

## Interdisciplinary Research: -- Thinking and Tinkering --

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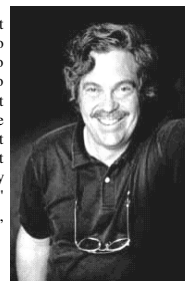
## Thinker versus Tinker



Ludwig Boltzmann (1884-1906)

"There is nothing so  
practical as a good  
theory."  
--- Ludwig Boltzmann

"Don't worry about what  
anybody else is going to  
do... The best way to  
predict the future is to  
invent it. Really smart  
people with reasonable  
funding can do just  
about anything that  
doesn't violate too many  
of Newton's Laws!"  
— Alan Kay in 1971,

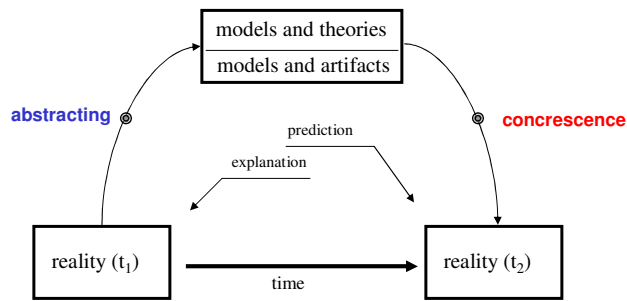


Alan C. Kay (1940-)

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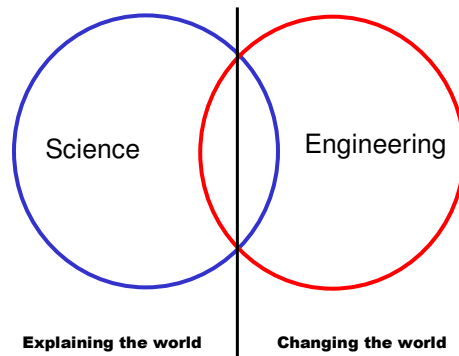
# What is research all about?



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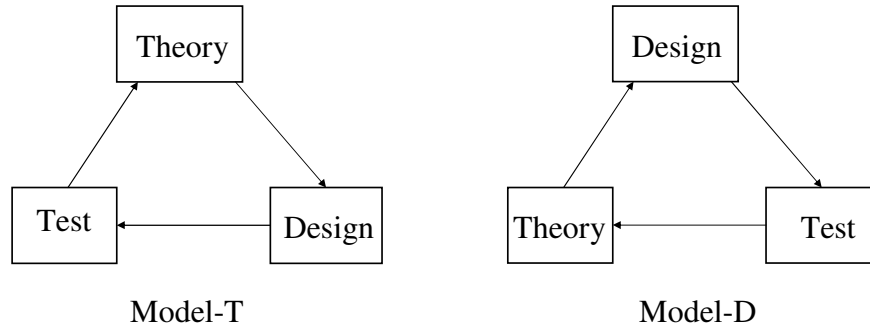
# Who is doing research?



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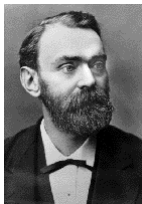
# Knowledge: but which one?



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## Thinker versus Tinker



(1833-1896)

### Alfred Nobel

**Alfred Nobel's last will and testament is clear and concise:**

"The whole of my remaining realizable estate shall be dealt with in the following way. The capital shall be invested by my executors in safe securities and shall constitute a fund, the interest on which shall be annually distributed in the form of prizes to those who, during the preceding year, shall have conferred the greatest benefit on mankind.

