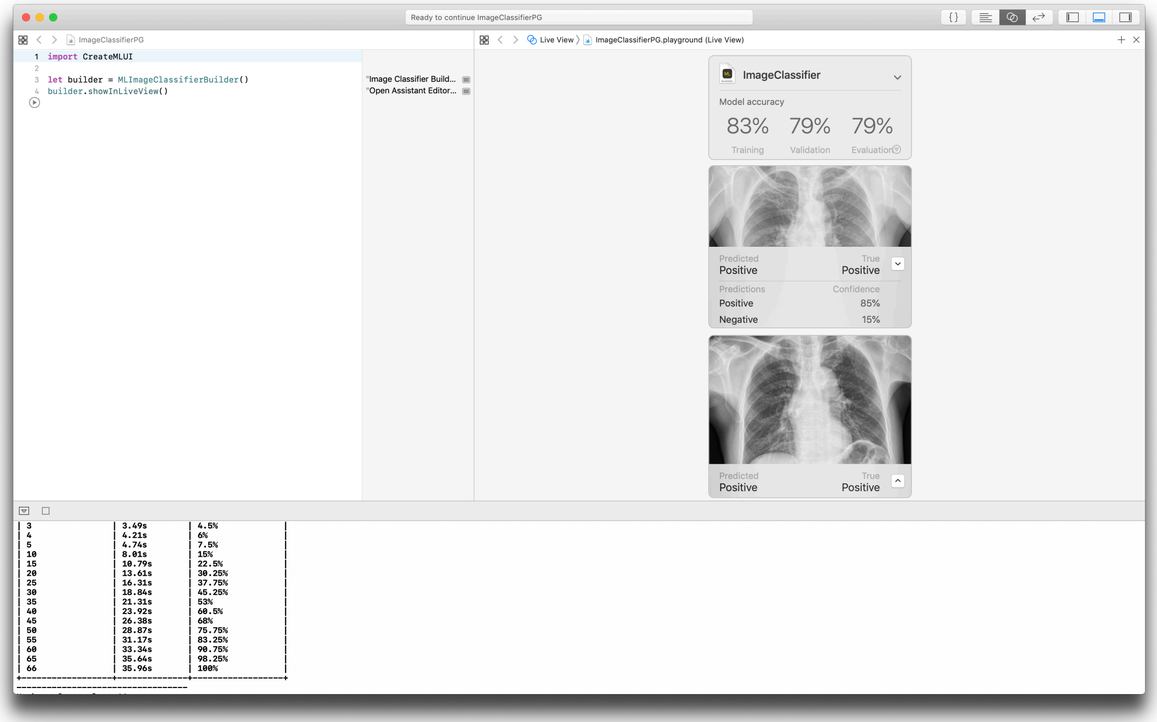

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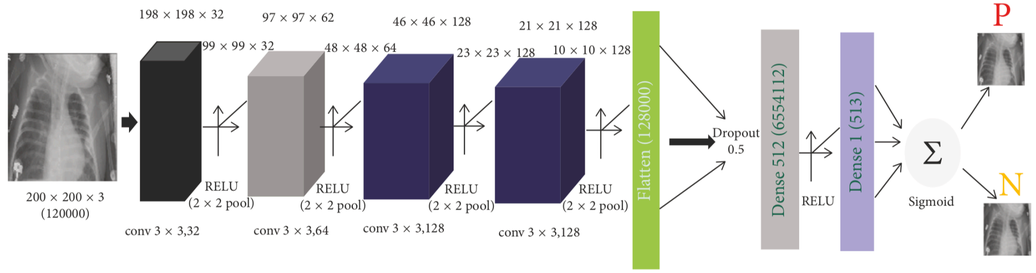


FIGURE 3: The proposed architecture.

TABLE 2: The output of the proposed network architecture.

