CHRISTIANS·IN·SCIENCE™

Tonight's Lecture

Dr Roger Tucker

From Academic to Entrepreneur - lessons in the Evolution of Technology

Overview

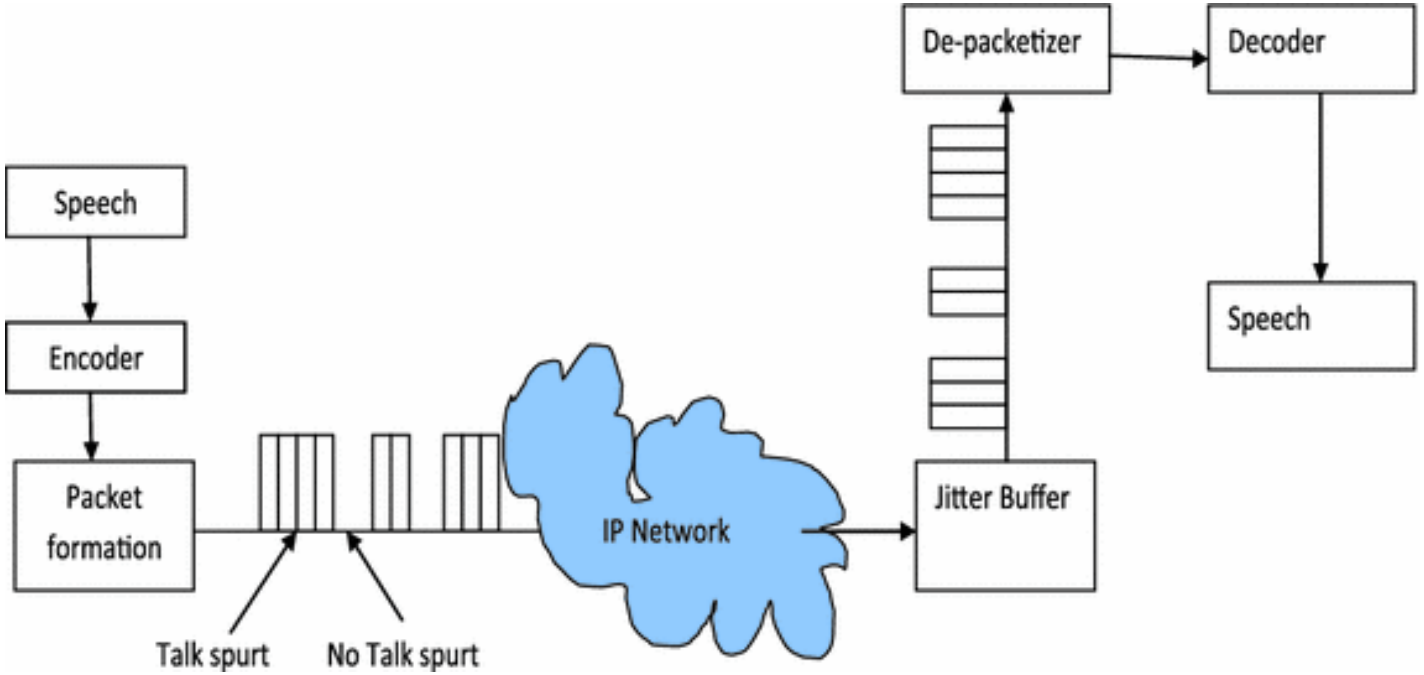
Part 1 – Technology Research

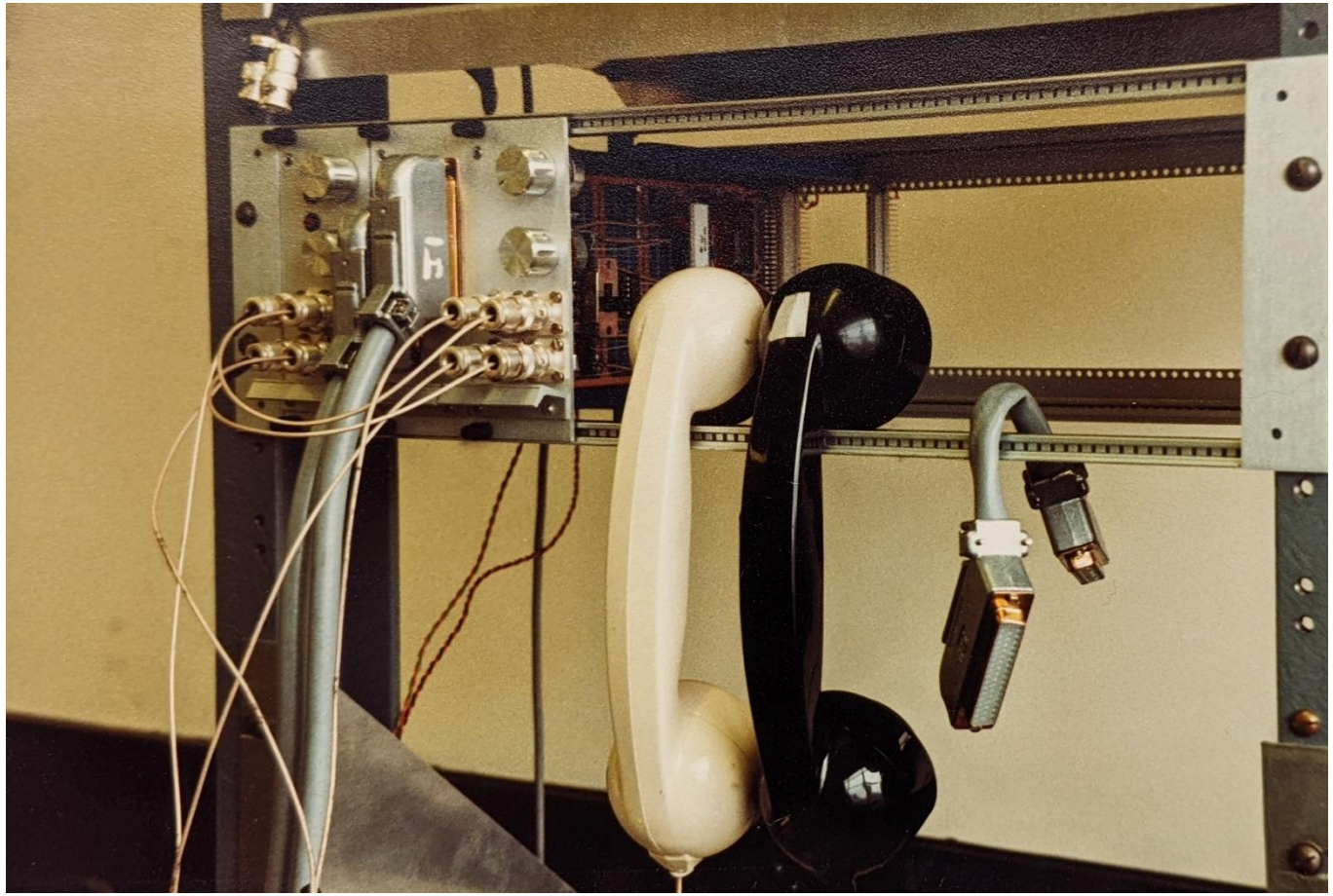
Part 2 – Inclusive Technology

Part 3 – Technology & Biology

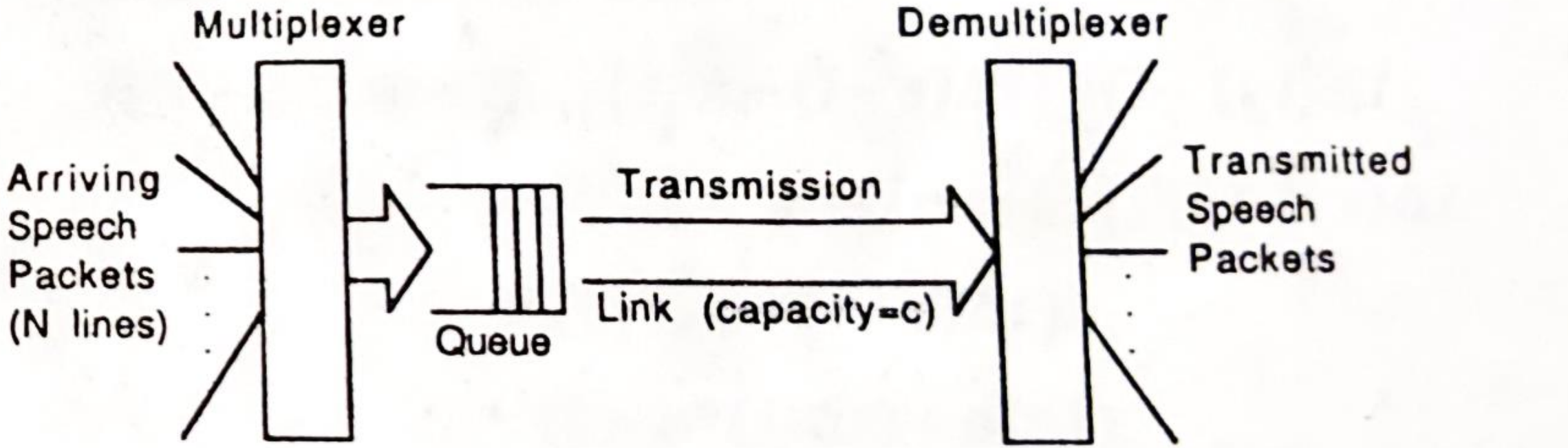
Part 1 – Tech Research

Speech over packet-switched networks (1981)



