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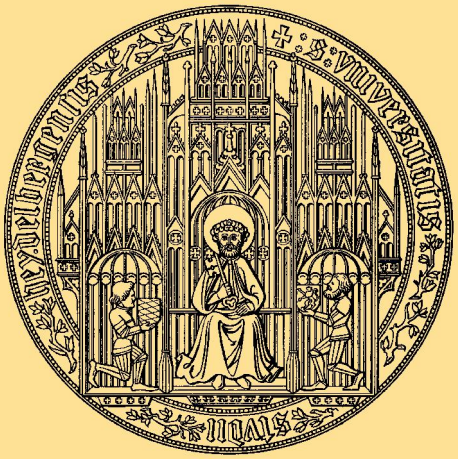

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Age differences in the reaction to incentives – do older people avoid competition?

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Abstract

The "aging employee" has recently become a hot topic in many fields of behavioural research. With the aim to determine the effects of different incentive schemes (competition, social or increased monetary incentives) on performance of young and older subjects, we look at behaviour of a group of younger and older adults on a well-established real effort task. We show that older adults differ from younger adults in their performance in all conditions, but not in the improvement between conditions. The age difference in performance is however driven by women. While we replicate the gender difference in competitiveness found in the literature, we do not find a significant age difference in competitiveness. Social incentives have an at least as strong or even stronger effect on performance than increased monetary incentives. This effect is driven by men; women do not show an increase in performance with social incentives.

JEL classifications: C72, C91, J10, J33

Keywords: aging, competition, social production functions, experiment, incentives

Introduction

"The aging society" has recently become the focus of attention both of popular media and of scientific research. Psychologists, cognitive (neuro-)scientists and empirical economists, among others, study how age affects decision making and outcomes of decision making in many domains of life (Schonberg et al., 2011).

The few experimental studies that so far have looked at age effects on economic decision making have compared age groups without testing specific hypotheses based on psychological knowledge about life span changes. In these studies, few differences have been found (e.g. Kovalchik et al., 2005; Charness and Villeval, 2007). Research in cognitive psychology however has shown the existence of age differences in decision making: some studies find that older people are more risk averse than younger people, while others do not confirm this result (Carstensen and Hartel, 2006; Mata et al., 2011). In our own research (Sproten et al., mimeo), we show that older adults do not differentiate in the propensity to gamble under risk or ambiguity, whereas young adults do. It also has been shown that older adults follow different goals than younger individuals in decision making and are more motivated to keep a positive affective state (e.g. Carstensen et al, 1999; Mather, 2006).

In many western countries, there is presently a debate on increasing the retirement age to balance the accounts of pension systems. In France, the retirement age will be increased stepwise from currently 60 years to 62 years in 2018; in Germany, it has recently been raised to 67 years. In the light of this, one especially important aspect is whether older subjects in a work setting can be incentivized with the same incentives as young subjects. We take a first step towards an answer using controlled experiments. We base our research on a well-established experimental design and extend it beyond different monetary incentives to social incentives.

There are various theories in the field of cognitive psychology that explain why the reaction to different types of incentives should change over the life-span. We base our experiment on one of the most comprehensive theories, called social production functions-successful ageing theory or *SPF-SA* (Steverink & Lindenberg, 2006; Steverink et al., 1998). The SPF is a theory of motivation of behaviour that implies a hierarchy of universal needs, instrumental goals and resources. For reasons of simplicity we will focus here mainly on the universal needs dimension and refer the interested reader to Steverink's article on the topic. Needs are in this theory understood as a restricted set of basic physical and social needs that must be at least minimally fulfilled to achieve wellbeing. Needs are universal, inherent, and relevant to people of all ages. Goals and resources are the instruments by which needs can be fulfilled. People are inclined to maintain and improve levels of need satisfaction. There are three basic social needs: the need for affection (e.g. love, relationships), the need for behavioural confirmation (e.g. doing the "right" thing in the eyes of relevant others), and the need for status (e.g. being treated with respect).

The SPF-SA theory is an extension of the SPF theory. The latter posits that there are age-related changes in the availability of resources for need satisfaction, with affection relatively more age proof than the two others as it depends less on performance. Two main processes guide these changes:

- A patterned change in the availability of resources for the satisfaction of the three social needs over the life span: status satisfaction is the most difficult to maintain, followed by

behavioural confirmation, and the satisfaction of the need for affection is the easiest to maintain in relation to the two other needs.

