

# Practical Meaning of Human Cognitive Differences

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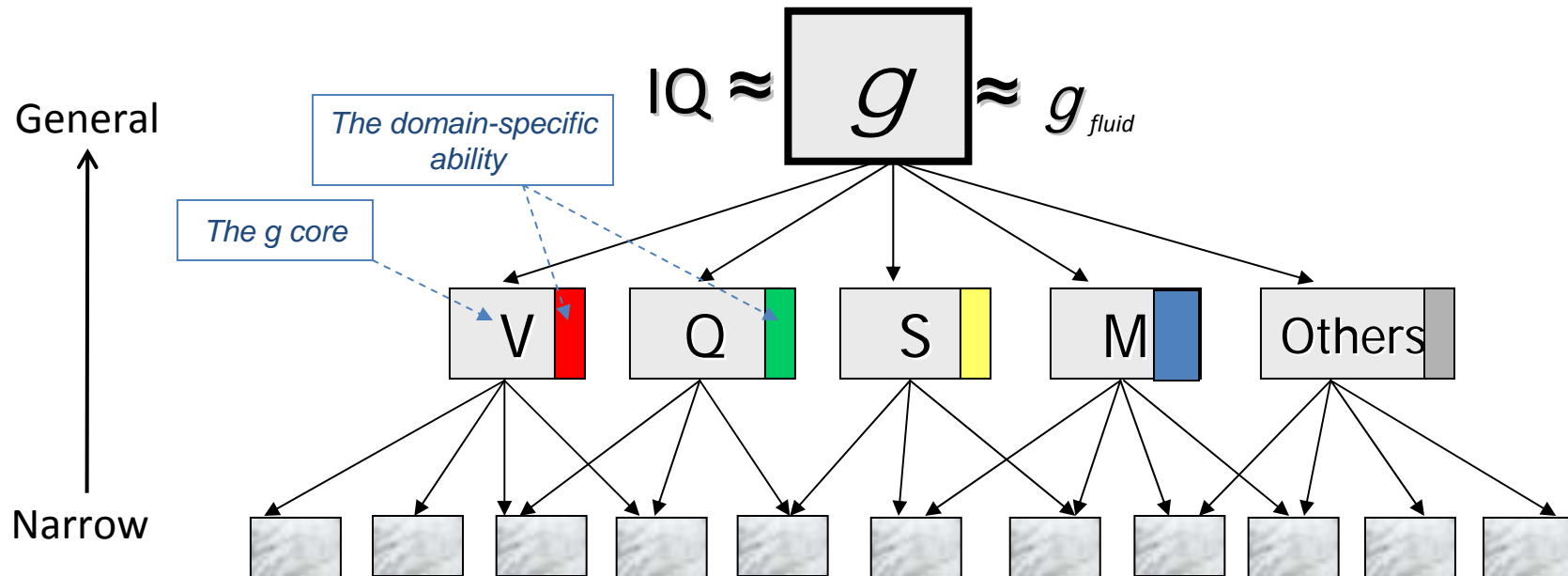
# Point 1

There are many cognitive abilities, but they all tend to rise or fall together, because they all share the same core—*g*

# General intelligence ( $g$ )

Individuals' differences in  $g$  represent differences in:

- Proficiency at learning, reasoning, thinking abstractly
- Ability to spot problems, solve problems
- Not knowledge, but their ability to accumulate and apply it



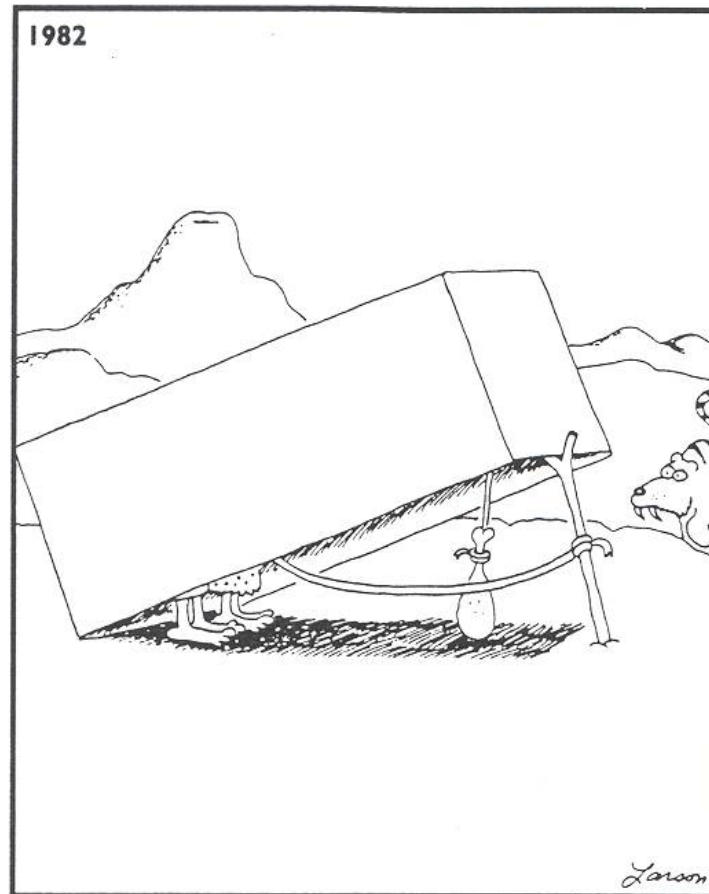
V = verbal, Q = quantitative, S = visuospatial, M = memory

## Point 2

*g* level matters to some extent in virtually all life arenas, because all require continual learning and reasoning

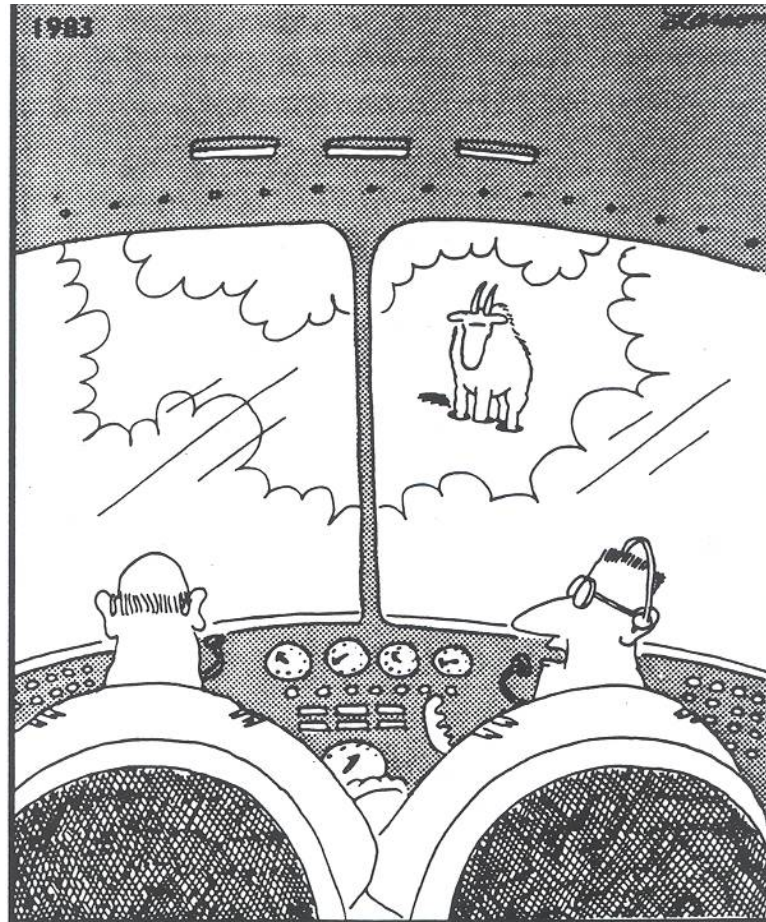
Examples...

# Important for planning, anticipating problems



“Shhhh, Zog! ... Here come one now!”

