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Causes and consequences of stress

Interplay between cognition, social aspects and biology

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Psychology, Master
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Foreword

This work is the result of interests related to people coping with challenges caused by stressors in life. The approach of the research has had a focus on emotions as mediators; how they are used can regulate physiological change, behavior and adjustments that people make. The idea was to not only find explanations but also practical interventions that can be applied to life. While working with people, I've found that it gives them encouragement to understand that they can take charge of their lives, and most of the tools they need are within themselves.

I would like to thank my supervisor Ole Åsli for his encouragement and feedback. He has provided suggestions as to what types of general questions to keep in mind while continuing the research and writing process. I would also like to thank Frank Siebler for some useful structural advice that helped reorganise my thoughts and Joar Vittersø for some inspirational exchanges on the topic of emotions some time ago.

Kristi Nolen, Nov. 2015, Tromsø

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Abstract

The purpose of this article is to explore the roles of cognitive, social and biological reasons for stress and to relate practical interventions to them. Understanding stress and how it can play out is pivotal in managing it. The physiological stress response works much in the same manner in individuals everywhere; first observing something that is potentially perceived as a threat to the self, and then processing this in the brain. Different parts of the system then react to the alarm and finally outwardly noticeable signs of physiological change occur, such as sweating and increased heart rates. Naturally the system responds to obvious biological threats without conscious choice. There are differences, however in the reasons for the stress response becoming active. One key appears to be in the internal interpretation of dangers in the environment. What stimuli are picked up as relevant for the system depend on prior learning and evaluations which are based on cues from emotions that ultimately guide the individual towards their goals. The process relies on using cognitive evaluations as well as understanding social contexts, and then attempting to find equilibrium in those states. This interplay has dimensions to it, which can have imbalances; if one of the three (cognitive, social or biologically based) aspects is out of balance, it is more likely that the individual will enter heightened experiences of stress. If the imbalanced state perseveres, the other two remaining categories will also be affected.

CAUSES AND CONSEQUENCES OF STRESS

A literature review

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1. Introduction

Stress can be defined as a real or interpreted threat to an organism in a biological or a psychological sense. It results in physiological or behavioral responses (McEwen, 2009. In the physiological sense it can alter levels of stress hormones such as cortisol in the system, increase heart rate, reduce mental capacity and change digestive processes. The psychological reasons for stressful experiences, can for example be the result of challenging life events, managing tasks without the skills to do so or being met with sudden personally significant events (McEwen, 2009).

The history of stress research has undergone some changes since it began. In his quest to find a new hormone, the ”father of stress” (Selye, 1975) injected extracts from cattle ovaries into rats. When the rats showed the same symptoms regardless of what types of toxins he injected, he made connections to previous human patients and their symptoms. This is what later led him to develop the General Adaptation Syndrome, which includes three stages (alarm, resistance and exhaustion). He described stress to be a ’nonspecific’ response of the body to any demand, meaning that whether the stressor is positive or negative it will stimulate the same response. As cited by Trotter (1975), this was challenged by another physician, John Mason who claimed stressors to be ’specific’ and that the difference between the two perspectives was psychological components. In essence this meant that psychological stress could cause the same effect of biological tissue damage as physiological stressors.

To prove this, Mason and his team conducted an experiment with monkeys. When one monkey was not fed for some days while in the presence of other monkeys who got food, it became physiologically stressed. However, if several monkeys were not given food for some days in a secluded area, they did not become stressed (Trotter, 1975).

For the field of psychology, this was significant: As an essential part of the stress response, the idea of it including cognitive components and evaluations was later developed into attributional theories. Through this approach the focus could shift to coping mechanisms within individuals themselves.

How to cope can range from individual to individual, yet they can be divided into categories of emotion- or problem-focused coping. If the stressor is something that cannot be changed, emotion-based coping is more effective (DeGraff & Schaffer, 2008) and includes self-reflection and reappraisal strategies (Carver, 2011). If the problem involves causes that can be altered or removed, practical steps can be taken to do so which implies taking control

of the situation and possibly actively seeking out information of how to do so (Lazarus, 1991). In addition, there are coping strategies, which begin by altering the biological stress response state, and in turn this lowers the psychological experience of stress. Such techniques involve relaxation and slowing down breathing, resulting in lowered blood pressure and a more focused mind (Dusek et al., 2008). This type of coping mechanism appears to require conscious awareness of the stressor and an assessment process where an individual knows it is safe to take their time to calm down. In general, for any type of beneficial coping mechanism some common features reappear: taking control, seeking out information and evaluation of gains or losses.

Everyone is born with a biological set of tools to respond to stress; brain regions and connected parts of the autonomic nervous system as well as organs for observing, processing, assessing, learning and ultimately adjusting can occur with the help of these biological parts and physiological processes. People everywhere have nearly the same activation patterns in the body starting from the brain, stress response activation and reaction, but what differs is how they are used; when do they become activated and to what stimuli. Humans can become startled automatically, but as soon as it dawns on them that the source is not a threat, the response declines. If, however the threat is assessed as dangerous, the reaction will incline and cause many changes in the system starting from heart rates to hormone levels in the bloodstream. It appears that stress has a lot to do with 'how' information is processed and controls the relevancy of the mechanisms in each context.

After the initial response of an individual experiencing stress, there are consequences that depend on that persons' coping skills. These can remain within the individual mind or they can show up in societal levels. If they fall under the category of cognitive strategies, there are several ways this can play out. One is a type of self-focus that involves replaying past events over and over again, dwelling on the negative emotions they cause without focusing on solutions. Some of the consequences of this have been linked with depression and anxiety. However, going over past troublesome events to some degree even if it may feel tedious seems to result in taking redemptive action if the right determination is found. Humans seem to be motivated to pursue their goals if they have the right skills.

Another type of self-focus seems to include gaining skills which change the effects of the perceived past events. This has been linked with positive outcomes and people feel they gain control over their circumstances. Yet another internal approach is a type of mental hardiness, an attitude of welcoming challenges that could otherwise be seen as stressors. In

order to reach this state, stressors should be perceived as an opportunity to learn something new as well as potentially increase well-being. It appears that ideally this works in such a way that the stressor causes the individual to become mentally stronger and able to face similar future events.

How these three internal processes can take shape in life has many alternatives. Here is an example: A family house is undergoing renovations. The five-year old boy of the house is upset and can't stop thinking about how the contractors ate up all of grandma's cake even though he wanted some more (this is a case of self-focused negative dwelling). The contractors feel renewed energy to finish the current contract well, due to reappraising their role in the complications with the last client (this relates to self-focused ways of rethinking past negative outcomes and changing them). The mother is enjoying the progress in the house, as she envisions the lovely new kitchen. She has undergone renovations before and they don't bother her as much anymore (an example of mental hardiness, welcoming challenges).

On a societal level, what happens in relation to stress if people withhold their expressions of emotions? There are circumstances where it is important to express them but it appears it is as important to know when to do so. The consequences of disrupting vs. enabling this can be relevant for bonding with others due to expressions of emotions being central in communication. Another perspective in the social context involves emotions as a type of fast-spreading agonist of arousal states; it allows for few individuals to spread worry, like a flock of birds becoming alerted by a few cries. This is a fast-acting stressor even in cases of false alarms. This social influence factor that humans have, has also another type of result. It seems that caring for each other and sharing experiences is a part of human life. What consequences might this have? Imagining how another person feels causes a connection that seems to extend into the physiological effects and thus the stress response.

These three social perspectives could be seen in the above example of renovations as follows: The father of the house nods with a smile, maintaining eye contact as the contractor describes how a problem with the renovation was solved. This encourages the contractor to keep working, possibly even becoming engaged in a light-hearted discussion, whereas a long silence from the father would have less likely done so (this is an example of expressions verifying internal information of how people feel). The grandmother has come to visit the house, and upon entering she accidentally knocks over a bucket of nails, scaring everyone (this is an example of contagion of arousal states). The little boy decides to pass out pieces of

fresh-baked cake to everyone after hearing someone say they were hungry (an example of imagining how others feel and relating to them).

Overall, the scope of stress seems to be outlined as something that arises when people perceive a discrepancy between the physical or psychological demands in a circumstance and the resources of their psychological, social and biological systems (Sarafino, p. 2012). The following work attempts to identify and define components of these categories, as well as reveal in which ways stress can play out.

