Self-generated cognitive fluency as an alternative route to preference formation.

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Abstract

People tend to prefer fluently processed over harder to process information. In this study we examine two issues concerning fluency and preference. First, previous research has pre-selected fluent and non-fluent materials. We did not take this approach yet show that the fluency of individuals' idiosyncratic on-line interactions with a given stimulus can influence preference formation. Second, while perceptual fluency influences preference, the opposite also may be true: preferred stimuli could be processed more fluently than non-preferred. Participants performed a visual search task either before or after indicating their preferred images from an array of either paintings by Kandinsky or decorated coffee mugs. Preferred stimuli were associated with fluent processing, reflected in facilitated search times. Critically, this was only the case for participants who gave their preferences after completing the visual search task, not for those stating preferences prior to the visual search task. Our results suggest that the spontaneous and idiosyncratic experience of processing fluency plays a role in forming preference judgments and conversely that our first impressions of preference do not drive response fluency.

Keywords: processing fluency, affective judgements, preference, visual search, metacognition

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Selecting the perfect artwork to place on a blank wall at home could be based on a variety of consciously considered factors; for example, size, colour balance, or provenance of the piece. Such explicitly definable features of the artwork may very well influence choice or, at least, the way the choice is explained to others. It is likely that heuristics, however, are also employed to minimise the cognitive cost of such decisions, though they may not be available to conscious report. Previous work has shown that stimuli associated with fluent (effortless and fast) processing are preferred over stimuli that are processed with relative difficulty (see Alter & Oppenheimer, 2009a; Oppenheimer, 2008 for reviews). Both objective fluency and participant's subjective feeling of fluency have been linked with affective judgements (Forster, Leder & Ansorge, in press). Can this feeling of fluency, however, still influence preference formation towards stimuli that do not consistently prompt fluent processing across individuals? In a visual search task we presented participants with pictures of Kandinsky paintings or decorated coffee mugs that were not pre-selected to differ in terms of processing ease, to determine if participants' individual and spontaneous visual search times predict their preferences between the stimuli.

The link between fluency and affect

Empirical work strongly supports the association between affective evaluations and fluency (see Alter & Oppenheimer, 2009a; Oppenheimer, 2008). For example, Zajonc's (1968) seminal studies on the 'mere exposure' effect demonstrated that participants rated stimuli more favourably after repeated exposure. A processing fluency account of the mere exposure effect suggests that previously encountered stimuli access a previously activated representation and therefore receive facilitated processing. Then, via a feedback loop, the experience is registered as a positive affective processing episode and associated with the stimulus itself.

Beyond presentation repetition, the link between processing fluency and preferences has been shown with a wide variety of stimuli and in many task contexts. For example, skilled typists prefer letter dyads that are easier to type, while novice typists do not show the same preference (Beilock & Holt, 2007; van den Bergh, Vrana, & Eelen, 1990). Fluency effects can be found with judgements on quality (Galak & Nelson, 2011), distance (Alter & Balcetis, 2011), learning (Miele, Finn & Molden, 2011), intelligence (Oppenheimer, 2006), morality (Laham, Alter & Goodwin, 2009), riskiness (Song & Schwarz, 2009) and valuation (Alter & Oppenheimer, 2006; 2008a). The effect of fluency, however, is qualified. If participants become aware of the fluent experience and that it should bear no logical relation to their judgement, the effect is not observed and in some cases reversed (Oppenheimer, 2004, 2006; Oppenheimer & Frank, 2008; Schwarz et al., 1991).

The present study

Although research investigating fluency effects is abundant, typically researchers manipulate the stimuli or conditions explicitly to be overtly representative of either high or low fluency. For example, altering the pronounceability of names (Laham, Koval, & Alter, 2012), manipulating perceptual properties via pre-exposure (Zajonc, 1968), priming or contrast (Reber, Winkielman & Schwarz, 1998) or visuomotor fluency (Cannon, Hayes & Tipper, 2010; Hayes, Paul, Beuger & Tipper, 2008). Alternatively, researchers have observed differences between groups that are trained to find pre-specified actions easy to process (Beilock & Holt, 2007; van den Bergh, Vrana, & Eelen, 1990). Yet our everyday environment consists of a multitude of items that we spontaneously process and attend to that do not occupy the extremes of a fluency dimension. Even though appearing similar, some objects may nevertheless be processed more fluently than others and fluency-levels of individual exemplars of stimulus classes may vary idiosyncratically among people (and, by extension, may have a role in the development of personal preference).