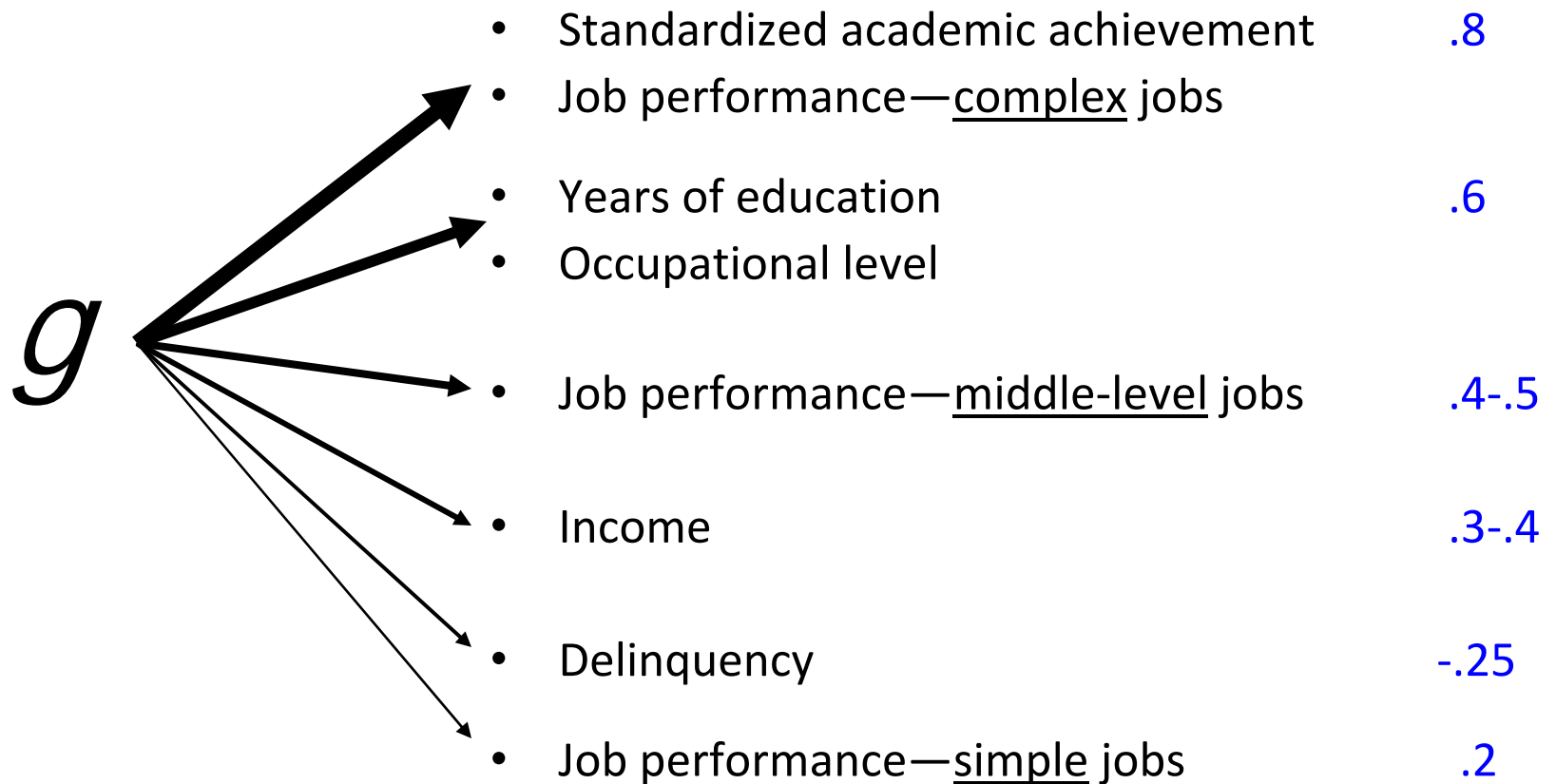
# Important for dealing with the unexpected



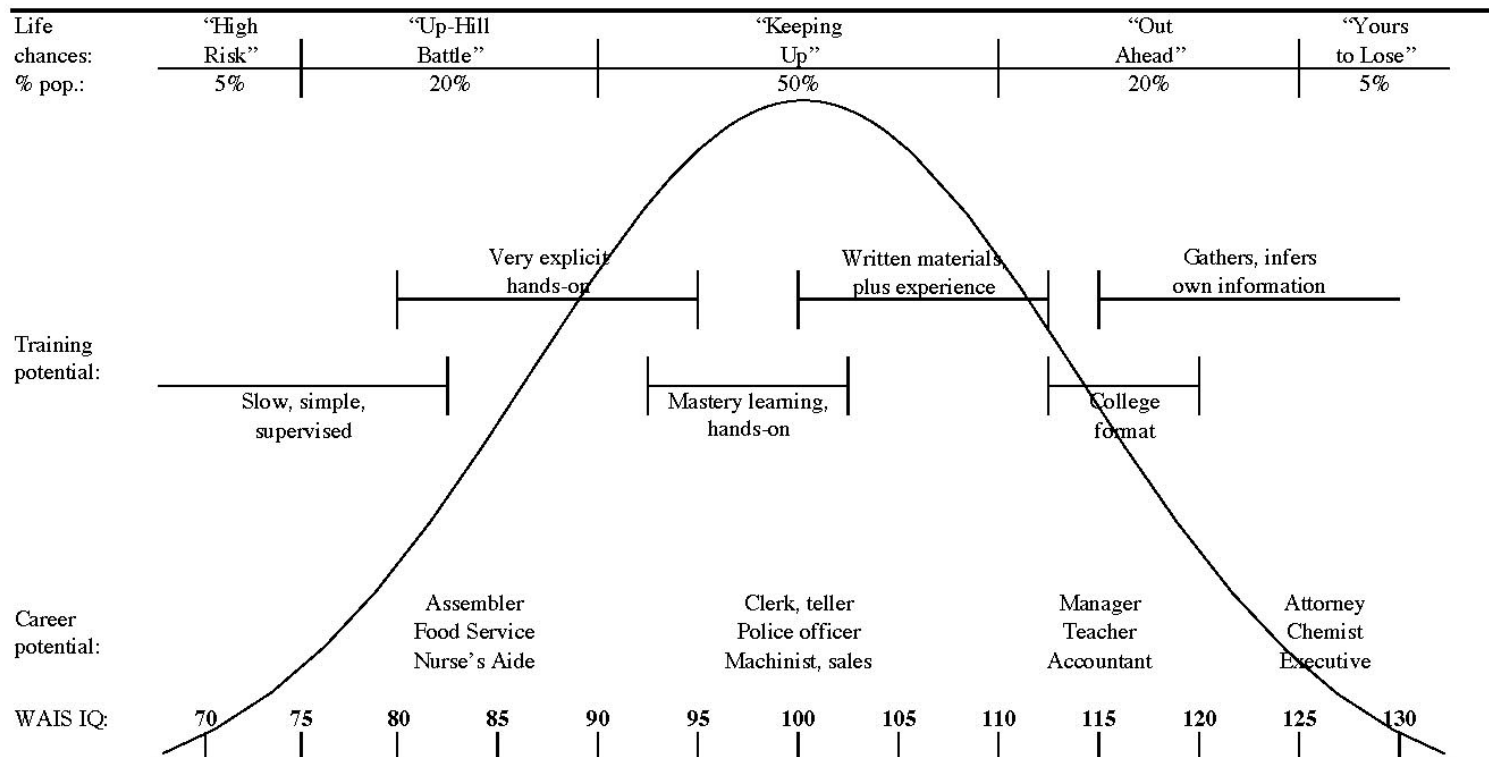
“Say ... what’s a mountain goat doing way up here in a cloud bank?”

