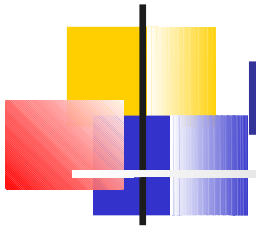
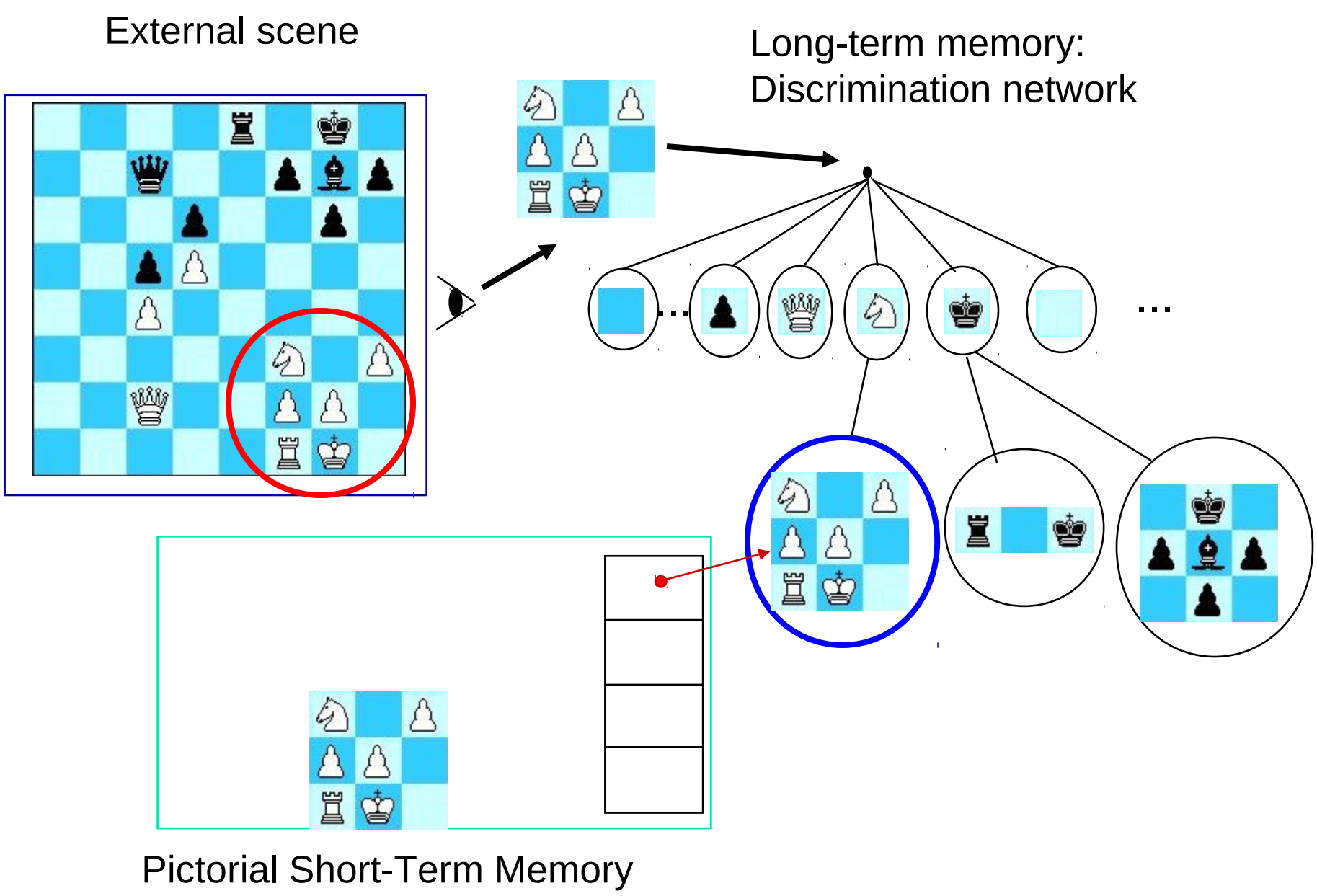
