

WHEN TO STOP LEARNING: SEARCH AND SATISFICING DURING SELF-REGULATED LEARNING ACROSS THE LIFESPAN

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INTRODUCTION

Using an Information Foraging framework (Pirolli & Card, 1999), we examined how learners studying a domain in a multi-text environment regulate their effort among multiple sources. Specifically, the goal was to understand what cues learners use in decisions to discontinue reading about one topic to explore another in that domain. We examined whether people continue study as long as they perceive themselves to be learning and contrasted two hypotheses about cues to perceived learning: Mnemonic cues: Encoding fluency / processing ease (Dunlosky et al., 2006), which is a misleading cue (e.g., showing low correlations with learning outcomes).

• Extrinsic: Potential for information gain (profitability), such that learners leave a patch/webpage when the rate of available information decreases (Charnov, 1976, Fu & Pirolli, 2007; Metcalfe & Kornell, 2005).

We tested this by creating three types of reading ecologies that varied in the amount of new information (I) and conceptual overlap (CO) across texts within a patch:

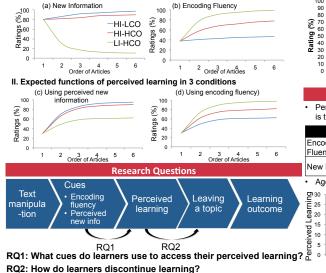
-HI-LCO: introduced more new ideas using new concepts (maximizing profitability)

-HI-HCO: introduced more new ideas using repeated concepts

-LI-HCO: introduced few new ideas using repeated concepts (maximizing fluency)

	Foraging	Learning		
Goal	Resources uptake	Knowledge building		
Determinants of uptake rates	Profitability of patch	Both texts and learners ability		
Resources	can be depleted.	cannot be depleted.		
Satiety mechanism/ stopping rules	Rate of gain, #prey, give up time	unclear		

I. Expected functions of perceived new info and encoding fluency in 3 conditions



Participants							Measure		Procedure		
	Study 1	Study 2	Study 3		Stud		Measuring Cognition: verbal (advanced vocabulary);	the study, your last situate much as you ny tesportant far y	EXERCICISES AND A STATE OF A STAT	al Transplants. There are lines note tuples, and your pacific to Transplants before 1 and you to resource contenses. It is not will note that the tuple tuple tuples are not professions.	
	N=52	N=37	N=38	N=17	Young N=17		speed (letter comparison)	olog the bearing p Sta, pile faces p if introdes to bear a mathing. If the of or abulan. In find finance are in refinity to find you	Name, you will seekd one kopic als a lime and ease a consistence of information along the one of the set and the contrast contrast product the head to be presented from the the sets of the topics are administrated and and the beginning you is inserted any set of the one administration of the contrast contrast of the beginning you is inserted any should make a more administration of the contrast of the beginning you is inserted any should make a more administration of the contrast of the beginning you is inserted any should make a more administration of the contrast of the contrast of the beginning you is inserted any should make a more administration of the contrast of the contrast of the beginning you is inserted any should make a more administration of the contrast of the contrast of the contrast of the contrast of the should be administration of the contrast of the contrast of the contrast of the should be administration of the contrast of the contrast of the contrast of the should be administration of the contrast of the contrast of the contrast of the should be administration of the contrast of the contrast of the contrast of the should be administration of the contrast of the contrast of the contrast of the should be administration of the should be administration of the contrast of the contrast of the should be administration of the should be administration of the contrast of the contrast of the should be administration of the should be administration of the contrast of the should be administration of the should be administration of the contrast of the should be administration of the should be administration of the should be administration of the should be administration of the should be administration of the should be administration of the should be administration of the should be administration of the should be administrating be administration	Learn as	
Age	38.9 (10.9)	38.1 (11.2)	37.5 (12.6)	40 (11.1)	21.5 (2.6)	71.6 (4.5)	Measuring Cues and Perceived Learning: - <u>Encoding fluency</u> : How easy was this article to read? (0:	ter maniferg mark an arrand. You will be a	bile wild in a lipit, you will in maked is with how many field bill with an origin of the set of th	much as you can under a	
Range	23-69	21-63	21-69	19-64	18-27		very difficult; 100: very easy) -The perceived amount of new information: <i>Including the</i>		Technolog the other activity that you have mail table, here much in	limit of time	
Female		59.5%	57.9%		76.5%		other articles that you have read today, how much new	Г		ANS: 14 Virules, 52 Seconds.	
Edu	15.3	15.6	15.4	15.3	15.0	16.2			Donation	nd Medical Transplants	
(yrs)	(1.9)	(1.9)	(2.5)	(2.1)	(1.4)	(2.4)	information was in this article?(0: no new information; 100:	B	one Graft	Blood Donation	
Verbal	8.0 (3.7)	9.3 (3.2)	9.9 (2.9)	10.2 (2.3)	8.9 (1.7)	10.6 (2.0)	completely new information) - <u>Perceived learning</u> : How much did you learn from this	S	emeal Transplants	Ţ	
Speed	10.4	41.6	39.5	38.6	34.7	48.4	particular article?(0: didn't learn anything at all; 100: learned a lot)		Direct densition is a precedure in which a person agrees	INE REALIST 14 Minutes, 39 Seconds. In have and deam as that if can be used to translations or separated into semponents to Advance adduced and advate and translation of european. Over the realistics of	
Speed	(10.3)	(10.7)	(10.2)	(10.2)	(7.2)	(10.0)	Measuring Performance: cued recall		obtaining blood from a donor, there are different types at seased from where the blood will be drawn is concluin of red blood cells as they fass through the needle. The bloo blood cells are hand an accurate machine to expanding it duri-	4 donations, the most common weigh is to belie blood from a vein as whole blood. The skin over the served, is is used to minimize the selvering floores that can objectively domage the of is exactly served in a flexible plantic long. Availant way is called adverses, in which the shades of the called served is a stude of the second served in the served in the second served second second served second sec	
	itment: S 5: Lab.	tudy 1 to 4	: Amazor	n Mechani	ical Tur	k;	Experimental Design Within-subject design			40 to control in non-statio, Hasting addit can usually down a prior of blood without bits 24 hours on allocat downloss, and the lost red blood calls within several weeks.	
• 3 topi	cs abou	t medical	transpl	ants and	donat	ion (54	Materials articles). • Only differ in #new concepts in one article ((a) glob	al	Go to OTHER TOPIC	Read NEXT ARTICLE	

