Attracting students towards mathematics the role of mathematicians

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BACKGROUND

- Assistant professor, research in automorphic forms (not of much use here !).
- Small experience in training teachers (primary & secondary) and trainers.
- Actions in popular science : Science festival, mathematical fair, libraries.
- Actions in schools : primary, secondary.
- Poster designing and conferences for a general audience. Some contacts with media.
- Meeting with teachers (IREM, APMEP).

THERE MUST BE 50 WAYS ...

- A social role : popular science.
  - Recognizing everybody's relevancy with respect to questions of science (mathematics being a part of it).
  - Avoiding restriction to a top-down approach.
  - A ~~citizen~~ humanist attitude ?
- Meeting/learning with a mathematician : one-way (passive mode), two-ways (active mode).
- Experiencing research.

PASSIVE WAY

- This is the easiest way of designing things, but if researchers come in contact with kids, they should not fear to actually get involved in a more open way ...
  - Movie show
  - Stand-alone posters or exposition
  - Conferences (BNF, *Promenades*)

ACTIVE WAY

- Workshops in situ (Fondation 93, IREM, Science festival/*Fête de la science*) : mostly in secondary schools, but sometimes in primary schools.
- Workshops extra-muros (Salon du jeu et de la culture mathématique, Fête de la science, rallye) : any public
- Work experience for secondary 4th up to CEGEP students.
- Movie followed by a debate (secondary school & CEGEP).

EXPERIENCING RESEARCH

- Open problems given to the whole classroom
  - Without any researcher during research : rallye
  - With a researcher (specially with a didactic study in mind) : research narration
- For small groups within a given classroom : hippocampe (Marseille).
- For small group on a volontary basis : Math.en.Jeans, math clubs (Animath).

STAKES FOR KIDS

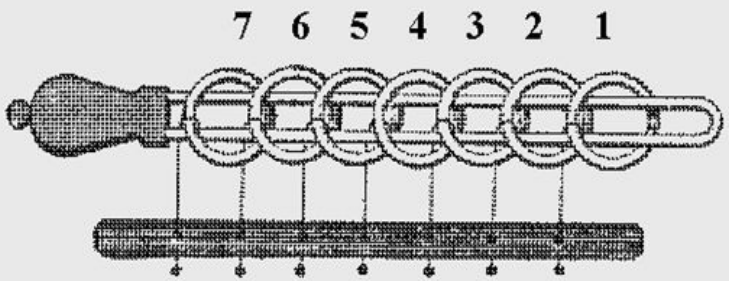
- Social.
- Change of viewpoint : on a given topic, on mathematics on a whole, transversally, with an emphasis on stageing.
- Curriculum discussions.
- Cultural dimension : what are the rules, goals and stakes of mathematics ?
- Research situations : towards a model/counter-model approach.

OTHER STAKES

- Social role, for math teachers, but not only (mostly not ?) : IREM, APMEP, academic referents.
- Resources (specially for primary school teachers), interactions and networking.
- Academic training.
- For researchers : meeting parents and general public, learning how to interact with them, and learn in return ... popular science.

OPERATING MODES

- Stageing or finding links with pertinent themes in society (and with some mathematical or pedagogical contents in mind).
- Construction of meaning by getting friendly with mathematical words.
- Stageing individual questions & collaborative ones.
- Towards abstraction & polysemy via model building.
- Concept drift (a situation approach ?).



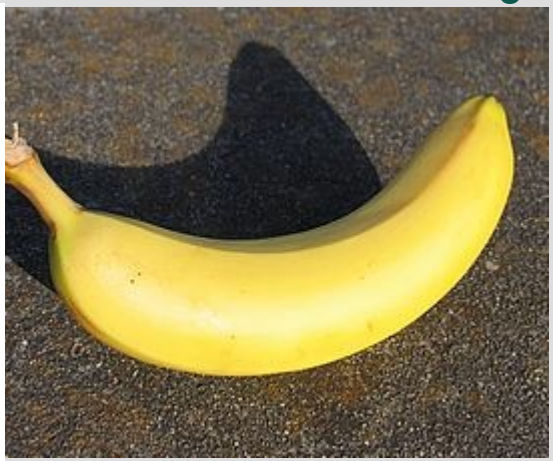
EXAMPLES

- Open a free paper and take an(y?) article : make mathematical remarks (and try to stay calm !).
- Stageing by appealing to games or magic (automatic tricks).
- Drift from chinese ring puzzle (baguenodier) to hard drive slicing using puzzles & Zome-tools :
  - Geometric interpretation via binary encoding
  - Cubes & hypercubes, a glimpse into space-time
  - Hamilton path on a cube

INFORMATION THEORY

- Mathematical structuring
- Model building
- Related themes :
  - Coding theory, arithmetic, permutation theory
  - Fonctions, transformations
  - Transmissions, sending & receiving
- Even if the information can be summed up as numbers, there is a profound need to show non numerical situations : mathematics cannot be restricted to be the science of numbers !

