Nicotine Replacement versus Acute Nicotine: Differences in cognitive tasks, social anxiety, stress and cravings.

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Abstract.

This study investigated the effects of nicotine levels on cigarette smoking and nicotine replacement on attention, memory and cravings in smokers. Another aim of the study is to examine if smokers or non-smokers exhibit higher levels of social anxiety and stress levels. Research has suggested that nicotine may enhance both short term memory and attention, but little research has been done on the different doses administered and its effect on cognitive tasks the current study had 103 participants (N=103). There where fifty two participants that took part in the cognitive tasks and completed the questionnaires on cravings, anxiety and stress, fifty two non-smokers also completed the questionnaires. The overall results showed that the higher the nicotine levels, the faster the reaction time was in the attention task. It showed no significant difference in memory or accuracy. With regards to cravings, a significant difference was seen between the acute administration and the nicotine replacement therapy. Nicotine replacement seemed to satisfy cravings better than the acute cigarette. The final part of the results showed that Non-smokers and smokers seen no significant difference between anxiety levels, stress levels and positive, negative moods, but when it came to social anxiety, a higher rate was found in non-smokers.

1. Introduction.

Though much is already known about the addictive properties of nicotine, much remains to be learned about nicotine replacement therapy (NRT) and the effects of both acute nicotine and nicotine replacement on cognitive processes. The purpose of this study is to determine does NRT have the same effect on cognitive processes as acute nicotine does, and which form of nicotine satisfies cravings the most. Another aim of this study is to discover weather smokers acquire a higher sense of social anxiety and perceived stress then non-smokers.

In Ireland cigarette smoking is responsible for over seven thousand deaths per annum. According to the health service executive of Ireland (2012) 21.1 percent of the Irish population smoked at least one or more per week. On their research the HSE noticed that smoking rates where the highest among young adults aged between eighteen and thirty four. A study done in 2000 noticed that a large number of adults who use tobacco reported that they smoked cigarettes as adolescents (Kandel & Chen, 2000). The study proves that nicotine addiction is hard to break as the pleasurable feeling it gives off is highly missed by the smoker. The aim to stop smoking over the year increased dramatically but is still one of the worst health issues in the world, contributing to five thousand two hundred deaths last year in Ireland (Department of health 2013), four hundred and forty thousand each year in America (Auguston et al,. 2008) and increasing cancer deaths worldwide every day. Overall in the twentieth century smoking caused one million deaths worldwide and if that trend continues to rise, the death toll for the twenty first century will be one billion. (World health organisation 2014).Health services for smokers cost approximately one billion per annum in Ireland. (Department of health and children 2009)

Adolescence is a time period of many changes combining physiological, psychological, emotional, intellectual and social status transitions. These behaviours will continue with you until adulthood and it's a main reason why a lot of adults find it had to break the habit of smoking (Flanagan et al, 2003). In the western world, tobacco is used a lot with adolescence which makes them dependant on the drug from a young age of 18. (Wittchen et al, 2008) This then turns the occasional smoker into that of a daily one. The use and misuse of substances among children and adolescents is an ongoing concern and an area that is highly interesting. The harmful effects of substance abuse in childhood and adolescence are extensive, negatively affecting personal health, emotional, psychological. (Kulig and committee on substance abuse 2005). The is a lot of attention and research done on why adolescence still continue to smoke when they know all the information on how bad it is for your health and well-being. A lot of attention is laid on the parents in causing or allowing the adolescent to smoke, other factors to be considered are socio-economic status and conflict between family members.

Information on what leads individual's to smoke can result in more effective ways to prevent smoking. Personality characteristics are part of gilberts (1995) situation-trait adaptive response model. Gilbert concluded that smoking was associated with all three personality characteristics measured by Eysenck's theory of personality: Extraversion (outgoing), neuroticism (depression and anxiety) and psychoticism (impulsiveness). The five personality factors central to this model is extraversion, agreeableness, conscientious, neuroticism and openness to experience. (John Srivastava 1999). Another theorist that proposed a different theory was Bandura. Bandura (1997) proposed the social learning theory. This theory emphasises the importance of observational learning and this suggests that smoking may be directly influenced by peer and family use. Peer groups play a crucial role in adolescent smoking behaviour (Brauman et al,. 1984) and smoking behaviour seems to be more evident among friends (Eiser et al., 1991). A study conducted in

2008 by tucker et al, showed that peer and family influences are risk factors for future smokers and that family and friends in pro social situations are significantly predicted to influence adolescence tobacco use. A large number of adults who use tobacco report that they smoked cigarettes as adolescents. (Kandel & Chen 2000).

Though much is known about the addictive properties of nicotine, much remains to be learned about nicotine replacement therapy and its effects on cognitive processes. Nicotine replacement therapy is now one of the most popular aids in smoking cessation. (Silagy, Lancaster and stead 2004). And it is believed to be an effective method in smoking cessation. (Cummings &Hyland 2005). A recent survey conducted in Britain on 11,400 English smokers found that 14% regularly used nicotine replacement therapy for temporary abstinence in situations. (Beard et al 2011). Nicotine replacement therapy is available in two forms, orally and through the blood stream. Skin patches where the first of the nicotine replacement products to enter the market. They deliver nicotine slowly into your body throughout the day. The other forms of nicotine replacement therapy are all orally administered. These are nicotine gum, nasal spray, inhalers, tablets and more recently new to the market electronic cigarettes. Nicotine nasal spray was shown to improve prospective Memory performance in smokers and abstinent smokers (Rusted& Trawley 2006)

The electronic cigarettes are battery powered devices that deliver vaporised nicotine, usually in propylene, glycol or glycerine. This device allows the physical sensation of smoking, while no tobacco or smoke are actually involved. E-cigarettes have been observed to reduce cravings/desire to smoke in non-frequent users (Bullen et al., 2010 & Dawkins et al 2012). E-cigarettes are shown to not be as effective as a tobacco cigarette for satisfying cravings. Although the electronic cigarette efficiency hasn't been empirically explored, researchers have shown that the quit rates are 29-49% higher. (Polosa et al 2011, Seigel, Tanwar & wood 2011).

1.1 Nicotine.

Nicotine is an acetylcholine agonist that binds and activates receptors called cholinergic receptors. When these receptors are activated neurotransmitters such as dopamine are released causing feelings of pleasure. Nicotine is a psycho stimulant that can be absorbed into the blood stream. After it crosses the blood brain barrier, it increases at the acetylcholine and dopamine receptors. (Greenhoff &Svenson 1989). Dopamine is another neurotransmitter which belongs to the catecholamine and phenethylamine families, dopamine plays an important role in brain and bodies of people and animals. Dopamine is responsible for transmitting signals from nerve cells to other nerve cells in the brain, it is also involved in the motor control, the release in hormones and the ability to experience pleasure and pain. Dopamine levels increase when nicotine is administered to the body, when this neurotransmitter is released it causes pleasure in the nucleus accumbens. This area is known as the pleasure pathway in the brain. Research has shown that rodents showed an increase in levels of endogenous opids in the nucleus accumbens and striatum after exposure to nicotine. (Phillips et al 2006).This is the reason why many smokers are addicted to nicotine as it provides a pleasurable experience each time a cigarette is taken. Nicotine has be proven to effect cognitive functions like memory and attention but results are mixed in the findings.