- A process of compensation and substitution regarding the social need satisfaction over the life course. Behavioural confirmation and affection are substitutes of and compensate for decline in status need satisfaction, and affection need satisfaction also compensates and substitutes for the decline in behavioural confirmation need satisfaction.

Hence SPF-SA claims that gains in affection need satisfaction are more prominent in older adults than in young adults, the latter being more status and behavioural confirmation oriented.

The design we use has originally been used by Niederle & Versterlund (2007) to study gender differences in the reaction to incentives. In this experiment, subjects can earn money by solving real-effort tasks (summing up two-digit numbers). They start out with a piece-rate payment scheme, followed by a winner-takes-it-all competition in groups of four. In a third round, subjects can choose whether they prefer a competitive incentive scheme or a piece-rate incentive scheme for this round. Round four enables participants to select whether to be paid in a piece rate or competitive incentive scheme for round one. We added a fifth round to the original four rounds of the Niederle and Vesterlund experiment to investigate the motivational effects of social versus monetary incentives. There is no relative feedback given during the game, but subjects learn for each sum they calculated whether it was wrong or correct. After all rounds have been played, participants are asked to indicate how they would rank themselves in each part and the accuracy of this ranking is incentivized. Niederle & Vesterlund report a significant gender difference in choice. Women are less willing to enter a competition than men, such that – based on performance – too few women, but too many men enter the competition. By now many papers replicate findings of the earlier studies with different age and cultural groups (e.g., Gneezy & Rustichini, 2004, Gneezy et al, 2008, Dreber et al., 2009), but in terms of age groups they all focus on younger rather than older subjects – usually children or teens.

In the current study, we can show that older adults seem to differ from younger adults in their performance in all conditions, but not in the reaction to incentives. The age difference in performance is driven by women; men do not differ on any of the performance measures. We replicate also the gender difference in competitiveness found generally in the literature: women enter a tournament less often than men. This holds for both age groups, while there is no general age difference.

We also show that the two factors that explain most of the variance in tournament entry are the gender of participants and their self-ranking (i.e., a measure of self-confidence). Participants who are more confident about their relative performance are more likely to compete than participants who are less confident. Furthermore, women are less likely to compete, a result that also holds when controlling for absolute and believed performance. Age and actual performance on the other hand do not have a significant effect on the likelihood to enter a competition. At the same time, we find a general difference in most of the performance measures those who choose to compete perform better than those who do not choose competitive incentives.

With respect to social incentives, they seem to have a stronger effect on productivity than monetary incentives. We hypothesize different motivational effects for social and monetary incentives, as we find a marginally significant effect of the nature of incentives on the number of correctly solved problems. This effect is driven by men; women do not show an increase in performance with social incentives.

Methods

Subjects

We invited a sample of people older than 58 (N = 45, 24 women, 21 men) to the experimental laboratory (AWI Lab, Heidelberg University, Germany), and a comparison sample of 40 students (mean age 24 years, 24 women, 16 men). All participants received a show-up fee of 3€ and an additional payment according to their performance (0.5€/correct answer if paid in the piece-rate treatment, 2€/correct answer for the winner out of four competing subjects in the competition treatment, and 1€/correct answer if paid for the high monetary-incentive treatment).

The task

Subjects had to carry out a real effort task, consisting of the addition of five two digit numbers. We mainly followed the set-up by Niederle and Vesterlund (2007). Subjects were told that the game consisted of five parts, and that one of the five parts would be chosen at random for payment.

In a first round, subjects played the task with a piece rate payment scheme. Subjects were paid thence for correct answers without competing. In the second round, a competitive incentive scheme was introduced. In this trial, subjects earned an amount of money four times higher than in the piece rate scheme if they were the best out of a randomly matched group of four. The other subjects earned nothing. In the third round, subjects could decide whether to be paid in a piece rate or in a competitive incentive scheme. In the final round, subjects played the task with a modified piece rate payment scheme: roughly half of the participants played the game with increased monetary incentives, the other half of the participants played the game with social incentives. To investigate the motivational effects of social incentives, the experimenter[1] read aloud a text asking participants to make a last effort and to try to answer as many questions as possible. He stressed that it would be very important for the experimenter that subjects really try hard. Subjects were paid as in the standard Piece Rate condition. In the high monetary incentives treatment, subjects were paid twice the price of the standard piece rate payment for each correct answer. Additionally, participants could decide retrospectively whether to be paid in the piece rate or in the competitive incentive scheme for round one.