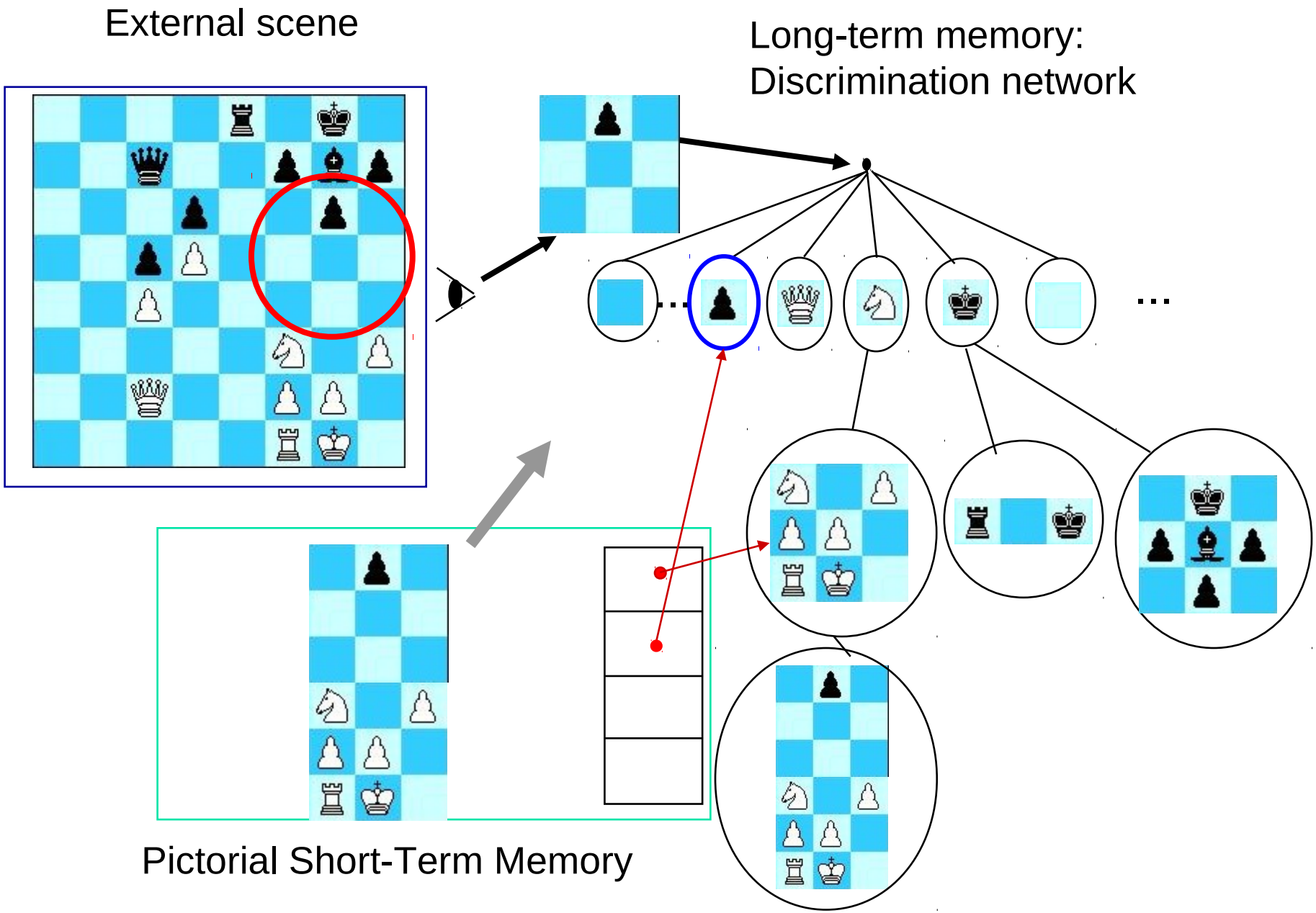


