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COGNITION

Cognition 81 (2001) B87–B96

www.elsevier.com/locate/cognit

Brief article

Wisdom and aging: irrational preferences in college students but not older adults

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Received 2 May 2000; received in revised form 6 December 2000; accepted 25 April 2001

Abstract

A decision-maker is "irregular" if she would choose B from {A, B, C} but not from {A, B} (for example, preferring vanilla ice cream in a choice between vanilla and chocolate, but chocolate in a choice among vanilla, chocolate and strawberry). Similarly to previous studies we observed irregular choices by college students faced with hypothetical discount cards for supermarkets. However, older adults showed no such tendency. The same pattern was observed in three separate studies. We interpret the results in terms of a choice strategy by older adults that protects them from excessive spending.

Keywords: Wisdom and aging; Irrational preferences; College students; Older adults

1. Introduction

Cognitive abilities show a complex pattern of decline after middle age. Changes include increased processing time in sensorimotor tasks (Rabbitt, 1996; Schneider & Pichora-Fuller, 2000), reduced working memory (Hultsch & Dixon, 1990; Zacks, Hasher, & Li, 2000), limited ability to divide attention (McDowd & Shaw, 2000; Ponds, Brouwer, & Van Wolffelaar, 1988), and longer encoding times for learning (Park, Smith, Lautenschlager, & Earles, 1996). Older subjects also appear less adept

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0010-0277/01/$ - see front matter
PII: S0010-0277(01)00137-8

at filtering irrelevant information from consciousness (Hasher, Zacks, & May, 2000; Zacks & Hasher, 1994). Since complex abilities often depend on rapid execution of fundamental skills, deterioration in judgment and reasoning can be expected with advancing age (Salthouse, 1996), especially if the frontal cortex is compromised (Parkin, Walter, & Hunkin, 1995; Raz, 2000; West, 1996). It may thus be noteworthy that precisely the reverse developmental pattern seems to be obtained for an elementary decision error known as "irregular preference". In what follows we explain the nature of the error, describe our experimental results with younger and older reasoners, and then discuss a potential explanation for the seniors' superiority.

Suppose that you are disposed to choose Corn Flakes over Wheaties when your breakfast options are limited to just these products. Then your preferences lack consistency if you are also disposed to choose Wheaties over Corn Flakes and Cheerios when the latter product is added to the options. A decision-maker free of such conflict is called "regular", and otherwise "irregular". Regularity is widely assumed to be a necessary condition on rational preference. (See, for example, Sen (1971) where regularity is called "Property alpha".)

The regularity principle is applicable only if adding the third product (like Cheerios) does not provide new information about the original options. Thus, the switch from Corn Flakes to Wheaties cannot be faulted if the introduction of Cheerios provides evidence of a nutritional defect in Corn Flakes. The stimuli used in previous studies of irregularity (like those figuring in the experiments reported below) appear to allow a valid test of regularity because the presence of option C in these studies communicates no relevant information about A or B.

Irregular choice has been demonstrated in university students using both hypothetical and concrete options (Huber, Payne, & Puto, 1982; Simonson & Tversky, 1992). In these studies, one randomly assigned group of students chose between options A, B, and another among A, B, C. The stimuli were constructed so that C was an unattractive choice, but more easily compared to B than to A. For example, in one demonstration (Simonson & Tversky, 1992) A, B, C corresponded respectively to six dollars in cash, an elegant pen, and a not-so-elegant pen. In these circumstances, the proportion of people choosing B was significantly greater in the three-alternative group than in the two-alternative group, implying a violation of regularity on the part of many participants.

In the three studies reported below, we replicate the finding of irregular choice by college students, but document virtually perfect regularity in the choices of older adults.

2. Stimuli

All our experiments rely on options like those appearing in the questionnaire of Fig. 1. The theme of the questionnaire – namely, supermarket discounts varying in price reduction and required minimum purchase – was designed to be of interest to both college students and older adults. Observe that there are no hidden features in

	Discount offered	Minimum purchase required	I would choose:
Card A	15%	$20	
Card B	25%	$45	
Card C	26%	$100	

Fig. 1. The questionnaire administered to the ABC group in Study 1.

these options. The discount and minimum purchase levels are all there is to know about the discount cards (unlike the situation in which one must choose among complex commodities like automobiles). Whether C is present or absent, card B (for example) offers a discount of 25% with a minimum purchase of $45. For this reason, it seems unlikely that the presence of C provides much information about A or B when all three options are available. Pilot studies confirmed that students do not believe that their preferences between A and B are influenced by the presence of C. This suggests that they don't perceive C to hold much information about the other options. The students are nonetheless mistaken about the influence of C on their preferences, as revealed by the data reported below. Such influence leads them to irregular preference.