The topics have been organised in a way so that first the individual human is in focus, then the extended network and finally the biological aspect of stress, expanding into the big picture of strains on the system:

In cognitive coping mechanisms, according to Carver (2011), self-reflection and reappraisal strategies can be successful. Therefore self-focused coping strategies and their consequences are presented: Is it always good to turn inward, and what consequences can follow? What if it is adjusted? Is there a way to do it successfully, alleviating stress?

In social settings, is it best to express ones' emotions or suppress them? If so, when is it best to do so? What happens in crowds when emotion expression such as fear happens rapidly? How is the stress response affected by being attuned with other people?

Finally, the biological balance of the system will be described, as it is reactive to both cognitive and social influences. Some of the key areas of the brain relating to stress are outlined, then the physiological stress response; what happens during stress that causes it to impact the system as it does? Finally, how does this fit into the big picture of human development?

There are two aims. First: Finding explanations for negative stress and reducing it. Second: Identifying ways to increase resilience through understanding stress and seeing what interventions can be used. Identifying and then defining the processes related to stress could help raise awareness of the different traps people fall into. Knowing the consequences of each coping style or behavior can also help recognise them in ones' self and in others. Interventions have been shown to work for people coping with stress, therefore in several segments of this work, some of these methods have been mentioned which relate to their respective topics.

2. Cognitive, social and biological aspects

2.1 Cognitive aspects

Once many years ago I was helping care for an elderly man in his late nineties. He had become increasingly disoriented when it came to factual processing of information over the last months, yet appeared calm in his countenance. He was fairly mobile and used a stroller to attend common coffee sessions down a corridor. Sometimes he would take a wrong turn and end up in a closet, trying to figure out if someone had rebuilt the room. It appeared that he was mostly curious more than anything else as he commented that he must be getting old. One day as I walked beside him, he stopped in the middle of the corridor and started looking up and down the walls. His eyes opened wider as he pointed slowly in the direction he was looking at. He asked: "What are those?" When I asked him what he was looking at, he started waving his index and middle finger against each other and said: "Those things that look like white paper birds, skidding (like this) up and down the walls. Is that something new they have come up with?" I looked where he pointed, and saw nothing. He looked back at me and asked: "Are they dangerous?" I told him that they were not. As we continued our

peaceful journey through the corridor, now and then he looked up, eyes tracing things I could only imagine -and he remained at ease.

This segment is about the individual, keeping the focus on internal processes. First, self-focused negative thinking about past events is outlined (rumination), then how people can take an active role in problem-solving although still focusing on themselves and past negative events (reappraisal) and finally gaining mental robustness and perceiving stressors in a positive light (resilience).

2.1.1 Rumination

What are the consequences of thinking about past events? As always, there is certainly some balance to be found in how much to dwell on the past as well as in what way it is done; and it appears that delving into them too much after upsetting events can have negative consequences.

Rumination is a tendency to respond to distress by focusing on the causes and consequences of problems without active problem solving (Nolen-Hoeksema, 2009). It interferes with people's ability to solve issues, to obtain help from others as well as being a dysfunctional mode of self-focused attention that implies repetitively going over one's negative emotional state and on related causes and consequences (Huffzige, et al., 2012). It has been found to likely contribute to both anxiety and depression, and even possibly serve as a transdiagnostic factor for these two (McLaughlin & Nolen-Hoeksema, 2011).

There is indication that the way rumination contributes toward anxiety and depression is through making the individual less effective at generating solutions to problems (Donaldson & Lam, 2004), causing ambivalence and uncertainty in using possible solutions as well as causing the person to be less likely to accept support and thus more likely to have frictitious relationships (partly due to being perceived as less favorably by others) (Schwartz & McCombs, 1995). Rumination is an alternative to distraction, which belongs under the response styles theory (Nolen-Hoeksema, 1987) and according to this it predicts, maintains and generates depressive states as well as activates negative associative memory networks and impairs cognitive processes.

In a study, researchers wanted to find out if rumination mediates the return to baseline in post stress situations. During a stress response, levels of stress-related hormones such as cortisol become elevated and usually an individual returns to a balanced state once the event is over. However, in some cases habituation of the system does not occur as readily. Being

subject to a psychological stressor more than once should build up a type of resistance, so that the system recovers faster. However, when researchers controlled for differences after a social stress test (where participants were exposed to challenging tasks while being pressured with time and performance) on consecutive days, they found that it was dependant upon post stress rumination. That is, participants who did not habituate as readily, were dwelling on the negative events and emotions generated by the facets of the experiment, showing higher levels of cortisol for an extended time period, indicating maladaptive stress response patterns due to rumination (Gianferante et al, 2014).

Another consequence of rumination appears to be linked to specific regions in the brain. Research showed (using fMRI) that rumination in depressed individuals was associated with increased sustained reactivity of the amygdala as well as with some activity patterns of the hippocampus (Mandell, et al, 2014). These findings indicate an imbalance in key regions needed for managing emotional states that are important for maintaining an emotional equilibrium.

As rumination is indicative of future susceptibility to depression, is linked to negative health outcomes and emotionally taxing states overall, it seems useful to find a way to counteract this effect in time.

In a study performed on healthy individuals, the effect of mindfulness was tested on rumination. Both of these are a form of self-focused attention and essentially serve as emotion regulation strategies (Kohl, Rief, & Glombiewski, 2012). Participants were asked to carry palmtops with them over the course of three weekdays. On the different days they were prompted to give accounts of their ruminative self-focus and mood, after receiving mindful vs. ruminative cues. The results showed that the induced rumination immediately caused their sense of calm to deteriorate, whereas the induced mindful attention enhanced calmness (Huffziger et al. 2013). Thus, unlike rumination, mindfulness appears to be a protective strategy.

According to health experts and doctors, there are effective ways to reduce stress, one of which is mindful meditation (eg. Kabat-Zinn, founder of mindfulness-based stress reduction). Essentially it involves staying in the moment (for example by focusing attention to the physiological sensations in the body), perceiving events and thoughts without judgment and having an awareness of mind.

In fact, a team of scientists and neuroscientist (Lutz et a., 2004) have taken brain scans of individuals who have been meditating as long-term practitioners, and claim to have found

some of the happiest people on the planet, for example monk Matthieu Ricard (who is one of the authors of the same scientific article).

However, most people don't have the lifestyle of a monk. Instead there are responsibilities and families involved and therefore people might benefit of a different way to cope. If meditation is not a viable option, a possible intervention for rumination could be a walk in the park. Researchers (Bratman, Hamilton, Hahn, Daily & Gross, 2015) set up a study where urban participants were sent on a 90-minute walk in nature as opposed to a busy road with many lanes of traffic. They were tested for pre-walk rumination levels as well as undergoing fMRI scans, and were measured again upon return. Results showed reductions in rumination in the participants who took their walk in a natural environment.

2.1.2 Reappraisal

Another form of focusing attention on ones' self is reappraisal, which differs essentially from rumination in the sense that it involves problem solving.

Reappraisal is a strategy where "the meaning of a situation is reinterpreted in such a way that the emotional impact of the situation is changed." (de Veld et al., p. 2012). It has been related to experiencing more positive emotions and greater well-being (Gross & John, 2003). As a form of a self-regulatory skill, it appears to have beneficial outcomes in relation to stress and has been shown to reduce blood pressure reactivity in highly stressful events (Maier, Waldstein & Synowsk, 2003). It is a form of proactive coping that differs from other types of coping theories, such as the conservation resource theory or cognitive motivational relational model of stress and coping (Folkman & Lazarus, 1987) in the sense that it focuses on future goals by means of thinking over past events in a constructive way. As a future-oriented coping system, it seems feasible to base the change on past experiences by going over them again.

Another dimension, namely the present -appears to be added into one approach. According to Martin Seligman (2004), it can be beneficial to increase awareness of positive emotions by dividing them into three main categories; the past, the present and the future. He further explains how increasing optimism (felt in the now) about the future can lower vulnerability to depression and increases productivity, physical health and immune activity in the system. By practicing the skill of disputing unrealistic catastrophic thoughts, increased optimism can be achieved. Furthermore, from that state it is easier to increase gratitude, which as a skill can amplify satisfaction about the past (a form of reappraisal).

The past includes such states as contentment, satisfaction and serenity. The future; optimism, hope, trust and faith. The present; joy, comfort, mirth and pleasure which translate into gratification. He thus suggests that this mental state contains the additional element of virtue and ”flow” (the state an individual can enter into when their strongest abilities meet with the greatest challenges). It appears then that this crossroad; identifying the strengths and virtues one has and then using them whenever possible would lead to gratification (Seligman, 2004).