1.2 Memory and Attention.

Memory is a process that retains, retrieves and uses information that is no longer present. (Goldstein, 2011). It is suggested that memory has multiple structures including sensory memory, short term memory, long term memory and more recently working memory. Memory is involved in processing vast amounts of information. This happens in a three stage process. These processes are encoding, storage and retrieval. According to Atkinson and Shiffrins (1968) multi-story model, there are three memory stores or structures. Sensory memory, short term memory and long term memory. The sensory memory is where information is gained by the senses. It is responsible for processing and storing visual and auditory information. Short term memory is known as primary and active memory. It is the information we are currently thinking about. The long term memory receives information from the short term memory and puts it into storage. The information is either influenced by attention, the stimulus or information which is rehearsed in the short term memory and then sent to the long term memory until it needs to be returned to the short term memory. The multi-story modal has been highly influenced and is supported by neuropsychological research. (Nee & Jones 2011)

Although the multi-story model proposed by Atkinson and Shiffrin (1968) has been based on most memory theories. It has been highly criticised by Baddeley and Hitch (1974) for being too simple. Baddeley & Hitch suggested that short term memory is more complex then what the multi-story model suggests and they redefined short term memory as working memory. Baddeley (1991) noticed that this model did not account for the ability to perform two simultaneous tasks, for example reading whilst remembering certain numbers (Goldstein 2011). Baddeley (2000) proposed that working memory which is a short term storage system as well as having the ability to manipulate the information that is presented, which differs from short term memory as it only stores the information.

The multi-story model assumes that short and long term memory operate on a unitary base but much research disagrees with these statements. Eysenck (2005) noticed that short and long term memory stores did not run unitarily and that different complexes in the brain held different forms of short term memory. The multi-story model also assumes that information stored in short term memory is transferred to the long term store through rehearsal. Rehearsal is very limited in everyday life and cannot account for knowledge stored in the long term memory.

Working memory is the co-ordination, sustaining and the manipulation of information. It is fundamental to preforming cognitive tasks for everyday life. (Wager & Smith). Working memory is extremely important as it emphasises the role of cognition. The digit span tests are the most common way to research working memory. This usually entails the participant having to recall a list of numbers or words. Miller (1956) conducted a study called the magic number. He proposed that people would remember seven plus or minus two pieces of information each time they were asked. Research on working memory has found that subjects remember pictures and words together better than words alone. This supports the dual coding theory. (Milis et al 2004, Paivio 1971). The original working memory model of Baddeley and Hitch consisted of three components: Phonological loop, Central executive system and a visuospatial sketchpad. (Baddeley 2001).

The Phonological loop has two components, the phonological store and the articulatory rehearsal process. The phonological store acts as an inner ear remembering speech sounds in there temporal order, whilst the articulatory process acts as an outside voice and repeats the words on a loop to stop them from decaying. The phonological loop allows for better remembrance of items by repeating the information. Research done by Baddeley et al(1984) reported that the length of words affects memory, and that short words are recalled better then long words. This research shows that the phonological loop does in fact increase memory.

. The second component is the central executive, this is a system responsible for the control and regulation of cognitive processes. It is thought to be the most important of the three components .It has limited capacity and is responsible for shifting between tasks and retrieval strategies, coordination of the slave systems and for selective attention and inhibition. Central executive system divides attention between different tasks a person is doing, for example recalling visual information while listening to back ground music. The central executive will attempt to ignore the less important information (the music) and concentrate on the real information (the visual). Hulme & Tordoff studied acoustic music and word recall and their findings also supported baddeleys workings. Baddeley (1996) also used random generation digits and letters in studying the central executive, as this type of task requires attention. Participants were required to generate a random sequence of digits while holding one to eight digits in the short term memory. His experiment supposed the hypothesis that memory words increased and performance on generation of digits decreased.

The third component is visuo-spatial sketchpad. This area manages the visual and spatial information in the brain. Logie (1995) proposed that visual learning can be further subdivided into two categories. The visual cache which stores information about form and colour. The second category is the inner scribe. This deals with the spatial and movement information. It also rehearses information in the visual cache and transfers information to the central executive.

In 2000, Baddeley added a fourth component to the model. This was named the episodic buffer. This component has a limited capacity system that provides temporary storage information for a multiple of sources. It is assumed to be important for the chunking of information in the short term memory. (Miller 1956). The episodic buffer is also assumed to play an important role in immediate memory for prose, allowing densely amnesic patients with well –preserved intelligence or executive capacity's t show apparently normal, immediate although not delayed,

and recall of a prose passage that would far exceed the capacity of either of the subsidiary systems (Baddelery & Wilson 2002).

Attention allows selection and processing of a portion of perceptual information that is received and involves concentration of mental activities. (Matlin 2009). There are many theories of auditory and visual attention such as attenuation theory, filter theory, capacity modal, Deutsch and Deutsch, multimode theory, schema theories. The first main theory was that of Donald Broadbent (1958). Broadbent's bottleneck filter theory suggest information is allowed though the filter and other information is blocked out. The filter theory allowed other researchers to advance and put forward different theories of selective attention. Broadbent's theory suggested that we filter out information once it has passes our sensory levels. One of the inputs is then selected on the basis of its physical characteristics for further processing by being allowed pass through the filter. The filter is designed to prevent the information processing system from being overloaded. Broadbent's theory predicts that hearing your name when you are not paying attention should be impossible because unattended messages are filtered out before you process the meaning. Broadbent's experiments where highly criticised from researchers and the participants of the study. Treisman (1960) put forward another theory of selective attention whereby the filter system does not completely block out irrelevant stimuli, but weakens it. This theory lead to the Deutsch and Deutsch model. (1963). All these theories grew from Broadbent's original filter theory. Recent studies by lacher (2004) confirmed Broadbent's theory and demonstrated people cannot identify a usual stimulus unless they pay attention. Attention is necessary for short term memory so it does not become overloaded. In the more recent years, visual attention has become more researched over auditory attention. The main researchers in this area where Corbetta and Shulman (2002) and Posner (1990). Visual attention is thought to operate as a two stage process, voluntary and involuntary. Visual selective attention can be examined using the additional

singleton task (Theevwes, 1992, 1994), in which subjects search for a feature single target among a varying number of non-targets.

Studies done on memory and attention have had quite varied results. Levin et al. found a significant enhancement in working memory in rats due to nicotine exposure whereas jones et al (1992) did not support the findings. They studied the effects of acute nicotine on attention, information processing and short term memory on patients with Alzheimer's disease. The results showed no improvement in visual attention, reaction time and perception due to nicotine.

Attention research has also varied with regard to results, the effects of nicotine on visual tasks was studied by Roycroft et al in 2005. The results from the two experiments differed as in experiment one, the nicotine resulted in faster reaction time where as in experiment two the nicotine administration gave a greater percentage of fixations on the letters.

1.3 Social anxiety and perceived stress.

Anxiety is a general term for several disorders that cause nervousness, fear, apprehension and worrying. There are two types of anxiety, generalized anxiety disorder and social anxiety disorder. Social anxiety disorder is an anxiety disorder which is characterised by an intense fear of social situations generally due to a fear of being judged or evaluated negativity by other people. Social anxiety is defined by the DSM as a "persistent fear of one or more situations in which the person is exposed to an unfamiliar people or the scrutiny by others "(DSM-IV, 2013). Social anxiety can also be based on one specific fear. (Lietenberg 1990). In the United States of America, epidemiological studies have recently shown social anxiety disorder as the third largest psychological disorder after depression and alcoholism. Clinical studies have documented high

rates of cigarette smoking and nicotine dependence among treatment for depression, anxiety disorders and mental disorders. (Steinberg 2004). Stress plays an important role in smoking and relapse to smoking. Stress has been defined as "the negative feelings that occur when an individual feels unable to cope with the demands placed upon them by their environment" (Lazaruse, Folkman 1984). Adolescence is a time for a stress as a number of physiological, physical and sociological influences occur (Eugene 1990). According to Hajek, Taylor and Robbie (2010), many smokers believed that smoking helps to cope with stress and that stopping smoking would deprive them of a stress management tool. This study showed that smokers where completely dependent on nicotine and that it helps them cope with stress, but smoking cessation is associated with the lowering of stress. It is reasonable that nicotine withdrawal is stressful but the results of studies have shown mixed results. Manning et al (2005) studied the relationship between quitting smoking and perceived stress levels. The results showed that higher recorded stress levels where recorded when the smoking has not stopped and that lower perceived stress was noticed when the participant did not smoke. A heightened response to stress during withdrawal would be particularly problematic for smokers attempting to quit, since coping with negative emotions is frequently cited as a reason for smoking.