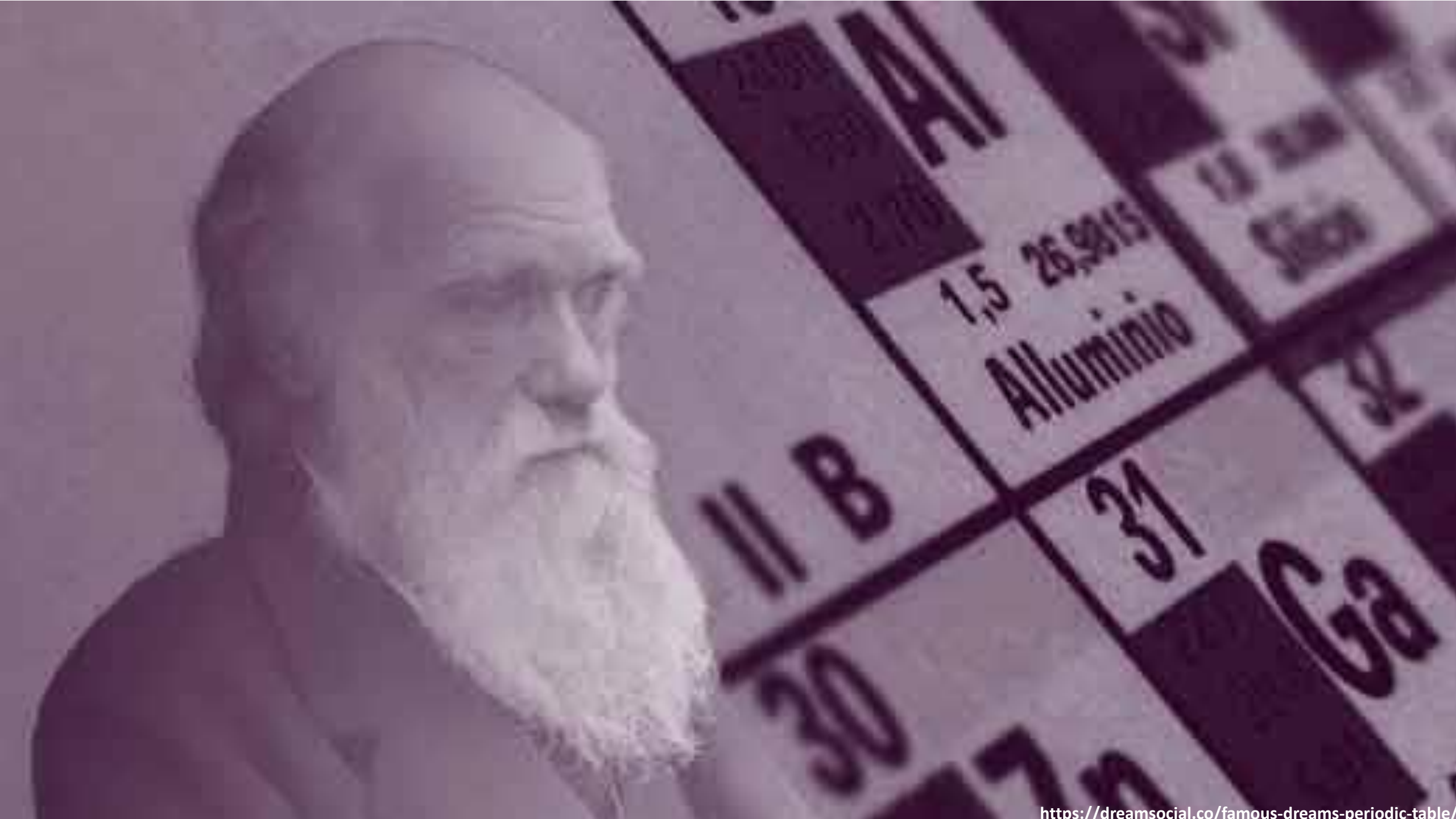


Packet-Speech Multiplexer



Your Father knows what you need before you ask him

Matthew 6:8



https://dreamsocial.co/famous-dreams-periodic-table/

Accurate Method for Analysis of a Packet-Speech Multiplexer

ROGER C. F. TUCKER

Accurate Method for Analysis of a Packet-Speech Multiplexer with Limited Delay

ROGER C. F. TUCKER

Abstract—**In a packet-speech multiplexer with limited delay, packets arriving once the queue has reached a certain limit are either discarded, or if embedded encoding has been used, shortened. In this paper, the uniform arrival and service (UAS) model, which assumes that the information flow in and out of the multiplexer is uniform rather than in discrete packets, is used to analyze such a multiplexer. The equilibrium queue distribution is described by a set of differential equations, which, together with a set of boundary equations describing the queue behavior at its limits, can be solved to yield equilibrium distributions of delay and packet loss. Comparisons to simulations using data collected from real**

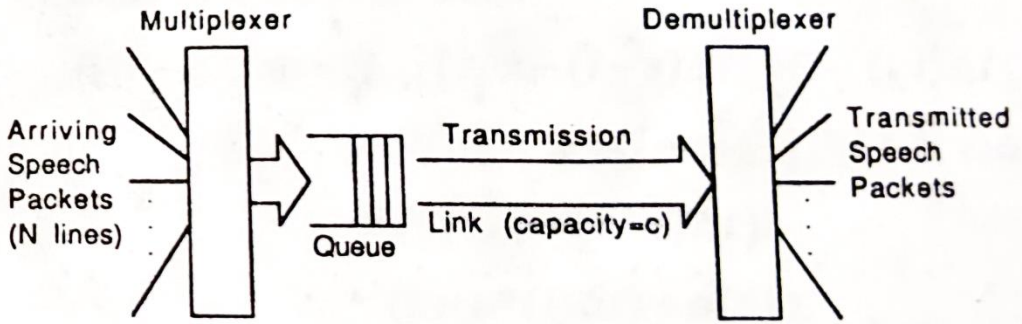


Fig. 1. A packet-switched speech link.

R.C.F. Tucker. Accurate method for analysis of a packet-speech multiplexer with limited delay.
IEEE Transactions on Communications, 36 (4) (1988)

(Energy Harvesting 2017)

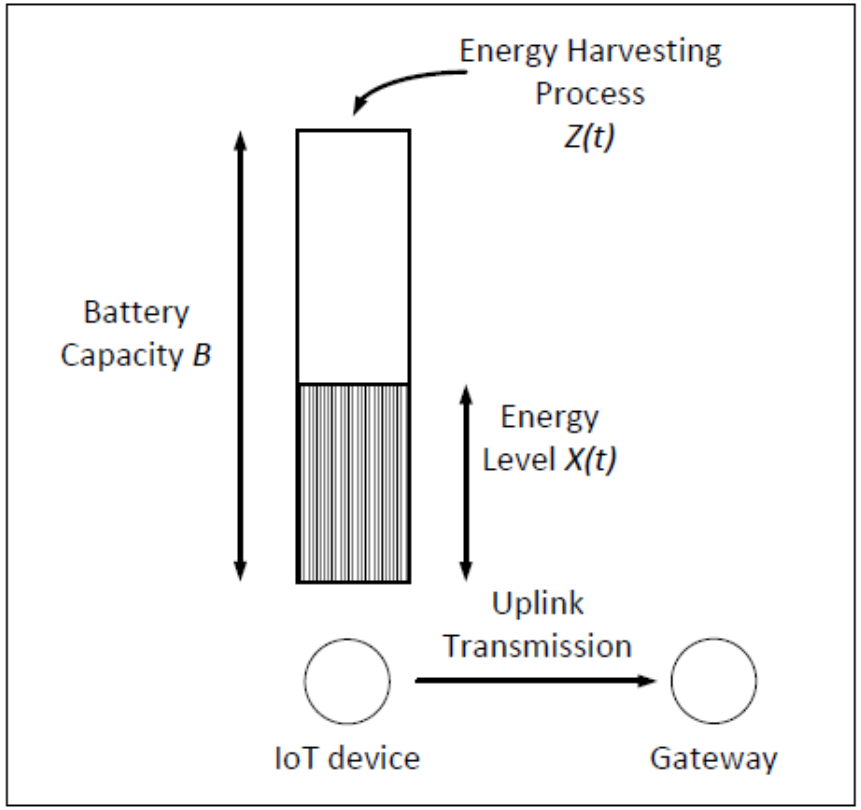
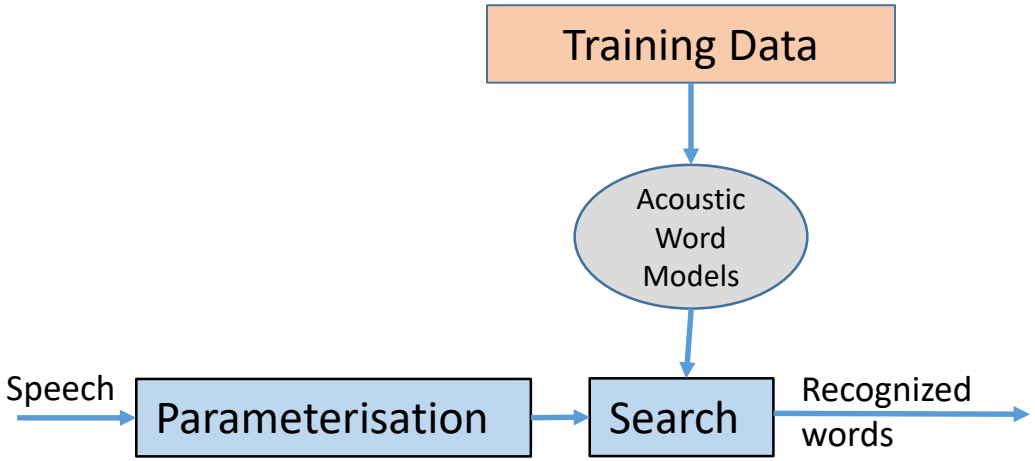


