The automatic nature of habitual goal-state activation in substance use; implications from a dyslexic population

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Abstract: Habitual goal-state activation may automatically elicit effects upon cognition, motivation, and emotion, through influence upon processes operating outside of awareness. For example, alcohol craving may be triggered by environmental cues. This experiment considered whether priming habitual goal-states would have similar effects for adult dyslexics and non-dyslexic controls. Dyslexia may be associated with automatisation deficits, which may affect habitual goal-state response. Dyslexics were compared to non-dyslexics on their reported alcohol cravings, following priming of one of two habitual goal-state conditions; studying or socialising. Within some of the exploratory analyses, a difference between dyslexics and non-dyslexics was demonstrated. However, the difference was not in the anticipated direction, as it was the dyslexics who were more affected by the primes. This suggests that dyslexics may be affected by primes differently to non-dyslexics. This research potentially helps understand the role that habitual goal-states play within substance use.

Keywords: Alcohol; Craving; Priming; Dyslexia;

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Certain goals or desired states can be activated automatically from environmental cues. These are learned sequences of behaviours that have become automatic in response to certain situations. Aarts and colleagues suggest that habits are a form of goal-dependent automatic behaviour, where the mere activation of a goal in the presence of a triggering stimulus is capable of automatically eliciting an action related to the goal's attainment (e.g., Aarts & Dijksterhuis, 2000a; Aarts, Verplanken, & van Knippenberg, 1998). This paper aims to explore the idea that such habitual goal-states can be automatically activated by comparing a control group to a group of participants that are potentially less able in automatic skill development, i.e. dyslexics. Substance use has been speculated to be a 'goal' that can be automatically activated when a participant encounters relevant stimuli (e.g. Sheeran *et al.*, 2005; see Klinger & Cox, 2004). This research normally takes the form of priming tasks and there is evidence to support such automatically activated behaviours (see Bargh and Chartrand, 1999). Therefore, by studying a dyslexic population, who may display a different pattern regarding automatisation (Nicolson & Fawcett, 2008) and learning (e.g. Kelly, Griffiths and Frith, 2002), compared to controls, it is possible to explore this aspect of substance use and goal activation in a novel way.

Developmental dyslexia (henceforth, dyslexia) is a condition which affects 5–17.5% of the population (Démonet, Taylor, & Chaix, 2004; Shaywitz, 1998). A number of theories have attempted to explain the nature of dyslexia. One of them is that dyslexia is a deficit regarding automatic learning (Nicolson and Fawcett, 2008). This view has received various levels of support in the literature. Dyslexia, as a learning deficit, is suggested to be the product of discrepancies in ability to convert a task, which is highly practised (a key concept in automaticity development), into an automatic process. This suggests that reading problems in dyslexia are the result of not being able to fully automate the decoding aspect of reading (cf. LaBerge and Samuels, 1974). For example, according to this view, dyslexics would have some difficulty with being able to automatise reading, as well as any other skill which can normally be automatised. If automatisation deficits are indeed present, then dyslexic participants could be used for the study of behaviours which are thought to operate automatically.

Automaticity would appear to be important in a broad range of cognitive processes. For example, it has been assumed that situations, goals, and actions are mentally represented and the perception of a situation is capable of automatically activating the *representation* of a goal and action. This is central to Bargh's (1996) model of the perception-behaviour link. Bargh found that mere priming alone could be enough to elicit a behaviour automatically. Behaviours can be non-consciously activated by the external environment and automatic perceptual activity itself can be enough to automatically induce a behaviour regardless of conscious awareness. Such a link between perception and behaviour can be described as automatic, as a situation can have an unintended, irrepressive, and passive influence on a behaviour (see Sheeran, Gollwitzer, & Bargh, 2013).

However, people are not just passively experiencing the environment. People also have goals and motivations, which, as well as the environment, influence behaviours. In this way, environmentally driven influences may be analogous to automatic processes. Bargh (1990) suggests that the environment itself is able to activate goals, which could themselves be mentally represented. If this is the case then, like other mentally represented characteristics, goals could become capable of being triggered by the environment, which in turn, could automatically elicit behaviour. This process has also been suggested to be extended to habits (see Aarts and Dijksterhuis, 2000a). The nature of alcohol abuse as a goal dependent automatic habit has been studied on numerous occasions and is the specific focus of this paper, due to its prevalence within the university student population this research adopts (e.g. Bewick, et al., 2008). Within the current experiment, university students' drinking habits were studied. Note that a university lifestyle has been found to be associated with excessive alcohol consumption (e.g. Gill, 2002). Evidence suggests that amongst university students, socialising is seen as a primary goal, which is heavily associated with drinking (e.g. Senchak, Leonard, & Green, 1998). Treise, Wohburg and Otnes (1999) observed that amongst university students the goal of socialising with friends leads to increased alcohol consumption, regardless of previous intention to drink. Such research supports the model of habits proposed by Aarts and colleagues and suggests that, for students, socialising is a motivating goal guiding alcohol consumption. Therefore the goal of socialising may automatically prime readiness to drink.