Seligman also has played a part in developing interventions for youth who suffer from pessimism, which appears to correlate with incorrect appraisals of ones' self. For example, the youth are encouraged to give accounts of events that have happened to them, describe the outcomes, such as a bad grade and then present their reasons for why they believe they got a poor grade. The youth may initially attribute the bad grade to themselves being ”dumb”, but after being asked to play detective and evaluate the facts again ”to generate alternative explanations for the stressful situation”, they reach more optimistic states through reappraisals.

2.1.3 Resilience

In the personal approach to stress, it appears that mindset is essential to the stress response and its outcomes. Since there seems to be no way for an average human to avoid stress in their lives, it could be more desirable to perceive stress in a welcoming light than as something entirely bad.

Resilience is defined as a positive adaptation in the context of adversity (Southwick & Charney, 2012), and when found, can increase well-being (Seligman, 2004). It can also provide a psychological buffer in moments of adversity and is adaptive (Reivich & Shatte´, 2002). This type of psychological coping functions in a positive way when dealing with stress (Lazarus, 1999). The newfound potential equilibrium after encountering adversities is termed allostasis, which differs from homeostasis in the sense that it ideally ”remains the same by being variable” (Schulkin, 2003), meaning that once the homeostatic balance has been disrupted and subsequently the individual is free to return to baseline; instead of doing so, there are new and better sets of coping mechanisms which serve as a type of antidote for future stressors. In fact, scientists allude to this in the system as an essential adaptation process, which once stabilised allows the individual to settle on a new homeostasis. Sometimes resilience varies in emotional responses to stress over time (even over the course of a day), but allostatic resilience could explain this (Ong, Reid & Zautra, 2006).

What is the difference between perceiving a stressor as bad or good for your health? It appears to play a significant role, according to research. In a longitudinal study, researchers found that people who believed stress to be bad for their health had a greater mortality rate than those who did not have this belief (Keller, Litzelman & Wisk et al, 2012). 30 000 adults were followed over the course of eight years in the US. Initially, they were asked how much stress they had experienced in the last year and did they believe stress was harmful for their health. The responses were then categorized into degrees from mild to severe. Finally, researchers compared the responses to public death records to see which individuals had deceased. People who experienced large amounts of stress were more likely (43% higher risk) to have died, however this was only true for those who believed it to be bad for their health. The individuals who had experienced large amounts of stress but did not consider it harmful for their health had no greater risk of dying and in fact, they were less likely to die than those who had experienced low levels of stress but considered it bad for their health.

Another relevant term is eustress, the positive outcome of a stressor. As a concept, eustress (Selye, 1974) was first linked to cognitive processes as being a positive cognitive response to a stressor (Lazarus, 1993), bearing positive feelings such as joy towards the stressor. First of all, there needs to be an evaluation process to determine whether the stressor will cause negative associations or eustress, and this is dependent upon the individual and their own goals. Furthermore, it involves assessments on the intensity of the stimulus, where it is coming from, can it be controlled and is it desirable (Le Favre et al., year).

Although it involves this initial cognitive component, it is also dependent upon what the individual does with the stimulus from then on. In general, rather than trying to reduce stressors, it could be beneficial to change the perception of stress into eustress. For example, when considering a political or ideological prisoner -first labeled as a threat to society, enduring forty years in prison and subsequently being released into society as a hero: most people would not choose the same fate. However, the person themselves may perceive the episode of residing in prison as a learning experience, see themselves as a helpful example of what needs to be changed and even describe a type of self-transcendence. As cited by scientists reviewing psychological research in regards to eustress, it can be seen as the possible generator of resilience, hardiness, self-reliance and life satisfaction (Kupriyanov & Zhdanov, 2014).

Therefore there seems to be a connection between eustress and the generation of resilience. The question is, what translates stress into eustress when facing adversities in order to see them in a positive light so that more resilience is achieved? It appears that one way to

do this is to prepare people for stress in a positive way. Under pressure, the mind and body react with a stress arousal state, which is felt in the body as a physiological stress response.

Scientists (Crum, Salovey & Achor, 2013) wanted to assess how the mindset of people affects the physiological response. They did this by showing participants three short factual video clips over the course of a week. In one condition the factual videos described stress as being debilitating (to health, performance and learning) and in the other, stress was described as being an enhancer. The participants were then exposed to a social stress test and told that they would be videotaped and evaluated in front of peers. Researchers found that the participants who had watched the 'stress is enhancing' videos had better responses to stress and less cortisol in their systems. Although "negative feedback can threaten self-esteem, leading to anxiety and stress" (Levy, Albright, Cawley & Williams, 1995) and the experience of stress is worse in general if the self is being negatively evaluated (Kemeny, 2003), they were also more likely to welcome feedback for things they could improve.

In this section, cognitive aspects of stress were described. How rumination as a coping style focuses on the self and can lead to anxiety and depression. There are ways to intervene on light rumination, but the best is to use another tactic when going over past events. Reappraisal allows for the individual to take an active role, take charge of the situation and rethink the details. Finding ways to improve the future by living in the now have been shown to increase well-being and lessen stress. Also, cognitive resilience was described as a form of positive stress, which can potentially be reached through training attitudes towards stressors. If exposed to optimistic sources of information on the same events, the response is better in the mind and in the body.

In the introductory story for cognitive aspects (involving the old man), these three types of internal processing could be seen as follows: The old man could potentially start ruminating and becoming upset over the factual things that had started disorienting him, yet he appeared to try and solve problems another way. For example when entering a closet and thinking it was a different room; he first wondered how it could have been rebuilt, then accepted through reappraisal that he must be getting old. Finally, he appeared to adjust to new stimuli of skidding paper birds on walls with acceptant resilience.

2.2 Social context

When I was young, I was told a story about a man who lived in Africa. He had a chicken house in his yard that he tended to with great care. He had also raised a lion from when it was a cub, which moved freely around the little farm. One day as the man approached the chicken house, he heard loud squawking from within. He stepped inside and saw feathers flying and the unmistakable flurry of movement caused by a lion tearing into his dear chickens. He immediately began yelling at the lion in anger and chased it out, following after it. The lion ran away from the man and after pausing at a distance to take one last startled look at him, it went out of sight.

The man stood in the yard for a moment wondering what had caused such an attack from the lion; he thought back at how the little cub had grown up around his chickens and never attacked them. He felt frustrated, furious and disappointed. He then turned and went back to inspect the damage, only to find his own lion approaching the scene from an entirely different direction with a look of curiosity caused by all the noise.

This section is about society, keeping the focus on interpersonal processes. Outlined first is whether or not expressing emotions to others effects stress experiences and in what conditions could it make things worse (expression of emotion), then how people can become influenced fast by others' stress responses in large settings (social contagion) and finally how the human characteristic of being inclined towards shared experiences, such as empathy (relating to others) can influence another person's stress response.

2.2.1 Expression of emotion

This segment outlines the expression of emotion to other people in relation to stress; what consequences are there to withholding expressions of internal states, or expressing them? Research shows that withholding emotional expressions from others can cause difficulties bonding, as well as stress on both sides.

Emotion expression is important for relationships and building interpersonal bonds (Clark, 2005). Not only do expressions assist in providing information to another person, but also helps navigate an interpersonal exchange. Expressions may convey information about specific needs, or even that there are no pressing needs at the moment. For example if someone is sad, they may be communicating that they need help in solving a problem or need comfort. On the other hand if they are happy, this could serve as encouragement to keep doing what they are doing.

Suppression of emotion expression can inhibit the formation of bonds and disrupt several aspects of social exchange, causing stress for both the regulator and the person they are interacting with (Wilhelm et al., 2003). In a study, researchers wanted to find out what happened when pairs of previously unacquainted women were asked to discuss upsetting topics. In one group, one part was asked to suppress emotional expression during the exchange. Compared to controls, this disrupted communication and the suppression caused magnified blood pressure responses in the suppressor's partner. In another part of the study, it was found that the regulator's suppression had a negative impact on their own emotional experience and increased blood pressure in both parts, causing distraction, reduction in responsiveness as well as inhibited relationship formation; when one woman inhibited her emotion expressions, it dramatically reduced her partner's motivation to become further acquainted (Wilhelm et al., 2003).