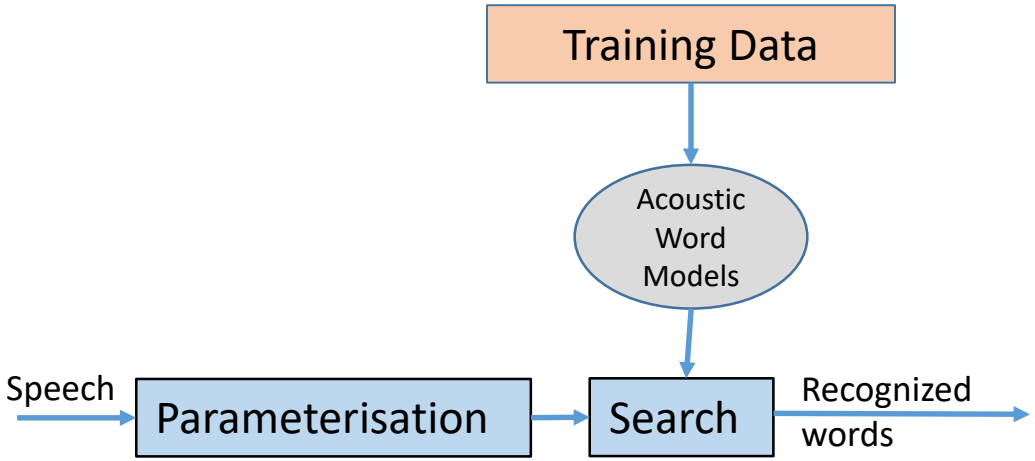
Figure 1: Illustration of an energy harvesting IoT device.

from: Markov fluid queue model of an energy harvesting IoT device with adaptive sensing.
Performance Evaluation, Volume 111, 2017, pp. 1-16

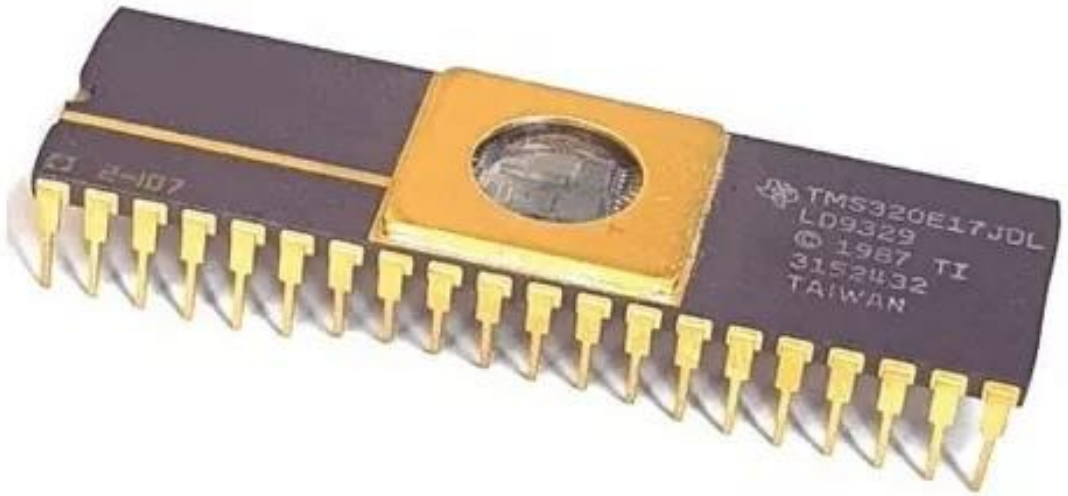
Speech Recognition



Speech Recognition on a single device (1987)



- ½ kB of RAM
- 8kB Program memory



Sensitive Voice Activity Detector (1991)

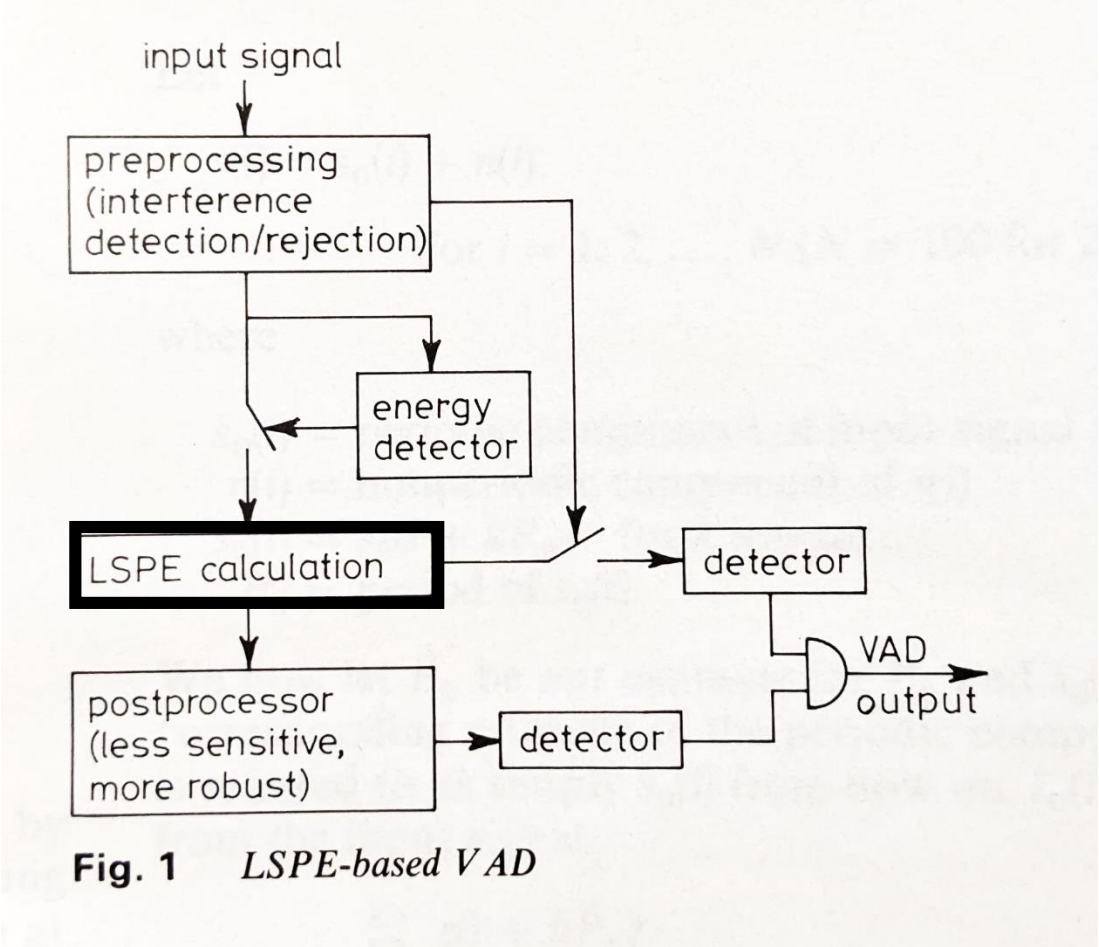
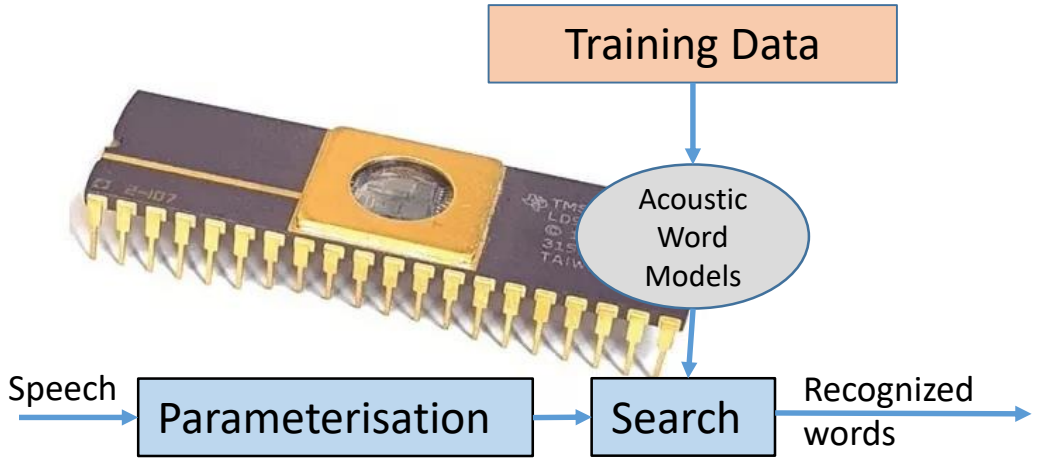


Fig. 1 *LSPE-based VAD*

R. Tucker, "Voice activity detection using a periodicity measure", IEE Proc. I, vol. 139, no. 4, pp. 377-380, 1992.

Some Lessons

- Combination
- Re-use
- Modularity
- Unpredictability of success!



