Illness Schema Activation and the Effects of Illness Seasonality on Accessibility of Implicit Illness-Related Information

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Abstract

Background. Research has demonstrated that implicit models of illness can be activated by priming techniques. **Purpose.** We tested the hypothesis that following a supraliminal? prime for the common cold, illness-related schematic information would be more accessible when the illness is 'in-season' than when it is 'out-of-season'. **Methods.** A 2(common cold vs. neutral prime) X 2(in-season vs. out-of-season) experimental design. Participants (*N*=85) were primed prior to completing a modified Stroop color-naming task to assess accessibility of implicit illness related information. **Results.** Moderated linear regression of response latency to common cold words on the independent variables revealed the predicted main effect of prime and significant two–way prime X seasonality interaction effect. Illness-related information was more accessible in participants primed when the common cold was in-season than when it was not in-season. **Conclusions.** Social-environment factors such as seasonality makes specific illness schema more salient and affects responses to illness-related stimuli.

Keywords: seasonal; accessibility; illness Schema; illness representations; priming; common cold

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The Common-Sense Model (CSM) of self regulation proposes that people possess schematically-organized implicit cognitive representations of health threats comprising information about illness such as symptoms, causes, label, duration, consequences and procedures for managing threat [1,2,3,4]. The proposed function of these stored knowledge structures is to activate a self-regulation process that might protect or restore a state of wellbeing [5]. The CSM proposes that the schematic representation is centrally activated by detection of deviations from the normal functioning self (i.e., experienced symptoms). The identification of illness and the initiation of self-management attempts follow from the search for illness relevant cognitive structures and the matching of the content of illness schema to the symptomatic experience.

Many studies have employed explicit self-report measures and used correlational methods to explore the relationship of illness representations to the self-management process [6,7,8]. One recent development is illness-perception profiling, in which multiple illness representation dimensions are considered simultaneously to produce ‘profiles’ of representations that reflect higher or lower illness threat and are associated with different illness outcomes. [9, 10,11]. Profiling is an important step in investigation of the contents of an illness schema that might be simultaneously activated during an illness episode. A further line of research concerns the processes involved in the activation of implicit illness representations. For example, studies have shown that both general and specific illness schemata can be activated in the absence of symptoms, using priming techniques that are either supraliminal (e.g., writing about a recent illness experience) [12,13] or subliminal (e.g., rapid presentation of illness-related stimuli in computer administered decision tasks beyond an individual’s awareness) [14]. Importantly, Henderson et al. [13] showed that priming increased the

accessibility of the primed illness (common cold or cardiovascular disease), without activating information related to non-primed illnesses. These data provide supporting evidence that illness schemata are specific to particular illnesses. The present study extends this line of research by examining the proposition that the accessibility of the schema for a particular illness might be influenced by the context in which activation occurs.

Since it is important to investigate priming effects in the context of an illness with which people have experience, so that a laboratory prime will activate an existing cognitive representation, the present studies were conducted in the context of the common cold, which was also the target illness in previous experiments [13, 14]. Although the principal route to illness schema activation is a bottom-up process by which symptom detection is matched to conceptual elements of the schema such as the disease label, the CSM also posits alternative top-down routes to risk perception [4]. Media images or stories, or observations of family members might also activate illness schema and consequent self-scrutiny [2,3,4]. In the instance of a high-incidence, relatively inconsequential illness such as the common cold, wherein sufferers remain largely functional and highly visible, activation by direct observation of people with illness in the social environment is also likely. Seasonal illnesses such as the common cold are also the target of television advertising and marketing campaigns to promote sales of remedies by for example, the placement of cold remedies next to a supermarket checkout. There is evidence that cold management strategies become encoded in common cold illness representations [14]. Since activation of one aspect of an illness schema will simultaneously activate component elements of that schema such as typical means to manage the illness, it follows that cues related to the typical management strategies (e.g., advertisements for common-cold remedies in the supermarket) may also activate the representation of a common cold. These considerations lead us to speculate that the variety of primes that might exist in the social environment when the illness is in-season would create a low-level schema activation that implies a state of perceptual readiness to detect and match

symptoms, when they occur, to the common-cold label. Following this line of reasoning, we speculated that the common-cold schema would be more accessible when activated by a laboratory prime delivered when the illness is ‘in-season’ than when it is ‘out-of-season’.

