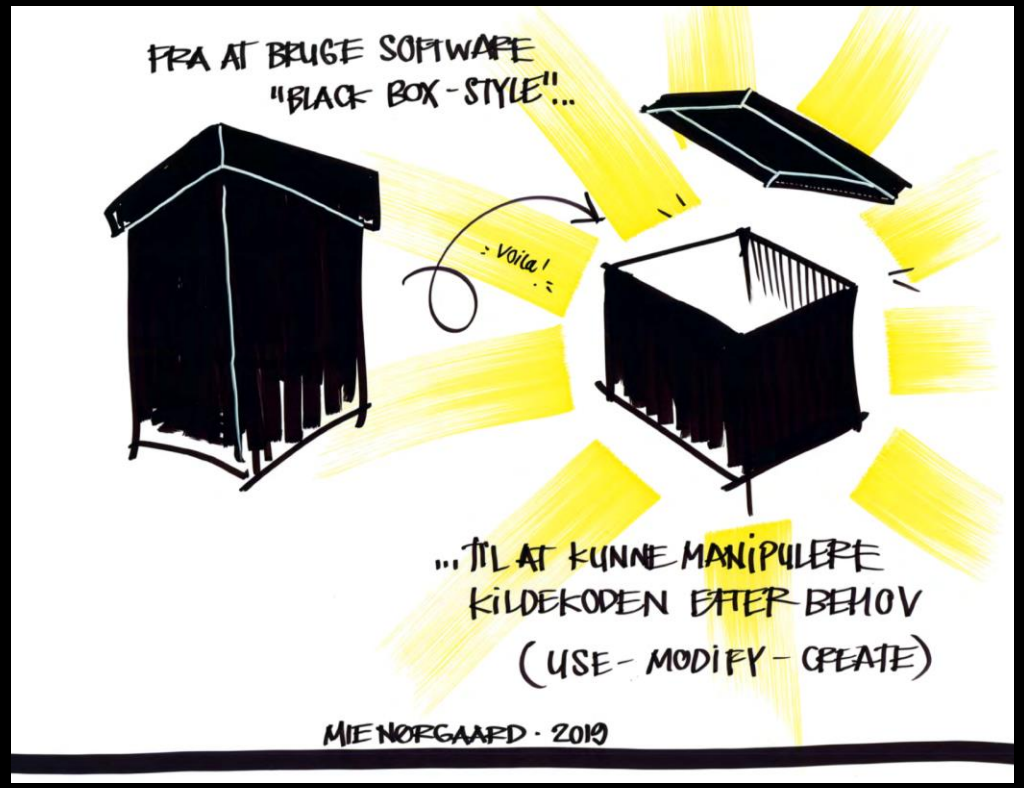
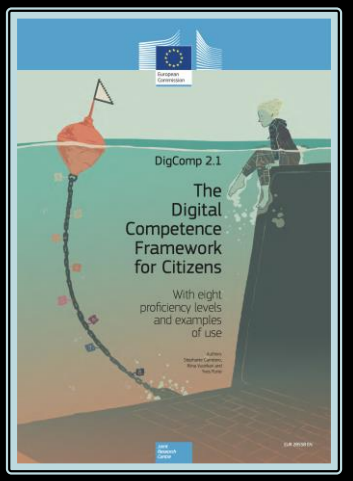
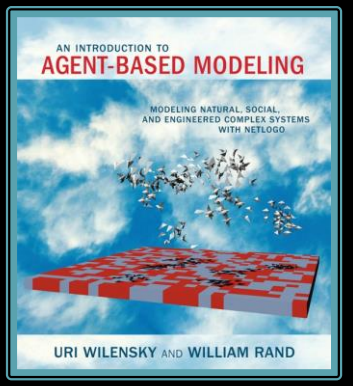
Digital vs. computationel



Digitale brugskompetencer
Kommunikation
Samarbejde
Sikkerhed
Internettet
WWW
SoMe
Apps
Data
Big data
Digitalisering
Internet of things
Kunstig intelligens
Computational literacy
Computationelle metoder
Computationel modellering
Program or be programmed...

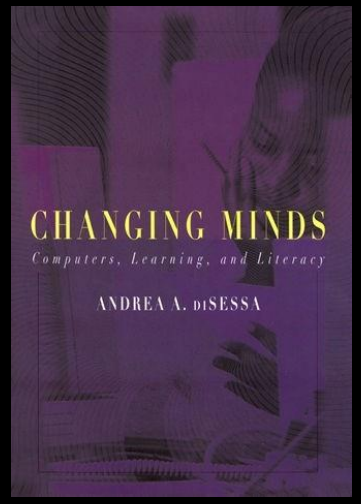
2005, 2013, 2016, 2017, ...