The current study therefore attempts to detect fluency effects on affective evaluations with stimuli not explicitly designed to have fluent/disfluent dichotomies. We sought to determine if participants' individual and spontaneous experience with a stimulus, as measured by reaction time and movement time in a reach-to-touch visual search task, could lead to self-induced preference biases. Reaction time serves as an indirect measure of processing fluency as it represents the relative level of difficulty in cognitive processing associated with an individual's ability to locate and identify a target. Participants performed the search task with one of two sets of stimuli (abstract paintings or decorated mugs; very different types of stimuli to which people develop individual preferences for in everyday life), and either indicated their preferences before or after the task. By comparing participants who gave their preferences before completing the task with those who made their choices after the visual search task, we are able to investigate the direction causality in any fluency effects we may find.

Our primary hypothesis regards the performance of participants who select their preferred items *after* they have completed the visual search task. We hypothesise that the individual stimuli that they select as preferred following the search task will be associated with faster reaction times in the previously-completed search task This pattern would be attributable to a fluent experience during visual search leading to an association between the positive affective trace and the target stimulus. This would show that individual patterns of responses to stimuli could contribute to preference formation. However, the behaviour of participants who declare their preferences *prior to* completion of the visual search task is also critical for the interpretation of the 'preference after search' group. We hypothesise that fluency will drive – but not be driven by – preference formation. Thus, stimuli that are preferred at the start of the study will *not* be identified more rapidly during the subsequent visual search task. That is, preference will not influence visuomotor fluency, demonstrating the direction of the relationship between processing fluency and the formation of idiosyncratic preferences.

Method

Participants

One hundred and twenty-eight right handed volunteers (93 females, *M* = 19.8 years, *SD* = 3.87 years) participated for course credit. They gave informed consent, had normal or corrected to normal vision and indicated no familiarity with the stimuli. Participants were randomly assigned to indicate their preferences either before or after the task.

Design

The study employed a 2x2x2 mixed design. The time at which participants gave their preferences ('preference time'; before or after the task) and 'stimuli set' (paintings or mugs) were between subjects factors. 'Item preference' served as our within subjects factor, with two levels; items selected as preferred by the individual participant (*n* = 3 per participant) and items not selected as preferred (*n* = 4 per participant). We measured reaction time (RT) and movement time (MT) on each trial.

Stimuli and Apparatus

Seven pictures of abstract paintings by Kandinsky ('Fragment 2 for Composition VII' (1913), 'Ravine Improvisation' (1914), 'In Blue' (1925), 'Several Circles' (1926), 'On the points' (1928), 'Upward' (1929), Composition X (1939) and seven pictures of hand painted mugs (handle oriented rightwards; painted with abstract designs by participants in another unrelated study; see Figure 1). The paintings were cropped to measure 250 x 160 pixels; the mugs measured 220 x

200 pixels. These items were selected based on ratings of a larger set of stimuli (120 mugs, 33 paintings) by 54 naïve raters. For each item, these individuals were asked "how much do you like this painting/mug?" on a nine point Likert scale. Items with similar, moderate ratings and relatively low standard deviations were selected (see Appendix A for more details). The experiment was presented using E-Prime 2.0 on a 3M Microtouch touchscreen monitor.

Procedure

The keyboard was 10 cm away from the edge of the table. Participants sat with their torso 30cm from the monitor and with their right index finger resting on the spacebar.

Preference Component. Participants viewed an array of seven pictures (positions randomised across participants). They were asked to indicate the three they liked the best from their immediate impression by pointing to the images. There was no time limit, but the participants were encouraged to provide their preferences after only a short period of consideration.

Visual Search Component. Trials began with a centrally presented prompt to depress and hold the spacebar with their right index finger. After 1000ms a centrally located picture of the randomly-selected target image appeared for 1000ms. The display cleared for 1000ms before an array of six items (randomly selected, positions randomised) appeared from the stimuli set for 3000ms or until response (see Figure 1). On ‘target present’ trials the participant touched the target on the screen, lifting their right index finger from the spacebar and reaching towards the screen in a smooth action. Each individual stimulus served as the target on 48 target present trials. On ‘target absent’ trials (16% of trials), participants held down the spacebar until the array offset. A tone followed an error (i.e. either selecting the incorrect stimulus, or touching a non-target area of the screen). Each participant completed 400 trials over four blocks; the entire session took approximately 45 minutes.