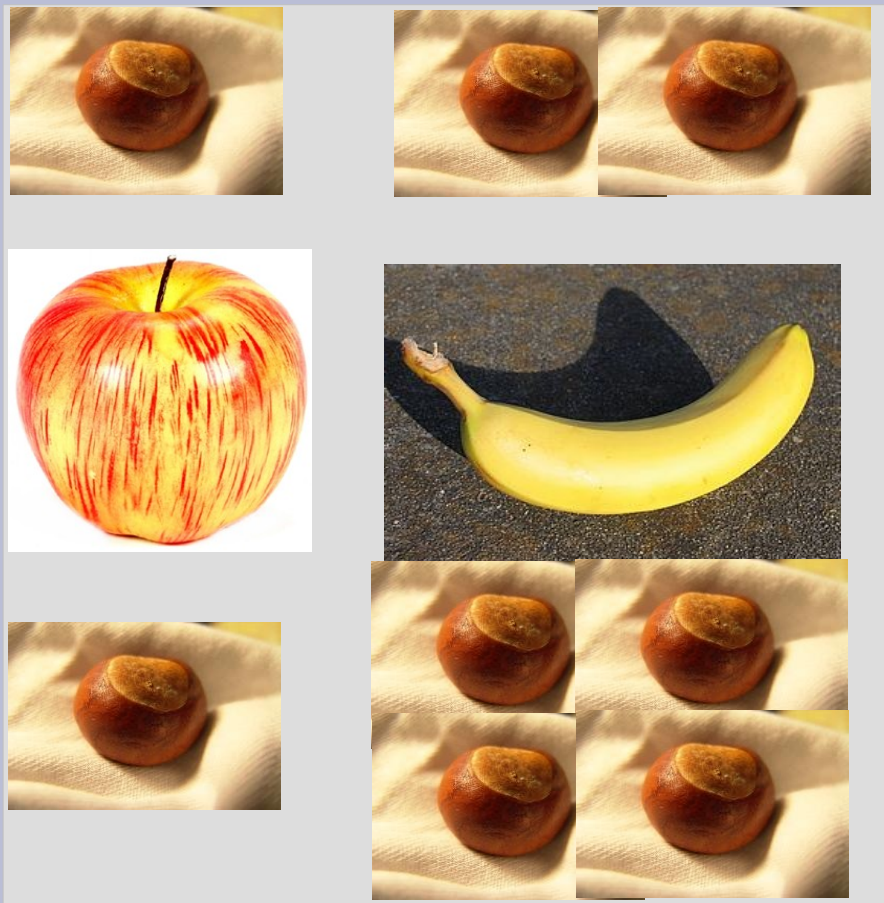
PRE-READING SITUATIONS



- Put some chestnuts & two fruits on a table and make two groups of people.
- Each group first gets some chestnuts and then takes a fruit.
- Depending on the fruit, each group can take more chestnuts.

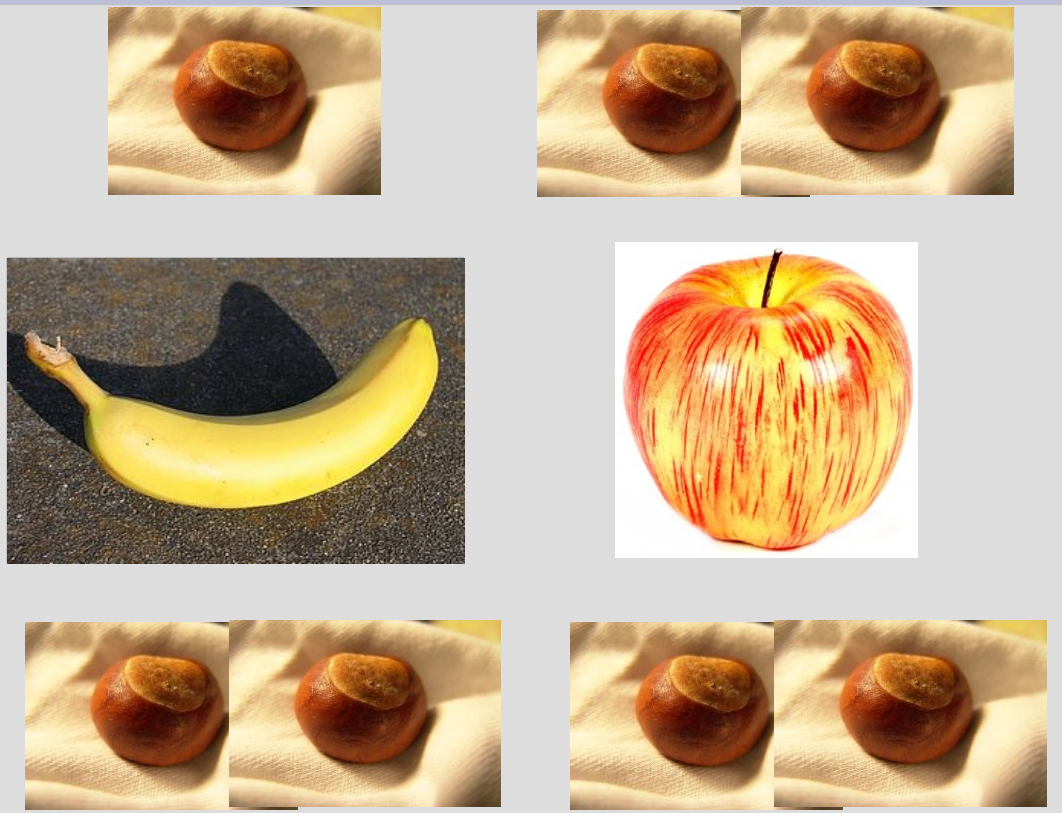
Viewing the number of chestnuts left, decide which group took which fruit.