2015

Computational Literacy



Andrea diSessa, professor @ UC Berkeley

Changing Minds: Computers, Learnign and Literacy, MIT Press (2000)

If a true computational literacy comes to exist,
it will be infrastructural in the same way current literacy is in current schools.

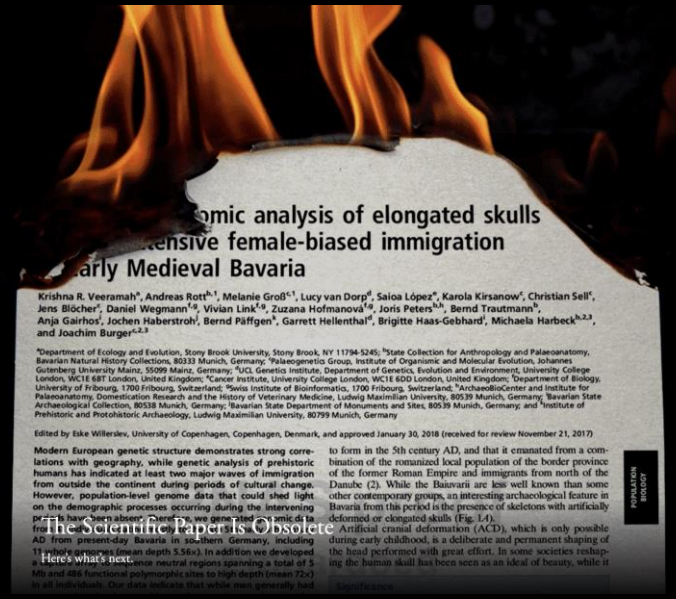
Students will be learning and using it constantly through their schooling careers and beyond in diverse scientific, humanistic, and expressive pursuits.

Outside of schools, a computational literacy will allow civilization to think and do things that will be new to us in the same way that the modern literate society would be almost incomprehensible to preliterate cultures.

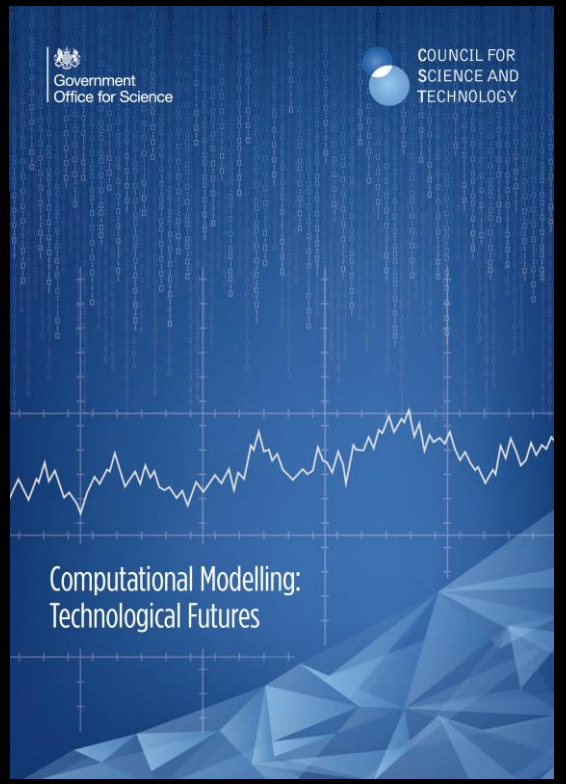
Tendenser og muligheder

Computational modelling in
- public policy
- business and manufacturing
- finance and economics
- ...

Computational essays



The Scientific Paper Is Obsolete
Here's what's next.



A: digital

Kommentar: Systemforståelse – et fag, du ikke kan få

Peter Hesseldahl | 9. oktober 2019 kl. 21.00 |

KOMMENTAR: Vi ville stå bedre rustet i en kompleks og omskiftelig verden, hvis vi lærte at forstå de generelle mekanismer, der præger udviklingen af alle systemer – fra biologi, økonomi og til internettet. Men mærkværdigvis er systemforståelse slet ikke på skemaet.

