Creating an Intelligent Character Prototype to Teach Early Math Skills

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Children's Early Learning from Media

- STEM Skill deficiency in U.S.
- Media characters→ children's friends & playmates
- Onscreen characters vary in:
  - Social meaningfulness (Krcmar, 2010)
  - Social contingency (Krcmar, 2010)
- *How do* relationships and interactions with media characters influence children's learning, particularly of STEM concepts?
- *How do* favorite characters become children's favorite teachers?

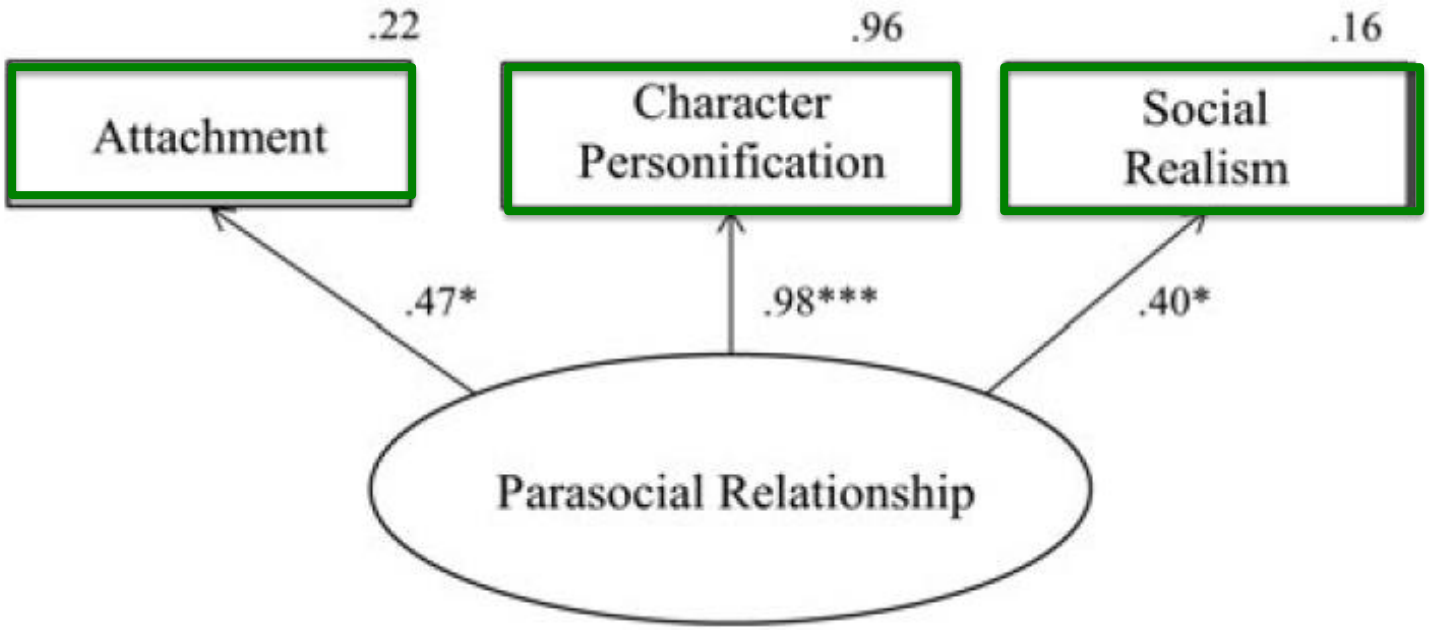
WHAT ARE PARASOCIAL RELATIONSHIPS & PARASOCIAL INTERACTIONS? THE CHARACTER

Parasocial Relationships & Parasocial Interactions

- **Parasocial relationship:** emotionally tinged relationship develops between an audience member and a media figure (Hoffner, 2008)
  - Social Meaningfulness
- **Parasocial interaction:** a pseudo conversation between a child & a media character in which it appears that there is a mutual interaction (Lauricella, Gola, & Calvert, 2011)
  - Social Contingency

What Qualities Comprise a Child's Parasocial Relationship?

(Bond & Calvert, 2014)



Attachment

- **Eigenvalue: 1.52**
- **% of variance explained: 11.67**
  - [Character] makes [child] feel comfortable.
  - [Character] makes [child] feel safe.
  - The voice of [character] soothes [child].

