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Risk Related Behaviour under Different Ambient Scent Conditions

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Abstract

The article analyses the effect of two ambient scents (peppermint and vanilla) and their intensiveness on risk related behaviour that is expressed through selected decision making heuristics.
Purpose of the article: The purpose of this article is to identify the relationship of ambient scent type and intensiveness with risk related behaviour that is expressed through selected decision making heuristics.
Methodology/methods: 2×2 factorial experiment with control group was run. Ambient scent type (vanilla vs. peppermint) and intensiveness (8 (1mg) vs. 16 sprays (2mg) of scent concentrate in the same room) were manipulated as between subject variables. Risk aversion, effect of anchoring heuristic on bidding, and affect (risk and benefit) heuristics were tracked as dependent variables.
Scientific aim: To identify whether ambient scent type and intensiveness have effect on risk related behaviour.
Findings: Evidence suggests that there are effects of ambient scent on risk related behaviour, thus fulfilling the missing gap to relate ambient environment to decision making heuristics when risks are involved. However, not all heuristics were affected by experimental conditions. Subjects were bidding significantly higher amounts under low anchor conditions, when peppermint scent was around (if compared to vanilla group). Affect risk was perceived as lower in peppermint ambient scent conditions, if compared to the control group. Intensity of ambient scent also had influence on affect risk: subjects perceived less risk under high scent intensity conditions.
Conclusions: By manipulating ambient scent, marketers may reduce or increase consumers risk perception and behaviour and as a consequence influence their purchase decisions. Marketers could use peppermint scent in high intensiveness in the situations where they want consumers to undertake higher risks (expensive purchases, gambling, insurance), since stakes were higher under peppermint ambient scent condition, and risk was perceived as lower.

Keywords: ambient scent, decision making heuristics, risk aversion, anchoring, affect heuristic

JEL Classification: M31

Introduction

Focus of early research in consumer decision making was heavily concentrated on product characteristics that could be cognitively assessed: features, price, and package. However, the latest research puts a lot of basis for arguments that consumer decisions are not rational, since they are related to the contextual cues and are based on mental shortcuts without rational background. Deviations from rationality are especially evident in risk-related behaviour. When assessing risky choices, people fail to compute mathematical expressions of probabilities, moreover, they fail to understand that the law of big numbers does not apply for small samples (Tversky, Kahneman, 1974). Besides that, they rely on lucky chance of winning, without relying on mathematical chances, especially if their risk aversion is not deeply rooted. The tendency to overcome rational background and making decisions by relying on cognitively processed or subconscious selected external cues is explained by a number of decision making heuristics.

The underlying property of heuristic decision that it relies not on rational, but on contextual cues. Although scent is recognised as one of contextual cues, affecting consumer behaviour in the variety of ways, to our knowledge its effect on risk related decision making was omitted in the research. Scent's impact is explained through emotions and body states, whereas risky behaviour is also related to the same aspects of behaviour, thus the field for the enquiry is rich.

Common denominators (emotions, body states) allow making an assumption that behaviour when people have to assess risks and make choices under risk related conditions could be affected by scents as atmospheric stimuli. Thus, the purpose of this paper is to identify the relationship of ambient scents' type and intensiveness with decision making heuristics when risks are involved. Factorial experiment was performed to explore the relationship of the variables.

1. Theoretical background

1.1 Scent impact on human behaviour

Scents are recognised as one of the factors in consumer behaviour since the research of Laird in 1932, who has demonstrated that scented socks are purchased more frequently. The effect of scent is explained by a number of arguments.

Scents affect moods and emotions (see Hertz, Engen, 1996 for the review). Partially it is explained via pleasant or unpleasant associations and memories that are activated through olfactory system (Ackerman, 1996; Hertz, Engen, 1996). However, the ability of scent to evoke mood or emotion is not necessarily associated with particular objects, since scent in general are recognized as pleasant or unpleasant, holding different stimulating properties. Physiologically scent cannot be avoided while breathing. Even without cognitive awareness of scent it sends the message to the parts of a brain that are responsible for various reactions. Although the scent is not making a chemical reaction in human brain or body *per se*, it still influences humans physically (Wright, 1964), for example, causing facial muscle reaction towards a strong lemon scent. Effect of scents on physiological body states was demonstrated by Raudenbush *et al.* (2001), who proved that the presence of an ambient scent increased the performance of athletes in running speed, number of push-ups, and hand grip. In general, scents hold stimulating and calming properties. For example, peppermint is known as a scent that stimulates physiological reactions, whereas vanilla is a calming scent (Raudenbush *et al.,* 2001; de Wijk, Zijlstra, 2012).

