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Social anxiety, gender and the impact of anticipatory processing vs. distraction on cardiovascular reactivity to social stress

Diplomarbeit

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Abstract

Interactive effects of social anxiety, anticipatory processing and gender on cardiovascular reactivity to and recovery from a social stressor were examined as well as effects of these factors on cognitive and affective processes. 128 normotensive subjects were assigned to groups according to their gender and social anxiety and by building pairs that got split between research conditions at random. Following a ten minute resting phase participants underwent a five minute period of either anticipation or distraction, followed by preparing a speech for five minutes and performing it for five minutes. Systolic blood pressure (SBP), diastolic blood pressure (DBP) and heart rate (HR) were measured at given intervals. In terms of cardiovascular reactivity, stronger HR increases in the low socially anxious (LSA) were found during anticipation/distraction, as well as prolonged HR recovery of the high socially anxious (HSA). Moreover the HSA and women perceived the task as more difficult and their own abilities to successfully master it as lower than the LSA and men. During the anticipation / distraction period HSA of the anticipation condition experienced stronger increases in negative affect than other participants. It was found that HSA and individuals of the distraction condition experienced more pronounced increases in negative affect during the speech compared to LSA and those of the anticipation condition. HSA also experienced a prolonged recovery of negative affect compared to LSA. Research condition failed to influence cardiovascular reactivity. HSA individuals ruminated more than LSA individuals. Some gender differences were found with women generally showing higher HR although during preparation and the speech task itself woman showed higher SBP and DBP than men. In general this study found support for some of the current theories as well as some new findings that merit further research.

Keywords: social anxiety, anticipation, distraction, gender, cardiovascular reactivity, recovery, stress.

Zusammenfassung

Interaktive Effekte der sozialen Ängstlichkeit, antizipatorischer Verarbeitung und des Geschlechtes auf die kardiovaskuläre Reaktivität und auf Recovery von einem sozialen Stressor wurden untersucht, wie auch Effekte dieser Faktoren auf kognitive und affektive Prozesse. 128 normotone Kandidaten wurden anhand ihres Geschlechts, Ausprägung der sozialen Ängstlichkeit und durch Paarbildung und anschließendem randomisierten Aufteilen den Untersuchungsgruppen zugeordnet. Nach einer zehn minütigen Ruhephase folgte eine fünf minütige Antizipations oder Distraktions Phase, gefolgt vom Vorbereiten und Halten einer Rede, mit fünf Minuten pro Phase. Systolischer Blutdruck (SBD), diastolischer Blutdruck (DBD) und Herzrate (HR) wurden in vorgegebenen Intervallen gemessen. Während der Antizipations/Distraktions Phase wurden stärkere Anstiege in der HR in den niedrig Sozialängstlichen (NSÄ) und eine verlängerte Recovery der HR in den hoch Sozialängstlichen (HSÄ) festgestellt. Des weiteren beurteilten HSÄ und Frauen die Aufgabe als schwieriger und ihre eigenen Fähigkeiten zur Bewältigung als niedriger als NSÄ und Männer. Ergebnisse zeigten, dass nur die subjektive negative Befindlichkeit, aber nicht die kardiovaskuläre Reaktivität durch die Untersuchungsbedingung beeinflußt wurde. Während der Antizipations / Distraktions phase hatten HSÄ der Antizipationsbedingung stärkere Anstiege im negativen Affekt als andere Teilnehmer. HSÄ und Personen der Distraktionsbedingung zeigten höhere Anstiege im negativen Affekt während der Rede. Die Recovery war bei HSÄ verzögert. HSÄ neigen des weiteren stärker zur Rumination als NSÄ. Es wurden einige Geschlechterunterschiede gefunden. Frauen weisen eine höhere HR auf als Männer, allerdings zeigten die Ergebnisse während der Vorbereitung und des Haltens der Rede einen höheren SBD und DBD bei den Frauen. Die aktuelle Studie fand weitere Bestätigung für aktuelle Theorien, aber auch einige neue Ergebnisse, welche weiterer Untersuchung bedarfen.

Schlüsselwörter: Sozialängstlichkeit, Antizipation, Distraktion, Geschlecht, kardiovaskuläre Reaktivität, Recovery, Stress.

1.) Introduction:

Social interactions are a big part of everyday life and yet there are people with high social anxiety for whom these social encounter also encompasses a certain amount of stress and though this in itself might not be perceived as a problem, over some decades it might influence the cardiovascular system in a negative way due to prolonged activation. To be able to better understand the factors influencing the cardiovascular system as well as the emotions that people experience it is essential to take a closer look at all the factors at play.

The main focus of this study is to take a look at the influence of the social anxiety trait on cardiovascular reactivity and recovery before, during and after a stressful event, while also inspecting the effects of anticipation, distraction and gender. Different studies have tried to analyse the effects of anticipation, but they have rarely used distraction as the counterpart condition, even though using distraction instead of the more common prolonged resting period might make some effects more obvious, as cognitions and behaviours typical for socially anxious individuals should be reduced due to their attention being bound to the distraction task. Gender differences have been relatively ambiguous in the research of cardiovascular reactivity and social anxiety and therefore this study tires to shed some light on the differences, if there are any, between genders in this context.

2.) Cardiovascular System

The cardiovascular system consists of the heart, blood vessels and blood. While the heart keeps the blood circulating through the body the blood vessels transport oxygen, amino acids and other nutrients to the cells throughout the body and take waste products to be processed or removed (Schmidt & Thews, 1990). Another of it's functions is the transportation of hormones via the blood's liquid plasma, which is important for the hearts own regulation of blood pressure (Cacioppo, Tassinary & Bernston, 2007).

2.1) Heart

The heart is a muscular pumping organ located along the body's mid-line in the thoracic region. It has three layers: a muscle layer (myocardium), it is needed for the heart to be able to beat, the myocardium is enclosed in the second layer, a serous membrane (pericardium) that produces serous fluid to lubricate the heart and protect it from friction of the surrounding organs during beats. The third layer can be found in the inside of the heart and is called endocardium, it prevents the blood from sticking to the inside of the heart.

Even though the heart is one organ it is technically split into two sides by the septum which is a wall between the two sides. Each of the sides has it's own function, the right side is responsible for the pulmonary circulation, it pumps de-oxygenated blood to the lungs where the blood takes up oxygen before flowing into the left side of the heart which is responsible for systemic circulation, it pumps the oxygenated blood from the heart through most of the tissues of the body, where the blood delivers the oxygen and nutrients and removes cellular waste before flowing back into the right side of the heart so a new circle can begin. Both circles are running simultaneous, so each cycle consists of both sides of the heart pumping at the same time, to keep the blood from regurgitating back into the heart it's valves are one-way only (La Roche, 1984).

There are two distinct states that the heart chambers can be in at any given time. The systole is when the muscle tissue is contracting and thereby pushing the blood into the blood vessels and out of the heart and the diastole is when the muscle cells relax so that the heart fills up with blood. Blood pressure is higher during systole and lower during diastole because the blood pumped into the major arteries during systole increases pressure.

Under normal circumstances the heart sets its own rhythm and conducts it's own signals to maintain its rhythm. The conduction system starts with the sinoatrial node which is also responsible for setting the pace of the heartbeats, from here the signal gets picked up by the atrioventricular node, from where it goes into the atrioventricular bundle which carries it to the apex of the heart where purkinje fibers stimulate the walls of the ventricles to contract.

The autonomic nervous system has a direct influence on heart activity via chemical neurotransmitters, with the sympathetic system having an activating and the parasympathetic system having an inhibiting effect (Schmidt & Thews, 1990).

2.2) Factors of cardiovascular reactivity

In this study heart rate as well as systole/diastole for blood pressure were measured as these are most often used in psychophysiological studies.

Blood pressure is the force exerted by the blood against the vessel walls, it is a function of total peripheral resistance, which is the resistance to flow over the entire systemic circulation (mainly impacted by vessel diameter) and cardiac output (mainly impacted by heart rate and volume of blood). Overall arterial pressure varies between the highest level of pressure seen at systole (systolic blood pressure or SBP) and the lowest level seen in diastole (diastolic blood pressure or DBP) (Cacioppo, Tassinary & Bernston, 2007). A SBP of around 120mmHg and a DBP of around 80 mmHg is considered normal for a healthy adult (Birbaumer & Schmidt, 2006).

Heart rate is measured in beats per minute and a rate of around 70 bpm is considered normal in a healthy adult under neutral circumstances (Birbaumer & Schmidt, 2006). In a healthy organism the body adjusts heart rate activity autonomously to match the given conditions, increasing it when there is a physical need for it, but also during psychological stress like fear or pain and decreasing it in resting situations or during periods of mental concentration (Gramann & Schandry, 2009).

2.3) Regulation of blood pressure

An appropriate amount of blood pressure is needed in order for the organs to be able to function correctly. Insufficient pressure could lead to organs being poorly supplied with blood and therefore not getting the nutrients and oxygen they need, while excessive amounts of pressure could damage the blood vessels or organs. Short-term as well as long-term regulation are achieved via changes in the total peripheral resistance and cardiac output (Lang & Lang, 2007). Beyond local intrinsic autoregulatory processes are extrinsic regulatory processes associated with autonomic and hormonal systems. The cardiovascular system is under control of both the sympathetic and parasympathetic branches of the autonomic nervous system. A given organ system is often innervated by both autonomic branches, which typically exert opposing actions, although there are exceptions where both branches have synergistic rather than opposing effects. Additional hormonal and organ systems contribute to body water and electrolyte balance and thus play an important role in blood volume, blood pressure, water distribution, and hence cardiovascular regulation (Cacioppo, Tassinary & Bernston, 2007).

2.4) Measuring blood pressure

Blood pressure can be measured in a number of ways, invasive, using intraarterial pressure transducers, or non-invasive, using auscultatory or oscillometric methods, arterial tonometry, or the volume-clamp method (also called the Peňaz method). For this study the non invasive oscillometric method was used, it utilizes oscillations in pressure in the cuff to determine systolic, diastolic and mean arterial pressure (Borow & Newberger, 1982; van Montfrans, 2001). The cuff inflates to a pressure above the systolic pressure where oscillations can be measured in the cuff, then it is slowly deflated. The systolic pressure is taken as the pressure when the oscillations in the cuff first begin to get larger, and the diastolic pressure is taken as the point when the cuff pressure oscillations no longer get smaller in amplitude (Cacioppo, Tassinary & Bernston, 2007).

2.5) Hypertension

Chronic high blood pressure is called hypertension and it is a major health problem worldwide. It's definition is somewhat arbitrary because distribution of blood pressure levels in the population are continuous and not bimodal. Though the general consensus is, that a chronic blood pressure of over 140mmHg systolic and over 90mmHg diastolic is considered to be hypertension (Cacioppo, Tassinary & Bernston, 2007). Though not everything under those values should be considered safe, the Joint National Committee on Prevention, Detection, Evaluation and Treatment of High Blood Pressure concluded that the risk of cardiovascular disease already begins with blood pressures greater than 115/75mmHg even though these used to be considered as benign (Chobanian et al., 2003).

Due to blood pressure being moderately heritable, a family history of hypertension is a major risk factor, but other factors also play a role like body weight, diet and alcohol intake amongst others. The main danger of hypertension is that the chronically higher workload within the cardiovascular system, as well as increased pressure in the organ systems could lead to kidney damage, strokes up to cardiac failure (Cacioppo, Tassinary & Bernston, 2007).

3.) Factors influencing the cardiovascular system

3.1) Genetics

The genetic influence on blood pressure variability has been estimated at 30–60% for a given individual (Kupper et. al. 2005), and the genetic heritability of hypertension estimated at 30% (Agarwal, Williams & Fisher, 2005).

Family history of cardiovascular diseases is a risk factor (Cacioppo, Tassinary & Bernston, 2007), but epidemiological studies showed that out of pairs of twins, only those exhibited cardiovascular diseases that also had high amounts of stress over prolonged periods of time (Birbaumer & Schmidt, 2006), which indicates a more complex mechanism underlying.

3.2 Gender

Information from epidemiological and medical studies shows that there are gender differences in the prevalence, causes, symptoms, treatment and outcome of heart disease, however there is a complex interaction of psychological and physiological factors underlying, so that these differences have to be analysed carefully as to not be interpreted in an oversimplified way. The incidence of heart disease increases in both genders with age, but more so for woman after menopause, because they are protected by the oestrogen hormone before. The diagnosis of the disease in woman is on average ten years later than in men, which means that in young and middle-aged individuals a far greater number of men die of coronary artery disease and while in the elderly population the number of female deaths due to coronary artery disease is higher. In general the death rate of coronary artery disease has decreased over the last forty years, but less so for woman than men. This is mostly due to differences between the genders in the prevalence of risk factors during their lifespan. Men exhibit more risk factors, like smoking, high cholesterol, at a younger age, while at an older age woman have the higher prevalence of risk factors. There is also a difference in how men and woman react to stress, which in general induces changes in cardiac functioning, especially during achievement focused stressors, where men have larger responses than women, this appears to be modified by individual differences in personality traits (Stoney, 2003).

3.3 Age

The cardiovascular system, like the rest of the human body, changes with age. The main difference with higher age is the decrease in elasticity of the blood vessels, which leads to a higher prevalence of arteriosclerosis and hypertension in the elderly. As already mentioned the differences are greater in woman who in general have lower blood pressure than men before menopause, but higher afterwards (Schmidt & Thews, 1990).

3.4 Physical activity

There is a lot of evidence suggesting that regular physical activity decreases the risk for cardiovascular diseases. It seems that physical activity has protective effects against cardiovascular disease mortality, regardless of the presence of metabolic risk factors, which makes it one of the best risk reducing options without the help of drugs or medical procedures (Reddigan, Adern, Riddell & Kuk, 2011).

While physical activity increases the blood pressure short term it has a blood pressure reducing effect long term and regular physical activity in general leads to reduced body weight which in turn positively influences blood pressure (Bönner, 2006).

3.5 Eating habits

Eating habits have an influence on the cardiovascular system in two different ways. First off a healthy diet in itself can help reduce blood pressure by reducing the amount of salt the body has to process which is in a direct relation to blood pressure and also by reducing arterial clogging. The second influence a healthy diet has is that it generally leads to weight loss which is one of the best ways to reduce blood pressure according to Stoschitzky, he found in his studies, that a reduction in blood pressure between 5-20mmHg / 10kg of weight loss can be achieved (Stoschitzky, 2004). These findings further confirm that an above normal Body-Mass-Index is rightfully a risk factor for cardiovascular disease (Bierbaumer & Schmidt, 2006).

3.6 Alcohol

The function of alcohol consumption to cardiovascular disease seems to be U- shaped, where in both extremes of the spectrum (no alcohol consumption at all and high alcohol

consumption) the risk for cardiovascular disease is higher than with moderate alcohol consumption (Matsumoto, Miedema, Ofman, Gaziano & Sesso, 2014). According to recent systematic reviews and meta-analyses, the alcohol-attributed cardiovascular disease mortality in 2012 was 30.8% lower than earlier estimates had suggested. meaning that the influence of alcohol on cardiovascular disease could very well be lower than assumed (Rehm, Shield, Roerecke & Gmel, 2016).

3.7 Nicotine

The various adverse effects of smoking are well known and documented, but there is also evidence directly linking it to cardiovascular disease. One-third of deaths from smoking are secondary to cardiovascular disease and 11.1% of these deaths occur in people with exposition to second hand smoking, with epidemiological research pointing to a strong casual relationship between second hand smoking and coronary heart disease, the former increasing the latter by 25-30% (Baronya & Glantz, 2005; Faught, Flouris & Cairney, 2009). Findings also suggest that even with low levels of exposure smoking increases risk measurably (Law & Wald, 2003).

