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## Born lucky? The relationship between feeling lucky and month of birth

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### Abstract

Research suggests that season of birth is associated with several psychiatric and neurological disorders, and also with adult monoamine neurotransmitter turnover. Personality traits are modulated in part by neurotransmitters; and population studies show season of birth variations in adult personality traits such as novelty seeking. Also, neurotransmitters are involved in suicidal behavior; and studies have found season of birth associations with suicide methods. The present general population survey was conducted via the Internet, and involved 29,584 self-selected participants (51.6% women) from 67 countries. For those born in the UK (75.6%), we investigated the relationship between season of birth, the participant's belief in being a lucky person, and personality attributes related to this belief. In both genders and in all age groups, birth during the summer half-year was associated with significantly higher belief in being lucky, as compared to birth during the winter half-year, with a maximum around birth in May and a minimum around birth in November. Women scored significantly higher on listening to intuition and employing techniques to improve intuition, in perseverance, believing in positive long-term outcomes, and chatting to strangers. Men scored significantly higher on feeling lucky, not worrying or dwelling on failures, and expecting good things in life.

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## 1. Introduction

The study of how environmental factors may influence brain development is of considerable interest in neuropsychology. The seasonally varying climatic conditions in high latitudes—with summer–winter differences in the amount of photoperiod, temperature and snow coverage, and the resulting summer–winter differences in the prevalence of infectious agents and in our behavioral rhythms and habits like sleeping, eating, substance use, physical activity and social interactions—provide an opportunity to study the influence of these seasonal environmental variations on the early development of the brain. The individual's season of birth is an environmental variable that is proxy for the environmental influences on his or her development sometime during conception, gestation, or the perinatal period. Several of the associations with seasons of birth discussed below have been shown to be different for the two genders.

Season of birth is known to be associated with several psychiatric and neurological disorders (Torrey, Miller, Rawlings, & Yolken, 1997, 2000), including schizophrenia (Davies, Welham, Chant, Torrey, & McGrath, 2003; McGrath & Welham, 1999; Tochigi, Okazaki, Kato, & Sasaki, 2004), epilepsy (Procopio & Marriott, 1998) and brain tumors (Brenner et al., 2004). The most striking and well-documented empirical observation is an excess of winter–spring births among persons with schizophrenia as compared to those in the general population, both in the Northern hemisphere (Davies et al., 2003) and in the Southern hemisphere (McGrath & Welham, 1999).

The influence of season of birth on early brain development is further supported by studies on monoamine neurotransmitter turnover. In a clinical sample of adult patients with affective and anxiety disorders in Sweden, Chotai and Åsberg (1999) found variations according to the season of birth in the cerebrospinal fluid (CSF) levels of the dopamine metabolite homovanillic acid (HVA), the serotonin metabolite 5-hydroxyindoleacetic acid (5-HIAA), and the norepinephrine metabolite 3-methoxy-4-hydroxyphenylglycol (MHPG). The levels of HVA and MHPG showed a maximum for those born around the winter months November–December, and a minimum for those born around the summer months May–June (Chotai & Adolfsson, 2002; Chotai & Åsberg, 1999). Higher CSF levels of these metabolites are generally considered to be positively correlated with higher turnover of the corresponding neurotransmitters in the brain. A subsequent study on newborn infants born in the USA with age ranging from birth to about three months (Chotai, Murphy, & Constantino, *in press*) has similarly shown highest CSF levels of HVA and MHPG for those born during the winter months around November–December.

Thus, the season of birth effect on early brain development seems to be a significant factor among the complex myriad of processes modulating behavioral and personality characteristics in adulthood. In a register of all completed suicides during 42 years in a county of northern Sweden, those born during the spring months March–April were significantly more likely to have used hanging as the suicide method compared to those born during the rest of the year (Chotai & Adolfsson, 2002; Chotai & Salander Renberg, 2002). It is speculated in those studies that the lower serotonin turnover for those born during the spring months March–April, suggested by the earlier clinical study from southern Sweden (Chotai & Åsberg, 1999), may be statistically valid in the general population, thereby disposing suicidal individuals born during March–April to prefer hanging; low serotonin turnover is known to be a risk-modulating factor in suicidology (Mann, 2003).