Perception and Memory in Chess

- First domains of application of CHREST
- During the learning phase
  - The program incrementally acquires chunks and templates by scanning a large database of positions
  - About 50,000 games taken from master-level games
  - Nets of various sizes are created
  - This enables unambiguous and quantitative predictions


External scene
Long-term memory:
Discrimination network
Pictorial Short-Term Memory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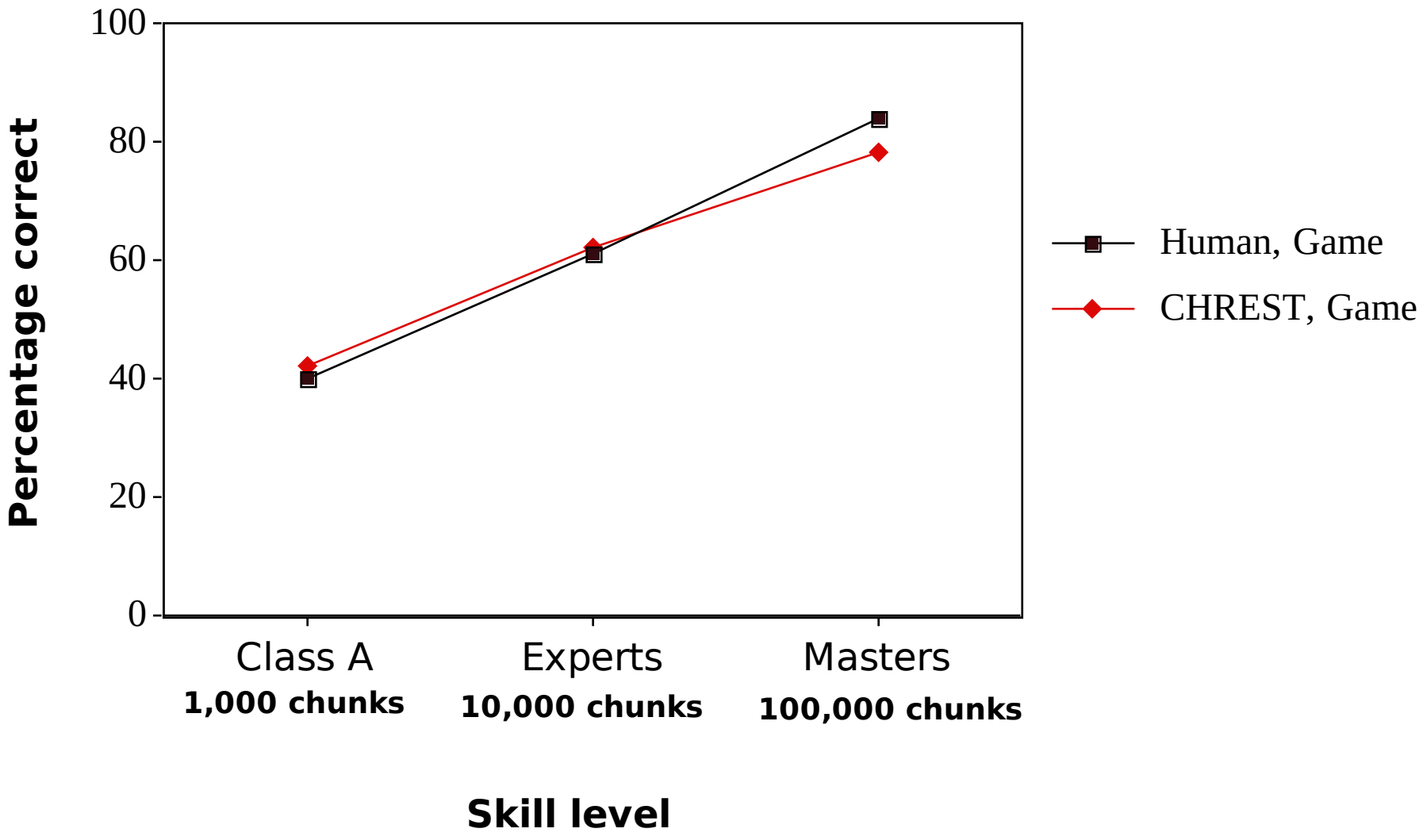
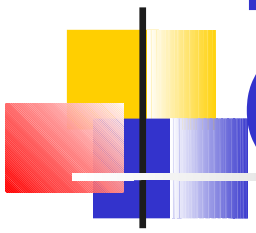
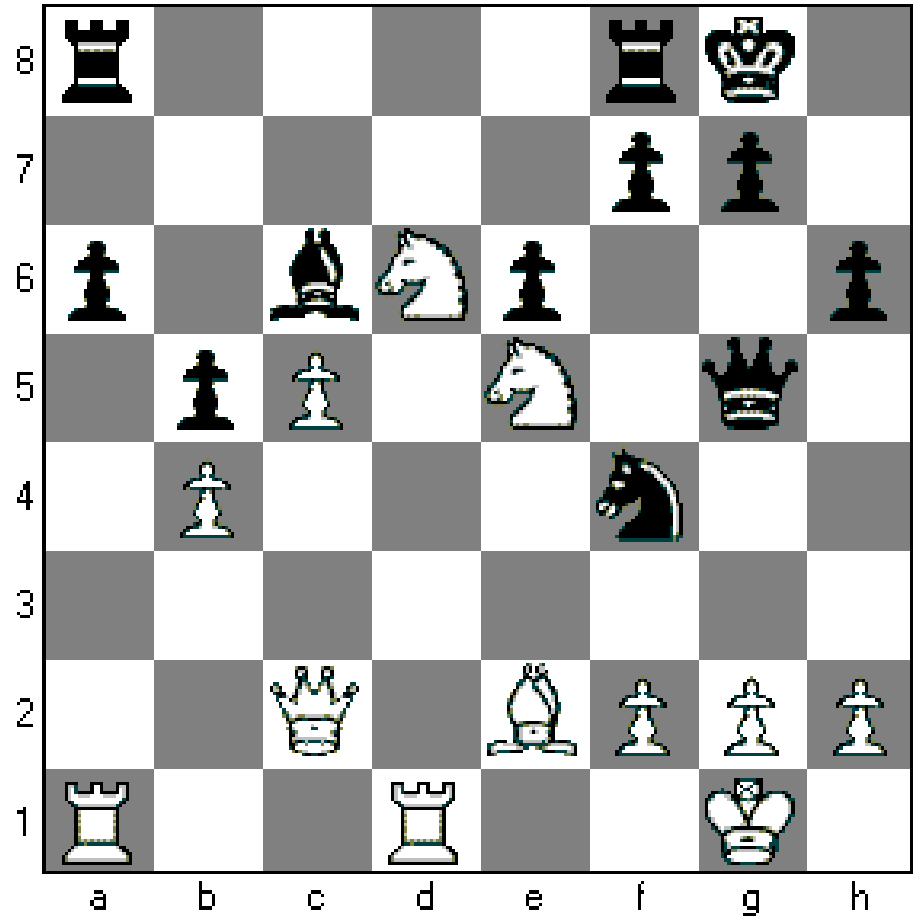
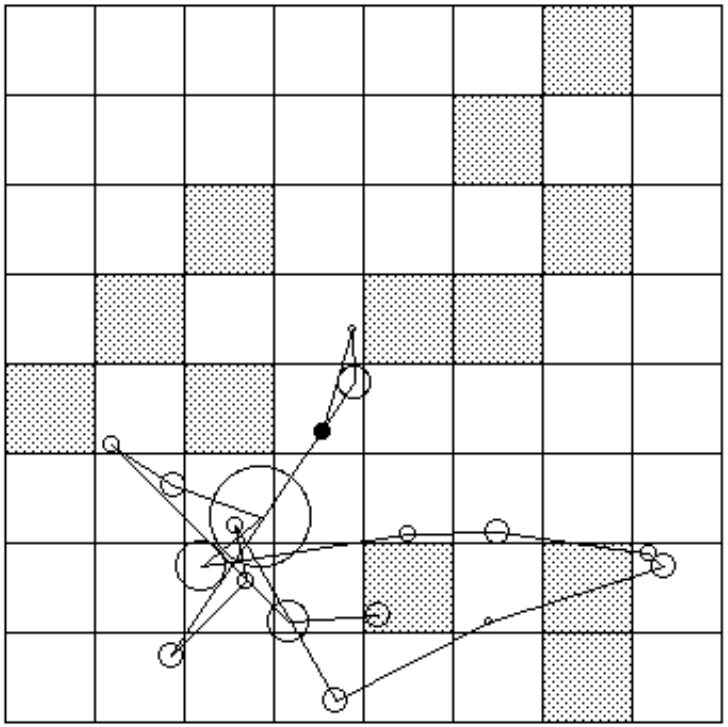