Based on the literature, we hypothesize a difference in choice of competitive incentives between age- as well as between gender groups.

Results

1) Age and gender differences in performance and the choice of competitive incentives

[1] All sessions were run by the same experimenter (A.S.).

Our first aim was to search for age differences in the choice of competitive incentives. We do not find a general age difference in choice: 42.5% of older adults and 37.8% of young adults choose to compete in round 3. This age difference is not significant ($\chi^2 = 0.197$; $p = 0.657$)[2]. This holds for both sexes: young men choose the competitive incentive scheme in 62.5% of the cases, older men in 52.4% ($\chi^2 = 0.379$, $p = 0.538$), and 29.2% of young women chose to compete, compared to 25% in the older women ($\chi^2 = 0.105$, $p = 0.745$).

Table 1

Group		Choice	Frequency	%
Young		Piece rate	23	57.5
		Competition	17	42.5
		Total	40	100
Older		Piece rate	28	62.2
		Competition	17	37.8
		Total	45	100
Male		Piece rate	16	43.2
		Competition	21	56.8
		Total	37	100
Female		Piece rate	35	72.9
		Competition	13	27.1
		Total	48	100
Older	Male	Piece rate	10	47.6
		Competition	11	52.4
		Total	21	100
Young	Male	Piece rate	6	37.5
		Competition	10	62.5
		Total	16	100
Older	Female	Piece rate	18	75
		Competition	6	25
		Total	24	100
Young	Female	Piece rate	17	70.8
		Competition	7	29.2
		Total	24	100

An effect well known in the literature (Müller & Schwieren, 2011; Niederle & Vesterlund, 2007) is a gender difference in the choice of competitive incentive schemes. We can test whether this holds not only for young women, but also for older women. Whereas 56.8% of men choose to compete in round 3, only 27.1% of women do so ($\chi^2 = 7.666$, $p = 0.006$). If we split the sample by age groups, this effect still holds: 29.2% of young women choose the competitive incentive scheme, compared to 62.5% in men ($\chi^2 = 4.365$; $p = 0.037$). This effect is marginally significant in older adults: 52.4% of older men choose to compete, compared to 25% of older women ($\chi^2 = 3.572$, $p = 0.059$).

To interpret the differences found, it is important to know whether there is an age difference in performance in any of the incentive conditions or in improvement between piece rate and competition. Table 2 shows that there are age differences in performance in all conditions: in the piece rate incentive scheme ($t_{(83)} = 2.221$, $p = 0.029$)[3], in the competitive incentive scheme ($t_{(83)} = 2.232$, $p = 0.028$), in the choice incentive scheme ($t_{(83)} = 2.549$, $p = 0.013$); and marginally in the social or increased piece rate incentive scheme ($t_{(83)} = 1.877$, $p = 0.064$). But, there is no age difference in

[2] Unless otherwise mentioned, we report Pearson's χ^2 value with an asymptotic two-sided significance level.
[3] Unless otherwise mentioned, we report p-values for two-sided t-tests.

improvement from one to another condition: young and older subjects do not differ in the improvement between piece rate and competition incentive scheme ($t_{(83)}$ = 0.111, p = 0.912), nor do they differ in improvement between piece rate and the final phase ($t_{(83)}$ = 0.412, p = 0.682).

If however performance is split by gender and by age, we can show that the age difference in performance is only driven by women, and that there is no significant difference in men (cf. table 3): young women give more correct answers than older women in the piece-rate (marginally significant, $t_{(46)}$ = 1.988, p = 0.053), in the competitive (marginally significant, $t_{(46)}$ = 1.872, p = 0.068), in the choice ($t_{(46)}$ = 2.278, p = 0.027), and in the social or increased monetary incentive scheme (marginally significant, $t_{(46)}$ = 1.971, p = 0.055). There are no such differences in men (all p > 0.1). Age differences in improvement from piece rate to the competitive or to the social or increased monetary incentive scheme do neither appear in men (competitive: $t_{(35)}$ = 0.135, p = 0.893; social/monetary: $t_{(35)}$ = 0.994, p = 0.327), nor in women (competitive: $t_{(46)}$ = 0.195, p = 0.846; social/monetary: $t_{(46)}$ = 0.342, p = 0.734).