The said interest shall be divided into five equal parts, which shall be apportioned as follows:

**one part to the person who shall have made**

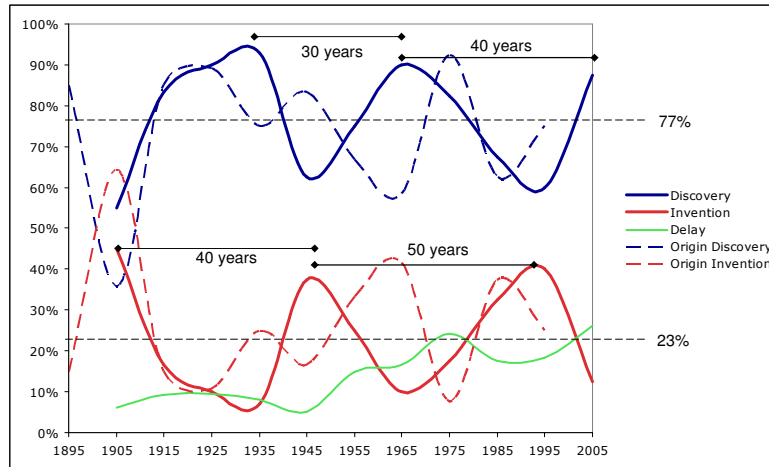
**the most important discovery or invention within the field of physics;**

one part to the person who shall have made the most important chemical discovery or improvements; one part to the person who shall have made the most important discovery within the domain of physiology or medicine; one part to the person who shall have produced in the field of literature the most outstanding work of an idealistic tendency; and one part to the person who shall have done the most or best work for fraternity among nations, for the abolition or reduction of standing armies and for the holding and promotion of peace congresses."

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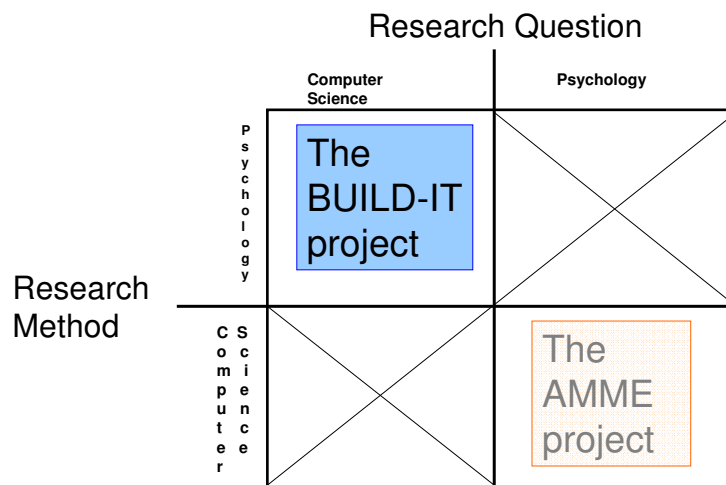
## Trends in Nobel Prizes for Physics over 11 Decades



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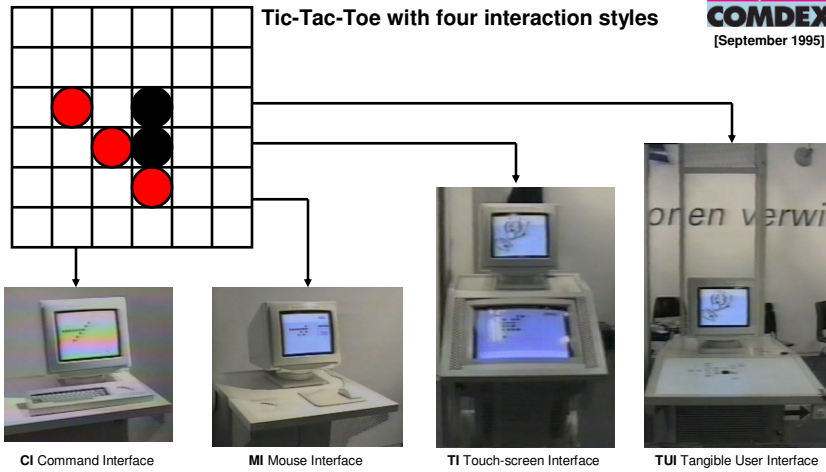
## Our Approach: thinking and tinkering