1.4 Cravings.

Although there is no direct definition for what a craving is, a craving is assumed to be an intense desire for a particular experience may it be food, drugs or alcohol. Cravings can be considered a motivation state to use a substance that has been previously associated with a pleasant emotional state. (Baker et al 1987, Franklin 2003). Cigarette cravings are one of the most often expressed

difficulties related to quitting smoking. The intensity of the cravings that the smoker experiences over the first few days are often what researchers use to predict success. (Ferguson, Shiffman & Gwaltney 2006). Heavier smokers have higher withdrawal symptoms then light smokers and it is often why the fail rate of heavy smoker's cessation is always very high. (Killen, Fortman, Telch & Newman 1988). Negative reinforcement modals such as bakers (2004) postulate that individuals that experience abstinence associated with craving secondary to withdrawal. This means that the craving is part of the withdrawal syndrome. This research is supported by an experiment conducted by Guthrie et al, 2004, who found that there was a direct correlation between nicotine and levels. There are two types of cravings a smoker can experience, background cravings and episodic cravings. (Ferguson et al 2004). Back ground cravings denotes a steady state of cravings where the individual is reminded constantly of a desire for a cigarette. The second craving is known as an episodic craving. This type of craving is controlled by a pharmacotherapy or a nicotine replacement therapy. An example of this would be a nicotine patch which is administered into the blood stream or orally used products like nicotine gum and the newest on the market, the electronic cigarette. These episodic cravings are triggered by an exposure associated with smoking. This could be a stress related work issue or something simple like a cigarette after a coffee.

The purpose of the present study is to examine the effect of different doses of nicotine by cigarette, nicotine gum and the electronic cigarette on memory recall and attention. Another aim of the study is to look at weather smokers or non-smokers exhibit higher levels of social anxiety and perceived stress. A twenty five word recall list will be used to examine short term memory, followed by a stroop task to test for attention. It is hypothesised that:

- There will be a significant difference between electronic cigarettes, nicotine gum and acute smoking on memory and attention
- Acute smoking users will show more anxiety, craving and stress then the replacement nicotine.
- Smokers will experience a higher level of social anxiety and perceived stress levels than non-smokers.

  On revision of previous research, it is clear that there are inconsistencies regarding the effects of nicotine on memory recall and attention tasks.

2. Methodology

2.1 Materials

For this research five questionnaires were administered to participants. The perceived stress scale (Cohen et al 1983), the Panas scale (Watson et al 1988), the interaction anxiousness scale (Leary 1983), the social avoidance and distress scale (Watson&friend 1969) and a ten item cravings questionnaire. Along with these five questionnaires there was also two twenty five word lists, two memory recall sheets, a packet of Nicotine gum, e-cigarettes, a packet of smokes, a pen, a computer, a stopwatch, questionnaires with printed consent forms.

Perceived Stress Scale (Appendix E)

The perceived stress scale is the most commonly used scale to measure perceived stress. The scale examines situations that stimulate stress to which people feel they have no control over their lives. The scale is a ten point questionnaire scale and the participant is asked to rate the statement from 0(which is never) to 4(very often). The questions on the scale talk about how people feel over a month in relation events problems and emotions. E.g." In the last month, how often have you felt things where piling up so high you could not cope?" (Cohen et al, 1983). This scale has great validity and a high rate of reliability. (A global measure of perceived stress 1983).

The Panas Scale (Appendix C)

This scale is used to measure positive and negative effects of how a person's been feeling over the past month. The scale consists of twenty words and the participant has to rate these statements from 1(very slightly/not at all) to 5 (extremely). The words on the scale describe different feelings and emotions.

Interaction Anxiousness Scale (IAS.)(Appendix B)

The IAS scale was developed to provide a measure of tendency to experience social anxiety. The scale is a questionnaire composed of fifteen items that measure social anxiety by providing positive and negative statements. "I get nervous when I speak to a member of authority". The scale is rated from a five point Likert scale ranging from 1(not at all a characteristic of me) to 5 (extremely a characteristic of me). The scale scores range from fifteen indicating low anxiety to 5 which indicates high level of social anxiousness. This scale has received widespread use and has a lot of data to support its reliability and validity. (Leary, 1993)

Social Avoidance and Distress Scale (SADS). (Appendix D)

This scale is a twenty-eight item scale used to measure various aspects of social anxiety and the avoidance of social situations. The statements are given and the participant is asked to decide whether each statement is true or false. Scores on the SADS have been shown to correlate with scores on the fear of negative evaluation scale.

Craving Scale. (Appendix F and G)

Is a craving questionnaire measuring your dependence and craving on nicotine. There is ten questions to be answered and the scale is rated from 1(strongly disagree) to 7 (strongly agree). The ten item questionnaire scale was taken from the original questionnaire on smoking urges. This questionnaire was developed by cox et al (2001). The questionnaire was used before and after the experiment took place.

E-prime was used to create a stroop processing task. This consisted of a series of coloured words which is printed in a colour not denoted by the name. E.g. the word yellow would be printed in red. There were four words in total yellow, blue, green and red. The participants were required to press the letter of the colour of the word on the keyboard. The participants could not move on to the next randomised word until the correct word was chosen. E-prime recorded the reaction times and the number or correct response when the correct colour was picked.

A record sheet and pen where given to write down the words they could recall. This was done twice. Once before the usage of nicotine and once after the nicotine had been administered. A stop watch was used to time the participants to complete the task. They were given ninety seconds to complete. This was to test short term memory and attention before and after administration of nicotine.

2.2 Participants

The study consisted of fifty two non-smokers and fifty two light smokers. The participants from different backgrounds took part, including family members, friends and undergraduate students who attended Dublin Business School. The participants were recruited by oral invitation and took part willingly. There were no payments or rewards given for the participation. The participants were questioned on arrival regarding the inclusion criteria. The criteria required them to be over the age of eighteen and to be that of a light smoker. All Participants needed to have not smoked for four to five hours previous. All participants were required to sign a consent form agreeing to take part in the experiment. The details of the experiment where explained in full to the participants before the experiment commenced. They were also informed that they were free to leave at any stage of the experiment, as each participant got a unique number. The participants were informed that the results would be kept for a year and if they had any questions about the experiment or the results were given a contact email.

2.3 Design

This is an experimental independent repeated measures design. The independent variable was the different doses of nicotine that where administered. These doses where given all orally and where given through a normal cigarette, nicotine gum and an electronic cigarette. The dependant variables where memory, attention, anxiety and cravings. The participants were randomly assigned to the nicotine groups. Participants of the both groups, non-smokers and smokers where required to complete the questionnaires on cravings anxiety and perceived stress. The scores from the memory and attention tasks where compared before and after the nicotine was administered.