3. Choices made by college students versus older adults

3.1. Study 1

A sample of 299 college students was randomly divided into two groups, to be designated the AB and the ABC groups in what follows. Thirty percent were male and the average age was 18.8 years (SD 1.19). The students were recruited from classes at Duke University and the University of Arizona. One hundred forty-five students fell into the AB group, and 154 fell into the ABC group.

A sample of 189 senior citizens was also randomly divided into AB and ABC groups. They ranged in age from 58 to 79 years with a mean of 69.0 years (SD 4.21). Thirty-nine percent were male. The senior citizens were recruited from the Durham, NC and Tucson, AZ areas. Ninety-six senior citizens fell into the AB group, and 93 fell into the ABC group. All were drawn from a larger pool of healthy well-educated

adults. Participants at both age levels were given nominal payment for their participation.

All subjects in the ABC group responded to the questionnaire shown in Fig. 1; the AB group responded to the same questionnaire except that reference to option C was removed. Aside from requesting each person's date of birth, sex, and occupation (present or last), no further questions were posed. The choices of the younger and older groups are summarized in Table 1 (including the number of subjects opting for C).

It can be seen that a greater proportion of the students opted for B when C was offered compared to when C was absent. Indeed, a minority of 46% chose B in the AB group whereas a majority of 62% chose it in the ABC group. This reversal is statistically significant ($\chi^2 = 7.86$, d.f. $= 1$, $P = 0.005$). No such tendency towards irregularity is observed for the older adults inasmuch as their choice of B is lower when C is present than when it is absent (40 versus 44%). Thus, the younger but not the older subjects give evidence for irregular choice. A sharper comparison of the difference between the two ages is achieved via the Breslow–Day statistic, which tests the hypothesis that the ratio of B-choosers in the two groups is the same across ages (see Agresti, 1996). Applied to the data in Table 1, the statistic points to a reliable difference in the two ratios ($\chi^2 = 4.73$, d.f. $= 1$, $P = 0.03$). Note that the difference is not due to the rate of C choice in the ABC groups since subjects in both ages chose C roughly 9% of the time when available (see Table 1).

3.2. Study 2

We carried out a new version of Study 1 using Italian college students encountered on university campuses, and senior citizens recruited within associations and clubs in the Milan metropolitan area. (Note that intergenerational differences in education are in general more pronounced in Italy compared to the United States. Few older Italians have been to college.)

Our sample of 250 college students was divided evenly (and randomly) into AB and ABC groups. The students ranged in age from 19 to 31 years with a mean of 22.3 years (SD 2.36). Thirty-seven percent were males. A sample of 120 senior citizens was randomly divided into an AB group of size 62 and an ABC group of size 58. The older participants ranged in age from 65 to 88 years with a mean of 72.9 years (SD 4.74). Thirty-nine percent were male.

Table 1
Choices of students and older adults in the groups AB and ABC of Study 1[a]

Group	Students (%)		Older adults (%)	
	Chose B	Did not choose B	Chose B	Did not choose B
AB	66 (46)	79 (54)	42 (44)	54 (56)
ABC	95 (62)	59 (38)	37 (40)	56 (60)

[a] Thirteen students in the ABC group (8.4%) chose C. Nine older adults in the ABC group (9.7%) chose C.

Stimuli used in Study 2

Card	Discount	Minimum purchase
A	20%	25,000 Lire
B	38%	80,000 Lire
C	40%	200,000 Lire

Stimuli used in Study 3

Card	Discount	Minimum purchase
A	20%	15,000 Lire
B	33%	45,000 Lire
C	34%	120,000 Lire

Fig. 2. Stimuli used in Studies 2 and 3.

An Italian version of the questionnaire from Study 1 was prepared using the discounts and minimum purchases displayed in the top half of Fig. 2. (Note that that 1 US dollar equals approximately 2000 Italian Lire.) Results are shown in Table 2.

Similarly to Study 1, B was more attractive to the students when C was offered than otherwise. Indeed, 33% chose B in the AB group whereas just more than half chose it in the ABC group. The reversal is significant ($\chi^2 = 7.97$, d.f. $= 1$, $P = 0.005$). The older adults showed no such tendency: a smaller proportion chose B when C was offered than otherwise (26% compared to 35% in groups ABC and AB, respectively). The Breslow–Day statistic rejects the hypothesis of equality between the two ages in the ratio of B-choosers among AB and ABC groups ($\chi^2 = 6.27$, d.f. $= 1, P = 0.012$). Thus, just as for Study 1, the present results suggest violation of the regularity principle among college students but not among senior citizens.

