

The Rising **Complexity** of Everyday Life

Linda S. Gottfredson, PhD
School of Education
University of Delaware
Newark, Delaware USA

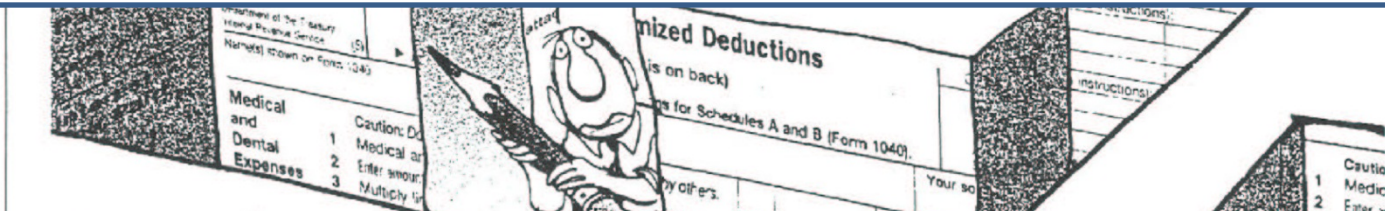
Presented to the Alumni Association of the School of Psychology
Karl Franzens University of Graz
Graz, Austria
13 November 2012

[illegible]

Cognitive demands of everyday life



1. People differ in cognitive ability (g)



2. Life tasks differ in cognitive complexity (g loading).



3. So what?

Everyday literacy

Name a reading task:

- Very simple for most people
- Very difficult for most people

What about this one?

Label on a prescription vial

Acme Pharmacy Dept. **7806**

Rt. 4 & Elkton Road

Newark, DE

Date: 07/05/03

Phone: (302) 453-2335

Rx# 19253

LINDA GOTTFREDSON

TAKE 4 CAPSULES BY MOUTH

1 HOUR PRIOR TO DENTAL APPT.

AMOXYCILLIN 500MG CAPSULE By GENEV

Orig.

Date **7/31/02**

Refill **Y**

Qty. **4**

RPh **SSM**

Sample literacy items & error rates

TOHFLA test

Patients examine the actual vials or documents

% of urban hospital outpatients <u>not</u> knowing:	Health literacy level		
	V-low	Low <small>Error rate</small>	OK <small>(%)</small>
How to take meds 4 times per day	24	9	5
When next appointment is scheduled	40	13	5
How many pills of a prescription to take	70	34	13
What an informed consent form is saying	95	72	22

Sample TOHFLA Items & Error Rates

Patients examine the actual vials or documents

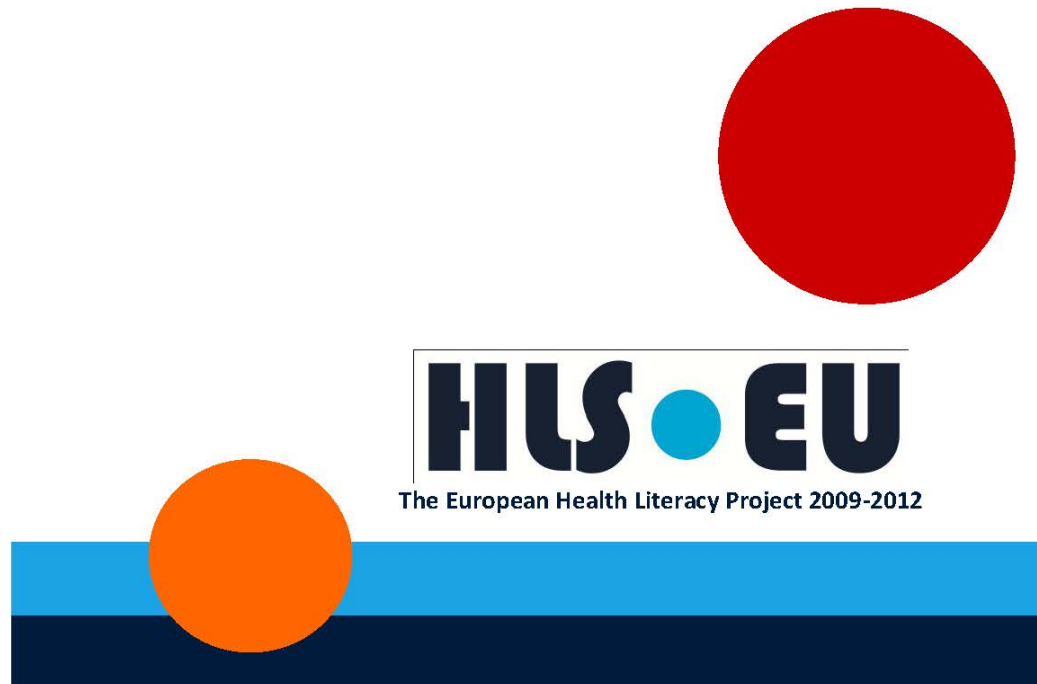
% of urban hospital outpatients <u>not</u> knowing:	Health literacy level		
	V-low	Low <small>Error rate</small>	OK <small>(%)</small>
But how representative?			
How to take meds 4 times per day	24	9	5
When next appointment is scheduled	40	13	5
How many pills of a prescription to take	70	34	13
What an informed consent form is saying	95	72	22

Typical literacy items, by difficulty level

National Adult Literacy Survey (NALS), 1993

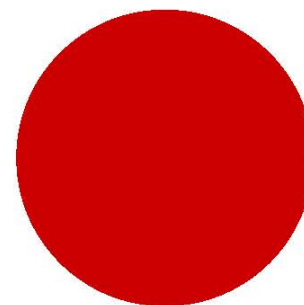
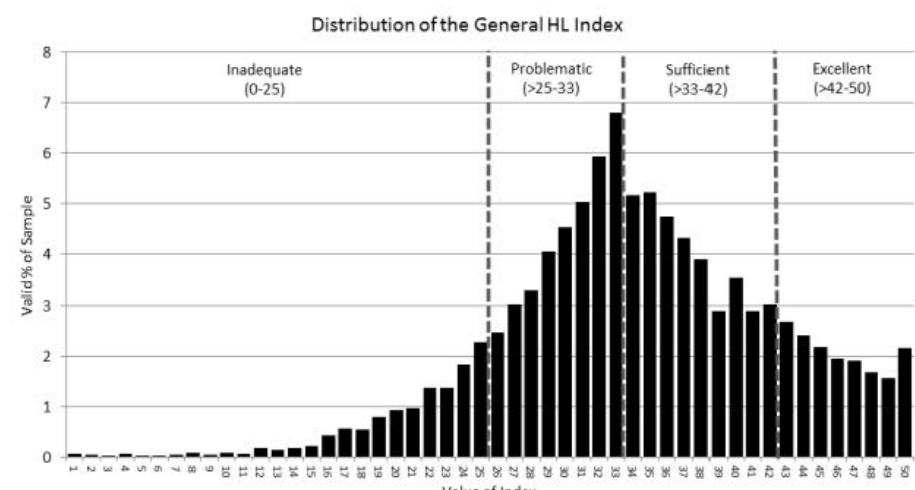
NALS difficulty level (& scores)	% US adults peaking at this level	Simulated everyday tasks
		Daily self-maintenance in modern literate societies
5 (375-500)	3%	<ul style="list-style-type: none">▪ Use calculator to determine cost of carpet for a room▪ Use table of information to compare 2 credit cards
4 (325-375)	15%	<ul style="list-style-type: none">▪ Use eligibility pamphlet to calculate SSI benefits▪ Explain difference between 2 types of employee benefits
3 (275-325)	31%	<ul style="list-style-type: none">▪ Calculate miles per gallon from mileage record chart▪ Write brief letter explaining error on credit card bill
2 (225-275)	28%	<ul style="list-style-type: none">▪ Determine difference in price between 2 show tickets▪ Locate intersection on street map
1 (0-225)	23%	<ul style="list-style-type: none">▪ Total bank deposit entry▪ Locate expiration date on driver's license

COMPARATIVE REPORT ON HEALTH LITERACY IN EIGHT EU MEMBER STATES



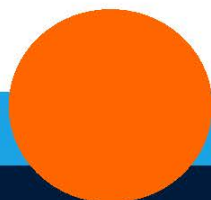
COMPARATIVE REPORT ON HEALTH LITERACY IN EIGHT EU MEMBER STATES