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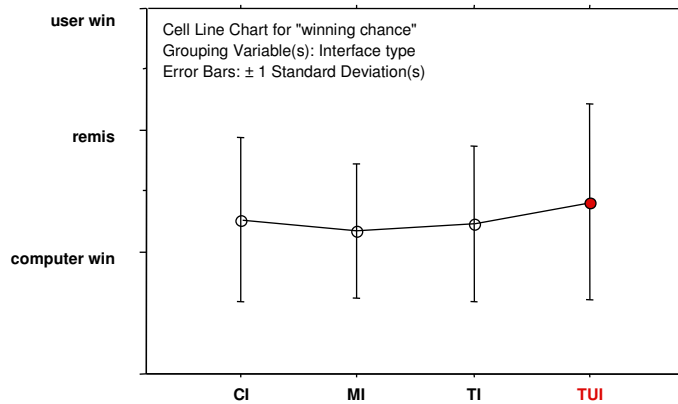
# BUILD-IT: discovery



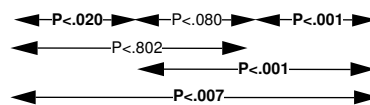
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## Empirical Results : winning chance per dialog technique



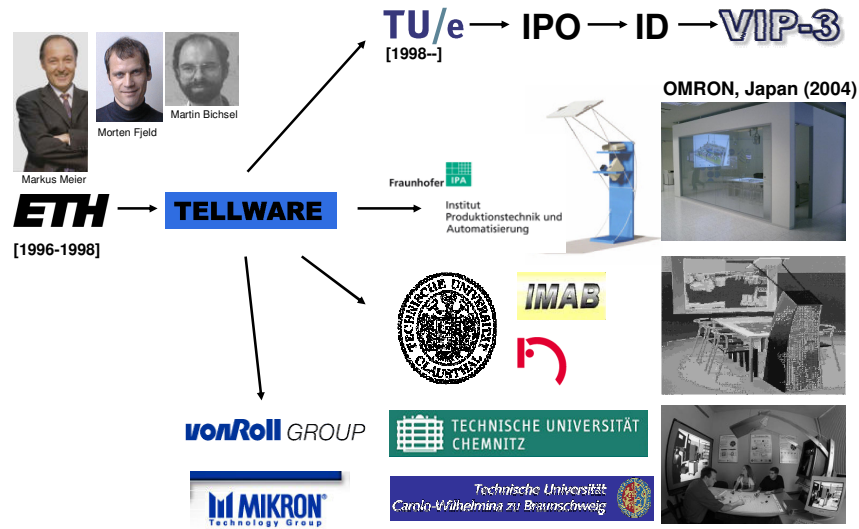
We recorded automatically 9'006 contacts with in total 96'739 moves.  
 CI = 1'128 player contacts,  
 MI = 3'645 player contacts,  
 TI = 2'881 player contacts,  
 TUI = 1'352 player contacts.  
 In total 3'801 completed games.



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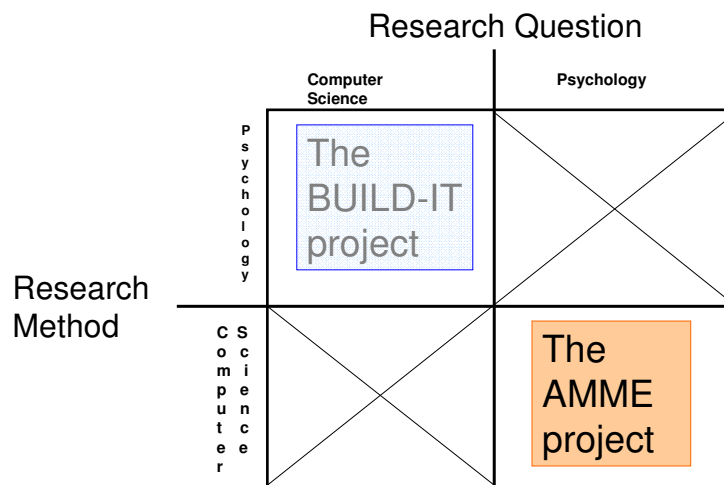
# BUILD-IT: invention