3.3. Study 3

We replicated Study 2 with a new sample of Italian subjects, using different

Table 2
Choices of students and older adults in the groups AB and ABC of Study 2[a]

Group	Students (%)		Older adults (%)	
	Chose B	Did not choose B	Chose B	Did not choose B
AB	41 (33)	84 (67)	22 (35)	40 (65)
ABC	63 (50)	62 (50)	15 (26)	43 (74)

[a] Eleven students in the ABC group (8.8%) chose C. Six older adults in the ABC group (10.3%) chose C.

discounts and minimum purchases (for a test of generality). Two hundred twenty-eight college students and 121 senior citizens were recruited as before (none participated in the earlier study). The students ranged in age from 19 to 30 years with a mean of 22.2 years (SD 2.09). Thirty-four percent were males. The senior citizens ranged in age from 65 to 91 years with a mean of 74.4 years (SD 6.48). Nineteen percent were males. One hundred and eighteen students were randomly assigned to group AB, leaving 110 for group ABC. For the older sample, 61 senior citizens were randomly assigned to AB, and 60 were assigned to ABC. The bottom of Fig. 2 displays the discounts and minimum purchases used. Results are shown in Table 3.

Once again, the students showed more interest in option B when C was also present. The percentage of B-choosers increased from 44% in the AB group to 61% in the ABC group, which is a significant difference ($\chi^2 = 6.47$, d.f. $= 1$, $P = 0.011$). The older adults' choices were essentially stable, 36% of the AB group choosing B, compared to 38% of the ABC group. The Breslow–Day test applied to this contrast does not reach significance ($\chi^2 = 1.60$, d.f. $= 1$, $P = 0.206$). Overall, the results confirm the pattern seen earlier, namely evidence for irregular choice by the younger subjects but not by the older.

3.4. Gender across the three studies

The age differences documented above cannot be attributed to differences in the gender composition of the two samples. In each of the three studies, the proportion of males was similar between ages (as reported above). Overall, 32% of the students were male compared to 31% of the older adults. Combining the data from all three studies and segregating by gender yields the results shown in Table 4. For younger males, the increased preference for B between the AB and ABC groups is significant by a χ^2-test ($P = 0.014$) whereas there is no such increase for the older males. The Breslow–Day statistic rejects the hypothesis of equality in the ratio of B-choosers among the AB and ABC groups with $\chi^2 = 7.971$, d.f. $= 1$, $P = 0.005$. Similarly, for younger females the shift in preference is significant by χ^2 ($P = 0.001$), but insignificant for older females ($P = 0.633$), and the Breslow–Day test yields $\chi^2 = 3.834$, d.f. $= 1$, $P = 0.05$.

We also note that there was no systematic evidence in our data for a difference in the choice behavior of older subjects above and below 75 years of age.

Table 3
Choices of students and older adults in the groups AB and ABC of Study 3[a]

Group	Students (%)		Older adults (%)	
	Chose B	Did not choose B	Chose B	Did not choose B
AB	52 (44)	66 (56)	22 (36)	39 (64)
ABC	67 (61)	43 (39)	23 (38)	37 (62)

[a] Eleven students in the ABC group (10.0%) chose C. Two older adults in the ABC group (3.3%) chose C.

Table 4
Choices of students and older adults segregated by gender in the groups AB and ABC combining the data from all three studies

Group	Students (%)		Older adults (%)	
	Chose B	Did not choose B	Chose B	Did not choose B
Males				
AB	59 (47)	66 (53)	40 (51)	38 (49)
ABC	79 (63)	47 (37)	20 (36)	35 (64)
Females				
AB	100 (38)	163 (62)	46 (33)	95 (67)
ABC	146 (56)	117 (44)	55 (35)	101 (65)

4. Why do seniors exhibit more regular choice?

The findings cannot be explained in terms of age-related differences in the attractiveness of discounts or the unattractiveness of minimum purchases. This is because the two age groups were remarkably similar in their preferences when just A and B were offered (see Tables 1–3). Combining over all three studies, the percentage of B-choosers among students in the AB groups is 41.0%, and 39.3% for the older subjects. This near-equality is to be contrasted with the percentages of B-choosers in the ABC groups, summing across the three studies. For students, the percentage rises to 57.8% whereas it drops to 35.5% for older subjects.

An alternative explanation for our findings portrays older adults as less able than students to integrate the attractions and repulsions arising from distinct dimensions of an option (in our case, the discount and minimum price associated with each card). Each older chooser would have a tendency to seize on just one aspect of the choice, ignoring the other. (See Johnson (1990) for evidence of non-compensatory rules in another decision context.) However, the one-dimension-only hypothesis is not consistent with the fact that 39.3% of the older subjects chose B in the AB groups – thereby manifesting a putative focus on discount – yet only 8.1% selected C in the ABC groups even though C is the most attractive option from the point of view of discount.