Sheeran *et al.* (2005) investigated whether drinking habits are goal-dependent within a cognitive-motivational model of habit processes. They measured readiness to drink after heavy (HD) and light drinkers (LD) were either primed with the goal of socialising or not. They observed an interaction between activation of the goal to socialise and the strength of drinking habits; drinking habits were only increased when the socialising goal was activated; when the unrelated goal was activated, habit was not affected. Socialising goal activation automatically led to an increase in alcohol use behaviour. This result is intriguing in light of the current paper; as previously discussed, dyslexics may be less developed in automatic skill development (see Nicolson and Fawcett, 2008).

Therefore this experiment aims to investigate whether the priming of socialising can automatically affect drinking behaviour (as measured in the current study using a craving measure), in a sample of undergraduate dyslexics and nondyslexic controls. The current study will provide novel results regarding the impact of priming/automatic processes, in relation to alcohol use (heavy vs. light drinkers), between dyslexic and nondyslexic participants.

METHOD

Participants and Design

One hundred undergraduate students at a UK university participated. Of these participants, 69 were non-dyslexic controls (13 males; mean age=21.52 years; sd=4.82) and 31 dyslexic (14 males; mean age=22.06 years; sd=7.18). The experiment had a 2(group: dyslexia vs. control) x2(prime: study vs. socialising) between-groups design. 15 dyslexic and 37 control participants were in the study prime group. Control participants were psychology undergraduates. Dyslexic participants were identified through the Swansea University Disability Office and had been professionally assessed by educational psychologists as such. There was a significant difference between dyslexics and controls in terms of their scores on the Adult Dyslexia Checklist (ADC; Vinegrad, 1994;$t(98)=10.181;p<.0005;d=2.06$), supporting the assumed dyslexia distinction.

Participants were assigned to HD or LD groups, based on their reported weekly alcohol use. The Department of Health guidelines were used for the basis of the distinction

(Shenker, Sorensen, & Davis, 2009). Accordingly, LD (N=34; Average unit count=3.27;sd=1.79) were defined as males drinking on average less than 6 alcohol units/week and females less than 4 alcohol units/week (one alcohol unit=10 ml. of pure alcohol) and HD (N=20; Average unit count=20.98;sd=6.25) as males consuming more than 21 units of alcohol/week and females more than 14 units/week. There was no difference in drinking behaviour between dyslexics and controls, on the four alcohol questions: how often they drank in the last two weeks ($t(98)=.376;p=.708;d=.08$), how many times they had been intoxicated in the last two weeks ($t(98)=.445;p=.657;d=.09$), when they last drank ($t(98)=.271;p=.787;d=.06$), and how many units they consumed last time they drank ($t(98)=.485;p=.269;d=.10$). These results suggest that the groups did not differ in terms of drinking behaviour, so any differences in reported urges/craving would be due to prime-type or dyslexia group.

Procedure and Materials

Participants completed the ADC (Vinegrad, 1994), and, randomly, one of the two questionnaires enquiring about either study habits or socialising behaviour. Note, we employed the ADC as an additional measure to ensure participants were in fact in dyslexic. It consists of a list of 20 'Yes' or 'No' questions. The ADC was on one A4 page, whilst the priming questionnaire was on a separate page. Participants completed the ADC first and were given as much time as they required, due to the potential problems that dyslexics may have with reading. Note, no dyslexic (or nondyslexic) participants had any problem with understanding the (very simple and brief) instructions.

The priming questionnaire was based upon Sheeran *et al.* (2005). The first half of the questionnaire focused on either studying or socialising with the aim of priming habitual goal-states. The questions in the two questionnaires were matched e.g. 'Do you socialise as much as you would like to?' or 'Do you study as much as you would like to?'. Seven questions were balanced with the word socialising and studying used in the respective versions of the questionnaires. The rest of the questionnaire focused on alcohol use and the same four questions were on each questionnaire, the purpose of which was to screen for drinking behaviour. Participants were then presented with a visual analogue scale and told to place an X on the line relating to their typical urge to drink alcohol, ranging from a weak urge to a strong urge. Therefore, a higher score indicated more craving. This scale was

measured in millimetres using a ruler, after the participant had completed the task and was the main dependent variable of the study.

Statistical Analysis

A 2(group: dyslexia vs. control) x2(prime: study vs. socialising) between-participants analysis of variance was performed. We then used t-tests to explore in more detail differences between dyslexics and controls. We also performed a 2(group: dyslexia vs. control) x2(prime: study vs. socialising) x2(alcohol use: HD vs. LD) between-participants analysis of variance, as a main test of our hypothesis, and further post hoc t-tests to explore particular differences between the dyslexics and controls.