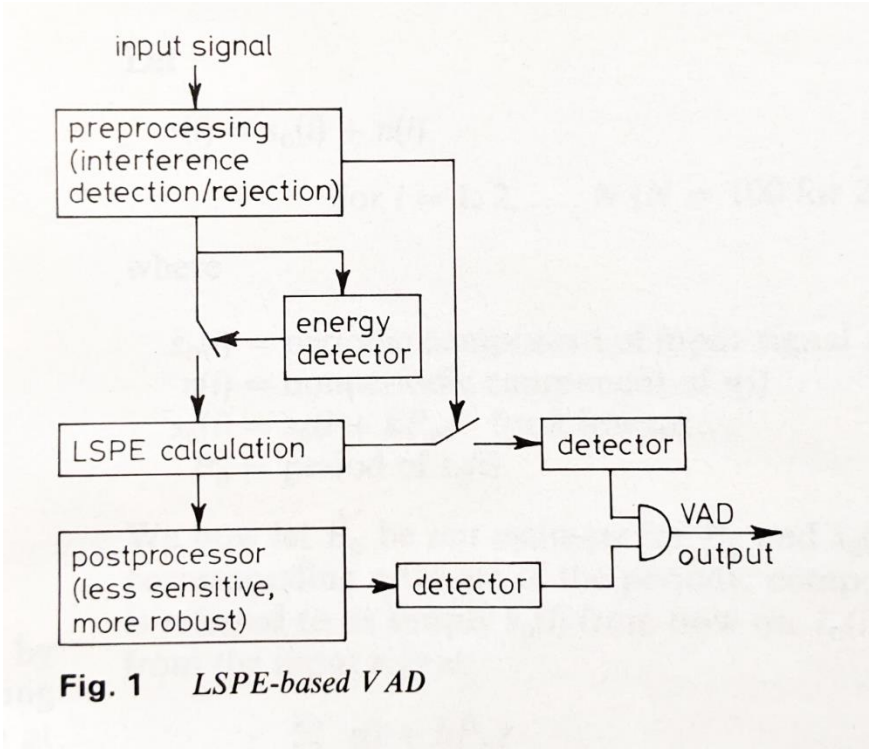
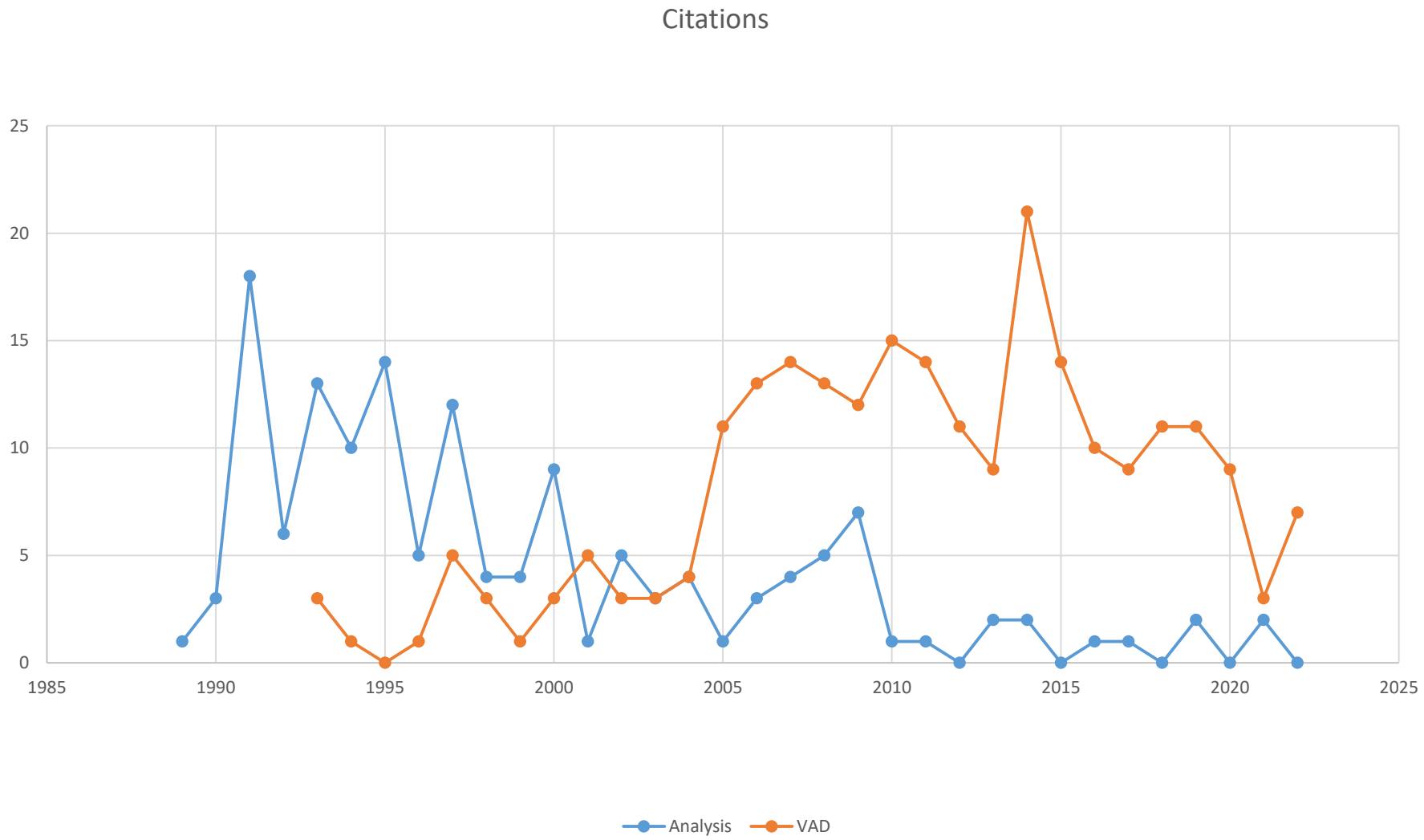


Fig. 1 *LSPE-based VAD*

“Canonical”?


Citations
25
20
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1985
1990
1995
2000
2005
2010
2015
2020
2025
Analysis
VAD

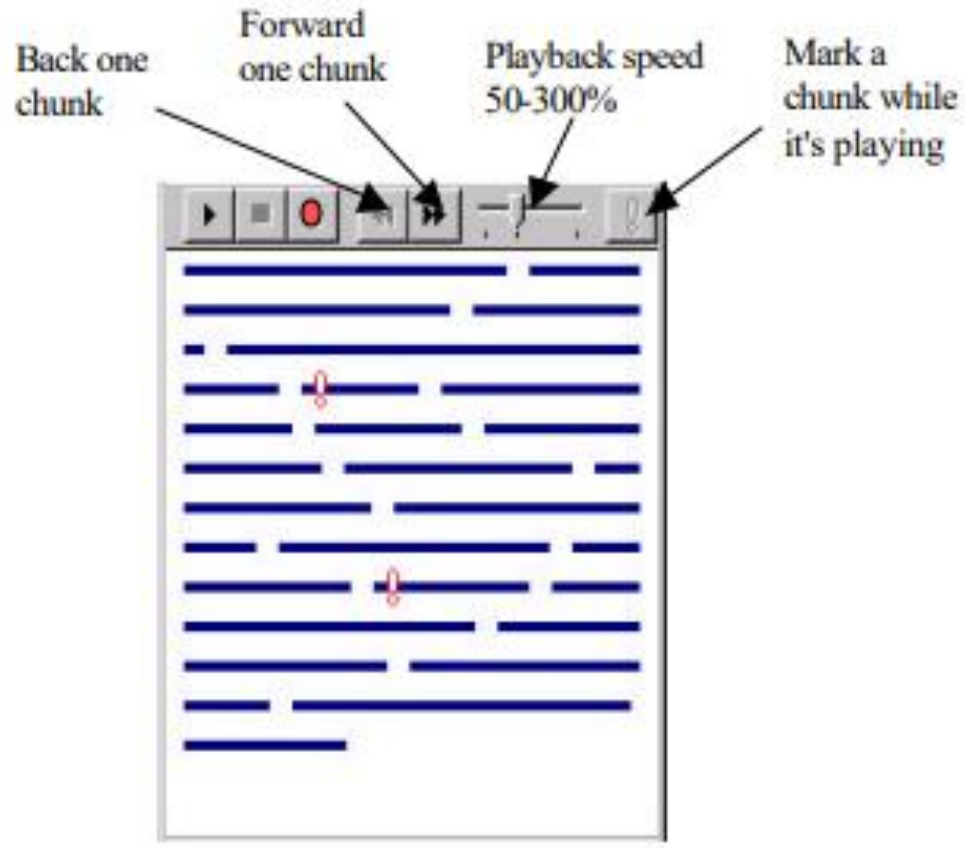
Part 2 – Inclusive Technology

https://www.huffingtonpost.co.uk/kim-lawther/how-technology-is-transforming-disabled-peoples-lives_b_9479556.html