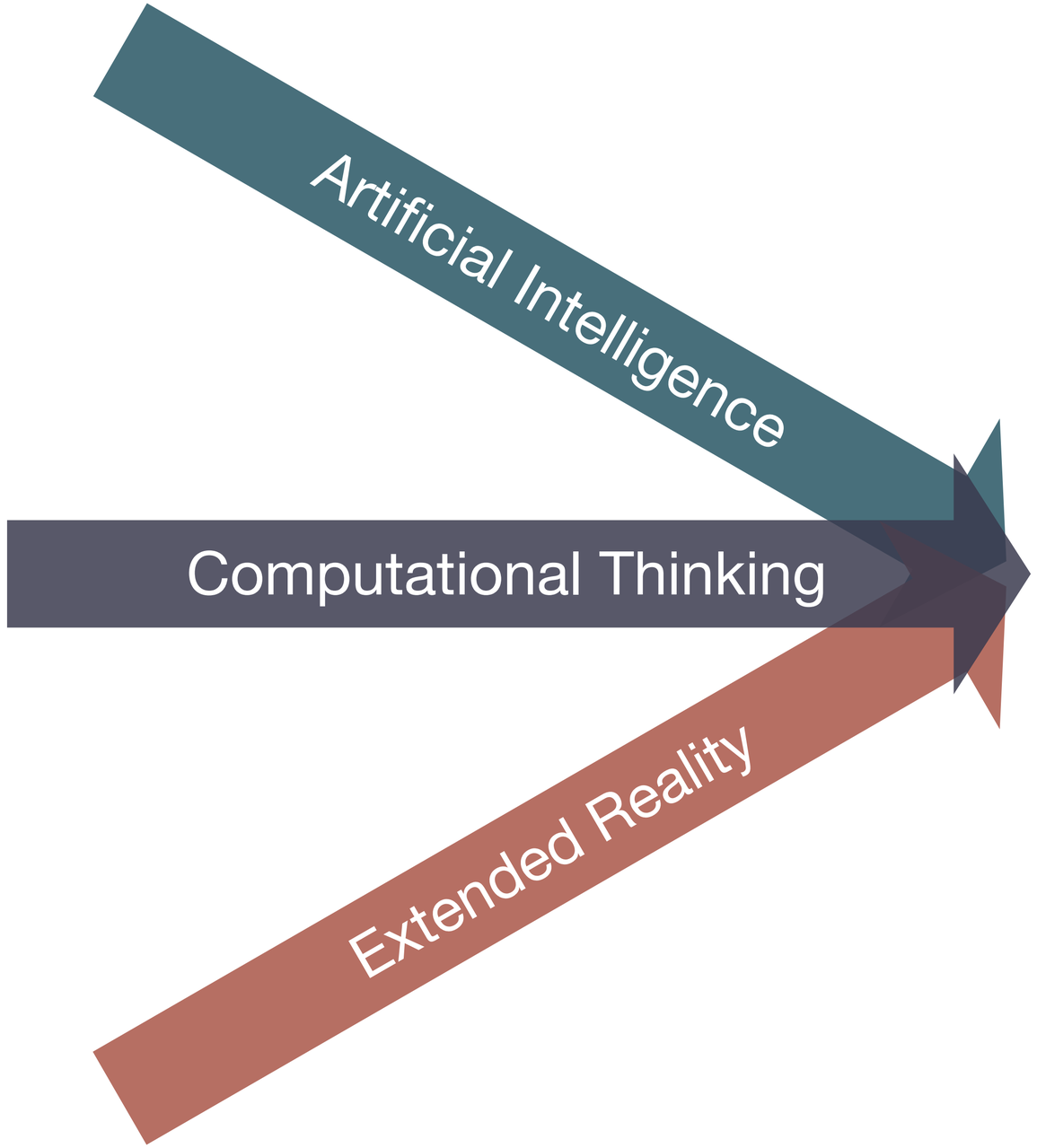
Layer (type)	Output shape	Turtles
conv2d_9 (conv2D)	(None, 198, 198, 32)	896
max_Pooling2d_9 (MaxPooling2)	(None, 99, 99, 32)	0
conv2d_10 (conv2D)	(None, 97, 97, 64)	18496
max_Pooling2d_10 (MaxPooling2)	(None, 48, 48, 64)	0
conv2d_11 (conv2D)	(None, 46, 46, 128)	73856
max_Pooling2d_11 (MaxPooling2)	(None, 23, 23, 128)	0
conv2d_12 (conv2D)	(None, 21, 21, 128)	147584
max_Pooling2d_12 (MaxPooling2)	(None, 10, 10, 128)	0
flatten_3 (Flatten)	(None, 12800)	0
dropout_3 (Dropout)	(None, 12800)	0
dense_5 (Dense)	(None, 512)	6554112
dense_6 (Dense)	(None, 1)	513