3.8 Coffee

The effects of coffee consumption on the cardiovascular system are somewhat unclear with some studies showing positive and some showing a negative correlation with heart disease. Generally coffee seems to have an adverse effect on short term blood pressure due to the caffeine (Rebello & van Dam, 2013), but it seems that habitual coffee drinkers develop a partial tolerance and a recent meta analytic study showed that moderate coffee consumption reduces risk for cardiovascular disease in a non linear manner, where no cups of coffee per day and more than four cups of coffee per day had a higher risk of cardiovascular disease than three to four cups per day (Crippa, Discacciati, Larsson, Wolk & Orsini, 2014).

4.) Stress

The definition of stress changed over the last decades and had many iterations. A relatively accurate description would be the one by Cohen, Janicki-Deverts and Miller, and it is described as follows: „Psychological stress occurs when an individual perceives that

environmental demands tax or exceed his or her adaptive capacity.“ (Cohen, Janicki-Deverts & Miller, 2007). A further component of stress is that under threatening conditions, adaptations occur that help the individual survive the stressful environment, while searching for more favorable circumstances (Chrousos & Gold, 1992).

One of the definitions that had lead research for a long time was that, if a stressor is potent enough to be seen as a major threat to the stability of *homeostasis* (a state of internal equilibrium), than it places the organism in a state of stress and activates a non-specific adaptive response, during which the brain interprets the stressor as threatening, thus responding in a progressively generalized and hence non-specific way (Chrousos, 1998), why this last definition is outdated will be shown in the following chapters.

4.1) The stress system

The stress system is one of the most important and highly preserved systems in the human body. It is located in the central nervous system and the periphery. It's main function is keeping the organism in a state of homeostasis. The way and magnitude of the response to a stressor is defined by it's intensity as well as the body’s ability to achieve and maintain an appropriate level and duration of activity (Cacioppo, Tassinary & Bernston, 2007).

If the level or duration of the stress systems response to a stressor is in any way inadequate, excessive, too brief or prolonged, then health-damaging effects may arise (Cacioppo, Tassinary & Bernston, 2007).

The stress system works via two separate axis, one is the sympathetic-adrenal axis, the other is the hypothalamic-pituitary-adrenocortical axis (Linden, Earle, Gerin & Christenfeld, 1997).

4.1.1) Sympathetic-adrenal axis

This axis mainly activates if there is a demand due to motor and cognitive effort, if there is also simultaneous adrenocortical hormone suppression to be found, then this activation can be seen as a positive stress reaction due to the fact that is short-lived and permits the body an appropriate response with maximal strength (De La Torre, 1994).

The biological changes during activation in the sympathetic-adrenal axis are rises in epinephrine, norepinephrine, muscle tension, plasma free fatty acid levels, cardiac output, and blood pressure (Herd, 1984).

4.1.2) Hypothalamic-pituitary-adrenocortical axis

Activation in the hypothalamic-pituitary-adrenocortical axis is thought to be in correspondence to affective distress as a result of chronic stress. It can also be observed during anticipation of a negative event (Linden et al., 1997).

The biological changes during activation in the hypothalamic-pituitary-adrenocortical axis are increased circulating free fatty acids, suppression of immune function and increase glucocorticoid production (Herd, 1984).

Activation in this axis seems to have a much higher relevance in the development of diseases, partly because activation in the sympathetic-adrenal axis can be found during physical exercise which has been proven to be an inoculating factor against cardiovascular disease (Dienstbier, 1989).

4.2) Stress and cardiovascular reactivity, recovery

One of the main risks of chronic stress is an increased risk for hypertension through repeated blood pressure elevations as well as by stimulation of the nervous system to produce large amounts of vasoconstricting hormones that increase blood pressure. The effect on blood pressure multiplies the more risk factors are coupled with other stress producing factors (Kulkarni, O'Farrel, Erasi & Kochar, 1998).

A theory that has to be mentioned in this context is the „reactivity hypothesis“, which states that high cardiovascular responses may lead to tissue damage, deregulation and finally disease (Gerin, Pickering, Glynn, Christenfeld, Schwartz, Carroll & Davidson, 2000), but as previously already described (see chapter 4.1.1) this theory does not seem to always hold up. Literature shows, that not just the activation during the stressor but also the recovery afterwards has an important influence on the cardiovascular system, which is the reason why recovery is a crucial factor in measuring the effects of stress (Linden et al., 1997). Brosschot and Thayer (2003) suggest that the type of affect triggering the activation plays a role in moderating the duration of the recovery. Even though positive and negative stimuli can exhibit similar cardiovascular reactivity in the short term (Jacob et al., 1999), only negative affect showed prolonged activation during recovery and this prolonged activation is necessary

for causing the intermediate chronic pathogenic state that leads to a disease endpoint (Brosschot & Thayer, 1998).

Another important factor to consider is the activation component in the cardiovascular system. When reacting to stress, activation can be observed to be either myocardial or vascular, strength and duration varies between individuals and the response patterns also differentiate between types of psychological challenges (Linden et al., 1997). In this context Obrists (1981) active vs. passive coping concept plays a very decisive role (see chapter 4.4), as well as dispositional factors, which are personality traits that lead to higher reactivity and recovery eventually combined with inadequate coping strategies and higher exposition rate (Gerin et al., 2000). An example for this would be social anxiety, socially anxious people experience a very high amount of stress in everyday situations which means a high exposition rate that leads to higher reactivity and they tend to prolong the negative affect leading to longer recovery (Dannahy & Stopa, 2007).

4.3) Stress theories

Stress theories can generally be categorized into the following three sub categories depending on their focus: response, stimulus, interaction(transaction)

4.3.1) Response

Generally these theories see stress as a response to a threatening situation, that is regulated by the sympathetic-adrenal axis and the hypothalamic–pituitary–adrenal axis (Knoll, Scholz & Rieckmann, 2011).

Fight or flight

The first step to analysing the body's reaction to a threatening situation, Cannon (1932) proposed the concept of *fight or flight*, where he described an animals response to threat as bodily change, characterized by a general discharge of the sympathetic nervous system which primes the animal for fighting or fleeing.

General adaptation syndrome

One of the first iterations of a physiological stress concept was by Selye in 1936, where he proposed to look at stress as a three phased process, with the phases being: activation, resistance, exhaustion. During the first phase the body activates all physiological defence systems. Should the stressor however persist, then the body changes to the second phase: resistance, during which it tries to adapt to the stressor and thereby drains its energy reserves. When the reserves are depleted the body transitions to the final phase, exhaustion, during this phase it is left vulnerable due to the high amounts of cortisol that have been released in the previous phases, and possible immune-suppressive effects follow (Knoll, Scholz & Rieckmann, 2011; Selye, 1936).

This system claimed that the body reacts to every stressor with generalized activation of all defence systems, though this was changed later on to at least distinguish between the two previously mentioned sympathetic-adrenal axis and the hypothalamic–pituitary–adrenal axis (Linden et al., 1997).

Allostasis and allostatic load

The term allostasis refers to the body's effort to maintain stability through change, for this it has to output stress hormones which try to restore homeostasis. The hormonal mediators of the stress response that are essential for short term regulation, have damaging effects over longer time intervals. Allostatic load represents either the presence of too much stress or the inefficient operation of the stress hormone response system, which needs to be turned on to react to stress, but turned off again as soon as the stressful situation has been resolved (Mc Ewen, 2000). There are different types of allostatic load, which will be explained in a following chapter (see chapter 4.4).

4.3.2) Stimulus

These theories have the stress inducing stimulus as their main point of focus, seeing stress as any significant life event or change that demands response, adjustment or adaptation. Holms and Rahe (1967) developed the so called Social Readjustment Rating Scale consisting of forty-two life events scored according to their degree of impact on an individual. There were several problems with this theory, foremost the subjects were seen as a passive recipient of stress with no influence on the degree, intensity or duration that any stress caused by their proclaimed life events caused, although this view was changed to later (1978) include a

differentiation between positive and negative experiences. Further problems statements by this model were that every change was inherently stressful, that variances in the experience, personality, environment of the individuals were not taken into consideration i.e. stress caused the same level of adjustment across the population and that there was a common threshold beyond which illness would automatically result (Knoll, Scholz & Rieckmann, 2011).

4.3.3) Transaction

These theories look at stress in the context of an interaction between the individual (including multiple systems: cognitive, physiological, affective, psychological, neurological) and the complexity of its environment.

Transactional theory of stress and coping

This model by Lazarus and Folkman (1984) sets its focus on the individuals perception and appraisal of any given situation. It states that stress is only experienced, if the individuals assessment of a situation leads to a negative conclusion. Assessment is done on two simultaneous levels, *primary appraisal* of the situation grades its effects on the persons well being, it can either be irrelevant, or anywhere between positive to stressful. At the same time the secondary appraisal reviews available resources to decide if they are sufficient to successfully master the given situation. When the individual perceives the event as stressful, further categorization follows between the following categories: harm-loss, threat or challenge. If a stressors source lies in the past and there is no way of changing it then it is automatically perceived as harm-loss, but if its source is in the future it can be seen as either a threat or a challenge or both. If the conclusion is that the event or situation is seen as a threat and that there are insufficient resources available to manage it then a stress reaction will follow. Reappraisal of the situation will be done afterwards based on new information from the environment, which could change the individuals perception (Lazarus & Folkman, 1984).

4.4) Coping

According to Obrist (1981) a stressful situation leads to one of two types of coping: *active* or *passive*, based on the stressor demands and the individuals cardiovascular reaction to it.

He found that during an active coping situation the individual has to invest energy to overcome the given challenge and in this case the reactivity was typically *cardiac* in nature due to beta-adrenergic activation. Increases in heart rate and vasodilation, lead to a higher cardiac output and lower vascular resistance, a „U-shaped“ interaction can be observed due to the increases in heart rate and systole but lesser changes in diastole, this is defined as a *cardiac* reaction. Obrist considered the systole the most important factor in determining an active reaction, because it is only mediated by sympathicotonic beta-adrenergic stimulation, while the heart rate can have parasympathetic influences and the diastole is regulated by beta- as well as alpha-adrenergic stimulation (Manuck, 1994; Obrist, 1981).

Obrist (1981) deemed the cardiac reactivity to active coping to be excessive and hence stated that it could be an inherent risk factor for developing hypertension, if an individual is exposed to a multitude of active coping situations or long-lasting ones. The explanation behind this assumption being, that higher demand would lead to hypertrophy of the vascular muscles, which in turn would mean higher peripheral resistance due to reduced diameter of the blood vessels and that being a risk factor for the development of hypertension (Obrist, 1981).

Passive coping on the other hand was found to exhibit *vascular* reactivity, characterized by alpha-adrenergic stimulation which leads to higher peripheral vascular resistance. Cardiac output can either show no change or decreases, while blood pressure increases with typically greater increase in the diastole than systole (Hartley, Ginsburg & Heffner, 1999).

Obrists (1981) notion that the cardiac reactivity in an active coping situation is negative and has an inherent risk for hypertension was later contested by Dienstbier (1989), who categorized Obrists (1981) assertion as a „negative view of arousal“. This lead to a lot of follow-up research, which hinted that the risk for hypertension due to cardiac activation was not as high as Obrist(1981) had assumed (Steptoe, Willemsen, Kunz- Ebrecht & Owen, 2003). The main reason for this discrepancy seems to be, that cardiac activation is a function of engagement during a task, meaning that it is short lived and plays no role during the recovery phase unlike vascular activation which seems to linger even after the task is completed (Steptoe et.al 2003). Research indicates that the lingering effect of vascular activation is a sign of *distress*. A psychological explanation for this is the concept of *rumination*, stating that stressors which have a negative emotional component are kept active by the individuals thought processes even after the stressor itself is not present any more (Glynn, Christenfeld & Gerin, 2002). This was shown by Glynn and colleagues (2002) where they tested two neutral

and two negative stressors. The neutral stressors had high reactivity during the task, but no effects during the recovery, while the stressors with negative emotional association showed vascular activation during the recovery phase. Subjects in both conditions were tasked to think about the stressor, further proving that rumination only has an effect on blood pressure if the experienced stressor had a negative emotional component.

These finding suggest that vascular activation due to it's lingering nature might be more relevant than cardiac activation in the development of cardiovascular disease.

Another model based on these findings is the „perseverative cognition hypothesis“ by Brosschot, Gerin and Thayer (2006). This model takes the importance of negative emotion even one step further and states that the cognitive presence of the stressor in itself is enough to show vascular activation, hence cognitive processes like *worrying* could have negative effects on different bodily systems: cardiovascular, endocrinological, immunological (Brosschot, Gerin & Thayer, 2006).

A theory that takes all of the above mentioned factors into account is the previously mentioned „allostasis and allostatic load“ model by McEwen (1998). He states that unlike homeostatic systems of the body like blood oxygen level, body temperature, etc. that have to be maintained within very narrow ranges, allostatic systems have much broader range in which they can act. The body's response to a stressor is to turn on the allostatic response, most commonly involving the previously mentioned sympathetic-adrenal axis and hypothalamic-pituitary-adrenocortical axis and as soon as the situation is resolved, turn it off again. For example giving a public-speaking test usually starts an allostatic response in an individual, which is a healthy reaction, but as soon as the speech has been given the system should return to its base-line levels due to inactivation of the allostatic system. However if the inactivation is inefficient, overexposure to stress hormones is the result and this leads to allostatic load and its pathophysiologic consequences. According to McEwen (1998) there are four situations that can lead to allostatic load. First: frequent stress. Second: Lacking adaptation to repeated stressors of the same type. Third: Inability to shut off allostatic response after a stressor is terminated. Fourth: Inadequate responses by one allostatic system triggers overcompensation in others (McEwen, 1998). These assumptions implicate that high reactivity should not be the only focus when trying to deduce the effects stressors have on the body like Selye (1953) suggested. Another model supporting this point of view is Dienstbiers (1989) theory of „physiological toughness“. This model states that activation can either be positive or negative, with positive activation being mainly on the SA-axis and the subject feeling little to no distress and negative activation on the SA and the HPA-axis with the subject feeling high

distress. Another interesting finding of this study was that not the intensity of the arousal, but its timing was more important, he stated that an ideal reaction to stress would be as follows: baseline levels of activation should be low, energy mobilisation during confrontation with the stressor should be high with activation from the SA-axis and little to no activation of the HPA-axis, after the stressor is gone returning to the baseline levels should be quick and if exposition to the stressor is recurring than habituation should follow (Dienstbier, 1989).

4.4.1) Motivation, task difficulty and perceived capability

As previously stated cardiac activation shows mobilization of energy to overcome a certain stressor, but how does the body decide when and how much energy it should invest in a given task? One theory trying to explain this is the „Energization Theory“ by Wright (1996) He agrees with Obrist (1981) that cardiac activation induces energy mobilization and that the systole is the primary indicator for this, but in his theory he assumes that the amount of activation is not excessive, but rather exactly as high as it needs to be. To this end he assumes that there are more components for influencing the activation. Those components are *task difficulty* and *perceived capability* on one hand and *potential motivation* on the other. Task difficulty has a linear connection with the motivational arousal, with easy tasks only exhibiting little arousal and the more difficult the task gets the higher the arousal, up to a cut off point where the task is too difficult or too demanding, here arousal is dropped again since it does not help to overcome a task that is deemed to difficult. The perceived capability influences how a person estimates task difficulty, the individual assesses the task and if it assumes that it's own capabilities to successfully complete it are low then it deems the task as difficult, hence already seizing energy mobilization at an objectively low difficulty level. The other factor, potential motivation, states that everyone has their own limitations as to how much energy they are willing to invest into a given situation. This can be influenced by a number of factors, like momentary needs (if you haven't eaten for two days you will be more willing to invest energy into getting food than if you have just eaten half an hour ago), the value attributed to succeeding (winning in a game of billiard might have different values to different people), and the perceived probability to successfully completing a task (motivation differs depend on the chance, for example 10% vs 90%, of getting a prize after successfully completing a task). If the potential motivation is very low than energy mobilization seizes even if the task is not deemed as too difficult (Wright, 1996).