Table 2

Condition	Mean young (SD)	Mean older (SD)	$t_{(83)}$-value	p-value
Piece rate	11.35(5.19)	9.02(4.47)	2.221	0.029
Competition	12.78(5.07)	10.38(4.83)	2.232	0.028
Choice	13.25(5.56)	10.49(4.41)	2.549	0.013
Monetary/Social	12.88(4.97)	10.87(4.88)	1.877	0.064
Impr. piece rate – comp.	1.43(2.70)	1.36(3.04)	0.111	0.912
Impr. Piece rate – soc./monet.	1.53(3.48)	1.84(3.65)	0.412	0.682

N young adults: 40; N older adults: 45

Table 3

Gender	Condition	Mean young (SD)	Mean older (SD)	df	t-value	p-value
Male	Piece rate	12.38(6.87)	9.81(4.52)	35	1.369	0.180
	Competition	13.44(6.49)	11.00(4.38)	35	1.363	0.181
	Choice	14.44(7.08)	11.43(4.52)	35	1.574	0.124
	Monetary/Social	13.06(4.94)	11.76(4.69)	35	0.745	0.461
	Impr. piece rate – comp.	1.06(2.35)	1.19(3.17)	35	0.135	0.893
	Impr. Piece rate – soc./monet.	0.69(3.34)	1.95(4.17)	35	0.994	0.327
Female	Piece rate	10.67(3.70)	8.33(4.40)	46	1.988	0.053
	Competition	12.33(3.94)	9.83(5.22)	46	1.872	0.068
	Choice	12.46(4.26)	9.67(4.23)	46	2.278	0.027
	Monetary/Social	12.75(4.35)	10.08(5.00)	46	1.971	0.055
	Impr. piece rate – comp.	1.67(2.91)	1.50(2.98)	46	0.195	0.846
	Impr. Piece rate – soc./monet.	2.08(3.53)	1.75(3.22)	46	0.342	0.734

N young male: 16; N older male: 21; N young female: 24; N older female: 24

In summary, we show in a first step that there is no significant age difference in competitiveness, neither in men nor in women. We replicate also the gender difference in competitiveness found generally in the literature: women enter a tournament less often than men. This effect holds for both age groups. Concerning performance, older adults generally perform worse in all conditions than young participants. However, young and older adults do not differ in the increase in performance form one condition to another. This means that even if overall performance of older adults on this task is worse than that of young adults, the effect of conditions points in the same direction in both age groups. Furthermore, the age difference in performance is driven only by women; men do not differ significantly on any of the performance measures.

To test for the robustness of these effects found in pairwise comparisons, we also run logistic regressions (table 4).

Table 4

Factor	Model 1	Model 2	Model 3	Model 4
Age	-.310	-.127	-.695	-.581
	(.509)	(.796)	(.654)	(.713)
Female	-1.290	-1.201	-1.345	-1.283
	(.006)	(.012)	(.055)	(.074)
Piece Rate		.085		.044
		(.115)		(.452)
Impr. piece rate – comp.		-.016		-.083
		(.854)		(.401)
Rank			-.615	-.615
			(.044)	(.077)
Age*gender			.355	.344
			(.714)	(.726)
Constant	1.740	.661	2.920	2.438
	(.032)	(.553)	(.023)	(.137)
R^2	.124	.166	.185	.212

Logistic regressions. Dependent variable: choice to compete. N = 85

In these regressions, we confirm that gender is a robust predictor of competitiveness (all $p < .1$) and that neither age, nor the interaction between age group and gender, has significant effects on competitiveness. Women are less likely to compete, a result that also holds when controlling for absolute and believed performance. On the other hand, age and actual performance (as measured by performance on the piece rate trial and by the increase in correct responses from the piece rate to the competition trial) do not have a significant effect on the likelihood to enter a competition.
The second factor that significantly influences competitiveness is self-ranking. Participants who are more confident about their relative performance (as measured by self-ranking) are more likely to compete than participants who are less confident. This result also holds when controlling for actual performance ($p < .1$).

