Uddannelses- og Forskningsmøde 2018

Digital dannelse

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Medlem af ATV's Digitale Vismandsråd

Digital dannelse

faktalink.dk
"At kunne begå sig socialt, etisk og kritisk
i den virtuelle virkelighed"

videnskab.dk
"Evnen til at kunne anvende og forstå digitale medier og at kunne reflektere kritisk over brug og betydning"

wikipedia
The use and comprehension of information in the age of digital technologies

Digital dannelse

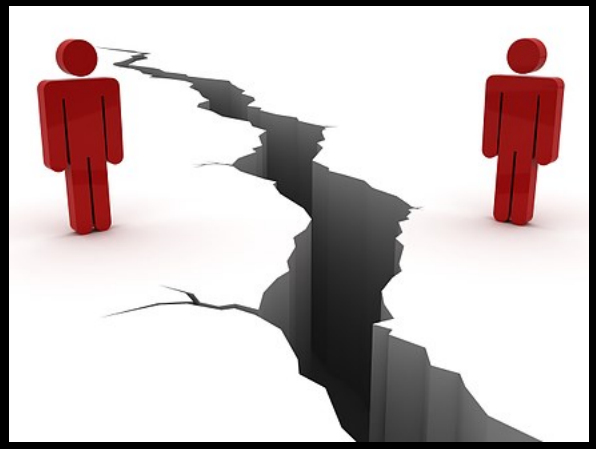
faktalink.dk
"At kunne begå sig socialt, etisk og kritisk
i den virtuelle virkelighed"

KUN fokus på BRUG
og it som medie

Det essentielle 'digital divide'

Bruge

~~Ikke kunne bruge~~



Konstruere

~~Kunne bruge~~

Informatik

– det 21. århundredes matematik

Programmering

– det 21. århundredes skrivning

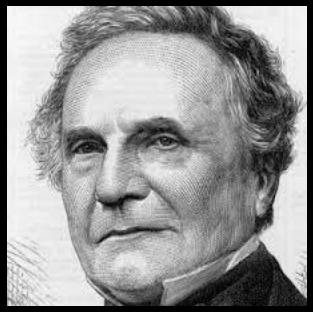
Industri 4.0

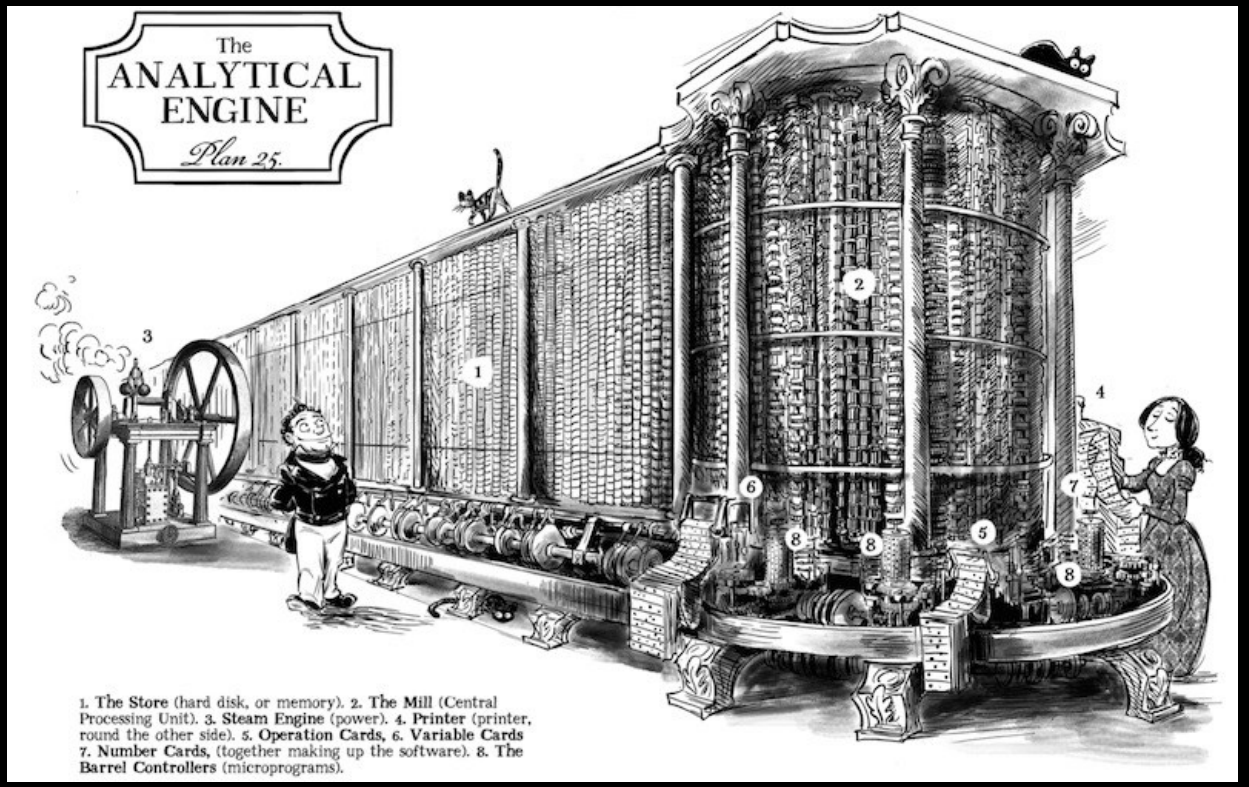
tja...

It er ikke bare "endnu en teknologi"

Andre teknologier strækker vores fysiske formåen

It strækker vores mentale formåen





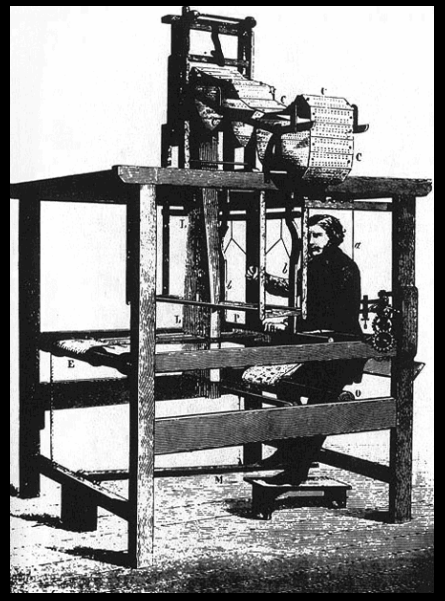
From Calculation to Computation

Again, it might act upon other things besides 'number' […]

Supposing, for instance, that the fundamental relations of pitched sounds in the science of harmony and of musical composition were susceptible of such expression and adaptations, the engine might compose elaborate and scientific pieces of music of any degree of complexity or extent.