# But practical value of $g$ level differs by task complexity & life arena

correlation with IQ



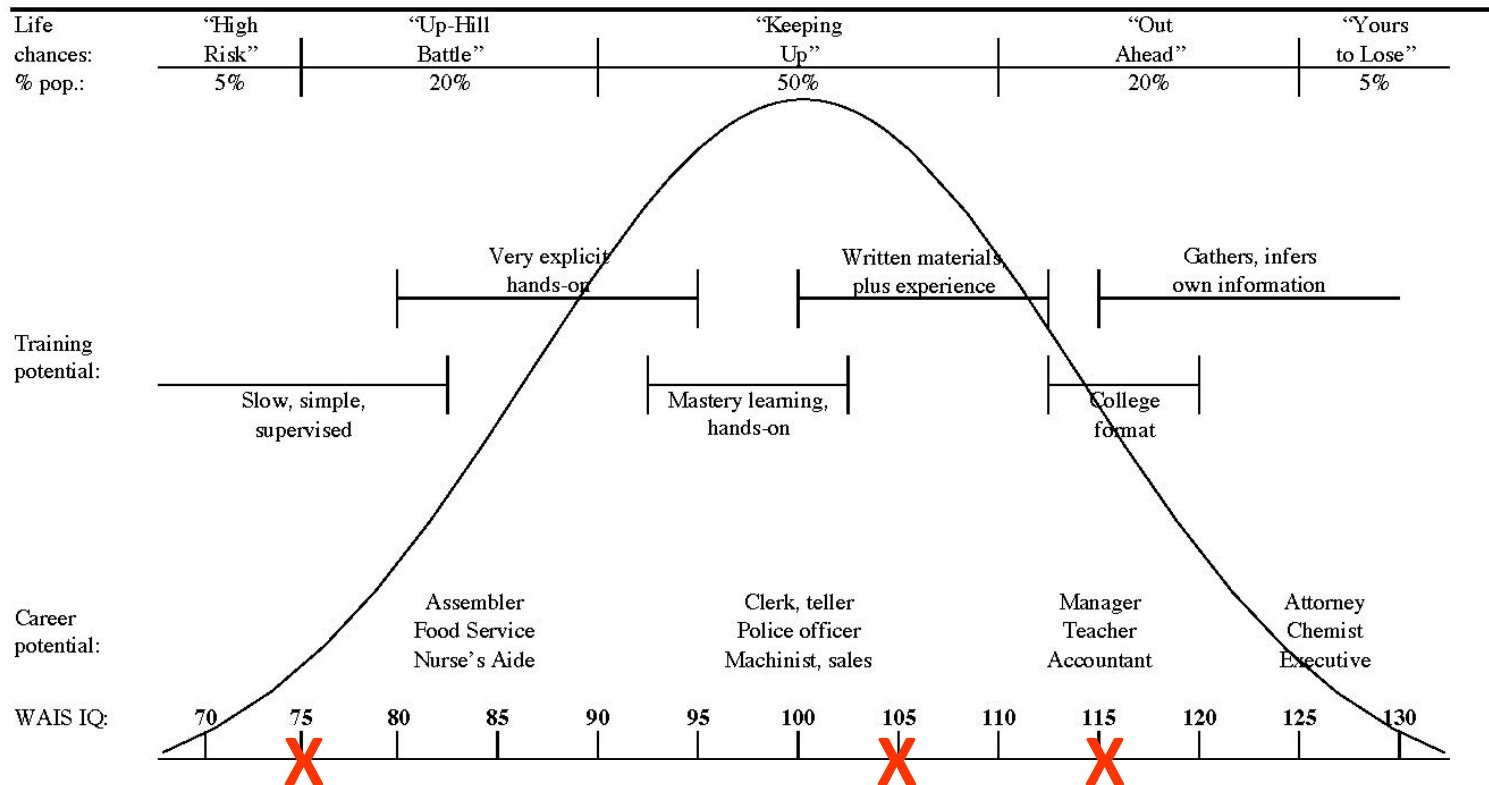
# Typical life outcomes along the IQ continuum



Odds of socioeconomic success increase



# Critical thresholds along the IQ continuum



50/50 chance of:

Mastering elementary school curriculum

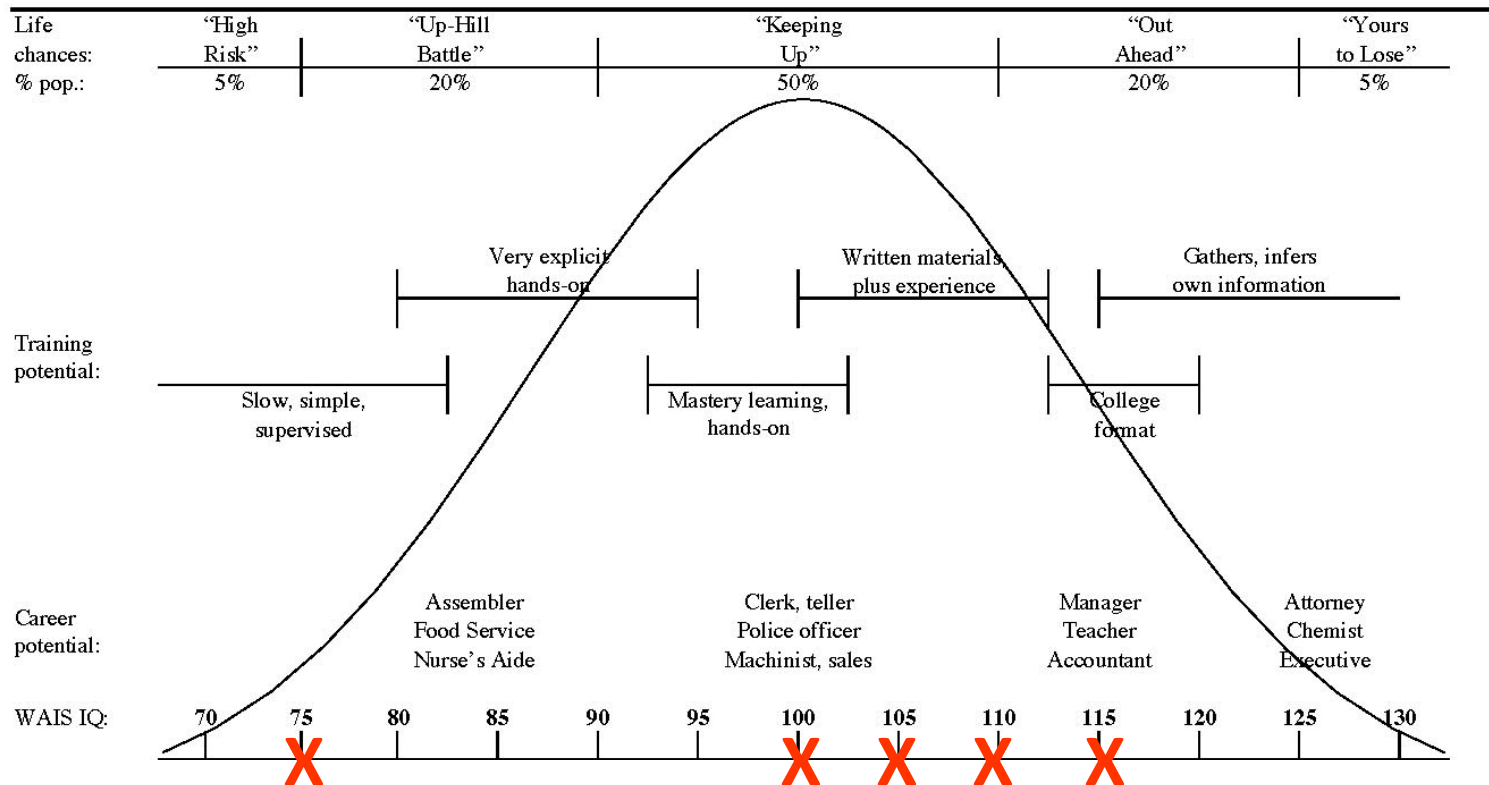
Doing well enough in HS to enter 4-yr college

Doing well enough in college to enter grad/professional school

Most critical threshold:

Ability to function as independent adult

# IQs not raised, so IQ thresholds must fall, when higher % of population attends college



50/50 chance of:

Mastering elementary school curriculum

Doing well enough in HS to enter 4-yr college

Doing well enough in college to enter grad/professional school

Most critical threshold:

Ability to function as independent adult

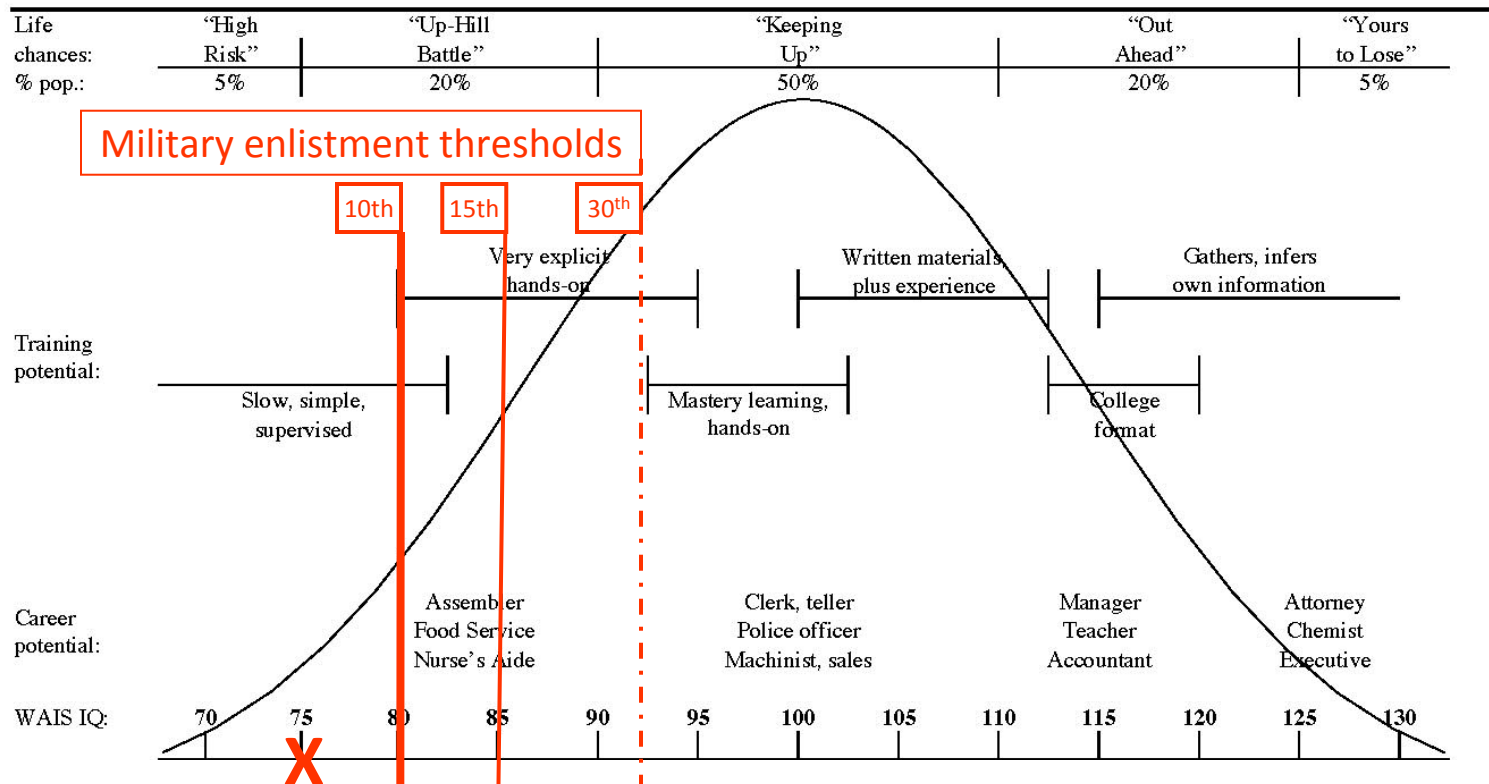
# Point 3

Human diversity in  $g$  is far greater  
than most people realize

Examples...

# Military requires minimum “trainability”

Armed Forces Qualifying Test (a test of  $g$ )



Military enlistment thresholds

10th

15th

30th

Most military jobs require at least 30<sup>th</sup> percentile

Military policy forbids induction below 15<sup>th</sup> percentile

US law forbids induction below 10<sup>th</sup> percentile

# Estimated levels of usual cognitive functioning

U.S. Dept of Education 1993 survey of adult functional literacy  
(nationally representative sample, ages 16+, N=26,091)

NALS Level	% pop.	<b>Simulated Everyday Tasks</b> Routinely able to perform tasks only up to this level of difficulty
5	3%	<ul style="list-style-type: none"><li>• Use calculator to determine cost of carpet for a room</li><li>• Use table of information to compare 2 credit cards</li></ul>
4	17%	<ul style="list-style-type: none"><li>• Use eligibility pamphlet to calculate SSI benefits</li><li>• Explain difference between 2 types of employee benefits</li></ul>
3	31%	<ul style="list-style-type: none"><li>• Calculate miles per gallon from mileage record chart</li><li>• Write brief letter explaining error on credit card bill</li></ul>
2	27%	<ul style="list-style-type: none"><li>• Determine difference in price between 2 show tickets</li><li>• Locate intersection on street map</li></ul>
1	22%	<ul style="list-style-type: none"><li>• Total bank deposit entry</li><li>• Locate expiration date on driver's license</li></ul>

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Difficulty based on  
“process complexity”

- level of inference
- abstractness of info
- distracting information

Not reading per se, but  
“problem solving”

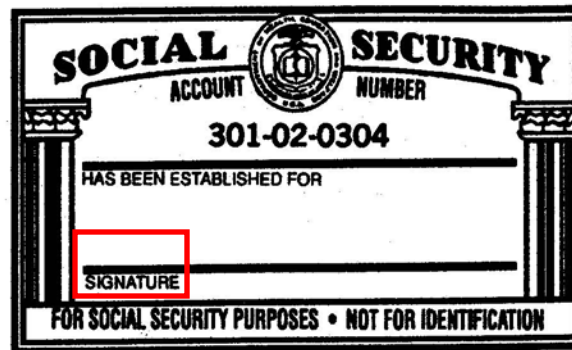
# Item at NALS Level 1\*

22% of US adults

78% of adults do better

Here is a Social Security card. Sign your name on the line that reads "signature."

- Literal match
- One item
- Little distracting info



\*80% probability of correctly answering items of this difficulty level

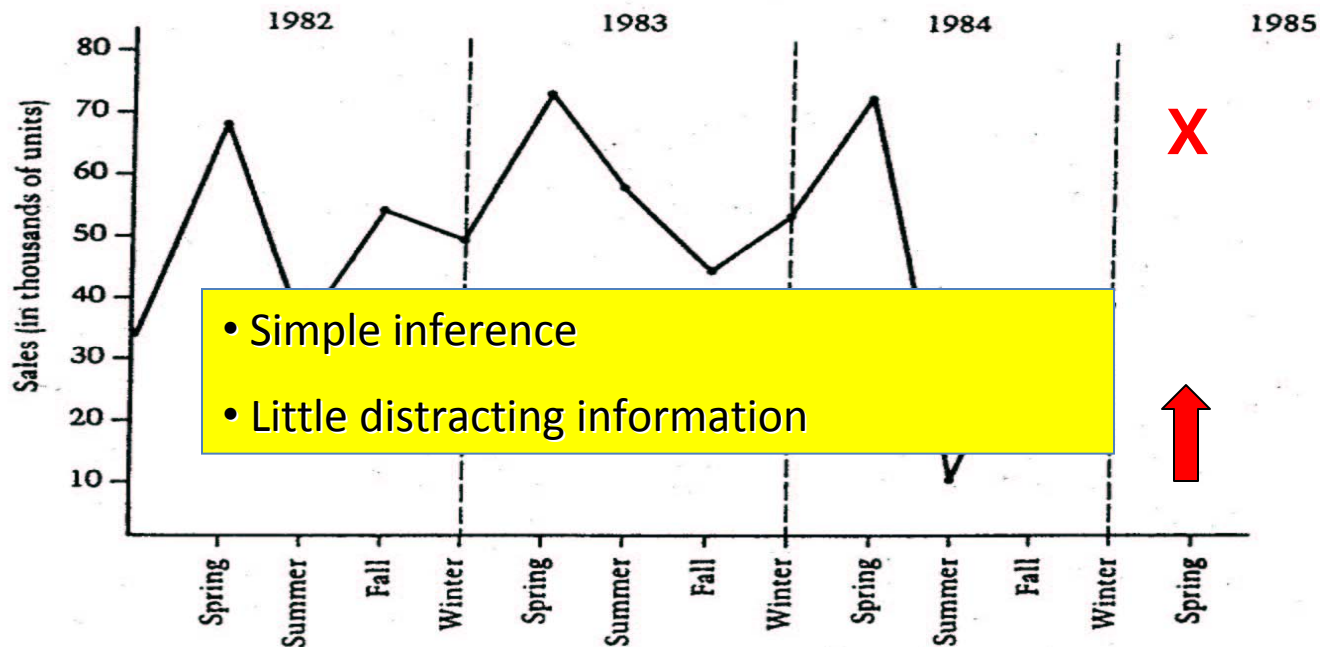
# Item at NALS Level 2

22%

27% of US adults

51%

You are a marketing manager for a small manufacturing firm. This graph shows your company's sales over the last three years. Given the seasonal pattern shown on the graph, predict the sales for Spring 1985 (in thousands) by putting an "x" on the graph.





# Another item at NALS Level 2

22%

27% of US adults

51%

What is the gross pay for this year to date?

HOURS				PERIOD ENDING		REGULAR	OVERTIME	GROSS	DEF. AMT.	NET PAY
REGULAR	TIME	SHIFT	OVERTIME	TOTAL	03/15/85					
500				500	CURRENT	62500		62500		45988
					YEAR-TO-DATE			426885		

TAX DEDUCTIONS				
	FED. W/H	STATE W/H	CITY W/H	FICA
CURRENT	10894	1375		3831
YEAR TO DATE	73498	8250		26167

OTHER DEDUCTIONS					
CODE	TYPE	AMOUNT	CODE	TYPE	AMOUNT
07	DEN	412			

NON-NEGOTIABLE

- Match two pieces of info

Reduced from original copy.

# Item at NALS Level 3

49%

31% of US adults

20%

You need to smooth wood in preparation for sealing and plan to buy garnet sandpaper. What type of sandpaper should you buy?

ABRASIVE SELECTION GUIDE																			
MATERIAL & OPERATION	PRODUCTION®					GARNET				WETORDRY®				FRE-CUT®		EMERY			
	EC	C	M	F	EF	C	M	F	EF	VF	EF	SF	UF	VF	EF	C	M	F	
<b>WOOD</b>																			
Paint Removal																			
Heavy Stock Removal																			
Moderate Stock Removal																			
Preparation for Sealing																			
After Sealer																			
Between Coats																			
After Final Coat																			
<b>METAL</b>																			
Rust and Paint Removal																			
Light Stock Removal																			
Preparation for Priming																			
Finishing and Polishing																			
After Primer																			
Between Coats																			
After Final Coat																			
<b>PLASTIC &amp; FIBERGLASS</b>																			
Shaping																			
Light Stock Removal																			
Finishing & Scuffing																			

EC = Extra Coarse C = Coarse M = Medium F = Fine VF = Very Fine EF = Extra Fine SF = Super Fine UF = Ultra Fine

## SAFETY INFORMATION:

■ Wear approved safety goggles when sanding.