An important aspect of individual personality differences in human circadian rhythms is the degree of morningness or eveningness. The circadian rhythm is known to be related to the individ-

ual's melatonin rhythm. Moreover, the melatonin and dopamine systems are considered to be mutually inhibitory paracrine signals for night and day, respectively. In a large sample of Italian and Spanish university students, it was found that those born during winter around December were significantly more morning types compared to the summer borns; also, women were more morning types than men only among the summer borns (Natale & Adan, 1999; Natale, Adan, & Chotai, 2002). These results have been suggested to be due to a likely season of birth variation in the melatonin and dopamine rhythms according to the season of birth.

Various personality dimensions have been shown to be modulated in part by different monoamine neurotransmitters (Ebstein, Benjamin, & Belmaker, 2000; Reif & Lesch, 2003; Van Gestel & Van Broeckhoven, 2003); low serotonin turnover is associated with impulsivity, aggressiveness, and anxiety-related traits like neuroticism and harm avoidance, whereas low dopamine turnover is associated with exploratory traits like novelty seeking. Therefore, a few studies have examined relationships between the season of birth and personality traits obtained from self-report questionnaires in general populations. Employing a seven-factor personality instrument called the Temperament and Character Inventory (TCI) (Cloninger, Svrakic, & Przybeck, 1993), Chotai, Forsgren, Nilsson, and Adolfsson (2001) found that the winter-borns had lower levels of the personality trait called novelty seeking compared to the summer-borns among adults. However, an opposite season of birth relationship with novelty seeking was found among adolescents (Chotai, Jonasson, Hägglöf, & Adolfsson, 2002). These results were replicated in a separate study including both adolescents and adults (Chotai, Lundberg, & Adolfsson, 2003). A recent study on the personality trait of sensation seeking found lower levels of sensation seeking among the winter-borns as compared to the summer-borns for adults above 45 years, but an opposite association for adults under 45 years (Joinson & Nettle, 2005).

In the present paper, we investigate the relationship between the season of birth and the individual's feeling of being lucky in life, which is measured as the participant's degree of agreement with the formulation "I tend to experience lucky breaks and be in the right place at the right time". Recent work on the subject of luck, done extensively by Wiseman (2003), has suggested that those who consider themselves as lucky persons differ from those who consider themselves as unlucky persons, in several personality dimensions measured by the five-factor personality inventory NEO FFI (Costa & McCrae, 1992). He found that lucky persons scored significantly higher on the Extraversion and Openness dimensions, and scored significantly lower on the Neuroticism dimension, compared to unlucky persons (Wiseman, 2003). Thus, the feeling of being a lucky person is a reflection of specific personality characteristics.

In traditional psychological research, belief in luck has been considered to be an irrational belief in an externally determined locus of control that may lead to detrimental effects on the individual's psychological well-being (Rotter, 1966; Seligman, 1975). However, recent research has shown that belief in good luck (Darke & Freedman, 1997; Day & Maltby, 2003) as well as self-enhancement or positive self-illusions and self-perceptions (Gana, Alaphilippe, & Bailly, 2004; Kwan, Love, Ryff, & Essex, 2003; Levy, Slade, & Kasl, 2002; Taylor & Brown, 1988, 1994) are associated with better psychological well-being and better health, partly as a result of optimism and the rejection of maladaptive irrational beliefs or superstitions (Day & Maltby, 2003). They may also be associated with lower autonomic responses to stress and with lower resting hypothalamic-pituitary-adrenocortical (HPA) axis levels (Taylor, Lerner, Sherman, Sage, & McDowell, 2003). Methods

that boost and foster personality traits which are positively associated with belief in good luck have been increasingly developed and advocated (Wiseman, 2003).

On the basis of previous work described above, it is predicted that the feeling of being lucky will be related to month of birth, with an excess of individuals considering themselves unlucky being born in the winter months.

## 2. Method

The Edinburgh International Science Festival (EISF) is an annual 12-day event aimed at the general public, and consists of many science-related talks, experiments and events. It is the United Kingdom's (UK) largest public festival of science and technology. The 2004 EISF took place between 3 and 14 April and, as part of this event, participants were invited to take part in a survey examining the possible relationship between luck and month of birth. The subjects responded anonymously to a list of 13 statements covering their belief in luck and their personality attributes via drop down menus. For each statement, the participant responded with either 5 (strongly agree), 4 (agree), 3 (uncertain), 2 (disagree), or 1 (strongly disagree). Each of the drop-down menus contained a default option stating 'Please select'. Participants were required to select a non-default response to each item before their responses could be submitted into the database. The participant also stated his or her gender, date of birth, and country of birth.