Another potential element in knowing if (and what type of) emotion expressions are appropriate is the contextual difference between private (family, friends) and public

(colleagues, civil servants) settings. Relationships can be divided into two general categories (Clark, 2005): Communal vs. exchange relationships. This distinction helps trace possible consequences of stress.

Exchange relationships are often characterised by business deals, responsibilities and work; it is good to keep track of inputs and favors, for there is an expectation of returned favors. Negotiations may take the shape of analytical loss/gain evaluations, even potentially communicating with an enemy, to whom an individual is unwilling to convey personal needs and therefore naturally suppresses emotion expression of such needs. In this case it would be more stressful to express the urgency of private needs and therefore more beneficial to suppress them. Communal relationships can include close people such as families or domestic partnerships; the presence of personal needs and the expression thereof are more present, even amplified (source). Since this type of relationship often involves giving and receiving care, individuals are more inclined to be supportive of each others' welfare and even show willingness to hear about emotions connected to a stressor that they cannot do anything practical about. Ideally, in a communal relationship, partners help reappraise and regulate each other's emotions to external stimuli, and the requests made to one another are hopes, not requirements.

In a study with first semester college students, researchers checked for how close the subjects felt to their roommates after initial stages of the semester. Depending on expressions and sharing of emotions (anxiety, sadness) there was a connection with how close they became and also how much support they received from their roommates.

The formation stage of such a relationship appears to be related to successful expressions of emotions. For example, if people are more willing to express negative emotions resulting from stressful events, it builds the relationship and they are indicating their willingness to accept support, even though simultaneously risking being rejected (Clark, 1991).

However, expressing positive emotions in an existing close relationship appears to have direct effects on its quality (Algoe, Haidt & Gable, 2010). For example when gratitude is expressed, it can increase comfort in voicing relationship concerns (Lambert & Fincham, 2010). As was uncovered in the segment on reappraisal in the last section, gratitude is correlated with a healthy coping system against stress (Seligman, 2004).

As seen in the above examples, it is important to express internal states to the surrounding, but it would seem that this needs to be in the right context and proportion to what type of

relationship is involved. This is a balance that could be tricky to achieve in larger groups of people.

2.2.2 Social contagion

Expressions are important in relationships; when to suppress -and when to express them can impact stress. However, sometimes emotional states transfer from one person to another rapidly. In stressful events, a worry can spread from one to another, termed interpersonal anxiety transfer (Parkinson & Simons, 2012). In groups, emotional states can spread from one person to another and can be considered an influence, which involves socially transmitted affective states (Ilies, Wagner & Morgeson, 2007). In crowds, collective emotions are in focus that result from "synchronous convergence in affective responding across individuals towards a specific event or object (von Schove & Ismer, 2013, p. 406). For example if everyone in a crowd acts angry, an individual in their midst may also feel anger.

In a crowd, social contagion can have clear patterns. What may start out as a small perceived threat could spread into large panic and involve many people. In an example from year 2010 of fast social contagion in large groups (Bosse, Hoogendoorn, Klein, Treur, van der Wal, & van Wissen 2013), 20 000 people were gathered in an open space (Dam square) in the Netherlands for the National Remembrance of the dead. There was to be a two-minute silence in honor of this occasion. During the silence, a man in the crowd began screaming, which ultimately resulted in people fleeing over fenced barriers and over 60 people becoming injured. In pictures of the scene, there is a clear pattern; the people immediately around the man stayed put and did not run whereas the rest of the square depicts fleeing people. From eyewitness accounts later it is evident that the distinction was clear: those around the man who could see him judged him to be crazy and no threat. The ones further away and unable to see the man became startled and looked at each other for cues of danger. The more people that ran, the more people panicked. Some cried "not again" remembering the chaos from the previous year when a man drove into a crowd killing eight people.

Some thought it sounded like a suicide bomber before an attack and others described the scream to come from a bereaved and shocked person whose loved one had just been killed. People scanned the symptoms of panic in others and heard loud sounds, then attributed reasons for them. The collective response may thus take on a cognitively polarised concept of what happened, but the common emotion in the crowd in this case (for those who could not see the crazy screaming man) was fear and distress.

It is tricky being in a large crowd, since most of the people are strangers. There can be unpredictable behavior, sudden accidents that cause people to scatter and the physiological stress response, once activated goes on high alert while the person tries to find out what is going on. But in a smaller scale and in a calm setting, what does it mean to relate to others and imagine how they are feeling? What role can stress play in this?

2.2.3 Relating to others

How do humans relate to each other during stress and what psychological or physiological changes may happen? According to research, shared experiences are amplified (Boothby, Clark & Bargh, 2014). In an experiment, investigators asked participants to try out different products. Part of the time a confederate (without communicating) tasted chocolate at the same time as a participant. If the chocolate was a good one, it was rated as better if tasted simultaneously. Similarly, if it was bitter it was rated as worse than if tasted at a different time than the confederate. This shows that both pleasant and unpleasant experiences may be perceived as stronger when shared.

Furthermore, other research has shown that memories of stimuli may be also enhanced this way as well as intensifying pursuit of goals (Carr & Walton, 2014).

Attention and relating to another person seems to be the key, as if another person's presence potentially enhances experiences. People seem to attend more to shared stimuli (Shteynberg & Galinsky, 2011) and this implies that any stimulus that is perceived by more than one person changes the experience itself. But what is the role of shared experiences by people that are close? Scans have shown that people have similar patterns in brain activity when their romantic partner is in pain as if they themselves experienced it (Singer et al., 2004) and this effect could be suggested to involve empathy.

Empathy helps understand others' thoughts and intentions and when two people have similar emotions, they are better able to understand each other and perceive intentions. There is also increased predictability (Keltner & Kring, 1999). Without predictability there is more stress and therefore empathy appears to act as a buffer for interpersonal stress.

In a study about relating to others, which identified strengths in interpersonal connections, empathy appeared to be more advantageous than cognitively based methods. Ultimately, empathy produced stronger accuracy in emotional understanding in general (Gilin, Maddux, Carpenter & Galinsky, 2013).

In stressful situations, how can this implied empathy or connectedness be seen in a social setting that involves interpersonal dynamics? To test this, participants of a study (Cwir,

Carr, Walton & Spencer, 2011) were lead to feel socially connected to a confederate who was preparing for a stress-inducing speech. The participants reported feeling greater stress themselves if they felt socially connected to the confederate. In another part of the study, the participant's heart rates went up while the confederate was asked to run in place at a high pace. By relating to others, it seems humans activate a physiological mimicry-stress response.

There is, however another aspect to this. Instead of the onlooker being influenced by the stressed person it can also be the other way around. The Social Baseline Theory (Beckes & Coan, 2011) unfolds the dynamics of social proximity through the perspective that the primary ecology to which humans are adapted naturally involves other humans, that this state allows individual humans to preserve resources through social regulation of emotion.

It started with efforts to help individuals be more effective regulators of emotion, and they had people connected to scanners to find a baseline state. The people were measured for fear responses to the threat of electric shock and then again measured while another person held their hand. The expected outcome was that the prefrontal cortex would become active while they held hands, thus regulating the responses in the emotional parts of the brain. In other words that an active prefrontal cortex would serve as a mediator for the handholding effect. However, no mediator was found and in fact there was no activity in the prefrontal cortex, although the subjects benefited from handholding. This led to revising what the baseline was: Could it be that the handholding condition was the brain's more natural state as baseline? This then included new research into behavioral ecology and how organisms interact with the world.

What appears to have been constant in human evolution around individuals is other humans and thus introduces a social regulatory emotional platform.

If watching an upsetting movie, the prefrontal cortex may become active when the subjects tell themselves it is only a movie; focused attention on that concept becomes prominent. This, however doesn't appear to be necessary for social regulatory responses. More important is, who the other person is. What relationship the subject has to them and what the history of their social dynamic is for that subject is relevant.

In his work with John Gottman who worked with identifying problem areas between married couples, Coan found interesting changes in autonomic responses of the couples. When the couples were in the lab arguing, if one part suddenly said to the other something like: "It will be ok and we will work it out, I love you" the other part would rapidly have a decline in autonomic levels of arousal. This indicates that emotions have a social dynamic beyond the individual processes in the brain, and that individuals use the social environment

for emotion regulation. These dynamics, when understood can be used actively in close relationships to regulate stress.