Percentage correct
100
80
60
40
20
0
Class A
1,000 chunks
Experts
10,000 chunks
Masters
100,000 chunks
Skill level
Human, Game
CHREST, Game

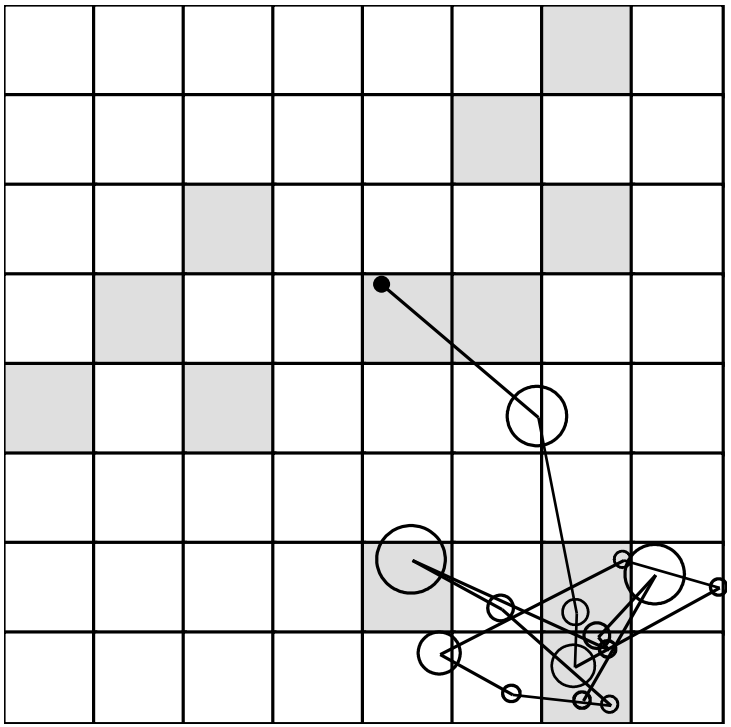
Perception: Eye Movements (De Groot & Gobet, 1996)