Graph 6: Distribution of the General HL Index for Total

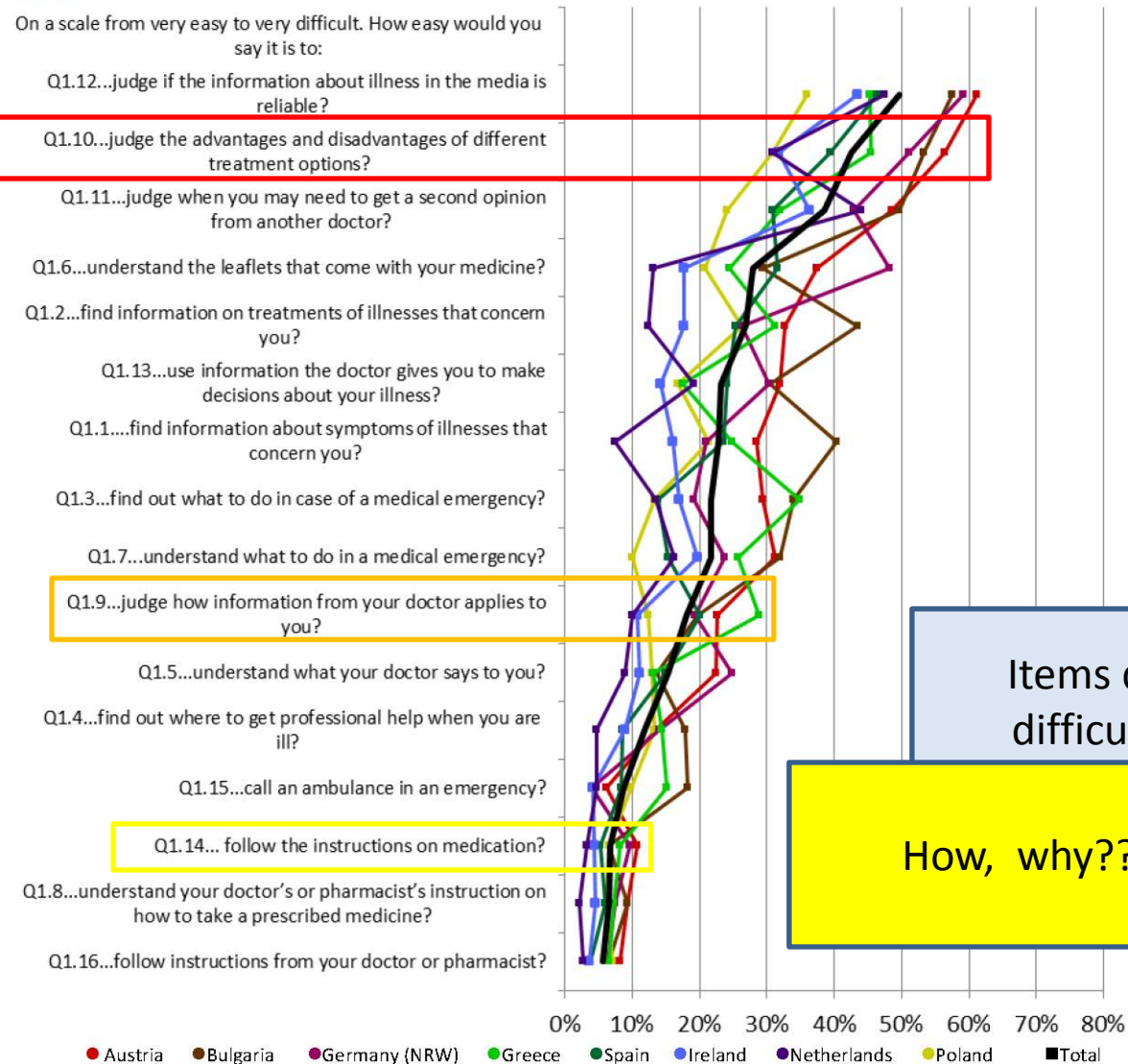


HLS • EU

The European Health Literacy Project 2009-2012



Graph 1: Shares of 'Fairly Difficult' and 'Very Difficult' Answers of Health Care Items for Countries and Total



What makes some items more difficult?

“Information processing complexity”

NALS difficulty level (& scores)	% US adults peaking at this level	Simulated everyday tasks
5 (375-500)	3%	<ul style="list-style-type: none"> Use calculator Use table of information
4 (325-375)	15%	<ul style="list-style-type: none"> Use eligibility requirements Explain different benefits
3 (275-325)	31%	<ul style="list-style-type: none"> Calculate mileage Write brief letter
2 (225-275)	28%	<ul style="list-style-type: none"> Determine different Locate intersection
1 (0-225)	23%	<ul style="list-style-type: none"> Total bank deposits Locate expiration date

Elements of “process complexity”

- number of features to match
- level of inference
- abstractness of info
- distracting information

Not reading per se, but “problem solving”

“To be, or not to be. That is the question.”

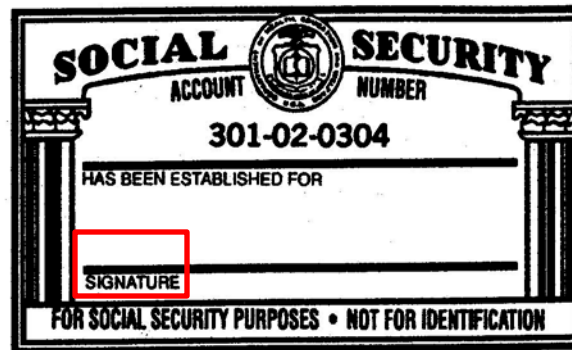
Item at NALS Level 1*

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

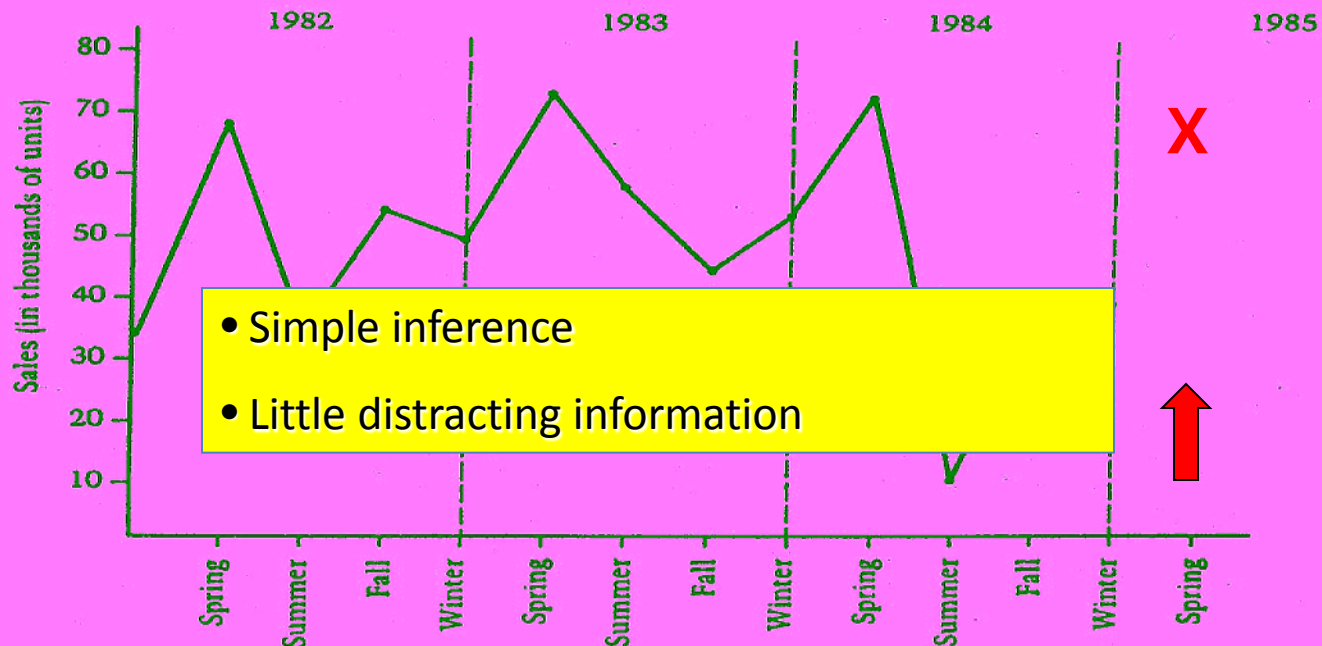
Item at NALS Level 2

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.



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
WOOD																		
Paint Removal																		
Heavy Stock Removal																		
Moderate Stock Removal																		
Preparation for Sealing																		
After Sealer																		
Between Coats																		
After Final Coat																		
METAL																		
Rust and Paint Removal																		
Light Stock Removal																		
Preparation for Priming																		
Finishing and Polishing																		
After Primer																		
Between Coats																		
After Final Coat																		
PLASTIC & FIBERGLASS																		
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.

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Reduced from original copy

- 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> ROUTE 5 VISTA GRANDE <p>This bus line operates Monday through Saturday providing "local" service to most neighborhoods in the northeast section. Buses run thirty minutes apart during the morning and afternoon rush hours Monday through Friday. Buses run one hour apart at all other times of day and Saturday. No Sunday, holiday or night service.</p> </div> <div>Solved</div> </div>												
OUTBOUND from Terminal						INBOUND toward Terminal						
Leave Downtown Terminal	Leave Hancock and Buena Ventura	Leave Citadel	Leave Rustic Hills	Leave North Carlesee and Oro	Arrive Flintridge and Academy	Leave Flintridge and Academy	Leave North Carlesee	Leave Rustic Hills	Leave Citadel	Leave Hancock and Buena Ventura	Arrive Downtown	
AM	6:20	6:35	6:45	6:50	7:00							through Friday only
	6:50	7:05	7:15	7:20	7:30							through Friday only
	7:20	7:35	7:45	7:50	8:00							through Friday only
	7:50	8:05	8:15	8:20	8:30							through Friday only
	8:20	8:35	8:45	8:50	9:00							
	8:50	9:05	9:15	9:20	9:30							
	9:20	9:35	9:45	9:50	10:00							
	10:20	10:35	10:45	10:50	11:00							
	11:20	11:35	11:45	11:50	12:00							
PM	12:20	12:35	12:45	12:50	1:03	1:15	1:15	1:27	1:42	1:47	1:57	2:15
	1:20	1:35	1:45	1:50	2:03	2:15	2:15	2:27	2:42	2:47	2:57	3:15
	2:20	2:35	2:45	2:50	3:03	3:15	3:15	3:27	3:42	3:47	3:57	4:15
	2:50	3:05	3:15	3:20	3:33	3:45	3:45	3:57	4:12	4:17	4:27	4:45 Monday through Friday only
	3:20	3:35	3:45	3:50	4:03	4:15	4:15	4:27	4:42	4:47	4:57	5:15
	3:50	4:05	4:15	4:20	4:33	4:45	4:45	4:57	5:12	5:17	5:27	5:45 Monday through Friday only
	4:20	4:35	4:45	4:50	5:03	5:15	5:15	5:27	5:42	5:47	5:57	6:15
	4:50	5:05	5:15	5:20	5:33	5:45	5:45	5:57	6:12	6:17	6:27	6:45 Monday through Friday only
	5:20	5:35	5:45	5:50	6:03	6:15						
	5:50	6:05	6:15	6:20	6:33	6:45						Monday through Friday only
	6:20	6:35	6:45	6:50	7:03	7:15						