■ Use particle/dust mask or other means to prevent inhalation of sanding dust.

■ When using power tools, follow manufacturer's recommended procedures and safety instructions.

- Cycle through complex table
- Irrelevant info

# Item at NALS Level 4

80%

17% of US adults

3%

On Saturday afternoon, if you miss the 2:35 bus leaving Hancock and Buena Ventura going to Flintridge and Academy, how long will you have to wait for the next bus?

<div> <div>Or,</div> <div> <div>ROUTE 5</div> <div>VISTA GRANDE</div> <div> <p>This bus line operates Monday through Saturday providing "local" service to most neighborhoods in the northeast section.</p> <p>Buses run thirty minutes apart during the morning and afternoon rush hours Monday through Friday.</p> <p>Buses run one hour apart at all other times of day and Saturday.</p> <p>No Sunday, holiday or night service.</p> </div> <div>Solved</div> </div> </div>											
OUTBOUND from Terminal						INBOUND toward Terminal					
Leave Downtown Terminal	Leave Hancock and Buena Ventura	Leave Citadel	Leave Rustic Hills	Leave North Carefree	Arrive Flintridge and Academy	Leave Flintridge and Academy	Leave North Carefree	Leave Rustic Hills	Leave Citadel	Leave Hancock and Buena Ventura	Arrive Downtown
AM	6:20	6:35	6:45	6:50	7:00	7:15	7:27	7:42	7:47	7:57	8:15
	6:50	7:05	7:15	7:20	7:30	7:45	7:57	8:12	8:17	8:27	8:45
	7:20	7:35	7:45	7:50	8:00	8:15	8:27	8:42	8:47	8:57	9:15
	7:50	8:05	8:15	8:20	8:30	8:45	8:57	9:12	9:17	9:27	9:45
	8:20	8:35	8:45	8:50	9:00	9:15	9:27	9:42	9:47	9:57	10:15
	8:50	9:05	9:15	9:20	9:30	9:45	9:57	10:12	10:17	10:27	10:45
	9:20	9:35	9:45	9:50	10:00	10:15	10:27	10:42	10:47	10:57	11:15
	10:20	10:35	10:45	10:50	11:00	11:15	11:27	11:42	11:47	11:57	12:15
	11:20	11:35	11:45	11:50	12:00	12:15	12:27	12:42	12:47	12:57	1:15
PM	12:20	12:35	12:45	12:50	1:00	1:15	1:27	1:42	1:47	1:57	2:15
	1:20	1:35	1:45	1:50	2:00	2:15	2:27	2:42	2:47	2:57	3:15
	2:20	2:35	2:45	2:50	3:00	3:15	3:27	3:42	3:47	3:57	4:15
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	5:20	5:35	5:45	5:50	6:00	6:15					
	5:50	6:05	6:15	6:20	6:30	6:45					
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- More elements to match
- More inferences
- More distracting information

To be sure of a smooth transfer, tell the driver of this bus the name of the second bus you need.

# Item at NALS Level 5

97%

3% of US adults

Using the information in the table, write a brief paragraph summarizing the extent to which parents and teachers agreed or disagreed on the statements about issues pertaining to parental involvement at their school.

- Search through complex displays
- Multiple distractors
- Make high-level text-based inferences
- Use specialized knowledge

## Parents and Teachers Evaluate Parental Involvement at Their School

Do you agree or disagree that . . . ?

	Total	Level of School		
		Elementary	Junior High	High School
<i>percent agreeing</i>				
Our school does a good job of encouraging parental involvement in sports, arts, and other nonsubject areas				
Parents	77	76	74	79
Teachers	77	73	77	85
Our school does a good job of encouraging parental involvement in educational areas				
Parents	73	82	71	64
Teachers	80	84	78	70
Our school only contacts parents when there is a problem with their child				
Parents	55	46	62	63
Teachers	23	18	22	33
Our school does not give parents the opportunity for any meaningful roles				
Parents	22	18	22	28
Teachers	8	8	12	7

Source: The Metropolitan Life Survey of the American Teacher, 1987

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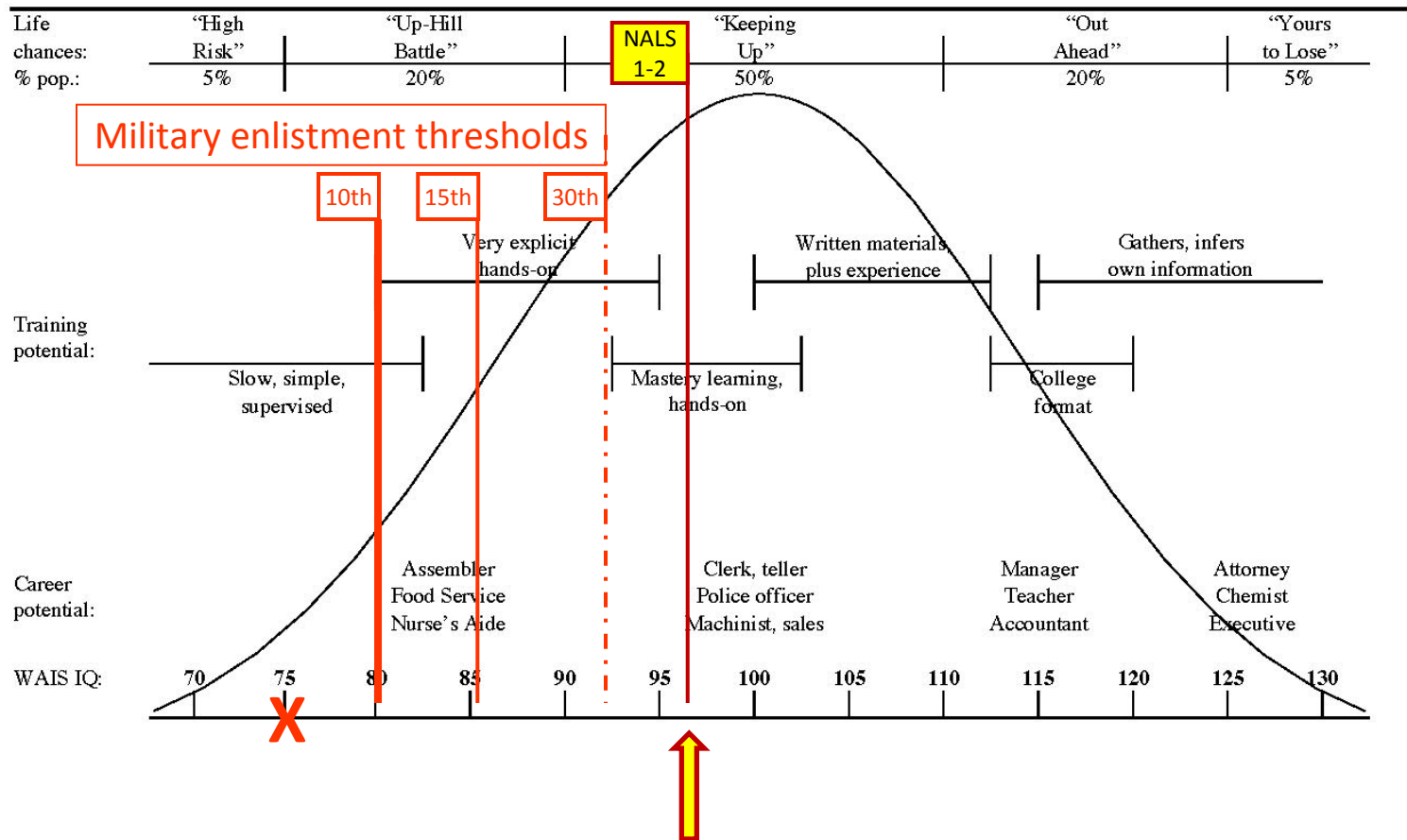
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US Dept of Education: People at levels 1-2 are below literacy level required to enjoy rights & fulfill responsibilities of citizenship		
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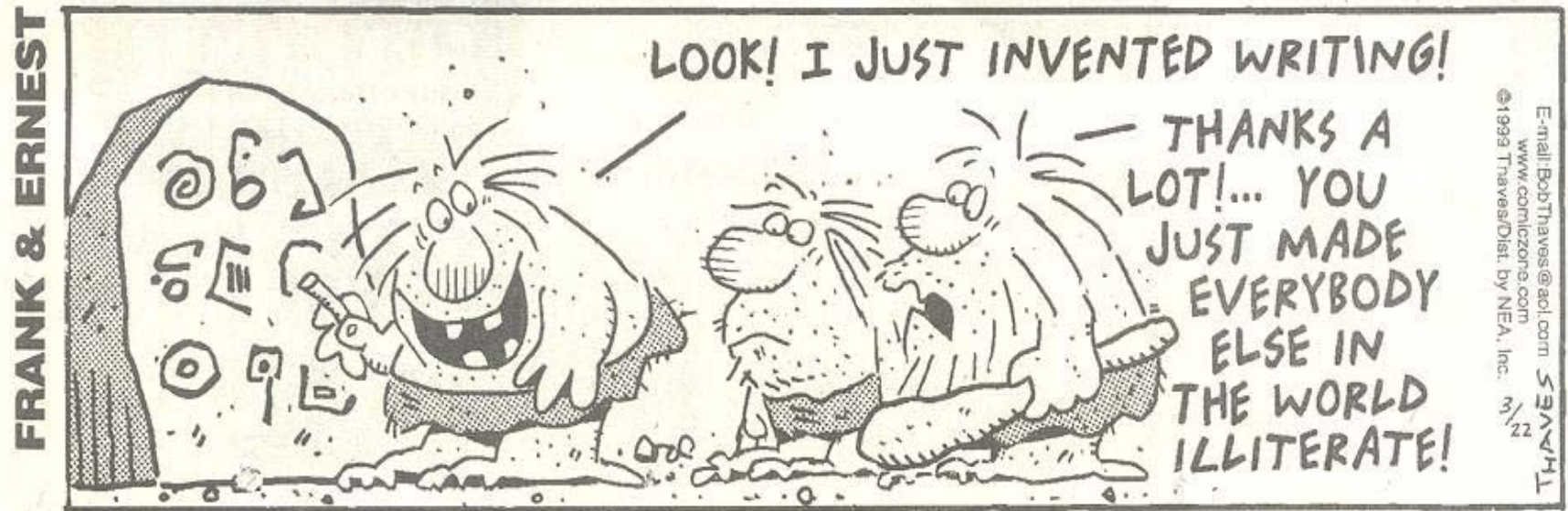
Could teach these individual items, but not all such tasks in daily life