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Økonomi, politik, klimaet, trafik, internettet, kroppen og vores sundhed. Det er emner, der er afgørende for vores trivsel, men hvis vi skal kunne forholde os konstruktivt og realistisk til dem, er vi nødt til at forstå de bagvedliggende mekanismer, der bestemmer, hvordan de udvikler sig som systemer.

- Hvis man ikke som udgangspunkt medtænker selvforstærkende tendenser og *tipping points*, så kan man ikke forstå, hvordan klimaet udvikler sig, eller hvordan historier spredes viralt på de sociale medier.

Vision og kompetencerammer

Model-Based Thinking and Practice

A Top-down Approach to Computational Thinking

Palle Nowack and Michael E. Caspersen
Centre for Science Education
Aarhus University, Denmark
{nowack, mec}@cse.au.dk

ABSTRACT

In this paper, we discuss using models and modeling in a new way to teach basic computing to pupils within the K-12 segment. We argue why we believe understanding and creating models are fundamental skills for all pupils as it can be characterized as the skill that enable us to analyze and understand phenomena as well as design and construct artifacts. We also try to characterize the essence of model-based thinking and practice. We propose that a strong focus on the relation between mental models (of real or imaginary systems) and computerized models (embedded in computer-based systems) could provide a new approach to teaching computing. This approach should clarify and make explicit the role of models in computing in connection with other subject areas. We believe that such an approach would strongly broaden the participation in computing, as it will allow more pupils to become active creators with computing.[1]

Categories and Subject Descriptors

K.3.2 [**Computers and Education**]: Computers and Information Science Education—Computer Science Education

General Terms

Experimentation, Human Factors, Languages, Theory.

Keywords

Models, modeling, teaching, thinking, practice.

1. INTRODUCTION

During the last 50 years many attempts have been made to broaden the participation in computer science. One of the latest and most promising approaches is computational thinking: "Computational Thinking is the thought processes involved in formulating problems and their solutions so that the solutions are represented in a form that can be effectively carried out by an information-processing agent" [9]. Computational thinking involves thinking in terms of recursion, parallel processing, interpretation, generalization, naming schemes, correctness, efficiency, aesthetics, abstraction, decomposition, separation of concerns, representations, models, invariants, modularization, caching, planning, learning, scheduling, and much more [27].

This is a very broad selection of fundamental concepts, and it can be conceptualized and implemented in the classroom in many different ways. In Figure 1, we provide an attempt to characterize IT in education. "Basic ICT skills" and "ICT and learning" are in our opinion not relevant in relation to computational thinking, so in the remainder of the paper we focus on IT as a subject versus IT in subjects ("What to learn" in the illustration). Computational thinking lends itself very much to the use of IT in other subjects, whether in subjects as we know them today (journalism, economics, chemistry, etc.) or as a defining technology for transforming and innovating subjects (e. g. digital journalism or bioinformatics). But it appears that both these (in-subject) applications of computational thinking require a reformulated (more general) IT-subject (in the sense IT-as-a-subject) and not computer science as such. Hence in order to broaden the participation in computing, we advocate broadening the computing subject itself.

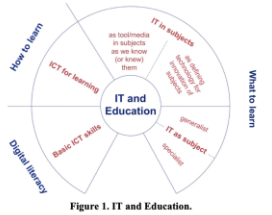

Figure 1. IT and Education.

In this paper we describe one direction in which to search for a new and broader computing subject based on computational thinking. We propose to focus on the use of models and modeling, both in order to benefit from a strong tradition in computing, but also to build bridges to a wide range of other subjects. We focus on the teaching of computing for pupils within the K-12 segment. That is, we focus on knowledge and skills, which we find generally useful at the same level as basic reading, writing and mathematics.

An early version of this paper was submitted and accepted as a white paper for the "Future directions in Computing Education Research Summit" in Orlando, January 2014. The accepted white papers were not published but are available from the summit website.