- More elements to match
- More inferences
- More distracting information

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

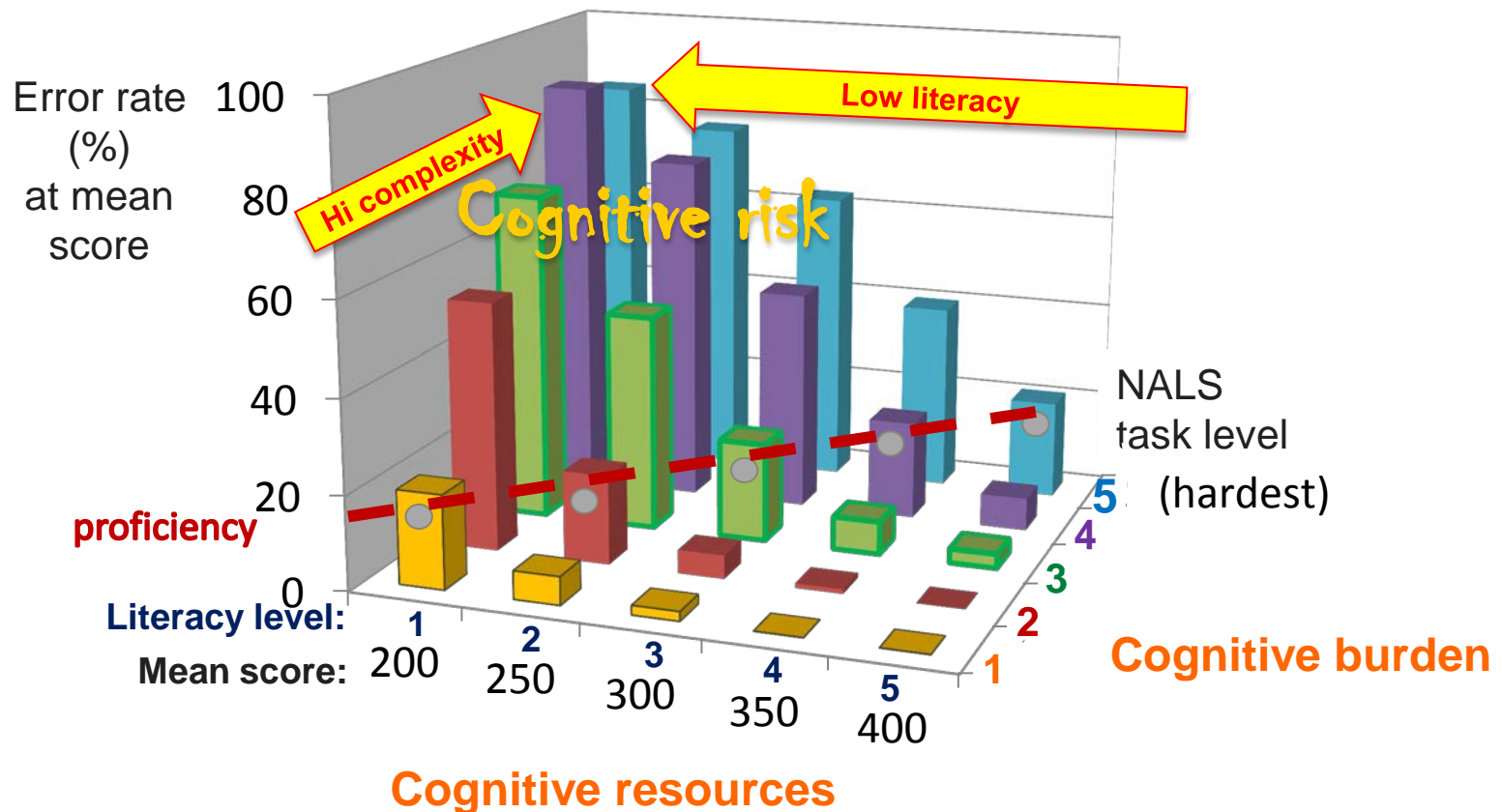
Parents and Teachers Evaluate Parental Involvement at Their School

Do you agree or disagree that . . . ?

		Level of School		
	Total	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

Landscape of cognitive risk

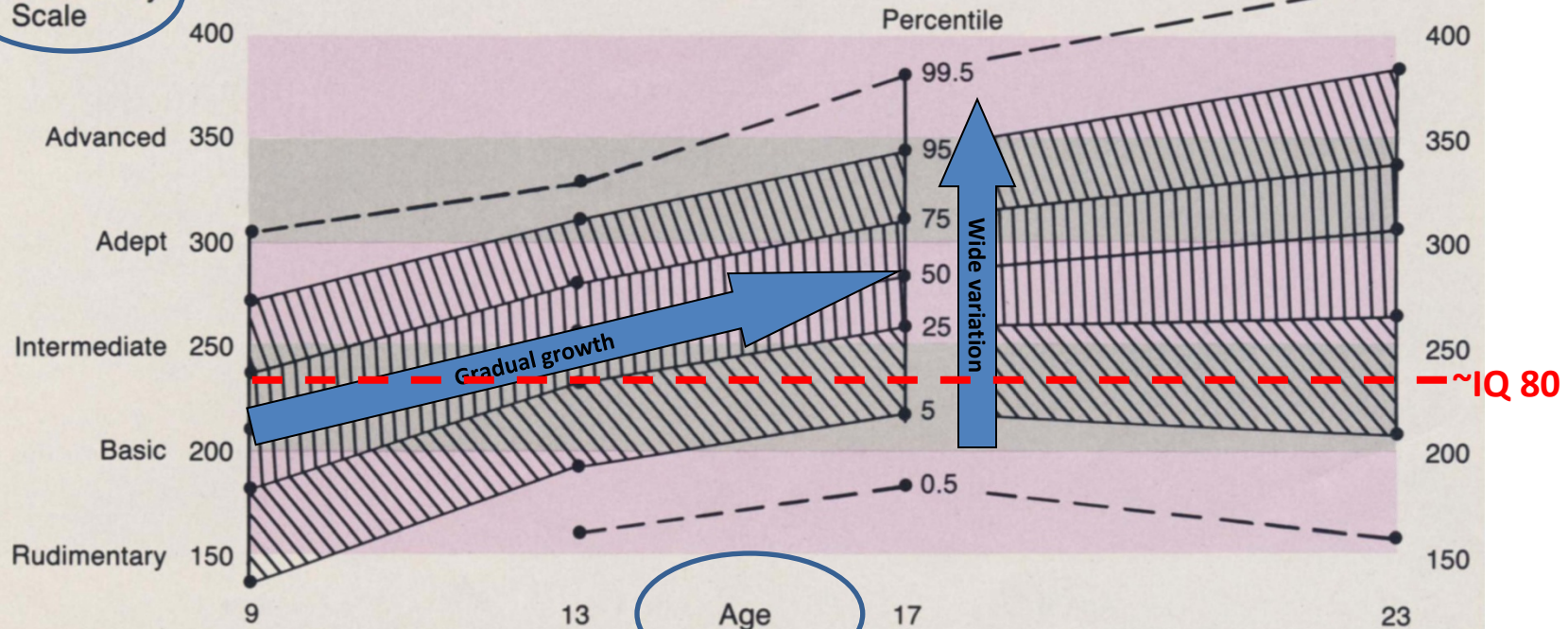


Could teach these individual items, but not all such tasks in daily life.

“Literacy” \approx verbal comprehension \approx general ability

FIGURE 1.
Total Groups, 1984 In-School Assessment,
Plus Young Adult Data, 1985

Reading
Proficiency
Scale



Source: Derived from *The Reading Report Card*, pp. 65-71.

John B Carroll

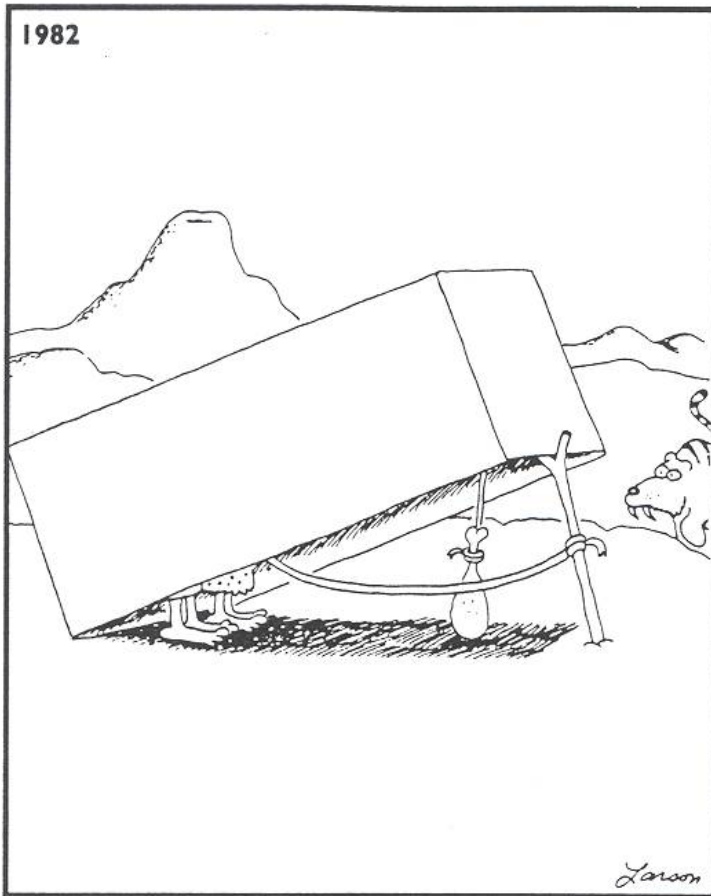
Sample IQ Items

(individually administered)