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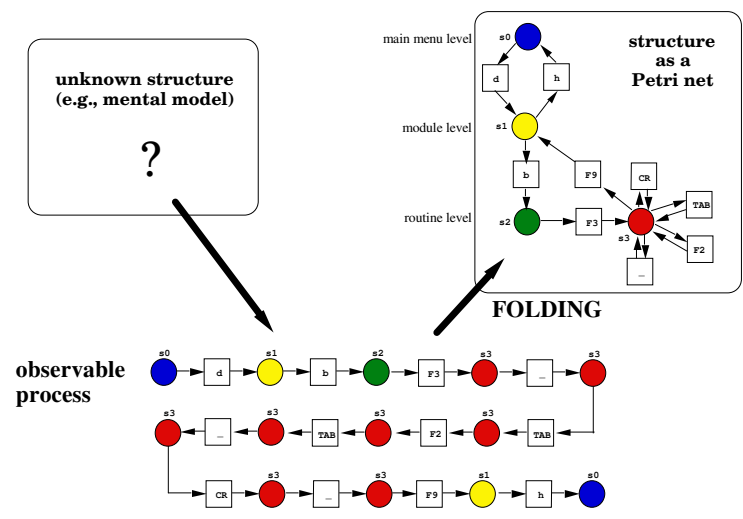
## Our Approach: tinkering and thinking



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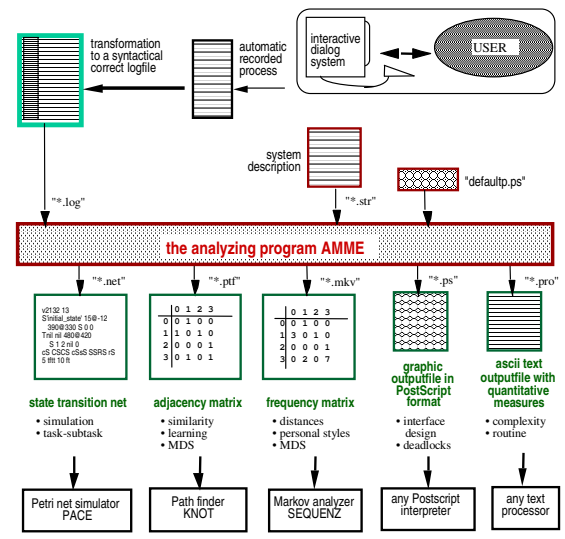
# AMME: invention



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## The AMME Program Structure



- M. Decasper
- J. Hofmann
- C. Leuchter
- P. Merz
- P. Meyer
- J. Rudnik
- C. Sentfen
- E. Zeller

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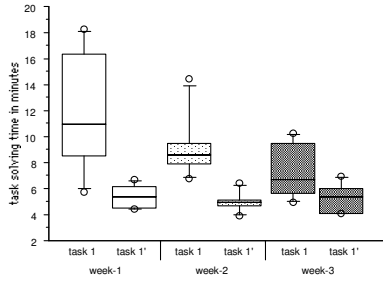
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# AMME: discovery

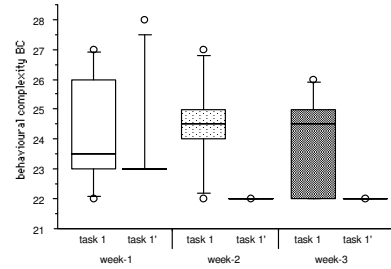
N=6 men (average age of 25 ± 3 years)