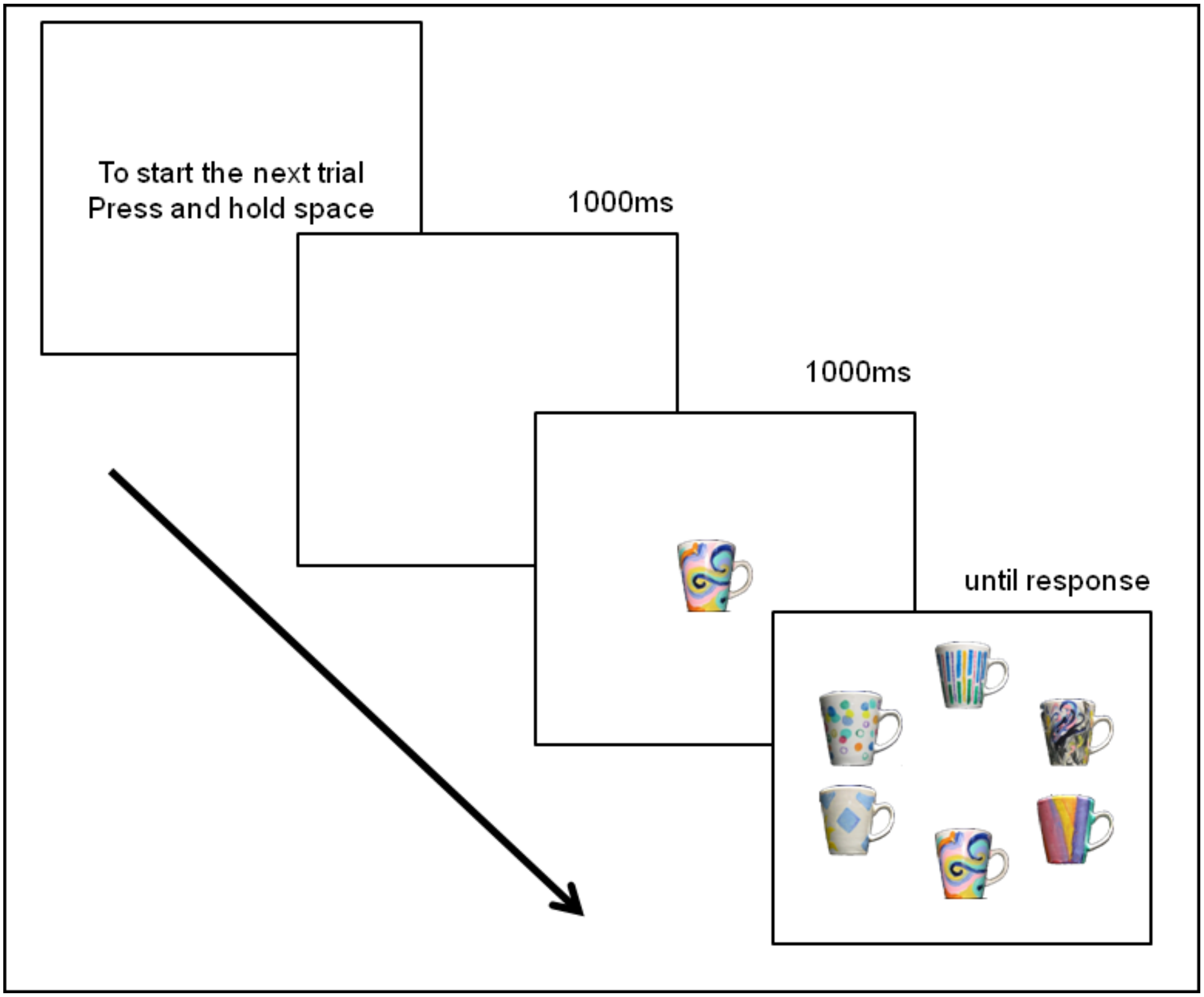

Figure 1. The timecourse of a trial.