The Present Studies

First, we report a pilot study in which we aimed to validate our assumption that people associate, as a result of social experience, the winter months (when the common cold is ‘in-season’) with frequent colds relative to the summer months (when the common cold is ‘out-of-season’). Second, we conducted an experimental study in which participants tested either at the end of the winter or at the end of the summer were primed with the common cold in the laboratory using previously-validated supraliminal priming methods [13]. We tested participants’ accessibility of the common cold illness schema by measuring their response latency to illness-related words relative to neutral words matched for frequency and length in a modified Stroop color-naming task [12,13]. The Stroop task [15] capitalizes on interference in cognitive systems arising when asked to name the color in which a target word is presented. Latency in color naming illness-related words reflects the automatic interference of word meaning that will arise when the illness schema is highly accessible. We hypothesized that in line with previous research [13] we would obtain a main effect of illness prime on response latency to implicit illness-related information (common cold words in the Stroop task), and that we would obtain a significant interaction effect of illness prime and season on accessibility of common cold stimuli such that response latency to implicit illness-related information would be greater at the end of winter relative to the end of summer.

We expect the proposed research will make an original incremental advance on previous research on illness schema priming with important implications for theory and practice. In terms of theory, it tests the hypothesis that illness schema are sensitive to the context in which illness stimuli are processed by individuals. If an individual is presented with common-cold stimuli in a context in which they have previously associated with increased

prevalence and risk of that illness, we propose that they are more likely to be sensitive to that stimuli and the associated schema is more likely to be activated. Given research that has demonstrated an associative link between illness-related information and stored coping-related information [cite HP article here], we speculate that individuals may be more likely to seek out appropriate coping measures in the illness-sensitive period. Our research may have important implications for practice because medical professionals and health practitioners can target campaigns to raise people's awareness of particular illnesses and accompanying treatment or preventive strategies in contexts where individuals are most likely to be receptive e.g. advertisements for 'flu vaccination in the run-up to winter.

Study 1

Method

Participants were volunteers (N = 120, 28 men, 92 women, M age = 20.55, SD = 6.46) who took part in a cross-sectional questionnaire study. Participants were asked to rank order the twelve months of the year from January to December according to common cold incidence. Participants were instructed as follows: "We are interested in which months of the year you think people may have more colds in the UK. Please rank order the following list of months with the single month you believe people experience the MOST numbers of COLDS and 12 as the month you belief people experience the LEAST numbers of COLDS".

Results and Discussion

The median rank score for the six winter months was 3.98 while the median rank score for the six summer months was 9.03. A Wilcoxon signed-rank test indicated that the median rank difference between the two seasons was significantly different from zero (W (118) = 9.5, p < .0001), lending support to our hypothesis that people perceived the common cold to occur more frequently at the end of the winter than at the end of the summer. Therefore, at the end of winter we would expect to observe enhanced priming effects due to seasonal accessibility,

compared to the end of the summer, when the common cold has been neither prevalent nor salient for 6 months.

Study 2

Method

Design. We adopted a 2 (illness prime: common-cold prime vs. control) X 2 (in season: end of winter vs. out of season, end of summer) experimental design. Participants were recruited at either the end of winter or the end of summer and were randomly assigned to either an illness prime or control condition. Participant pool restrictions were employed to ensure that no participant took part in the study at both time points and identity details were also checked as additional verification. Simple randomization to prime or control conditions was applied at recruitment within each season by the use of sealed envelopes containing the prime or control materials.