STAGEING



9-(1+ 2)-(2x2+**1**x1)=**1**

Group 1 took fruit 1



9-(1+ 2)-(**2**x1+1x2)=**2**

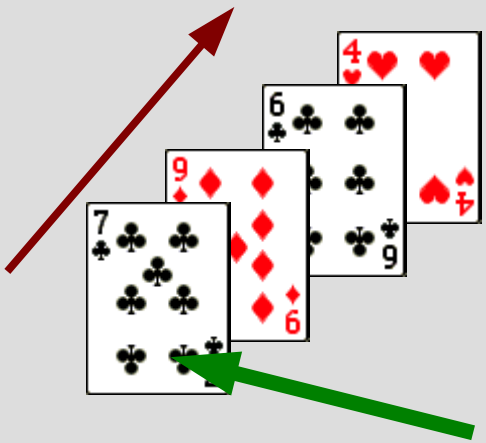
Group 2 took fruit 1

EXTENSION

- 3 groups, 3 fruits, 24 chestnuts.
- 1, 2 or 3 chestnuts at start.
- Once, twice or 4 times the initial number of chestnuts.
- 1, 2, 3, 5, 6 or 7 left.

- One-to-one functions
- Numeration : $\Sigma\, n_i\, 2^i$?
- Approximate or memorize ?

REDUNDANCY
ERROR CORRECTING

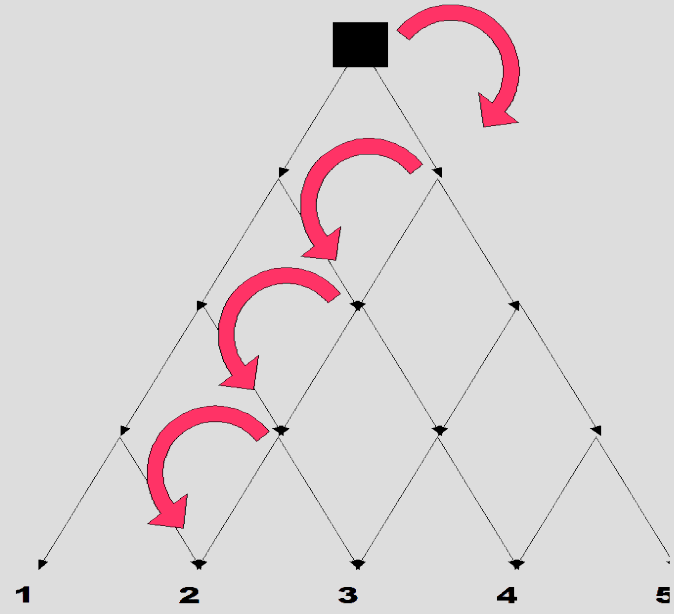


- People in a row, each sees card of people in front of him but nor his/hers nor those of people behind.
- Each has to guess one's card, starting by the last in the row and forward ...