E-Inclusion

https://www.weforum.org/agenda/2021/02/digital-divide-rural-india-internet-access-microsoft/

Text-free Mobile/PC?



Speech Technology and Localisation *Tucker, Roger C.F.; Hickey, Marianne; Haddock, Nick* HPL-2002-43

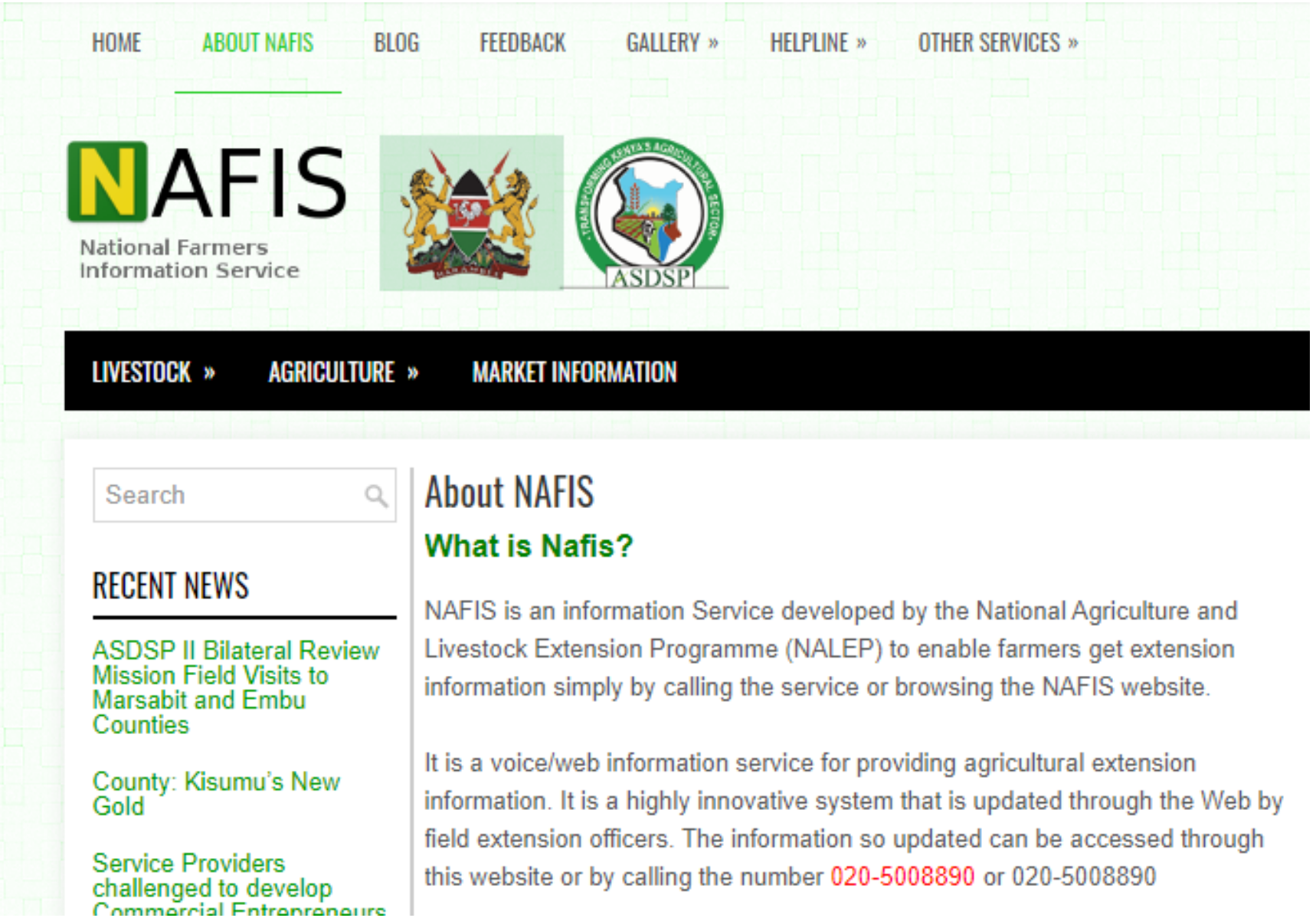
India Visit

Local Language Speech Technology Initiative 2003-06

Local Language Speech Technology Initiative 2003-06

Failure or Success?

Failure or Success?



nafis.go.ke

Failure or Success?

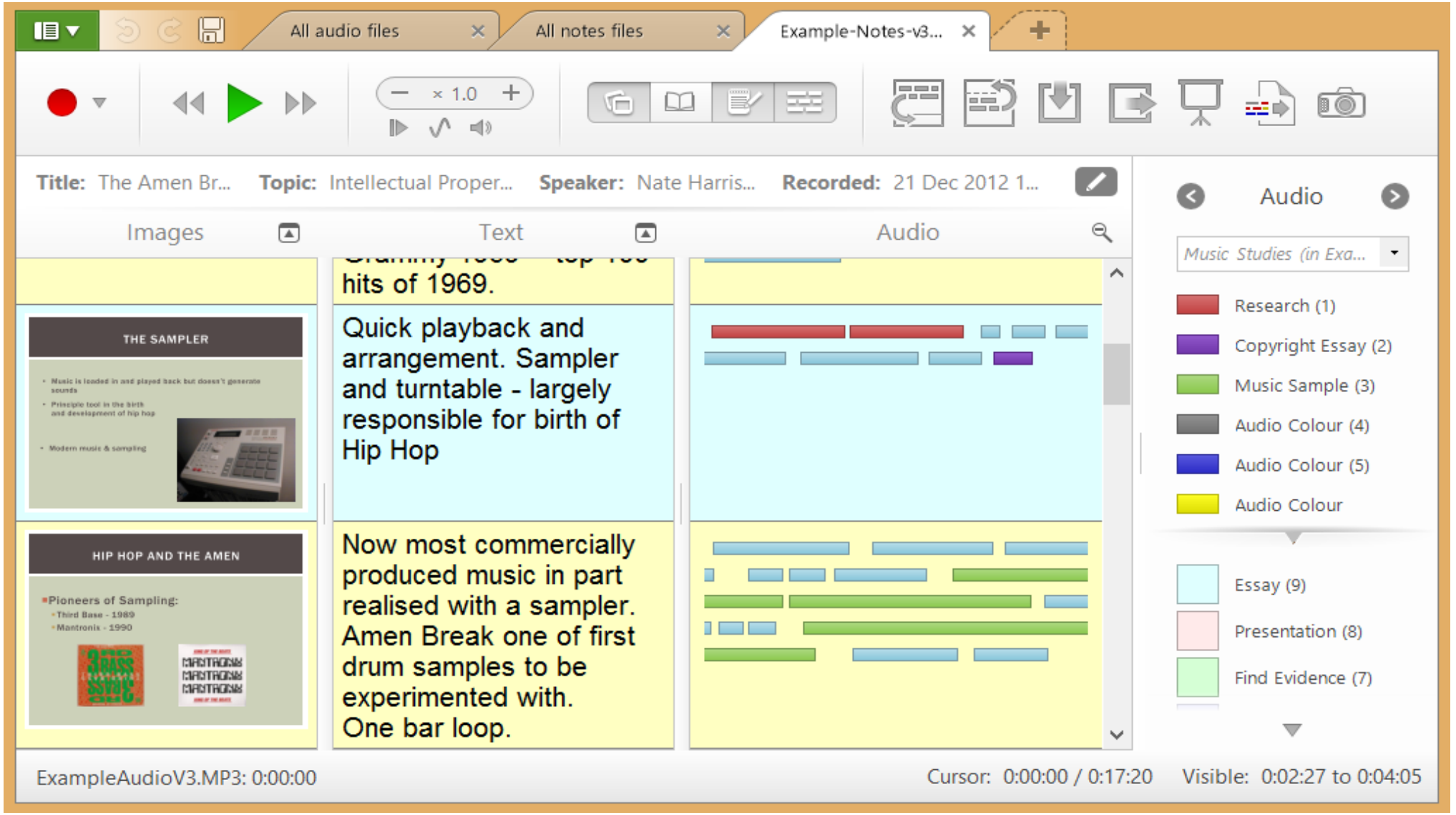
The seeds of this effort were planted years ago. Roger Tucker, a multinational visionary of speech technology, has been one of the people at the forefront of the attempt to expand speech technologies into Africa. He was so early, in fact, that he might have been *too* early. He founded the Local Language Speech Technology Initiative (LLSTI), dedicated to incubating speech technology centers in the developing world, in the early years of the 21st century. He noted that the funding basics for this part of the world differ from those of the western corporate world; these technologies need to be created for the benefit of the people, because the citizenry were a top priority (and resource) inside each developing country. In fact, South African developers have no problem turning down your money if investor goals are not in sync with theirs.