Participants. In order to ensure that participants did not have an active cold schema representation due to current illness at time of testing, and were not inadvertently primed prior to study participation, it was important that they were illness free and naïve to the study purpose at recruitment. Participants volunteered to take part in a study of cognitive processes for course credit. Data for participants with a current cold, flu or hayfever were subsequently excluded in order to control for the effects of an active illness schema due to a current cold and control for effects of the illness itself on task performance. However, these exclusion criteria were established and applied after data collection, since to ask participants if they were currently suffering from a common cold may have primed the cold schema in all participants or alerted them to the purpose of the study. All participants were native English language speakers.

Materials. The experiment comprised: a) a supraliminal prime (common cold vs. control) derived from previous studies [10,11], b) a modified Stroop color naming task [15] comprising common cold vs. neutral words, c) a questionnaire and debrief.

Prime. The prime task was derived from previous studies [13]. In the experimental prime condition, participants were presented with the following text: "Please write a short narrative about your most recent common cold experience. Please think about how it felt to have the cold and what you did when you had the cold. You can be as descriptive and explanatory as you like". Participants assigned to the control condition received a control prime identical to the experimental prime in which the word 'shopping' was substituted for 'common cold'. Participant narratives were content-analyzed by the experimenter at the end of the experiment to ensure that participants had engaged in the prime task[1]. No participant data was excluded on the basis of the inspection of the narratives.

Stroop task. The Stroop task was controlled by an Apple Macintosh computer and presented on a 14-inch color monitor. The experiment was generated using the Superlab™ computer program. Participants made judgments regarding 60 target stimuli (30 cold related and 30 neutral). Ten common cold-related words (e.g. phlegm, mucus, sneezing) and ten neutral words (e.g. stairs, waves, amphibian) were each presented in random order in three colors: blue, green, and red [13]. Each word appeared eight millimeters high and was presented in the center of the screen. Each word remained on the screen until the participant responded [16]. A 160ms inter-stimulus interval was used because it is considered the most appropriate interval for good effect with least number of errors [15]. Latency in color naming was recorded via the participant pushing red, blue, and green color buttons on a keyboard and was measured in milliseconds from the presentation of the stimulus to the response. The number of correct responses was also logged. We employed cold and control word lists developed by Henderson et al. [13] who report a series of pilot studies to develop a list of 20 single words that were independently rated as 'very strongly associated with the common cold and no other illnesses

[1] While we conducted a content analysis of the scripts, the analysis was confined to compliance and did not evaluate time spent writing or length of the narratives or the specific detail provided. This precluded a potential moderation analysis to test whether effects were magnified or diminished as a consequence of engagement in the prime. We look to future investigations to examine this potential moderation hypothesis.

or conditions'. The common cold word list and neutral word list were matched for frequency in the English language and length using the CELEX database [18].

Procedure. Participants were shown into a testing cubicle and asked to sit at a desktop-mounted computer. The experimenter asked participants to complete a standard consent form and then explained the task. The researcher placed an instruction sheet containing either the experimental or control prime according to the assigned condition and a paper questionnaire face down on the desk next to the computer. The participant was told that after the researcher left the room, they were to turn over the top sheet of paper (the prime instructions) and complete the task precisely as described. Participants were instructed that they could take as long on this task as they wished. The instruction sheet for the experimental prime prompted participants to write a short narrative about their most recent experience with common cold, while the sheet for the control condition required participants to write a short narrative about their most recent shopping experience. After completing the priming task, participants were instructed to press a button on the computer to begin the modified Stroop task. Finally, participants were asked to complete a questionnaire comprising demographic questions and were asked if they were currently suffering from a common cold before being debriefed and thanked.