In fact, the engine may be described as being the material expression of any indefinite function of any degree of generality and complexity...

Ada Lovelace, 1843

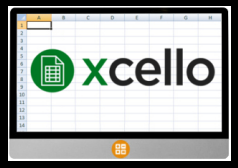


Generisk teknologi

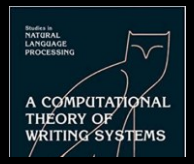
Computeren alene kan intet

+

Med software kan man (næsten) alt





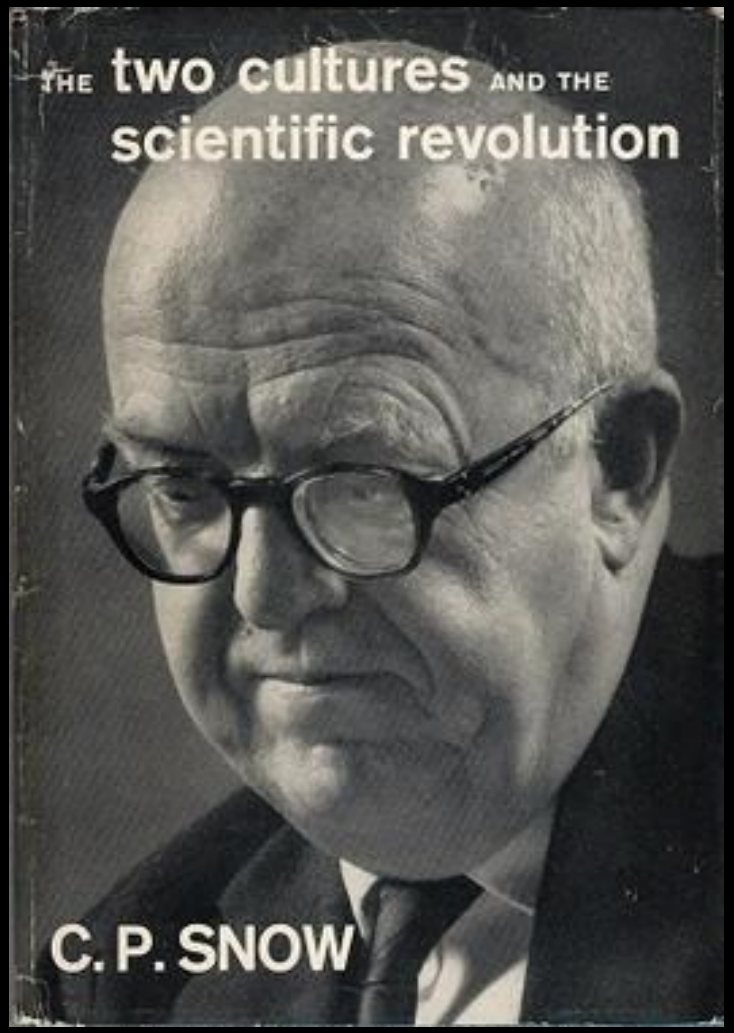
Computer + software = konkrete teknologier
(og vi er kun lige begyndt...)

C.P. Snow (1905-1980)

Artikel i New Statesman fra 1956
Forelæsning på Cambridge University i 1959
Udgivet som bog i 1961

Those who don't understand algorithms,
can't understand how decisions are made.

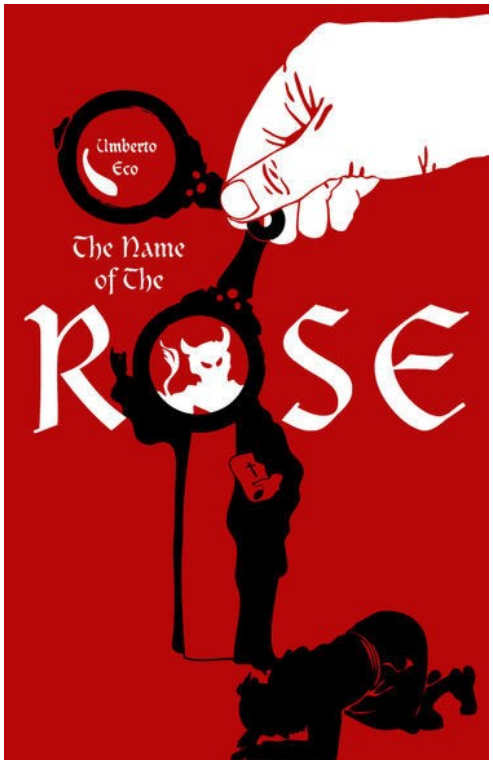
A handful of people,
having no relation to the will of society,
having no communication with the rest of society,
will be taking decisions in secret
which are going to affect our lives
in the deepest sense.