Data Analysis

Three participants made >3*SD* more errors than the group mean, and were removed from analysis; henceforth, n = 125. Prior to statistical analysis, trials with errors (1.8% of trials), along with trials with response times >3*SD* above and below the mean for each individual item for each participant (4.6% of trials) were removed. RT was calculated as the time from array onset until the participant released the spacebar. Though we anticipated our effects to emerge primarily in RT, we also calculated MT to assess fluency effects during reach and to investigate any potential RT-MT tradeoffs. MT was calculated as the time between the release of the spacebar and the finger reaching the touchscreen. Mean RT and MT for each participant's three preferred items were averaged, and compared with the averages for their four items that were not selected (i.e. non-preferred items).

Results

Reaction time. A 2x2x2 mixed factor ANOVA revealed a significant main effect of 'item preference', $F(1,121) = 13.3$, $MSE = 3172$, $p < .001$, $\eta_p^2 = .099$, with faster RTs for preferred compared with non-preferred stimuli (610 ms vs. 635 ms). The main effect of stimuli set was also significant, $F(1,121) = 13.8$, $MSE = 13519$, $p < .001$, $\eta_p^2 = .10$, participants in the mugs group responded faster than the paintings group (595 ms vs. 650 ms). The main effect of 'preference time' was non-significant, $F(1,121) <1$, $MSE = 13519$.

Critically for our hypothesis, the interaction between 'item preference' and 'preference time' was statistically significant, $F(1,121) = 6.63$, $MSE = 3172$, $p =.011$, $\eta_p^2 = .052$, because the average RT for preferred stimuli was faster than non-preferred stimuli, but only when the visual search task was completed *before* making selections (see Figure 2). Participants found the targets they later chose as preferred quicker than targets they did not prefer, both for paintings (623 ms vs. 676ms), $t(30) = 3.16$, $p = .004$, $dz = .57$ and mugs (582ms vs 617ms), $t(30) = 3.03$, $p = .005$, $dz = .54$. In contrast, participants who performed the visual search task after indicating their preferences showed no RT differences between preferred and non-preferred items for paintings, $t(30) = 1.38$, $p = .18$, $dz = .25$ or mugs, $t(31) = -.82$, $p = .42$, $dz = .15$.