Complexity is the active ingredient:
More complex tasks are more “*g* loaded”

	Easy	Moderate	Hard
<i>Fill in the next two numbers</i>	3, 5, 7, 9, __, __	3, 5, 6, 8, 9, __, __ Infer the rule	10, 9, 8, 9, 8, 7, __, __
<i>Name one similarity</i>	orange—banana (93%)	table-chair (55%) More abstract	Praise-punishment (25%)
<i>Define the word</i>	conceal (87%)	reluctant (50%)	ominous (20%)

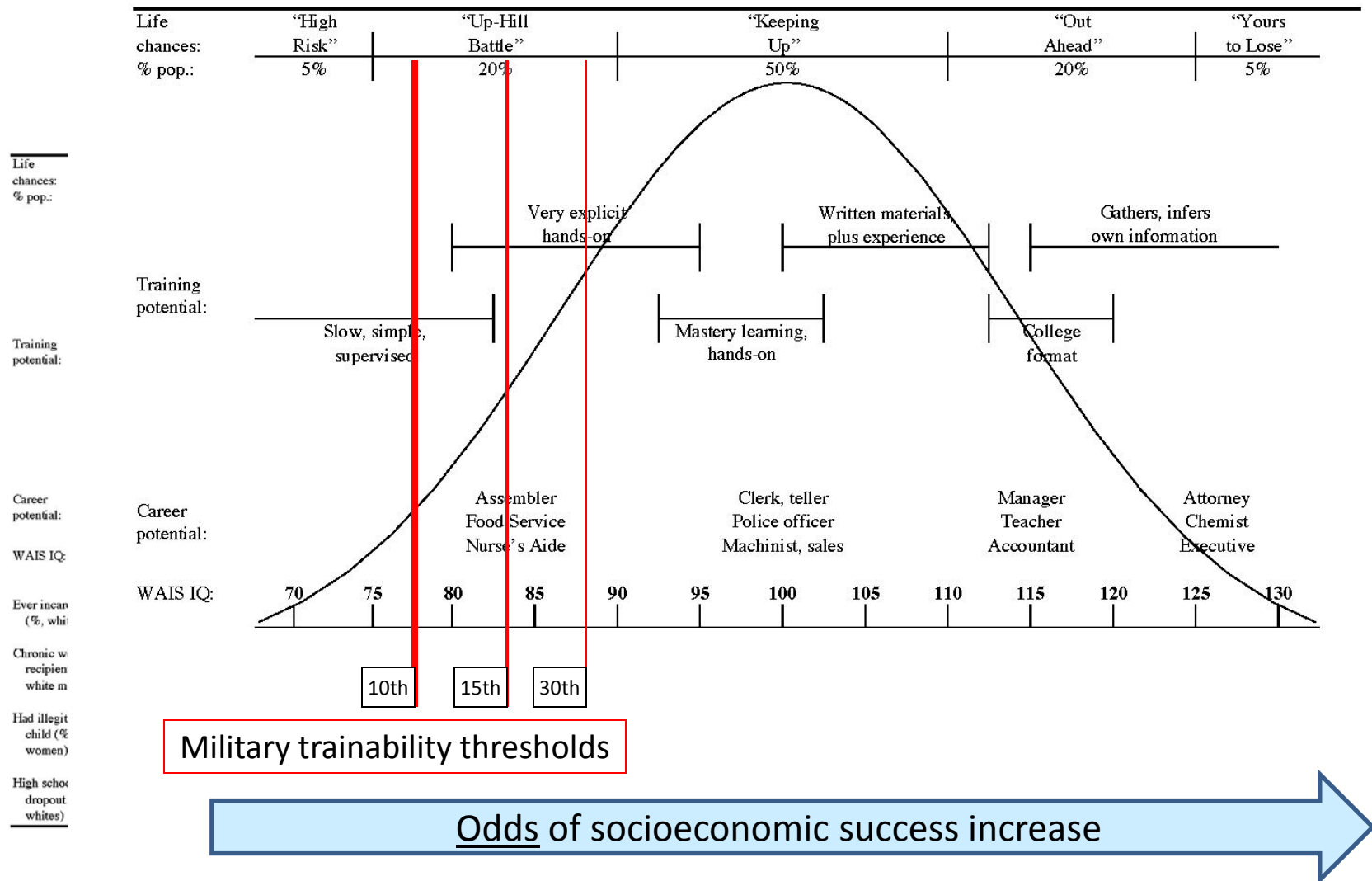
Literacy/IQ/ g is:



“Shhhh, Zog! ... Here come one now!”

- Ability to avoid cognitive error
- Not content specific

Typical life outcomes along the IQ continuum



“Reasoning & Judgment” factor

Job analysis 1 (Arvey, 1986)

Job requirements:

Correlation with factor

- | | |
|--|------------|
| ▪ <u>Learn</u> and recall relevant information | .75 |
| ▪ <u>Reason</u> and make judgments | .71 |
| ▪ Deal with <u>unexpected</u> situations | .69 |
| ▪ <u>Identify problem situations</u> <u>quickly</u> | .69 |
| ▪ React <u>swiftly</u> when <u>unexpected</u> problems occur | .67 |
| ▪ Apply common sense to <u>solve problems</u> | .66 |
| ▪ <u>Learn</u> new procedures <u>quickly</u> | .66 |
| ▪ Be alert & <u>quick</u> to <u>understand</u> things | .55 |

More results

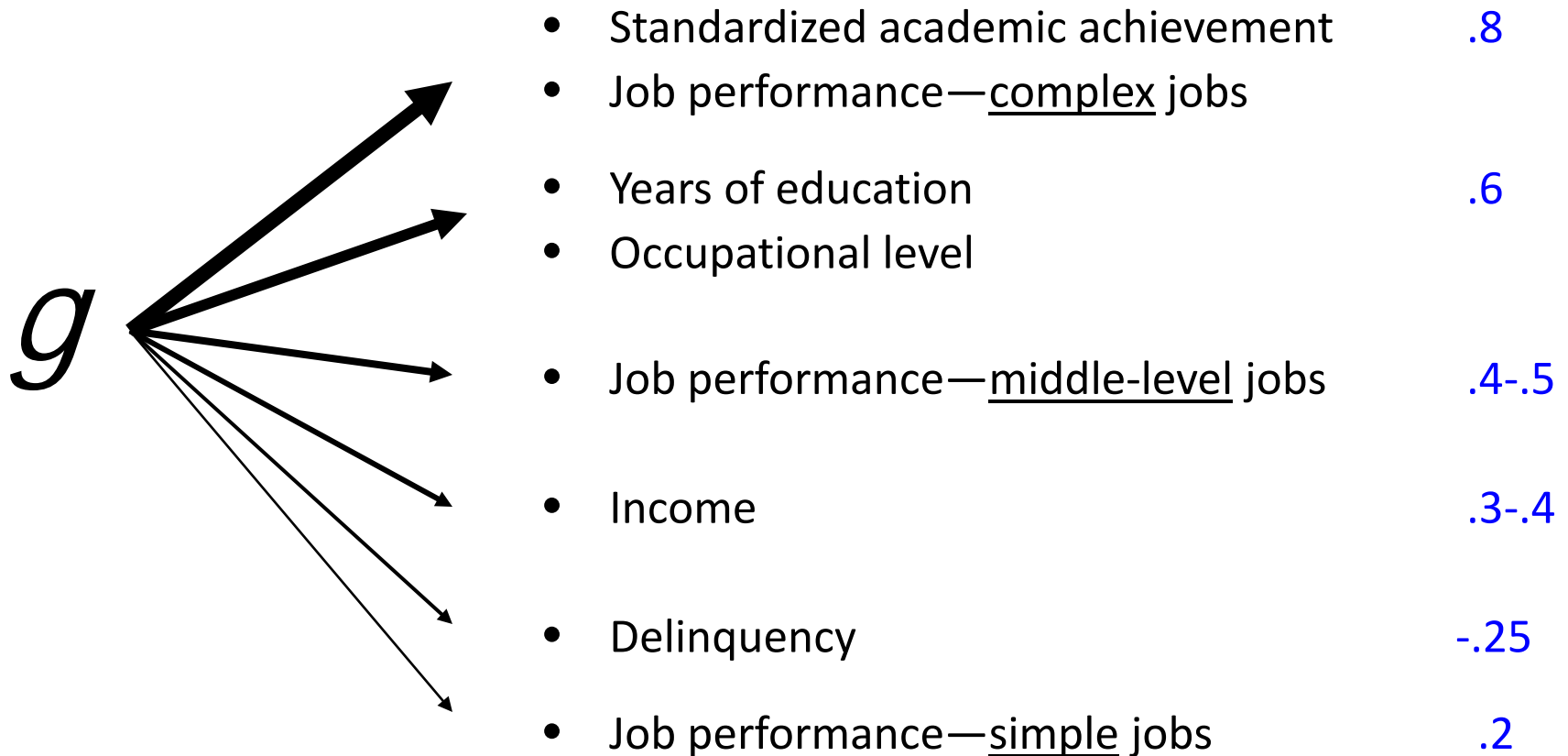
❖ Job attributes that correlate highly with job complexity:

Cognitive requirements	Working conditions	Task characteristics
Compile info	Ambiguity, change	Abstractness of info
Combine info	Uncertainty, unpredictability	Incomplete info
Transmit info in writing & orally	Distractions	Amount of irrelevant info
	Time pressure	Inferences required
Learn & recall relevant info	Lack of structure	Unclear means-ends
Reason, analyze	No set procedures	Multiple competing tasks
Make decisions	Little feedback	
Evaluate, judge	Lack of supervision	
Advise, persuade		
Plan, schedule, coordinate		
Update knowledge		
Spot problems quickly		
React quickly to unexpected problems		

Like life itself!