4.4.2) Challenge and threat

Another model incorporating the studies by Obrist (1981), Dienstbier (1989) and Lazarus and Folkman (1984) was made by Tomaka, Blascovich, Kelsey and Leitten (1993). This model takes a look at how activation changes based on the individuals perception of a given situations demands and available resources. Tomaka et al. 1993 differentiate between two types of arousal, positive (cardiac) and negative (vascular). Two appraisal processes (primary and secondary) take place, the primary appraisal discerns how demanding a situation is and secondary appraisal measures whether the available resources are sufficient to overcome the situation. Two different reactions can be seen depending on the outcome of the appraisal, if the individuals resources outweigh the given demands then it sees the task as a challenge and cardiac activation follows to mobilize energy in preparation of the task, but if the demands outweigh the resources then the situation is perceived as a threat and a vascular activation can be seen. The latter part is very important since vascular activation is characteristic for a passive task (i.e. when the stressor cannot be influenced by the individual), but if a given situation is interpreted as a threat than vascular activation can be found even during active tasks which would normally warrant cardiac activation, this can be seen as a sign that the individual deems that it cannot change the outcome of the situation through its own effort (Blascovitsch & Tomaka, 1996).

5.) Personality and cardiovascular reactivity

A lot of studies have been carried out during the past decades to take a look at different personality traits and how they influence the development of cardiovascular disease. For a lot of traits the findings have been somewhat inconclusive, but there are a few that show a relatively solid interaction with cardiovascular disease.

5.1) Anger and Hostility

Although anger and hostility are two different concepts, they often get used interchangeably in literature and studies, which makes it hard to differentiate results concerning these concepts, which is the reason why some meta-analyses pulled both together into an Anger and Hostility concept (Chida & Steptoe, 2009).

How anger and hostility influence cardiovascular disease has been a point of discussion for some time. Early research data suggested that a type A behaviour, which is primarily defined by hostility, ambition, competitive drive, a sense of urgency, was related to cardiovascular disease development, but later meta-analytic studies failed to support these findings. The focus later shifted to investigate whether, anger, hostility and related constructs (which is one of the key elements of type A behaviour) are maybe more closely linked with cardiovascular disease. A meta-analysis including thirty-nine studies found that anger and hostility are significantly associated with cardiovascular heart disease in healthy populations as well as poor prognosis in patients with existing cardiovascular heart disease, although these findings were only significant before controlling behavioural covariates that are typical for highly hostile subjects, such as smoking, physical activity or body mass index and socio-economic status, suggesting that the effect of anger and hostility might not be direct, but instead brought on by negative behaviour correlated to those personality traits (Chida & Steptoe, 2009).

5.1.1) Anger

Anger is usually described as an emotional state that consists of feelings varying in intensity from mild irritation to intense fury, and aggressive verbal or physical behavioural patterns such as shouting, intimidation, physical assault (Chida & Steptoe, 2009).

Two different dimensions of anger have been described by literature, depending on how the individual acts when angered. When a subject suppresses its anger instead of expressing it we are observing *anger-in*, when it directs it towards another person or object it is called *anger-out* (Spielberger, Johnson, Russell & Crane, 1985).

One interesting finding in the research of anger was, that anger-in was associated with prolonged recovery in total peripheral resistance, while anger-out did not show prolongation (Dorr, Brosschot, Sollers & Thayer, 2007).

5.1.2) Hostility

Hostility is a negative attitude or cognitive trait directed toward others, typical factors of hostility are cynicism, hostile attribution, resentment, suspicion (Barefoot et al., 1989; Buss & Durkee, 1957). It is associated with greater systolic and diastolic blood pressure responses during debate tasks (Smith & Allred, 1989). A study by Kline, Fekete and Sears (2008)

showed a relationship between chronically suppressed emotion and disease development, which is similar to the already mentioned effects that anger-in has.

6.) Social Anxiety

Social anxiety can be described as a cumulation of feelings consisting of such as: self-consciousness, emotional distress in anticipated or actual social-evaluative situations and apprehension. Wanting to make a favourable impression, but doubting that one will succeed is the basis for social anxiety (Schlenker & Leary, 1982). The essence of social anxiety is the fear of negative evaluation by others and the rejection that could follow such an event. A very important factor in this is, that the belief that a situation involves evaluation or scrutiny by others is sufficient for social anxiety to arise regardless of whether this is actually true or not (Leitenberg, 1990).

Social anxiety is a phenomenon found everywhere, nearly everyone has experienced anxiety connected to a social situation at some point in their life, maybe before giving a speech, while trying to arrange a date with a person they were interested in or after saying something that they considered shameful, embarrassing, humiliating, or when expressing disagreement with a person of authority. There are a lot more examples of everyday situations like the aforementioned, that have some sort of real or perceived probability of negative evaluation which is an unpleasant experience to almost all humans. It is important to note that even if there is no immediate interpersonal context perceivable, as long as failure implicitly involves some expectation of a negative interpersonal consequence, the anxiety felt by the individual should be considered social anxiety (Leitenberg, 1990).

It is important to note, that the effects of social anxiety do not only show themselves in individuals suffering from social anxiety disorder, but in everyone to different extents. Social anxiety can have physiological symptoms (Brodt & Zimbardo, 1981) as well as effects on the self-esteem of an individual through negative self-evaluation (Clark & Arkowitz, 1975).

Research has shown that socially anxious individuals exhibit uniformly negative self-concepts, they see themselves as less dominant, less sociable, lower in well-being and having fewer positive and more negative thoughts (Cacioppo, Glass & Merluzzi, 1979; Haemmerlie, Montgomery & Melchers, 1988; Heimberg, Acerra & Holstein, 1985).

A model of social anxiety in social evaluative situations was created by Rapee and Heimberg (1997). Its basis are the following two statements: people with social anxiety have a

fundamental need to be positively appraised and they assume that other people will inherently evaluate them negatively. There are several processes that generate and maintain social anxiety and these work in a similar fashion regardless of the situations nature, ie. if a social situation is anticipated, encountered or reflected upon in retrospect. When an individual encounters an evaluative situation, they create a mental representation of themselves in the way they imagine their audience is seeing them and at the same time focus their attention on this mental image and on any perceived threat around them. In addition to allocating resources for these foci the individual also tries to predict the expectations of it's audience. Then it compares it's mental image with the audience's expectations to determine the likelihood of negative evaluation and the consequences of the expected negative evaluation, which in turn increases anxiety leading to physiological, behavioural and cognitive changes that influence the individual's mental representation which now fares even worse in comparison to the perceived expectations and thus elicits more anxiety, which again changes the mental representation and so forth (Rapee & Heimberg, 1997).

6.1) Social anxiety, anticipation and rumination

Hinrichsen and Clark (2003) looked at the cognitive anticipatory processes underlying social anxiety conducting two studies on this topic. In the first study forty subjects categorized as either high or low socially anxious reported their mental processes during periods of anticipatory social anxiety in form of a semi-structured interview. The second study tested the effects of the mental processes found in high anxious subjects during the first study. Prior to a free speech task the participants, who were again categorized as either high or low socially anxious, had to either engage in the aforementioned processes or perform a distraction task. The findings of the study showed that engaging in the processes typical for socially anxious individuals was associated with sustained elevations of anticipatory anxiety and led to higher peak anxiety during the speech in both groups. These results suggest that there are systematic differences in the mental processes used prior to a stressful social event between high and low socially anxious individuals (Hinrichsen & Clark, 2003).

Dannahy and Stopa (2007) investigated the influence of social anxiety on post-event processing of test subjects, the fifty participants had to partake in a conversation task with an unknown individual and immediately afterwards were asked to appraise their performance, with a second appraisal following one week later before an anticipated second conversation task. Results showed, that the high socially anxious group experienced more anxiety,

predicted worse performance as well as underestimated their own performance and engaged in more post-event processing than low socially anxious participants. Negative post-event processing was related with negative appraisal of performance and extent of social anxiety. Similar results were also found by Edwards et al. (2003). Especially the link between the amount of post-event processing and extent of social anxiety is an interesting find considering the negative effects that prolonged activation has on the cardiovascular system (Dannahy & Stopa, 2007; Edwards, Rapee & Franklin, 2003).

Kocovski et al. (2005) further underlined the tendency of rumination in people with high social anxiety, finding similar results in regards to post-event rumination (Kocovski, Endler, Rector & Flett, 2005).

Rapee and Abott (2007) examined how certain cognitive processes mediate the relationship between trait and state social anxiety. Participants with social phobia had to complete measures of their general (trait) social anxiety then perform an impromptu speech a week later. Of the two-hundred-thirty-nine individuals attending the experimental sessions two-hundred participants had complete data on both sessions and while two-hundred-four-teen had complete data for the first session. The results supported the cognitive models of social phobia by Clark and Wells (1995) and Rapee and Heimberg (1997), showing that trait social anxiety predicted state social anxiety in response to delivery of a public speech through its relationships with the individuals self perceived performance and the tendency to focus attention on “inappropriate” directions, as well as on the probability and cost of expected negative evaluation. The results also showed that the discrepancy between the participants self-perception of speech performance, which is generally biased towards the negative in socially anxious individuals, and the independent observers perception of the same performance was a mediator between trait and state anxiety in the social phobic subjects. This relationship was further mediated by the individual's ratings of the probability and cost of negative evaluation from others. Earlier studies by Clark and Wells (1995) suggested that a negative self-representation plays a key role in predicting later negative rumination and the results of Rapee and Abott (2007) replicated these findings giving further support to this theory. Furthermore they found support for the cycle of maintaining the negative self-image through rumination: Perception of speech performance immediately after the speech partially mediated between trait anxiety and rumination during the subsequent week and negative rumination on the other hand fully mediated the relationship between estimated probability and consequences of negative evaluation immediately after the speech and recall of speech performance one week later. So in theory due to the negative perception of speech

performance the individual indulges in more negative rumination after the event and this rumination then leads to the individual recalling their performance as even worse thus leading to a worse self representation. Given that one of the factors preserving social anxiety is the tendency for a negative memory bias when recalling social situations, the next time the individual is in a similar situation (ie. a speech task) he will recall this experience which will heighten or at least maintain the subjects social anxiety in the given situation.

Wong and Moulds (2009) investigated the impact of rumination versus distraction following a social-evaluative task on anxiety and maladaptive self-beliefs. Their results showed that the assumptions made by models of social phobia about the role of rumination are most likely true. In general Wong and Moulds (2009) found that all participants experienced lower levels of state anxiety in the distraction group while the rumination group maintained their levels of anxiety following the social-evaluative task and maladaptive self-beliefs strength was higher in high socially anxious individuals than in low socially anxious individuals. Also strength of one of the three maladaptive belief types (*unconditional beliefs*) in high socially anxious individuals was maintained by rumination and was reduced by distraction, while there were no differences for the other two belief types and low socially anxious individuals did not differ in the resultant strength of the maladaptive believes in either type. This finding is contrary to Clark and Wells (1995) theory that socially anxious individuals only activate these maladaptive beliefs while in a social-evaluative situation and deactivated once the situation passes and the threat is no longer present. According to Wong and Moulds (2009) at least part of the maladaptive beliefs are kept activated by rumination which further increases the importance of rumination in maintaining anxiety (Wong & Moulds, 2009).

A follow up study was conducted by Wong and Moulds (2011) to take a closer look at the effects of anticipatory processes versus distraction on anxiety in socially anxious individuals. High and low socially anxious subjects were randomly assigned to either an anticipation or distraction group and then completed an impromptu speech task. Again they found evidence supporting the effects of anticipation in social anxiety, with high socially anxious individuals in the anticipation group reporting increased anxiety and increased endorsement of *high standard beliefs* and *conditional beliefs,* which are two of the three types of maladaptive beliefs, and they also exhibited increased relative skin conductance compared to those of the distraction group. Low socially anxious individuals showed no differences in maladaptive beliefs and skin conductance between anticipation and distraction, but experienced higher anxiety in the anticipation than in the distraction group, although the

authors speculate that due the missing difference in skin conductance, the increase in self reported anxiety was not big enough to include activation of the physiology. The two studies taken together suggest that high standard beliefs and conditional beliefs are situational and thus are relevant for an impending social-evaluative event, however after the event has passed these become irrelevant and are deactivated even when post event rumination occurs, but then unconditional beliefs activate during rumination because they are independent from the situation. A further interesting finding was, that high socially anxious individuals had performance deficits in the anticipation group that were mediated by levels of state anxiety. Here the authors speculate that the perception of anxiety in high socially anxious individuals allows for the creation of a negative self-image, which in turn leads to negative in-situation behaviours and those could explain the observed poorer speech-performance. These processes taken together could also be seen as a way to maintain social anxiety: anticipatory processing generates a negative image, that heightens anxiety, which leads to adverse performance, thus reinforcing maladaptive beliefs and those increase post-event rumination (Wong & Moulds, 2011).

6.2) Social anxiety and cardiovascular reactivity

This chapter takes a look at the results of research investigating the effects of social anxiety on cardiovascular reactivity.

Davidson, Marshall, Tomarken and Henriques (2000) investigated the effects anticipation had on social phobics, while they were waiting to give a public speech for an audience that was described in a way to induce high evaluative threat in the subjects. The study included 18 subjects categorized as phobics and 10 non phobic subjects functioning as a control group. They had to give a free speech about a recent topic to an audience, prior to the speech there was an anticipation period. Results showed, that the phobics had a much higher anxiety during all three test phases (baseline, anticipation, speech) as well as a strong increase in negative affect during the anticipation period. In terms of physiological reactivity the study found that phobics had significantly higher heart rate during all three periods and what is especially interesting there was no difference in blood pressure during the baseline period but phobics had bigger increases in systolic as well as diastolic blood pressure during the other two stages, while the control group only had increased systolic blood pressure and nearly no changes in diastolic blood pressure, although these effects were not significant, there was an

observable tendency suggesting vascular activation in the phobic group (Davidson, Marshall, Tomarken & Henriques, 2000).

Gramer and Saria (2007) examined the effect of trait social anxiety and evaluative threat on psychological and physiological responses to active coping situations. Fifty-two female subjects participated in the study. The procedure consisted of a resting phase, a mental arithmetic task and a speech preparation and performance task. Participants were split into groups according to their score on the Social Anxiety Scale and then again between the high and low evaluative threat conditions. Results showed, that socially anxious subjects showed higher heart rate reactivity across all conditions and greater systolic and diastolic blood pressure under the low evaluative threat condition, while under the high evaluative threat condition blood pressure was somewhat attenuated, although this effect was not significant. Both of these findings are consistent with the energization theory mentioned in the above chapters stating that an individual increases energy investment up to a point where success seems impossible. This would explain the higher increases in the low evaluative threat condition: the individual perceives their own ability as low, but success still as possible and experiences greater distress, so it deems higher energization as justified and necessary, while under high evaluative threat success is seen as impossible and therefore no more energy is invested (Gramer & Saria, 2007).

In the study of Gramer (2006) thirty-six male and thirty-six female individuals categorized as either high or low socially anxious had to perform a mental arithmetic task and two interpersonal tasks requiring persuasive behaviour. The results were somewhat similar to the aforementioned study by Gramer & Saria (2006), with high socially anxious subjects showing lower increases in systolic blood pressure during one of the interpersonal tasks, suggesting a more inhibited coping approach. Low socially anxious subjects showed greater social competence as well as pronounced elevations in systolic blood pressure and heart rate which is a clear sign of a cardiac reaction. For the mental arithmetic task socially anxious subjects did not show behavioural inhibition and a cardiac activation pattern could be observed. Overall these findings suggest that active performance situations evoke a cardiovascular response largely based on the energy invested by the individual and that situational factors have to be considered in the research of social anxiety (Gramer, 2006).