Coan (2006) describes emotions as affective evaluations of contexts that cause coordinated outputs of responses that can be clustered into constructs called emotions. According to him, the regulation can happen before or after the emotion itself. For example, if something is experienced as fun, the person might want to intensify that something. On the other hand, if someone is inclined to feel anger towards a superior, they may want to suppress the feeling so it does not become visible and make things worse. This is a way of anticipating possible responses before they occur. Although a person would be ready to feel something different than they feel at that moment, it might be on hold until the right cue happens. Knowing when to push the button can decide the difference between a stressful or peaceful outcome.

What can help an individual learn about what is right in the first place? Appropriate behavior is picked up from cues in the environment. Understanding the concepts of fairness and justice in the world around an individual helps develop a social self-control in relation to the environment. The context is important in forming the relevant associations between aspects in the particular setting in which these connections take place. For example, the process of learning how to adjust to social contexts starts early, and according to studies, children as young as three years old can tell the difference between fair and not fair treatment. A team of investigators (LoBue, Nishida, Chiong, DeLoache & Haidt, 2009) set up a study with children ranging between the ages of three and five to see how they would respond to unequal distribution of rewards to the same task. Investigators asked the children (who were divided into pairs) to help clean up toys they had played with together. They were then given stickers of unequal number and probed for responses, first allowing time for coders to record spontaneous responses. Although the older children were able to use terminology such as "fair", all ages responded to unequal rewards.

However, it is difficult to know if exactly this type of tendency would emerge in a different environment. It is possible that humans develop an idea about fairness as a concept early on, but are dependent upon the specific context of their own culture to find out about its dimensions as it applies to their own life. Interaction with other people forms perspectives in a fundamental way, and can be mixed in with the attachment processes that happen for example with the primary caregivers. According to studies, adults' emotional displays serve as informative guides as the still developing individuals navigate their social environment which is a form of "social referencing" (Hertenstein & Campos, 2004).

In this section on social aspects of stress, first the expression of emotions was outlined. In what circumstances is it helpful to suppress or express internal states of emotion? It appears to likely be important for relationship formation and maintenance to know the context. In social contagion, the effect of interpreting other peoples' expressions can rapidly spread stress in a crowd, regardless if the danger is real or not. Panic spreads fast and in the example of Dam Square, everyone's stress response was activated. Finally the topic of relating to others was described. People who feel more connected to another person, will also feel the effects of the stress they are going though. Shared experiences appear to be amplified, regardless if they are positive or negative.

In the introductory story for social sources of stress (involving the man and the lions), these three types of social settings could be seen as follows: When the man became stressed and expressed his emotions of anger to the lion for tearing into his chickens, it ran away. If he would have known it was a wild lion, he might have shown a fear response instead. The chickens acted in a social contagion fashion where fear spread among them fast when under attack. Finally, the man went back to see how they were doing and could imagine their discomfort.

2.3 Biological factors

Several years ago a woman adopted an infant and brought her back to Northern Europe. The little girl was originally found behind a factory and had stayed in orphanages for some months. After the infant had left this environment and adjusted to her new home, once at a private lunch gathering she sat in one person's lap and indicated that she wanted their soup, which was then fed to her. When there was no more to be had she crawled over to the next person and communicated that she wanted what they were having. Compared to her peers, there was a clear difference in her relationship to food. The new mother asked people not to feed her too much. The response was a surprised: "But she is clearly hungry! Look at how eager she is for more." The mother explained how it was a problem for them to be in social gatherings if food was involved, because people gave the eager child bits of food without

knowing how much she had already consumed. Sometimes the consequence was that the girl threw up, and then started eating all over again. It was as if the child didn't recognise the feeling of being full and tried to get as much nutrition as possible while the opportunity was there. In a supportive manner, the mother tried to regulate mealtimes so the sensation of satisfaction would become familiar.

2.3.1 Regions of the brain

Limbic system and hypothalamus:

As described by Robert Sapolsky (2012), the limbic system has been identified as the brain region, which is relevant in processing emotion. It is composed of different clusters of neuronal bodies connecting to other clusters through axons. These clusters (eg. the hippocampus & amygdala) compete for activating the hypothalamus and thus have an effect on its specific activation patterns in turn. As each region sends signals to the hypothalamus, they simultaneously attempt to inhibit signals from the other regions. Furthermore, most regions have more than one pathway of circuitry to send their signals through and depending on urgency assessments from the individual based on the environment, the relevant one gets its message across and silences messages from the other regions. This in turn stimulates the hypothalamus by encoding information to it of what it is supposed to do. For example, once the organism is exposed to stimuli from its environment and processed it through relevant sensory intakes (as when exposed to a loud sound and a sudden pressure felt on skin), specific regions are implicated. Before being processed in the limbic system, the information passes through he prefrontal cortex, which appears to be involved in the regulation process of messages (these are then sent in to the inner brain and limbic system). Depending on the urgency of the threat to the organism, the amygdala can respond with great rapidity and silence the hippocampus in order to dominate over hypothalamic control.

Hippocampus and amygdala:

The amygdala and the hippocampus are linked together not only structurally, but also in activity: The hippocampus, as well as other parts of the limbic (and endocrine) system measures hormone levels in the system to be able to check for what the hypothalamus should be doing and thus can play a role in turning off the stress response. As mentioned earlier, the amygdala may serve in the role of activating the stress response whereas the hippocampus can serve inhibitory effects. The hippocampus is relevant for neurogenesis (generating new neurons), spatial navigation, processing relationships between different contextual stimuli and

recognising new circumstances or experiences (as well as being connected with associative cortical areas). It plays a vital role in episodic memory, consolidating long-term memory and advanced level cognition such as planning (Mannella, 2013).

The role of the amygdala is relevant in several ways to perception, emotion and behavior. Some of the easiest emotional states to study which relate to the brain are fear-related, and correlate with the amygdala, although its' functions are not only related to the startle response. There are two pathways of processing sensory input; one appears to be beyond conscious attention, which happens at great speed: preparing the organism for possible responses and the other allows for slower evaluations of what to do in a given situation. Due to the importance in selecting the focus of attention by the organism in relation to survival, alarms associated to threats have developed a faster track within the brain. The fast track as described by scientists (LeDoux, 2010) activates the amygdala through the thalamus after processing the sensory input including modes of information intake from key organs controlling sensory, visual, auditory and olfactory stimulation. In the amygdala, these sensations then comingle and begin an output process, which includes learned associations through memory (hippocampus) and emotional reactivity (LeDoux, 2011). The stress response is a result of the output from the amygdala once it has reached this stage.

Yet there is a further relationship between the amygdala and the hippocampus relating to prolonged stress. Since one of the roles of the hippocampus is to process emotional memory formation and to regulate the novel memories' establishment, there is an important connection between the hippocampus and a particular part of the amygdala called the basolateral amygdala. Its function, as cited by Mannella (2013) plays a key role in forming associations between neutral stimuli that predict appetitive or aversive consequences as well as in monitoring changes in the affective salience or perceived value of these stimuli.

More specifically associated with novel memory formation, the basolateral amygdala has a key role regulating hippocampal neurogenesis. In the context of fear-specific activation and reinforcement of memories, newborn neurons in adults thus become targeted in a recruitment of new neurons into emotional memory circuits (Sapolsky et al., 2012). Scientists performed lesions in the amygdala in rats and found that the basolateral amygdala suppressed adult neurogenesis whereas lesions in the central nucleus of the amygdala did not, as well as finding that the basolateral amygdala regulated fear context-specific activation of newborn neurons. The emotional arousal state can thus be said to possibly pass on to new neurons by a recruitment process of the state of fear to which the organism and thus the amygdala is

subject to, passing on the specific fears to the next generation of hippocampal neurons in charge of emotional memories.

Nucleus accumbens:

The nucleus accumbens plays a significant role in pleasure related activities and associations, subsequently having earned itself the nickname "pleasure/reward center". However, it is more than this and plays an important part in assessments, integrating cognitive and affective information for action patterns. These action patterns may be described as a type of selection; which situations are more prominent for enhancing approach-related behavior toward something that is in congruence with motivational goals, or suppression of inappropriate actions so that these goals may be achieved more effectively. Additionally, the nucleus accumbens is involved in encoding subsequent outcomes in order that the following outcomes may be guided (Floresco, 2015).

Other regions in the brain influence the nucleus accumbens, and three major contributors are the basolateral amygdala, the hippocampus and some regions of the prefrontal cortex. Scientists have found evidence indicating that each of these areas may bias distinct patterns of behavior via interactions with the nucleus accumbens (Floresco, 2015).