Results

Preliminary analyses. Data from participants who were subsequently found to be suffering from a current cold (N) or made greater than 6% errors in total (N) or whose mean response latency was two or more standard deviations above or below the mean (N) was removed from the data set. The final sample of 85 (28 men, 57 women) had a mean age of 25.27 years (SD = 10.69). Randomization checks showed that men and women were equally distributed across the two seasons (X^2 (1) = .49, p = .64) and across the prime and control conditions (X^2 (1) = .144, p = .16). However, a 2(common cold vs. neutral prime) X 2(in-season vs. out-of-season) ANOVA revealed a significant age difference between the two

seasons (F (1, 81) = 13.72, $p < 0.001$), a non-significant difference between prime conditions (F (1,81) = .520, p = .473), and a non-significant prime x season interaction (F (1, 81) = .500, p = .481). Randomization, even following the necessary post hoc data exclusions may thus be considered successful. While preliminary analyses showed no association of age with response latency, we nonetheless report an additional analysis in which age was covaried in order to rule out the possibility of systematic bias.

Response latency times to each word on the modified Stroop color-naming task were transformed using a natural logarithmic function because response latencies were not normally distributed [19]. The dependent variable was a relative measure calculated as the mean difference in the response latencies for the common cold-related words and the neutral words (i.e., neutral word mean latency subtracted from the common cold word mean latency) for each participant.

Effects of season and prime on response latency. Moderated linear regression was conducted to determine the role of season in moderating the effect of the prime on response latencies for common cold-related stimuli in the Stroop task. Response latency was regressed on prime and season at the first step and on the interaction of prime and season at the second step. There was a significant main effect for prime (β = .28, p = .009) that explained 6% of variance in response latency at the first step of the analysis (F (2,82) = 3.78, p = .027, R^2 = .06). The main effect of season did not reach significance (β = .07, p = .521). In the second step, the final equation (F (3,81) = 4.68, p = .005, R^2 = .12) revealed a significant prime x interaction effect (β = .26, p = .016) that explained a 6% increment in variation in response latency (ΔF = 6.02, p = .016, ΔR^2 = .06). The effect of prime also remained significant (β = .24, p = .026). When the analysis was re-run with age included as a covariate at the first step of the regression model, the effect of age was non-significant (β = -.007, p = .95, F (1,81) = .004, p = .951). The second step revealed the significant effect of prime (β = .28, p = .01, $\Delta F = 3.76$, $p = .028$) and a significant prime x season interaction effect (β = .25, p = .02, $\Delta F = 5.67$, p =

.02) in the third step. The final model explained 12% of variance in response latency as in the model without the covariate (F (4, 78) = 3.411, p = .013).

We decomposed the interaction using Aiken and West's [20] procedures. We computed simple slopes for the effect of season on Stroop response latencies for common cold-related stimuli at each of the two levels of prime (common-cold vs. control prime; Figure 1). In the control prime condition, seasonality had no significant effect on response latency on common cold-related stimuli in the Stroop task (β = .163, p = .250). However, the predictive validity of season on response latency was heightened when participants were primed with the common cold (β = .34, p = .027). These findings indicate that season enhances the effect of the cold prime on Stroop response latencies for common cold-related stimuli.

Discussion

The purpose of this study was to evaluate our hypothesis that seasonal context might influence the accessibility of an illness schema following a supraliminal prime for the illness. Results were in line with our hypotheses. A pilot study indicated that participants perceive and retrieve memories of people having colds in winter months, so that in our main study participants primed at the end of winter, or when colds have been 'in-season', demonstrated greater schema accessibility that interfered with color naming in a Stroop task, compared to those primed at the end of the summer, when common colds have been 'out-of-season'. We also obtained a significant main effect of prime, as anticipated. So long as people possess a knowledge structure for a particular illness, a prime for stimuli related to the illness will activate that knowledge for everyone.

We can speculate upon a number of potential implications for theorizing about negative and positive consequences of illness schema activation. If frequent exposure to illness primes in the environment increases accessibility of a particular illness label or *identity*, this will increase the chances of people rapidly detecting, labeling and acting to manage symptoms they experience. In the context of a rising pandemic, this might be effective and beneficial in

initiating management of spread of the illness or treatment, if available [22, 23]. However, increased accessibility of a particular schema may also increase the possibility of self-misdiagnosis of symptoms with similar characteristics to the accessible illness [4]. Relatedly, an accessible illness schema may lead the 'worried well' to match minor somatic signs of deviation from the normal self to the accessible schema [4,5,24, 25, 26] and conclude that they are ill.