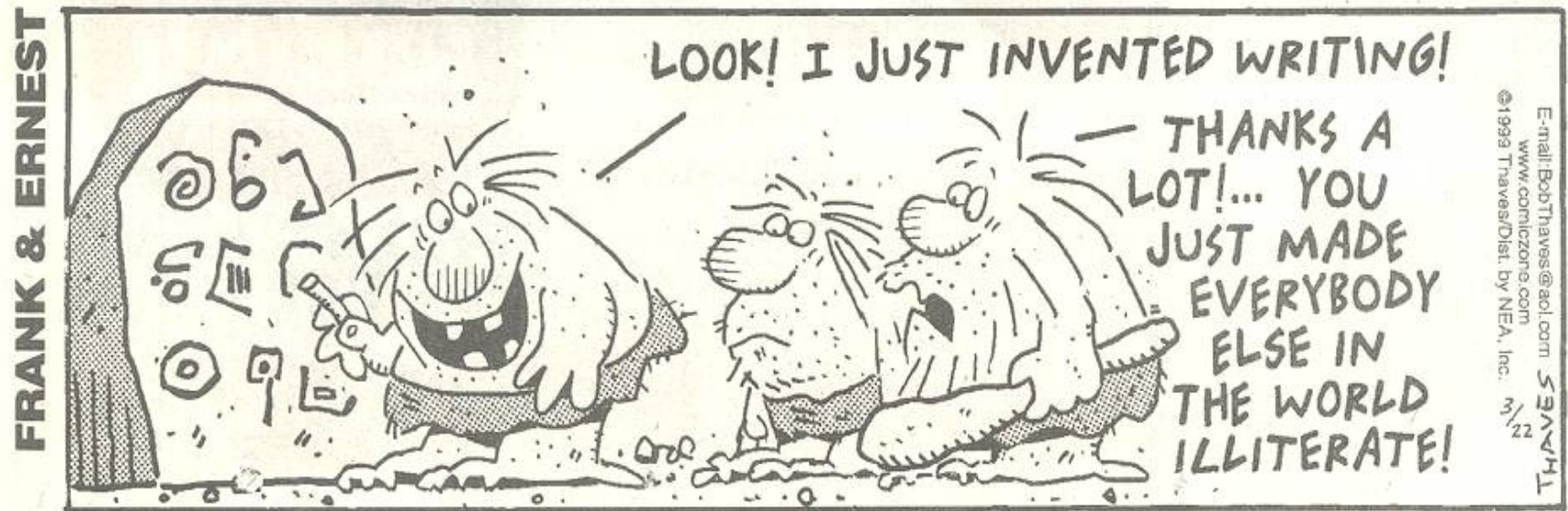
Practical value of g level differs by task complexity & life arena