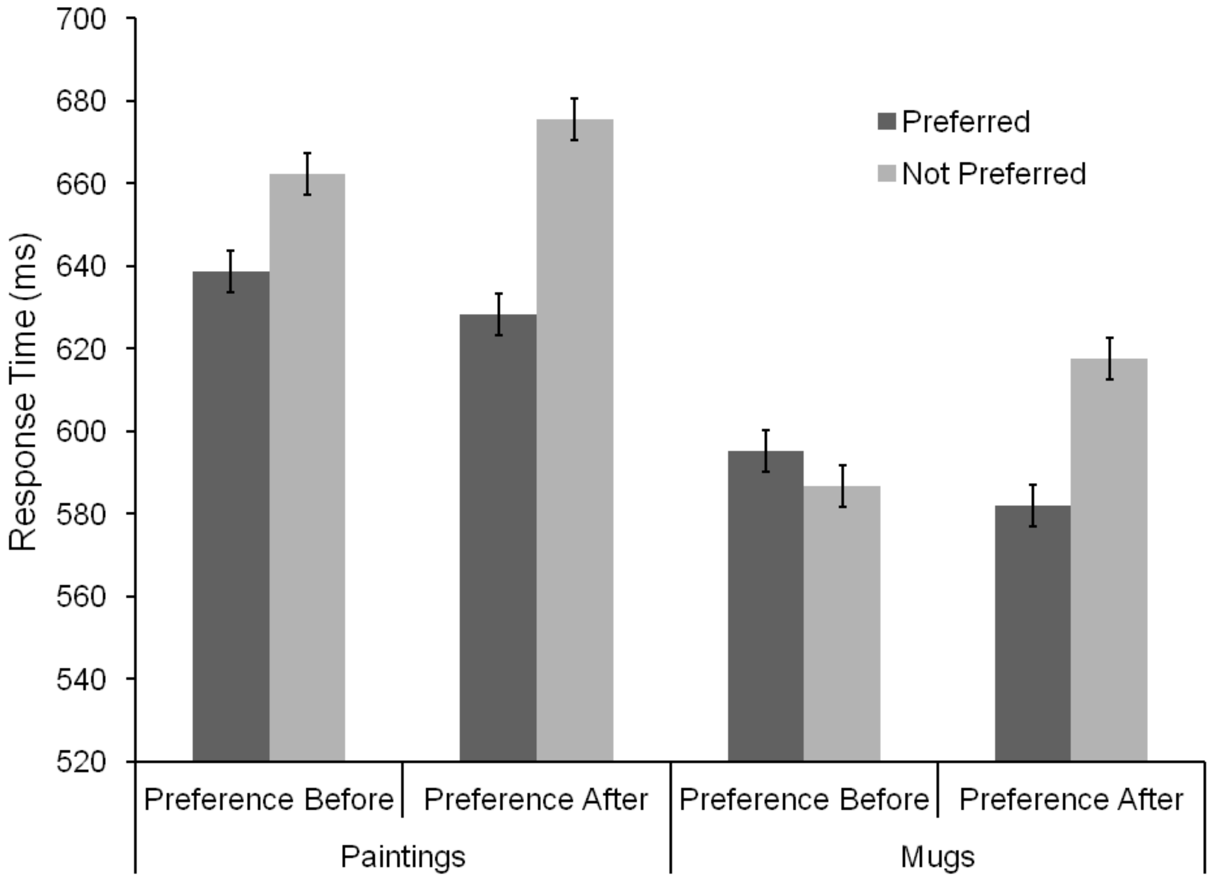

Figure 2. RTs for preferred and not preferred stimuli groups by preference time (before or after the task) and stimuli set (paintings/mugs). Error bars denote standard error of the mean for within subjects effects (Loftus & Masson, 1994).

The remaining two-way interactions did not reach significance; stimuli set did not interact significantly with either item preference, $F(1, 121) = 3.04$, $MSE = 3172$, $p =.08$, $\eta_p^2 = .025$ or preference time $F(1, 121) < 1$, $MSE = 13519$. The three-way interaction did not approach significance, $F(1, 121) < 1$, $MSE = 3172$.

Movement time. The main effect of 'stimuli set' approached significance, $F(1,121) = 3.65$, $MSE = 15,715$, $p =.059$, $\eta_p^2 = .029$ (Mugs = 424ms vs. Paintings = 455ms). The other main effects were non-significant (*F*'s < 1). The interaction between item preference and stimuli set was significant, $F(1,121) = 6.83$, $MSE = 31.2$, $p = .01$, $\eta_p^2 = .053$ (see Table 1) because participants moved towards preferred mugs slower than non-preferred mugs (425ms vs. 423ms), $t(62) = 2.25$, $p = .028$, $dz = .28$, but this effect was absent for participants in the paintings condition, $t(61) = -1.6$, $p = .12$, $dz = .20$ (454ms vs. 455ms). No other interactions associated with movement time were significant, all *F*'s < 1.

Table 1
Mean RT (ms) and MT (ms) for each group and condition with standard deviations displayed in parentheses.

	Preference Before		Preference After	
Stimuli	Preferred	Not Preferred	Preferred	Not Preferred
		Reaction Time		
Paintings	639 (89)	662 (101)	628 (82)	676 (112)
Mugs	595 (79)	587 (79)	582 (79)	617 (84)
		Movement Time		
Paintings	468 (93)	470 (97)	439 (93)	440 (92)
Mugs	416 (86)	415 (84)	434 (82)	432 (81)

Discussion

We sought to determine if an individual's interaction with particular stimuli in a visual search task would result in preference differences between the stimuli. In sharp contrast to previous work, the stimuli were not pre-selected for levels of perceptual fluency. We found that on average, participants had quicker mean RTs to their three preferred stimuli than to the four non-preferred stimuli but only when the participant gave their preferences *after* completing the task. To our knowledge, this is the first evidence departing from a stimulus based fluency approach to look at individual differences in processing fluency.