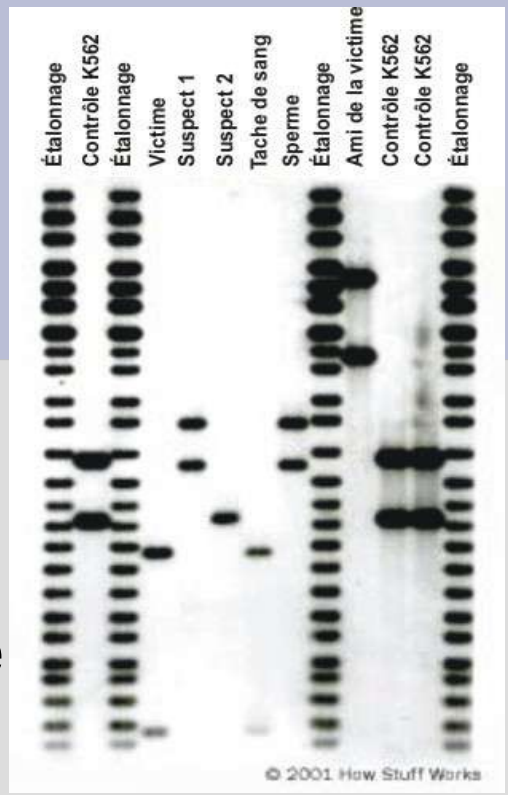
- Guess only red/black or suit. Restrict to numbers.
- Individual strategy vs. collaborative strategy.
- Probabilistic analysis vs. probabilistic strategy.
- In a probabilistic strategy, mean expectation is relevant, but standard deviation too !

CHANCE
JUSTICE & PROBABILITIES
IN PRIMARY SCHOOL

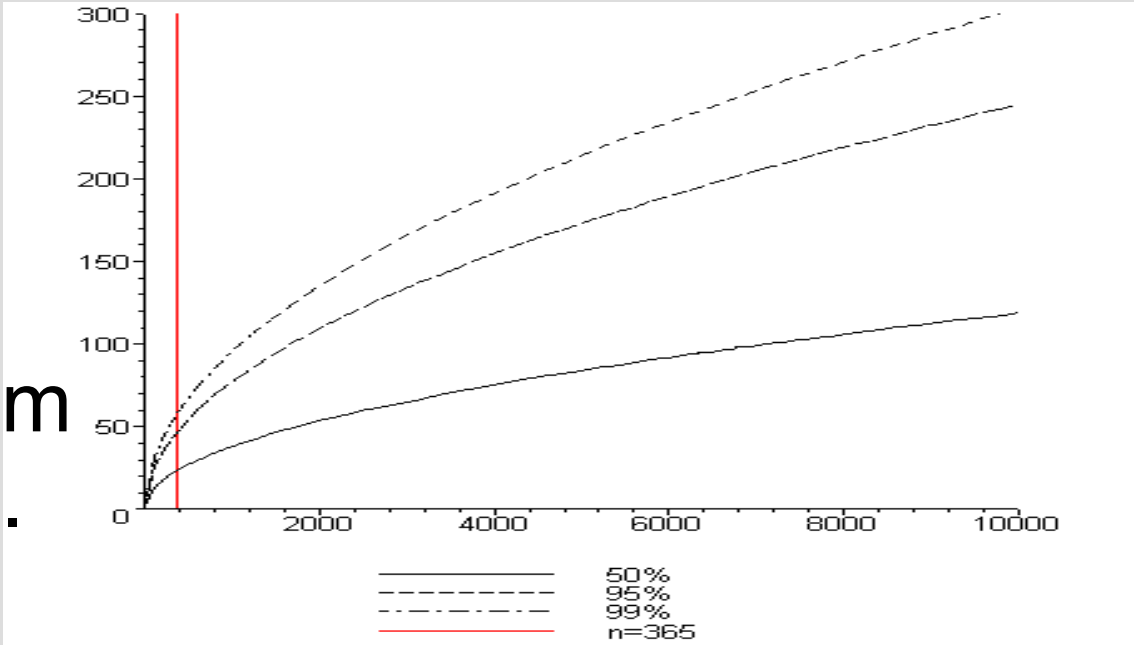
- Sharing a gain or a loss in a « wedding contract » : mathematical debate in a classroom on a playground issue.
- The point is that there is no unique answer and each people point of view does evolve during his/hers lifetime.
- Probabilistic point of view :
  - Third party comes in.
  - Gambler's ruin.
- Sharing ressources : a « gaussian » hopscotch.



LAST EXAMPLE



- Questions about DNA evidence :
  - Chance and risk in society, in biology.
  - Success means uncertainty while failure means certainty ...
  - Noncoding (junk) DNA vs. coding DNA.
- Evaluation of probability ($5^{13} \approx 10^6$).
- Links to probability tests, birthday problem (or birthday paradox).



Open question

How do we attract mathematicians
to attract students ?!

(make them go and listen to
Yvan Saint-Aubin's lectures ?)

Thank you for your attention.