These factors serve as mediators for various consumer behaviour, such as product assessments, time of stay in premises, purchases (Bone, Jantrania, 1992; Bone, Scholder, 1999). Further the research of scent effect has expanded into other areas, such as cleaning behaviour (Holland *et al.*, 2005), volunteering (Baron, Bronfen, 1994), driving (Baron, Kalsher, 1998), and gambling (Hirsch, 1995). In the same manner it will be explored further on what is the effect of scent on risk related behaviour.

1.2 Risk related behaviour and its relation to decision making heuristics

Starting from the works of H. A. Simon (1955), the concept of bounded rationality, or decision making heuristics was extensively developed by D. Kahneman and A. Tversky (1973, 1979, 1984, 2000). Now there is sufficient scholarly proof that the decision making process is not rationally framed, and so called "invisible hand" of hidden forces drives people decisions (Ariely, 2010). Not surprisingly, current research focuses on determination of factors that might explain the irrationality, making it at least partially predictable and manageable.

Current developments account an extensive list of recognisable irrational behaviours that are called heuristics (Wilke, Mata, 2012). A portion of them is related to human behaviour when risky decisions are involved. This area is especially interesting due to the proven fact that when people are selecting risky outcomes vs. non-risky ones, are involved in the

activities when risks have to be assessed (for example, gambling or insurance), or assess situations as risky vs. beneficial, their behaviours do not follow the patterns of rational choice based on mathematically calculated alternatives (Kahneman, Tversky, 2000; Finucane *et al.*, 2000). Risk related behaviour is understood as anchoring, risk aversion, and affect seeking heuristics in this article.

Anchoring heuristic (adjustment to a starting point) was first introduced by Kahnemann and Tversky in 1973. This heuristic is based on the anchor (number that is generally accepted as high or low) that is primed to the person prior to making the decision. It is assumed that the anchor (which is not related to the further object of decision) is affecting person's judgment as a basis for comparison, since the upcoming numeric decision will be seen as reasonable, depending to which anchor, higher or lower, it was compared (Epley, Gilovich, 2006). Anchoring heuristics is visible in negotiations, betting or auctions. When initially exposed to higher values, people assess proposals, probabilities to win, stakes attached differently. The same remains true in risk free situations, for example, when customers are exposed to the most expensive wine first, and later assess cheaper alternatives (still expensive ones) from the wine list as better deals (Barrows, 1996).

Risk aversion appears when individual is more willing to accept an option with more sure gain rather than to take a risk and accept an option with lower probability of occurrence, even if the potential gain is higher. Risk seeking is the opposite to risk aversion, explaining the propensity to accept more luring options with less sure probabilities of occurrence (Kahneman, Tverky, 1979).

Affect heuristic explains how individual is judging risk and benefit in a given potentially risky situation. The two dimensionality of affect was firstly discussed by Zajonc (1980) who argued that initial reaction to an action is not related only to the processed information, but rather to the emotions related to it (in this context, risks and benefits associated with an action). Two dimensions of affect heuristic, risk and benefit, are linked together in individual judgement (Finucane *et al.,* 2000). According to Damasio (1994) arguments, memories allow evoking positive or negative feelings related to risks, when situations to which risks refer are recognisable. When an object which was used to cause negative emotions appears as a possible future outcome, it is giving an alarm (negative emotion) to the person. Risks are assessed via this prism, since if underestimated, they are related to negative consequences and emotions.

1.3 Scent effect on risk related behaviour and hypotheses development

As demonstrated, scent effect on human behaviour is related to emotions, memory, and physiological body states that in turn cause different behaviours.

In a similar manner, decision making heuristics is also affected by subconscious judgments, which are related to sensory cortices (Bechara *et al.,* 2000). As somatic marker hypothesis claims, decisions cannot be made only on cognitive level, since they are also affected by the emotions that in turn are induced by external or internal stimuli (Damasio *et al.,* 1991). There is some evidence that body states (for example, being concentrated or relaxed) could influence decision making heuristics (Russel, 2009).

Common denominators (emotions, body states) allow making an assumption that decision making heuristics could be affected by atmospheric stimuli, that is, scents. Thus, the questions could be raised "Would individuals, exposed to different scents, demonstrate different risk related behaviour patterns?", "Would scent intensiveness, not only scent type, be influential on risk related behaviour?".

Although the direct links between risky and irrational behaviour and atmospheric stimuli are still difficult to establish, evidence of their effects is existent. Hirsch (1995) has experimented by scenting slotting machines and observing gambling behaviour. Gambling was far higher on scented machines in comparison to non-scented, when controlled for the week and day.

