Cognitive benefits of learning to play chess and other strategy games

Dr. Chandramallika Basak
University of Texas at Dallas
The Center for Children and Families 2017 Spring Lecture Series on "Expanding Opportunities for Children and Youth
March 3, 2017
What is cognition?

How does it change across human lifespan?
Three speculative models of cognitive change across the lifespan.

Park & Bischoff (2010)

Craik & Bialystok, 2006
Over 5000 participants whose ages ranged from 10 to 66 years performed a multi-tasking experiment on the internet. Automatic and consciously controlled influences in a word-stem completion task.
Working Memory

It is those mechanisms or process that are involved in the control, regulation, and active maintenance of task relevant information in service of complex cognition. It is capacity limited.

In many cognitive tasks, WM must be continuously updated => Requires Attention Control
Correlation between cortical thickness and Cognition in 449 children below 12 years of age.

Walhovd et al., 2016

O’Connell & Basak, submitted
Functional connectivity in Attention Control Networks: Older Adults < Younger Adults

Voss et al., 2010; 2012.
Myths and facts about “cerebral” games

**We think** Chess instruction makes you smarter, especially in mathematics.

- Achievement in mathematics => STEM
- One Solution: Teach chess at school
- Chess is an optional subject in several countries.
- Spanish parliament has approved of chess instruction during school hours.
- Large project: Chess curriculum in 175 UK schools

**Fact:** Chess players are more intelligent than general population

**But** this does not prove that teaching chess to any child will improve their IQ/mathematics skill
How to establish causal link?

• Randomized Controlled Trial (RCT) – clinicaltrials.gov

• Randomize children into chess training vs. a different type of training

• Assess their change in cognition after training
Review

Do the benefits of chess instruction transfer to academic and cognitive skills? A meta-analysis

Giovanni Sala, Fernand Gobet

- Reviewed 24 studies on primary or secondary grade children
- Outcomes considered: mathematics, reading or cognitive skills
- Results show a modest overall effect size ($g = 0.338, K = 40$)
- Larger effects on mathematics than reading
- These effect is short of expected educational interventions
- Doubts about real effectiveness in practice.
- Publication is an important factor
- $>25$ h was in the expected range
Myths and facts about “cerebral” games

_We think_ playing videogames makes you aggressive.

_We think_ playing videogames makes you smarter.

**Fact:** Experienced gamers > Novices on perceptual skills and attention control

**But** this does not prove that training on video games will improve these skills
What is common between chess and video games?

• Not all games are created equal.
  – *Ray et al., under review*
• Turn-based or real-time strategy video games involve similar cognitive mechanisms as in chess.
• Therefore, research from one domain can advance our understanding of the other domain.
Strategy Video Game Training in Adults

Q 1: Can video game training in older adults improve higher-level complex cognitive skills?
   
   Basak et al., 2008, Psych & Aging.
   
   Basak et al., in preparation.

Q 2: Does more volume in certain brain regions or initial brain state (EGG) predict improvement in videogame performance?
   
   Basak et al., 2011, Brain & Cognition.
   
   Erickson, Boot, Basak, et al., 2010, Cerebral Cortex.
   
   Mathewson, Basak et al. in press, Psychophysiology.

Q3: Are there any strategies to enhance learning, brain function & memory?
   
   
   Voss et al., 2012, Neuroimage
   
   Basak & O’Connell, 2016; Frontiers of Psychology
Real-Time Strategy (RTS) Video Game

Rise of Nations

- Build cities and farms
- Generate revenues
- Assign citizens to work
- Monitor multiple cities
- Monitor available resources
- Expand a national border

*Basak et al., 2008, Psychology & Aging*
Chess training in children

Can attention control in children be improved with training on this classic strategy game?
Projects in collaboration with Jim Stallings and UTD’s Chess Club

http://www.utdallas.edu/chess/education-camp/camp.html

Ages: 7-14 years Camp groups include

Beginners, who master the basic rules and fundamentals of chess

Intermediate players, who build on basic chess knowledge with key strategies and ideas

Advanced players, who sharpen their competitive edge with advanced strategies for tournament play

Research questions:
1) What are cognitive predictors of chess learning?
2) Does cognition improve with short duration of intensive chess training?

Age: 7-12 years
Preliminary results (n=12)

- Children recruited from the chess camp improved in focusing attention to the target and in multi-tasking skills.
- These improvements suggest that chess instruction has the potential to improve the “building blocks” of complex cognitive skills.

Stay tuned in late fall!
Take home ideas

• Inability to focus attention to the relevant task is an issue in children, particularly those diagnosed with ADHD.
• Ignoring distractors and focusing on task at hand is important for most cognitive tasks and educational achievements.
• Learning chess or related strategy games may induce efficient focusing of attention in children, by enhancing underlying neural networks.
• Talk to children about “brain plasticity”.
• Play strategy-based board games with children.
• Don’t judge all video games to be same. Some may prove to be beneficial not only for your child, but also for your parent.
• Grandparents and children can both benefit from strategy game training. What about grandparent-child summer camps!
Thanks to

LiNC lab team!
- Evan Smith
- Nicholas Ray
- Eva Qin
- Alex Hinerman

UT Dallas’ Summer Chess Camp
- Jim Stallings

LiNC lab of UT Dallas
- linc@utdallas.edu
- Call lab phone: 972-883-3761/3767