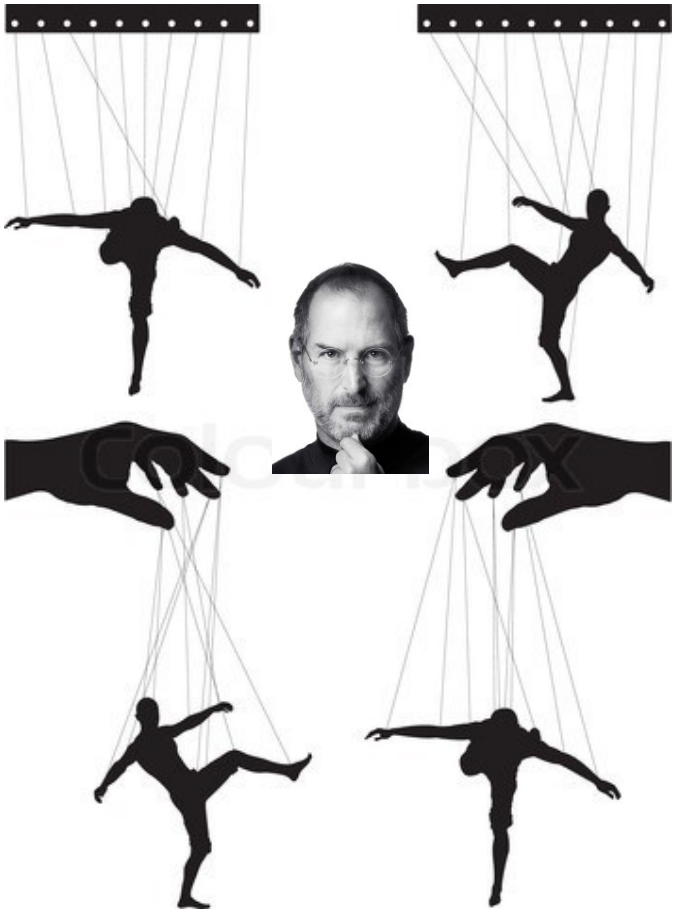
Den største fare er

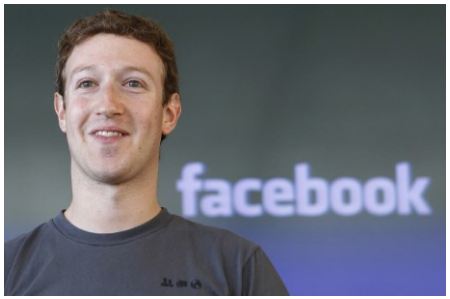
ikke kloge robotter men dumme mennesker...

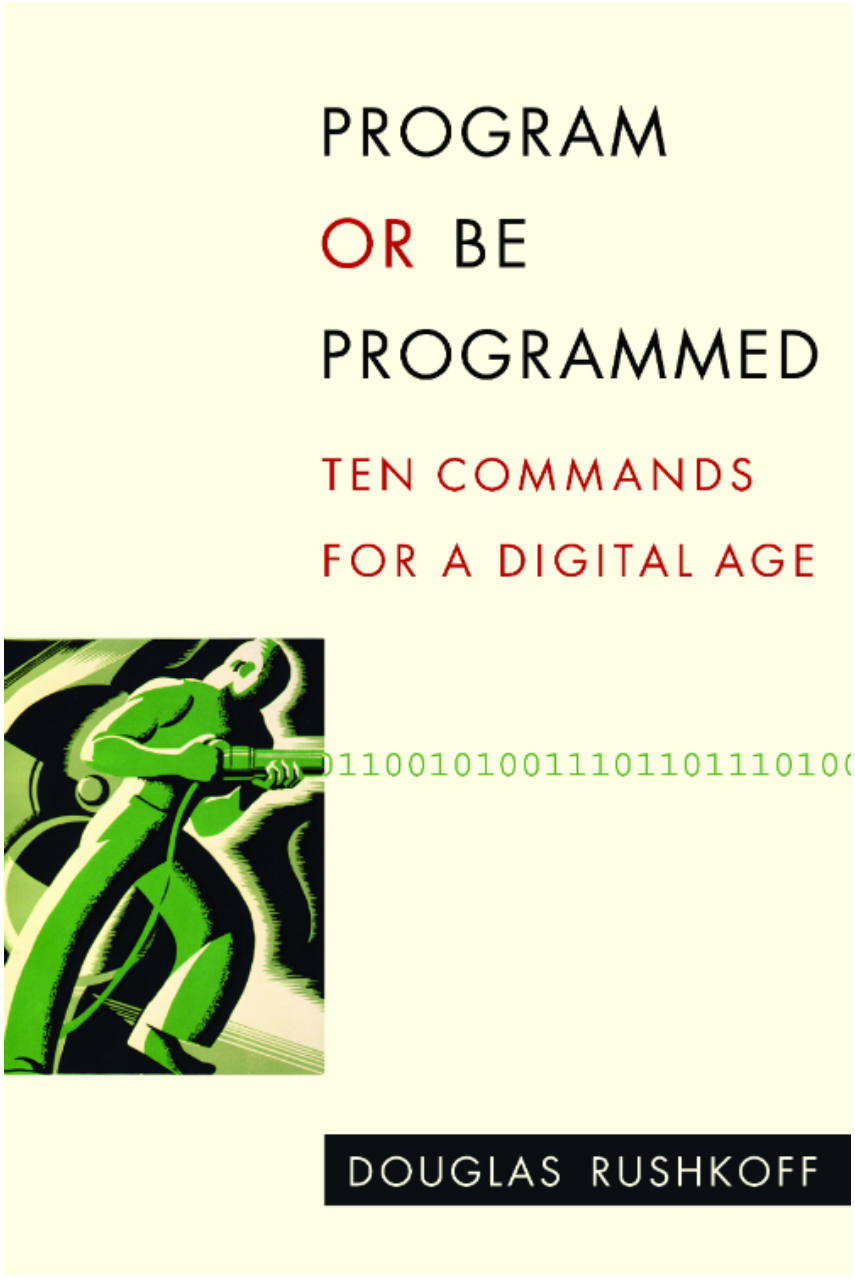
Den mørke Middelalder



Kontrolpanel til civilisationen







"In a digital age
whoever holds the keys
to programming
ends up building the reality
in which the rest of us live."

- Douglas Rushkoff

Videoklip på YouTube

Magtkoncentration

Ti stærkeste brands i 2018

1. Amazon
2. Apple
3. Google
4. Samsung
5. Facebook
6. AT&T
7. Microsoft
8. Verizon
9. Walmart
10. ICBC*

* Industrial and Commercial Bank of China

Alan Perlis (1922-1990)

First Turing Laureate (1966)

1961: *Computer science should be part of a liberal education.*
Computer science is the study of process.
Automated execution of process changes everything!