Gramer and Sprintschnik (2008) took a closer look at the effects of anticipation in high and low socially anxious people as well as differences in recovery. Fifty-six normotensive female subjects participated in the study and were tasked with the preparation and giving of a speech after either a prolonged resting phase or an anticipation phase. Social anxiety had a

substantial effect on cardiovascular reactivity with high socially anxious subjects showing lower heart rate and blood pressure reactivity than low socially anxious individuals. The tendency for this type of heart rate response was stronger in the anticipation group particularly during the Speech Performance. These findings indicate reduced activation in socially anxious subjects due to the situation exceeding their perceived coping ability. Furthermore the anticipation period seemed to have a positive effect on the recovery, with accelerated recovery in the anticipation group, although this effect was partially mediated by negative anticipatory affect (Gramer & Sprintschnik, 2008).

Grossman, Wilhelm, Kawachi and Sparrow (2001) investigated cardiovascular responses to a socially threatening situation among older men and women with social phobia and control subjects, thus taking a closer look at gender differences. Grossman et al. too chose a public speaking task as their method of testing reactivity. Their sample consisted of thirty social phobics and thirty control subjects. Unlike the previously mentioned studies, Grossman et al. only found differences in the physiological measures between the anxiety and the control group in woman, and not in men, which would suggest gender differences. Both groups manifested more anxiety, embarrassment and somatic complaints, again hinting that affect and physiological reactivity are not directly connected (Grossman, Wilhelm, Kawachi & Sparrow, 2001).

Eckman and Shean (1997) researched the effects of social anxiety on habituation of cognitive and psychological arousal. Fifty-two subjects were split into two groups (high and low socially anxious) and after a three minute resting period to assess the baseline, were instructed to hold three speeches with three minute breaks between speeches. The results showed a significant reduction of negative expectations, self reported nervousness and heart rate across trials in the low anxiety group, while the high anxiety group had no significant reduction in any of those measures. These results would indicate, that high socially anxious individuals are slow to decrease cognitive and autonomic responsiveness to stressful social situations. These findings would support the theory that social anxiety can lead to allostatic load due to the missing habituation to recurring stressors (Eckman & Shean, 1997)

Brosschot and Thayer (2003) examined the difference in recovery between positive and negative emotion. While his study was not directly related to social anxiety it still has important implications for it due to the fact that social stressors invoke a lot of negative emotions in high socially anxious individuals. Thirty-three healthy subjects partook in the study and reported their emotional arousal, emotional valence and physical activity and recorded their heart rates after a beep each sixty minutes, that were followed by two

subsequent recordings five and ten minutes after the initial measurement. The findings showed that the initial heart rate was predicted by activity and emotional arousal, independent of the emotional valence, but the prolonged activation of the following measurement was only predicted by emotional valence at the initial reading, showing longer recovery times for negative emotions. These findings are in accordance with the energization theory and the theory of allostatic load, showing that during initial reactivity the investment of energy is the main factor and not the emotional valence, but that emotional valance can prolong activation after the stressor is gone, which is a factor in leading to allostatic load. As an explanation for the prolonged activation Brosschot and Thayer (2003) suggest that rumination might be the explanation (Brosschot & Thayer, 2003).

7.) Research Questions and Hypotheses

7.1) Research Questions

The research trying to explain the correlation between cardiovascular disease and social anxiety has shown ambiguous results, although certain tendencies can be observed there is still a lot of research to be done before we can have a final statement on how exactly social anxiety influences the development of cardiovascular disease. A lot of studies have shown that socially anxious individuals tend to have more pronounced cardiovascular reactions to a social evaluative stressor than their non socially anxious counterparts (Davidson, Marshall, Tomarken & Henriques, 2000; Gramer & Saria, 2007; Gramer & Sprintschnik, 2008), but there were differences in the type of reactivity, with some studies finding more pronounced HR responses and others finding SBP or DBP to be a more important factor in differentiating the reactivity patterns of high and low socially anxious individuals.

The theories of “Coping” by Obrist (1981), “Challenge and Threat” by Blascovitsch and Tomaka (1996), “Energization Theory” by Wright (1996), „perseverative cognition hypothesis“ by Brosschot, Gerin and Thayer (2006) and “allostasis and allostatic load“ model by McEwen (1998) helped get a better understanding of the complex underlying mechanisms of social anxiety. Studies using these models as their basis for exploring the effects of social anxiety found evidence suggesting that due to cognitive processes often used by socially anxious individuals their perception of a socially evaluative situation leads to them

categorizing it as a threat at lower difficulty levels than non socially anxious individuals which in turn causes them to exhibit a cardiac reaction at low difficulty levels but switching to a vascular reaction at moderate difficulty levels, because they already perceive the task as impossible at that point (Gramer & Saria, 2007; Gramer 2006; Davidson, Marshall, Tomarken & Henriques, 2000).

Further findings also suggest that socially anxious individuals have trouble adjusting their reactions if exposed to the same stressor repeatedly which points to a problem with habituation (Eckman & Shean, 1997). Similarly their negative self image, strong focus on negative aspects of stressful situations and tendency to ruminate keeps them in a cycle of anxiety that maintains or heightens anxiety levels and sustains their negative self-perception in the future. Due to this *rumination* has been a point of interest for research with finding showing heightened anxiety levels and prolonged recovery times for cardiovascular measures and negative affect in high socially anxious individuals compared to low socially anxious individuals (Brosschot & Thayer, 2003). Anticipation has shifted into the focus of research as well with findings suggesting that it effects high socially anxious individuals differently than low socially anxious individuals. They experience more anxiety and think of their own abilities to handle a stressful situation as worse than their counterparts, although anticipation shows a positive effect on ruminative tendencies. Both anticipation and rumination seem to work with different mechanisms influencing the individuals self image which seems to explain a part of the cycle of keeping anxiety alive (Wong & Moulds, 2009; Wong & Moulds, 2011).

There have been studies taking a closer look at either anticipation (Davidson, Marshall, Tomarken & Henriques, 2000; Wong & Moulds, 2011) or rumination (Wong & Moulds, 2009; Dannahy & Stopa, 2007; Edwards, Rapee & Franklin, 2003) in context of social anxiety, but few like Gramer and Sprintschnik (2008) investigating how both of these constructs work together, therefore this is one of the main focuses of the current study. There have been few studies inspecting gender differences in socially anxious individuals, and results have been very ambiguous to say the least with some studies finding the effects of social anxiety being generalizable across genders (Gramer, 2006) or that the effects were confined to males (Burns, 1995) or to females (Grossman et al., 2001), therefore this study will take an explorative approach on the effects of gender. In conclusion the following three research questions cover the main topics of the current study:

Question 1:

Are there differences between high and low socially anxious individuals in respect to their cardiovascular reactivity, recovery and their experienced affect?

Question 2:

Are there differences between the two experimental conditions (anticipation / distraction) in respect to the subjects' cardiovascular reactivity, recovery and their subjective affect while also taking levels of social anxiety into consideration?

Question 3:

Are there differences between men and women in respect to their cardiovascular reactivity, recovery and their experienced affect while also taking levels of social anxiety into consideration?

7.2) Hypotheses

7.2.1) Baseline level hypotheses

Previous studies found no differences between high and low socially anxious individuals in their cardiovascular measures (SBP, DBP, HR) at baseline levels (Larkin, Ciano-Federoff & Hammel 1998; Gramer, 2006; Gramer & Sprintschnik, 2008). In a resting situation, where no social evaluative stressor is present, there should also be no difference between high and low socially anxious individuals in terms of their levels of positive and negative subjective affect. The stressor is needed to activate the mechanisms of social anxiety, that in the end lead to differences between the two groups in terms of their experienced subjective affect as well as differences in cardiovascular reactivity. Lots of studies suggest a difference in blood pressure levels between genders, that can be observed at baseline levels, with some finding differences in SBP only, with men showing higher SBP than women (Gramer, 2004; Gramer, 2006; Lawler, Wilcox & Anderson, 1995) and some finding differences in both SBP and DBP, where again men showed higher SBP and also higher DPB than women (Glynn, Christenfeld & Gerin, 1999; Allen, Blaskovich & Mendes, 2002). For HR no differences were found (Glynn, Christenfeld & Gerin, 1999; Allen, Blaskovich & Mendes, 2002; Gramer, 2006). Regarding psychological affect, a study by Carrillo and

colleagues (2001) found no differences between men and women at baseline level, but a study by Gramer and Berner (2005) found that men experienced more positive emotions than females, but no differences in negative emotions could be found (Carrillo, Moya-Albiol, González-Bono, Salvador, Ricarte & Gómez-Amor, 2001; Gramer & Berner, 2005).

Hypothesis 1.a)

There are no differences in cardiovascular measures between high and low socially anxious at the baseline level.

Hypothesis 1.b)

There are differences in cardiovascular measures between men and women at the baseline level.

Hypothesis 1.c)

There are no differences in subjective negative affect between high and low socially anxious individuals at the baseline level.

Hypothesis 1.d)

There are no differences in subjective negative affect between men and women at the baseline level.

7.2.2) Anticipation / Distraction level hypotheses

The anticipation condition is seen as a "passive" condition, it constitutes a psychological demand without the need or possibility for action, therefore a vascular reaction is expected with increases in blood pressure but not heart rate (Gregg, James, Matyas, & Thorsteinsson, 1999). Studies also found that anticipation leads to increases in state anxiety (Mansell & Clark, 1999; Gramer & Sprintschnik, 2008) and anticipating an emotional event is associated with elevated blood pressure (Doornen & van Blokland, 1992; Brand, Gortzak, Palmer-Bovba, Abraham & Abraham-Inpijn, 1995). The distraction condition is deemed to be an "active" condition, because the participants have to actively complete a task which needs focus and energization. Therefore the cardiovascular reactions during the anticipation / distraction phase were expected to reflect the different types of coping according to the model

by Obrist (1981), with increases in SBP and DBP but not HR for the anticipation condition and increases in SBP and HR as well as possible increases in DBP for the distraction condition. There is evidence of systematic differences in the mental processes between high and low socially anxious individuals before a stressful event occurs. High socially anxious individuals have a tendency for the utilization of problematic strategies like, retrieval of negative information or thoughts about avoiding the situation, while low socially anxious individuals seemingly prefer self-enhancing processes (Clark & Wells, 1995; Hinrichsen & Clark, 2003). Gramer and Sprintschnik (2008) found evidence supporting this. Their results showed that high socially anxious individuals experienced higher levels of negative affect than low socially anxious individuals during the anticipation period, furthermore anticipation in general lead to higher levels of negative affect compared to a prolonged resting period (Gramer & Sprintschnik, 2008). Individuals in the distraction condition should have increases in SBP and HR mainly, with possible increases in DBP since they have an active task to complete (Obrist, 1981). Gender differences during stressful situations were found by a number of studies, with Glynn, Christenfeld and Gerin (1999) as well as Allen, Blaskovich and Mendes (2002) finding that women tend to have more pronounced increases in HR than men, no differences were found for SBP and DBP. A study by Grossman and colleagues (2001) found similar results in social phobic men and women as well as differences in their experienced anxiety, with women showing a stronger increase in anxiety from baseline levels than men. Carrillo and colleagues (2001) found similar results in a non phobic group (Grossman et al., 2001; Carrillo et al., 2001). Although no studies were found that investigated these differences in an anticipation or distraction condition specifically. In a study by Glynn, Christenfeld and Gerin (1999) woman reported more stress than men, which could possibly influence their line of thought in a negative way compared to men. In terms of pre-task cognitive appraisal, studies generally found no gender differences (Kolk & van Well, 2007; Gramer & Berner, 2005). Therefore we formulate the following hypotheses:

Hypothesis 2.a)

Compared to baseline levels, increases in SBP and DBP are expected in the anticipation condition and increases in SBP, DBP and HR are expected in the distraction condition.

Hypothesis 2.b)

In the anticipation condition high socially anxious individuals have stronger increases in SBP and DBP than low socially anxious individuals. In the distraction condition, no differences

between high and low socially anxious individuals are expected in their changes in SBP, DBP and HR.

Hypothesis 2.c)

There are no differences between men and women in their increases in SBP and DBP, but women have a stronger increase in HR.

Hypothesis 2.d)

There are differences in the increases of subjective negative affect between men and women at the anticipation/distraction level.

Hypothesis 2.e)

In the anticipation condition high socially anxious individuals show stronger increases in subjective negative affect from baseline levels than low socially anxious individuals. No differences are expected in the distraction condition between high and low socially anxious individuals.

Hypothesis 2.f)

At the anticipation / distraction level there are no differences between men and women in the appraisal of task difficulty or the their perceived ability to complete the task successfully.

Hypothesis 2.g)

At the anticipation / distraction level high socially anxious individuals deem the task as more difficult and their own abilities to complete it successfully as lower than low socially anxious individuals.

Hypothesis 2.h)

Individuals in the anticipation condition show more negative thoughts than individuals in the distraction condition.

Hypothesis 2.i)

At the anticipation / distraction level women show more negative thoughts than men.

Hypothesis 2.j)

At the anticipation / distraction level high socially anxious individuals show more negative thoughts than low socially anxious individuals.

7.2.3) Preparation and speech task level hypotheses

A lot of studies have shown that being in a social evaluative situation will elicit changes in subjective affect not just in high socially anxious, but also in low socially anxious individuals. Although increases in subjective negative affect seem to be more prominent in high socially anxious individuals, and increases in subjective positive affect seem to be restricted to low socially anxious individuals (Gramer & Saria, 2007; Gramer & Sprintschnik, 2008). The preparation and performance of a speech task can be categorized as an "active coping task" in accordance with the model of Obrist (1981) and it has been used in a lot of studies focusing on social anxiety, due to it being an evaluative task condition. (Baggett, Saab & Carver, 1996; Grossman, Wilhelm, Kawachi & Sparrow 2001; Obrist, 1981). Active performance situations provide the participants with an option to influence the outcome of the given situation, which provoke large beta-adrenergically mediated increases in cardiovascular activity with systolic blood pressure and heart rate being most reliably affected, although increases in diastolic blood pressure have also been observed (Gramer & Saria, 2007; Smith, Limon, Gallo & Ngu, 1996; Wright, Martin & Bland, 2003). These cardiovascular changes are considered to result from energy investment by the individual, and therefore correspond directly to the experienced task difficulty up to a point where success seems impossible at which point engagement gets abandoned (Wright, 1996). High socially anxious individuals have a tendency for negative self-evaluation, impaired ability perceptions and shifting their focus on negative cues, therefore it is expected that they display greater effort, which should lead to more pronounced cardiovascular activation than low socially anxious individuals, as long as success is perceived as possible. However, high socially anxious individuals might more readily abandon energy investment in very demanding situations compared to low socially anxious individuals, which would lead to reduced myocardial reactivity (Rapee & Heimberg, 1997). Some studies found that enhanced reactivity of socially anxious individuals was confined to diastolic blood pressure, this could be due to an inhibited coping approach or abandonment of effort (Burns, 1995; Larkin, Ciano-Federoff & Hammel, 1998). According to most studies the cardiovascular changes seem to be unrelated to affective arousal (Cohen, Hamrick, Rodriguez, Feldman, Rabin & Manuck, 2000; Gramer & Saria, 2007). Since the speech task itself is more demanding, the increases in cardiovascular measures from the preparation level to speech task level should be significant as well as the increases from anticipation / distraction level to preparation level. Reduced confidence in socially anxious individuals was found in social evaluative situations (Efran & Korn, 1969), so it is expected

that high socially anxious subjects find the situation as more threatening and their self assessed performance as worse than low socially anxious individuals. Therefore we formulate the following hypotheses:

Hypothesis 3.a)

Cardiovascular measures differ from the baseline at all following task levels

Hypothesis 3.b)

There are increases in SBP, DBP and HR from the anticipation level to the preparation level and then again from the preparation level to the speech level.

