From Schema to Stereotypes
Talent, Hard Work, and Grit

What determines intelligence
Talent

Definition: A natural ability or aptitude, gotten but not earned. In other words, abilities brought by genes.

The common definition: Abilities thought of by most people as natural.

Ex. Good sight, logical thought process, comprehension of math concepts, and etc.
Hard Work

Definition: Efforts and perseverance.

Ex. Spending time reading books and articles, exercising, understanding scientific theories, and etc.
What determines intelligence?

• Genes - natural talent - do not confer specific abilities.
  o Ex. No GPA gene, no Chemistry gene, etc.

• Practice - hard work works.
  o Training and drills improve skills and knowledge.

• Mindset matters.
"Over time I came to understand a framework in which you could relish something that someone else was considering a failure."

- Carol Dweck, Stanford University

- Dweck made this observation in a study about a little boy who believed failure was a challenge he loved to face; an unusual but motivating attitude.
Intelligence

- Growth Mindset > Fixed Mindset
- Growth mindset: the notion that intelligence is developed rather than something you are born with
- Fixed mindset: the lack of motivation during struggles
- The brain can be thought of as a computer
Further Studies on Intelligence

• Two studies in the New York City public school system conducted
• Both studies showed that students who endorsed a strong growth mindset outperformed those that held a fixed mindset
• Taught students that the brain is a muscle, that becomes stronger and develops new connections.
**Fixed Mind-set**

Intelligence is fixed.

leads to a desire to look smart and therefore a tendency to...

**Challenges**

- Avoid challenges

**Obstacles**

- Give up easily

**Effort**

- See effort as fruitless or worse

**Criticism**

- Ignore useful negative feedback

**Success of Others**

- Feel threatened by the success of others

As a result, they may plateau early and achieve less than their full potential. All this confirms a deterministic view of the world.

**Growth Mind-set**

Intelligence can be developed.

leads to a desire to learn and therefore a tendency to...

**Challenges**

- Embrace challenges

**Obstacles**

- Persist in the face of setbacks

**Effort**

- See effort as the path to mastery

**Criticism**

- Learn from criticism

**Success of Others**

- Find lessons and inspiration in the success of others

As a result, they reach ever-higher levels of achievement. All this gives them a greater sense of free will.
Diversity & Intelligence

- Dweck and others then found a parallel trend:
  - growth mindsets $\leftrightarrow$ no gender gaps in math and science
  - fixed mindsets favored boys in math and science
- Takeaway
  - Growth mindsets can help girls achieve in STEM fields
  - Even the greatest minds faced struggles
Grit

- Definition
  - Perseverance and passion for long-term goals
- A more accurate predictor of success than intelligence
- A common trait among world-class experts and geniuses
Embracing Failure

- Grit can be developed and taught
  - Individuals can learn the value of effort and of struggle
- Failure as an opportunity to learn
- Currently, the development of grit is difficult
  - Society praises people for success that requires the least amount of effort
  - Struggling is often perceived as a weakness
What Can We Do?

• Praise effort and hard work
• Teach people that mistakes and failures are chances to learn and struggle is not something to avoid
• Help cultivate a sense of optimism and personal motivation
  o Encouraging individuals to sustain their own passion for a subject will encourage them to invest effort in their interest
Biology and Socialization

How different environmental factors influence our decisions
Case Study

• 298 families with preschool and young elementary school children videotaped while using interactive science exhibits in a museum

• Interested in how parents interacted with a single child while visiting the exhibits

• Looked at whether the parents explained an exhibit, gave directions at that exhibit, or talked about evidence
Findings

- boys and girls equally likely to be given directions and talk about evidence
- boys 3x more likely than girls to hear explanations from their parents
- Explanation: parents talked about casual connections within the exhibit interface i.e. "when you turn that fast, it makes more electricity" (hand-cranked generator)
Differences between Boys v. Girls Interactions
Significance of Case Study

- parents could be creating a gender bias in science learning years before a child's first classroom science instruction
- the explanation from parents shapes what children learn from such activities which leads to a deeper understanding in science and perhaps a deeper interest in science
- boys are more encouraged from parents to engage in scientific reasoning
Early Gender Schema

Adults feel they need to know their child's sex because the label helps them interpret their child's behavior and physical features.

- Parents usually refer to their newborn daughters as "pretty" and/or "sweet".
- A father is more likely to give his daughter a doll, than a truck.
- When a baby girl cries, adults see the crying as, "Please feed me".
- Congratulation cards for a baby girl are almost always more pink with rattles, rabbits, with a picture of a baby sleeping.
- When comparing a baby boy and girl, a mother would say their build is the similar with the girl being a little softer.
- Parents usually refer to their newborn son as "handsome" or "happy".
- A father is more likely to give his son a truck than a doll.
- When a baby boy cries, adults see the crying as angrier/ "Feed me now!!".
- Congratulation cards for a baby boy are almost always more blue with bears, sports equipment with a picture of a baby active.
- When comparing a baby boy and a girl, a father would say their son is bigger/more firm and more stronger, coordinated and alert.
Household Chores/Suggestions

Visible to parents: The different types of toys they give their children

Invisible to parents: How differently they treat their children

- The toys that boys get than girls don't, or vice versa could lead to their interest in future careers.
- A boy or girl's preference for certain toys can develop at the age of one, if they are initially given certain types of toys.
- These lead to a gender schema/stereotype.
- A girl playing with a truck or a boy playing with a doll can be considered "culturally deviant".
- As adults statistic found that women do more household chores than men even with equal careers and education. (Have you ever seen an article asking How Do Men Raise Kids and Manage to Work?)

Suggestions:
- Split chores around the house
- Buy toys all kinds of toys for your son and/or daughter
- Make less gender bias Congratulation cards (if you work in card making)
Can we declare victory for women in their participation in science?

Not yet...
Uneven Increase in Participation

- In 1966, women earned \(1/4\) of the Biology degrees as men.
- By 2007, women began to outnumber men, taking \(60\%\) of the Biology degrees.
- In Physics, the degrees given to women rose from \(14\%\) to \(21\%\).
Why So Uneven?

- Recent studies show minimal difference in Physics-related abilities.
- Do women believe they can have a stronger impact elsewhere?
- Or is it because women don't see how science fits with their desire to work with people?
- Is it even their choice...?
Early Influence

• As early as 8th grade, signs of interest in science reflect further education in science.

• Students with high confidence in their ability to achieve tend to grasp Physics more aptly.

• Parents, teachers, and peers influence a child's self confidence. As shown earlier, the gender bias that pushes women away from science starts at a very young age.
Solutions

• Early influence: Cutting edge labs, up to date text books, and peer teaching opportunities.

• Female role models in science, collaborative group work, and discussing the lives of female scientists.
"Where, after all, do universal human rights begin?...In small places, close to home...Such are the places where every man, man, and child seeks equal justice, equal opportunity, equal dignity."

~ (1958) Eleanor Roosevelt