It can be assumed that under stimulation (ambient scent supplemented with a scent that has stimulating properties) people are more prone to risk related behaviour: assess risks as lower, see more benefits in risks, demonstrate more risk seeking, bid higher. The calming scent in the environment should induce the opposite behaviour, that is, less risk will be taken and perceived as valuable. This leads to hypothesis No. 1.

H1. Risk related behaviour will be more evident under scent with stimulating properties (peppermint conditions, if compared to control group and vanilla conditions).

Another property of odour is intensity level. Stimulating or calming properties of an odour should be expressed differently under the different levels of intensity, resulting in differences in risk related behaviour. The previously mentioned experiment of Hirsch (1985) manipulated between weekdays that were scented with different intensiveness, and allowed detecting that more concentrated environments led to higher amount of money that was put on stake.

That leads to H2 and H3.

H2. Risk related behaviour will be more evident under high scent intensiveness conditions.

H3. There will be interaction effect between scent type and intensiveness on risk related behaviour.

2. Methodology

Research aimed to examine the relationship of ambient scents' type and intensiveness with risk related decision making heuristics.

Factorial 2×2 experiment with control group was performed.

Independent variables were scent type and its intensiveness level. Vanilla and peppermint scents were selected as two scent types on the basis of different reported stimulating properties. Peppermint scent has stimulating effects on human body (Raudenbush *et al.,* 2001). Vanilla scent is relaxing (Warrenburg, 2005). Whereas peppermint has impact on alertness and increases physiological arousal, vanilla is has a reverse effect, since it decreases heart rate, leads to lower activity levels and slower response time to tasks (de Wijk, Zijlstra, 2012).

Intensiveness level is directly linked with scent concentration in the air, which is perceived as strength of scent. 8 sprays of respective pure concentrate (each equal to 0,125 mg, or 1 mg in total) were used to create conditions of low intensiveness, 16 sprays (each equal to 0,125 mg, or 2 mg in total) were used to create conditions of high intensiveness. Sprays were delivered from different corners of the room to assure equal distribution.

Control group did not have any exposures to scent; the tasks were performed in a regular classroom environment.

Dependent variables were 3 risk related decision making heuristics: risk aversion (risk seeking being the reverse of the continuum), anchoring, and affect heuristic (perception of risk and perception of benefit).

Risk aversion was measured as the risk avoiding option selection in 6 tasks. Tasks were adapted from Friedman and Savage (1948) and Kahneman and Tversky (1984). Each of the tasks had two possible options, asking for the preferred one. The options were manipulated as an outcomes of the choice, where one outcome was a sure gain, and another outcome was a risky choice with unsure, however, higher gain, or a direct question whether the respondent would be willing to be involved in a gamble or risky choice. The final measure was the number of selected risk averse (sure gain or non-involvement in risky choices) options.

Anchoring heuristics was measured as bidding performance after low and high anchor. Low anchor question was: "Do you know that on average people drink 10 litres of liquids per week?", and high anchor question was "Do you know that on average one person drinks 500 litres of tea per year?" After each question (low anchor was exposed first), participants had to perform bidding procedure, which was manipulated using Becker, DeGroot and Marschak mechanism (1964). Experiment participants were instructed that they were playing a game which essence was to purchase iPod against random computer bid, generated by Random Integer Generator (http://www.random.org/integers/). If computer bid for the session was higher than participant's, the transaction was not completed, if lower – transaction was completed. At the same time, they had to save money. Participants could bid from 1 to 50 euro for each out of 10 sessions after each anchor. The final result of the game, as instructed to participants, was the number of completed transactions and the remaining money from bids. The participant who performed bidding task the most successfully in each group was promised a book as a prize. In fact, their bidding averages for low and high anchor conditions were measured as the dependent variable.

Since affect heuristic is related to the balance of risks and benefits associated with potentially dangerous, however, possibly rewarding situation (Finucane *et al.,* 2000), affect heuristic was measured on the basis of Weber *et al.* (2002) instrument. It provides a number of situations that are generally perceived as risky (for example, "Disagreeing with an authority figure on a major issue."), and asks the respondent to assess the risk of the given situation, and the benefit of it in a 5 point Likert scale (no benefits/no risk and great benefits/great risk). The final measure was the average for risk and benefit evaluations separately for 10 given situations.