2) Age and gender differences in performance and choice

In this step, we test whether participants choosing to compete in the choice trial differ in performance form participants that chose the piece rate. Participants also ranked their own performance in competition in a subsequent step and we can test for differences in beliefs about performance in the competition treatment. We expect participants choosing to compete to perform better and to rank themselves higher than participants choosing the piece rate incentive scheme. In a first step we show data for both age groups together, and subsequently we'll split groups by age and by gender. We will use one-sided t-tests for pairwise comparisons, as we have clear hypotheses about the direction of the differences. At the end of the section, we will run regressions to test for the relative importance of the factors involved.
Table 5 shows performance in the three first treatments (piece rate, competition, choice), the level of improvement from piece rate to competition, and subject's self-ranking. In all but the

improvement from piece rate to competition, subjects choosing to compete[4] perform better than subjects who choose the piece rate. In the piece rate treatment, competitive subjects give on average 11.50 correct answers in five minutes, compared to 9.20 correct answers in the noncompetitive group ($t_{(83)}$ = 2.154, p = 0.017). The effect goes in the same direction for the competition treatment (marginally significant, $t_{(83)}$ = 1.626, p = 0.054) and the choice treatment ($t_{(83)}$ = 2.024, p = 0.023). Subjects who choose to compete do not differ significantly from subjects who choose the piece rate incentive scheme with respect to improvement from the piece rate treatment to the competition treatment ($t_{(83)}$ = 0.786, p = 0.217).
Concerning self-ranking, competitive subjects rank themselves as significantly better than subjects who chose a noncompetitive incentive scheme ($t_{(83)}$ = 2.546, p = 0.007).

Table 5

Condition	Mean piece rate	Mean comp.	$t_{(83)}$-value	p-value
Piece rate	9.20(4.47)	11.50(5.32)	2.154	0.017
Competition	10.78(4.87)	12.59(5.21)	1.626	0.054
Choice	10.88(4.39)	13.15(5.91)	2.024	0.023
Impr. Piece rate – comp.	1.59(2.74)	1.09(3.06)	0.786	0.217
Rank	2.14(0.80)	1.68(0.84)	2.546	0.007

N piece rate: 51; N competition: 34

When focusing on age effects, the difference between participants who chose the piece rate incentive scheme and those who chose the competitive incentive scheme only holds for young subjects. Those young adults that choose to compete perform better in piece rate trials (marginally significant, $t_{(38)}$ = 1.639, p = 0.055), in competition trials (marginally significant, $t_{(38)}$ = 1.598, p = 0.059), and in choice trials ($t_{(38)}$ = 1.819, p = 0.039). They do not improve more from the piece rate trial to the competition trial than the other group ($t_{(38)}$ = 0.143, p = 0.444), but they rank themselves significantly higher (marginally significant, $t_{(38)}$ = 1.546, p = 0.065).
Older adults who chose to compete differ from those who chose the piece rate in none of the performance measures but in self-ranking ($t_{(43)}$ = 1.941, p = 0.030).

[4] For reasons of text fluency, we classify hereafter subjects that choose to compete as competitive, and subjects that chose the piece rate incentive scheme as noncompetitive. We are aware that by attributing the predicate “noncompetitive” to the participants we do not necessarily describe participants’ personality, but rather their preferences on the current task.

Table 6

Group	Condition	Mean piece rate	Mean comp.	df	t-value	p-value
Young	Piece rate	10.22(4.78)	12.88(5.48)	38	1.639	0.055
	Competition	11.70(4.66)	14.24(5.37)	38	1.598	0.059
	Choice	11.91(4.42)	15.06(6.52)	38	1.819	0.039
	Impr. piece rate – comp.	1.48(2.86)	1.35(2.55)	38	0.143	0.444
	Rank	1.96(0.71)	1.59(0.80)	38	1.546	0.065
Older	Piece rate	8.36(4.10)	10.12(4.95)	43	1.291	0.102
	Competition	10.04(5.00)	10.94(4.63)	43	0.605	0.274
	Choice	10.04(4.26)	11.24(4.67)	43	0.883	0.191
	Impr. piece rate – comp.	1.67(2.70)	0.82(3.56)	43	0.913	0.183
	Rank	2.29(0.85)	1.76(0.90)	43	1.941	0.030
Male	Piece rate	9.81(5.58)	11.76(5.81)	35	1.028	0.156
	Competition	11.69(5.28)	12.33(5.70)	35	0.353	0.363
	Choice	11.94(4.68)	13.33(6.70)	35	0.711	0.241
	Impr. piece rate – comp.	1.88(1.89)	0.57(3.27)	35	1.417	0.083
	Rank	1.88(0.81)	1.71(0.96)	35	0.541	0.296
Female	Piece rate	8.91(3.93)	11.08(4.63)	46	1.615	0.057
	Competition	10.37(4.70)	13.00(4.51)	46	1.741	0.044
	Choice	10.40(4.24)	12.85(4.62)	46	1.736	0.045
	Impr. piece rate – comp.	1.46(3.07)	1.92(2.57)	46	0.487	0.315
	Rank	2.26(0.78)	1.62(0.65)	46	2.640	0.006