# So, NALS 2 represents another critical threshold



Moreover, new technologies make life increasingly complex, which puts yet higher premium on  $g$



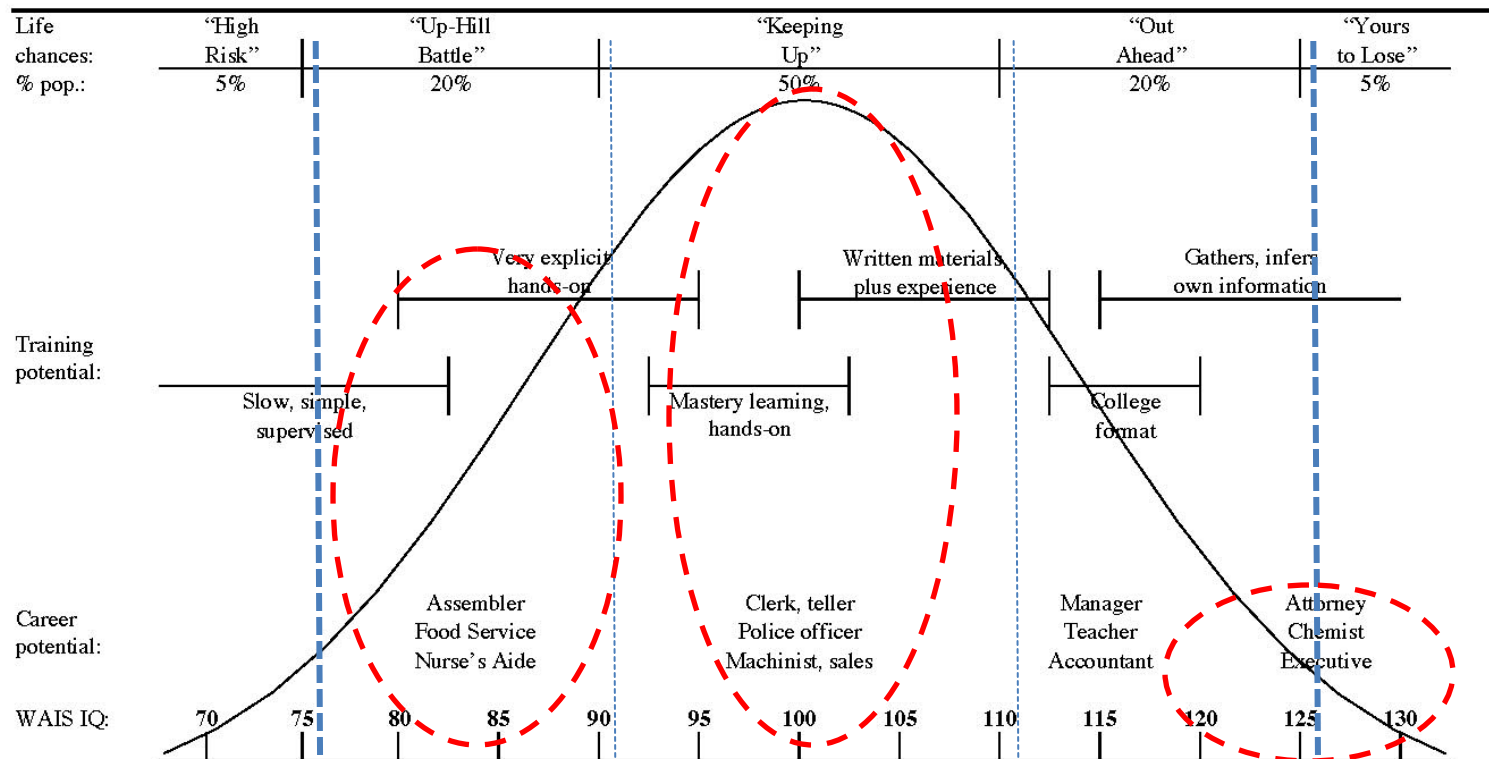
# Point 4

The landscape of human cognitive diversity should inform debates over whose intelligence should be enhanced, how, and for what ends

Examples...



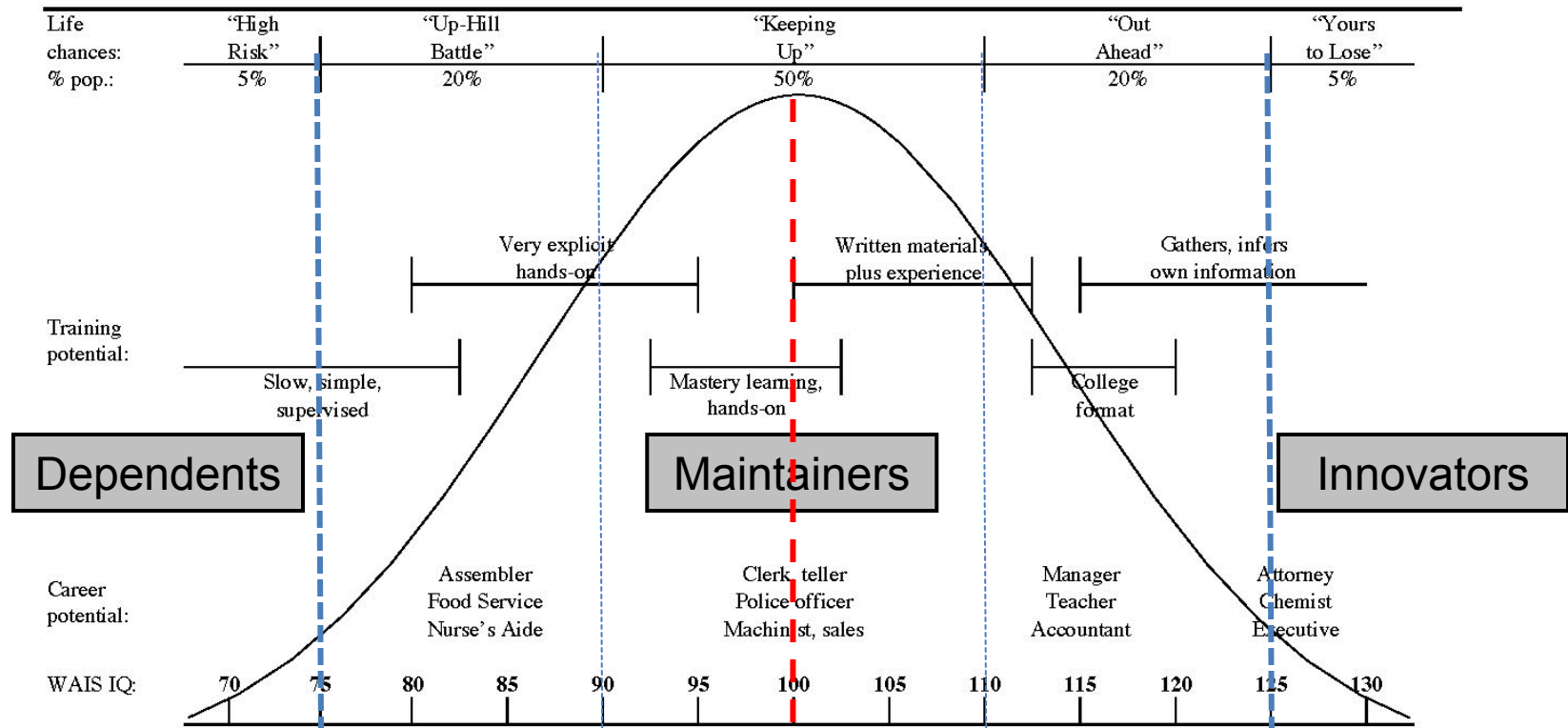
# Nation-level implications of enhancement?