Said Tucker more a decade ago: "Speech tech companies … did not transfer ownership of that tech to any of the speakers of that language. Minor languages were off the radar for these companies. There were in any case some deep problems involved in transferring technology to the developing world, resulting in too many rooms full of PCs that were left gathering dust, as puzzled community leaders or head teachers didn't really know what to do with them." Today, the landscape has changed, and it is time to take another look.

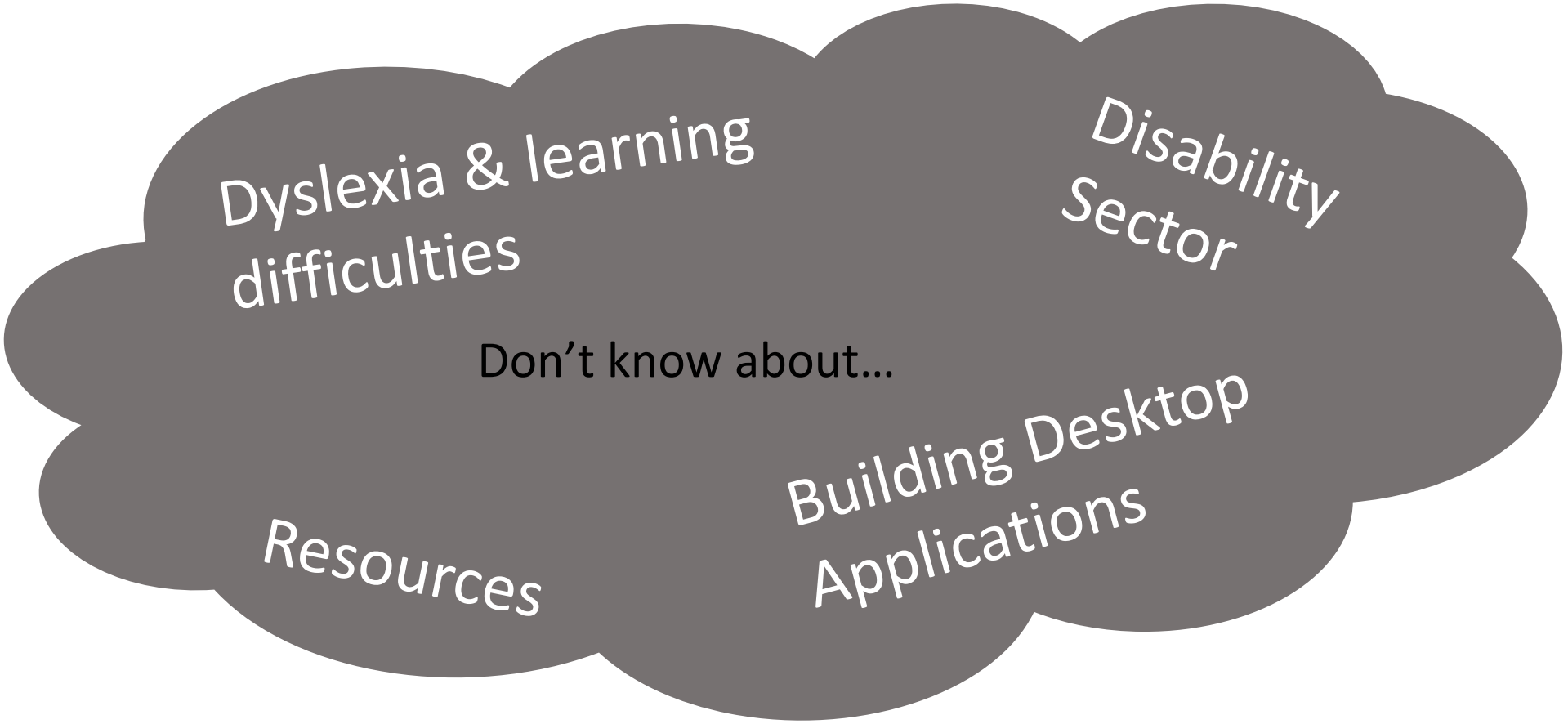
https://www.speechtechmag.com/Articles/Columns/In-Other-Words/Speech-Technologys-Next-Frontier-Developing-Countries-152311.aspx (2022)

Audio Notetaker 2007-17

Audio Notetaker 2007-17



Audio Notetaker 2007-17

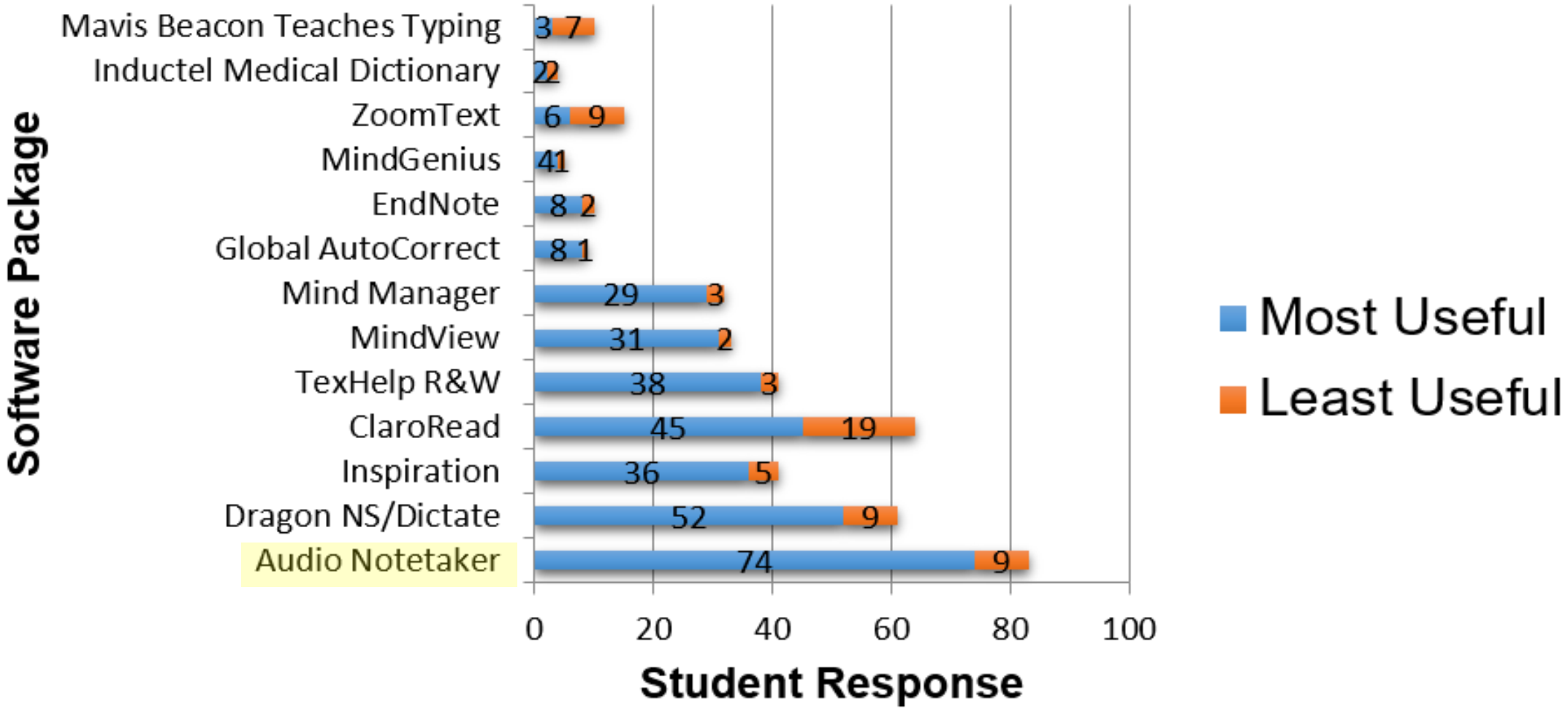


Audio Notetaker 2007-17

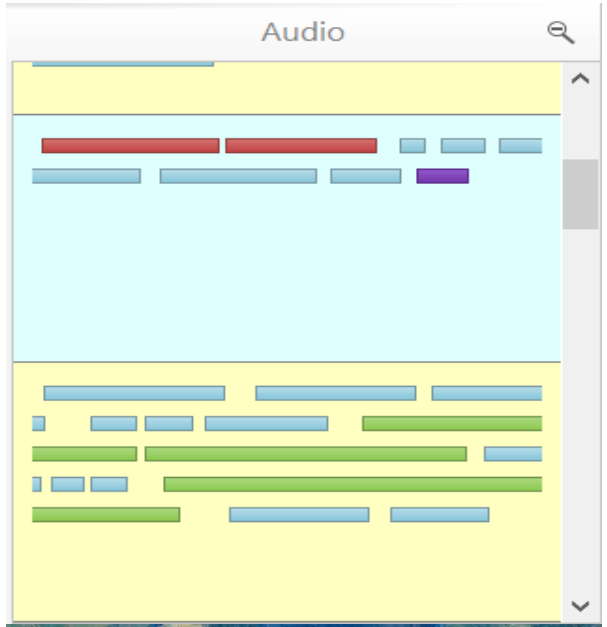
Ask and it will be given to you; seek and you will find;
knock and the door will be opened to you.