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ACM 978-1-4503-3065-7/14/11...$15.00
http://dx.doi.org/10.1145/2674683.2674686

Defining Computational Thinking for Mathematics and Science Classrooms

David Weintrop[1,2] · Elham Beheshti[3] · Michael Horn[1,2,3] · Kai Orton[1,2] · Kemi Jona[2,3] · Laura Trouille[5,6] · Uri Wilensky[1,2,3,4]

Data Practices	Modeling & Simulation Practices	Computational Problem Solving Practices	Systems Thinking Practices
Collecting Data	Using Computational Models to Understand a Concept	Preparing Problems for Computational Solutions	Investigating a Complex System as a Whole
Creating Data	Using Computational Models to Find and Test Solutions	Programming	Understanding the Relationships within a System
Manipulating Data	Assessing Computational Models	Choosing Effective Computational Tools	Thinking in Levels
Analyzing Data	Designing Computational Models	Assessing Different Approaches/Solutions to a Problem	Communicating Information about a System
Visualizing Data	Constructing Computational Models	Developing Modular Computational Solutions	Defining Systems and Managing Complexity
		Creating Computational Abstractions	
		Troubleshooting and Debugging	

Fig. 2 Computational thinking in mathematics and science taxonomy

Tentativ ramme for CT i cand.it.-uddannelser

August 2018

2. CT-kompetencebeskrivelse for humanistiske it-uddannelser
Studieordningernes kompetenceprofiler for humanistiske it-uddannelser suppleres med følgende:

Den studerende skal kunne

- anvende computermodeller til at opnå ny erkendelse af eget fagfelt,
- forstå computationelle tankeprocesser,
- gennemføre computationelle tankeprocesser og praksisser,
- tilegne sig et sprog (verbal og programmering) for at kunne forberede og konstruere digitale artefakter,
- argumentere for designprocessen og den endelige løsning gennem proces og data,
- konstruere eller redesigne et interaktivt digitalt artefakt til et proof of concept,
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147

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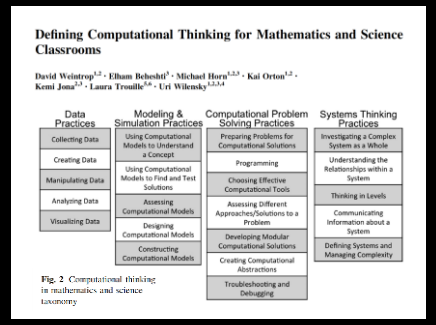

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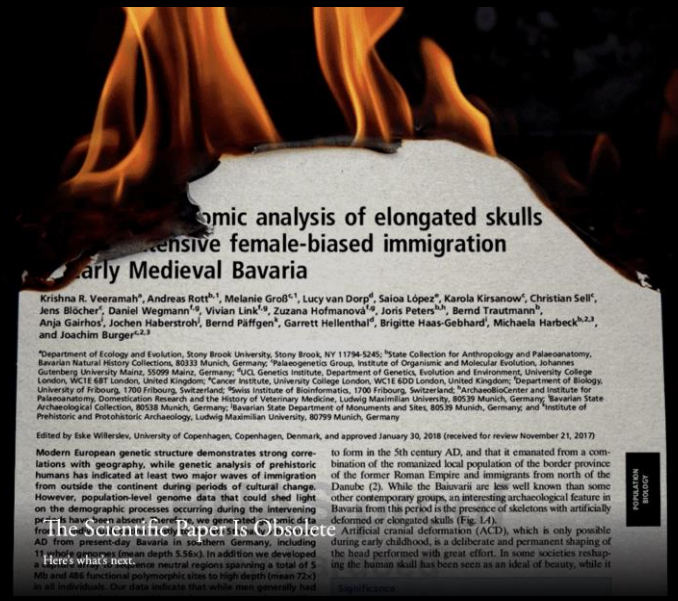
Fig. 2. Computational thinking in mathematics and science taxonomy

Computational essays



…omic analysis of elongated skulls
…tensive female-biased immigration
…arly Medieval Bavaria

Krishna R. Veeramah[a], Andreas Rott[b,1], Melanie Groß[c,1], Lucy van Dorp[d], Saioa López[e], Karola Kirsanow[c], Christian Sell[c], Jens Blöcher[a], Daniel Wegmann[f,g], Vivian Link[f,g], Zuzana Hofmanová[f,g], Joris Peters[h,i], Bernd Trautmann[b], Anja Gairhos[j], Jochen Haberstroh[j], Bernd Päffgen[k], Garrett Hellenthal[d], Brigitte Haas-Gebhard[l], Michaela Harbeck[h,2,3], and Joachim Burger[c,2,3]