The instrument included questions for manipulation checks. Namely, respondents in experimental groups were asked do they feel a scent, and those, who responded positively, were asked to identify the scent, and rate the intensity of scent in 6 point scale. Such type of manipulation checks ask respondents to identify scent and intensiveness in a cognitive manner, whereas it is believed that scents can have effect on subconscious level, therefore the results were treated as additional insights, not damaging the experiment validity.

Demographic variables of participants were collected at the end of the procedure.

Respondents were drawn from homogeneous students' sample and randomly assigned to experimental and control groups. The experiment took place in

well ventilated 59 square meters computer classroom which allowed participants to complete computerized tasks in created conditions. Breaks between sessions for extensive ventilation were made. Unaware of the real goal of the experiments, students entered the computer room for the scheduled studies' activity, and were asked to play a bidding game and answer questions about risk perceptions on the computer.

In total, 93 participants (46 male, 47 female) participated in the experiment, 18–19 per condition. Participants were of 18–35 years.

3. Results

3.1 Results of main experiment

In order to check whether the means of dependent variables significantly differ when different scent on different intensiveness were present, factorial (two way) ANOVA was run for experimental conditions and control group. The results are presented in table 1.

As results indicate, significant effects of created conditions were detected for the biding under low anchor conditions (F(1)=6.072, p=0.016), and for the affect heuristics risk perception (F(1)=6.08, p=0.016). The former effect was detected under different scents, the latter was detected under different levels of intensity. The interaction effects were not monitored for any of the dependent variables.

Post hoc Tukey test results indicate that subjects were bidding significantly higher amounts under low anchoring condition when peppermint scent was present (M=26.789), if compared to vanilla (M=23.074) (p=0.037). Risk was perceived as higher under no scent conditions (control group) (M=3.52)

Table 1. ANOVA test results of between subject effects for decision making heuristics under different scent type and intensiveness conditions and control group.

Dependent variable	Scent type effect		Scent intensiveness effect		Scent and intensiveness interaction effect	
	F value	Significance level	F value	Significance level	F value	Significance level
Risk aversion	0.413	0.522	2.077	0.153	3.199	0.077
Bidding under low anchoring	6.072	0.016*	0.062	0.804	0.158	0.692
Bidding under high anchoring	1.511	0.222	1.213	0.274	1.045	0.309
Affect (risk perception)	1.264	0.264	6.080	0.016*	1.307	0.256
Affect (benefit perception)	3.408	0.068	0.017	0.895	0.039	0.844

**Difference is significant at p<0,05 level. Source: Authors' own study.*

Table 2. Mean differences among groups of different scent type on bidding under low anchoring conditions heuristics and significance of post hoc (Tukey) test.

Scent type	Mean of bids under low anchoring condition	Scent type	Mean of bids under low anchoring condition	Significance of post hoc test
No scent (control)	26.147	Peppermint	26.789	0.933
No scent (control)	26.147	Vanilla	23.074	0.204
Vanilla	23.074	Peppermint	26.789	0.037*

**Difference is significant at p<0,05 level. Source: Authors' own study.*

Table 3. Mean differences among groups of different scent intensiveness level on affect (risk perception) heuristics and significance of post hoc (Tukey) test.

Intensiveness level	Mean of risk perception	Intensiveness level	Mean of risk perception	Significance of post hoc test
No intensity (control)	3.521	Low intensity	3.411	0.725
No intensity (control)	3.521	High intensity	3.121	0.017*
Low intensity	3.411	High intensity	3.121	0.041*

**Difference is significant at p<0,05 level. Source: Authors' own study.*

and low intensity scent conditions (M=3.411), if compared to highly scented conditions (M=3.121), (p=0.017 and p=0.041 respectively), suggesting that highly scented environment might reduce risk perceptions. Results are provided in tables 2 and 3.

In addition, we have run t-tests for each dependent variable to contrast all experiment groups (scent type wise and intensiveness wise). Since t-test is more sensitive than ANOVA (although confidence with ANOVA is higher), it allowed us to detect one more difference among groups. Besides findings that were detected with ANOVA, t-tests showed that participants perceived situations as less risky in peppermint conditions (M=3.2), if compared to control group (M=3.521) and vanilla scent conditions (M=3.321). However, results were significant only when control and peppermint group were compared (p=0.022).

3.2 Manipulation checks

Perceptions of intensity differed in high vs. low intensity groups significantly. However, when results were broken by stent type, and differences in intensity perceptions were tested once again, it appeared that Vanilla scent group failed to achieve differences in intensity on cognitive level. Results are summarized in table 4.