- Eye movements recorded during the first 5 seconds in a recall task
- Clear differences between masters and novices
  - Masters have shorter fixation times (250 msec vs. 300 msec.)
  - Masters show less variance in their fixation times
  - Masters cover more squares of the board
  - Masters tend to fixate important squares
- The results are simulated by CHREST


8
7
6
5
4
3
2
1
a b c d e f g h

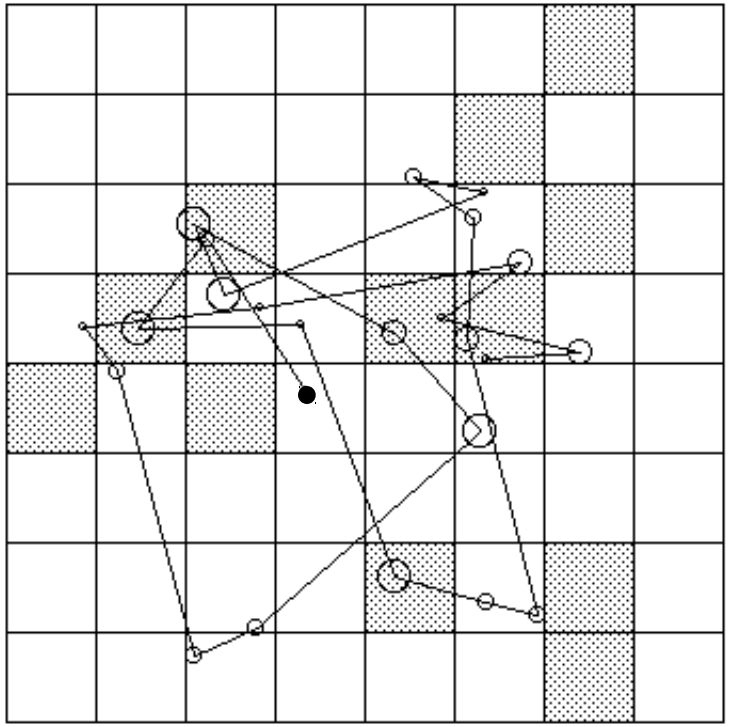


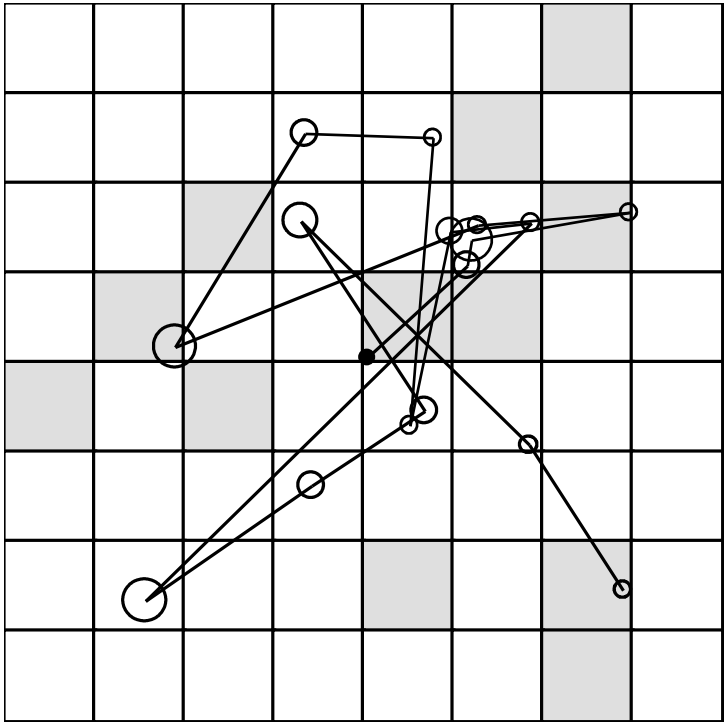


Human novice

CHREST novice

310 msec	*mean*	315 msec
140 msec	*sd*	154 msec

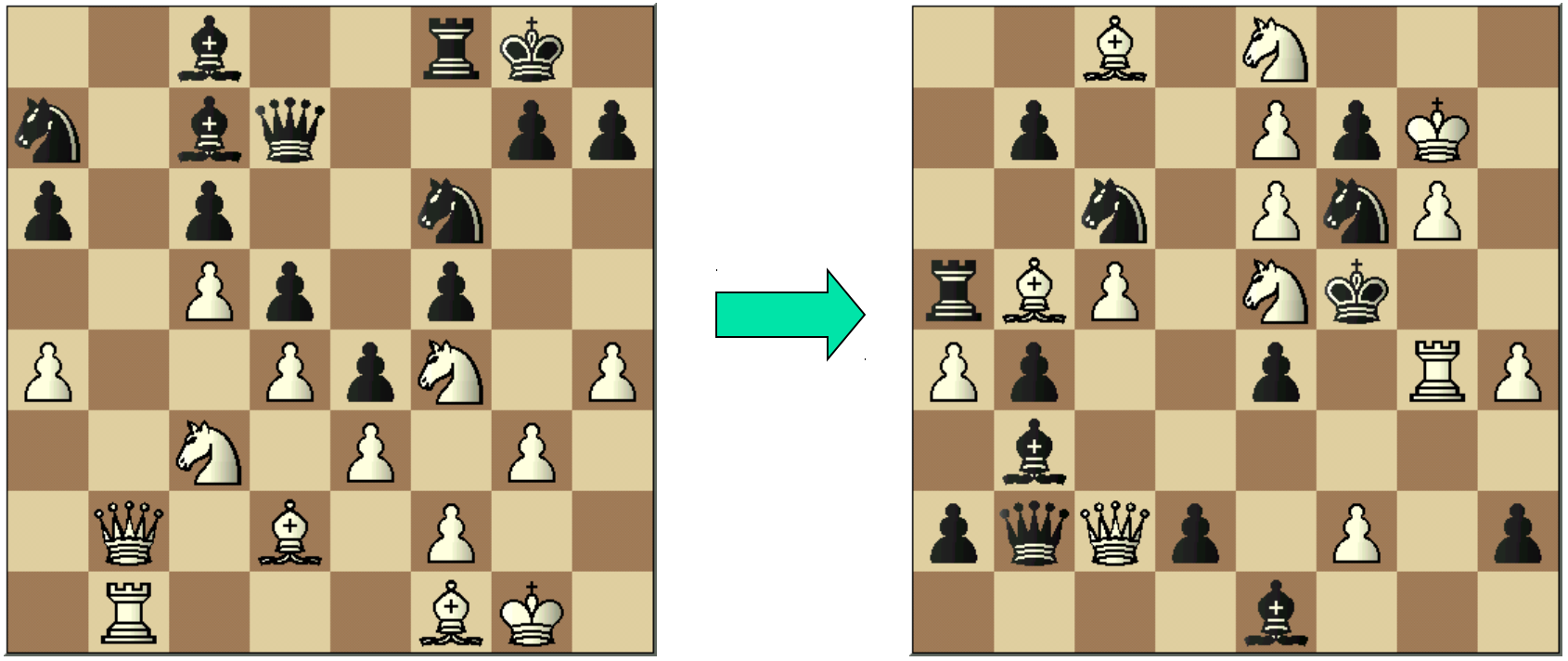




Human Master **CHREST Master**

260 msec	*mean*	272 msec
100 msec	*sd*	97 msec

What happens with randomised material?



Computer Simulations Can Question Old Truths

- Chase & Simon's (1973) classical result
  - Masters are much better with game positions
  - No skill effect with random positions
- Simulations with CHREST led to a non-intuitive prediction
  - Masters should also be better with random positions
  - Given their larger net, masters can identify more chunks than amateurs, just by chance
- Gobet and Simon (1996) carried out a reanalysis of the literature (13 studies)