In all, 29,926 participants took part in the survey. Of these, 29,584 (98.9%) gave complete responses and were of age 11–65 years. This sample contained 51.6% women and 48.4% men. Most of the participants were born in the UK (75.6%), followed by the USA (6.2%), Hong Kong (1.9%), Ireland (1.8%), Estonia (1.4%), Canada (1.3%), Greece (1.2%), and 60 other countries (10.6%) from both the Hemispheres each contributing less than 1%. The age distribution was 7.4% of age 11–20 years, 40.9% of age 21–30 years, 29.5% of age 31–40 years, 13.5% of age 41–50 years, 7.5% of age 51–60 years, and 1.2% of age 61–65 years.

The data analyses of the study were performed by the statistical software package SPSS for Windows Version 11.0. All statistical tests were two-tailed.

## 3. Results

Table 1 gives the results of responses to the statements S1–S13 separately for men and women, and in relation to age. Men scored significantly higher on feeling lucky, not worrying about life, expecting good things in life, and not dwelling on failures. Women scored significantly higher on listening to gut feelings, employing techniques to boost intuition, trying despite low chances of success, expecting people to be nice, believing in positive long-term outcome of negative events, and chatting to strangers. Age showed a significant negative correlation with considering oneself lucky, expecting good things to happen in life, and trying in spite of slim chances of success. A large number of the remaining items showed a positive correlation with age.

The personality statement S1 ("I am a lucky person") was investigated in relation to the month of birth. Fig. 1(a) shows the curve of the mean response to this statement according to the month of birth for the 22,372 participants (50% women) born in the UK, and Fig. 1(b) shows the

Table 1  
Gender differences in responses to the personality statements in the total sample (15,263 women and 14,321 men)

Personality statement	Average differences			Pearson correlation with age	
	Women (mean)	Men (mean)	<i>p</i> -Value	Women	Men
Age (years)	33.58	33.15	0.003		
S1: In general, I am a lucky person: that is, I tend to experience lucky breaks and be in the right place at the right time	3.18	3.30	<0.001♂	0.00	−0.03‡
S2: I do not have a tendency to worry and feel anxious about life	2.85	3.10	<0.001♂	0.07‡	0.02
S3: I am open to new experiences, such as trying new types of food and drinks	4.19	4.17	0.223	0.03†	0.04‡
S4: I often listen to my gut feelings and hunches	4.07	3.88	<0.001♀	0.12‡	0.05‡
S5: I have tried some techniques to boost my intuition, such as meditation or just going to a quiet place	2.81	2.59	<0.001♀	0.12‡	0.05‡
S6: I nearly always expect good things to happen to me in the future	3.32	3.38	<0.001♂	−0.01	−0.03†
S7: I tend to try and get what I want from life, even if the chances of success seem slim	3.56	3.52	<0.001♀	−0.04‡	−0.07‡
S8: I expect most of the people I meet to be pleasant, friendly and helpful	3.84	3.66	<0.001♀	0.09‡	0.07‡
S9: I tend to look on the bright side of whatever happens to me	3.54	3.55	0.150	0.11‡	0.04‡
S10: I believe that even negative events will work out well for me in the long run	3.55	3.47	<0.001♀	0.02	0.00
S11: I don't tend to dwell on the things that haven't worked out well for me	3.12	3.16	0.005♂	0.12‡	0.09‡
S12: I try to learn from mistakes I have made in the past	4.18	4.19	0.281	0.01	−0.01
S13: I sometimes chat to strangers when standing in a supermarket or bank queue	3.65	3.07	<0.001♀	0.27‡	0.18‡

‡ *p* < 0.001.

† *p* < 0.01.

♀ Women significantly higher than men.

♂ Men significantly higher than women.