Alan Perlis (1922-1990)

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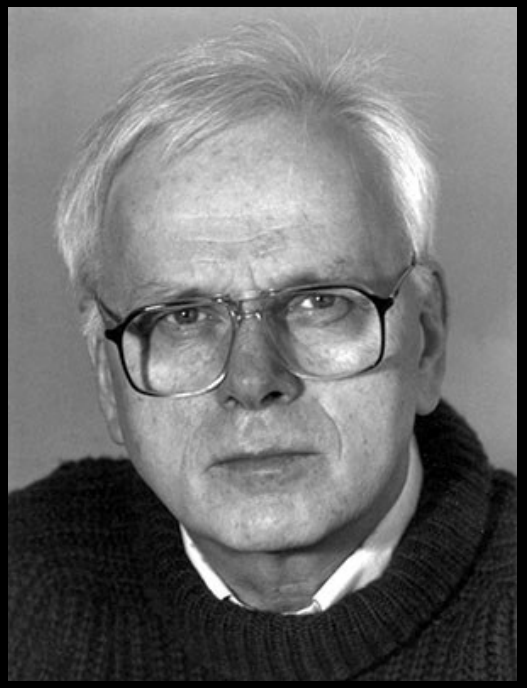
Computer science is the study of process.
Automated execution of process changes everything!

Kristen Nygaard (1926-2002)

Turing Laureate (2001)

1986: *Informatics is the science*
that has as its domain
information processes
and related phenomena
in artefacts, society and nature.

It should be a fundamental subject in school.



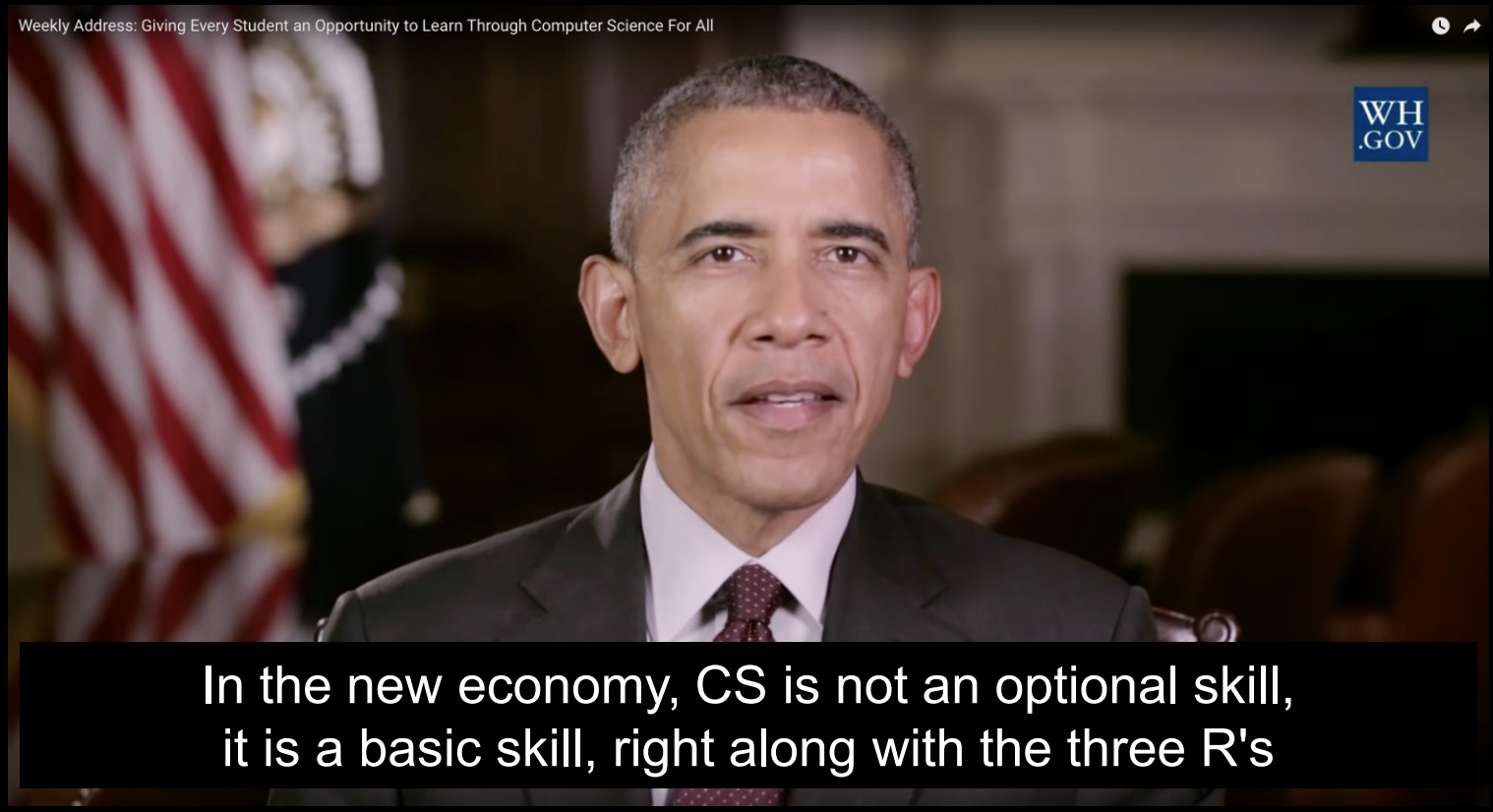
2013
2014
2015
2016

The White House
Office of the Press Secretary

For Immediate Release

January 30, 2016

Weekly Address: Giving Every Student an Opportunity to Learn Through Computer Science For All



https://www.whitehouse.gov/the-press-office/2016/01/30/weekly-address-giving-every-student-opportunity-learn-through-computer

