Lessons from the Marshmallow Test

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Walter Mischel, PhD
1930-2018
“Marshmallow Test” is a Measure of Executive Function

- Working memory
  *I can remember the goal of this activity*

- Inhibitory control
  *I can wait to respond and control my impulses*

- Flexibility/shifting
  *I can think about this in a new way or distract myself*

Mischel and colleagues
$F(6, 680) = 8.46, \ p < .001; \ Carlson (2011)$
Reflection Self-talk
How did Jane do?

Proportion of Time Delayed
(Carlson data)
Long-term Outcomes Associated with Delay of Gratification at Age 4

- 4 years old: EF (Go-NoGo), Academic, Social, Coping with stress, SAT scores
- Adolescence: Fewer interpersonal and drug problems, Higher ed level, Better coping
- 20s: Goal setting, Self-regulation, Lower BMI
- 30s: Better regulated with reward stimuli, behaviorally and in the brain
- 40s
Has Children’s Ability to Delay Gratification Changed Over Time?

“The children now love luxury; they have bad manners, contempt for authority; they show disrespect for elders and love chatter in place of exercise. Children are now tyrants, not the servants of their households. They no longer rise when elders enter the room. They contradict their parents, chatter before company, gobble up dainties at the table, cross their legs, and tyrannize their teachers.”
U.S. National Survey Study

- Delivered via Amazon’s Mechanical Turk (MTurk)
- 354 Adults (49% female)
- Age 20-69 years ($M = 36$)
- White (83%); African American (6.8%); Asian 6.8%; Hispanic (5.6%)
- 41 different states
- Household income $25k-200k$ (Median = $25k-50k$)
- 54% were parents
When compared with children 50 years ago, do you think children today would wait...

- Shorter: 257
- Same: 90
- Longer: 7
Cohort Study

- 1960s: $N = 165$ (Stanford)
- 1980s: $N = 135$ (Barnard)
- 2000s: $N = 540$ (UWA and UMN)
- Ages 3-5 years; ~50% female
- Similar race/ethnicity and SES
- Followed the standard procedure w/ both rewards visible and a bell
What did the data show?

Linear trend ($R = .21$, $R^2 = .043$),

$F(1, 839) = 38.11$, $p < .0001$;

Carlson, Shoda,… Mischel (2018, Dev Psych)
Why did adults get it wrong?

• Persistent complaints about “kids today”
  – Socrates

• Lack of perspective taking
  – Children do have less self-control than you

• Concerns about technology

• Rising standards
“As we care about more of humanity, we’re apt to mistake the harms around us for signs of how low the world has sunk rather than how high our standards have risen.”

--Steven Pinker (2017) *Enlightenment Now*
Why has delay of gratification improved?

• The basics: GDP, nutrition, etc.

• Abstract thought -- a benefit of technology?

• Parenting -- more autonomy-supportive

• Preschool education
Preschool Enrollment

Karch (2013)
Our work is far from over…

Watts et al. (2018)
Proportion of Time Waited by Population Adjusting for Age and IQ

$F(6, 576) = 7.08, p < .001; \text{Carlson (2011)}$
Adaptation in Low-Trust, Low Resource Environments?

Fig. 2. Proportion of children who waited the full 15 min without eating the marshmallow by condition. Error bars show 95% confidence intervals. In the unreliable condition, only 1 out of the 14 children (7.1%) waited the full 15 min; in the reliable condition, however, 9 out of the 14 children (64.3%) waited. We tested the difference using a two-sample test for equality of proportions with continuity correction at $z_{0.05} = 1.96$. The test found it to be highly significant ($X^2 = 7.6222, df = 1, p < 0.006$).

Kidd et al., 2012
Limitations of the Marshmallow Test

- Food rewards
- Trust
- Not below age 3
- Not above age ~10
- Has a bimodal distribution (“fail” or “pass”)
- Not good for repeated assessment
- Not practical for school settings
- Not age-normed
Minnesota Executive Function Scale (MEFS™) App
Carlson & Zelazo, 2014
Look, I have these boxes here. This one has a frog on it and this one has a butterfly on it. This is the shape game. In the shape game, all the frogs go here and all the butterflies go here. (tap + button)
See, here's a frog. It goes in the frog box. (E drag)
And here's a butterfly. It goes in the butterfly box. (E drag)
The 3 Facets of EF

- **Cognitive Flexibility**: Being able to switch between rules
- **Working Memory**: Remembering the rule and applying it in the correct way on a given trial
- **Inhibitory Control**: Resisting reflexive response of sorting by the initial rule in order to sort by the correct but conflicting rule
…170+ locations across 35 US States…
...and 13 Countries using 10 Languages
Executive Function from 2 to 70

Zelazo et al., 2013; Carlson & Zelazo, 2015
The EF Gap

$N = 812. F(2, 811) = 9.80, p < .001, \eta^2_p = .024, R^2 = .65$. At-risk preschoolers scored significantly lower than lab and community preschool samples. Bars show SE.
Lower SES is Associated with Lower EF

# of 12-month periods (after 15 months old) when family income was at or below U.S. poverty line

Adapted from Raver et al. (2013)
Trauma and EF

Risk for Negative Outcomes

# of ACES

0 1 2 3 4 ≥5

(ACEs Study Results – cdc.gov; Felitti, 2002; Felitti et al., 1998)
EF and School-Readiness

• **Indirect** role in creating optimal conditions:
  – Pay attention to teacher’s directions
  – Sit still, keep hands to yourself
  – Persist when frustrated
  – Maintain positive peer relations

• **Direct** role in learning itself:
  – Hold new information in mind to work with it
  – Inhibit old information or biases that interfere
  – Think about problems in a new way
Early Intervention
MEFS is Responsive to Interventions

Lower Socioeconomic Status Preschoolers Profit Even More from EF Intervention

Casey, 2016 dissertation
Closing the gap? Low-income Preschool Sites Varying in Quality
Take-home Messages

• Marshmallow Test is a classic measure of Executive Functioning
• Individual differences in delay are highly stable and predict later outcomes
• Despite adult predictions to the contrary, preschoolers’ delay performance has increased since the 1960s
• Preschool education might be one reason why
• We do not know about lower SES children, who tend to perform less well
• Newer measures suggest an EF Gap, beyond the Marshmallow Test
• Minnesota Executive Function Scale (MEFS) is a standardized tool for measuring EF across the full spectrum, capturing growth sensitively, making data-informed decisions for ECE, comparing geographical regions, and tracking future trends
Thank you!

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Questions?

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