correlation
with IQ

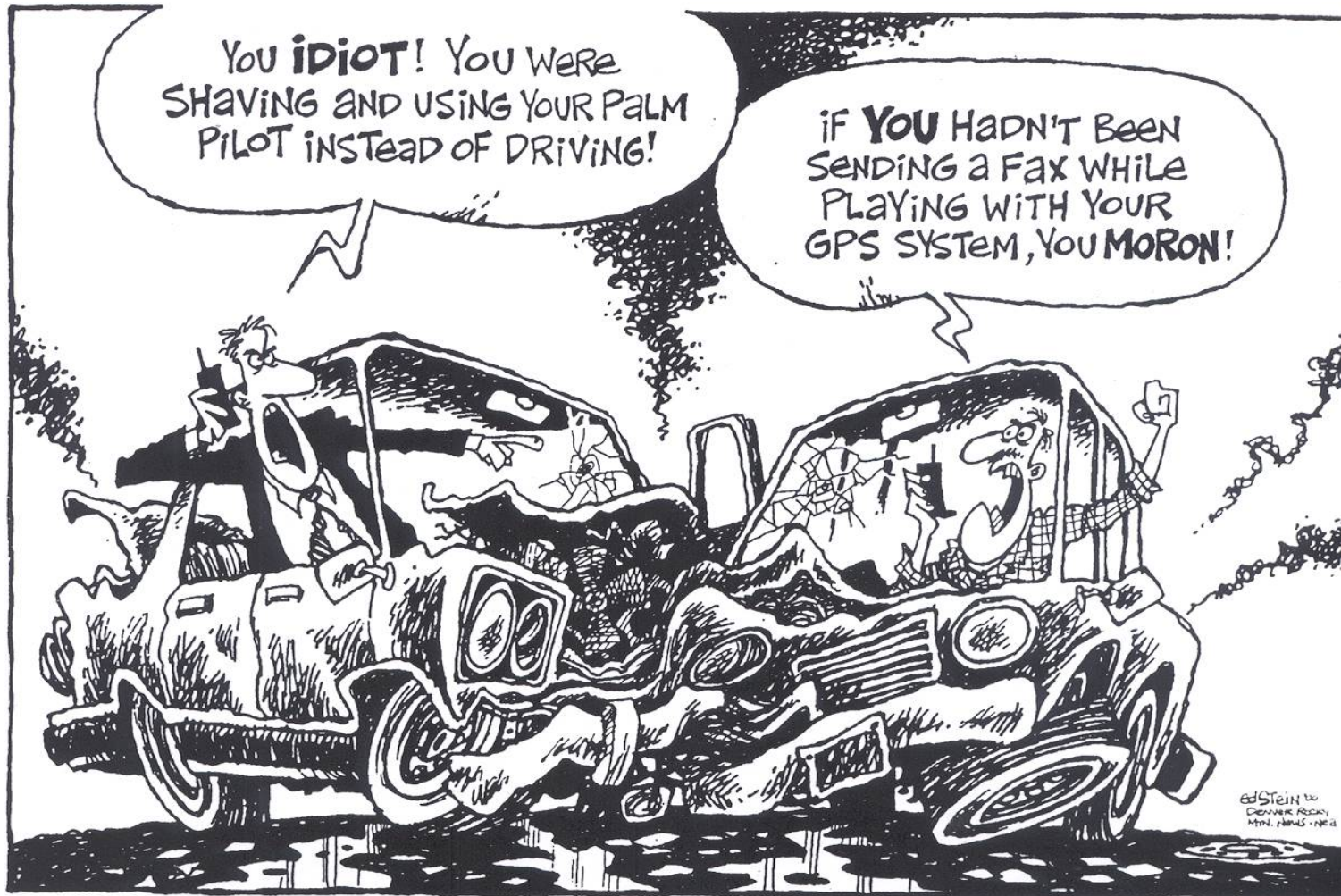


But all require some learning & reasoning

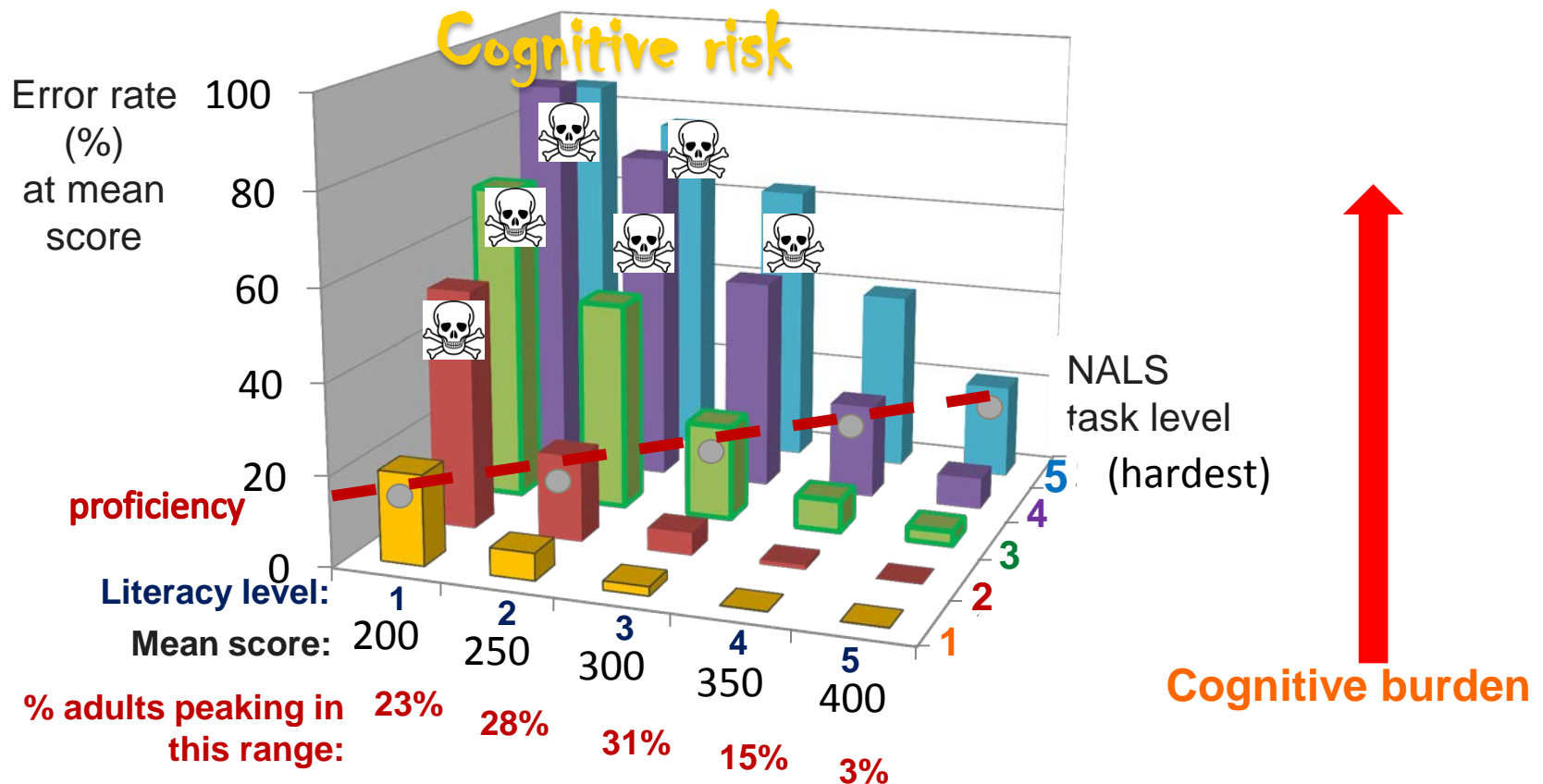
Innovation increases complexity



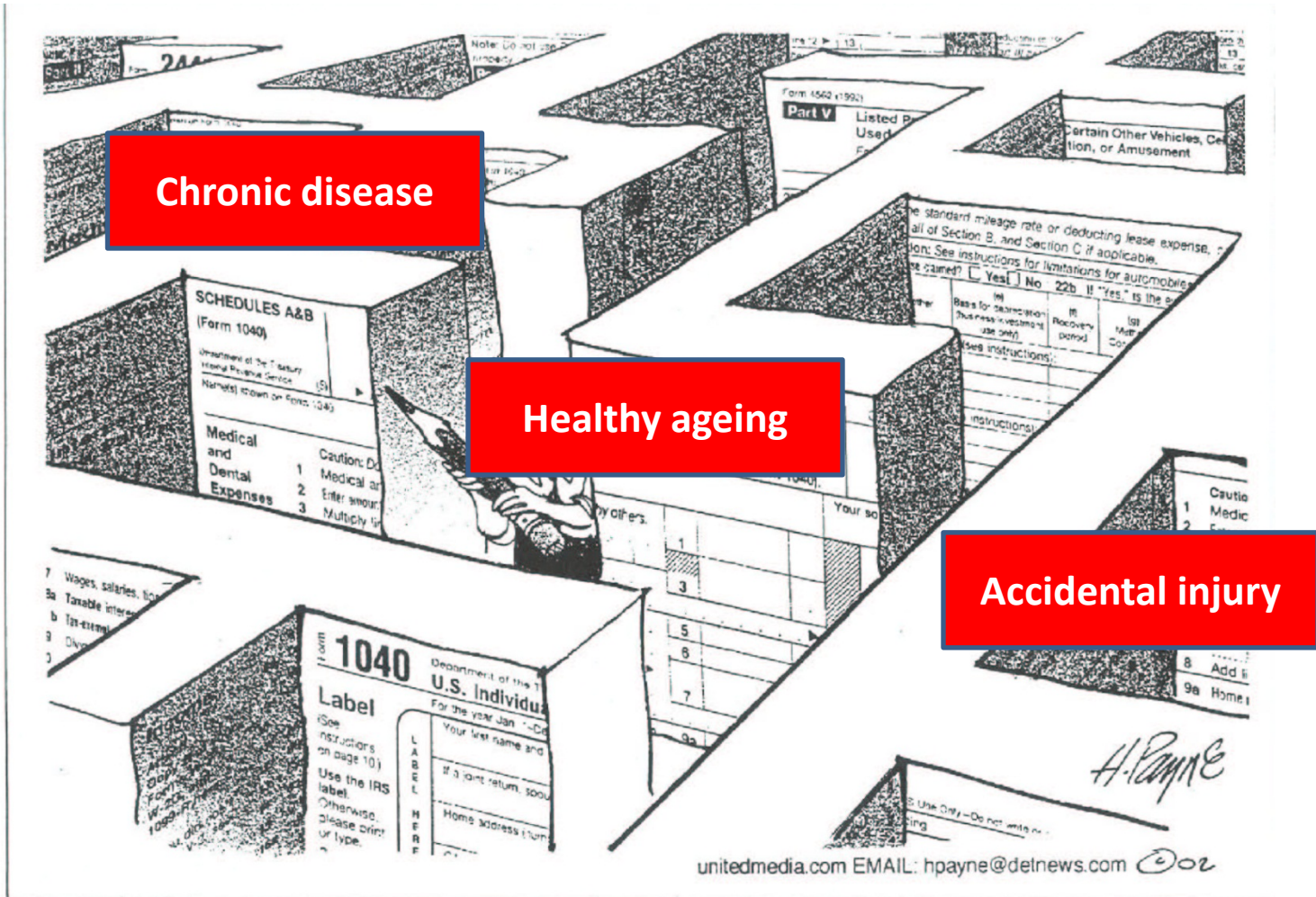
Hazards of innovation



Landscape of cognitive risk



So what?



Life Requires “Defensive Driving” to Prevent Accidents

Highly cognitive process

- Recognize hazards
- Prevent incidents starting
- Halt progress of incidents
- Limit damage during incidents
- Recover and redesign

Same process as with chronic illness.

% of civilian deaths

	USA (1986)				Ache (<1971)		
Age:	15-24	25-34	35-44	45-64	0-3	4-14	15-59
Illness	22	44	72	93	50	35	49
Accident	51	31	15	4	3	25	37
Suicide	13	12	7	2	0	0	0
Homicide	14	13	6	1	47	40	14

Drowning
Firearms
Vehicles
Lightning

Cut/pierced
Caught/crushed
Falling object
Machines

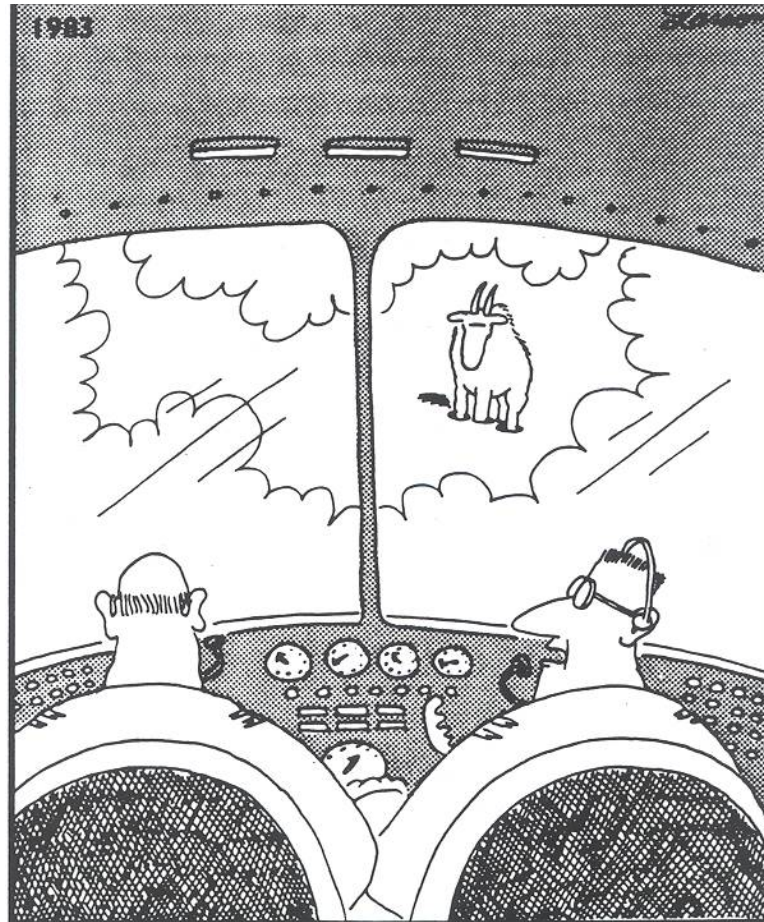
FIRE

Snake bite
Drowned
Lightning
Got lost

Snake bite
Falling object
Lightning
Jaguar

All preventable using "mind's eye"

Important for dealing with the unexpected



"Say ... what's a mountain goat doing way up here in a cloud bank?"

Chronic Illness Requires Foresight & Prevention

- Keep informed
- Live healthy lifestyle
- Get preventive checkups
- Detect signs and symptoms
- Seek timely, appropriate medical attention
- Adhere to treatment

“Health Self-Care Is As Important as
Medical Care”

US Surgeon General

**You are your own “primary
health care” provider”**

And it’s becoming a more complex job

State launches plan to stop rising rate of killer disease

About 15,000 in Del. don't know they're diabetic

By SEAN O'SULLIVAN
Staff reporter

Delaware health officials released a plan Tuesday they hope will help stop the rising rate of diabetes in the state by 2010, primarily through better education of adults and children, increased screening and by helping uninsured people treat the disease.

State officials estimate that 45,000 Delaware residents have diabetes, and that 15,000 of them do not know it because they have not been screened or diagnosed. Delaware has the fourth highest

diabetes death rate in the nation.

Diabetes is a disease that occurs when the body is not able to use sugar properly. Diabetes can cause adult blindness, kidney failure, heart disease and stroke, and require lower limb amputation. The ailment occurs more often in

women than men, more often in blacks than whites and more often among people older than 65. Those with a family history of diabetes also are at a greater risk, according to health officials.

The state's plan outlines a vari-



Registered nurse Bonnie Cunningham of Beebe Medical Center demonstrates the effect of high blood sugar on a person's veins.

Diabetes facts

Definition

Diabetes is a chronic disease that has no cure. Type 1 diabetes, in which the body does not produce any insulin, is most common in children and young adults. In Type 2, the body does not

Who is most at risk?

- People with high blood pressure — at or above 130/85.
- People in a family with a history of diabetes.
- Mothers who had diabetes during

Lots of self-instruction

tion and outreach in communities, schools and businesses, and expanded screening programs.