Informatik og CT

Nyt vidensområde i uddannelse

Nye basiskompetencer for alle

Tysk Musik ... Teknologi Design Innovation

Datalogi Samfundsfag Programmering Engelsk

Naturgeografi Afsætning Spansk Biologi Virksomhedsøkonomi

Historie Fysik Oldtidskundskab Kinesisk Kemi Bioteknologi

Læsning Skrivning **Informatik** Matematik

Teknologi-

forståelse

Skriftsprog er grundlaget for hele vores kultur

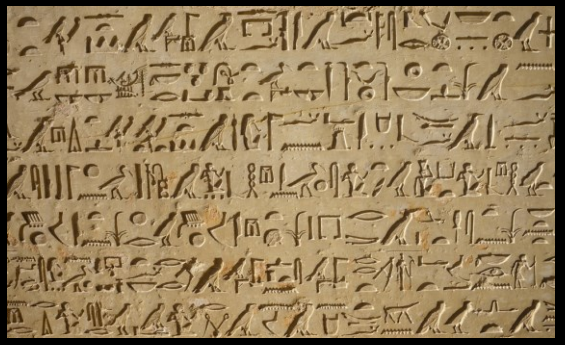
Science er videnskaben
og matematik er sproget
bag den teknologiske revolution

Informatik er videnskaben **og** sproget
bag den digitale revolution

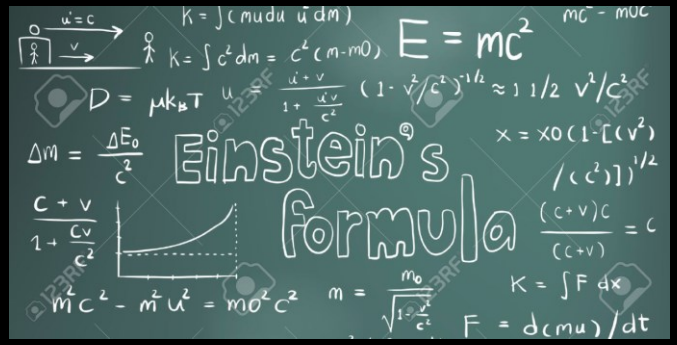
Det fjerde trin i sproglig udvikling

1. Talesprog

2. Skriftsprog

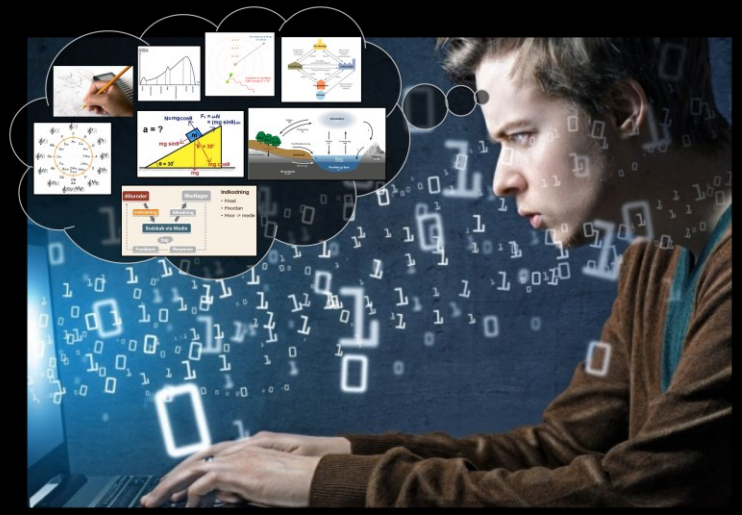


3. Matematisk sprog



Det tog menneskeheden 150 år at blive enige om tegnet for lighed (1557 - 1700)

4. Computationelt sprog



Informatik

Målet er ikke konkrete teknologier, ej heller generel teknologiforståelse, men derimod informatikkens mere grundlæggende

Principper

f.eks. digitalisering, automatisering, design og evaluering

Tænkemåder

f.eks. strukturanalyse, abstraktion, dekomponering samt afkobling af hvad og hvordan

Udtryksformer

f.eks. systembeskrivelse, specielt data- og proces-, designbeskrivelser og programmer

Arbejdsformer

f.eks. problemanalyse, modellering, iterativ designproces, brugerinddragelse, trinvis forbedring, test og fejlretning

Implikationer

f.eks. privathed, sikkerhed og validitet af data og information, men mere generelt informatikkens rolle som katalysator for forandringer i samfundet

Dannelse og literacy

Naturligt vs. matematisk sprog

Naturligt vs. matematisk sprog

It is indeed
too odd
    for words
that half's
three quarters
    of two thirds.

- Piet Hein

Naturligt vs. matematisk sprog

It is indeed
too odd
    for words
that half's
three quarters
    of two thirds.

- Piet Hein

$$\frac{1}{2} = \frac{3}{4} * \frac{2}{3}$$

Matematisk vs. computationelt sprog

The net vertical force from four sides is

$$\left(T\frac{\partial\zeta}{\partial x}\bigg|_{x+dx} - T\frac{\partial\zeta}{\partial x}\bigg|_{x}\right)dy + \left(T\frac{\partial\zeta}{\partial y}\bigg|_{y+dy} - T\frac{\partial\zeta}{\partial x}\bigg|_{y}\right)dx = T\left(\frac{\partial^2\zeta}{\partial x^2} + \frac{\partial^2\zeta}{\partial y^2}\right)dx\,dy$$

Continuity of vertical force on an unit area of the surface requires

$$p_o + p + T\left(\frac{\partial^2\zeta}{\partial x^2} + \frac{\partial^2\zeta}{\partial y^2}\right) = 0.$$

Hence

$$-\rho g\zeta - \rho\frac{\partial\Phi}{\partial t} + T\left(\frac{\partial^2\zeta}{\partial x^2} + \frac{\partial^2\zeta}{\partial y^2}\right) = 0, \quad z = 0. \tag{1.12}$$

which can be combined with the kinematic condition (1.3) to give

$$\frac{\partial^2\Phi}{\partial t^2} + g\frac{\partial\Phi}{\partial z} - \frac{T}{\rho}\nabla^2\frac{\partial\Phi}{\partial\partial z} = 0, \quad z = 0 \tag{1.13}$$