Social Realism

- **Eigenvalue: 1.88**
- **% variance explained: 14.47**
  - [Child] knows that [character] is imaginary
  - When [character] acts out a behavior on screen (like dancing, singing, or playing a game, [child] believes that [character] is performing the behavior in real life.
  - [Child] believes that [character] is real.

Character Personification

- **Eigenvalue: 4.26**
- **% Variance explained: 32.75**
  - [Child] thinks that [character] has thoughts and emotions
  - [Child] gets sad when [character] gets sad or makes a mistake
  - [Child] trusts [character]
  - [Child] treats [character] as a friend
  - [Child] believes that [character] has needs
  - [Child] believes that [character] has wants

Parasocial Relationships

- PSR are multidimensional constructs with high internal consistency; > 58% of variance
  - Personhood
    - You have to be *someone* to be my friend.
  - Social Realism (Rosaen & Dibble, 2008)
    - You have to *exist* to be my friend.
  - Attachment (Cohen, 1997; Giles, 2002)
    - You have to provide me comfort and/or security to be my friend.
- Parasocial breakups: Preschool Children's PSR last apx 2.5 years (Brunick, Calvert, & Richards, 2015)

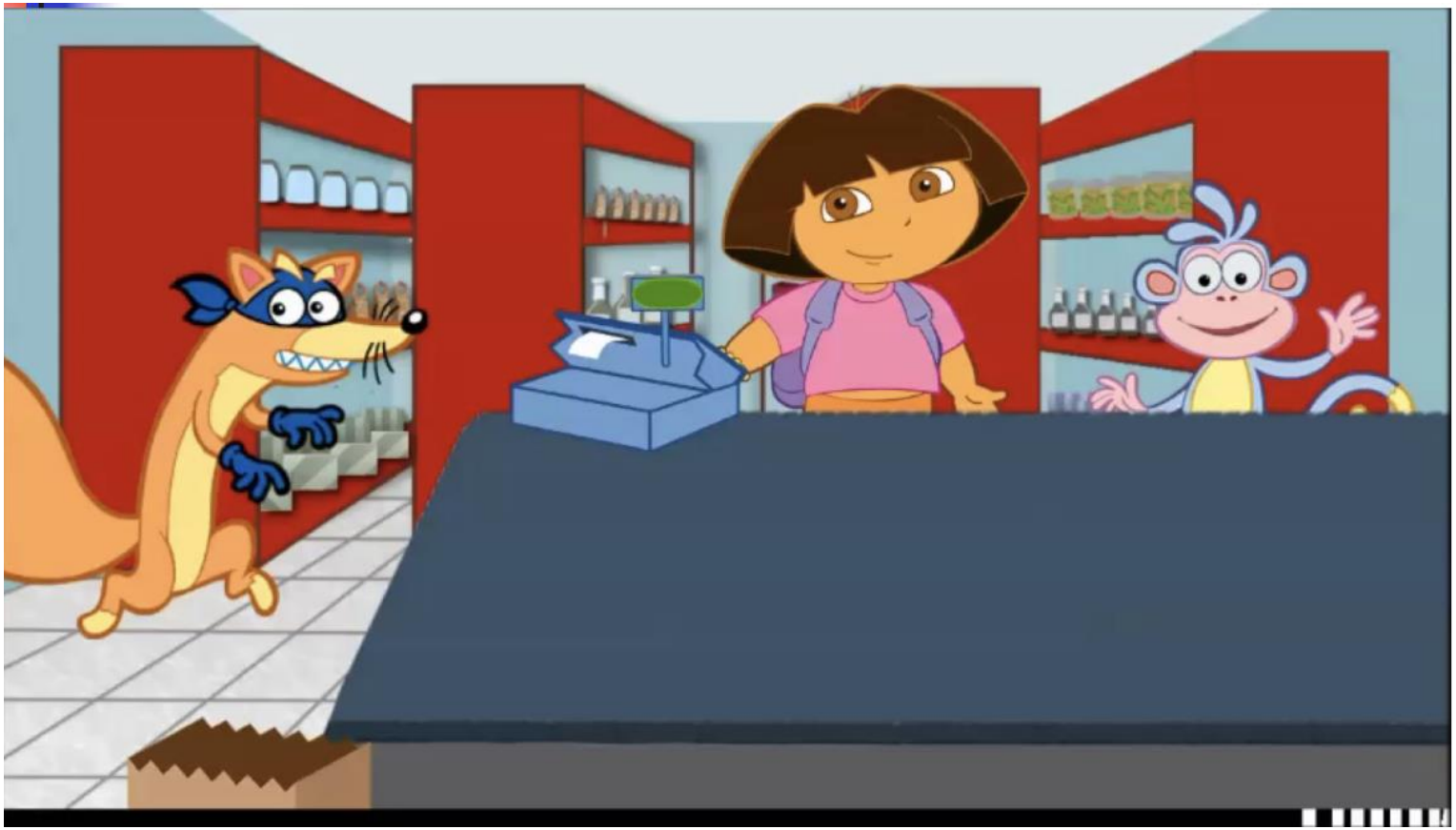
Future of Characters

- Uncanny Valley: Intelligent Agents often look strange, creating discomfort when looking at them
  - Popular media characters address the uncanny valley problem
  - Popular media characters are known entities
- Our focus has been more on PSR than PSI
- PSI in the past has been about pseudo interactions where what the child says does not really matter
- Characters are now becoming more interactive
- How will children respond to and learn when the character gives contingent feedback?
- How does small talk build relationships with characters? (Cassell, 2016)

Purpose

- Use Dora to understand how children's relationships with her (PSR) & interactions with her (PSI) influence their math skills
- Add one concept
- Intelligent Character: Dora responds contingently to what children do (PSI)
  - Wizard of Oz approach

The Game



Game Ending

Procedure

- Preschool-aged children play the game with Dora & an experimenter (plus the Wizard)
  - 4 rounds (n = 16 problems) that increase in difficulty
- Before playing the game, each child answers PSR questions about Dora using smiley faces

- Uses PSI → Contingent replies
  - Small talk- build repertoire
  - Answer math problems