2.4 Procedure.

As some of the participants where convince sample and where known to the researcher they were asked to take part verbally. A date and time was set and either took place in either Dublin Business School or a local household. The other participants were found through Dublin Business School. On arrival the participants were given a questionnaire booklet, pen and where told to sit at a table. The participants were given the questionnaire booklet which contained a demographic questionnaire, a cravings questionnaire, interaction anxiousness questionnaire, a social avoidances and distress scale questionnaire and two memory word recall sheets. The participants had to fill out a demographic questionnaire sheet to see if they were eligible for the experiment i.e. where all light smokers. These forms can be seen in the appendices. The experiment was explained in full about what the experiment entailed and that it was being conducted as part of a final year project. Participants were told that all results would remain anonymous and would only be used in this study. The experiment took approximately thirty minutes to complete. The researcher explained thoroughly too each participant what was need of them throughout the tasks. Once the questionnaire booklets where completed, the experiment commenced for light smokers. The experiment was conducted in groups of ones and twos. The participants were split up into three different groups. A cigarette group, a nicotine gum group and an electronic cigarette group. Each one of these groups used a different does of nicotine. The cigarettes used contained a nicotine dosage of 2.5mg, the nicotine gum contained a dosage of 4 mg and the electronic cigarette contained a dosage of 6mg. The experiment started off with the participant being given a list of twenty five words, the participant was given three minutes to remember as many words as possible from the list. A stopwatch was used to record the time of them memorising the words and also recalling the words. When the participants three minutes where up the participant has ninety seconds to recall as many words as possible. When the ninety

seconds was reached the participants were asked to put down their pens and move onto the next task. The next task was a stroop attention task, which was held on a computer. The participants were informed that a practice session would appear first and you would be told if the answer you selected was correct or incorrect. After the practice session, the real task started. Instructions where given on screen to press either the letter "R, Y, G, B" which stood for the colours red, yellow green and blue. These letters corresponded to the colour of the word and not the actual word on screen. The number of correct responses and reaction time was recorded and placed in a secure file on the computer. When that half of the experiment was completed, the participant was told go outside and either have a cigarette, a piece of nicotine gum or an electronic cigarette. In order for the nicotine gum to work, the gum needs to be chewed for minutes to get the full doe of nicotine. To keep track of the electronic cigarette ten puffs from it was the equivalent to smoking a normal cigarette. After the participants had finished there cigarette, nicotine gum or electronic cigarette the second part of the experiment commenced. This was a repeat of the first two tasks except this time nicotine had been administered to the participants. A new word list of twenty five word was given out and the participants had another three minutes to memorise as many words as they could, when the three minutes was up they had ninety seconds to recall as many words as they could. When that was over they started another stroop attention task. When they completed the attention task the experiment was over. A group of 52 no smokers also filled out the questionnaire booklets on social anxiety and perceived stress. These results will compare smokers and non-smokers on levels of social anxiety and perceived stress. Finally at the end of the experiment, participants were given the opportunity to ask any questions they had on the experiment. The data was all entered into SPSS and was safely stored on the researcher's laptop.

Results.

Demographic information.

Participants (103=N) took part in the study. 52 smokers and 52 non-smokers. The smokers that took part where either light smokers or people who had attempted smoking cessation, by means of nicotine replacement therapy. The participants were randomly assigned to three different groups where n=17, acute nicotine which was a normal cigarette, nicotine gum and an electronic cigarette. The other 52 participants where non-smokers and they took part in the questionnaire part of the experiment. Overall the participants included 50% females and 50% male and 50% smokers and 50% non-smokers.

Hypothesis one

In regards to the hypothesis which examined possible differences between the different nicotine doses in cigarettes, nicotine gum and the electronic cigarette on memory, attention and craving; a one way anova was conducted to test the differences in these three areas.

The results (see table 1) reported that in regards to reaction time via attention after nicotine was administered found there was a significant difference f (3,100) =3117.10, <0.5. In regards to cigarette smoking (m=929.73, SD=80.61), nicotine gum (m=805.7, SD=53.42) and electronic cigarettes (m=779.1, SD=44.78). This reports that higher reaction time did not depend on the amount of nicotine administered before the task. Post hoc analysis confirms that the differences where significant in reaction times with cigarettes (m=929.7, 95% CI(881.2-971.1), gum

(m=805.74,95%(778.2-833.2),<.05 and electronic cigarettes(m=779.1,95% CI(756.9-801.45)<..05. In regards to accuracy, there was no significant result found between different doses of nicotine and accuracy.

Table one

		Sum of Squares	df	Mean Square	F	Sig.
Reaction time after	Between Groups	18346958.088	3	6115652.696	3117.106	.000
	Within Groups	196196.483	100	1961.965		
	Total	18543154.571	103			

The results for memory showed that there was no significant difference between nicotine levels and memory. F (3,100) =310.4, <.05. Cigarettes (m=10.00, ds=1.76), gum (m=9.82, ds=1.62) and electronic cigarettes (m=9.83, SD=1.24). Post hoc analysis confirms that there is no 95%, CI (8.98-10.66) and electronic cigarettes (m=9.83, 95% CI (9.21-10.45).

Memory

	Type of nicotine	N	Subset for alpha = 0.05	
			1	2
Tukey HSD[a,b]	none	52	.2308	
	gum	17		9.8235
	e-cigarette	18		9.8333
	cigarette	17		10.0000
	Sig.		1.000	.985
Tukey B[a,b]	none	52	.2308	
	gum	17		9.8235
	e-cigarette	18		9.8333
	cigarette	17		10.0000

There was a significant difference in cravings between cigarettes and electronic cigarettes and cigarettes and nicotine gum but not between the two types of nicotine replacement. F (3,100) =132.9) p<0.5.Cigerattes found significant differences in satisfying cravings between cigarettes (m=37.88, SD=13.30) and electronic cigarettes (m=27.22, SD=10.16) and nicotine gum (m=30.94, SD=9.0) Post hoc analysis confirmed that the differences where significant between them. Cigarettes (m=37.88. 95%CI (31.04-44.72), nicotine gum (m=30.94), 95%CI (26.26-35.61) and electronic cigarettes (m=27.22, 95%CI (22.16-32.17). This shows that cigarette smoking satisfied cravings the most out of the three different groups.

Cravings after

	Type of nicotine	N	Subset for alpha = 0.05		
			1	2	3
Tukey HSD[a,b]	none	52	.5385		
	e-cigarette	18		27.2222	
	gum	17		30.9412	
	cigarette	17			37.8824
	Sig.		1.000	.461	1.000
Tukey B[a,b]	none	52	.5385		
	e-cigarette	18		27.2222	
	gum	17		30.9412	
	cigarette	17			37.8824

Hypothesis 2.

The other aim of the study was to see if there was a significant difference between smokers and non-smokers on stress levels, anxiety, positive and negative moods. The overall results from these four categories were mixed, with some being significant and others being not significant to test the differences in these variables an independent t-test was run.

Anxiety.

There was no significant difference in smokers (m=40.69, SD=6.96) and in non-smokers (m=40.38, SD=7.65). An independent t-test found that there was statically no significant difference between anxiety levels and smokers and non-smokers. T (102) =.214, p=.831. Therefore the null hypothesis cannot be rejected.

Positive and negative moods.

There was also no significant difference between smokers and non-smokers with positive and negative moods. Positive moods in smokers (m=30.38, SD=5.83) and in non-smokers was (m=32.90, SD=6.6) and negative moods in smokers was (m=24.32, SD=4.9) and in non-smokers was (m=22.29, SD=5.7).An independent samples t-test found that there statistically was no difference in anxiety levels versus smokers and non-smokers. Positive: T (101=-2.04, p=4.3) and negative T (101=1.92, p=.57). The null hypothesis can therefore not be rejected.

Stress.

There was no significant difference between smokers and non- smokers on overall stress levels. Smokers (m=18.75, SD=4.2) and non-smokers (m=17.77, SD=4.3). An independent samples t-test was conducted and found that here was statistically no significant difference between smokers versus non-smokers in stress levels. T (102) =1.16, 9=.248. The null hypothesis therefore cannot be rejected in this instance.