When viscosity is neglected, the normal fluid velocity vanishes on the rigid seabed,

$$\mathbf{n}\cdot\nabla\Phi = \mathbf{0} \tag{1.14}$$

Let the sea bed be $z = -h(x, y)$ then the unit normal is

$$\mathbf{n} = \frac{(\mathbf{h_x}, .\mathbf{h_y}, \mathbf{1})}{\sqrt{\mathbf{1} + \mathbf{h_x^2} + \mathbf{h_y^2}}} \tag{1.15}$$

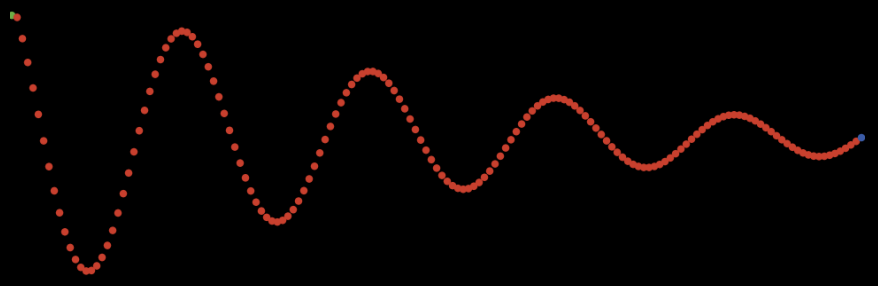
Hence

$$\frac{\partial\Phi}{\partial z} = -\frac{\partial h}{\partial x}\frac{\partial\Phi}{\partial x} - \frac{\partial h}{\partial y}\frac{\partial\Phi}{\partial y}, \quad z = -h(x, y) \tag{1.16}$$

Centralt

Stokastiske metoder, differentialligninger og mange andre "gode" sager

40 sider ikke-triviel matematik



```
set yvel yvel + ((([ypos] of (turtle (who - 1))) - ypos) +
                 (([ypos] of (turtle (who + 1))) - ypos))
set yvel ((1000 - friction) / 1000) * yvel  ;; apply friction
```

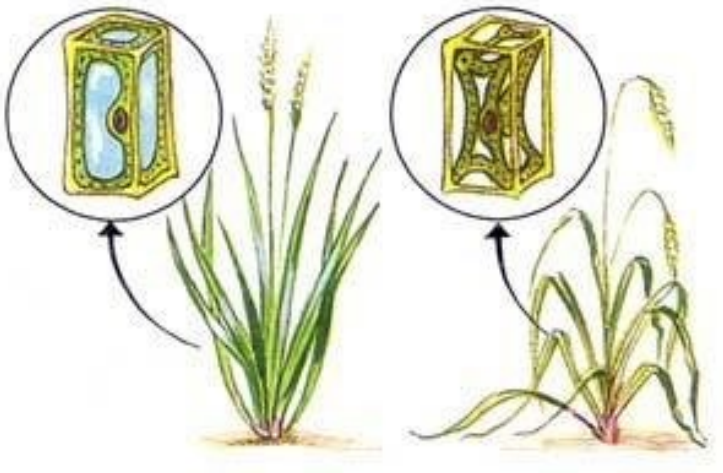
Decentralt

Simpel lokal regel: (a+b) / 2
Emergens og dynamik "foræret"

Agentbaseret modellering (ABM)

Radikal ny udtryksform: kreativitet fremfor reproduktion

En moderne biologiopgave



SCRATCH

Læringsspil
til elever i 3. klasse

For science, big data is the microscope of the 21st century

09. OKT. 2013 KL. 18:48 | OPDATERET 09. OKT. 2013 KL. 19:03

Bag om Nobelprisen 2013: Computerkemi

De tre kemikere Karplus, Levitt og Warshel hædres med Nobelpris for computermodel

De tre Nobelprisvindere udviklede computerprogrammer til at beskrive kemiske molekyler allerede fra starten af 1970'erne. For at give et indtryk af, hvad forskerne havde at arbejde med, ses her en Apple-computer fra 1976. Foto: TONY AVELAR © Scanpix

For science, big data is the microscope of the 21st century

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computer fra 1976. Foto: TONY AVELAR © Scanpix

Vincent Hendricks
Centre for Information and Bubble Studies (CIBS)

Kristoffer Laigaard Nielbo
Lektor, Afdeling for Religionsvidenskab / Center for Interacting Minds (IMC)

Computationel X, hvor X =

Økonomi

Uddannelse

Psykologi

Kemi

Historie

(Molekylær) Biologi

Lingvistik

Fysik

Musik

Arkæologi

Etnografi

Teologi

Litteratur

Jura

Journalistik

Samfundsvidenskab

...

Computational X – nogle nedslag

Society for Computational Economics
http://www.comp-econ.org
https://en.wikipedia.org/wiki/Computational_economics
ABM: http://www2.econ.iastate.edu/tesfatsi/ace.htm
Journal: http://www.inderscience.com/jhome.php?jcode=ijcee

Computational History
+ https://www.youtube.com/watch?v=NPliIRfWei4
+ https://www.technologyreview.com/s/601763/how-the-new-science-of-computational-history-is-changing-the-study-of-the-past/
+ https://dl.acm.org/citation.cfm?id=2638478
+ http://dh-r.lincolnmullen.com (book)
+ http://www.springer.com/gp/book/9783319462233 (CH and Data-Driven Humanities)

Computational Psychology
https://dornsife.usc.edu/psyc/computational-psychology/
https://en.wikipedia.org/wiki/Computational_cognition
http://cocosci.mit.edu/people

Computational Chemistry
+ http://cocosci.mit.edu/people
+ https://www.acs.org/content/acs/en/careers/college-to-career/chemistry-careers/computational-chemistry.html

Computational Physics
https://en.wikipedia.org/wiki/Computational_physics
https://www.wired.com/2015/11/what-computational-physics-is-really-about/
https://www.cmu.edu/physics/research/comp-phys.html

Computational (Molecular) Biology
https://en.wikipedia.org/wiki/Computational_biology
https://mitpress.mit.edu/books/series/computational-molecular-biology
https://www.crcpress.com/Handbook-of-Computational-Molecular-Biology/Aluru/p/book/9781584884064