N young piece rate: 23; N young competition: 17; N older piece rate: 28; N older competition: 17; N male piece rate: 16; N male competition: 21; N female piece rate: 35; N female competition: 13

When it comes to gender differences, the effect of competitiveness is stronger for women than for men. Women choosing competition perform better under forced competition than women choosing not to compete ($t_{(46)} = 1.741$, $p = 0.044$), whereas there is no such difference for men ($t_{(35)} = 0.353$, $p = 0.363$). For the self-ranking we also find a difference between the two groups in women ($t_{(46)} = 2.640$, $p = 0.006$) but not in men ($t_{(35)} = 0.541$, $p = 0.296$). In the piece rate and choice trials, as well as in improvement from piece rate to competition, we do not find any significant effect of competitiveness in men. We do not find a significant effect of competitiveness in the improvement variable in women neither, but we find significant differences in the competition ($t_{(46)} = 1.741$, $p = 0.044$), in the choice ($t_{(46)} = 1.736$, $p = 0.045$), and in the piece rate treatment (marginally significant, $t_{(46)} = 1.615$, $p = 0.057$).

In summary, we find a general difference in most of the performance measures (all except improvement) between subjects choosing to compete and those preferring piece rate incentives. When looking at age differences, the general difference only holds for young participants; older participants differ in self-ranking and in none of the other measures (replicating the finding of Charness and Villeval, 2007).

Based on the SPM-SA theory, we hypothesized that older adults should react more strongly to social than to monetary incentives, as social achievement becomes more important with age (table 7). We observe however that subjects in both, the monetary and the social group improve significantly from piece rate (social $t_{(22)} = 2.558$, $p = 0.018$; monetary $t_{(21)} = 2.177$, $p = 0.041$). This improvement is also marginally significant in young adults (social $t_{(19)} = 1.945$, $p = 0.067$; monetary $t_{(19)} = 1.959$, $p = 0.065$). The improvement from competition to the final phase is not significant in any of the groups.

Table 7

Age	Incentives	Improvement from	Mean	df	t-value	p-value
Young	Social	Piece rate	1.70(3.91)	19	1.945	0.067
		Competition	-0.15(2.72)	19	0.247	0.808
	Monetary	Piece rate	1.35(3.08)	19	1.959	0.065
		Competition	0.35(3.35)	19	0.468	0.645
Older	Social	Piece rate	2.04(3.83)	22	2.558	0.018
		Competition	0.61(2.54)	22	1.151	0.262
	Monetary	Piece rate	1.64(3.53)	21	2.177	0.041
		Competition	0.36(2.63)	21	0.649	0.523

When directly comparing social to monetary incentives, it turns out that social incentives have a slightly stronger effect on productivity. On average, subjects solve 12.77 problems in the social incentives group, but only 10.83 problems in the monetary incentives group (marginally significant, $t_{(83)} = 2.025$, $p = 0.074$). If however we split the sample by age groups, this effect disappears: older and young adults taken separately do not seem to differentiate between social and monetary incentives. Sample size however is now small.

When splitting the sample by gender instead of age, it becomes evident that the effect is driven by men. Men solve 14 problems correctly in the social incentive condition, and 10.74 in the monetary incentives condition (marginally significant, $t_{(35)} = 1.972$, $p = 0.057$). Women, on the other hand solve 11.88 problems in the social incentives condition versus 10.91 in the monetary incentives condition ($t_{(46)} = 0.689$, $p = 0.494$).