Stephen, Okeke, et al. "An Efficient Deep Learning Approach to Pneumonia Classification in Healthcare." *Journal of healthcare engineering* (2019).

Taxonomy of AI (e.g. Russell & Norvig 2011)

Dimensions of CT (e.g. Brennan & Resnick 2012)

Taxonomy of XR (e.g. Milgram & Kishino 1994)

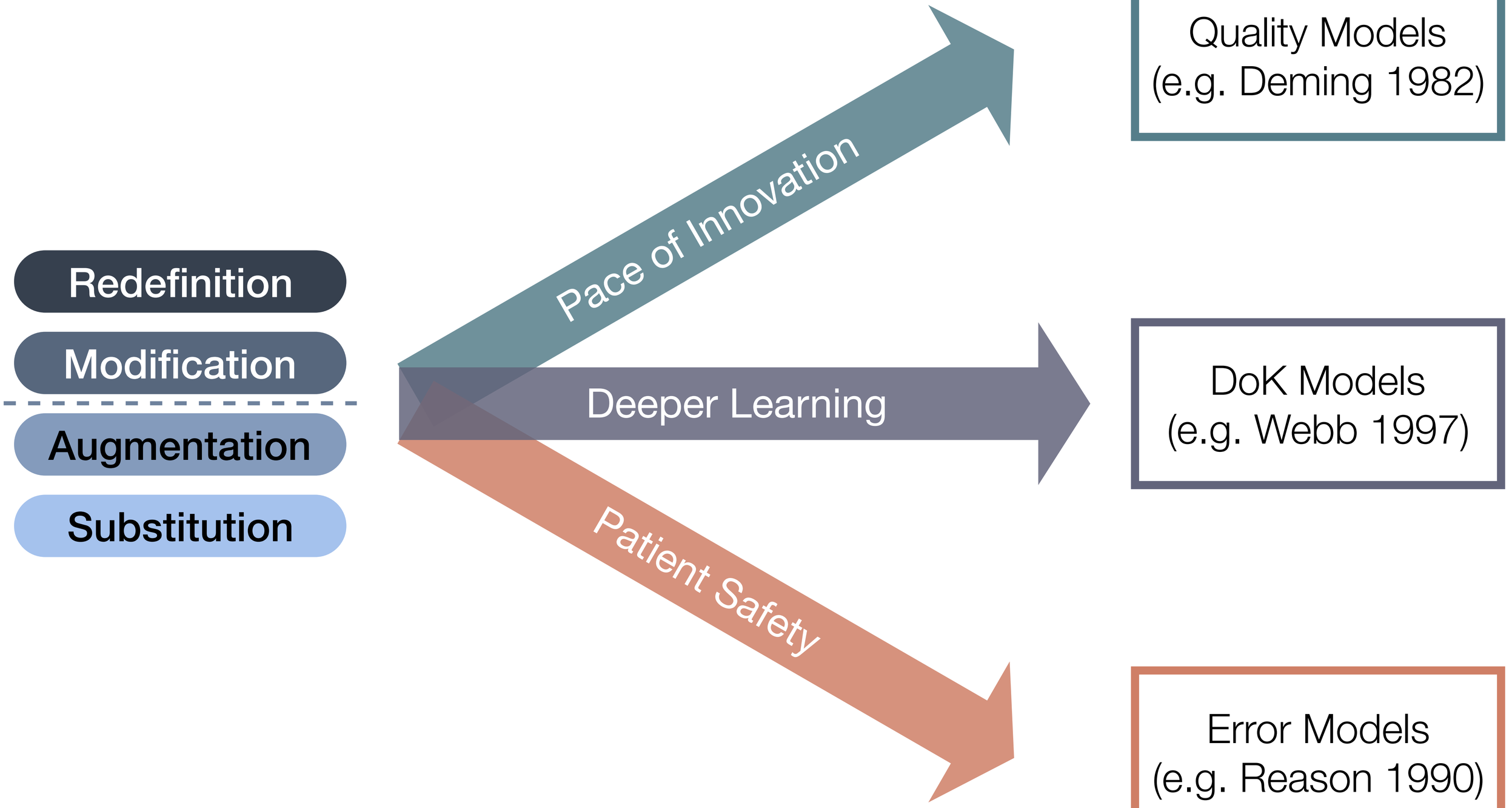


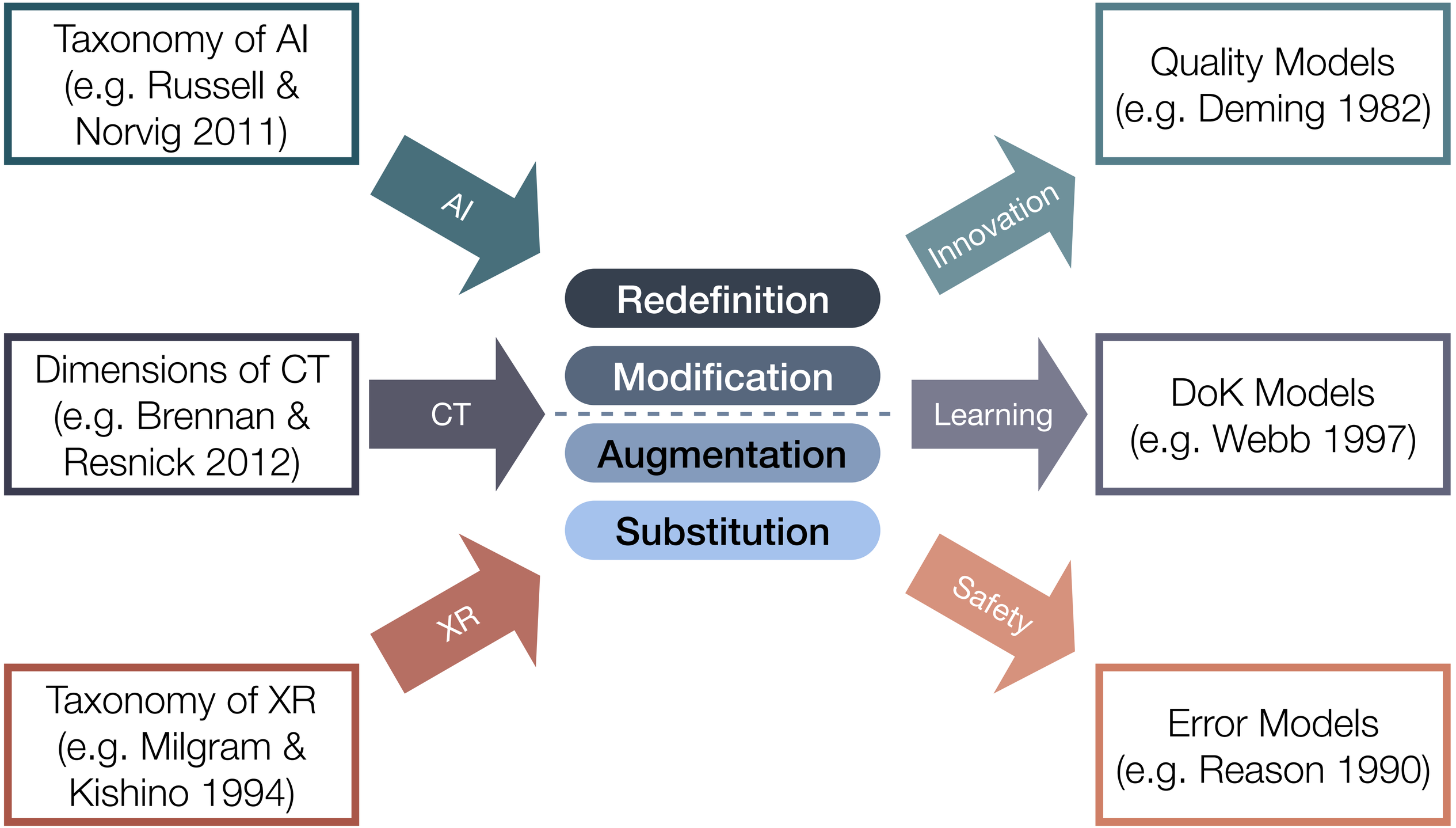