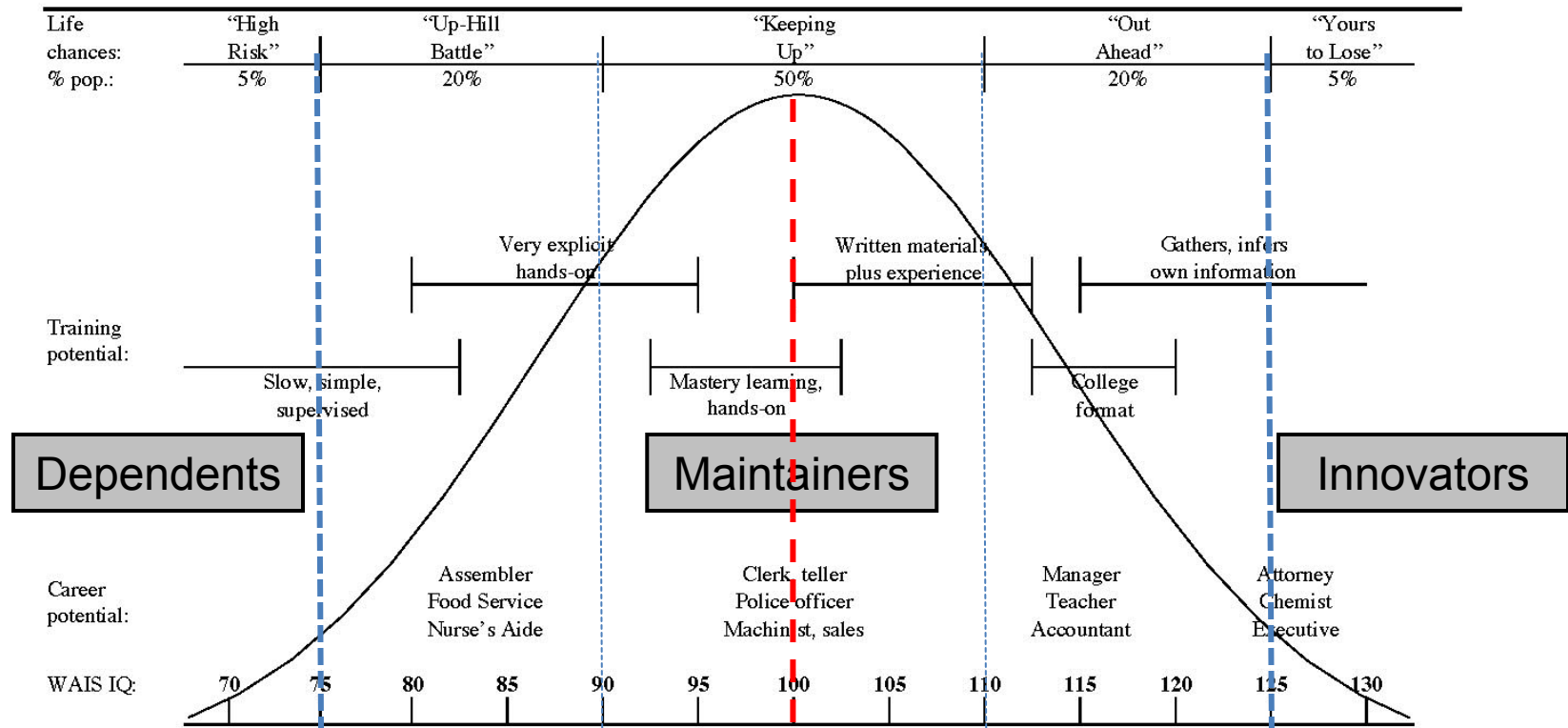
Potential debates about whom to target, and why—equality? productivity?

But suppose we raise the whole IQ bell curve by some means...

