Design and Innovation in Children and Adults: How Psychology and Design Combine

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Ownership is a matter of social convention (Snare, 1972)

• Daily life
• Behaviour towards objects
• Behaviour towards others
• Morality
A famous example..
Ownership is important

Essential for normal social interaction

Acting inappropriately towards other people's property results in social conflict

Getting employees involved in decision making can help give them a sense of ownership. Sometimes, a little too much.
A Matter of Cultural Convention
Or Core Principles

• Early competence
• Perhaps exist with hardly any culture
Why Study Kids?

- Understanding limited
- Acquisition slow and piecemeal
Ownership is important for social development as most of young children’s social conflicts concern possession and the use of objects (Ross 1996).

Ownership is an abstract concept as we cannot see whether someone owns an object.

Explicit statements of ownership
Young children’s understanding of ownership

• At 18-to-24-month of age, children demonstrate an ability to identify owners of familiar objects (Fasig, 2000)

• Ownership takes precedence over possession in 2- and 4-year-old children’s dispute outcomes with siblings (Ross, 1996)
Previous ownership studies

Ross (1996)

Friedman and Neary (2008)

The first studies to aim to establish the heuristics used when reasoning about ownership of objects, with which they are unfamiliar.
• Familiarity issue?
  – Is it best to test ownership with familiar objects or unfamiliar objects?
  – Depends on question you ask-- if one was to address whether children understands ownership, then children’s own objects may be the best objects to use. If one was to address what affects children’s ownership inferences, then it’s best to use objects that do not belong to the children.
Who owns what:
Already-owned objects

Friedman & Neary, 2008
First (known) possessor

i.e., prior possessor
Whose ball is it?

First, the girl plays with the ball.

Then, the boy plays with the ball.
First, the girl plays with the ball. Then, the boy plays with the ball.

Whose ball is it? ➔ NO CORRECT ANSWER
First, the girl plays with the ball. Then, the boy plays with the ball.

Whose ball is it? ← NO CORRECT ANSWER

Children and adults choose first possessor
% choices of first possessor

- 2: 79%
- 3: 73%
- 4: 84%
- 3-4: 75%
- 3-4: 83%
- Adults: 79%
- Adults: 65%
Young children’s ability to infer ownership

• Friedman & Neary (2008): children use ‘first possession heuristics’ when reasoning about ownership of objects, with which children are unfamiliar.
Young children’s ability to infer ownership

- **Age 2:**
  - Understanding of ownership (Fasig, 2000; Ross, 1996)
- **Age 3:**
  - First possession heuristics (Friedman & Neary, 2008)
- **Age 4-5:**
  - Control of permission (Neary, Friedman & Burnstein, 2009)
  - Transfer of ownership (Blake & Harris, 2009; Kim & Kalish, 2009)
Friedman, Neary & Defeyter (2013)

What’s this between the girl and the boy? That’s right!
First, the boy plays with the ball
Then, the girl plays with the ball
Whose ball is it?
Results – Suggests Historical Reasoning
Privileges of ownership
Property Ownership

An owner has..
(a) the right to possess property,
(b) the right to use and enjoy property
(c) the right to waste property
(d) the right to exclude others from interference with property
(e) the right to disposition or transfer of ownership either during life or upon death
Privileges of ownership

Right to exclude
Right to use
Right to transfer

Snare, 1972; Merrill, 1998; Neary & Friedman, 2014
Right to exclude

Awareness at age 2

Eisenberg-Berg et al., 1979, 1981
Right to exclude

Children *respect* the right to exclude.

Adults don`\t *(at least in regards to kids).*

**Puzzling:**

Children show awareness of right to exclude from early on. Adults train children to share *(not exclude)*

Neary & Friedman (2014)
Right to exclude

Innate, or learned early without overt instruction.

Overt instruction aimed at limiting exclusion, making it socially appropriate.
How we use objects

Doesn’t just depend on the design/conventional function or physical affordances of objects (Defeyter & German, 2009; Phillips, seson & Kelemen. 2012).

But also who owns the object.
You want the job done right... right?