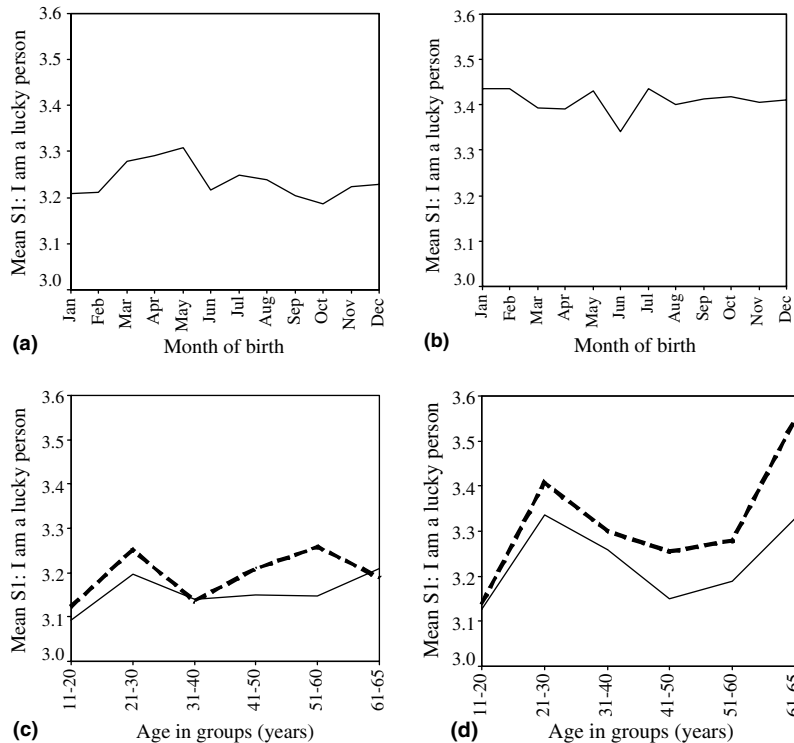


Fig. 1. (a) and (b) display the curves of the responses to the luck statement S1 according to the month of birth. (c) and (d) display such curves according to different age groups for the United Kingdom participants for the two genders separately; here, the broken line (---) denotes the curve for those born during the summer period March–August, and the unbroken line (—) denotes the curve for those born during the winter period September–February. (a) United Kingdom: both genders; (b) Other countries: both genders; (c) United Kingdom: women; (d) United Kingdom: men.

corresponding curve for the 7211 participants (56% women) born in all other countries (from both the Northern and Southern Hemispheres) pooled.

A nonlinear regression analysis fitting a cosine function (with one cycle per year) was performed similarly as by Chotai and Adolfsson (2002) and Chotai et al. (2003):

$$S1 = M + A \cos(0.5236t + F) + Bx + Dy,$$

where  $t$  denotes the month of birth (Jan = 1, Feb = 2, ..., Dec = 12),  $x$  denotes gender, and  $y$  denotes age in years. The coefficient of  $t$  is given by  $2\pi$  (one cycle) divided by the period of 12 months during a cycle, which gives  $2\pi/12 = 0.5236$ . The regression analysis estimates the parameters  $M$ ,  $A$  (amplitude),  $F$  (phase angle),  $B$ , and  $D$ . The cosine fit is considered to be statistically significant when the amplitude  $A$  is significantly different from zero.

These analyses gave a significant cosine amplitude only for the those born in the UK, as shown in Table 2. For women as well as for men, the maximum of the cosine curve (thereby indicating a higher degree of feeling lucky) was obtained for the birth month May, and the minimum for the birth month November. For these UK-borns, 50% of those born in May responded with “agreed” or “strongly agreed” to the luck statement S1, whereas the corresponding figure for those born in

Table 2

Results of regression analyses for fitting a cosine function to the curve for the personality statement S1 (“I am a lucky person”) according to the month of birth, adjusting for age and gender

Subsample	Sample size	Amplitude		Birth month <sup>†</sup> with maximum	Birth month <sup>†</sup> with minimum
		Estimate	<i>p</i> -Value		
<i>United Kingdom</i>					
Women	11,256	0.034	0.009	4.1 (May)	10.1 (November)
Men	11,116	0.041	0.002	4.7 (May)	10.7 (November)
Genders pooled	22,372	0.037	<0.001	4.4 (May)	10.4 (November)
<i>All other countries</i>					
Women	4007	0.037	0.084		
Men	3205	0.017	0.472		
Genders pooled	7212	0.013	0.412		

<sup>†</sup> Interval 0.0–1.0 denotes January, 1.0–2.0 denotes February, . . . , 11.0–12.0 denotes December.

November was 45%; this difference was statistically significant ( $p < 0.01$ ). For participants born outside the UK, the corresponding figures were 54% for those born in May, and 56% for those born in November.