Social anxiety.

There was a significant difference between smokers and non-smokers on social anxiety levels, Smokers (m=39.96, SD=1.72) and non-smokers (m=42.11, SD=6.96.) An independent samples t-test was run and found that there was statistically a significant difference between smokers and non-smokers on social anxiety. Smokers exhibiting less social anxiety then non-smokers' (102) =-.2.17.p=.033. Therefore the null can be rejected.

Group Statistics

	smoker	N	Mean	Std. Deviation	Std. Error Mean
Anxiousnes s	yes	52	40.6923	6.96923	.96646
	no	52	40.3846	7.65725	1.06187
positive	yes	52	30.3846	5.83147	.80868
	no	51	32.9020	6.64004	.92979
negative	yes	52	24.3269	4.92979	.68364
	no	51	22.2941	5.74210	.80406
Stress	yes	52	18.75	4.233	.587
	no	52	17.77	4.382	.608
social anxiety	yes	52	39.9615	1.72594	.23935
	no	52	42.1154	6.96111	.96533

Discussion

The aim of this study was to examine the effects of acute nicotine and nicotine replacement therapy on cognitive tasks such as memory and attention and on which nicotine item satisfies cravings more. A secondary aim was to assess whether smokers or non-smokers exhibit higher levels of social anxiety, perceived stress and positive, negative moods. The area of memory and attention has received much interest in the past, however psychologists have had mixed results over the experiments used to test for attention.

Memory, Attention and cravings.

The principle question this study was devised to answer was does acute levels of nicotine differ from nicotine replacement levels on cognitive tasks and cravings. Previous research has shown that nicotine has improved memory but does it depend on the amount of nicotine administered was what the research wanted to find out Rusted and Steven (2006) found improvements and impairments on memory after nicotine exposure depending on the different task, but research by Kleyamp et al (2000) disagreed with rusted and Stevens research and found that nicotine had no effect on memory. The groups consisted of a cigarette group with a dosage of 2.5mg, a nicotine gum group with a dosage of 4mg and an electronic cigarette of 6mg.

A one way analysis of variance showed that there was no significant difference between the three nicotine groups and memory recall. $F(3,100) = 310.4$, $p = .05$. The hypothesis that the higher the nicotine level the more word recall would be enhanced was not supported in the aspect that word recall from each of the three groups where sufficiently the same no matter what the dose of nicotine was that was administered. When the mean number of correct recall words for each group where examined a slight difference can be seen between each group. Cigarettes (M=10.00,

SD=1.7), nicotine gum (M=9.8, SD=1.62) electronic cigarettes (M=8.05, SD=1.2). Although the word recall did improve and supported past research, it did not improve according to the nicotine administered.

Attention was split into two sections for the research, reaction time and accuracy. Studies on attention have shown mixed results on weather on not nicotine enhances attention or keeps it the same. Heisman et al (1994) was interested in the effects of cigarette smoking and nicotine administration on attention. The researchers concluded that nicotine produced some enhancements in tests of attention but in other cognitive tasks there was no enhancement. They concluded that abstinent smokers showed a higher rate of nicotine enhancement on selective and sustained attention. Reaction times showed a significant difference with regards to nicotine levels. The higher dose of nicotine which was administered through the electronic cigarette (M=779.18, SD=44.7) showed the fastest reaction time out of the three groups, with the nicotine gum coming second (M=805.7, SD=44.78) and the cigarette coming in last (M=929.73, SD=80.61).This supports the hypothesis and shows that the higher the nicotine level, the faster the participants reaction time will be. In regards to accuracy, there was no significant difference between the three groups. When the mean number of correct response where studied, a slight difference in groups could be seen. Group one (cigarettes) results showed a (m=.988, SD=0.10) Group 2(nicotine gum) showed results of (M=.9925, SD=.014) and group 3 showed results of (M=.9963, SD=.010). This shows that the nicotine levels does not have an effect on accuracy on attention tasks

Cravings.

Nicotine replacement therapy is used as a smoking cessation tool to stop the cravings of nicotine. The purpose of this research was to see if the nicotine replacement satisfied cravings as much as acute nicotine does. A Recent human laboratory study found that acute use of 42mg transdermal nicotine replacement reduced nicotine withdrawal symptoms but not in usual brands supply. (Tidy et al 2008). This study found that there was a difference between acute nicotine cravings and nicotine replacement cravings, but there was no difference in the two groups of nicotine replacement. Acute nicotine, i.e. the cigarette (M=37.88, SD=13.30) had the highest craving for a nicotine and the participants in this group where the least satisfied after the nicotine had been administered. The majority of the participants still felt they had a craving for nicotine after they had finished there cigarette. The second group, i.e. nicotine gum satisfied a lot of the participant's cravings. When the participants were absent from smoking they first rated there cravings on the ten item cravings questionnaire. On the first set of results nicotine gum scored (M=50.70, SD=8.80). After chewing on the gum for fifteen minutes, another cravings questionnaire was given to the participants. The cravings for nicotine had been reduced (m=30.94, SD=9.08). Electronic cigarettes satisfied the craving/desire for nicotine the most. Before the nicotine was administered the electronic cigarette desire/craving for nicotine was the highest. (M=52.94, SD=11.23). After the cravings dropped to (M=27.22, SD=10.16). This shows that the results where significant and that the null hypothesis was rejected. There could be many reasons different reasons why the electronic cigarette scored the highest on cravings, because the electronic cigarette contain more nicotine then the other two groups it was able to fulfil the craving fully unlike the other two groups. The cigarette group only contained a small dose of nicotine which although would satisfy a craving it would also entice you to have another smoke,

with the electronic cigarette and the nicotine gum the cravings where being fulfilled and enticing the participant to not feel the need to smoke again.

Hypothesis 2.

Hypothesis two was the secondary question that was asked in the research. The aim was to assess the difference between smokers and non-smokers on social anxiety, perceived stress and positive, negative moods. An independent t-test was conducted to analyse the four variables.

The hypothesis for anxiety was that smokers would exhibit more anxiety then non-smokers. The hypothesis was rejected as the results were insignificant an independent t-test yielded result showing a non-significant result. Smokers scored (M=40.69, SD6.96) and non-smokers scored (M=40.38, SD=7.65). Several authors (Breslau 1995, Gilbert 1995, Richardson & Stefanis 1995, and Spielberg 1986) had documented that anxiety and anxiety disorders occur more often in smokers then non-smokers, Farely & Lester (1995) disagreed with these findings and predicted that anxiety was common in all types of people. The findings of this research agreed with Farley & Lester's findings. Anxiety can be caused by environmental factors, medical factors, genetics, brain chemistry, substance abuse or a combination of all of these. Stress is the number one trigger for anxiety and everyone has in some point in their life been stressed out. Due to our current economic climate and socio economic status, a lot of people are anxious over money and jobs, this could be a main reason why both smokers and non-smokers are exhibiting the same anxiety levels.

Another part of the hypothesis was to test social anxiety on smokers and non-smokers, again an independent t-test was done and the results showed significant differences in smokers and non-smokers. Non-smokers scored higher (M=42.11, SD6.96) showing that they exhibit larger

amount of social anxiety then smokers do (M=39.96, SD=1.72). Many smokers believe that they feel less socially anxious when in a public place due to having a cigarette or absorbing the nicotine. Nicotine increases dopamine in the Brian, creating a pleasurable experience for the smoker, a sensation that non-smokers do not experience. Another reason this could be the case is that smokers face a distraction in social situations. The have something to focus on other than being in a group which takes there mind off the social situation and makes them feel more relaxed and less anxious. Grant et al (2008) stated that 48% of people have been diagnosed with social anxiety during their lifetime.