Since the sample was small, it was manually checked how many correct scent identifications appeared in each group. None of the respondents identified peppermint in low intensity conditions. In high peppermint intensity conditions, 8 out of those who claimed they feel a scent identified peppermint correctly (assuming that both peppermint and mint are correct answers). In low intensity vanilla experimental group 3 people out of 18 were able to recognize the type of odour; in high intensity group 10 people out of 20 identified the type of odour correctly.

One of the explanations why subjects reported vanilla scent as more prevalent, if compared to peppermint, could be that peppermint is probably more usual scent to their nose. Mint or peppermint is a widely used and naturally growing herb in Lithuania, whereas vanilla is not. The usage of mint not only among ambient scents, but also among variety of products (tee, culinary, confectionary, cooks, toothpaste, chewing gum) is high. Vanilla (scent or extract) is not so widely used in pure condition, as it is too sharp, and is usually used for culinary and confectionary in a diluted manner. The proof that mint is more usual for respondents comes from the answers that they were able to detect it correctly more often, if compared to vanilla. Following Adaptation level theory (Helson, 1948), if the stimulus (scent in this case) is more usual in the surroundings, people cease to detect it cognitively.

The results should not suggest that manipulations were not sufficient. Every person might evaluate the intensity of odour and scent differently due to the differences in sensory perception (Duffee, 1968). Observations of cognitive reports on scents are considered to be additional insights to the experiment results, and not diminish the value of the experiment, since risky behaviour should be affected on subconscious level.

4. Discussions

The hypotheses were confirmed only partially. There were effects of scent and intensiveness separately on some heuristics, whereas other tracked heuristics remained unaffected. Still, the results are in line with expectations: peppermint, as alerting (stimulating) scent induces higher bets, if compared to vanilla odour; scented environments reduce risk perception.

The results should be treated giving regard to the limitations. The sample was rather small per condition. Only two types of scents were tested. The results could be affected by respondents' age group.

Table 4. Results of manipulations checks: cognitively evaluated scents and levels of intensity.

	Scent intensity	N	Mean	Levene's test of equality		t	df	Sig (2-tailed)
				F	p			
Overall experiment	Low	36	2.472	12.510	0.001	–3.702	72	0.000*
	High	38	4.184					
Peppermint	Low	18	1.500	3.014	0.092	–4.478	34	0.000*
	High	18	4.333					
Vanilla	Low	18	3.444	1.901	0.176	–0.991	36	0.328
	High	20	4.050					

**Difference is significant at p<0,05 level. Source: Authors' own study.*

Also, the experiment was performed on different time periods during the day, thus day time could affect the level of risk-related decisions and perceptions. Nevertheless, the results open the room for the enquiry across wide range of scent type and intensiveness conditions, different types of heuristics, various nationalities, age groups, and different genders. It would also be valuable to detect the break point of manipulated variables to induce reasonable behaviour changes of the participants.

5. Conclusions

This research was performed aiming to fulfil the gap in knowledge about ambient scent effects on consumer behaviour, namely, risk related behaviour. The experiment treated ambient scent on different levels of intensiveness as potentially valuable 'manipulator' of consumer risk related decision. Since a number of consumer decisions might seem risky for them variety of risks (financial, performance, technology, psychological, etc.), it is important to know what might affect the decision in risky situations.

Not all heuristics were equally expressed on different scent type and intensity conditions. It was detected that biding after lower anchor was significantly higher when peppermint condition was present, in comparison to vanilla scent prevalence. Risk was perceived as significantly lower in high intensity scent condition, if compared to non-scented or slightly scented environment.

Although effects were scattered (risk aversion, bidding under high anchor conditions, perceptions of risk benefit were not affected by the manipulated conditions), they allow making judgments that under scented conditions, especially in case when peppermint scent is prevalent (in comparison to vanilla or control group), the feeling of risk reduces, and people tend to bid higher. The results are in line with the reported characteristics of peppermint scent, since it increases alertness, captures attention, and speeds up physiological processes (Raudenbush *et al.,* 2001). All of them are related to risks, for example, gambling. Although increased physiological states, such as heart rate, are usually monitored as an outcome of gambling (Krueger *et al.,* 2005), not the cause of it, the processes might be interrelated.

Since individual risky behaviour and perception of risks were affected by ambient scent, marketers might use the scent in order to reduce consumers risk perceptions, and consequently influence their purchase decisions. Judging from the results of the experiment, peppermint and highly scented environments would be useful to induce consumer behaviour when potentially risky decisions are involved (purchase of the insurance, lottery tickets, gambling, or unsure and expensive purchases in general), since risks were perceived as lower and bids were higher in these environments.

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