Hypothesis 3.c)

Subjective negative affect differs from the baseline at all following task levels.

Hypothesis 3.d)

Subjective negative affect differs between the anticipation / distraction level and the speech task level.

Hypothesis 3.e)

Men have higher increases in SBP than women, during preparation as well as during the speech task, and woman have higher hear rate increases than men, during preparation as well as during the speech task.

Hypothesis 3.f)

High socially anxious individuals in the anticipation condition have higher increases in cardiovascular reactivity from anticipation / distraction levels to preparation as well as speech task levels than low socially anxious individuals. No differences are expected in the distraction condition.

Hypothesis 3.g)

High socially anxious individuals show more pronounced increases in subjective negative affect than low socially anxious individuals during the speech task.

Hypothesis 3.h)

Individuals of the distraction condition show more pronounced increases in subjective negative affect than individuals of the anticipation condition during the speech task.

Hypothesis 3.i)

There is no difference between men and women in their increases of subjective negative affect during the speech task.

7.2.4) Recovery level hypotheses

Some studies have shown that the duration of stress-induced cardiovascular arousal varies according to the experienced distress emotions with negative affect prolonging activation during the recovery (Brosschot & Thayer, 2003; Glynn, Christenfeld & Gerin, 2002). Brosschot and Thayer (2003) described the concept of *perseverative cognition,* as repeated or chronic activation of a cognitive representation of one or more psychological stressor (Brosschot & Thayer, 2003). The perseverative cognition model suggests that following a stressful event the individual is left in a state of "action preparation", that can be described as highly vigilant state that may produce moderate but chronic levels of activation of the cardiovascular system, even when no need for physical activity (fight or flight) is present (Brosschot & Thayer, 2003; Tallis & Eysenck, 1994). In concordance with these theories, high socially anxious individuals were expected to exhibit a prolonged recovery due to their increased tendency for rumination (Dannahay & Stopa, 2007), specifically a delay in blood pressure reduction was expected, due to the results of Glynn et al. (2002) who found that recalling an emotional task lead to delayed recovery of blood pressure but not heart rate (Glynn, Christenfeld & Gerin, 2002). Although some studies found contradicting results where cardiovascular recovery was not prolonged (Gramer & Saria, 2007). Furthermore some studies suggest that anticipation of a stressful task reduces the duration of the cardiovascular recovery, an explanation for this might be, that anticipatory processing of a specific stressor leads to a shortened cognitive prevalence of the stressor in the post-event period (Gramer & Sprintschnik, 2008). According to Wong and Moulds (2009) rumination maintains anxiety in both high and low anxious individuals and unconditional beliefs in high socially anxious individuals. Allen, Blascovich and Mendes (2002) found contradictory evidence for gender differences in terms of physiological recovery from a stressor, in their study women showed faster recovery after a cold pressor task but not after a mental arithmetic task (Allen,

Blascovich & Mendes, 2002). It is important to note that the mental aritmetic task is more akin to the speech task in that both are active coping tasks while the cold pressor task is more passive in nature. Some studies found evidence pointing in a different direction, with women having a higher tendency to ruminate which in theory would lead to prolonged rather than shortened recovery in women (Blanchard-Fields, Sulsky, & Robinson-Whelen, 1991; Nolen-Hoeksema, Larson, & Grayson, 1999), but a follow up study by Nolen-Hoeksema and Jackson (2001) found that these gender differences were no longer significant when personality variables like "perceived mastery over one's circumstances" or "controllability of negative emotion" were included as mediating variables. These findings might explain the different results in some studies, it is reasonable to assume that no gender difference exists, but rather differences in personality that lead to more pronounced rumination tendencies and those in turn prolong the duration of the cardiovascular measures during recovery (Nolen-Hoeksema & Jackson, 2001). Therefore we formulate the following hypotheses:

Hypothesis 4.a)

At the recovery level SBP and DBP are higher than at the baseline level. No differences in HR are expected between baseline and recovery levels.

Hypothesis 4.b)

Individuals in the distraction condition show less pronounced reduction of SBP and DBP during the recovery period than individuals in the anticipation condition.

Hypothesis 4.c)

There is no difference in the reduction of SBP and DBP between men and women during the recovery period.

Hypothesis 4.d)

High socially anxious individuals of the anticipation condition show less pronounced decreases in their subjective negative affect than low socially anxious individuals. No difference is expected for the distraction condition.

Hypothesis 4.e)

There is no difference in ruminative tendencies between men and women.

Hypothesis 4.f)

High socially anxious individuals of the anticipation condition show a greater amount of negative and less positive cognitions during the recovery phase than low socially anxious individuals. No difference is expected for the distraction condition.

8.) Method

8.1) Design

For this study a 2 (research-condition) x 2 (social anxiety) x 2 (gender) design was chosen. Participants got sorted to the groups by building pairs according to their social anxiety (high vs. low), gender (man vs. woman) and then splitting the pair randomly between research-conditions (anticipation vs. distraction). Since two researchers were conducting the experiment the participants per cell were equally split between them to avoid any researcher bias (see Figure 1).

Figure 1

Design: 2 (research-condition) x 2 (social anxiety) x 2 (gender)

N =128	**Women**		**Men**	
	Anticipation	**Distraction**	**Anticipation**	**Distraction**
High socially anxious	16	16	16	16
Low socially anxious	16	16	16	16

8.2) Study sample

The final sample for this study consists of one-hundred-twenty-eight participants (sixty-four men and sixty-four women) between the ages of eighteen and twenty-nine. Recruiting of the participants was done via university bulletinboards and active recruiting before lectures at the university where general information about the study was given as well as the promise that participants get a confirmation of their participation. The study consisted

of two steps, first the participants had to fill out online questionnaires as part of a preliminary examination so that a representative sample for the main examination could be found, then if they were considered for the main part of the study they were contacted via email or telephone to make an appointment for the next part. Three-hundred-seventy-nine individuals began filling out the online questionnaires with two-hundred-sixty-one finishing them completely, of those one-hundred-twenty-nine had to be excluded from the second part of the study due to factors like prevalent hypertension, medication, age, scoring too high on the "Social Desirability Scale" by Lück and Timaeus (1969) or because they didn't show up. That left us with one-hundred-thirty-two individuals who completed the second part of the study, and of those four more had to be excluded due to data loss of the blood pressure measuring device, which left us with our final number of one-hundred-twenty-eight participants (Lück & Timaeus, 1969).

Mean age was 22,02 (SD = 2.97) overall, with it being 21.19 (SD = 2.63) for women and 22,86 (SD = 3.07) for men, while BMI was 22,22 (SD = 2,9) overall, 21,7 (SD = 3,07) for women and 22,75 (SD = 7,22) for men. In terms of their life habits, 35 (16 women, 19 men) participants admitted to smoking regularly, 49 (22 women, 27 men) regularly drink coffee and 40 (16 woman, 24 men) regularly drink alcohol, 75 (37 women, 28 men) exercise regularly and 27 (18 women, 9 men) took prescription medicine. On the day of the main study 19 smoked, 39 consumed coffee and 17 worked out, but none in the last four hours before the testing began. Family background showed that 58 participants had a parent with some history of hypertension, for 36 (22 women, 14 men) it was their fathers and for 22 (11 women, 11 men) it was their mother.

8.3) Research material

8.3.1) Preliminary examination

Social anxiety – SAP (Lück, 1971)

Social anxiety of participants was assessed during the preliminary examination with the SAP questionnaire by Lück (1971). This questionnaire consists of twenty-six statements about the individual with dichotomous answers ("right" or "wrong") as options. Twenty-one

of the items are phrased in direction of social anxiety, so that a “right” answer is coded as one point, and the remaining five items (11, 14, 15, 17 & 23) are phrased in the opposite direction so that a “wrong” answer is coded as one point, therefore a high score in the SAP points towards high social anxiety in the individual. Split-half reliability for the SAP lies at $r_c = .74$ after Spearman-Brown correction based on a sample of n = 146 students.

Our sample had an overall SAP mean score of 10,14 (SD = 5,66) with women having a mean score of 11,52 (SD = 5.63) and men a mean score of 8,77 (SD = 5,39). Subjects got grouped into high or low socially anxious by splitting them at the median, giving us a high socially anxious female group with a mean score of 16,31 (SD = 3,34), a high socially anxious male group with a mean score of 13,50 (SD = 2,79), a low socially anxious female group with a mean score of 6,72 (SD = 2,39) and a low socially anxious male group with a mean score of 4,03 (SD = 2,24).

Social desirability control – SDS (Lück & Timaeus, 1969)

The SDS measures how likely an individual is to alter their answers in favour of what they think is socially desirable, instead of answering honestly. This scale was used to exclude participants that scored too high from the second part of the study since a tendency to answer in a socially desirable way would mask their responses. It consists of twenty-three items with dichotomous answers (“right” or “wrong”). The higher the score the higher the tendency to answer in a socially desirable way. Split-half reliability is at $r_c = .77$ after Spearman-Brown correction. Cut-off point for this study was set at 19.

Anticipatory processes - MMAP (Feldman & Hayes, 2005)

The MMAP is a questionnaire consisting of fifteen items that measure patterns of mental preparation that are productive or unproductive in coping with future events. The items are statements about different problem solving procedures like “I try to understand how the problem came to be” and how likely the individual is to use those. Answers are given on a five point likert scale from “don't agree” at all to “completely agree”. Furthermore two distraction items by Vassilopoulos (2008) were included during the testing “I engage in other activities to distract myself” and “I try to think about other, less intimidating things”, although

these had to be removed again, since they failed to form the supposed third factor called "distraction". Which lead to two factors separating the items describing the productive from the unproductive mental preparation strategies, the two factors were labelled "positive rumination" with a Cronbach α of .82 and "negative rumination" with a Cronbach α of .85. Both factors together amounted to 53.86% of total variance. The factor "positive" amounted to 22.81% with 7 items loading on it and the factor "negative" amounted to 31.04% with 7 items loading on it.

Blood pressure influencing variables

At the end of the online questionnaire further questions about their person (age, gender, height, weight), regarding the lifestyle (alcohol and coffee consumption, medication, smoking and exercise habits) and hypertension background in their families was recorded, since these factors are known to have effects on blood pressure and therefore could skew the studies results.

8.3.2) Main examination

Affect – BFB (Muhrer, 2007)

Affect was measured with the BFB questionnaire. It consists of fourteen adjectives that each describe a different feeling or percept. The participant has to rate how well each adjective corresponds to their feelings on a five-level rating scale going from "not at all" to "extremely". A two factor stucture was found in accordance with literature. These two factors amount to 58.86% of total variance with 18.51% coming from factor one, with 4 items loading on it and 40.35% from factor two with 8 items loading on it. Calculations for reliability showed a good internal consistency for both factors after removing items 3 (überlegen / superior) and item 13 (passive / passive), as well as reversing one factor (selbstbewusst / confident), because it loaded low on the positive factor but very strongly on the negative factor. In the end the questionnaire showed a Cronbach-α of .83 for the "positive

affect" factor and a Cronbach-α of .88 for the "negative affect" factor. Factor loadings can be found in the appendix.

Prospective assessment of threat – Cognitive appraisal (Tomaka et al., 1993)

For measuring the participants pre-task cognitive appraisal three items were used with a seven-level rating scale going from "not at all" to "very threatening". The questions were "how threatening is the upcoming task for you?", "how difficult will the upcoming task be according to your expectation?" and "how would you rate your ability to successfully complete the upcoming task?"

These questions were also rephrased and then used for retrospective assessment of threat.

Cognitive processes – ASBQ (Hinrichsen & Clark, 2003)

This questionnaire is a shortened version of the SBQ by Clark et al., 1995. The ASBQ measures cognitive strategies used by individuals during anticipation of a social situation and consists of twelve items describing cognitions, the individual states how often they experienced those conditions via a five-level rating scale from "never" to "all the time". The cognitions used in this questionnaire are those identified as problematic in high socially anxious individuals, like "I thought about similar situations, where I failed in the past" or "I imagined the worst possible outcomes". In the factor analysis for the ASBQ one factor was found as expected and all items had a reasonable loading on it. Reliability was found to be strong with a Cronbach-α of .86 without removing any items. Factor loadings can be found in the appendix.

Rumination – Thoughts Questionnaire (Edwards, Rapee & Franklin, 2003)

The German translation by Muhrer (2007) was used in this study. The original version by Edwards, Rapee and Franklin (2003) has twenty-nine items assessing the negative as well as the positive ruminative tendencies of the individual, who has to answer on a five-

level rating scale, how often specific thoughts crossed their mind with options ranging from “never” to “very often”. A two factor structure was found for the TQ, matching expectations from literature. Both factors together amounted for 59.75% of total variance. The “positive rumination” factor was responsible for 16.71% with 6 items loading on it and the “negative rumination” factor was responsible for 43.04% with 12 items loading on it. Calculations for reliability showed a good internal consistency for both factors after removing item 17. A Cronbach-α of .85 was found for the “positive rumination” factor and a Cronbach-α of .94 for the “negative rumination” factor.

Physiological measuring

Measuring of blood pressure and heart rate was conducted with an automatic blood pressure monitor (boso – TM – 2430 PC2) via a cuff placed on the non dominant arm of the participant, the placement was 2-3cm above the elbow. The subjects were told to move as little as possible and to try to keep the arm with the monitor as still as possible. Measurements were started manually by the examiner and the measured data was copied to the computer automatically by the blood pressure monitor.

Anticipation vs. distraction

To be able to properly capture the effects of anticipation, distraction was chosen as the counterpart of this condition in the study and not a prolonged resting period, as was done in previous studies. The problem with a prolonged resting period is, that participants could engage in cognitive behaviours that could possibly influence their cardiovascular reactivity or psychological affect without the knowledge of the individual or examiner, but during an active distraction phase the subjects attention is guided to a specific task and this should not allow for their thoughts to wander, therefore effects of anticipation should be easier to distinguish in the results. For the distraction condition in this study a task was chosen that is easy, but requires attention and had a certain amount of time pressure as a component to further strengthen the individuals focus on the given task. Participants were shown pictures that had different statements written underneath them and they were told to rate these according to their level of agreement on a five-level rating scale going from “don't agree at

all" to "completely agree". They were told to try and finish as many pictures as possible while still answering to the best of their abilities. Furthermore it was made clear that there were no wrong or right answers as to not induce stress in the individual.

Speech

Preparing and holding a speech was chosen as the stress inducing social situation in this study, since this task has proven to be effective in eliciting cardiovascular reactions in participants and is also relevant in terms of social evaluative threat for social anxiety theories. The topic of the speech was a self presentation in context of a fictive job interview in their striven for line of work. Help as well as the criteria for the appraisal of speech performance were given to the participant on an instruction sheet. After receiving their instructions the participants had five minutes to prepare their speech and another five minutes to give it, they were told that they should try to fill the whole five minutes with their speech and that if it ended up being shorter than five minutes, than the measuring period would still continue over the whole duration. Signs were given by the examiner as when to start and when to stop, furthermore an audio recording was played during the preparation phase that informed the participants about their remaining time every minute, this should theoretically lead to more pronounced stress in the individuals. To further increase the social evaluative threat participants were told that they were going to get recorded on camera, with the camera and its recording indicator light being clearly visible to the individual. It was also made clear to them that their speech performance will be judged by the examiner based on different factors like "eloquence" or "persuasiveness" and to further increase the believability of this statement the examiner had a clipboard with the different criteria that he was filling out during the individuals speech.

8.4) Experimental procedure

8.4.1) Preliminary examination procedure

The preliminary examination was used for pre selection of participants, so that a representative sample could be achieved for the main examination. The examination was done via online questionnaires that the subjects could fill out at any PC with an internet connection. Participants were informed that their data would be handled with caution and coded to guarantee anonymity. The first questionnaire to be filled out was the SAP followed by the SDS and finally questions about blood pressure influencing variables like age, weight, height, etc. were given. After all questionnaires were filled out properly a code was generated for the individual.