Priming effects may also be relevant to promotion of positive management of diseases such as hayfever or asthma where prophylactic medication use is recommended. In these diseases, the illness schema and consequent self-management may not be activated until symptoms occur. Priming might activate the schema in the absence of symptoms and impact upon the timely use of preventive medications. Public media campaigns, such as the recent UK campaign "be clear on cancer" which aimed to increase early detection of lung cancer by encouraging people to seek medical examination for persistent coughs may also be interpreted within this framework. The campaign encouraged the matching of a particular symptom to the representation of lung cancer so that a subsequent cough might have more readily activated a lung cancer schema.

The present study utilized season as an indicator of likely exposure to common cold related information and confirmed that seasonality was strongly associated in peoples' minds with the relative prevalence of the illness. Contextual variables such as season are not elaborated within the CSM framework, or in explicit measures of illness perceptions [26]. Current findings suggest that it might be fruitful to consider season as a component of a cognitive representation of illness that functions to assist in the matching of symptoms to labels.

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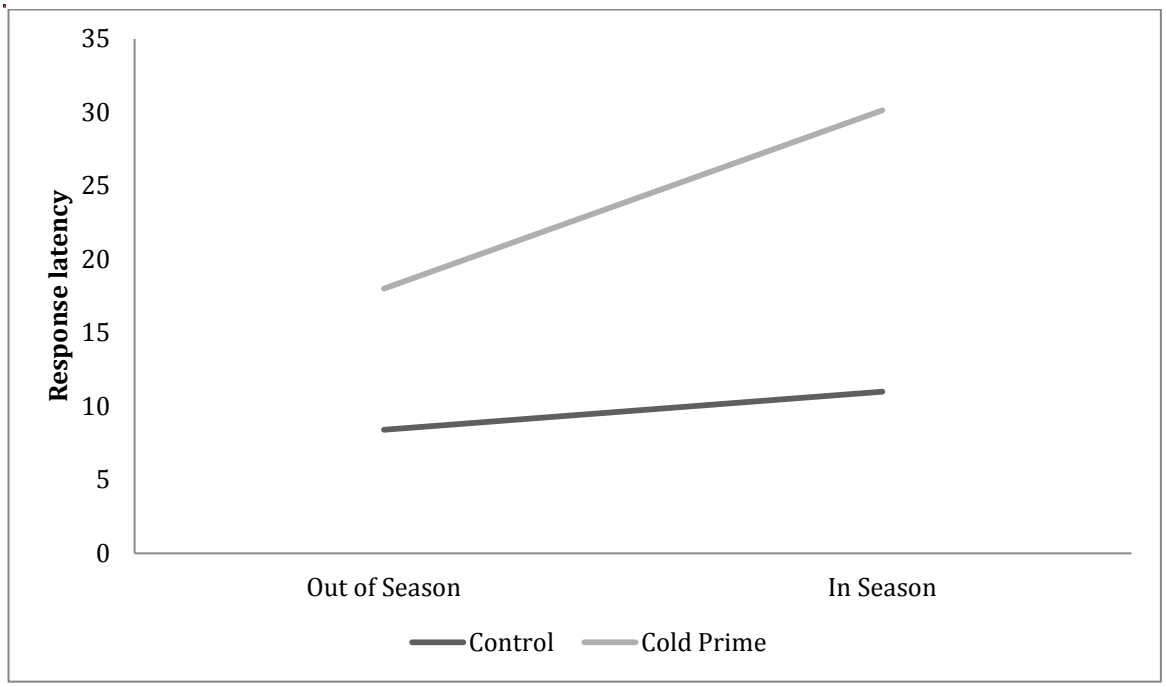
Figure 1.

Simple slopes for effect of seasonality on response latency in control condition and cold prime condition.



Note: Out of season refers to end of summer when the common cold is less accessible. In season refers to end of winter when the common cold is most accessible. Control vs. Cold prime refers to experimental prime condition.