The plan's authors also hope by 2010 to provide coverage for diagnosis and treatment for 75 percent of people who have insurance or not enough to cover adequate care. The 54-page document is a follow-up to the "Burden of Diabetes," a report issued by the state in March documenting the extent of the diabetes problem in Delaware.

Lt. Gov. John Carney said Tuesday that the action plan should help Delaware qualify for \$800,000 in federal grants to implement

non-traumatic lower limb amputations — amputations not caused by accidents. Diabetics are as much as four times more likely to have heart disease and suffer strokes.

Symptoms

- Frequent urination
- Excessive thirst
- Extreme hunger
- Unusual weight loss
- Increased fatigue
- Irritability
- Blurry vision
- Frequent infections

If you have one or more symptoms, see your doctor.

What to do

- Everyone older than 45 should be tested every three years.
- Those who are younger, but at higher risk, should consult with their doctors about starting screenings sooner and more frequently.

For information/help

- Call (800) 342-2383
- Visit the American Diabetes Association Web site at www.diabetes.org.

Sources: American Diabetes Association and the Centers for Disease Control and Prevention

See DIABETES — B2

The diabetes patient's job description

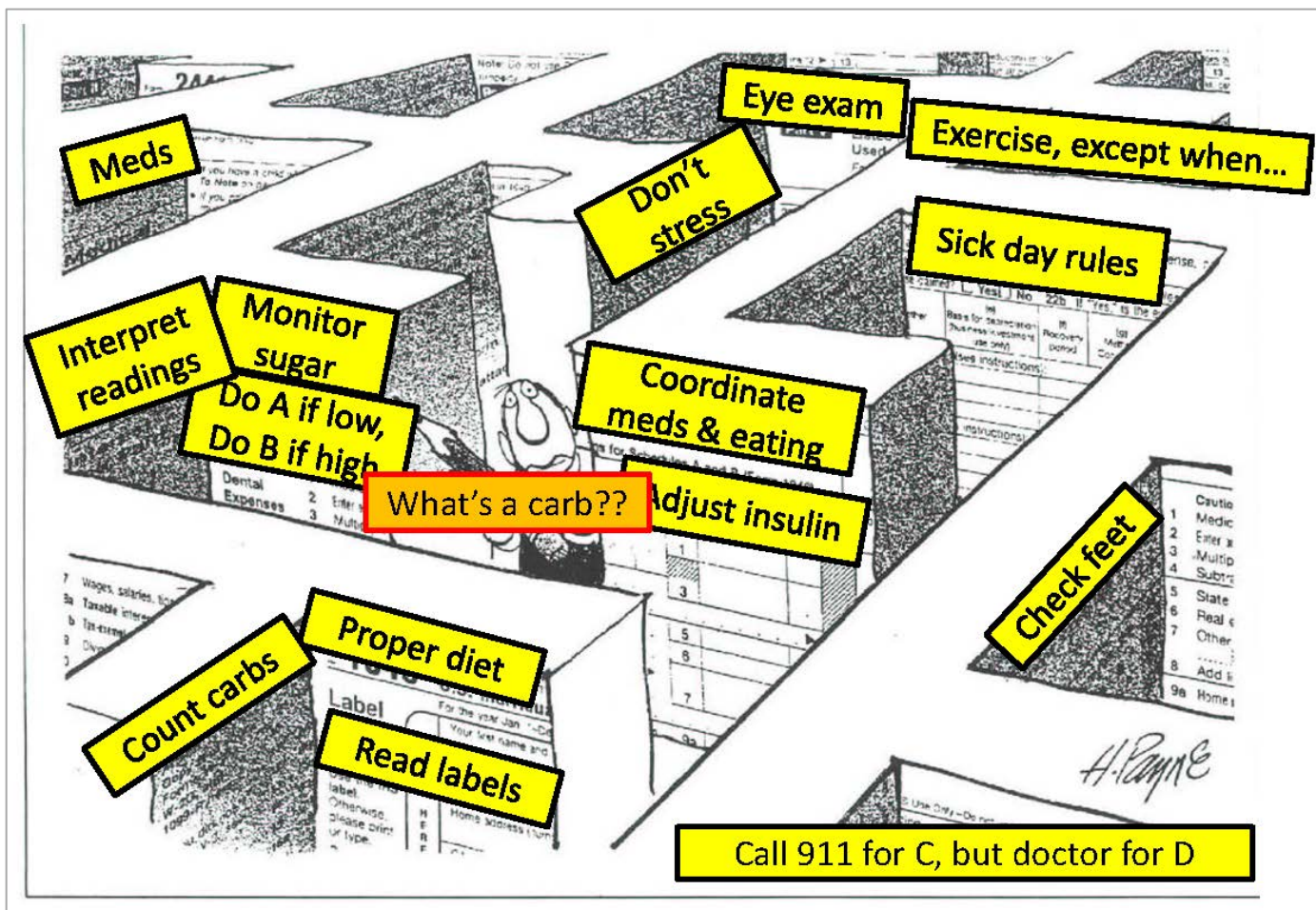
Objective: Keep blood glucose within safe limits

- **Learn about diabetes in general (At “entry”)**
 - Physiological process
 - Interdependence of diet, exercise, meds
 - Symptoms & corrective action
 - Consequences of poor control
- **Apply knowledge to own case (Daily, Hourly)**
 - Implement appropriate regimen
 - Continuously monitor physical signs
 - Diagnose problems in timely manner
 - Adjust food, exercise, meds in timely and appropriate manner
- **Coordinate with relevant parties (Frequently)**
 - Negotiate changes in activities with family, friends, job
 - Enlist/capitalize on social support
 - Communicate status and needs to practitioners
- **Update knowledge & adjust regimen (Occasionally)**
 - When other chronic conditions or disabilities develop
 - When new treatments are ordered
 - When life circumstances change
- **Conditions of work—24/7, no days off, no retirement**

Training

Self-management

Patient's everyday reality



Good glucose control requires good judgment

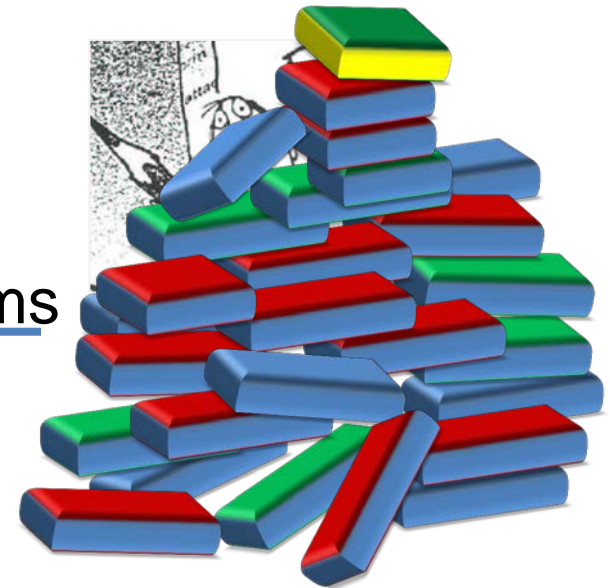
- ▶ **IT IS NOT** mechanically following a recipe
- ▶ **IT IS** keeping a complex metabolic system under control in often unpredictable circumstances (like accident prevention process)
 - ▶ Coordinate a regimen having multiple interacting elements
 - ▶ Adjust parts as needed to maintain good control of system buffeted by many other factors
 - ▶ Anticipate lag time between (in)action and system response
 - ▶ Monitor advance “hidden” indicators (blood glucose) to prevent system veering badly out of control
 - ▶ Decide appropriate type and timing of corrective action if system veering off-track
 - ▶ Monitor/control other shocks to system (infection, emotional stress)
 - ▶ Coordinate regimen with other daily activities
 - ▶ Plan ahead (meals, meds, etc.)
 - ▶ For the expected
 - ▶ For the unexpected and unpredictable
 - ▶ Prioritize conflicting demands on time and behavior

Preventing/managing chronic disease: Also a life-long “job”

Heavy cognitive burdens

that pile up

- Learn and recall relevant information
- Reason and make judgments
- Deal with unexpected situations
- Identify problem situations quickly
- React swiftly when unexpected problems occur
- Apply common sense to solve problems
- Learn new procedures quickly
- Be alert & quick to understand things



*Job analysis by Arvey (1986)

The health provider's reality

My blood sugar is 154 over 90.

I don't eat sugar any more. Just pasta.

Eye exam

Exercise, except when...

Don't

It's low fat, so it's healthy.

Interpret readings

Monitor sugar

Do A if low, Do B if high

I skipped lunch so I could have a big dinner.

What's a carb??

Adjust insulin

You mean I have to *measure* stuff?!

Check feet

Count carbs

Read labels

Never tested my sugar because I never figured out my meter.

Can I still eat donuts?