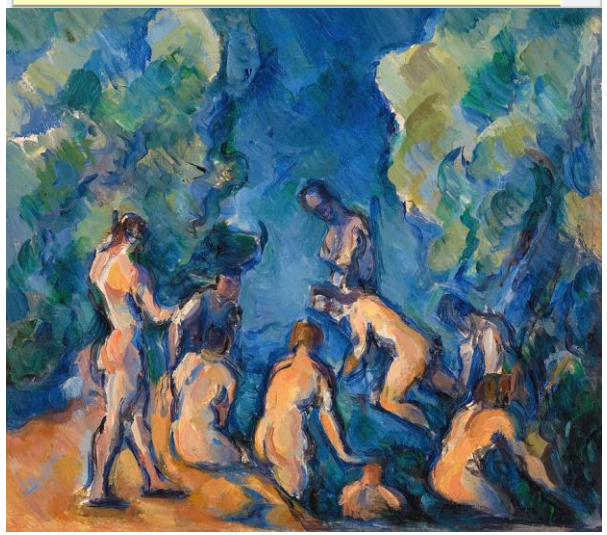
Matthew 7:7

Student Feedback on Software



Audio Notetaker vs Cezanne!





What we see is the representation of sound, information, words, and knowledge not in a written form…

…like looking at a work of art by Cézanne, who was said to have introduced into the world of painting a new form that moved from the literal and realist approach to capture a wholly different way of representing the world.

“Leading the Future of Technology” (Cambridge Elements, Dec 2020), Rebecca LaForgia (p22):

Part 3 - Technology and Biology

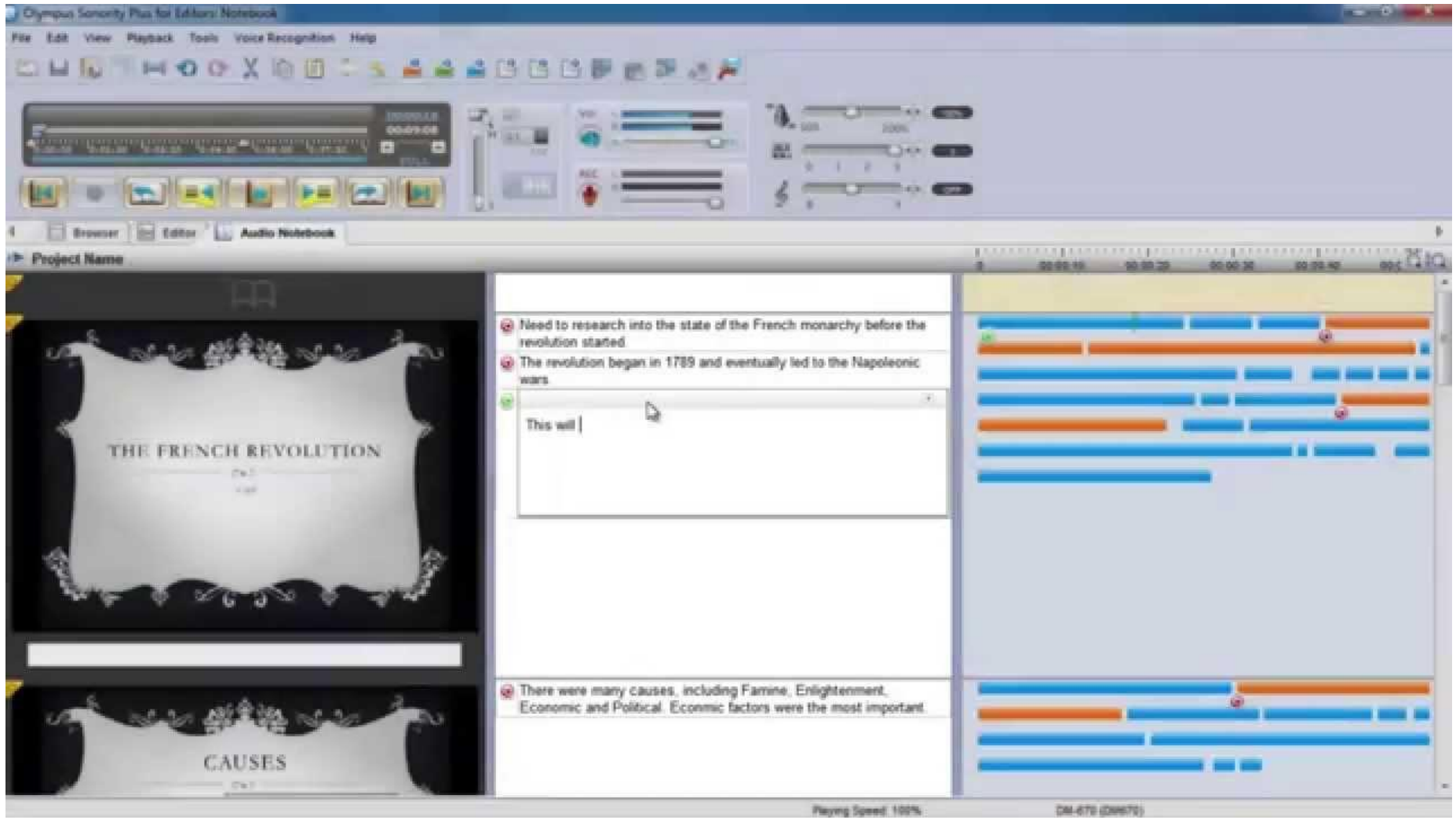
"He has set eternity in the hearts of men;
yet they cannot fathom what God has done from beginning to end."

Ecclesiastes 3:11

It is increasingly common for university and college lectures to be recorded and made available on-line, often to support distance learning. Whether full video or just audio, this opens up the possibility for students to use the recorded material as part of their note-taking strategy. Even when they have already heard the lecture, going back through the material a second time is excellent for re-enforcement.

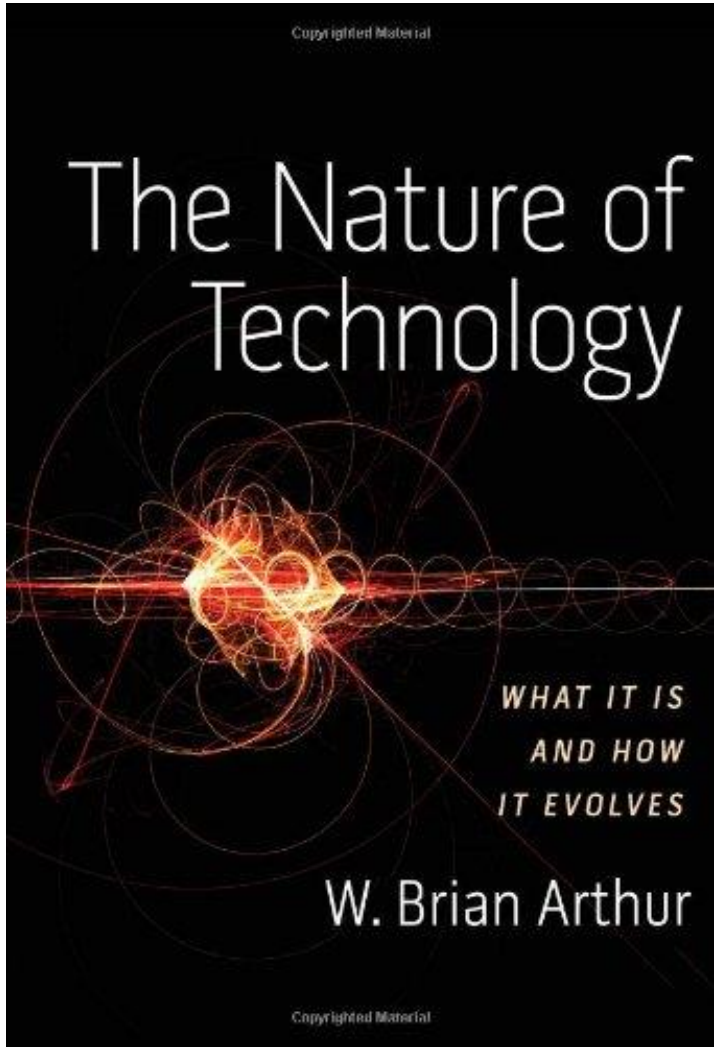
It was to help students who make their own recordings that we first developed Audio Notetaker, a software tool for editing and annotating audio recordings, which is now used by many thousands of students, particularly those with dyslexia. Our experience with Audio Notetaker has led us to the concept of *multi-modal note-taking* as a way of processing and working with all the different modes lecture material may be presented in. Multi-modal note-taking is *not* about converting everything to text, manually or automatically via speech recognition. It involves the