Table 8

Group	Mean social	Mean monetary	df	t-value	p-value
Young	13.90(5.64)	11.85(4.10)	38	1.316	0.196
Older	11.78(5.13)	9.91(4.52)	43	1.298	0.201
Male	14.00(5.95)	10.74(3.97)	35	1.972	0.057
Female	11.88(4.92)	10.91(4.79)	46	0.689	0.494

N young social: 20; N young monetary: 20; N older social: 23; N older monetary: 22; N male social: 18; N male monetary: 19; N female social: 25; N female monetary: 23

In the following, we report regressions on each of the performance measures.
In the piece rate incentive scheme, we regressed the only two measures at hand at this point of the game, namely age and gender, on the amount of correct solutions in this trial. The regression reveals that age, but not gender, has a significant effect on performance, and that young adults perform better than older adults. However, when controlling for the interaction between age and gender, this effect disappears.
For the competitive incentive scheme, we performed in a first step the same regression as for the piece rate incentive scheme, with the same overall result: age significantly influences performance, gender does not. In a second step, we included performance on the piece rate trial and the interaction between age group and performance as additional regressors. Not surprisingly, performance on the previous trial has a strong effect on performance on the competition trial, increasing the regression coefficient from .069 to .701 and cancelling out any significant effect of age.

In the choice condition, subjects had the possibility to choose their preferred incentive scheme, and we introduced into the model a binary variable for choice. The effect on performance of choosing or not choosing to compete is nonsignificant (p = 0.134). In the second model, we again introduced performance on the piece rate trial and the interaction between age and performance as supplementary regressors. In addition, we introduced a regressor for the interaction between the choice variable and performance. Performance on the piece rate trial has a strong effect on performance in the choice trial, increasing the R^2 from .130 to .734. None of the other regressors reveals being significant.

For the final incentive scheme, where subjects performed with social incentives or increased monetary incentives, we introduced in the first model age, gender, and the nature of incentives as regressors. Whereas gender does not influence significantly performance on the final trial, age has a significant effect (p = .050), and the nature of incentives seems to influence performance (p = 0.075) as well. In the second model, we added performance on the piece rate trial and the interaction between age and performance as regressors. Performance becomes the only significant variable explaining scores on the final incentive scheme.

Table 9

	Piece rate		Competition		Choice		Final	
Factor	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
Age	-.248	-.285	-.245	-.053	-.270	.078	-.212	-.057
	(.022)	(.424)	(.024)	(.717)	(.011)	(.571)	(.050)	(.747)
Gender	-.160	-.196	-.112	.021	-.130	-.049	-.112	.009
	(.135)	(.573)	(.297)	(.741)	(.236)	(.434)	(.296)	(.907)
Age*Gender		.051						
		(.913)						
Piece rate				.812		.997		.688
				(.000)		(.000)		(.005)
Age*Piece rate				.020		-.250		.043
				(.924)		(.213)		(.866)
Competition					.165	-.088		
					(.134)	(.530)		
Competition*Piece rate						.124		
						(.442)		
Incentives							-.201	-.080
							(.062)	(.295)
Constant	16.317	16.881	17.069	3.385	17.438	3.107	17.767	5.492
	(.000)	(.004)	(.000)	(.206)	(.000)	(.254)	(.000)	(.095)
R^2	.082	.082	.069	.701	.130	.734	.092	.533

Linear regressions. Dependent variables: number of correctly solved problems. N = 85.

In summary, the age, but not the gender, of participants influences performance in all four incentive schemes. When controlling for baseline-performance, (measured by performance on the initial piece-rate trial), the effect of age is cancelled out. As baseline-performance is influenced by the age of participants, we controlled also for the interaction between age and baseline performance. The interaction term however does not have a significant effect.

Another noteworthy effect is the influence of ”competitiveness” on performance in the first regression model of the choice trial. Even though the effect is only approaching marginal significance, we have shown earlier (cf. section 2) that choosing to compete is linked to performance on the choice trial.

In the first regression model of performance on the final incentive scheme, we introduced the nature of incentives (social or increased monetary) as regressor. Nature of incentives marginally significantly explains performance on the final trial, with a stronger effect of social compared to increased monetary incentives.

Discussion

In this experiment, our main aim was to explore age differences in the reaction to incentives. To achieve this goal, subjects participated in a real effort task with four incentive schemes: piece rate, tournament, choice between piece rate and tournament, and social or increased monetary incentives. On the whole, we replicated most of the effects previously known in the literature, and answered our main hypotheses.