RESULTS

We compared the differences for the urges/craving measure between the groups. A 2(group: dyslexia vs. control) x2(prime: study vs. socialising) between-participants ANOVA was performed, with the response on the craving scale as the DV. A significant main effect of dyslexia group was observed, $F(1,96)=4.802;p=.031;n^2=.048$, suggesting a difference in craving responses between dyslexics and controls. A significant main effect was also found for prime type, $F(1,96)=8.711;p=.004;n^2=.083$, suggesting that the prime did lead to a difference in reported craving. Socialising primes and studying primes led to different reported craving scores. The interaction effect was, however, not found to be significant, $F(1,96)=.950;p=.332;n^2=.010$. Figure 1 demonstrates the main effects.

The hypothesis regarding the role of priming in alcohol abuse within dyslexics and nondyslexics would have to be supported by a significant interaction effect. With the socialising cue, we hypothesised more craving for the controls, but no more for the dyslexics. For the studying cue, we hypothesised no craving for either the dyslexics or non-dyslexics. However, the interaction was not significant, so there are no statistical grounds for any further post hocs. Nevertheless, solely for exploratory purposes, it is instructive to consider the differences in craving in each between-participants condition separately.

A comparison of dyslexic (M=62.58;sd=35.01) and control (M=47.45;sd=29.15) participants showed a significant difference for the craving scale scores ($t(98)=-$

2.253;*p*=.026;*d*=.47). The means indicate that it was the dyslexic participants who reported increased craving, regardless of priming manipulation. This is an interesting finding: dyslexics reported more craving, whether they were primed for socialising or studying.

Regarding the group of participants who received the socialising questionnaire: In this case, a significant difference was found between dyslexic (n=16;M=74.94;sd=36.20) and control (n=32;M=54.34;sd=28.74) participants (*t*(46)=-2.144;*p*=.037;*d*=.63). This suggests that, when in the presence of socialising cues, dyslexics are more likely to report increases in alcohol craving.

Next, regarding participants who received the studying questionnaire: A significant difference was not found between dyslexics (n=15;M=49.40;sd=29.35) and controls (n=37;M=41.49;sd=28.55) for reported craving (*t*(50)=.898;*p*=.373;*d*=.27). This result suggests that both groups responded analogously with regard to alcohol craving, when presented with studying cues.

The previous findings are of some interest. We next performed the key analyses of Sheeran et al (2005); these researchers only found an effect of prime-type, if participants were already in possession of strong drinking behaviours. Therefore, if we take into consideration the HD/LD variable, one can examine the impact of possessing relatively strong drinking habits on reported craving, in relation to the two prime conditions. We first performed a 2(group: dyslexia vs. control) x2(prime: study vs. socialising) x2(alcohol use: HD vs. LD) between-participants ANOVA, with response on the craving scale as the dependent variable. The main effect of group (F(1,53)=1.461;p=.233;n^2=.031) was not significant. The main effects of prime (F(1,53)=8.201;p=.006;n^2=.151) and alcohol use (F(1,53)=9.122;p=.004;n^2=.165) were both significant. There was not a significant interaction between group, prime, and alcohol use, F(1,53)=1.628;p=.208;n^2=.034. This suggests that dyslexia did not affect performance on the craving scale. As before, the lack of interaction precludes further post hocs, but we report the relevant analyses as exploratory results. First, separate analyses were performed on dyslexic and control LDs. For both dyslexics (*t*(10)=-.569;*p*=.582;*d*=-1.49) and controls (*t*(20)=1.287;*p*=.213;*d*=.58), no significant results were observed between studying and socialising primes. Next separate analyses were performed on dyslexic and control HDs. For the dyslexic HD participants, a significant difference was

observed between studying (M=49.50;sd=9.19) and socialising (M=107.67;sd=20.21) primes (*t*(3)=3.676;*p*=.035;*d*=3.71). The control participants also now showed a significant difference between studying (M=47.0;sd=22.36) and socialising (M=86.40;sd=26.75) primes, (*t*(13)=3.023;*p*=.010;*d*=1.60). This indicates that the control participants are only affected by the prime-type, when they already possess strong drinking habits and are in the socialising group. This is a result analogous to Sheeran et al (2005). However, we have also replicated this result in dyslexics, contrary to expectation.