# Nation-level implications: Carrying capacity



# Nation-level implications: Carrying capacity

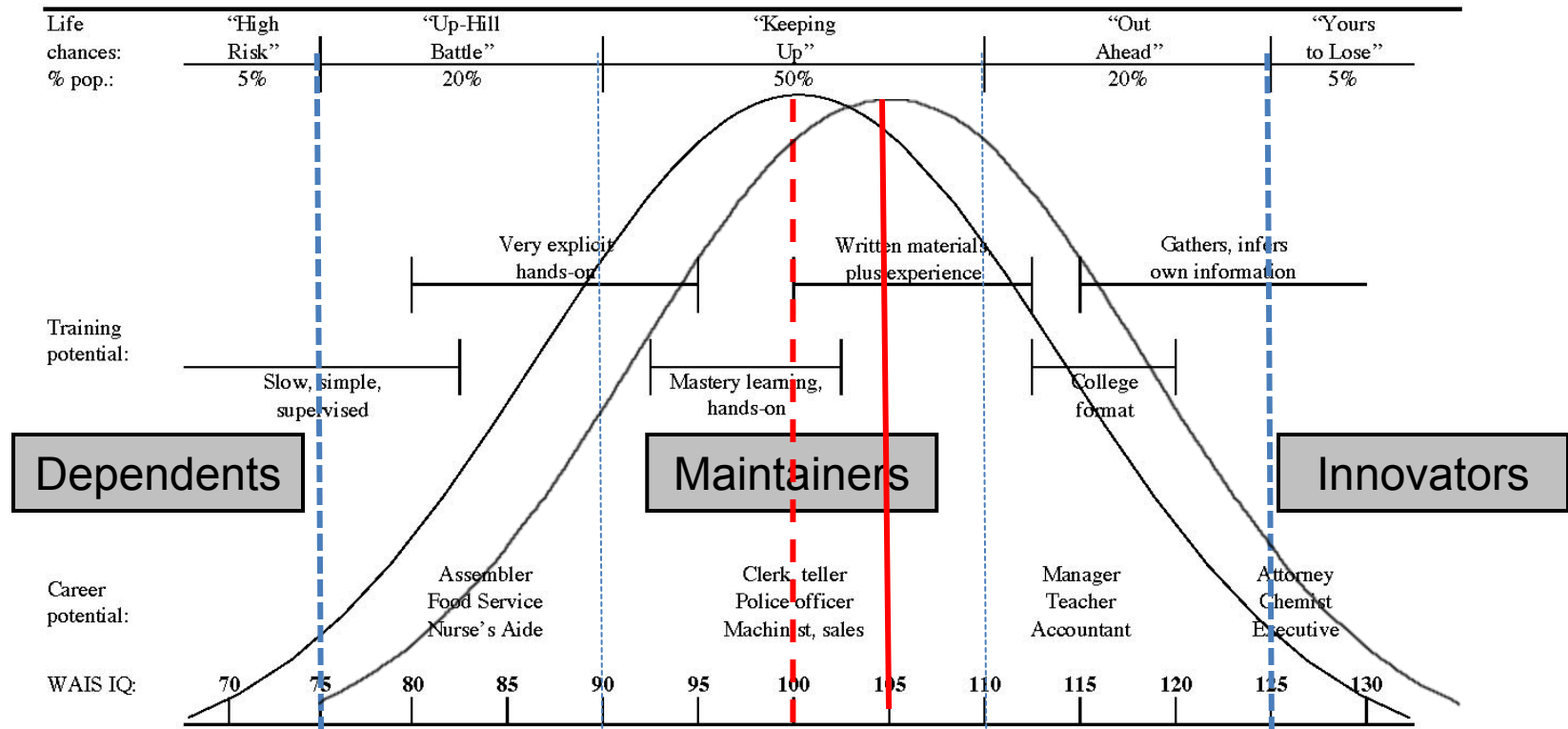


**Current standard**  
(Mean 100/SD 15)

$$\frac{\text{Innovators}}{\text{Dependents}} = \frac{5\%}{5\%} = 1.0$$

$$\frac{> \text{IQ } 100}{< \text{IQ } 100} = \frac{50\%}{50\%} = 1.0$$

# Nation-level implications: 5-point rise



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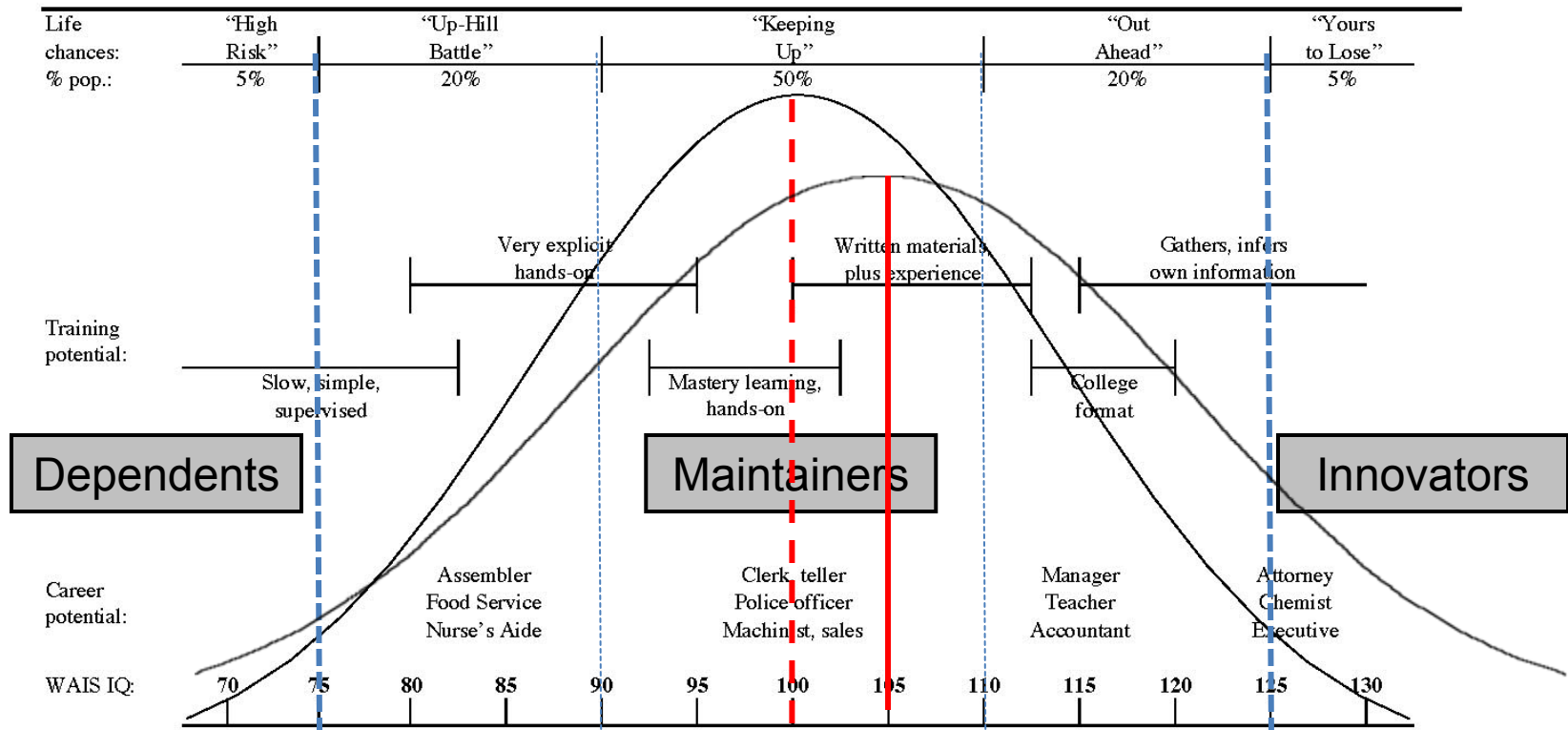
$$\frac{> \text{IQ } 100}{< \text{IQ } 100} = \frac{50\%}{50\%} = 1.0$$

**Higher**  
(Mean 105)

$$\frac{9.2\%}{2.3\%} = 4.0 \quad \leftarrow \text{Quadruples the ratio}$$

$$\frac{62.9\%}{37.1\%} = 1.7 \quad \leftarrow \text{Almost doubles the ratio}$$

# Nation-level implications: with rise & bigger SD



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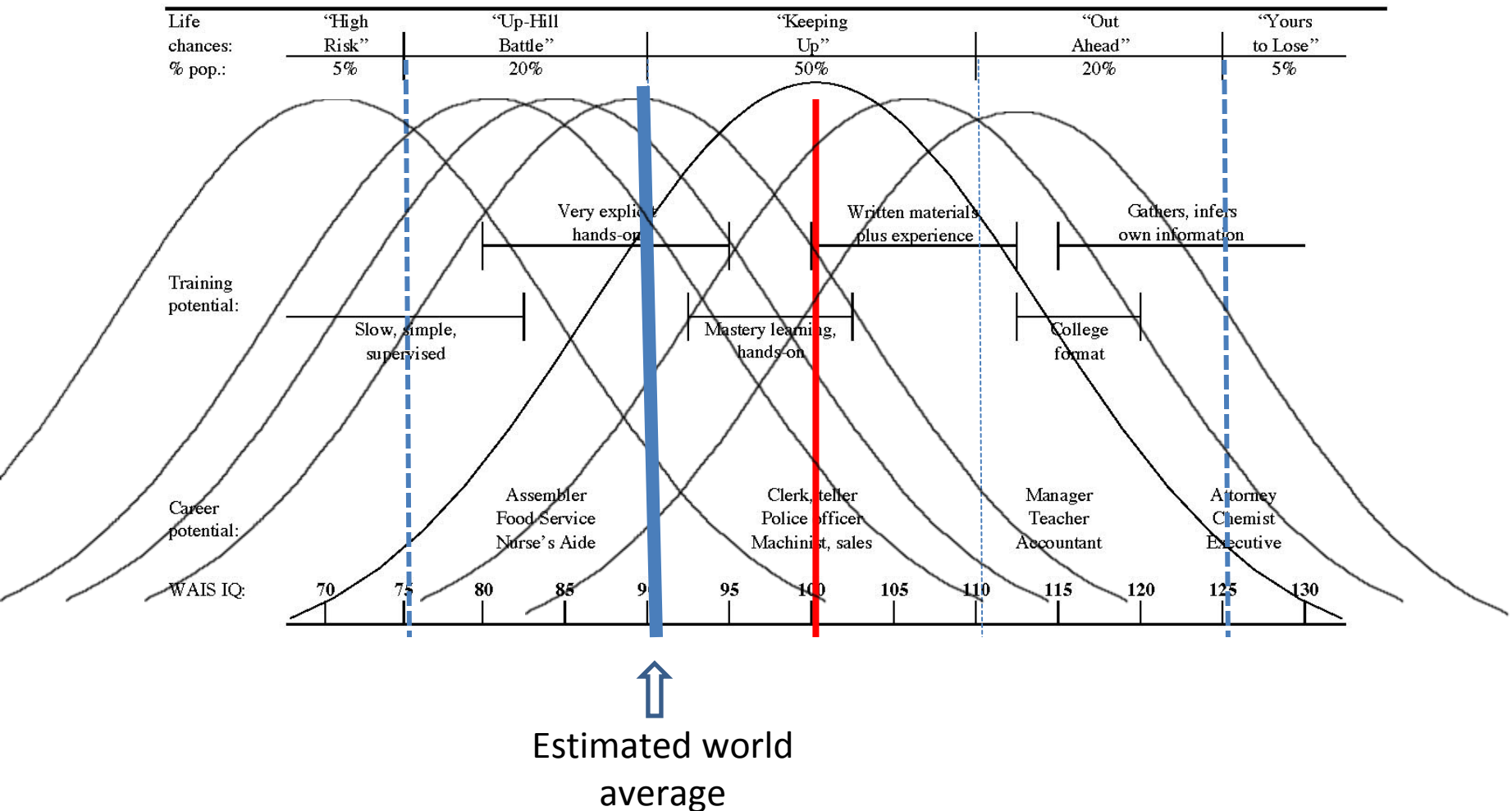
**Higher & less equal**  
(Mean 105, SD 17)

$$\frac{11.5\%}{3.9\%} = 2.9$$

$$\frac{61.6\%}{38.4\%} = 1.6$$

Smaller but still huge effects

# International implications



Countries & ethnic groups currently differ greatly  
So, many competing goals

# References

- Gottfredson, L. S. (1997). [Why g matters: The complexity of everyday life.](#) *Intelligence*, 24(1), 79-132.
- Kirsch, I. S., Jungeblut, A., Jenkins, L., & Kolstad, A. (1993). [Adult literacy in America: A first look at the result of the National Adult Literacy Survey.](#) Washington, DC: US Department of Education, National Center for Education Research.

# Thank you.

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- <http://www.udel.edu/educ/gottfredson>