This in turn could indicate that if any of these regions is out of balance, the effects are felt in the circuitry and ultimately in behavior. So how can the brain be optimised from the beginning of life? According to research, the answer could be love. Early experiences are important in how they impact a baby's organism and if there are problems, they can impact the development of the stress response as well as chemicals needed for the emotional system in a negative way. There is evidence, that experiences of shared joy between the infant and their carer release hormones that promote the growth and interconnection of brain cells (Gerhardt, 2006).

In this segment of biological aspects, brain regions involved in stress were outlined. These areas play a key role when observing stressors or while processing them. The areas are interconnected and respond to one another. Thought patterns cause changes in their activation, and if something is perceived as stressful, one region alerts the other, releasing hormones into the system, measuring them and adjusting their levels to optimise the organisms' use of them. The organism has no way of "seeing" what is a threat from the outside world except through the brain. And perception by the individual mind helps the brain activate the right parts.

2.3.2 Physiological stress response

What happens in the system when the physiological stress response is activated?
The organism first perceives a threat from its environment, the information is then sent to the amygdala, which interprets the information. When the perception of danger reaches the amygdala, it sends an alarm signal to the hypothalamus, which serves as a type of command center, controlling the activation of various involuntary reactions in the body through the autonomic nervous system. This system controls breathing, blood pressure, heartbeat and the dilation of relevant blood vessels. The autonomic nervous system is divided into two main components: The sympathetic and parasympathetic nervous systems. The sympathetic nervous system serves as an activator of necessary functions needed for either fighting the threat or fleeing from it; such as allowing epinephrine to flow into the bloodstream, which causes the heart to beat faster and more oxygen to be carried to muscles as well as the brain (increased alertness to take in more relevant information through senses such as hearing and sight), releasing glucose for nutritional use (for example in case of the need to run from danger arises). Key behaviors that are not crucial to immediate survival are suppressed (such as searching for food or digesting food).

When the first levels of epinephrine subside and the stimulation from the environment is still perceived as dangerous by the amygdala, the hypothalamus activates the HPA-axis (hypothalamic-pituitary-adrenal axis) and as a result, among others the "stress hormone" cortisol is pumped into the system.
The parasympathetic nervous system acts as a restorer of the organism to homeostasis (largely promoted by the vagus nerve which is functionally related to the prefrontal cortex, the hippocampus and the amygdala in the brain as well as other parts of the system) after the threat has passed. At this time such functions as resting, digestion of nutrients and sex may become active once again. Cortisol levels in the system after acute stress contribute to regaining lost energy by prompting the individual to eat, which happens through increased appetite. However, prolonged and sustained levels of cortisol in the system is not optimal, as it can cause coronary heart disease, increased blood pressure, ulcers and digestive problems. (http://www.health.harvard.edu, 2014; LeDoux, 2011).

In this segment, the physiological stress response was outlined. The process that is involved after the brain has alerted the system has several stages and is optimised to keep the organism going during stress. First it activates a short-term "acute stress" arousal state and if the threat

does not subside, it activates the ”chronic stress” state. Some of the functions of the organism become inhibited during prolonged stress and can cause health problems, due to the intended short-term coping mechanism of the stress response.

And how did humans evolve into emotional, abstract thinkers? What are the differences between other mammals and people? What is the role of differences in social norms?

2.3.3 Consequences of an evolved brain

“Over the long, slow evolutionary process of building brains, the neural systems humans have, were specifically designed to take care of important tasks” (LeDoux, p. 302, 2011).

Compared to other mammals and even primates, the human brain differs in that it has an evolved neocortex (neo meaning new). The limbic system; the part of the brain which processes emotion is evolutionarily speaking old (Zaki, Weber, Bolger & Oschner, 2009). Emotion-eliciting events from the environment may trigger these regions faster than conscious choice allows. However, the relevant part of navigating in cognitive and social environments relates to how the information is processed which in turn changes the emotional experience. The physiological stress response was developed over time for outrunning threats or fighting them off for some minutes at a time, like with other animals (Sapolsky, 2012). The difference with humans is, the same system is used for extended periods of time and for mentally challenging constructs such as traffic jams or chess tournaments.

Emotion regulation

If the person wants to regulate their emotional response, they need to use the frontal lobe since this is the part of the brain which is in charge of executive functions such as evaluating risks, decision making, planning and carrying out tasks. This region allows then for the individual to generate a narrative for the observed event, processing the factual information related to it. If benefits are found in inhibiting emotions, this region then sends signals to the limbic system and diminishes the reactivity of the amygdala. The key then, appears to be in conscious control.

For stress, the difference between learning how to regulate, for example fearful emotions and learning how to stop being afraid of something are slightly different. If it is an older habit of responding, the pathways may already be better established in the brain and extinction may take some patience while reducing the activity of the amygdala. However, there are some fear-eliciting stimuli which have evolved in humans to cause a stress response

simply because it better ensured the survival of the organism. Snakes, disease and heights are examples of these types of phobias that many people have (Öhman & Mineka, 2003). Cars, for example are a greater threat to modern humans than are snakes but the fear has not had time to evolve.

Culture

But are other human emotions related to modern stress evolutionarily shaped? Or rather adjusted by the social environments in which humans live? Perhaps the answer is not one or the other. According to the social construction theory of emotion, humans evolved a general response system to their environment through the specific needs, which arose in relation to the specific pressures. Environments differed greatly and humans adapted accordingly. The only common thing that people have had in common during evolutionary development is other humans (Chentsova-Dutton, 2012); living in cultural environments which were cohabited. Although there are some common responses such as fleeing from snakes, emotions developed primarily in assisting navigate the social environments, to adjust behavior, what to focus attention on and ultimately to regulate emotions themselves. The sets of basic emotions in each environment appear to have been consistent, but they seem to have taken different forms. According to Chentsova Dutton (2012), different cultures perceive emotions differently; for example in East Asian settings they are seen as something that unfold in social contexts and in interpersonal environments, whereas European Americans consider them to be experiences within themselves and their expressions are separate. Additionally, the measurements may also be contingent upon these cultural differences; among European Americans the mere thought of themselves can intensify the emotion, whereas among East Asians, the thought of a closely connected person can prime for stronger emotional intensity.

The difference between cultures can be a cause of stress in interactions, as racism arises due to misunderstandings of how to navigate the new environment socially. In a study involving immigrant Asians in the US, researchers (Miller, Yang, Farrell & Lin, 2011) wanted to find the degree to which racism-related stress was predictive of mental health problems. The correlation was significant and the effects were worse for those who were first-generation immigrants. US-born younger generations adjusted easier if they were not closely associated with their own cultural norms.

These differences in cultural perspectives in how to interact appear to be overcome in a relatively short time-period from an evolutionary-cultural perspective, supporting the idea

that people have adjusted to socio-environmental changes over the course of time and only needed to adjust the "when and how" to express their emotions.

Within cultures there can be differences too. For example, studies show that in Russia (2013) people have beliefs about negative emotions as useful for different functions and therefore people seem to seek some negative emotions even if they are unpleasant. If an individual differs from how normative emotions play out in their culture, they may perceive themselves as different. This in turn appears to serve as a perception-specific interception; either the individual feels different and suffers from stress, or rejects the norms openly and owns it as part of their identity. It is, however unavoidable that most individuals grown up in a cultural setting are aware of the general scripts and the variation can be seen on a more individual level of how those scripts interact in experience and expression of emotions. This could then imply that people who seek negative emotions act in ways to achieve their goals and enter into circumstances that facilitate this tendency.

Emotional states

However, another researcher claims that emotions do not imply behavior. Roy Baumeister describes how traditionally people's actions have been explained by what emotional state drove them to the action. In a study (Baumeister et al., 2011), subjects were found to have strong behavioral responses without having strong emotional responses as driving forces for the behavior. This result prompted Baumeister to find out what role emotions have in guiding behavior and ultimately developed the theory of ego depletion.

According to this theory, after exerting self-control in one task, there is less control available for the next. In one form of the experiment the task includes emotional focus; for example watching an emotionally demanding film (which causes one to feel their emotions more intensely) and thus may allow emotions to play a role in behavior but not necessarily causationally. The role of emotion plays out in behavior by shaping it rather than causing it; and it is incorrect to say that the beginnings of behavior are in an emotional state, since there are myriads of behaviors and less emotions. How humans act appears to be worked out in the situation, roughly divided into avoid or approach tendencies from which specific applications are contextually calculated.