As some of the participants had attempted smoking cessation, the idea of researching the difference in positive and negative moods in smokers and non-smokers was interesting. When smokers abstain from smoking for a period of time, the distress does not instantly disappear. Withdrawal from smoking is often associated with negative moods. Studies have shown that a large number of people who smoke where either depressed or anxious before they started smoking, this could be due to greater nicotine dependence or greater nicotine withdrawal symptom like heightened negative moods. The results showed insignificant differences in positive and negative moods. Positive mood smokers scored (m=30.38, SD=5.83) against non-smokers (M=32.9, SD=6.6) while negative mood smokers scored (m=24.3, SD=4.9) against non-smokers (M=22.2, SD=5.7).

Stress is a state of mental or emotional strain or tension resulting from adverse or demanding circumstances. In this study it was hypothesised that smokers would exhibit higher levels of stress then non-smokers. After the t-test was run and the results found, it showed that although there was a slight difference in stress levels with smokers (M=18.75, SD=4.2) and non-smokers (M=17.77, SD=4.3) there was no significant difference in the findings. These results do not support past research from Parrott (2000). Parrott reported that adult smokers say cigarettes help them relax, but also report feeling more stressed then non-smokers. As some of the participants in the study had attempted smoking cessation this may have cause the low levels of stress in smokers. Parrott (2000) reported that smokers gradually become less stressed over time. This could be a factor as to why the results did not have a significant outcome.

Limitations

This study has a number of limitations that should be considered before attempting to replicate those findings. First, the sample size was relatively low (N=103). A bigger sample would provide more reliable results. Secondly the study consisted of mainly college students. The amount of nicotine administered could have a completely different effect on older people then it had on student participants. The next limitation we will discuss is the questionnaire part of the experiment. All data was collected using self-report questionnaires, the problem with self -report questionnaires is that some students may feel embarrassed to report certain factors of their lifestyle regarding anxiety, and stress levels. To better this if the study was going to be replicated, online questionnaires could be used to widen the findings and to keep the questionnaires that bit more anonymous. The last and final limitation would be to do with the

strop task. Each participant had two goes at the stroop task each with a practice session, if the study was to be replicated the second practice test would not need to be included as the participants already know how the task is going to commence which is just improving their reaction time for the second half of the task.

Implications

This study implicates that there is a difference between attention reaction time on nicotine levels on people aged 18-25. The study also has shown that non-smokers exhibit higher levels of social anxiety then smokers do. This research shows that the higher the nicotine levels are, the faster your reaction time will be.

Conclusion.

The current study had a number of aims to research. We wanted to investigate whether different levels of nicotine from acute cigarettes and nicotine replacement differed on cognitive tasks and cravings. The second aim of the study was to research weather smokers or non-smokers experience higher levels of anxiety, stress, positive and negative moods, social anxiety. We were able to show that the higher the nicotine level, the faster the participant's reaction time was. The results from the cravings questionnaire showed that there was a difference in cravings being satisfied between the cigarette and the nicotine replacement but not just between the nicotine replacements i.e. the nicotine gum and the electronic cigarette. In regards to smokers and non-smokers, although there was no significant difference in anxiety levels, stress levels and positive and negative moods.

References.

American Psychiatric Association (2013) the diagnostic and statistical manual of mental disorders (5th Ed) Arlington, VA. American psychiatric publishing.

Baddeley, A.D, Eysenck, M & Anderson M, C (2009) Memory, New York, Psychology Press.

Baddeley A, Lewis, V &Wallar G (1984) Exploring the articularury loop, the quarterly journal of experimental psychology, 36, 233-252

DOI: 10.1080/1464074808402157.

Baddeley, A, D & Hoth, G, J, Bower, G, A) (1974) Working Memory, The psychology of learning and motivation, 47-89. New York Academic Press.

Baddeley, A, Wilson, B & Kopelman, M (Eds) (2002) Handbook of memory disorders, 2nd edition, Chicester, w, Sussex, John Wiley & Sons ltd.

Baker, T.B, Morse, E & Sherman, J.E (2004). The role of attentional bias in substance abuse, Behavioural cognitive neuroscience review, 3:243-260

Beard, E, McNeil A,Aveyard P,Fidler J, Michie S, West R (2010). Use of nicotine replacement therapy for smoking reduction and during enforced temporary abstinence, a national survey of English smokers. Addiction 2011, 106(1) 197-204.

Brauman, E, Fisher, L.A, Bryan, E.S & Chenweth, R.L (1984) Antecedents, subjective expected utility and behaviour. A panel study of adolescent cigarette smoking. Addictive Behaviours 9(2) 121-136.

Broadbent, D, E (1958) the selective nature of learning. Perception and communication. 340.244.267. DOI: 10.1037/10037-010.

Bullen, C, McRobbie, H, Thornley, S, Glover M, Lin R, Laugesen M- Effect if an electronic nicotine delivery device on desire to smoke and withdrawal, user preferences and nicotine delivery randomised cross-over trial.

Carter BL, Lam CY, Robinson JD. Real Time craving and mood assessments before and after smoking. (2005)

Chilcoat.H, D & Breslau (1999) Pathways from ADHD to early drug use, Journal of the American academy of child adolescent psychiatry. 38(11) 1347-1354.

Coulson, N.S, Eiser, C & Eiser J, R (1997). Diet, smoking and exercise interrelationships between adolescent's health behaviour, child: care, health and development 23(3), 207-216.

Cummings, K & Hyland, A (2005) Impact of nicotine replacement therapy on smoking behaviour. Annual review of Public health, 26(1) 583-599.

Dawkins, C, Turner, J, Hasna S and Soar, K, (2012) the electronic cigarette, effects on desire to smoke withdrawal symptoms and cognition. Addictive. Doi:10.1016/j.addbeh.2012.03.2004/

Deganhardt L, Hall W, Lynskey M: Alcohol, Cannabis and tobacco use among Australians. A comparison of their associations with other drug use and use disorders, affective, anxiety disorders and psychosis. Addiction. 2001, 96 1603-1614

Department of health, social services and public safety, Northern Ireland (2013). Annual statistics on smoking cessation services in Northern Ireland.

Eugene A, L (1990) Childhood stress, stress in child and adolescence, New York, John Wiley and Sons ltd.

Farley,J & Lester, D (1995) Smoking and trait anxiety, psychological reports.

Ferguson, S, G, Shiffman, S & Gwaltney C.J (2006) Does reducing the withdrawal severity mediate nicotine patch efficiency. A randomised clinical trial. Journal of consulting and clinical psychology. 74(6), 1153-1161

DOI:10.1037/1022-006x.74.6.1153

Ferguson, S, G, Shiffman, S (2009). The relevance and treatment of cue induced cravings in tobacco dependence. Journal of substance abuse treatment. 36,235-243

DOI:10.1016/j.jsat.2008.06.005.

Fleming, S, E, Lombardo, T, W: Effects of cigarette smoking on phobic anxiety. Addict Behaviour. (1987), 12:195-198

Flanagan E, Bedford D, O'Farrell A, Browne C, Howell F. Smoking, Alcohol and illicit drug use among young people in a health board region in 1997 and 2002: A comparative study.

Gehricke JG, Loughlin SE, and Whalen CK: Smoking to self-medicate attentional and emotional functions.

Gilbert D, G, Gilbert B, O: Personality, Psychopathology and nicotine response as mediators of the genetics of smoking. Behavioural Genetics. (1995).25:133-147

Hajek, P, Taylor, T & McRobbie, H (2010) the effect of stopping smoking on perceived stress levels. Addiction. 105(8) 1466-1471.