Factor for D

Patient fails to take control

Attention-diverting labeling



Macaroni and Cheese

Nutrition Facts

Serving Size 1 cup (228g)

Servings Per Container 2

Amount Per Serving

Calories 250

Calories from Fat 110

% Daily Value

Total Fat 12g 18%

Saturated Fat 3g 15%

Cholesterol 30mg 10%

Sodium 470mg 20%

Total Carbohydrate 31g 10%

Dietary Fiber 0g 0%

Sugars 5g

Protein 5g

Vitamin A 4%

Vitamin C 2%

Calcium 20%

Iron 4%

* Percent Daily Values are based on a 2,000 calorie diet.
Your Daily Values may be higher or lower depending on
your calorie needs:

		Calories:	2,000	2,500
Total Fat	Less than		65g	80g
Sat Fat	Less than		20g	25g
Cholesterol	Less than		300mg	350mg
Sodium	Less than		2,400mg	2,800mg
Total Carbohydrate			300g	375g
Dietary Fiber			25g	30g

Pros:

- Fewer items
- Single vertical list
- Major headings stand out

Cons:

- Lots of irrelevant info
- Seemingly inconsistent info

Macaroni and Cheese

Nutrition Facts

Serving Size 1 cup

Servings Per Container 2

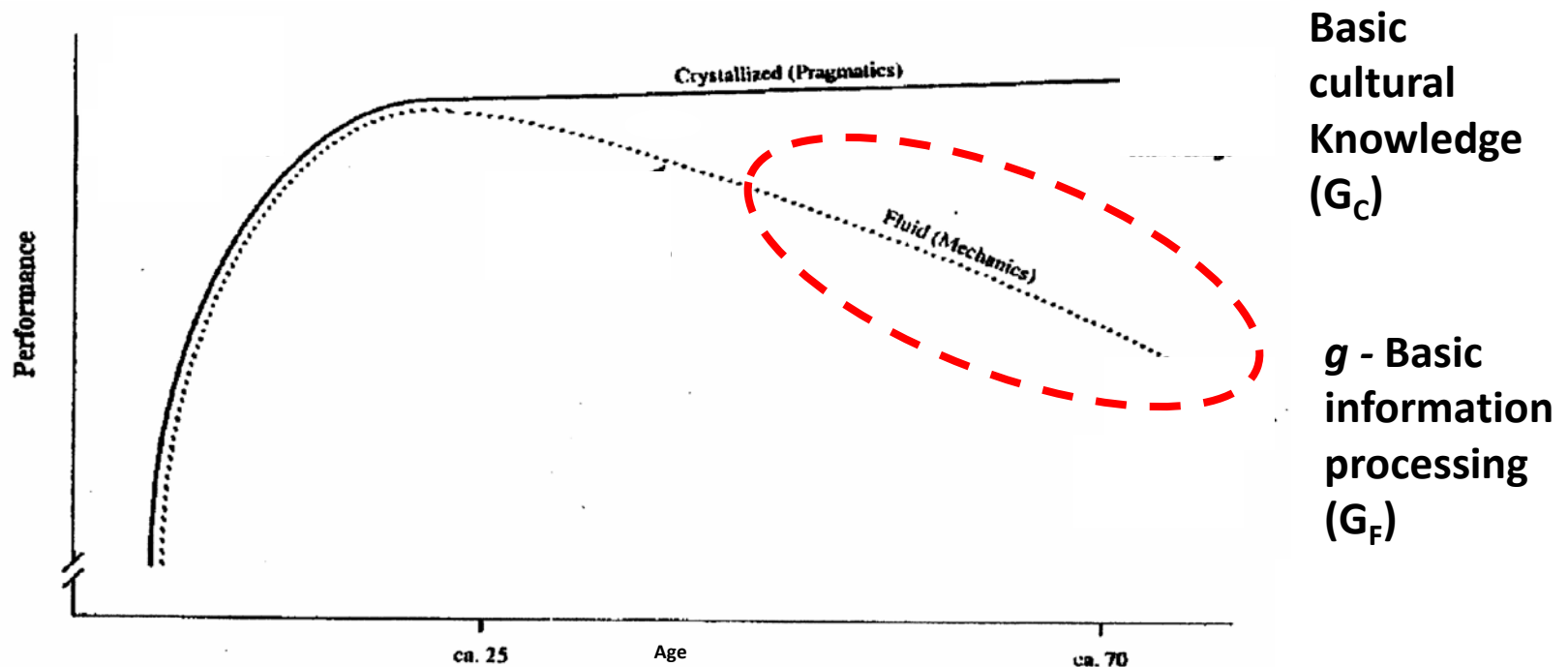
Amount Per Serving

		%
Total Carbohydrate	31g	
Dietary Fiber	0g	

Increasing Complexity Favors the Young

Raw mental horsepower (ability to learn and reason) rises into early adulthood, then falls

Average profile only



Score relative to age mates ("IQ") is stable from adolescence on

Complexity & Aging

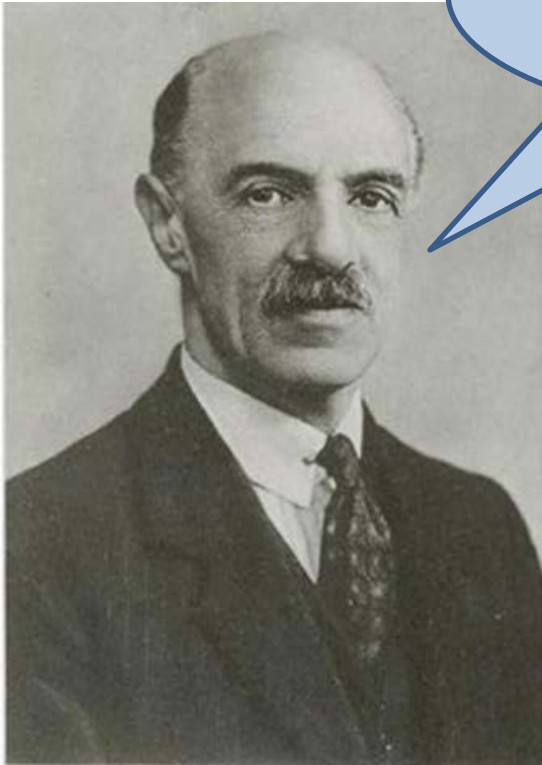


"Okay your father
managed to get a mouse.
Now how do we use it?"

Literacy levels require different cognitive support

NALS difficulty level (& scores)	% US adults peaking at this level	Simulated everyday tasks National Adult Literacy Survey (NALS), 1993	
5 (375-500)	3%	Minimal	line cost of carpet for a room to compare 2 credit cards
4 (325-375)	15%		to calculate SSI benefits en 2 types of employee
3 (275-325)	31%		n from mileage record chart ng error on credit card bill
2 (225-275)	28%	Moderate	price between 2 show tickets reet map
1 (0-225)	23%	Strong	n driver's license

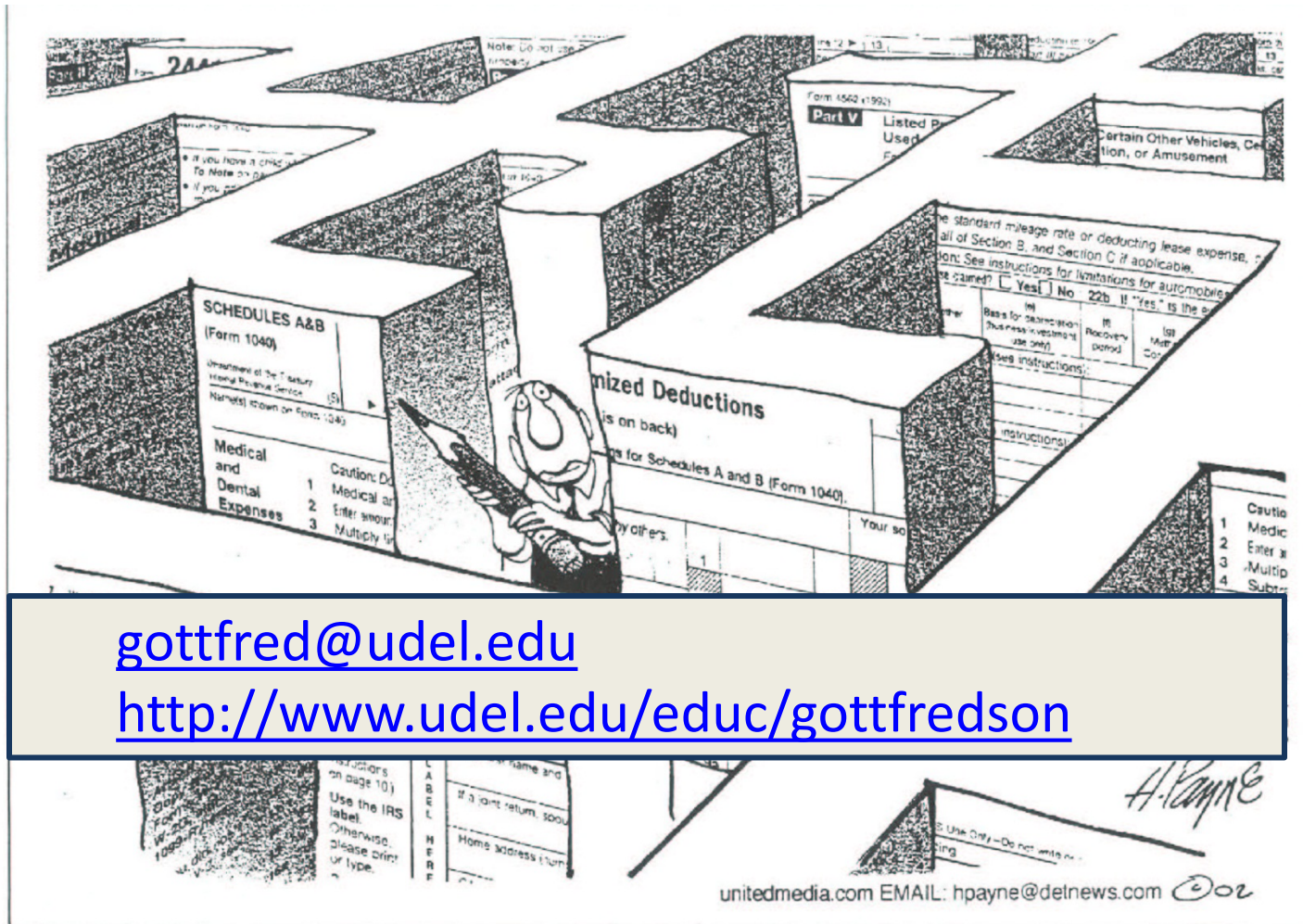
1. When cognitive budget is small,
spend it wisely.



High g loadings
are expensive.

2. Focus on critical tasks
3. Teach g -efficiently
4. Supply g support

Thank you.



gottfred@udel.edu

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