Task solving time



Behavioral complexity

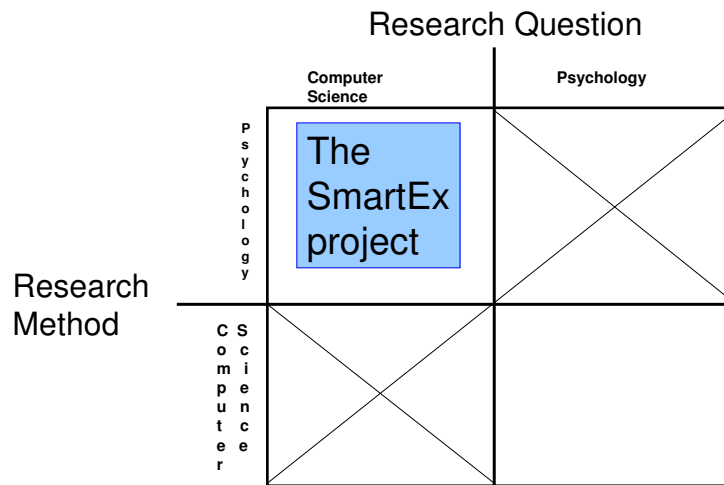


Time structure and knowledge structure are different!

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## Our Approach: thinking and tinkering

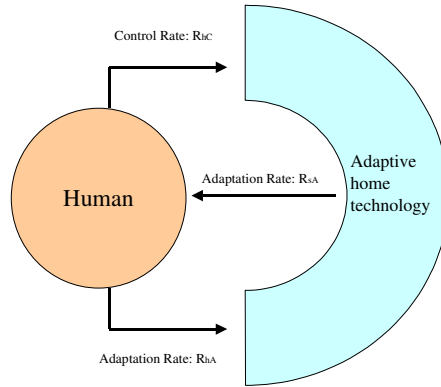


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## Ongoing Research: the adaptive environment



If two adaptive systems (e.g., the human being and the adaptive technology) are coupled with each other, the following aspects have to be taken into account:

- (1) the adaptation rate ( $R_{sA}$ ) of the technical subsystem, and
- (2) the two different kinds of human influences on the technical subsystem: the explicit control rate ( $R_{hC}$ ) and the implicit adaptation rate ( $R_{hA}$ ).

The main challenge of designing such a coupling is to avoid an unintended acceleration between both subsystems based on the closed loop coupling; with other words, what is the appropriate design for such kind of closed loop coupling?

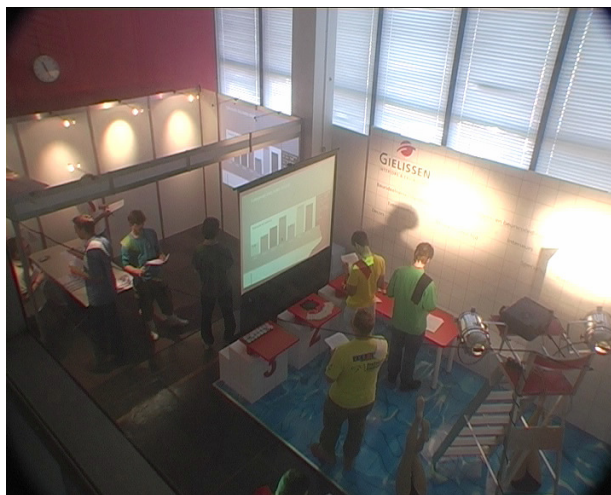
How should be the relation  $[R_{hC} + R_{hA}] \leftrightarrow [R_{sA}]$  established? Secondly, what is the proper balance between  $[R_{hC}] \leftrightarrow [R_{hA}]$ ?

These are two central research questions.

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## SmartEx: discovery -> invention



Ben Salem

### Experiment [June 2005]

Test conditions are:

- (1) Standard without displays
- (2) Standard with displays
- (3) Adaptive displays



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Thank you for your attention.