1. Introduction to Mac OS X, Cocoa T.m4v: 0:01:37 Cursor: 0:01:30 / 0:47:00 Visible: 0:00:00 to 0:02:33


File Edit View Playback Tools Voice Recognition Help
Browser
Editor
Audio Notebook
Project Name
THE FRENCH REVOLUTION
CAUSES
Need to research into the state of the French monarchy before the revolution started
The revolution began in 1789 and eventually led to the Napoleonic wars
This will
There were many causes, including Famine, Enlightenment, Economic and Political. Econmic factors were the most important

Technology as an Evolutionary System

Technology as an Evolutionary System



W Brian Arthur:

"the *collective of technology* builds itself from itself with the agency of human inventors and developers much as a *coral reef* builds itself from itself from the activities of small organisms."

(Arthur, 2009, p. 169)

Two kinds of Search

Goal-directed

- At evolutionary level, search for market success
- Variations have specific goal

Exploratory

- At evolutionary level, search for increased fitness
- Variations are random & small

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  - goal ⇏market success
  - limited by imagination (TRIZ)

Exploratory

- At evolutionary level, search for increased fitness
- Variations are random & small

Two kinds of Search

Goal-directed

- At evolutionary level, search for market success
- Variations have specific goal
  - goal ⇏market success
  - limited by imagination (TRIZ)

- Experience encapsulated in knowledge, components, methods & tools

Exploratory

- At evolutionary level, search for increased fitness
- Variations are random & small

- Experience encapsulated in genome

Similar Organising Principles

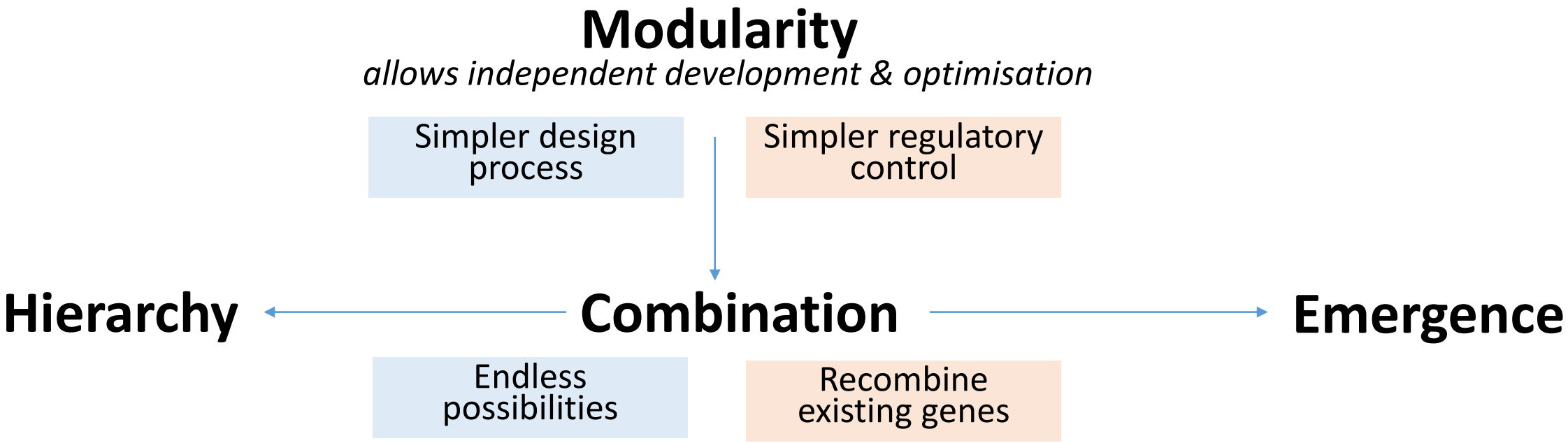
Modularity

allows independent development & optimisation

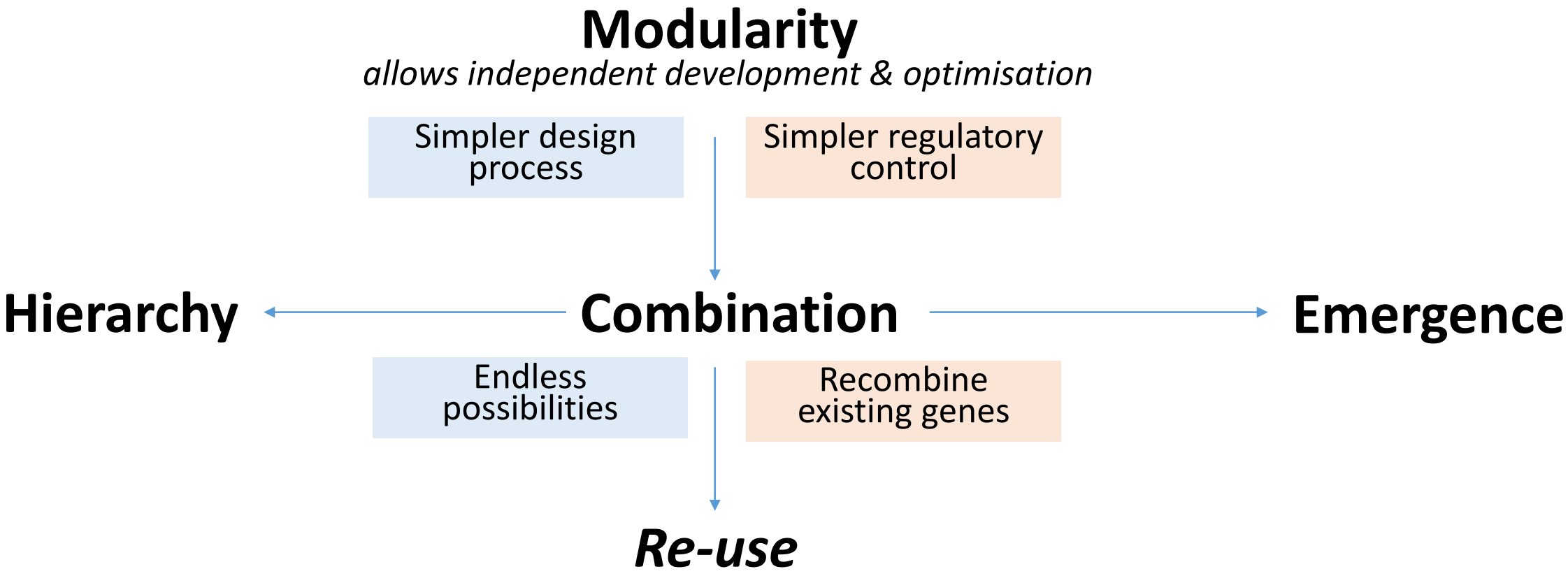
Simpler design process

Simpler regulatory control

Similar Organising Principles

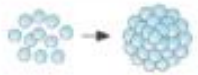
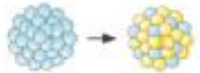
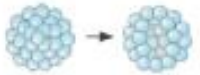


Similar Organising Principles



E.g. Multicellular Re-Use

Table 1. Key dynamical patterning modules, their respective molecular constituents and physical principles, roles in evolution and development, and schematic representations.

DPM	Molecules	Physics	Evo-devo role	Effect
ADH	Cadherins	Adhesion	Multicellularity	
LAT	Notch	Lateral inhibition	Coexistence of alternative cell states	
DAD	Cadherins	Differential adhesion	Phase separation, tissue multilayering	
POL_a	Wnt	Cell surface anisotropy	Topological change, interior cavities	
POL_p	Wnt	Cell shape anisotropy	Tissue elongation	
ECM	Chitin, collagen	Stiffness, dispersal	Tissue solidification, elasticity, EMT	
OSC	Wnt + Notch	Chemical oscillation	Segmentation, periodic patterning	
MOR	TGF-β/BMP FGF, Hh	Diffusion	Pattern formation	
TUR	MOR + Wnt + Notch	Dissipative structure	Segmentation, periodic patterning	

Newman, S.A. and **Bhat**, R. (2008) 'Dynamical patterning modules: Physico-genetic determinants of morphological development and evolution', *Physical Biology*, 5(1).

*"**Life** can only be **understood backwards**, but it must be **lived forwards**"*

Søren Kierkegaard

Thank You!

roger.tucker@gmail.com