For the remaining 12 statements S2–S13, a factor analysis with varimax rotation was run for those born in the UK, and this yielded three factors explaining totally 46% of the variance. A factor loading of at least 0.40 was used to include an item in a factor. High values of the first factor (explaining 26% of the variance) included S2, S6, S9, S10 and S11, and are indicative of the inverse of the Neuroticism personality trait. High values of the second factor (explaining 11% of the variance) included S3, S4, S5, S7 and S12, and are indicative of the Openness personality trait. High values of the third factor (explaining 9% of the variance) include S8 and S13, and are indicative of the Extraversion personality trait. The luck statement S1 was significantly positively correlated with each of these three factors (Pearson correlation coefficients 0.45, 0.29, and 0.19, respectively;  $p < 0.001$ ), consistent with the earlier results of Wiseman (2003).

Nonlinear regression analyses to fit a cosine curve to the month of birth variation in the mean levels of each of these three factors for the UK-borns, similar to that described for S1, yielded significant cosine amplitudes for each factor with maximum in May–June and minimum in November–December (results not shown).

#### 4. Discussion

We have thus shown, in a very large sample of participants born in the UK who responded to our Internet questionnaire regarding the feeling of being lucky in life and related personality attributes, that the summer-borns considered themselves significantly more lucky compared to the winter-borns. Also, the responses to the personality statements by the summer-borns indicated that they may have significantly less Neuroticism, more Openness and more Extraversion in their personality traits, as compared to the winter-borns. These season of birth associations were true for both the genders and in all the age groups, even though the two genders showed differences in

the mean levels of these self-reported personality attributes. Our study also confirms earlier results by Wiseman (2003), that the feeling of being a lucky person is correlated with less Neuroticism, more Openness and more Extraversion.

Different personality dimensions are believed to be modulated in part by different monoamine neurotransmitters. Anxiety-related traits of personality like high Neuroticism or harm avoidance are associated with low serotonergic turnover, and exploratory traits like high Extraversion or novelty seeking are associated with low dopaminergic turnover (Ebstein et al., 2000; Reif & Lesch, 2003; Van Gestel & Van Broeckhoven, 2003). Thus, our results here are in line with earlier research showing associations between the season of birth and monoamine neurotransmitter turnover on the one hand, and between the season of birth and personality dimensions on the other hand. Winter-borns have earlier been found to have low novelty seeking (Chotai et al., 2001, 2003) and high harm avoidance (Chotai et al., 2003), as well as high dopaminergic turnover (Chotai & Åsberg, 1999; Chotai et al., *in press*) and low serotonergic turnover (Chotai et al., *in press*), compared to the summer-borns. However, earlier studies have also found some evidence that the season of birth association with personality traits may be age-dependent (Chotai et al., 2002, 2003; Joinson & Nettle, 2005), indicating that the developmental dynamics of personality traits across the life-span are complex.

Although statistically significant associations have been obtained for the UK-borns between the season of birth and the feeling of being a lucky person, it is interesting to estimate the magnitude of this effect at the population level. Of the 11,672 participants born during the summer half-year March–August, 47.9% considered themselves as lucky persons (responded with “strongly agree” or “agree” to the luck statement S1). Of the 10,700 participants born during the winter half-year September–February, 44.9% considered themselves as lucky. If we remove the effect of summer birth in increasing the number of lucky persons (that is, if the summer-borns had the same percentage of lucky persons as the winter-borns), then it can be calculated from this that the group of all the lucky persons would then be reduced by 3.4% (which is called the attributable fraction or the aetiological fraction). At the population level, the percentage of lucky persons in our sample is 46.5%, but if the effect of summer birth in increasing the number of lucky persons was removed, this percentage would have been 44.9%.

Although the attributable fraction here is only 3.4%, it is comparable to attributable fractions obtained in studies investigating the effect of specific gene alleles on personality traits, where they are frequently less than 5% (Benjamin et al., 1996; Ebstein, Nemanov, Klotz, Gritzenko, & Belmaker, 1997; Noble et al., 1998). In other studies investigating the effect of the environmental variable season of birth on the personality trait of novelty seeking or in suicidology, the attributable fractions were around 5.3% (Chotai et al., 2001). Thus, the personality traits related to feeling lucky are likely modulated by a large number of genetical and environmental circumstances, each contributing with a small effect on its own.

A limitation of the present study is that it was conducted by anonymous responses through the Internet, so these self-selected participants do not represent a truly random sample. Another limitation is that we did not employ previously validated extensive instruments that would measure the participant's belief in luck or personality traits. This depends on the nature of the study, which required only a few minutes from participants.



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