DISCUSSION

Given the absence of an interaction, no strong conclusion can be drawn. Nevertheless, we report certain interesting trends, with the intention of highlighting these as directions for future research. The results were consistent with those of Sheeran et al. (2005), as prime-type and reported alcohol use affected participants' responses. However, contrary to the hypothesis, dyslexia was not found to affect participants' responses, as revealed by the non-significant interaction. This finding may suggest that automaticity is not involved in priming or that dyslexics are not impaired in automaticity development. Our findings suggest that there were differences between the dyslexics and controls, in terms of craving. The dyslexics were primed regardless of prime-type, whereas the controls were only primed in the socialising condition, when participants were HD. However, the lack of an interaction means that a strong conclusion cannot be drawn and report these results only as trends in the data. The initial hypothesis for the study anticipated that the dyslexics would be less influenced by primes, whereas the controls would demonstrate a greater habitual goal-state effect. The post hoc results revealed an opposite pattern: that dyslexics were more readily primed than controls.

The result of a null dyslexia interaction may suggest that dyslexics responded the same as nondyslexic controls on this task. This lack of interaction could be explained in a number of ways. Firstly, the results may suggest that theories according to which goal states are automatically elicited in relevant situations may be flawed (e.g. Bargh and Chartrand, 1999). However, this is unlikely, as the results of the current experiment, in terms of the control participants, are consistent with Sheeran et al. (2005), supporting the view that goal states can be elicited automatically. Instead, it may be that the dyslexics are not impaired in

automatic skill development. The hypothesis that automatisation deficits exist in dyslexia is debated (see Beaton, 2002; Bishop, 2002). But, regardless of the viability of the hypothesis, it is possible that it does not apply to a population of dyslexics who attend university, potentially, as they have learnt to consciously compensate for any deficits. Perhaps such compensation strategies mean that their automaticity development skills are analogous with those of nondyslexics (cf. Pothos and Kirk, 2004). Nevertheless, the exploratory post hoc findings would suggest that dyslexics were primed regardless of HD/LD. This result is also contrary to the hypothesis that dyslexics would have a decreased susceptibility to the automatic nature of goal-states. These results, although only exploratory, may have implications for understanding habitual goal-states.

Control participants were found to be susceptible to priming, if they were HDs and the goal was drinking-related. When considering all types of drinking habits, for the controls, although in the expected direction, the results were not significant. This suggests that, for nondyslexic control participants, in order for the goal-related prime to affect behaviour, it is important that participants possess relatively strong drinking habits, as observed through the post hoc analyses (Sheeran, et al., 2005). This therefore implies that habituation of behaviours is a robust and unavoidable mechanism that guides behaviour. When a person engages often in a behaviour, it is expected that there will be an association between relevant cues and habit. These cues can subsequently automatically activate a habitual behaviour, potentially without the need for awareness. Clinical applications of such a notion would suggest that substance abusers may lose control over their habitual behaviours, should they be presented with cues related to substance abuse. It would therefore appear important to investigate ways of disrupting these associations and habits for the effective treatment of substance abusing individuals. Research on nonconscious processes has demonstrated significant potential in relation to health applications (cf. Sheeran, et al., 2013). Consideration of habitual goal-state activation should ultimately enhance the effectiveness of behaviour change efforts, which would in turn help alleviate behaviours deemed unhealthy, such as excessive alcohol use.

Clearly, the strength of the conclusions in this work is limited by the non-significance of some interactions, even though we think that the overall pattern of significant results and trends is informative enough. A major limitation in the study concerns population sampling,

which consisted entirely of university undergraduates. The validity of the present results will crucially depend on a suitable generalization with a more extensive sample. Moreover, the data collection procedure needs refinement in future extensions, notably in relation to the time of the day, which can impact on alcohol craving. Some participants may experience differing levels of sensitivity to drug reward and craving at different times throughout a day (Adan, 2013). Without controlling for such individual differences, it is possible that we allow excessive noise in the measurement of the dependent variable in this study, alcohol craving. Therefore, any replication or extension should be mindful of this important aspect of individual differences.

Overall, dyslexics were more readily primed than controls in post hoc analyses, unless reported alcohol use was taken into account; then dyslexics and controls were primed similarly, a result that was also implied from the interaction effects. The results indicate that controls are only primed by socialising cues, if they are themselves HDs. Dyslexics were primed regardless of HD/LD status, as shown in post hoc analyses. The results may reflect a dissociation between the automatic nature of habits and an awareness of the goal driving behaviour. The results were broadly consistent with the notion that drinking habits are a form of goal-dependent automatic behaviour. On the whole, participants' craving was greatest when the goal was related to drinking. The results suggest that perception of a goal, in this case socialising, is capable of automatically eliciting a behaviour, in this case increased craving (cf. Bargh and Chartrand, 1999). The present conclusions broadly align with those of Sheeran *et al.* (2005), but differences were found in the way that dyslexics are primed compared to controls. We highlight an interesting direction for further research, based on our observation of a trend suggesting that dyslexics are more readily primed for habitual goal-states than controls.

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