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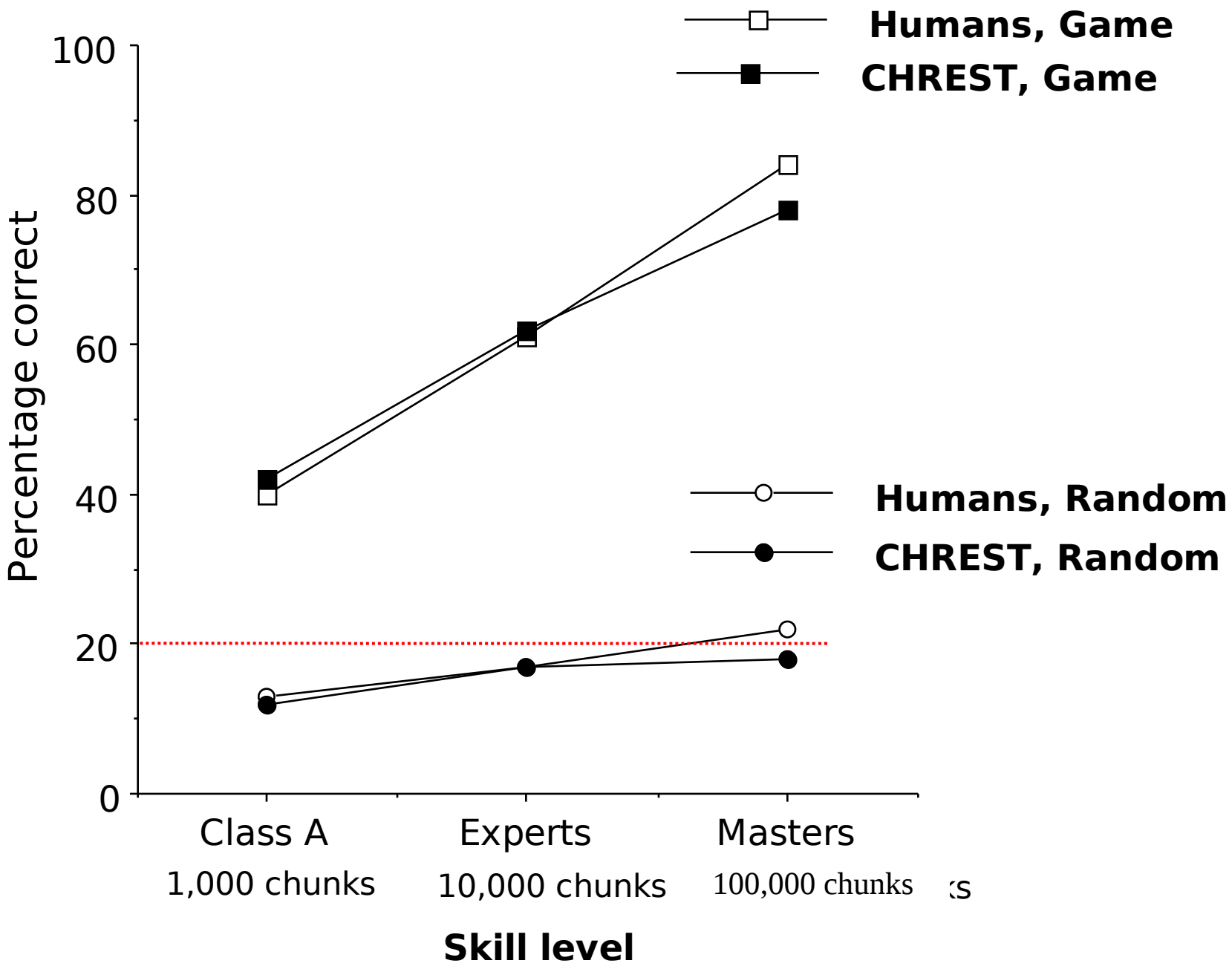
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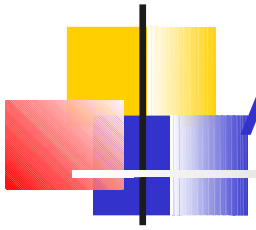
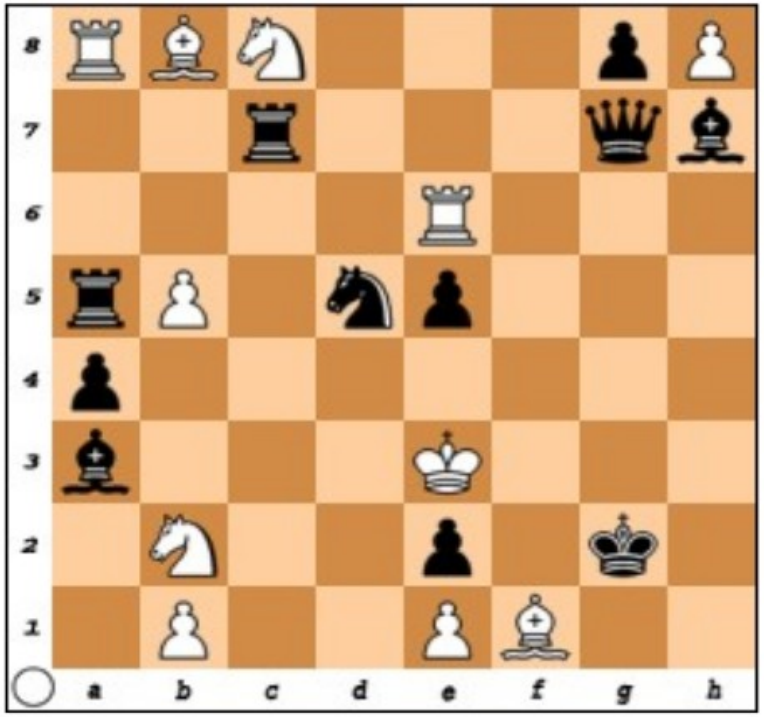