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Does Knowledge of Object Ownership/Design Function Affect Innovation/Creativity?

• *Functional fixedness*

• Functional Fluency

• No research has investigated the affect of ownership on children’s problem solving/creativity
Functional Fixedness

• People practice to solve a problem in a particular way
• Presented with a new problem that they could solve in a simpler way BUT...
• They stick with old solution
• Fixation on reproduction of familiar way to solve problem
Duncker’s (1926) Candle Problem
Creativity is much more than problem solving tasks

<table>
<thead>
<tr>
<th>Torrance Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>In a standardized Torrance Test of Creative Thinking, subjects are given simple shapes (left column) and are asked to use them (top row) or combine them (middle row) in a picture or to complete a partial picture (bottom row). Evaluators judge whether the results are more or less creative.</td>
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<table>
<thead>
<tr>
<th>Starting Shapes</th>
<th>Completed Drawing</th>
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<tbody>
<tr>
<td><strong>Use</strong></td>
<td><strong>More Creative</strong></td>
</tr>
<tr>
<td><img src="use-circle.png" alt="Circle" /></td>
<td>Mickey Mouse</td>
</tr>
<tr>
<td><strong>Combine</strong></td>
<td></td>
</tr>
<tr>
<td><img src="combine-rectangle.png" alt="Rectangle" /></td>
<td>King</td>
</tr>
<tr>
<td><strong>Complete</strong></td>
<td></td>
</tr>
<tr>
<td><img src="complete-square.png" alt="Square" /></td>
<td>A fish on vacation</td>
</tr>
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Table 1
Percentage of children selecting the target object for the first solution attempt according to age and condition in Experiment 1

<table>
<thead>
<tr>
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<th>5-year-olds</th>
<th>6-year-olds</th>
<th>7-year-olds</th>
</tr>
</thead>
<tbody>
<tr>
<td>Function demonstration</td>
<td>60%</td>
<td>40%</td>
<td>40%</td>
</tr>
<tr>
<td>Baseline</td>
<td>80%</td>
<td>80%</td>
<td>95%</td>
</tr>
</tbody>
</table>
### Table 1

Mean function scores according to age, with ‘design function’ and ‘novel function’ subscores for children in Experiments 1 and 2 (SDs in parentheses)

<table>
<thead>
<tr>
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<th>Total functions (SD)</th>
<th>Design functions (SD)</th>
<th>Novel functions (SD)</th>
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<tbody>
<tr>
<td>Experiment 1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5-year-olds</td>
<td>8.05 (3.93)</td>
<td>5.20 (3.27)</td>
<td>2.85 (2.62)</td>
</tr>
<tr>
<td>7-year-olds</td>
<td>9.65 (3.69)</td>
<td>8.40 (3.39)</td>
<td>1.25 (1.25)</td>
</tr>
<tr>
<td>Age Group</td>
<td>Condition</td>
<td>Total functions (SD)</td>
<td>Design functions (SD)</td>
</tr>
<tr>
<td>-----------</td>
<td>--------------------</td>
<td>----------------------</td>
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</tr>
<tr>
<td>5-year-olds</td>
<td>Function demo</td>
<td>12.65 (3.54)</td>
<td>5.70 (3.42)</td>
</tr>
<tr>
<td></td>
<td>No function</td>
<td>4.70 (1.42)</td>
<td></td>
</tr>
<tr>
<td>7-year-olds</td>
<td>Function demo</td>
<td>12.85 (4.37)</td>
<td>10.60 (5.52)</td>
</tr>
<tr>
<td></td>
<td>No function</td>
<td>9.35 (3.43)</td>
<td></td>
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Study 3: Experimental Conditions (Defeyter et al., accepted)

N = 30 3-4 year-olds and 30 5-6 year-olds

Children given blocks one week prior to test
"Would you like to help me do something? This is Sally, she needs to get to the other side of the river. I will show you some objects that you can use to fix the bridge so she can cross safely".