It appears, rather that emotions developed for the purpose of learning. Since people devoid of emotions do not behave effectively, there is a useful purpose in relation to behavior, however it could be said to play a different type of role in a feedback system in which the emotions help reflect on experiences after they have occurred. For example the feeling of

guilt could be used in this perspective in the following way: An individual does something, which has consequences that then cause guilt. This then encourages the person to reflect on the events that lead to this feeling. This in turn generates thoughts of what could have been done differently to avoid the feeling from arising. The ideas unfolding leave a trace, storing a type of emotional tag for the next time a similar situation arises and there could be temptations to act in a similar way. The tag reminds the person automatically of the previous time and could encourage regulation of behavior. As long as the feeling of guilt is not something that occurs often, it can serve as a guide.

To sum it up, some rumination is beneficial in the sense that the individual has had the opportunity to reflect on different courses of action, engage in counterfactual thinking and settle on one alternative action and store it away for later; a type of anticipation of an emotional response which then facilitates future processes (2010). Thus, according to Baumeister the focus should not be in examining current emotional states as the relevant parts (only as controls) but in what anticipated emotional states people have.

If learning is the key, and focusing on the anticipated outcome is what matters, then it brings the focus back to perception and appraisals. The perception of the physical stress response appears to activate in many people the idea that something is wrong and that it is not a good state to be in, and indeed; as mentioned previously, prolonged stress has been linked to health outcomes such as cardiovascular diseases. However, this mediating role of how to think of the response could prove central, and if emotions have a role in creating learning through memory tags, then in future stressful events this could be used: If an individual notices the activation of their physical stress response, they may recall the feelings generated by coping and resilience (even if it was a small tag) which in turn can change the physiological profile of the system, a new loop of positive regulation may occur.
However, if emotions developed for more reasons than learning and helping mediate themselves, could the consequences of evolutionary background of human societies explain more reasons for stress?

Change of societies over time

Cosmides (2010) describes the human mind as something shaped by natural selection and designed to operate in an ancestral environment of hunter – gatherer life. The lifestyle would consist of small groups of people, perhaps 50-200 in size where daily problem solving would constitute coping with specific problems of that setting. The phenomenon of changes in

societal structures from villages to urban settings and cities would show up in relationship dynamics in new ways.

If humans are evolved from small societies, they would have engaged in explicit exchange deals, which entail that an individual may ask for an exchange for and it would work. As human societies have entered a state of large communal networks, the individuals are constantly reminded of the fact that they are not valued for other than their role of contributing to the whole and their own welfare or needs are not important. There is one currency type with which to attain anything needed such as nutrition or services. Each time a customer pays for something, they are reminded that they are not close to the salesperson and they are not uniquely valued. This could be said to cause social distancing and therefore a lack of connection, resulting in isolation and other stressful states. The same principle would apply to decision makers from the perspective of the individual, since they regulate based on what a mass of people can do for the society as a whole, not what an individual could uniquely need (Tooby & Cosmides, 2013).

Violence and empathy

The shift in evolutionary conditions in which people now live can pose challenges of emotion regulation, calibration of behavior and well-being, but can also give hope.

The transition from tribal living to modern societies, as described by Steven Pinker (2011) has brought about a new type of adjustment in relation to violence and emotions. According to him, violence has greatly dropped in the world and in fact there is a greater rate of death by violence (caused by other humans) in small tribes, compared to more modern societies (book: The Better Angels of Our Nature: Why Violence Has Declined, 2011). For example, in the middle ages a contemporary European had a one in thirty-five chance of being murdered, which is unthinkable today. Partly the decline can, according to Pinker be explained by a common system of punishment by a unified governmental body. The individual may be deterred by the threat of punishment, but also calmed by the fact that their enemy would receive the same punishment and thus rest assured of the balance in justice. In addition the spread of reason, knowledge of history, economically mutually dependent trade and better individual self-control have contributed to better societies.

Emotionally uncontrolled violence is in the decline and empathy is increasing, due to the fact that there is more interchange between societies. People become more familiarized with each other's ways and are able to relate to each other better, creating a sense of connection.

If this is the case, knowledge and empathy appear to be relevant in this context. With the evolvement of the brain, many changes may have occurred not only with the thinking of individuals, but in how societies function. With the increase in thinking capacity, it seems the complexities of what cause stressors on individuals has increased.

In this section, first the brain and its regions were outlined; what role does the brain play in the stress response and in which way it passes messages within itself. The physiological stress response was described; how it becomes activated by the brain and how it regulates the stress hormones and keeps humans going. Finally, consequences of an evolved brain and mind was presented where perspectives on what role emotion has in relation to regulation and learning. The evolved mind seems to be useful in managing interpersonal differences and building common understandings of empathy, which can result in less stress if the dynamics are better understood.

In the introductory story for biological contributors (involving the adopted girl), these three topics could be seen as follows: When the girl ate more than her body needed, she showed signs that she had learned food to be scarse and acted in a distressed manner until more was given to her. Finally, her system could be viewed from the light of it being an evolutionary and cross-cultural product that is capable of adjusting, learning regulation and navigation in abstract social structures.

In this article, some causes and consequences of stress were reviewed. First, the concept of stress itself was visited. Stress is a threat to an organism which results in physiological responses or changes in behavior. The source of threat which causes stress can be either real or interpreted to be so by the individual. Some psychologically relevant concepts have emerged in stress research involving coping mechanisms, which have helped define the sources of stress themselves. For example, in the case of emotion- vs. problem-based coping: If the problem is something that cannot be influenced, it is better to use emotion-based coping, which involves strategies that include self-reflection. If the problem appears to be something that can be altered, the individual may engage in actively solving it.

The first section of the work involved the individual person and their cognitive processes.
What happens when people focus inward without trying to change anything?
How about when the focus is on the self but includes re-evaluations?

What if the attitude to stress itself changes?

Some cognitive approaches to stress were reviewed; rumination is a self-focused attention on causes of stress and the negative emotions associated with them without active problem solving. It can cause anxiety and depression and is associated with negative health outcomes. Some ways to intercept rumination is to be mindful or go for a walk in nature if living in an urban environment. Reappraisal is another internal way to focus on past events, however it includes problem solving such as assigning new meaning to the events so that the emotional impact is changed. This active role of changing the impact involves self-regulation and being constructive, as well as placing the self in the 'now' in relation to past and future. A way to encourage reappraisal in people who ruminate is to give them the skills to divide their positive emotions into past, present and future and then use tools to re-evaluate the past events. It has also been shown to effect physiological stress factors positively.

Resilience to stress is a positive adaptation to difficulties, which has been associated with increased well-being. It includes the concept of becoming stronger and stronger through adapting a welcoming attitude towards stressors. In order to adapt, change is required and this state of change, allostasis enables the person to gain robust cognitive capacities. Studies show that seeing stress as something bad for your health, changes the level of physical impact. Eustress shows a different dimension; this is something people can feel when experiencing even joyful emotions towards a stressor. Usually eustress is categorized as positive stressors, whereas resilience is an attitude towards potentially negative stressors as well as positive ones. If it is up to the individual to evaluate a stressor to be positive or negative, this leaves a lot of room for interpretation. To sum it up, the interpretation of stressors can be perceived as eustress, which can create more resilience. And to create resilience, people can be helped to perceive the stress response itself in the body as healthy.

The second section of the paper was the next level from the individual: Social context of stress.
What happens if emotion expression is withheld vs. expressed?
How are humans socially contagious, what happens when emotions and their expression activate the stress response fast?
How is relating to the emotions of others involved in influencing stress?

The social context included the notion that expression of emotion is important to building bonds with others. Expressions convey information of internal states and personal needs. If emotion expression is suppressed, this can cause disruptions in social exchanges, inhibit relationship formation and cause stress to both parties. It was also shown that context is important; when to suppress feelings and when to let them be amplified. The difference between communal and exchange relationships was explored. In communal relationships people are more able to describe their personal needs and emotions (and it is even beneficial as in the case of gratitude expression to ones' partner), whereas exchange relationships involve things like business deals and assigned tasks that don't imply personal needs being in first place.

In the context of social contagion, the emotional responses of a few can spread very fast. Whether the source of agitation is real or imagined, an event or object can cause people to feel the same way in unison. The example of Dam Square was presented, where people panicked from hearing a screaming man and then seeing others flee. The people who could see the man, assessed him to be of no danger and therefore stood still. The rest of the people ranged in their appraisals of what had happened, yet all had responded with distress.