Yet another interpretation of the data acknowledges that everyday experience in the marketplace teaches a person to beware of contextual effects in judging the value of merchandise. Older adults would benefit from greater experience and thus manifest more regular choice. This interpretation is consistent with the finding that familiarity with a product category can reduce irregular decision-making (Coupey, Irwin, & Payne, 1998; Wedell & Bockenholt, 1990). The marketplace expertise available to senior citizens might therefore offer a buffer against decline in inhibitory control, allowing option C to be set aside durably when faced with A, B, C. Buffering of this kind has been reported in the inhibitory control literature (Li, Hasher, Jonas, Rahhal, & May, 1998).

Experience in the marketplace might also impart caution about impulsive

purchases. Selecting a discount card with a minimum purchase superior to one's normal supermarket budget is an invitation to excessive spending. So it makes sense to set aside any card whose minimum exceeds one's budget, and to choose among those remaining. Call this the "prudent" strategy.

To assess the prevalence of the prudent strategy among students and seniors, we recruited two new groups of Italian subjects (none participated in earlier studies). Each was asked to estimate their supermarket expenditure per visit, and either to choose a card from the AB set or from the ABC set used in Experiment 3 (see Fig. 2). The order of the expenditure and choice questions was counterbalanced. There were 40 students (mean age 21.5 years, SD 2.39), and 40 seniors (mean age 73.9 years, SD 5.64). At each age, half the subjects were randomly assigned to the AB group, and half to the ABC group.

The two ages revealed similar grocery budgets. The median budget for seniors was 35 000 liras per visit. For students, the median was 32 500. As before, students but not seniors gave evidence of irregular choice. Students in the AB group chose B seven times out of 20 compared to 11 times out of 20 in the ABC group (along with one choice of C). Seniors showed the reverse pattern, choosing B from AB 11 times compared to seven times in the ABC group (and one choice of C). More to the present point, 11 of the 40 students chose a card with a minimum purchase requirement exceeding their per-visit grocery expenditure whereas this pattern occurred only three times among the seniors. The difference is reliable ($z = 2.36$, $P = 0.02$), suggesting greater use of the prudent strategy on the part of seniors compared to students.

An additional study provides further support for the hypothesis that older adults focus on the desire to avoid excessive spending. A sample of 87 senior citizens in Milan was confronted with the choices shown in the top half of Table 5, and another sample of 103 faced the choices at the bottom. (Both samples were separate from the other studies.) In these choices, the discount associated with option B is exceptionally high, yet had little impact on choice. Compared to Studies 1–3, roughly the same proportion of older subjects in both groups chose option A, suggesting that many of them were insensitive to B's discount because of its substantial minimum purchase. As a control, we asked yet another group of 85 older adults to choose between cards in which the minimum purchase for the B option was made very

Table 5
Choices of 87 older adults faced with 20%, 15 000 versus 60%, 45 000 and 103 older adults faced with 20%, 15 000 versus 75%, 45 000[a]

Card	Discount (%)	Minimum purchase (Lire)	No. choosing (%)
A	20	15 000	46 (53)
B	60	45 000	41 (47)
A	20	15 000	55 (53)
B	75	45 000	48 (47)

[a] Only the discount for B distinguishes these options from those of Study 3 (see Fig. 2). The identical percentage choices in the two manipulations is coincidental.

Table 6
Choices of 85 older adults faced with 20%, 15 000 versus 33%, 150 000

Card	Discount (%)	Minimum purchase (Lire)	No. choosing (%)
A	20	15 000	67 (79)
B	33	150 000	18 (21)

unattractive. The results are shown in Table 6. In this condition a larger majority than usual chose card A, confirming the impression that minimum purchase is a potent determinant of choice among older adults.

5. Discussion

Our results indicate a greater respect for the regularity principle among older choosers compared to younger. Indeed, there was virtually no sign of irregular choice by seniors in any of the experiments whereas the students' choices violate regularity in all the studies. At least superficially, seniors thus showed more judgmental wisdom than students, a developmental difference that has not been easy to document in other problem-solving contexts (Baltes & Staudinger, 1993; Baltes, Staudinger, Maercker, & Smith, 1995).

One potential explanation for the seniors' superiority is their greater attraction to the prudent strategy of ruling out cards whose minimum purchase requirement exceeds typical expenditure at the grocery store. Our test of this hypothesis is far from complete. But if correct, it illustrates the compatibility of information-processing decline with increased adaptation to the challenges of daily life. In Staudinger and Pasupathi (2000), such compatibility is expressed in terms of cognitive "mechanics" versus "pragmatics", and applied to several dimensions of the aging process.

However, our findings are best interpreted, they suggest one sense in which age-related differences in cognition are favorable to older people. The choices of senior citizens appear to satisfy an elementary axiom of rational decision whereas the choices of many college students probably do not.

Acknowledgements

This research was supported in part by the National Institute on Aging, grant R37 4306.

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