Dora Intelligent Character

- 55 children (M_{age} = 4.86 years; 23 males & 27 females; n = 5 dropped) played the game
- 91% of children complete game
  - Average time apx 13 min. (SD = 4.63 min)
- Answer 12.86 problems on 1st try
  - 1.39 1st level scaffolds
  - .90 2nd level scaffolds
  - .83 3rd scaffold with Boots
- Older children > younger children
  - Answer problems correctly on 1st try, r = .37, p = .009
  - Quicker response times, r = -.38, p = .007

Results (cont'd)

- Visual Attention
  - Looked 88% of the time at the game
  - 5% of the time at the experimenter beside them
  - 7% elsewhere
- PSI Interface was effective
  - Respond on average to 83% of small talk prompts
  - Respond 94% on average to math prompts
- Children who felt more emotionally close to Dora, a measure of PSR (attachment & friendship), responded to more small talk prompts, $r = .29$, $p = .046$

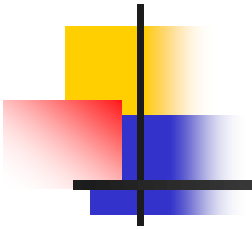
Results (cont'd)

- Sequentially Presented Rounds: Faster from Round 1 to Round 2, *Wilks Lambda* (1,48) = 7.24, *p* = .01 for latency
  - Latency Round 1 = 17.55 sec (SD = 3.34)
  - Latency Round 2 = 10.92 sec (SD = 2.54)
- Randomly Presented Rounds: Round 3 to Round 4; Latency becomes longer but ns;
  - Round 4 difficult even for older children
  - Latency Round 3 = 13.13 (SD = 2.52)
  - Latency Round 4 = 19.88 (SD = 5.15)

Observations: PSI & PSR

- PSI with character
  - Natural interactivity with character
- Different levels of scaffolds help learning at specific level
- Prototype is engaging for children
- Intelligent characters can respond contingently to children
- PSI & PSR are linked; direction of relation is unclear

In Planning: Other Game Versions



- Dora versus No Character
- Diego having a party for Dora
- Gender Stereotype Threat
- Dora, Diego & No Character that have TV-like PSI, i.e., non-contingent replies
- Play the game more than once
- DV's: attention; time to completion; errors; PSR scores; Transfer task

Conclusions

- Media characters are children's friends, playmates & teachers
- Meaningful PSR relationships with characters lead to better learning from those characters when onscreen (Calvert, Richards, & Kent, 2014; Gola, Richards, Lauricella, & Calvert, 2013)
- Future characters will respond contingently to what children say, making their promise as engaging teachers even more powerful (Brunick, Putnam, Richards, McGarry, & Calvert, 2016).

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