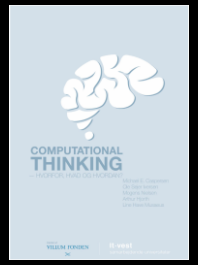
[a]Department of Ecology and Evolution, Stony Brook University, Stony Brook, NY 11794-5245; [b]State Collection for Anthropology and Palaeoanatomy, Bavarian Natural History Collections, 80333 Munich, Germany; [c]Palaeogenetics Group, Institute of Organismic and Molecular Evolution, Johannes Gutenberg University Mainz, 55099 Mainz, Germany; [d]UCL Genetics Institute, Department of Genetics, Evolution and Environment, University College London, WC1E 6BT London, United Kingdom; [e]Cancer Institute, University College London, WC1E 6DD London, United Kingdom; [f]Department of Biology, University of Fribourg, 1700 Fribourg, Switzerland; [g]Swiss Institute of Bioinformatics, 1700 Fribourg, Switzerland; [h]ArchaeoBioCenter and Institute for Palaeoanatomy, Domestication Research and the History of Veterinary Medicine, Ludwig Maximilian University, 80539 Munich, Germany; [i]Bavarian State Archaeological Collection, 80538 Munich, Germany; [j]Bavarian State Department of Monuments and Sites, 80539 Munich, Germany; and [k]Institute of Prehistoric and Protohistoric Archaeology, Ludwig Maximilian University, 80799 Munich, Germany

Edited by Eske Willerslev, University of Copenhagen, Copenhagen, Denmark, and approved January 30, 2018 (received for review November 21, 2017)

Modern European genetic structure demonstrates strong correlations with geography, while genetic analysis of prehistoric humans has indicated at least two major waves of immigration from outside the continent during periods of cultural change. However, population-level genome data that could shed light on the demographic processes occurring during the intervening … to form in the 5th century AD, and that it emanated from a combination of the romanized local population of the border province of the former Roman Empire and immigrants from north of the Danube (2). While the Baiuvarii are less well known than some other contemporary groups, an interesting archaeological feature in Bavaria from this period is the presence of skeletons with artificially deformed or elongated skulls (Fig. 1A).

Artificial cranial deformation (ACD), which is only possible during early childhood, is a deliberate and permanent shaping of the head performed with great effort. In some societies reshaping the human skull has been seen as an ideal of beauty, while it

POPULATION BIOLOGY



The Scientific Paper Is Obsolete
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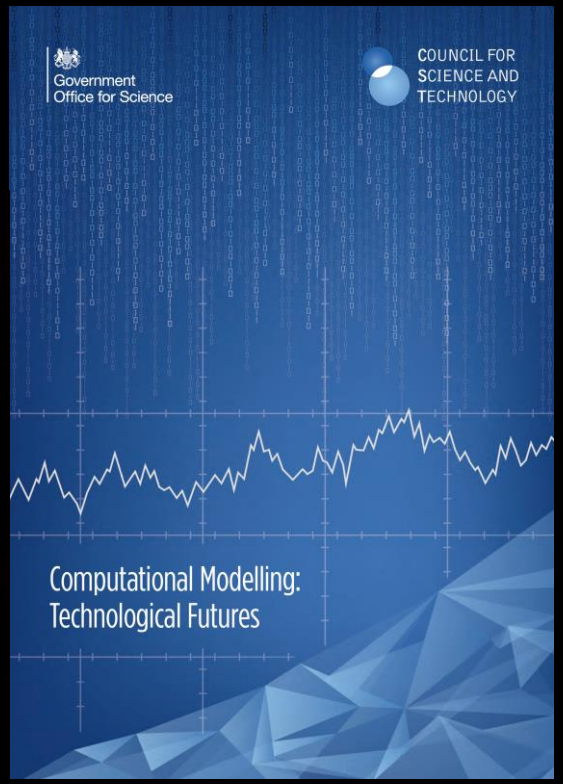

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It-vest
samarbejdende universiteter

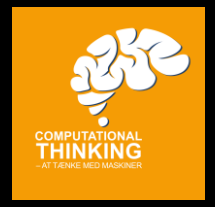
Anders Kristian Munk

Leder af TANTLab
AAU i København

"Hvert fagområde må overveje og
udvikle en computationel udgave af sig selv
nedefra og indefra.

Det handler netop *ikke* om at importere
en færdig datalogisk pakke
[en black-box].

Det gælder ikke mindst på HUM og SAMF,
hvor det kræver, at vi
stikker fingrene i den digitale frikadellefars
og er med til at bygge de værktøjer,
vi erkender verden med."



Episode 1.7
Folkekultur på Facebook – et besøg på det tekno-antropologiske laboratorium
Anders Munks morale: 25:00 – 26:20