Holme, C & Torduff, U, (1989) Working memory development: The effects of speech rate, word length and acoustic similarity on serial recall. Journal of experimental psychology, 47(1) 72-87.

Javik ME, Caskey NH, Rose.JE, Herskovic JE, Sadeghpor M (1989). Anxiolytic effects of smoking associated with four stressors. Addict behaviour.

Johnstown, L,D, O'Malley P,M, Bachman J,G, Schulenburg J,E ; Smoking continues gradual decline among US teens, smokeless tobacco threatens a comeback. Ann Arbour, MI; University of Michigan news service (2009)

Kessler, R, C, Ruscio A.M, Shear, K &Wittchen H.U (2010). Epidemiology of anxiety disorders in behavioural neurobiology of anxiety and its treatment. P21-35. Springer berlin Heidelberg.

Kozlowski, L.T, Gioviono G, A, Edward B, Difranza J, Foulds J, Hurt R, (2007). Advice on using over the counter nicotine replacement therapy-patch, gum or lozenge to quit smoking. Addict Behaviour 2007: 32:2140-50.

Lacher, J, Foster, K & Ruthruff, E (2004) Fort-five years after Broadbent (1958) still no identification without attention. Psychological review, 111,880-913.

DOI:10.1037/0033-295x.111.4.880

Lazarus R.S &Folkman, S (1984) Stress, appraisal and coping. New York, Springer-verlog.

Leitenberg, H (Ed) (1990) Handbook of social and evaluation anxiety. New York, Plenum

ISBN: 9780306434389.

Logie, R.H (1995) Visuo-Spatial working memory. Psychology Press.

Manning,B,K, Cathy D, Harris K, Mayo, M.S and Ahluwalia J.S(2005) Stress and quitting among African American smokers. Journal of behaviour medicine, 28(4) 325-333.

Matlin, M, W (2009) Cognitive psychology (7th edition). Hoboken: John Wiley & Sons ltd.

McGee R, Williams S: Predicators of persistent smoking and quitting among woman smokers. Addict behaviours. (2006)

Miller, G, A (1956) the magical number seven plus/minus two: some limits on our capacity for processing information. Psychological review, 63(2) 81-97

DOI: 10.1037/h0043158.

Pavio, A (1971) Imagery and verbal processes. New York, Holt, Rhinehart and Winston.

Polsa, R, Caponnetto, P, Morjaria, J.B, Papale, G, Campagna D &Russo, C (2011). Effect of an electronic nicotine delivery device (e-cigarette) on smoking reduction and cessation: a prospective 6 month pilot study. BMC, Public health, 11,786

Rusted, JM, Trawley, S, Kettle G, Walker, H (In press). Nicotine improves memory for delayed intentions, Psychopharmacology.

Rusted, J& Trawley, S. (2006) Comparable effects of nicotine in smokers and non- smokers on a memory task. Neuropsychpharacology.

Stead, L.F, Perera, R, Bullen, C, Mant, Lancaster, T (2008) Nicotine replacement therapy for smoking cessation. Cochrane data base system rev 2008

Steinberg,M L, Williams ,J,M, Ziedonis DM, Financial implications of cigarette smoking among individuals with schizophrenia, Tab control.(2004),13,206.

Siegal, M.B, Tanwar, K.LO, Wood, K.S (2011).Electronic cigarettes as a cessation tool: Results from online survey. American Journal of preventive medicine, 40,472-475.

Theeuwes,J,Stigchel,S.V,Beloplotsky,V,A, Peters,C.P, Wijen,G.J, Meeter,M.(1992) The limits of top down control of visual attention.

Treisman, A (1964) Monitoring and storage of irrelevant messages in selective attention. Journal of verbal and verbal behaviour 3,449-459. DOI:http:dxdoi.org/10.1016/5022-5371 (64)80015-3.

Wager, D, T, Smith, E, E, Neuroimaging studies of working memory: A meta-analysis

World health Organisation (2013) Guidelines for controlling and monitoring the tobacco epidemic. World health organisation.

Appendices

Appendix A

Consent Form

Dear participant:

I would like to enlist your help. I am an undergraduate student in psychology at Dublin Business School. I am conducting an experiment on nicotine replacement and acute nicotine on memory, attention, anxiety, perceived stress and cravings on occasional smokers as part of my research Project. The experiment will require you to take part in a nicotine experiment involving either electronic cigarettes, nicotine gum or regular smokes. The experiment will take approximately 30 minutes to complete. Your data will be kept anonymous and it will be unidentified results, therefore you will be unable to remove them once the experiment is complete. Should this study go well the information and results may be published or presented to organisations or at the student congress. You have the right to withdraw from the study at any time and your help with this research is strictly voluntary. If you are in agreement with the following study, please sign your name below. If you would like to know the results of the experiment or have any queries regarding the experiment you can contact me on

Many thanks

Lauren O'Reilly.

Appendix B

Interaction Anxiousness Scale

(Leary, 1983)

Indicate how characteristic each of the following statements is of you according to the following scale:

1 = Not at all characteristic of me.
2 = Slightly characteristic of me.
3 = Moderately characteristic of me.
4 = Very characteristic of me.
5 = Extremely characteristic of me.

_____ 1. I often feel nervous even in casual get-togethers.

_____ 2. I usually feel comfortable when I'm in a group of people I don't know.

_____ 3. I am usually at ease when speaking to a member of the other sex.

_____ 4. I get nervous when I must talk to a teacher or a boss.

_____ 5. Parties often make me feel anxious and uncomfortable.

_____ 6. I am probably less shy in social interactions than most people.

_____ 7. I sometimes feel tense when talking to people of my own sex if I don't know them very well.

_____ 8. I would be nervous if I was being interviewed for a job.

_____ 9. I wish I had more confidence in social situations.

_____ 10. I seldom feel anxious in social situations.

_____ 11. In general, I am a shy person.

_____ 12. I often feel nervous when talking to an attractive member of the opposite sex.

_____ 13. I often feel nervous when calling someone I don't know very well on the telephone.

_____ 14. I get nervous when I speak to someone in a position of authority.

_____ 15. I usually feel relaxed around other people, even people who are quite different from me

Appendix C

PANAS

Directions

This scale consists of a number of words that describe different feelings and emotions. Read each item and then circle the appropriate answer next to that word. Indicate to what extent you have felt this way during the past month

Use the following scale to record your answers.

(1) = Very slightly or not at all (2) = A little (3) = Moderately (4) = Quite a bit (5) = Extremely

	Very slightly or not at all	A little	Moderately	Quite a bit	Extremely
1. Interested	1	2	3	4	5
2. Distressed	1	2	3	4	5
3. Excited	1	2	3	4	5
4. Upset	1	2	3	4	5
5. Strong	1	2	3	4	5
6. Guilty	1	2	3	4	5
7. Scared	1	2	3	4	5
8. Hostile	1	2	3	4	5
9. Enthusiastic	1	2	3	4	5
10. Proud	1	2	3	4	5
11. Irritable	1	2	3	4	5
12. Alert	1	2	3	4	5
13. Ashamed	1	2	3	4	5
14. Inspired	1	2	3	4	5
15. Nervous	1	2	3	4	5
16. Determined	1	2	3	4	5
17. Attentive	1	2	3	4	5
18. Jittery	1	2	3	4	5
19. Active	1	2	3	4	5
20. Afraid	1	2	3	4	5

Appendix B

This questionnaire is composed of 28 statements regarding your feelings in social gatherings. Circle YES if you consider that the statement if true of your feelings most of the time. Circle FALSE if you consider that the statement is rarely true of you. Remember that this information is completely *confidential*