Computational Linguistics
https://en.wikipedia.org/wiki/Computational_linguistics
https://plato.stanford.edu/entries/computational-linguistics/
https://www.quora.com/How-is-computational-linguistics-different-from-natural-language-processing
http://www.uni-heidelberg.de/courses/prospective/academicprograms/Computational_Linguistics_ba_en.html

Computational Musicology
https://en.wikipedia.org/wiki/Computational_musicology
https://pushpullfork.com/computational-musicology/
https://www.jstor.org/stable/30200278?seq=1#page_scan_tab_contents
http://www.springer.com/series/8349

Computational Theology
+ https://en.wikipedia.org/wiki/Computational_theology
+ https://books.google.dk/books?id=i5iQ_MA45bEC&pg=PA81&lpg=PA81&dq=computational+religion&source=bl&ots=bsh1a1tcUR&sig=nOfK5DrFFI3lF-uUtdZq6Ivx_ss&hl=en&sa=X&ved=0ahUKEwj9jMeWw7DYAhXBCpoKHblpB8QQ6AEIUzAI#v=onepage&q=computational%20religion&f=false
+ http://pure.au.dk/portal/da/persons/kristoffer-laigaard-nielbo(aef8887c-d4e9-4270-9031-1a15553f5590)/publications/computing-religion(9891ac55-8c83-48ab-82c9-2d2a6e2f88f7)/export.html

Computational Archaeology
+ https://science.howstuffworks.com/environmental/earth/geology/computational-archaeology.htm
+ https://en.wikipedia.org/wiki/Computational_archaeology
+ https://www.ucl.ac.uk/prospective-students/graduate/taught/degrees/computational-archaeology-gis-data-science-complexity-msc
+ https://computationalarchaeology.wordpress.com/about/
+ http://isaacullah.github.io

Computational Ethnography
+ https://orgtheory.wordpress.com/2015/01/20/computational-ethnography/
+ http://stuartgeiger.com/talks/2017-09-14-computational-ethnography
+ https://books.google.dk/books?id=vAv0DQAAQBAJ&pg=PT105&lpg=PT105&dq=computational+ethnography&source=bl&ots=jkmQS7dz-H&sig=wDui9UiGsipL-K3-1KDYCNx8tB4&hl=en&sa=X&ved=0ahUKEwiogubqxLDYAhUBJpoKHc-7BJwQ6AEIXTAJ#v=onepage&q=computational%20ethnography&f=false

Computational Literature
https://www.newyorker.com/books/page-turner/an-attempt-to-discover-the-laws-of-literature
https://www.frontiersin.org/research-topics/5802/computational-linguistics-and-literature
http://www.caltech.edu/content/art-tech-panel-computational-literature

Computational Journalism
https://en.wikipedia.org/wiki/Computational_journalism
http://www.jomec.co.uk/blog/what-is-computational-journalism/
http://cjlab.stanford.edu
https://cacm.acm.org/magazines/2011/10/131400-computational-journalism/fulltext

Computational Social Science
https://en.wikipedia.org/wiki/Computational_social_science
https://iriss.stanford.edu/css
https://www.microsoft.com/en-us/research/group/computational-social-science/
http://as.cornell.edu/block/computational-social-sciences
http://www.springer.com/series/11784
https://www.gesis.org/en/institute/departments/computational-social-science/

Computational Law
https://en.wikipedia.org/wiki/Computational_law
https://law.mit.edu/Computational-Law-Course
https://law.stanford.edu/projects/computational-law/
https://www.wired.com/2016/10/computational-law-symbolic-discourse-and-the-ai-constitution/

The Cathedral of Computation
https://www.theatlantic.com/technology/archive/2015/01/the-cathedral-of-computation/384300/

Tostrenget strategi:

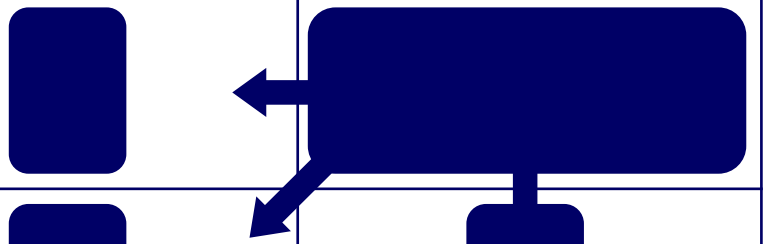
Informatik og CT

- som fag/udd. (specialisering)
- i alle fag/udd. (integrering)

[På alle uddannelsestrin]

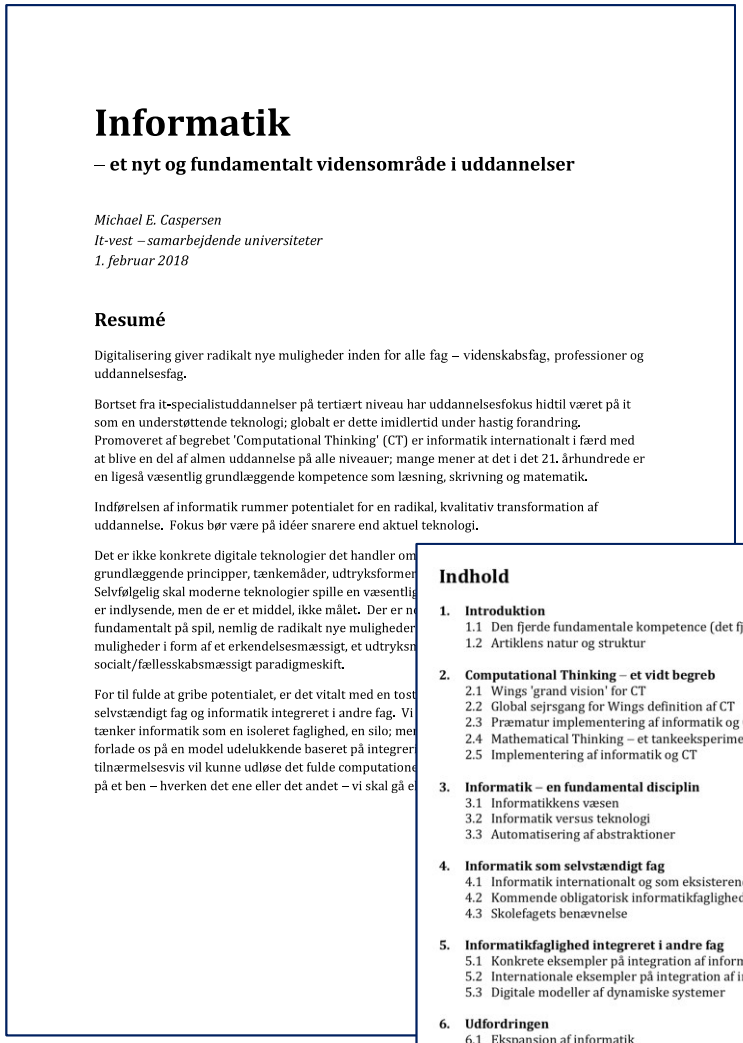
En mægtig udfordring

Ekspansion af informatik (tænk mat)