"This is my block. This is a block" Repeat

**Control Questions**: Which block belongs to me? What colour is this (the other block)? (Gelman et al, 2014)

"Okay, here is your job. Can you fix the bridge so that Sally can get to the other side of the river? Ready? Go!"
Study 3: Results

3-4 year-olds
FET, p < 0.005

5-6 year-olds
FET, p < 0.01

No significant time differences in selecting 1st object
Study 4: Experimental Conditions (in press)

Another’s Stick  My Stick  Your Stick

N = 30  3-4 year-olds and  30  5-6 year-olds

Children given sticks one week prior to test
Estimated Marginal Means of picked up owned vs not owned (A)

- **Age Groups**: 4 year olds, 5 year olds

- **Conditions**: control, expt stick, Ss stick

- **Graph**
  - X-axis: condition
  - Y-axis: estimated marginal means

- **Legend**
  - 4 year olds: blue line
  - 5 year olds: green line
Study 4: Results

3-4 year-olds
FET, p < 0.001

5-6 year-olds
FET, p < 0.001
Experiment 5
Defeyter et al. (under revision)

N = 30 3-4 year-olds and 30 5-6 year-olds
Children given ownership on day of testing
Experiment 5: Results

No significant differences across conditions or age in terms of time to select first object choice.
Study 6

N = 30  3-4 year-olds  and  30  5-6 year-olds
1\textsuperscript{st} Object Selected to Solve the Task

3-4 year-olds
FET 7.78, p < 0.05

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<th>Experimenter Owned</th>
<th>Child Owned</th>
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<tr>
<td>3-5 year-olds</td>
<td>2.73 secs</td>
<td>1.60 secs</td>
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<tr>
<td>6-7 year-olds</td>
<td>2.47 secs</td>
<td>1.87 secs</td>
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5-6 year-olds
FET 6.65, p < 0.05
Methodology

Timeline

February
Before half-term

February-Easter

Easter
Finish DOT
Penultimate week

Week before
Easter

After Easter-End of May

June

Experimental schools----Exp.& Con schools----Control schools----------------------Exper. & control schools

Train teachers
Using DOT Materials
for use in
‘experiment’ schools

DOT Materials taught in
experimental schools

Data collection BOTH experimental and control groups

Quantitative data
Buzan divergent thinking test (or similar)
Use of objects test
Semantic completion task
Baron-Cohen Empathy survey

Qualitative data
Interview pupils

Train teachers
Using DOT Materials
For use in ‘control’ schools.
Ensure all baseline
data has been collected

DOT Materials taught in
control schools

Data collection BOTH experimental and control groups

Quantitative data
Buzan divergent thinking test (or similar)
Use of objects test
Semantic completion task
Baron-Cohen empathy survey

Qualitative data
Interview pupils

Ill-defined problem test
Context

- Stimulus sheets introduced as part of lesson 4
  - Stimulus sheets to avoid fixation
  - Fixation exercises (e.g. list 20 everyday animals) and discussion prior to stimulus sheets being introduced.
  - Talked about designers using analogies

- Lessons 1-3 covered
  - Population diversity i.e. statistics cards
  - Experience experiments i.e. gloves/glasses
  - Task analysis-identify highest hurdles
Creativity is much more than problem solving tasks

### Torrance Test

In a standardized Torrance Test of Creative Thinking, subjects are given simple shapes (left column) and are asked to use them (top row) or combine them (middle row) in a picture or to complete a partial picture (bottom row). Evaluators judge whether the results are more or less creative.

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• Explicit ownership information affects children’s selection of tools in problem-solving attempts
• Similar pattern of results shown across both age groups for both artefacts and natural kinds.
• Relatively simple problem-solving tasks so demand on executive function is low and no physical alteration
• Further research required in terms of the distractor objects (e.g. Nielsen et al., 2014)
• Future studies investigating affect of ownership on using a familiar tool when not provided explicit information about ownership
• Creativity...ownership of thoughts, ideas, material and space
Collaborators

• Ori Friedman (University of Waterloo)
• Tamsin German (UCSB)
• Steve Avons (University of Essex)
• Jill Hearing (Post-doc)
• Sarah Malcolm (PhD student)
• Bill Nichol (Cambridge University)
• Kim Sheridan (Washington State University)
• Lila Chrysikou (Kansas University)

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