More specifically, with respect to age and gender differences, we found that:

Concerning performance, older adults generally perform worse in all conditions than young participants. This effect supposedly is due to age differences in cognitive domains such as processing speed (Salthouse & Madden, 2008) and fluid intelligence (Bugg et al., 2006). Young and older adults do however not differ in the increase in performance in between the conditions. This shows that even though overall performance of older adults on this task may be worse than that of young adults, the effect of conditions points in the same direction in both age groups. When controlling for gender and the interaction of gender and age, the age effect however disappears. Performance increases from the piece rate to all subsequent trials. Subjects do neither increase in performance from competition to the choice trial, nor do they increase from competition to the final trial. One possible interpretation of the latter result could be that subjects are equally motivated to perform well by competitive incentives and by piece rate settings with increased performance incentives.

Another noteworthy effect is the influence of competitiveness on performance. Like Charness and Villeval, we find a general difference in most of the performance measures (all except improvement between trials) for competitive and noncompetitive participants, competitive participants performing better than their noncompetitive pairs.

Unlike the common stereotype that older adults “are less willing to learn, and implicitly less interested in working hard and competing” (Charness and Villeval, 2007), in the setting of our experiment we do not find decreased competitiveness, neither in men, nor in women. We replicate also the gender difference in competitiveness found in the literature (Müller and Schwieren, 2011; Niederle and Vesterlund, 2007): women enter a tournament less often than men. This effect holds for both age groups. The two factors that explain the most of this variance of tournament entry are the gender of participants and self-ranking. Participants who are more confident about their relative performance are more likely to compete than participants who are less confident. Furthermore, women are less likely to compete (a result that also holds when controlling for absolute and believed performance). Age does not have a significant effect on the likelihood to enter a competition.

Like competitiveness on the choice trial, nature of incentives explains part of the variance of performance on the final trial. As predicted by the SPF-SA theory, social incentives seem to have a stronger effect on productivity than monetary incentives. The performance-increasing effect of increased monetary incentives or additional social incentives seems to have a similar strength as a competitive environment, as we did not find significant increases in productivity from the competition trial to the final trial neither with monetary nor with social incentives.

With respect to the SPF-SA theory, in our experiment, we tested the effect of social need satisfaction with an emphasis on status (being taken seriously, achieve more than others) and behavioural confirmation (doing things well, being useful, contribution to a common goal). The need for affection (feeling that you are liked, empathized with, etc.), on the other hand, plays a less important role in our set-up. In the social/monetary treatment, behavioural confirmation is in our eyes the most prominent need that can be satisfied, as the experimenter asks subjects to *make a last effort* (i.e. doing things well) *because it is very important for the success of the study* (i.e. contribution to a common goal). The competition treatment, and to some extend also the choice treatment, have rather a status satisfaction dimension, as participants here have the possibility to achieve more than others. Whereas in young adults, status and behavioural confirmation are two needs that are easily fulfilled, older adults have less opportunities to achieve these needs due to changes in life situation (e.g. retirement), and are thence more prone to react to conditions that enable them to fulfill these needs (Steverink and Lindenberg, 2002). Even though we do not observe strong differences between age groups in the reaction to status and behavioural confirmation treatments, we observe a neat increase in performance in both age groups in reaction to social-need-satisfaction conditions, compared to the piece-rate treatment, where any of the social needs can be fulfilled. Especially the social/monetary treatment, in which confounding factors like task familiarity or learning should not play a role, shows that behavioural confirmation has a stronger effect on performance than a doubling of the financial incentives.

Conclusion

Concluding, older subjects seem to differ in their reaction from younger subjects, but not always in the way stereotypically expected. While the differences are not large, they do show that we need to differentiate not only between young and older adults, but also between men and women. Overall, older women's performance is slightly lower than that of younger women, whereas we do not find this age difference in men. When it comes to social incentives, the motivational effect of social incentives seems to be higher than the motivational effect of monetary incentives.

More work is necessary to fully understand the implications of our results for workplace design, especially focusing on social incentives and also studying over- and underconfidence in older populations. Further experiments should also look at age-mixed settings, as this might be the more relevant setup with respect to real-world workplaces.

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