Uddannelses-niveau	**Integration** (i fag/uddannelser)	**Specialicering** (som fag/uddannelse)
Videregående uddannelser		
Ungdoms-uddannelser		
Grundskolen		

Almengørelse ♦ Curriculum ♦ Materialer ♦ Lærere (fødekæden) !

Bilag



Informatik

– et nyt og fundamentalt vidensområde i uddannelser

Michael E. Caspersen
It-vest – samarbejdende universiteter
1. februar 2018

Resumé

Digitalisering giver radikalt nye muligheder inden for alle fag – videnskabsfag, professioner og uddannelsesfag.

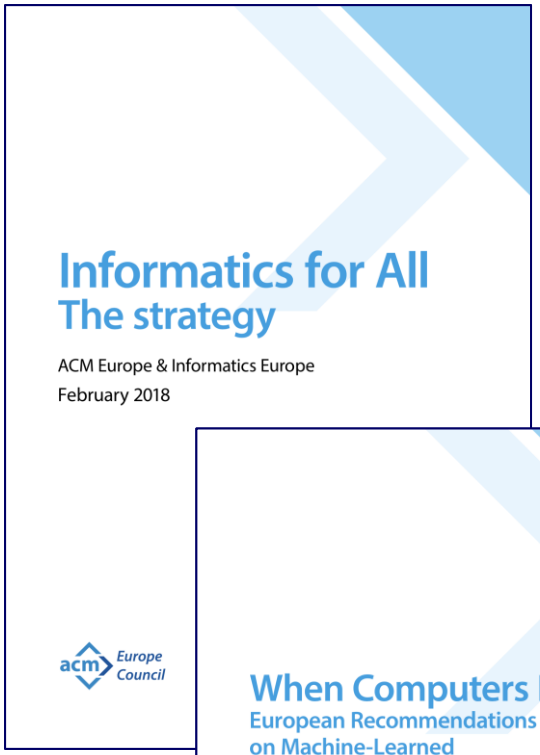
Bortset fra it-specialistuddannelser på tertiært niveau har uddannelsesfokus hidtil været på it som en understøttende teknologi; globalt er dette imidlertid under hastig forandring. Promoveret af begrebet 'Computational Thinking' (CT) er informatik internationalt i færd med at blive en del af almen uddannelse på alle niveauer; mange mener at det i det 21. århundrede er en ligeså væsentlig grundlæggende kompetence som læsning, skrivning og matematik.

Indførelsen af informatik rummer potentialet for en radikal, kvalitativ transformation af uddannelse. Fokus bør være på idéer snarere end aktuel teknologi.

Det er ikke konkrete digitale teknologier det handler om
grundlæggende principper, tænkemåder, udtryksformer
Selvfølgelig skal moderne teknologier spille en væsentlig
er indlysende, men de er et middel, ikke målet. Der er n
fundamentalt på spil, nemlig de radikalt nye muligheder
muligheder i form af et erkendelsesmæssigt, et udtryksm
socialt/fællesskabsmæssigt paradigmeskift.

For til fulde at gribe potentialet, er det vitalt med en tost
selvstændigt fag og informatik integreret i andre fag. Vi
tænker informatik som en isoleret faglighed, en silo; me
forlade os på en model udelukkende baseret på integrer
tilnærmelsesvis vil kunne udløse det fulde computatione
på et ben – hverken det ene eller det andet – vi skal gå e

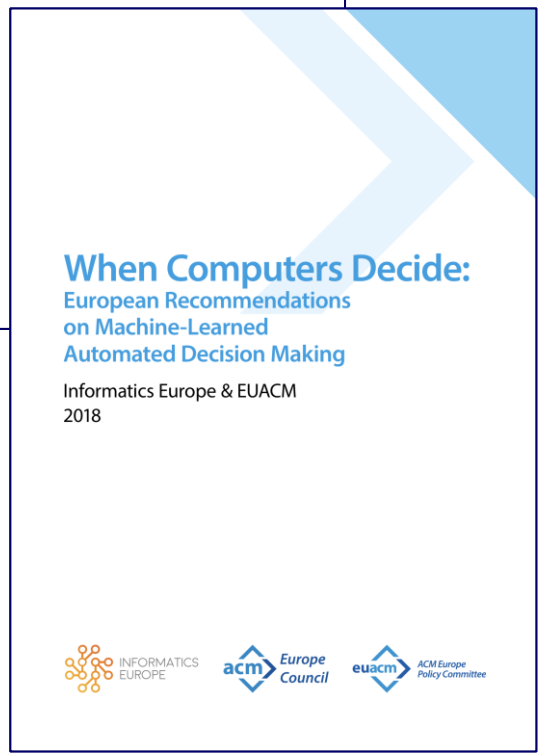
Indhold



Informatics for All
The strategy

ACM Europe & Informatics Europe
February 2018

acm Europe Council



When Computers Decide:
European Recommendations on Machine-Learned Automated Decision Making

Informatics Europe & EUACM
2018

INFORMATICS EUROPE
acm Europe Council
euacm ACM Europe Policy Committee

To the uneducated, even the simplest technology seems like magic...

Teknologifrygt

er ikke kun irrationel
og kan hverken uddannes
eller snakkes bort.

Fordrer lovgivning!