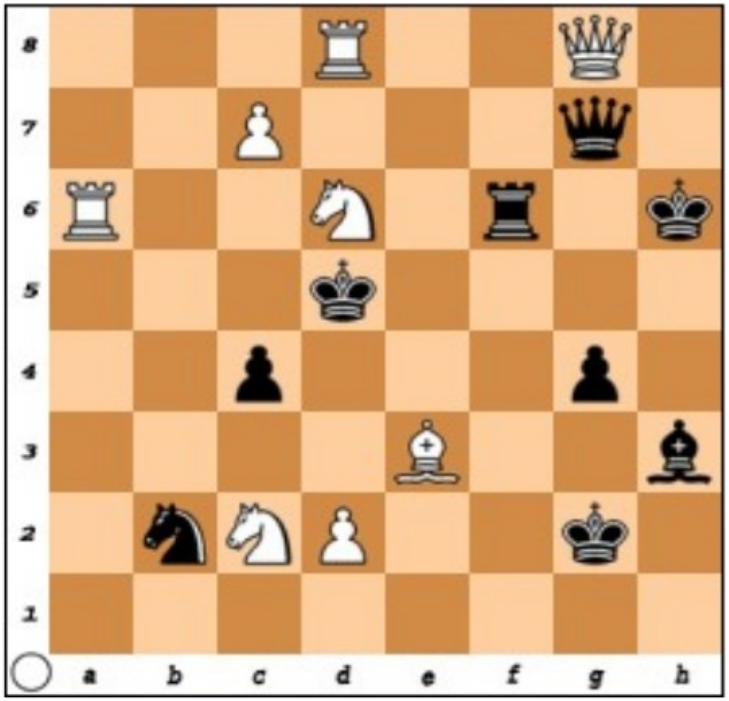
A Challenge

- Vicente and Wang (1998) challenged the skill effect with random positions
- Random positions used in the literature are not really random
  - Only one White King
  - At most eight Black Pawns
- In “truly random” positions, different pieces have equal probability

Random position



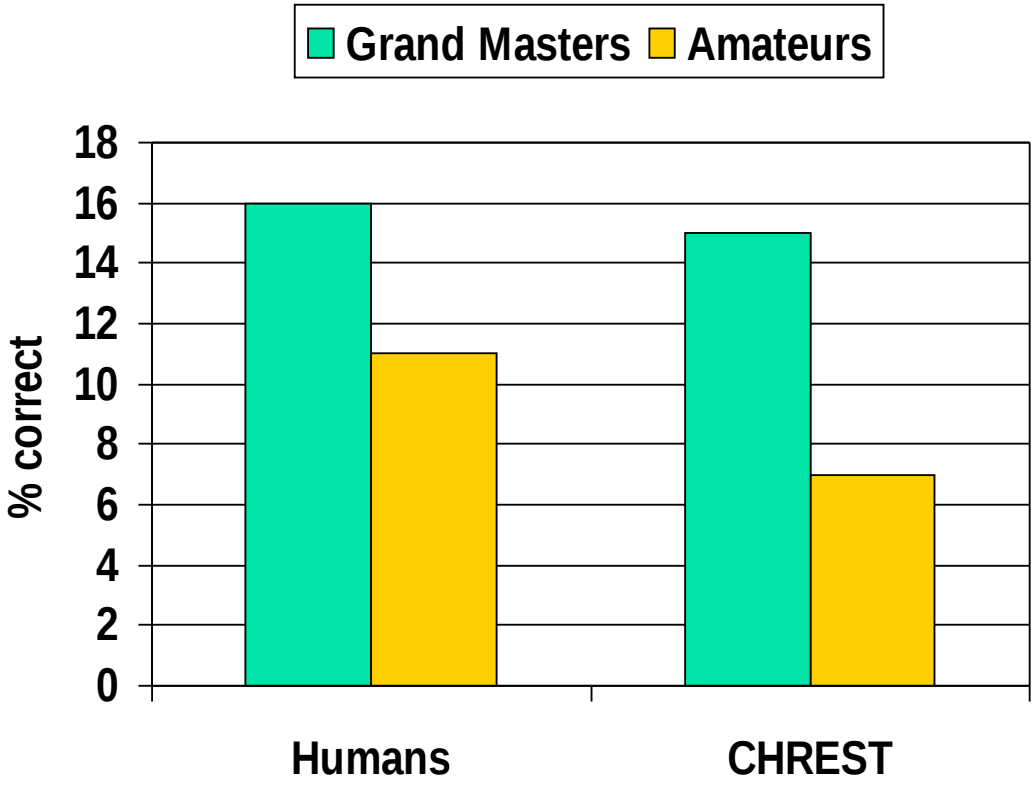
‘Truly random’ position



Truly Random Positions

- CHREST predicts a (small) skill effect
  - Masters can find chunks even in these positions

- Gobet and Waters (2003) tested these predictions
  - 36 players (including 7 Grandmasters)
  - Controls: motivation, visual memory, motor ability



Data Accounted for by CHREST in Chess Expertise

- Perception
  - Eye movements during first 5 seconds
  - Rapid recognition of chunks and templates
- Memory experiments
  - Random and game positions
  - Effect of various position modifications
  - Role of presentation time
- Problem solving
  - Rapid recognition of moves
  - Average depth of search follows a power law of skill