8.4.2) Main examination procedure

Following the preliminary examination the final sample was categorized and pairs were made based on gender and SAP score, then assigned randomly to the anticipation / distraction conditions. The resulting cells were split evenly and randomized between examiners, so that an influence by examiner could be avoided or at least minimized. Afterwards appointments were made with every participant. Testing took place over a period of four months. Participants had appointments one at a time and the tests were conducted in a room provided by the university. After arriving the subject was informed that participation was on a voluntary basis and that the test can be aborted at any time if they feel the need to. A piece of paper and a pencil was provided for all participants (for taking notes during the speech preparation phase). After the participants sat down and were comfortable they were given the first questionnaire about recent activities that are known to influence the cardiovascular system (i.e smoking, alcohol consumption, sportive activity, etc.) and the BFB questionnaire. Following that they received the instruction for the following ten minute resting period and were told that the blood pressure monitor will be affixed to their non dominant arm and that blood pressure measures will be taken throughout the whole examination. After they read the instruction and had no more further questions the blood pressure monitor was affixed according to general guidelines. Participants were told to hold their non dominant arm as still as possible throughout the examination. Afterwards the ten minute resting period started with blood pressure and heart rate taken at the one, five and nine minute mark. At the end of the resting period they were given the BFB questionnaire again and the next instruction, which was different depending on the study condition, was given to them. Individuals in the participation condition were told that the following test phase takes

five minutes and that they were to prepare and give a speech with a topic that will be given to them following this phase, they were also informed that their speech would be recorded and rated by the examiner and that an audio recording will notify them about the remaining time every minute, while participants of the distraction group were also given instructions about the procedure of the distraction task. Cardiovascular measures were taken at the one and four minute mark during this phase. Following the anticipation / distraction period participants were given three questionnaires, the BFB, the ASBQ and questions about their pre-task cognitive appraisal, after completing all three they were given their speech topic and had five minutes to prepare with cardiovascular measures being taken at the one and four minute mark again, the preparation phase was followed by yet another BFB questionnaire. As soon as participants were finished they were told to face the camera that was prepared on a stand. The examiner walked over to the camera, turned it on and then told the participant to start with their speech, this was done so that the recording was believable and evaluative threat was visibly present. Cardiovascular measures were again taken at the one and four minute mark. At the end of this phase the blood pressure monitor cuff was removed from the participants arm and they were once again asked to fill out a BFB questionnaire as well as the post-task cognitive appraisal questions and were then given instructions for the recovery phase. During the ten minute recovery period they were to relax and not talk or move. Cardiovascular measures were taken at the one, five and nine minute mark. After the recovery period participants had to fill out the BFB questionnaire for the last time and were asked to answer the Thoughts Questionnaire as well. No further information about the study was given even after the participants completed it, as not to endanger the status manipulation. Finally, before leaving their participation notification was awarded to them. A timetable for cardiovascular measures can be found in Figure 2 and for the surveys in Figure 3.

Figure 2

Timetable for the collection of cardiovascular data

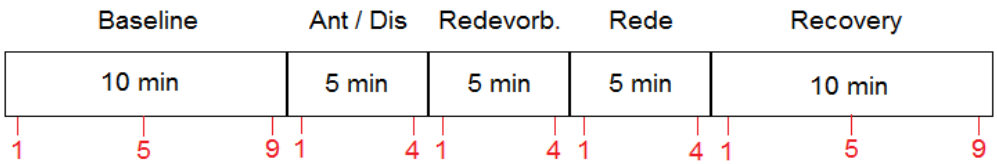

Figure 3

Timetable for the collection of psychological data

9.) Results

Statistical Data was analysed using SPSS version 21.0.0 for Windows. Results were interpreted as statistically significant at $p \leq .05$ and as a tendency at $p \leq .07$. For some of the statistical methods used in this study certain conditions had to be met. The dependent variable was checked for *normality of the distribution* with the Kolmogorov-Smirnof test, although due to the sample size of 128 (minimum 30) even if normality is not given for a certain variable, the chosen method can be used. Levine's tests were conducted to check *homogenity of variance*, although analysis of variance procedures are very sturdy even if homogenity of variance is not given, especially when all groups are of equal size (Bühner & Ziegler, 2009). *Sphericity* was checked by using Mauchly's sphericity test and in case of a violation a Greenhouse-Geisser correction was implemented.

9.1) Preliminary examination results

The 128 participants were split into 8 groups with 16 individuals per group. Uniform distribution of blood pressure influencing variables was tested with chi-squared testes for hypertension history in the family, smoking, alcohol consumption, coffee consumption and regular exercise. One significant difference ($p = .02$) was found in the reported regular exercise between anxiety groups, with more low socially anxious individuals (44 out of 64) than high socially anxious individuals (31 out of 64) regularly exercising, so this variable was included in further calculations as a covariate, but since no effects could be found it was later removed. An ANOVA was conducted to check distribution of BMI and age

in the groups and significant differences were found between genders with men (22,85 yrs) being generally older than women (21,18 yrs) and having a higher BMI (22,75) vs. (21,69), these were taken into consideration for all further calculations, if the effects were significant they remained in the calculations as a covariate and if not, calculations were repeated without the covariate.

9.2) Baseline level results

First t-tests were calculated for the baseline cardiovascular measures to determine if the second of the three measurements during baseline significantly differed from the third. The first measurement was excluded due to it being shortly after the arrival of the subject and therefore influences from movement and general activation due to arriving into the testing situation were expected.

The second and third baseline measurements did not significantly differ for any of the three factors, SBP: $t(127) = 1.05$, $p = .29$, DBP: $t(127) = 1.08$, $p = .29$ and HR: $t(127) = -1.63$, $p = .11$. As the t-tests showed no significant difference between the second and third baseline values, it was chosen that each cardiovascular measure should be averaged (without inclusion of the first measurement) to get a more solid baseline than solely using the third baseline value.

H1.a: *There are no differences in cardiovascular measures between high and low socially anxious at the baseline level.*

H1.b: *There are differences in cardiovascular measures between men and women at the baseline level.*

Calculations for hypotheses 1.a and 1.b were executed with the use of 3-way ANOVAs for SBP and HR and a 3-way ANCOVA with “history of hypertension in the father” as a covariate for DBP. Social anxiety group (high / low), research condition (anticipation / distraction) and gender (men / woman) were the factors used in all three calculations.

Due to correlations with assessed cardiovascular influencing elements (BMI, fathers history of hypertension, smoking before the examination) ANCOVAs had to be

conducted first for all three cardiovascular parameters, with the relevant elements being determined by correlating each cardiovascular measure with all of the cardiovascular influencing variables that were previously assessed. For SBP and HR none of the cardiovascular influencing elements had a significant influence in the ANCOVAs, therefore the calculations were simplified to a ANOVA for SBP and HR. For DBP one covariate (history of hypertension in the father) stayed significant ($F_{1,119} = 4.61$, $p = .03$, $\eta^2 = .04$), therefore for DBP the ANCOVA was kept as the method of analysis.

A significant main effect for gender could be found for SBP ($F_{1,120} = 18.38$, $p = .00$, partial $\eta^2 = .13$), with men showing higher SBP than women ($M = 125.8$ vs. $M = 111.63$) but not for DBP ($F_{1,119} = 1.35$, $p = .25$, partial $\eta^2 = .01$) or HR ($F_{1,120} = 1.16$, $p = .28$, partial $\eta^2 = .01$).

For social anxiety no significant main effects were found for SBP ($F_{1,120} = .89$, $p = .35$, partial $\eta^2 = .01$), DBP ($F_{1,119} = .7$, $p = .41$, partial $\eta^2 = .01$) or HR ($F_{1,120} = 1.71$, $p = .19$, partial $\eta^2 = .01$) although a significant interaction between gender and anxiety was found for DBP ($F_{1,119} = 4.11$, $p = .05$, partial $\eta^2 = .03$), with low socially anxious men showing higher baseline DBP than high socially anxious men ($M = 75.19$ vs. $M = 71.03$, $p = .03$), and no difference between low and high socially anxious women ($M = 70.39$ vs. $M = 71.95$, $p = .43$). It should be noted, that a significant interaction was also found for HR regarding the research condition (anticipation / distraction), but since participants were not aware which group they were assigned to and later calculations used delta values for the cardiovascular parameter, this finding can be seen as a coincidence and will therefore be disregarded. In case of a significant correlation between baseline HR and a HR delta value, the baseline HR was included as covariate in further calculations.

Figure 4

Mean values and standard deviation (in brackets) for SBP, DBP and HR for all groups.

Condition	**Anticipation**				**Distraction**			
Gender	Men		Women		Men		Women	
Social anxiety	HSA	LSA	HSA	LSA	HSA	LSA	HSA	LSA
SBP	123.38	123.63	114.31	117.53	118.47	122.50	115.41	113.81
	(9.42)	(6.58)	(8.36)	(8.06)	(10.30)	(7.80)	(8.51)	(11.14)
DBP	72.00	76.44	71.94	72.56	70.06	73.94	71.97	68.22
	(6.59)	(6.54)	(8.81)	(7.38)	(6.70)	(8.20)	(7.61)	(7.97)
HR	75.03	71.16	79.78	79.06	82.56	80.44	80.63	77.69
	(11.43)	(11.81)	(8.95)	(10.75)	(10.82)	(10.72)	(10.01)	(8.66)

Notes. SBP = systolic blood pressure (mmHg), DBP = diastolic blood pressure (mmHg), HR = heart rate (bpm),

H1.c: *There are no differences in subjective negative affect between high and low socially anxious individuals at the baseline level.*

H1.d: *There are no differences in subjective negative affect between men and women at the baseline level.*

Calculations for hypothesis 1.c and 1.d were implemented with the use of a 3-way ANOVA for negative baseline affect with social anxiety group (high / low), gender (men / woman) and research condition (anticipation / distraction) as factors.

There was no significant difference between genders ($F_{1,120} = .03$, $p = .85$, partial $\eta^2 = .00$). A significant main effect for social anxiety ($F_{1,120} = 11.1$, $p = .00$, partial $\eta^2 = .09$), with high anxious individuals experiencing more negative affect than low anxious individuals ($M = 12.14$ vs. $M = 10.56$) was found, which could be explained within anxiety theories as not a basic difference between the two groups in a resting situation, but rather being in a testing situation and meeting an unknown individual eliciting anxiety in high socially anxious individuals before arrival and therefore leading to differences beforehand. As expected there was also no significant effect of research condition ($F_{1,120} = 3.29$, $p = .07$, partial $\eta^2 = .03$), since at this point participants were not yet aware which research condition they have been assorted to.

9.4) Anticipation / distraction level results

Figure 5

Changes in SBP, DBP, HR and negative affect from baseline to anticipation / distraction

Condition	**Anticipation**				**Distraction**			
Gender	Men		Women		Men		Women	
Social anxiety	HSA	LSA	HSA	LSA	HSA	LSA	HSA	LSA
SBP	3.63	2.03	0.16	3.46	3.63	3.09	1.03	3.72
DBP	1.38	-0.78	1.5	6.38	1.81	0.03	2.53	5.06
HR	0.19	-1.38	2.53	6.53	-2.38	2.75	2.66	4.41
Negative affect	3.94	0.63	5.38	1.63	1.56	2	1.69	0.31

Notes. SBP = systolic blood pressure (mmHg) , DBP = diastolic blood pressure (mmHg), HR = heart rate (bpm)

H2.a: *Compared to baseline levels, increases in SBP and DBP are expected in the anticipation condition and increases in SBP, DBP and HR are expected in the distraction condition.*

Repeated measures ANOVAs were conducted for each cardiovascular measure (SBP, DBP, HR) with time as the within-subject factor and two levels (baseline level, anticipation/distraction level). The values used for the two levels were created by calculating the mean value of baseline measurement 2 and 3 and anticipation/distraction measurement 1 and 2 for SBP, DBP and HR respectively. Data was split according to research condition (anticipation/distraction) so that the effects can be interpreted separately for the groups.

For SBP a significant difference between the two time points was found in the anticipation ($F_{1,63} = 6$, $p = .02$, partial $\eta^2 = .09$) as well as the distraction ($F_{1,63} = 7.05$, $p = .01$, partial $\eta^2 = .10$) condition with a change from a mean value of 119.71 ± 8.91 mmHg to 122.03 ± 10.5 mmHg in the anticipation condition and from 117.55 ± 9.88 mmHg to 120.41 ± 12.06 mmHg in the distraction condition.

DBP showed significant differences as well in both the anticipation ($F_{1,63} = 4.56$, $p = .04$, partial $\eta^2 = .07$) with mean changes from 73.23 ± 7.45 mmHg to 75.35 ± 8.24 mmHg as

well as the distraction ($F_{1,63}$ = 8.42, p = .01, partial η^2 = .12) condition with mean changes from 71.05 ± 7.76 mmHg to 73.41 ± 7.83 mmHg.

Similar results were found for HR in both the anticipation ($F_{1,63}$ = 5.97, p = .02, partial η^2 = .09) with mean changes from 76.26 ± 11.09 bpm to 78.23 ± 12.94 bpm as well as the distraction ($F_{1,63}$ = 4.18, p = .05, partial η^2 = .06) condition with mean changes from 80.33 ± 10.00 bpm to 82.19 ± 11.86 bpm.

H2.a was partly confirmed with subjects experiencing increases in SBP, DBP and HR in the distraction condition and increases in SBP and DBP in the anticipation condition, but due to an unexpected increase in HR in the anticipation condition this hypothesis was only partly confirmed. This hints at cardiac activation even though the anticipation condition is expected to invoke a vascular reaction due to the passive nature of the situation.

H2.b: *In the anticipation condition high socially anxious individuals have stronger increases in SBP and DBP than low socially anxious individuals. In the distraction condition, no differences between high and low socially anxious individuals are expected in their SBP, DBP and HR.*

H2.c: *There are no differences between men and women in their increases in SBP and DBP, but women have a stronger increase in HR.*

First, delta values were calculated for SBP, DBP and HR using baseline level and anticipation level mean values. Afterwards 3-way ANOVAs were conducted for each cardiovascular measurement with anxiety group (high / low), condition (anticipation / distraction) and gender (men / woman) as the factors.

For SBP no significant interaction between social anxiety and research condition was found ($F_{1,120}$ = .01, p = .94, partial η^2 = .00) and no significant main effect for gender ($F_{1,120}$ = .47, p = .49, partial η^2 = .00).

For DBP no significant interaction between social anxiety and research condition was found ($F_{1,120}$ = .16, p = .69, partial η^2 = .00), but a significant interaction between social anxiety and gender ($F_{1,120}$ = 5.17, p = .03, partial η^2 = .04) where low socially anxious women were found to experience significantly higher DBP than high socially anxious women (M =

5.72 ± 6.3 mmHg vs. M = 2.02 ± 7.91 mmHg, p = .04) while the difference between men was not significant (M = -.38 ± 8.03 vs. 1.59 ± 5.2, p = .25).

For HR no significant interaction between social anxiety and research condition was found ($F_{1,120}$ = .95, p = .33, partial η^2 = .01), but the main effect for gender was significant ($F_{1,120}$ = 13.83, p = .00, partial η^2 = .10), with women showing an increase in HR, while men show a slight decrease in HR (4.03 bpm vs -.20 bpm). A significant main effect for social anxiety was also found ($F_{1,120}$ = 4,18 p = .04, partial η^2 = .03), with low socially anxious individuals having a higher increase in HR than high socially anxious individuals (3.08 bpm vs .75 bpm)

H2.b can be seen as unconfirmed, since there was no significant interaction between social anxiety and research condition in any of the cardiovascular measures, furthermore the only significant main effect that was found in regard to those two factors was a main effect of social anxiety where low socially anxious individuals experienced stronger increases in HR than high socially anxious individuals. In SBP and DBP there were no differences between social anxiety groups or research conditions.