Relating to others includes the concept of shared experiences being amplified. People deem experiences stronger if done at the same time as another person, regardless if it is good or bad. Memories and pursuit of goals can also be amplified by sharing them, and the key seems to be focusing attention on what others could be experiencing. Close partners are shown to have pain-related areas of the brain activate at the same time as their partner experiences the pain itself. This relates to empathy and being able to anticipate someone else's thoughts and motivations which helps increase predictability. Empathy appears to relate to interpersonal connection and have better accuracy of emotional understanding. A study was described where people were lead to feel connected to the confederates, and their own stress responses increased while watching the confederate, depending on the level of connectedness. The idea of a social baseline describes a perspective of humans being at baseline when with others; that this is the status quo, not the individual. Social proximity has a direct influence on the dynamics which does not compute from the standpoint of one human. The response in one person and their stress reaction can change by small adjustments that play out in between people, not only inside the individual. A perspective of anticipatory emotion was described, meaning that regulation happens before or after the stressor. A study involving the sense of justice at an early age was presented to show how understanding of social contexts can happen. These concepts are taught to children by social referencing.

The third section of this paper described the biological processes involved in stress.
The brain and the most relevant regions.
The physiological stress response.
The evolved mind, what consequences are there of having the brain and system of a human?

The regions of the brain which are most important to stress were presented. The limbic system is the center of emotional processing, which includes several areas. The hypothalamus controls the activation of the pituitary gland and thus norepinephrine flow. The hippocampus is related to learning and measuring levels of hormones in the system, so it can check if the hypothalamus needs to be messaged for activation or not. The hippocampus can override the amygdala if the brain interprets there to be no immediate threats. The amygdala is associated with startle responses and stress. It can override the hippocampus if the need is urgent and has a fast track to the hypothalamus. The amygdala also has a region which regulates emotional memory formation in newborn braincells in the hippocampus. This implies that if there are many fear- or joy -related memories, the next generation will take over these. The nucleus accumbens involved in integrating cognitive and affective information into action patterns. This implies a form of selection. It processes regulation by encoding outcomes so future behavior can be guided towards the organism's goals. Love has a positive effect on the brain. Shared joy between a young baby and its caregiver releases hormones that promote the growth and interconnection of brain cells as well as helps develop the stress response system including all the fine-tuning needed for it.

The physiological stress response was then outlined. Once the brain has registered a threat and the amygdala has activated the hypothalamus, various changes happen in the body. The autonomic nervous system is divided into two main components: one acts like a break to the system and the other as a excitor. When under threat, the system shuts down unnecessary functions and uses its energy resources on what is essential for survival. If the system is activated for short periods, it can be good. If the stress arousal state stays on for prolonged periods, it can be harmful for the system and cause damage.

In the segment on an evolved mind, some of the consequences of the human brain having evolved into what it is today were presented. It differs from other animals' brains by having an evolved cortex. This allows for humans to uniquely think in abstract ways. The system, meaning the brain and the stress response have been finetuned through natural selection to function optimally for short periods of time while escaping or fighting dangers.

Humans evolved more complex social structures than any other animal due to the increased capacity (or the other way around) and as a result humans are able to become stressed over things just by remembering them. The same system is thus used for a different type of stress, and regulation becomes even more relevant. Emotion regulation can happen better if the right narratives are used through the executive control system, the prefrontal cortex, since this area has the power to diminish the activity of the amygdala.

The cultural context had to do with other people. Each region has its own expression codes of how to interact in the larger community. There are differences between groups and how emotions are observed: For some they unfold between people and for some they are private. These perceptions can cause difficulties in adapting to each other and possibly cause racism. The importance of knowing how to relate to the environment became in focus.

A perspective of ego depletion was described: how people who have used up energy for a task then have less to use for the next. This could explain why people become impatient and stressed after tiresome tasks. The concept of emotional tags being placed on experiences was described; how people can be reminded of the last time they were in a similar situation and how it went, thus being able to plan better for "next time".

How societies might have changed over time was described; and what influences that may have on individual humans. The change from small villages to urban settings would have changed the dynamics and expectations of the way people are important. From being in smaller and mutually useful communities, humans now often live in places where the mass is evaluated for what they can do for society as a whole, instead of what an individual uniquely may need.

How violence and empathy play out in this new type of world has implications on individuals in relation to it. The way that social systems keep behavior in check causes a sense of equality and calm. Although there is unrest, statistically there are less violence related deaths by other humans than before. Living in a world that allows for cultural exchange is helping people relate to each other better, increasing the sense of connection.

In what way does all of this belong together? How do these aspects connect to each other? What is the role of individual coping and management in relation to social dynamics? How about the body and the way it works?

As mentioned in the introduction, everyone is born with a biological set of tools to respond to stress with. The brain and the stress response system are like servants to each human: They do

what is asked of them. They activate regions in response to the one in charge. The hippocampus generates baby neurons and the amygdala trains them in what kinds of emotional memories they should be associated with, as Sapolsky and his team (2012) found. If the human decides to use a different coping mechanism with something they have struggled with, these recruitments will happen less and less. Resilience can be trained for by shifting the attitude towards stressors (Seligman, 2004) and simply by perceiving the stress response as beneficial to helth, the body is healthier (Keller et al., 2012).

Rumination would likely contribute to the recruitment process of new neurons in a strengthening way, since it involves going over the same event many times without a plan to change it (Nolen-Hoeksema, 2009).

Increasing awareness of positive emotions by taking charge of the past, the present and the future can not only increase optimism but also make a human more healthy physically (Seligman, 2004). This can be related back to the body: if the mind (with the help of the frontal lobe) can see the big picture and focuses on well-being, it silences the amygdala. The amygdala, again is simply a servant of the mind; it cannot see what is out and beyond the brain. It has evolved to serve the survival of the organism and it does so through the help of the assessments of the individual.

From this perspective of processes on the individual level, the perspective can be expanded to society. Healthy coping systems translate into this level as well. Whatever is going on inside the individual is of no use if it cannot be expressed to the co-sources. The new baby needs joyful exchanges with its caregiver (Gerhardt, 2003) to develop its brain, and luckily there are smiles and laughter to express this. Hormones are released in the brain and body, which are needed for establishing equilibrium.

Each human as a biological entity can be seen as a car. It has all the basic parts in the motor (brain) and connecting wires between each instrument. It has a gas pedal (sympathetic nervous system) and a break (parasympathetic nervous system) The finetuning oils (hormones) are helping things go smoothly in the motor. All of this is contained within the protective frame of the car. The human mind with its choices (cognitive component) is like the driver who tailors the care over life. As children, people are still trying to find out the rules of what is fair in traffic, as in the example of the study with children and sticker distribution (LoBue et al., 2009). Later, humans may at times drive too fast or run out of gas. Sometimes there are chaotic traffic situations, but the ones closest to the blockage can see if it is worth it or not to join in honking like everyone else as with the people who stood still around the crazy yelling man (Bosse et al., 2013). The car does what is asked of it, and if used

optimally will last longer. If using it to transport a fourwheeler, it has no say in how the load is attached to the bed of the truck (cover photo).

The reasons for stress may be many, but the key for coping with them appears to have some self-awareness mingled with healthy problem solving (Gross & John, 2003). The optimal way of approaching stressors appears to be with resilience (Seligman, 2004).

The role of shared experiences seems to have another central concept and that is the state of empathy, since it seems to help humans relate to others on a deeper level (Keltner & Kring, 1999). This then can imply that in the big context of human societies, people can overcome cultural difficulties better (Pinker, 2014).

The interconnectedness of the human biology and the use of mind is close. Dealing with stress optimally would include the following: Understanding why humans act the way they do, identifying it in ones' self or in others and taking charge over it. This can be made easier by knowing what tools work. Understanding the mechanisms of the body and brain, how they evolved and for what -is the basis. Then getting an overview of how the individual may deal with this "toolkit" and ultimately how it fits into society as a whole is the next task.

The aim of this paper was twofold: To identify and describe sources of stress so that they would be better understood and thus used to reduce negative. Also, to identify ways of increasing resilience and well-being, and it appears that again understanding stress could play a role in this. The aim was also to find interventions for some of the identified stress states. These goals have been reached, but it is clear the materials are vast and the topics complex. More research on the topic will be welcome in the field to uncover its complex nature so that humans can become better drivers of their personally tailored cars. The driver and the car are as one, passing though landscapes and different weather. The better the interplay is understood, the smoother the ride.

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