3 topics about medical transplants and donation (54 articles). · Articles in 3 conditions did not differ in following properties. and (b) local conceptual overlap). HI-LCO HI-HCO LI-HCO (a) Global Conceptual Overlap

Number of words	220 (3.1)	220 (3.1)	220 (3.1)	م
Number of sentences	13.2 (0.4)	13.4 (0.4)	12.6 (0.4)	tion
Sentence length	16.9 (0.5)	16.7 (0.5)	17.8 (0.5)	Proportion
Log word frequency (WF)	2.9 (0.0)	2.9 (0.0)	2.9 (0.0)	5
Flesch-Kincaid grade level	10.1 (0.2)	10.2 (0.2)	9.5 (0.2)	
#unique concepts in one patch	172-190	100-106	56-80	

New Info Perceived Learning

-Encoding Fluency

75 80 85 90 95

Higher Verbal

Older -Higher Verbal

Younger - Higher Verbal

70 75 80 85 90 95 Encoding Fluency

-New Info

RQ1: Cues used to Gauge Perceived Learning

₅100

80

60

04 Q

ā 20

Verbal x Encoding Fluency on Perceived Learning

60 65 70

20 Eam

15 ceived

10

60

65

100 90

20

10

Reading Ease

Perceived new information

Est (SE) t

Lower Verbal

Younger - Lower Verbal

Mean Age - Lower Verbal

60 65 70 75 80 85 90 95 Encoding Fluency

7.31

69.31 Pel

is the dominant cue

(0.02)

(0.01)

0.82

Encoding 0.14

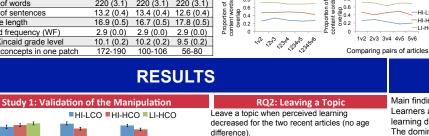
Fluency

New Info

Age x

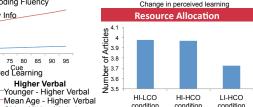
<u>ک</u>30

5



to leave a

0.9 0.8 0.7 0.6 Clikelihood t 0.3 0.1 0.1 0.1 0.1 0.1 0.1 HI-LCO -HI-HCO -LI-HCO 0 -5 -10-15-20-25-30-35-40-45-50-55-60-65-70-75



Study 5: Actual Learning Outcome Perceived learning was associated with the actual learning outcome of a topic. -Did not vary with condition and age

DISCUSSION

Main findings:

-HLI CO

-ні-нсо

LI-HCO

(b) Local Conceptual Overlap

Learners are likely to discontinue study as perceived learning decreases.

The dominant cue used to gauge perceived learning was the perceived amount of new information. However, encoding fluency was a relatively more important cue among older adults with lower levels of verbal ability. The study established a novel paradigm to better investigate adult learning in the wild, and suggests extensions of theories of foraging and metacognition to account for adult age differences in learning. · Consistent with the foraging metaphor, learners discontinue study when they reach "satiety" (cf. Murayama et al., 2015)

 Monitoring and patch-leaving rules based on perceived learning appear to be preserved with age. · However, cues to perceived learning are weighted differently depending on the age and abilities of the learner

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METHOD