Given we only obtained a significant fluency effect when participants provided their preferences after completing the visual search task suggests that the participant's experience of metacognitive ease, as measured by RT, shaped their preference towards individual stimuli. Crucially, participants who gave their preferences *prior* to completion of the visual search task showed a null effect of preference on RT. The lack of effect when preference ratings were made at the start of the experiment suggests that the results are neither explainable in terms of (a) initial inherent idiosyncratic differences between stimuli at the level of the individual participant, nor (b) greater motivation on trials involving a preferred stimulus – both of which would predict faster reaction times for preferred stimuli in the ‘preferences given before search’ condition. Moreover, as supported by the absence of a three-way interaction with stimuli set, our data are robust across two different stimulus types (paintings by a renowned artist and mugs painted by members of the normal population).

It is conceivable that participants were only able to settle on their true preferences after being given adequate time to reflect upon their affective responses. This might explain the different results in the ‘preference given before visual search’ and ‘preference given after search’ groups. We feel that this is unlikely however, following the findings of Niimi and Watanabe (2012), who showed that affective ratings towards objects encountered briefly or for longer durations are highly correlated and consistent. In everyday life, we often make choices after a long deliberative process but many selections we make, such as choosing postcards from a news stand, are made on very brief exposures. We therefore do not believe that we set our participants a difficult or unfamiliar task by asking them to provide preferences after only one exposure to a set of stimuli.

One additional finding that may be difficult to explain under a fluency framework is that participants moved toward preferred mugs slower than non-preferred mugs, but a null effect was observed for the paintings. Because the magnitude of the effect of preferred versus non-preferred mugs on MT was extremely small (i.e. 1-2ms) relative to the RT fluency effects (35-48 ms), we simply note this effect with interest. Perhaps some form of efficiency trade-off, whereby the completion of a search is balanced with a slowed reach, could underlie the effect, as observed in other selective reaching tasks (Meegan & Tipper, 1998). Clearly this is speculation, though it does suggest that fluency can alter preferences at one stage of processing (perhaps during identification as indicated by RT) but not another. Finally we note that this interaction in the MT data did not involve 'preference time', so unlike the RT data, this interaction was not dependant on whether the search task had been completed or not.

What remains to be determined is what visual search processes underlie this self-generated fluency effect. For example, detection speed is influenced by the basic visual features of the stimulus (e.g. differences in orientation contrast, see Nothdurft, 1991) and the salience of the local distractors (Theeuwes, 1992). As our targets and distractors were the same for each participant, however, it may be reasonable to suggest that individual differences in the fluency of processing stages occurring after early visual processing (e.g. response selection).

This work joins the growing body of literature suggesting that fluency is a causal construct (e.g. Alter & Oppenheimer, 2008b, 2009b; Koch & Forgas, 2012; Reggev, Hassin & Maril, 2012; Ruder & Bless, 2003). Moreover, we have shown for the first time that the idiosyncratic fluency of interactions with individual stimuli can drive – but not be driven by – preference formation. The data presented here therefore open a new and promising avenue for research associated with individual differences in processing fluency and how factors at the individual level can influence preferences. Further research is needed to determine the mechanisms behind this self-generated fluency effect, its putative role in the development of personal taste and how it relates to consumer behaviour. Indeed, this self-generated fluency effect may provide an alternative route to brand preference to traditional advertising (i.e. personalised marketing).

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Appendix A

Table A1.

Number of experimental participants who chose each stimulus and mean liking ratings provided by a separate sample of 54 independent raters.

Stimulus	Preference given before search	Preference given after search	Mean Rating (SD)
Ravine Improvisation	6/31	5/31	6.09 (1.59)
Several Circles	21/31	22/31	5.69 (1.68)
In Blue	15/31	20/31	5.96 (1.72)
On the Points	13/31	14/31	5.65 (1.89)
Upward	11/31	14/31	5.87 (1.76)
Composition X	13/31	6/31	6.02 (172)
Frag. 2 for comp. VII	14/31	12/31	5.78 (1.92)
Mug 1	13/32	11/31	4.87 (1.78)
Mug 2	23/32	10/31	5.35 (1.80)
Mug 3	6/32	10/31	5.87 (1.51)
Mug 4	13/32	14/31	4.91 (1.39)
Mug 5	17/32	17/31	5.09 (1.88)
Mug 6	4/32	10/31	5.43 (1.64)
Mug 7	20/32	21/31	5.09 (1.73)