	Please circle	
I feel relaxed even in unfamiliar social situations	**YES**	**NO**
I try to avoid situations which force me to be very sociable	**YES**	**NO**
It's easy for me to relax when I am with strangers	**YES**	**NO**
I have no particular desire to avoid people	**YES**	**NO**
I often find social settings upsetting	**YES**	**NO**
I usually feel calm and comfortable in social situations	**YES**	**NO**
I am usually at ease when talking to someone of the opposite sex	**YES**	**NO**
I try to avoid talking to people unless I know them well	**YES**	**NO**
If the chance comes to meet new people, I often take it	**YES**	**NO**
I often feel nervous or tense in casual get-togethers in which both sexes are present	**YES**	**NO**
I am usually nervous with people unless I know them well	**YES**	**NO**
I usually feel relaxed when I am with a group of people	**YES**	**NO**
I often want to get away from people	**YES**	**NO**
I usually feel uncomfortable when I am in a group of people I don't know	**YES**	**NO**
I usually feel relaxed when I meet someone for the first time	**YES**	**NO**
Being introduced to people makes me tense and nervous	**YES**	**NO**
Even though a room is full of strangers I may enter it anyway	**YES**	**NO**
I would avoid walking up to and joining a large group of people	**YES**	**NO**
When my superiors want to talk to me, I talk willingly	**YES**	**NO**
I often feel on the edge when I talk to a group of people	**YES**	**NO**
I tend to withdraw from people	**YES**	**NO**
I don't mind talking to people at parties or social gatherings	**YES**	**NO**
I am seldom at ease in a large group of people	**YES**	**NO**

Continues overleaf…

	Please circle	
I often think up excuses in order to avoid social engagements	**YES**	**NO**
I try to avoid formal social occasions	**YES**	**NO**
I usually go to whatever social engagements I have	**YES**	**NO**
I find it easy to relax with other people	**YES**	**NO**

Instructions.

The questions in this scale ask you about your feelings and thoughts during the last month.

In each case, you will be asked to indicate how often you felt or thought a certain way.
Perceived stress scale

For each question circle one of the following options:

0 = **never** 1 = **almost never** 2 = **sometimes** 3 = **fairly often** 4 = **very often**

1	In the last month, how often have you been upset because of Something that happened unexpectedly?	**0**	**1**	**2**	**3**	**4**
2	In the last month, how often have you felt that you were unable To control the important things in your life?	**0**	**1**	**2**	**3**	**4**
3	In the last month, how often have you felt nervous and stressed?	**0**	**1**	**2**	**3**	**4**
4	In the last month, how often have you felt confident about your ability To handle your personal problems?	**0**	**1**	**2**	**3**	**4**
5	In the last month, how often have you felt that things We're going your way?	**0**	**1**	**2**	**3**	**4**
6	In the last month, how often have you found that you could not cope With all the things you had to do?	**0**	**1**	**2**	**3**	**4**
7	In the last month, how often have you been able to Control irritations in your life?	**0**	**1**	**2**	**3**	**4**
8	In the last month, how often have you felt that you Were on top of things?	**0**	**1**	**2**	**3**	**4**
9	In the last month, how often have you been angered because of Things that happened that were outside of your control?	**0**	**1**	**2**	**3**	**4**
10	In the last month, how often have you felt difficulties were piling up So high that you could not overcome them?	**0**	**1**	**2**	**3**	**4**

Appendix E

Appendix F

Cravings measures.

Circle one below

Before experiment After experiment

Type of nicotine: Cigarette Nicotine gum E-cigarette

1= Strongly disagree, 2=Slightly disagree,3=disagree 4=neither agree or disagree 5=agree 6=slightly agree 7= strongly agree.

Place numbers 1-7 beside each question.

Smoking urges.

1. I have a desire for a cigarette right now
2. Nothing would be better than smoking a cigarette right now
3. If it were possible I would probably smoke right now
4. I could control things better right now if I could smoke
5. All I want right now is a cigarette.
6. I have an urge for a cigarette right now.
7. A cigarette would taste good right now.
8. I would almost do anything for a cigarette right now.
9. Smoking would make me less depressed.
10. I am going to smoke as soon as possible.

Appendix G

Cravings measures.

Circle one below

Before experiment After experiment

Type of nicotine: Cigarette Nicotine gum E-cigarette

1= Strongly disagree, 2=Slightly disagree,3=disagree 4=neither agree or disagree 5=agree 6=slightly agree 7= strongly agree.

Place numbers 1-7 beside each question.

Smoking urges.

1. I have a desire for a cigarette right now
2. Nothing would be better than smoking a cigarette right now
3. If it were possible I would probably smoke right now
4. I could control things better right now if I could smoke
5. All I want right now is a cigarette.
6. I have an urge for a cigarette right now.
7. A cigarette would taste good right now.
8. I would almost do anything for a cigarette right now.
9. Smoking would make me less depressed.
10. I am going to smoke as soon as possible.

Appendix H

Memory Recall Word List 1.

- Weak
- Tears
- Fact
- Seven
- Point
- Rooms
- Young
- Speed
- Threw
- Cheap
- Press
- Tyres
- Drive
- Brake
- Think
- Couch
- Ocean
- Month
- Crowd
- Stick
- House
- Traffic
- Zipper
- Ham
- Egg

Appendix I

Memory recall task 2.

- edge
- watch
- name
- collect
- horse
- letters
- class
- failure
- break
- animal
- fight
- best
- level
- friends
- carry
- earth
- blood
- property
- repair
- baby
- clouds
- homework
- banana
- sword
- bank

Appendix J

Memory Recall Task 1.

Please recall as many words as you can for the next 90 seconds.

Appendix K

Memory Recall Task 2.

Please recall as many words as you can for the next 90 seconds.

Appendix L

Demographic Questionnaire

Section 1. Please provide the following personal information. Tick (√) as appropriate

Email Address:

1) Date of Birth

2) Gender: Male ☐ Female ☐

3) What age are you? _____

4) Nationality? _____

5) Age at which formal education ended? _____
(if ongoing indicate your current level)

6) do you have friends and family that smoke?

No ☐ 1-2 smokers ☐ More than 2 ☐

7) what is your smoking status?

Never-smoker ☐ Smoker ☐ Ex-smoker ☐

8) are you encouraged to smoke by friends or family? No ☐ Yes ☐

Section 2. This section is only to be completed if you have indicated that you are a smoker. Please answer each of the following questions. Tick (√) as appropriate

1) How often do you smoke? Daily ☐ Weekly ☐ Monthly ☐

2) How many cigarettes do you smoker per day? _____

3) Does this amount vary? Yes ☐ No ☐

4) Can you state the maximum you have smoked in a day? _____

5) can you state the minimum you have smoked in a day? _____

6) what age were you when you first started smoking? _____

7) What age were you when you became a daily smoker?_____

8) what is your attitude towards smoking?

☐

Wish I could stop

Enjoy it but know its bad ☐

Don't think about it ☐

Hate it but can't stop ☐

9) How soon on waking do you smoke your first cigarette?

Less than 30 minutes ☐ **More than 30 minutes** ☐

10) Do you find it difficult to refrain from smoking in places where it is forbidden?

Yes ☐ **No** ☐

11) which cigarette would you hate to give up?

The first one in the morning ☐ **All others** ☐

12) How many cigarettes do you smoke per day?

10 or fewer ☐

11 - 20 ☐

21 – 30 ☐

31 or more ☐

13) Do you smoke more often during the first hours after waking than during the rest of the day?

Yes ☐ **No** ☐

14) Do you smoke even if you are so ill that you are in bed most of the day?

Yes ☐ **No** ☐

15) Have you previously attempted to stop smoking?

Yes ☐ **No** ☐

16) Please indicate the number of attempts that you have had? _____

17) How long has it been since your last cigarette?_____