H2.c was partly confirmed with the expected gender main effect for HR showing that woman have stronger increases from baseline than men, but only partly confirmed because for DBP a significant interaction was found where low socially anxious women experienced more pronounced increases in DBP than high socially anxious women.

H2.d: *There are differences in the increases of subjective negative affect between men and women at the anticipation/distraction level.*

H2.e: *In the anticipation condition high socially anxious individuals show stronger increases in subjective negative affect from baseline levels than low socially anxious individuals. No differences are expected in the distraction condition between high and low socially anxious individuals.*

First, delta values were calculated for negative affect using baseline level and anticipation level values. Afterwards a 3-way ANOVA was conducted with anxiety group (high / low), condition (anticipation / distraction) and gender (men / woman) as the factors.

Results showed a significant interaction between social anxiety and research condition ($F_{1,120} = 6.13$, $p = .02$, partial $\eta^2 = .05$) upon further examining the effects it was found, that there was only a significant difference between high and low socially anxious individuals in their reported negative affect, if they were in the anticipation condition ($F_{1,60} = 16.44$, $p = .00$, partial $\eta^2 = .22$), with increases in negative affect being more pronounced in high ($M = 4.66$, $SD = 4.27$), than low ($M = 1.13$, $SD = 2.46$) socially anxious individuals ($MD = 3.53$, $p = .00$). No difference between anxiety groups could be found in the distraction condition ($F_{1,60} = ,29$, $p = .6$, partial $\eta^2 = .01$).

The gender main effect was not significant ($F_{1,120} = .13$, $p = .72$, partial $\eta^2 = .00$).

In conclusion H2.d seems to be following models of social anxiety showing that the subject has to engage in the cognitive processes common in social anxiety to experience heightened negative affect. By binding their attention to another task that prevents them from engaging in said processes the difference between high and low socially anxious individuals in terms of their experienced negative affect are mitigated.

H2.e can be abandoned since no differences between genders were found.

H2.f: *At the anticipation / distraction level there are no differences between men and women in the appraisal of task difficulty or their perceived ability to complete the task successfully.*

H2.g: *At the anticipation / distraction level high socially anxious individuals deem the task as more difficult and their own abilities to complete it successfully as lower than low socially anxious individuals.*

To test these hypothesis we first had to divide the “expected strain” by the “expected coping ability” according to Tomaka et al. (1993) to form the coping variable. Then a 3-way ANOVA was calculated with the coping variable (appraisal ratio) as the dependent variable and anxiety group (high / low), condition (anticipation / distraction) and gender (men / woman) as the factors. According to Tomaka et al. (1993) a ratio under 1 can be interpreted as the individual perceiving the situation as a challenge and above 1 it is seen as a threat.

Results showed a significant main effect for gender ($F_{1,120} = 12.72$, $p = .00$, partial $\eta^2 = .1$) and for social anxiety ($F_{1,120} = 26.06$, $p = .00$, partial $\eta^2 = .18$). Upon closer inspection of the mean values it could be deducted that women ($M = 1.13$) and high socially anxious individuals ($M = 1.21$) were more likely to perceive the task as threat, while men ($M = .77$) and low socially anxious individuals ($M = .69$) were more likely to perceive it as a challenge. For social anxiety findings were according to theory, showing that socially anxious individuals underestimate their own abilities in social evaluative situations or expectations thereof, while also overestimating task difficulty. For genders the findings were unexpected. It could be argued that maybe the specific task configuration or circumstances were more threatening to women than to men.

H2.h: *Individuals in the anticipation condition show more negative thoughts than individuals in the distraction condition.*

H2.i: *At the anticipation / distraction level women show more negative thoughts than men.*

H2.j: *At the anticipation / distraction level high socially anxious individuals show more negative thoughts than low socially anxious individuals.*

For these hypotheses the overall score of the ASBQ was calculated and used as the dependent variable in a 3-way ANOVA with anxiety group (high / low), condition (anticipation / distraction) and gender (men / woman) as the factors. The lower the score the more negative thoughts were present during the phase. Significant main effects were found for gender ($F_{1,120} = 3.91$, $p = .05$, partial $\eta^2 = .03$) and social anxiety ($F_{1,120} = 22.36$, $p = .00$, partial $\eta^2 = .16$) with findings showing that women ($M = 43.84$, $SD = 9.64$) and high social anxious individuals ($M = 41.88$, $SD = 8.56$) experienced a greater amount of negative thoughts than men ($M = 46.67$, $SD = 7.86$) and low socially anxious individuals ($M = 48.64$, $SD = 7.89$), which is in congruence with our theories and hypotheses. For the research condition no significant main effect was found ($F_{1,120} = .90$, $p = .34$, partial $\eta^2 = .01$) which could mean that the distraction task did not bind the individuals focus enough to keep them from engaging in negative cognitions, which would have interesting implications for future research in regards to how anticipation conditions are executed.

9.5) Preparation / speech level results

Figure 6

Changes in SBP, DBP, HR and negative affect from anticipation / distraction to speech preparation and speech.

	Condition	**Anticipation**				**Distraction**			
	Gender	Men		Women		Men		Women	
	Social anxiety	HSA	LSA	HSA	LSA	HSA	LSA	HSA	LSA
Preparation	SBP	8.72	3.31	8.06	14.09	6.9	4.69	12.78	9.56
Speech		22.31	21.94	27.44	33.28	19.66	19.28	25.43	31.44
Preparation	DBP	7.88	1.44	1.47	3.69	1.84	5.22	9.38	6.84
Speech		13.44	10.53	21.5	19.28	11.34	11.09	18.09	14.34
Preparation	HR	5.31	8.16	8.41	9.44	5.5	6.06	9.91	5.53
Speech		6.63	11.34	7.66	7.03	3.38	8	6.63	6.38
Speech	Negative affect	2.06	0.81	3.38	-0.38	3.25	1.31	5.63	3.88

Notes. SBP = systolic blood pressure (mmHg) , DBP = diastolic blood pressure (mmHg), HR = heart rate (bpm)

H3.a: *Cardiovascular measures differ from the baseline at all following task levels*
H3.b: *There are increases in SBP, DBP and HR from the anticipation level to the preparation level and then again from the preparation level to the speech level.*

For H3.a and H3.b mean values were calculated for SBP, DBP and HR at each level by using all recordings at each specific level. The only exception for this was the baseline level where only the second and third recordings were used. Afterwards repeated measures ANOVAs for each cardiovascular measure (SBP, DBP, HR) were conducted with time as the within-subject factor and five levels (baseline level, anticipation/distraction level, pre speech level, speech level and recovery level).

The results for SBP showed a significant effect for time corrected according to Greenhouse-Geisser ($F_{2.986,379.263} = 138.97$, $p = .00$, partial $\eta^2 = .52$). Upon further inspection it was found, that SBP differed from baseline significantly at every following level:

baseline (M = 118.63) to ant/dis (M = 121.22) (p = .00)

baseline (M = 118.63) to speech prep (M = 129.74) (p = .00)

baseline (M = 118.63) to speech (M = 146.32) (p = .00)

baseline (M = 118.63) to recovery (M = 126.26) (p = .00).

It was also found that the increase in SBP from speech preparation to the speech task was significant: speech prep (M = 129.74) to speech (M = 146.32) (p = .000)

The results for DBP showed a significant effect for time corrected according to Greenhouse-Geisser ($F_{3.091,392.497} = 52.24$, p = .00, partial $\eta^2 = .29$). Upon further inspection it was found, that DBP differed from baseline significantly at every following level:

baseline (M = 72.14) to ant/dis (M = 74.38) (p = .00)

baseline (M = 72.14) to speech prep (M = 79.1) (p = .00)

baseline (M = 72.14) to speech (M = 89.33) (p = .00)

baseline (M = 72.14) to recovery (M = 77.81) (p = .00)

It was also found that the increase in DBP from speech preparation to the speech task was significant:

speech prep (M = 79.1) to speech (M = 89.33) (p = .00)

The results for HR showed a significant effect for time corrected according to Greenhouse-Geisser ($F_{3.1,393.5} = 51.59$, p = .00, partial $\eta^2 = .29$). Upon further inspection it was found, that HR differed from baseline significantly at every following level, except for the recovery level:

baseline (M = 78.29) to ant/dis (M = 80.21) (p = .00)

baseline (M = 78.29) to speech prep (M = 87.5) (p = .00)

baseline (M = 78.29) to speech (M = 87.34) (p = .00)

baseline (M = 78.29) to recovery (M = 77.02) (p = .17)

It was found that there was no significant increase in HR from speech preparation to the speech task:

speech prep (M = 87.5) to speech (M = 87.34) (p = .87)

All in all it can be said that the task elicited an adequate response in the cardiovascular measures from the participants over the course of the examination. Furthermore the significant increases from preparation to speech task levels as well as peak values during the task, show that the task itself was the most demanding part of the examination as expected.

H3.c: *Subjective negative affect differs from the baseline at all following task levels.*

H3.d: *Subjective negative affect differs between the anticipation / distraction level and the speech task level.*

Similarly to the previous hypotheses the calculations for H1.d and H3.d were calculated with a repeated measure ANOVA. Summations of the negative affect scores at each level were calculated and the ANOVA was conducted with time as the within-subject factor and four levels (baseline level, anticipation/distraction level, speech level and recovery level).

Results showed a significant main effect for time on that negative affect corrected according to Greenhouse-Geisser ($F_{2.16,274.59} = 75.33$, $p = .00$, partial $\eta^2 = .37$). Further analysis proved that negative affect significantly differed from baseline at all levels except the recovery level:

baseline (M = 11.35) to ant/dis (M = 13.49) (p = .00)

baseline (M = 11.35) to speech (M = 15.98) (p = .00)

baseline (M = 11.35) to recovery (M = 11.26) (p = .67)

A significant difference was also found between the anticipation / distraction level and the speech task level:

ant/dis (M = 13.49) to speech (M = 15.98) (p = .00)

These findings show that the speech task itself elicited the strongest levels of negative affect during the examination and that there was a steady increase in negative affect from the baseline levels throughout the examination up until the recovery period where levels of negative affect went back to baseline levels after task completion.

H3.e: *Men have higher increases in SBP than women, during preparation as well as during the speech task, and woman have higher HR increases than men, during preparation as well as during the speech task.*

H3.f: *High socially anxious individuals in the anticipation condition have higher increases in cardiovascular reactivity from anticipation / distraction levels to preparation as well as*

speech task levels than low socially anxious individuals. No differences are expected in the distraction condition.

H3.e and H3.f were calculated with repeated measure ANCOVAs for SBP, DBP and HR separately. Delta values of the respective cardiovascular measure at each level were calculated by using mean values of the anticipation/distraction level and the respective level (preparation, speech). The ANCOVAs were conducted with time as the within-subject factor and two levels (pre speech level and speech level). "Conducting examiner" was left in as a covariate for SBP and DBP, as was baseline HR for HR, because of a previously tested significant correlation to the delta values of these cardiovascular measures and because the covariate proved to have a significant effect in the ANCOVAs, for SBP ($F_{1,119} = 18.37$, $p = .00$, partial $\eta^2 = .13$), DBP ($F_{1,119} = 7.98$, $p = .01$, partial $\eta^2 = .06$) and HR ($F_{1,119} = 21.11$, $p = .00$, partial $\eta^2 = .15$).

For SBP a significant main effect for time was found ($F_{1,119} = 92.27$, $p = .00$, partial $\eta^2 = .44$). Between subject effects analysis showed significant main effects for gender ($F_{1,119} = 10.6$, $p = .00$, partial $\eta^2 = .08$) with women ($M = 19.87$) showing greater increases in SBP than men ($M = 13.74$). No interaction between research condition and social anxiety was found ($F_{1,119} = .45$, $p = .51$, partial $\eta^2 = .00$).

For DBP a significant main effect for time was found ($F_{1,119} = 31.74$, $p = .00$, partial $\eta^2 = .21$). Between subject effects analysis showed significant main effects for gender ($F_{1,119} = 3.95$, $p = .05$, partial $\eta^2 = .03$) with women ($M = 11.59$) showing greater increases in DBP than men ($M = 8.09$). No interaction between research condition and social anxiety was found ($F_{1,119} = .07$, $p = .8$, partial $\eta^2 = .00$).

For HR no significant main effect for time was found ($F_{1,119} = 2.409$, $p = .12$, partial $\eta^2 = .02$).

These findings were entirely unexpected, with women showing more pronounced increases in their SBP and DBP and no difference between genders in HR. Furthermore the non significant interaction between social anxiety and research condition could possibly mean that the distraction did not work as intended.

H3.g: *High socially anxious individuals show more pronounced increases in subjective negative affect than low socially anxious individuals during the speech task.*

H3.h: *Individuals of the distraction condition show more pronounced increases in subjective negative affect than individuals of the anticipation condition during the speech task.*

H3.i: *There is no difference between men and women in their increases of subjective negative affect during the speech task.*

For these hypotheses a 3-way ANOVA was conducted for negative affect with anxiety group (high / low), condition (anticipation / distraction) and gender (men / woman) as the factors. The delta value for negative affect at speech level was calculated with the use of the sums at the speech and anticipation level.

Results showed significant main effects for research condition ($F_{1,120}$ = 7.27, p = . 01, partial η^2 = .06), with stronger increases in the distraction (M = 3.52) than in the anticipation (M = 1.47) condition and social anxiety ($F_{1,120}$ = 8.19, p = .01, partial η^2 = .06), with high socially anxious individuals (M = 3.58) showing stronger increases in negative affect than low socially anxious individuals (M = 1.46). No significant main effect for gender was found ($F_{1,120}$ = 2.78, p = .10, partial η^2 =02).

These results were conform with the hypotheses.

9.6) Recovery level results

Figure 7

Changes in SBP, DBP, HR and negative affect from baseline to recovery.

Condition	**Anticipation**				**Distraction**			
Gender	Men		Women		Men		Women	
Social anxiety	HSA	LSA	HSA	LSA	HSA	LSA	HSA	LSA
SBP	6.13	5	2.5	7.09	12.97	7.75	5.34	14.25
DBP	10.19	-1.19	1.38	5.5	6.56	7.5	8.03	7.41
HR	-4.49	0.09	-1.97	-1.19	-5.5	-0.13	-2.06	5
Negative affect	0.38	-0.75	1.56	-0.5	-0.38	-0.69	0	-0.38

Notes. SBP = systolic blood pressure (mmHg) , DBP = diastolic blood pressure (mmHg), HR = heart rate (bpm)

H4.a: *At the recovery level SBP and DBP are higher than at the baseline level. No differences in HR are expected between baseline and recovery levels.*

The results from the calculations for H3.a and H3.b already confirmed H4.a to be true:

SBP: baseline (M = 118.63) to recovery (M = 126.26) (p = .00)

DBP: baseline (M = 72.14) to recovery (M = 77.81) (p = .00)

HR: baseline (M = 78.29) to recovery (M = 77.02) (p = .17)

H4.b: *Individuals in the distraction condition show less pronounced reduction of SBP and DBP during the recovery period than individuals in the anticipation condition.*

H4.c: *There is no difference in the reduction of SBP and DBP between men and women during the recovery period.*

H4.b and H4.c were done using 3-way ANCOVAs for all three blood pressure parameters. Delta values of recovery measurements were used as dependent variable and anxiety group (high / low), condition (anticipation / distraction) and gender (men / woman) were used as the factors. Each calculation had at least one covariate and that was the last measurement of the speech period for each cardiovascular measure, so for example SBP had the measurement for SBP at the four minute marker of the speech period as a covariate. This was done so that the recovery was more easily interpreted. Furthermore due to a significant correlation and staying significant in the ANCOVA conducting examiner had to be included as a second covariate for DBP and baseline HR had to be included as a second covariate for HR. The delta values for each cardiovascular parameter were calculated using the recovery measurement at the one minute mark of the recovery period and the mean baseline value.