Redefinition

Modification

Augmentation

Substitution


Redefinition
Modification
Augmentation
Substitution
Pace of Innovation
Deeper Learning
Patient Safety
Quality Models
(e.g. Deming 1982)
DoK Models
(e.g. Webb 1997)
Error Models
(e.g. Reason 1990)


Taxonomy of AI
(e.g. Russell &
Norvig 2011)
AI
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CT
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Augmentation
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XR
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Kishino 1994)
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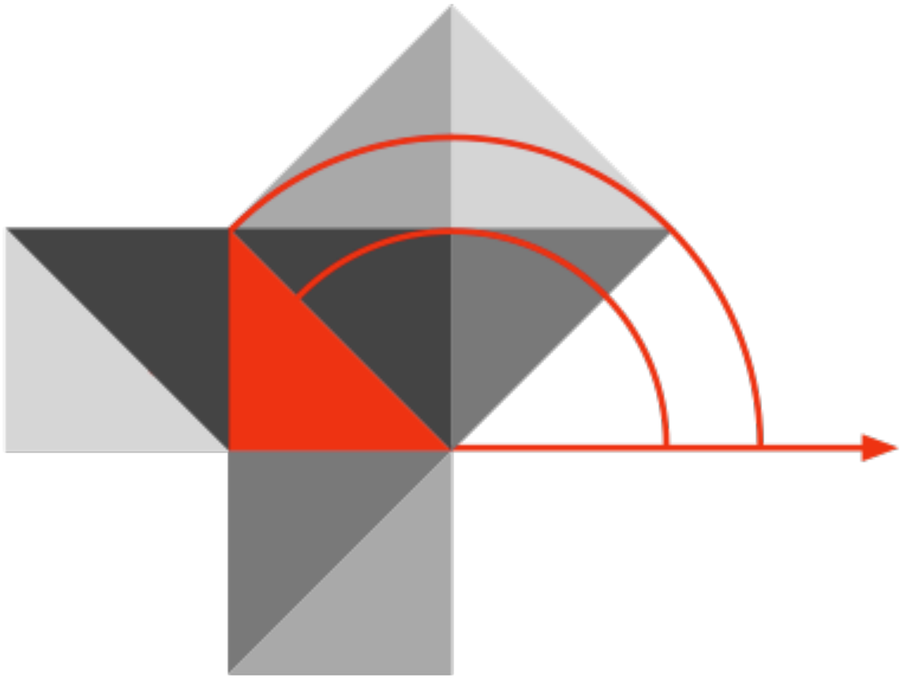
Hippasus



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