Results for SBP showed a tendency for the included covariate SBP measurement at min 4 of the speech level ($F_{1,119} = 3.67$, p = .06, partial $\eta^2 = .03$), a significant main effect for the research condition ($F_{1,119} = 4.68$, p = .03, partial $\eta^2 = .04$), with people in the distraction condition having more pronounced increases in SBP (M = 10.08, SD = 16.25) than people in

the anticipation condition (M = 2.18, SD = 12.17) and no significant effect for gender ($F_{1,119}$ = .13, p = .72, partial η^2 = .00).

Results for DBP showed a significant effect for the included covariates DBP measurement at min 4 of the speech level ($F_{1,118}$ = 6.04, p = .02, partial η^2 = .05), and examiner ($F_{1,118}$ = 5.62, p = .019, partial η^2 = .045) and no significant effect for gender ($F_{1,118}$ = .57, p = .45, partial η^2 = .01), or research condition ($F_{1,118}$ = 2.28, p = .13, partial η^2 = .02).

Results for HR showed a significant effect for the included covariates HR measurement at minute 4 of the speech level ($F_{1,118}$ = 14.68, p = .00, partial η^2 = .11) and baseline HR ($F_{1,118}$ = 16.27, p = .00, partial η^2 = .12), a tendency for a significant effect of social anxiety ($F_{1,118}$ = 3.76, p = .06, partial η^2 = .03), with high socially anxious experiencing higher HR (M = 6.54, SD = 19.22) than low socially anxious (M = 4.8, SD = 13.66) and no significant effect for research condition ($F_{1,118}$ = 1.39, p = .24, partial η^2 = .01).

For gender the findings were as expected. In regards to research condition only SBP behaved according to expectation, although with the examiner having a significant effect on DBP there could be further hidden effects not encapsulated by the covariate.

H4.d: *High socially anxious individuals of the anticipation condition show less pronounced decreases in their subjective negative affect than low socially anxious individuals. No difference is expected for the distraction condition.*

For H4.d a 3-way ANCOVA was conducted using the delta value of the recovery period for negative affect with anxiety group (high / low), condition (anticipation / distraction) and gender (men / woman) as the factors and baseline negative affect as a covariate, because of a correlation between the baseline value and the recovery delta value. The delta value was created with the use of recovery and baseline level sums of negative affect.

Results showed a significant main effect for the covariate baseline negative affect ($F_{1,119}$ = 41.42, p = .00, partial η^2 = .26). Furthermore a significant main effect for social anxiety was found ($F_{1,119}$ = 17.72, p = .00, partial η^2 = .13), with high socially anxious individuals having increases rather than decreases in their experienced negative affect and low

socially anxious individuals showing the expected decrease (M = .39 vs. M = -.58). Most interesting was a tendency towards a significant interaction between social anxiety and research condition ($F_{1,119}$ = 3.34, p = .07, partial η^2 = .03) showing an increase in negative affect in high socially anxious individuals and a reduction in low socially anxious individuals (M = .97 vs M = -.63, p = .00) of the anticipation condition. In the distraction condition there was a tendency for a difference between social anxiety groups, with negative affect decreasing in both groups, but more pronounced in the low than the high socially anxious (M = -.53 vs M = -.19, p = .06).

H4.e: *There is no difference in ruminative tendencies between men and women.*

H4.f: *High socially anxious individuals of the anticipation condition show a greater amount of negative and less positive cognitions during the recovery phase than low socially anxious individuals. No difference is expected for the distraction condition.*

For genders no significant main effect was found ($F_{1,120}$ = 2.41, p = .12, partial η^2 = . 02). For social anxiety a significant main effect was found ($F_{1,120}$ = 25.44, p = .00, partial η^2 = .18), with high socially anxious experiencing more negative thoughts than low socially anxious (M= 16.98 vs M = 8) but no interaction between social anxiety and research condition ($F_{1,120}$ = 2.3, p = .13, partial η^2 = .02).

10.) Discussion

The main task of this study was to investigate the influence of social anxiety, gender and anticipatory processing on cardiovascular reactivity and recovery from a social stressor. Furthermore psychological affect, cognitive appraisal and ruminative tendencies were taken into account to get a more complete picture of the complex underlying interactions.

Regarding the baseline values it was assumed, that social anxiety has no influence on cardiovascular measures in a neutral resting situation as previous studies have not shown any differences between high and low socially anxious individuals (Larkin, Ciano-Federoff & Hammel 1998; Gramer, 2006; Gramer & Sprintschnik, 2008). This was also the case in the current study with no differences in SBP, DBP or HR between the high and low socially

anxious. For gender previous research has shown ambivalent findings, some reporting higher SBP in men (Gramer, 2006; Lawler, Wilcox & Anderson, 1995), some reporting higher DBP as well as SBP in men (Glynn, Christenfeld & Gerin, 1999; Allen, Blaskovich & Mendes, 2002) and most finding no gender differences in HR (Glynn, Christenfeld & Gerin, 1999; Allen, Blaskovich & Mendes, 2002). The current study further supports the results of Gramer (2006) with higher SBP in men, but no differences in DBP or HR between the genders.

In terms of baseline negative affect literature suggested that no difference between anxiety groups or genders should exist (Carrillo, Moya-Albiol, González-Bono, Salvador, Ricarte & Gómez-Amor, 2001; Gramer & Berner, 2005). Although the current study found similar results in regards to gender, there was an unexpected result for social anxiety with high socially anxious individuals experiencing more negative affect in the baseline resting situation than low socially anxious individuals, although this might be explained within the framework of social anxiety theories. The participants had to come to the university and meet an unknown individual before going through the testing process in a relatively small chamber. Even though the resting situation in itself was not socially threatening, it might have been perceived as such by high socially anxious individuals, which would explain their heightened negative affect. Therefore the difference is not one generally found in neutral resting situations, but a circumstantial factor of the current study.

During the anticipation / distraction period we observed cardiac activation amongst the individuals of the distraction group, with increases in SBP, DBP and HR which is in accordance with coping theories (Obrist, 1981), since there was a task to which resources had to be allocated and hence activation followed. It was unexpected, that the anticipation group also experienced increases in SBP, DBP and HR even though they were only waiting for the next period to start and therefore passive coping and hence vascular activation should have been observed (Gregg, James, Matyas, & Thorsteinsson, 1999). The reason for this finding can only be theorized, but its possible that the participants engaged in some kind of mental preparation which lead to the increases in HR. Furthermore high socially anxious individuals were expected to show stronger increases in SBP and DBP in the anticipation condition, since they would have time to engage in the negative cognitions typical for social anxiety while waiting and anticipating the next task which would theoretically lead to more pronounced stress and therefore higher cardiovascular reactivity compared to low socially anxious (Doornen & van Blokland, 1992; Brand, Gortzak, Palmer-Bovba, Abraham & Abraham-

Inpijn, 1995). In the distraction condition no differences were expected since the attention of all participants should be directed at the task at hand and therefore the high socially anxious should not be able to engage in negative cognitions. Findings did not support these theories however with no significant interactions between social anxiety and research condition for any of the cardiovascular measures. Therefore the results beg the question, whether the distraction task was enough to bind the participants attention, or if it was maybe not difficult or interesting enough and therefore allowed the minds of the participants to wander while completing the task. Indeed the only significant effect of social anxiety that was found was one regarding HR, with low socially anxious individuals experiencing stronger increases in HR during the anticipation /distraction phase than high socially anxious individuals independent of research condition. This could be a sign of higher engagement and therefore stronger activation in low socially anxious participants. For genders a higher HR in woman was found which is in accordance with the theoretical differences between genders in activation (Allen, Blaskovich & Mendes, 2002). In comparison the results regarding subjective negative affect followed theories about social anxiety and the expected difference between the research conditions (Clark & Wells, 1995; Hinrichsen & Clark, 2003). It was found that there were only differences in subjective negative affect between high and low socially anxious individuals in the anticipation, but not on in the distraction condition. This finding is very interesting, because it would suggest that the distraction task worked as intended, but the cardiovascular findings did not support this. Differences between cardiovascular reactions and subjective negative affect are not uncommon, but distraction has rarely been investigated in this context and therefore further investigation is suggested in future studies. Literature suggests that a difference between genders exists (Glynn, Christenfeld & Gerin, 1999), but the current study could not confirm this as no difference in experienced subjective negative affect was found between genders.

Task perception by the participants was also examined and was in accordance with literature. High socially anxious perceived the task as a threat while low socially anxious saw it as a challenge. A second significant finding showed that women were also more likely to perceive the task as a threat and men were more likely to perceive it as a challenge. While this finding was somewhat unexpected (Gramer & Berner, 2005), it is not unreasonable. Since the participants were told that the speech they had to give was about presenting themselves for a job they want and his specific stressor might be more threatening to woman than men, as there are gender differences in how important a stressor is perceived by the individual (Kolk & van Well, 2007).

The amount of negative thought experienced by participants was also measured and examined at this point and it was found that woman and high socially anxious individuals engaged in more negative thoughts than men or low socially anxious individuals, which was in accordance with the literature (Glynn, Christenfeld & Gerin, 1999). Interestingly no interactions with research condition were found, which would suggest that the individuals in the distraction condition were also able to engage in negative thoughts, even though their attention should have been on the task at hand.

A check was performed to see if speech preparation and the giving of the speech elicited significant reactions from the participants. According to other studies using a speech as their method of inducing cardiovascular reactions (Baggett, Saab & Carver, 1996; Grossman, Wilhelm, Kawachi & Sparrow 2001), this study too found it to be effective with SBP, DBP and HR differing significantly from the baseline at all following examination levels with the only exception being a non significant difference between baseline and recovery level HR. Furthermore SBP and DBP also significantly increased from speech preparation to the speech task, showing that the task itself was the most demanding part of the experiment for participants. Similar results were observed for subjective negative affect, with significant increases from baseline to all levels except the recovery level and peak values showing during the speech period.

Upon closer inspection unexpected results were found in regard to gender, with woman showing stronger increases in SBP and DBP than men during preparation as well as during the speech task and no differences in HR between the two genders. This is contrary to literature (Allen, Blaskovich & Mendes, 2002), where mostly increased HR in women compared to men has been found. Although it might be that this specific task (application for a job) with a strong emphasis on self presentation in a social situation might have been more intimidating for woman, as the results from stressor appraisal suggest. This would explain the vascular response in women compared to men according to Obrist's (1981) coping theory. Differences between high and low socially anxious in their cardiovascular increases from anticipation to preparation and speech levels were expected in the anticipation but not the distraction condition, but the findings failed to support this theory, finding no difference in SBP, DBP or HR. This result is similar to the baseline results showing no difference in the cardiovascular reaction between research conditions.

The results for subjective negative affect were again conform with our hypotheses as well as the literature (Gramer & Saria, 2007; Gramer & Sprintschnik, 2008), with high socially anxious individuals and participants in the distraction condition showing more pronounced increases in their subjective negative affect than low socially anxious or those of the anticipation condition. No differences for gender were expected and non were found. Again these results show a distinct discrepancy between the psychology and physiology, suggesting that the negative affect in itself does not impact cardiovascular reactivity.

Literature (Brosschot & Thayer, 2003; Glynn, Christenfeld & Gerin, 2002) suggests, that the negative effects of social anxiety on the cardiovascular system might have prolonged recovery as the underlying reason as opposed to earlier theories that stated that the increased reactivity is responsible for the differences in long term cardiovascular damage. Therefore the recovery period was investigated in the recent study as well. Cardiovascular measurements were taken at the one, four and nine minute mark of the recovery period, but calculations showed that at the four minute mark the difference between baseline and recovery was already not significant. Therefore all further calculations were conducted with the one minute mark as the recovery value, at this point SBP and DBP significantly differed from baseline. For HR no significant difference was found as expected (Glynn, Christenfeld & Gerin, 2002). It was theorized, that the reduction in SBP and DBP should be slower for individuals of the distraction condition, because they had not had any time during the anticipation / distraction phase to process the stressor in advance and so they would do it during the recovery which should lead to prolonged activation (Gramer & Sprintschnik, 2008). This hypothesis turned out partially true with SBP showing the expected behaviour but not DBP, so it can be concluded that recovery of individuals in the anticipation condition was shortened due to their ability to deal with the stressor in advance. Between genders no difference was found in the cardiovascular values, as was expected (Nolen-Hoeksema & Jackson, 2001). An interesting finding was, that HR recovery was prolonged for high compared to low socially anxious individuals, although this was not expected, it suggests that high socially anxious individuals might have ruminated more than low socially anxious individuals and therefore prolonged their HR recovery.

For negative affect results were once more mostly in accordance with theory. A tendency for an interaction between social anxiety and research condition was found, showing that of the participants in the anticipation condition, high socially anxious individuals had an

increase in negative affect during recovery rather than a decrease while low socially anxious had the expected decrease in negative affect. This points at the problematic coping strategies of high socially anxious individuals, the increase might be explained through their tendency to focus on the negative aspects of their behaviour which increases their experienced negative affect (Wong & Moulds, 2009). In the distraction condition both high and low socially anxious individuals had a decrease in subjective negative affect, although there was a tendency for a difference, with low socially anxious showing a more pronounced decrease. These findings fit very well with current theories of social anxiety. In the anticipation condition the high socially anxious already had time to think about how the task could go wrong and how that would negatively impact them, these thoughts were perceived as confirmed by the individuals after the task was completed further increasing negative affect, while the individuals of the distraction condition had less possibilities to engage in these negative cognitions, so they had less negative bias that could be seen as confirmed by them and therefore less negative affect.

Ruminative tendencies were also measured during the recovery period. Between genders no differences were found as theorized (Nolen-Hoeksema & Jackson, 2001). For social anxiety it was assumed that there would only be a difference in the individuals of the anticipation condition, since they had a more biased basis after engaging in negative thought processes during the anticipation period. Unexpectedly the interaction was not significant, but rather a main effect for social anxiety was found. High socially anxious individuals engaged in more negative rumination than low socially anxious individuals, regardless of the research condition. This finding merits further research since it suggests that high socially anxious individuals will always engage in negative rumination after a socially stressful situation independently of what happened prior to the stressor, which is an extension of the findings of Wong and Moulds (2009).

In conclusion it can be said that most of the findings support recent theories about social anxiety, which seems to be a major factor in influencing cardiovascular reactivity and recovery as well as experienced negative affect. Further support was found for the theory that cardiovascular and experienced affect don't directly correlate with each other. The study found only few differences between genders, suggesting that other factors might outweigh gender differences and therefore the results of studies where only participants of one gender were included could most likely be generalized for the excluded gender as well. The recent study

was not without flaws though, which has to be mentioned as some of the results not turning out as expected might be due to these flaws. Most notably the factor that two examiners were conducting the study with one being male the other female might have led to different reactions amongst the participants, which was also partially confirmed in some of the calculations where the conducting examiner had to be taken in as a covariate due to an influence on the cardiovascular measurements.

The sample for this study was made up of young adolescents with higher education and therefore generalization can not be done without taking into account that socio-economic status has been proven to be a factor influencing health in general and that there might be differences in the elderly that this sample can't represent.

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12. Supplemental material (on CD)

A. Research materials

- A1. Questionnaires and Instructions
- A2. Sound file with time remaining
- A3. Distraction task

B. Raw Data

- B1. Data
- B2. Variables key

C. Calculations

- C1. Preliminary calculations and factor analyses
- C2. Calculations for baseline level hypotheses
- C3. Calculations for anticipation level hypotheses
- C4. Calculations for preparation and speech level hypotheses
- C5. Calculations for recovery level hypotheses