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Verfasserin (Autor):	Dr. med. univ. Filiadis Chrissoula
Matrikel-Nummer:	9406729
Studienrichtung (Field of Study):	A 442 Anthropologie (Anthropology)
Betreuer (Tutor):	Professor Dr. Karl Grammer
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**Dedicated to my parents and
to George S. !**

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1. INTRODUCTION

There have been various studies made that searched for a connection between cognitive biases and behavioral characteristics in the two sexes. Those studies focused on the mate-finding strategies rather, then on other cognitive aspects in humans. In this study we focused on the connection between Error Management Theory (Buss, Haselton and Dekay, 1998) and the performance of a patient-game, in order to expand our experience concerning cognitive biases in general. Therefore, we firstly described the parental investment theory (Trivers, 1972), as well as the mate finding strategies in men and women, in order to illustrate the evolutionary basis of the Error Management Theory. Then, we presented the Error Management Theory as described by Haselton et al. (1998) focusing on its effects in several other domains. The outcome of those past studies enabled us to expect similar results, when having people estimate their ability of mastering a patience-game; men should over-, whereas women should underestimate themselves, concerning the performance of the patience-game. Furthermore, we tried to ascertain the age-differences between four groups of men and women, prae- and postreproductive, which were defined according to their reproductive ability or desire. Our assumption was that there would be a decline in the Error-Management-Theory effect in both sexes with increasing age, meaning that men would over- and women would underestimate themselves less, because of the changing biological and social circumstances later in life. The age we chose as a barrier between younger and older individuals was the age of 50, which is the mean menopausal-age of middle-European women nowadays. Therefore, we described the menopause as a universal phenomenon in women, firstly from a biological and secondly from an evolutionary point of view (*grand-mother hypothesis*). In order to explain the decrease of the Error-Management-Theory effects in men, we used the Display-Hypothesis by Miller (1999). According to this hypothesis, there is a productivity peak at men in their early thirties, which can be explained in terms of mating and reproduction strategies. It is therefore thinkable, that along with the decrease of the productivity in men with increasing age, there would also be a decrease in the overestimation biases as well. On the bases of that theoretical background we created our two hypotheses (see 1.5.) and developed the study-design described in chapter 2.

1.1. Sexual Selection and Parental Investment (Trivers, 1972)

"Sexual selection depends on the success of certain individuals over others of the same sex, in relation to the propagation of the species; whilst natural selection depends on the success of both sexes, at all ages, in relation to the general conditions of life. The sexual struggle is of two kinds; in the one it is between individuals of the same sex, generally the males, in order to drive away or kill their rivals, the females remaining passive; whilst in the other, the struggle is likewise between the individuals of the same sex, in order to excite or charm those of the opposite sex, generally the females, which no longer remain passive, but select the more agreeable partners"

The Descent of Man and Selection in Relation to Sex (Darwin, 1871).

1.1.1. Introducing sexual selection and parental investment

In order to understand Error Management Theory, it is important to become familiar with sexual selection (Darwin, 1871) and parental investment theory (Trivers, 1972). Those two theories explain the reasons, why men and women follow different strategies, when seeking for a partner and, hence, why differences in cognitive biases, such as the Error Management Theory describes, have occurred.

Choosing a partner is one of the most individual and important choices in a persons life. This choice is influenced by a number of parameters, such as cultural and biological factors; personal preferences play an important role, as well as current social conventions and one's own self-perception and his or hers assumed market value (Buss, 1992).

Evolutionary models are based on the biological fitness and the reproductive success of the individual, rather than any sort of social norms. Therefore, choosing a partner can not just be a conscious process, but also involves unconscious elements, which have evolved during evolution and have been passed on from one generation to the other, in form of adaptations. This assumption can be supported by several studies, that have been made in different cultures and under different circumstances, and which all lead to the same results; there are culture-independent cognitive biases, that determine human behaviour, when it comes to mating strategies. Those morphological, physiological or psychological characteristics that guaranteed reproduction success in our ancestors are the same that influence the choices of modern individuals (Buss, 1989; Tooby and Cosmides, 1990).

Sexual selection, in addition to natural selection (Darwin, 1859), indicates that those criteria, which assure successful reproduction, irrespective of their survival-value, tend to be passed on from one generation to the other and are jointly responsible for the behavioural profile of humans. Individuals with the same survival skills could therefore show significant differences concerning their reproductive abilities. These differences do not only occur intrasexual - between individuals of the same sex - but also intersexual - between the two sexes. Males and females follow different strategies when it comes to selecting a mating partner due to their physiological and morphological characteristics. Researchers suggest that there is a distinct relationship between the sexual strategy of an individual and the level of the individual's parental investment (Buss, 2004).

When individuals of one sex battle against each other over the access to the members of the other sex intrasexual selection occurs. The winner or winners of this battle gain, through their special skills, the chance of copulating with more desirable partners which, finally, increases the chances of producing a larger number of offspring. The necessary attributes, mainly physical strength or certain social skills, are passed down to their children and assure therefore high quality offspring in the next generations. Intersexual selection describes biases that have evolved in the members of one sex and concern certain highly desired attributes when it comes to choosing a mating partner. Features such as special morphological, physiological or psychological characteristics make one partner superior to another and allow him or her, through having a larger amount of offspring, to establish those attributes in the generations that follow. Humans have developed both forms of sexual selection during evolution and still behave according to those evolved preferences.

The development of different sexual selection strategies between males and females depends on the different strategies of investment they practise, when it comes to their offspring. Asymmetrical-investment strategies (Trivers, 1972) result in intrasexual selection among individuals of the less investing sex and intersexual selection-strategies among the members of the higher investing sex. Parental investment (Trivers, 1972) describes the costs, counted in work and energy, which every parent invests, while raising his or her children and, simultaneously, assuring their survival. Investing in already existing children, lowers chances of producing further offspring, because of the limited energy-capacities of each parent. According to this

assumption, choosing a mating-partner gets a whole new perspective. The chosen partner must possess the very features, which complement our own, and assure the well-being of the common children. Some of the desired attributes are the same for men and women, such as certain personality traits e.g. bonding capacity or health, that are indispensable in a long-term-relationship with another individual. However, there are some features, such as social status, wealth and attractiveness, which are being evaluated differently from the two sexes, as described in 1.1.2. and 1.1.3..

1.1.2. Women's mating strategies

Women have to, due to their anatomical and physiological characteristics, invest more energy and time in their children; pregnancy and lactation are high costly and risky periods in a woman's life. This leads to an increased alertness, when it comes to choosing a partner (Geary, 2000). The father of their future children should be able to provide resources for themselves and the offspring and, therefore, increase their own survival and assertiveness potential. Men who meet such qualifications will pass them on to their children, a fact that guarantees high quality succession (Trivers, 1972).

Trivers enunciated this theory in 1972; women have to be very selective when choosing the father of their future children because their survival may depend on the quality of this choice. The decisive factors of the female's choice usually are a high social position and prestige in the men concerned (Symons, 1979; Sadalla et al., 1987; Hill, 1984). Studies confirm that women find socially established men more attractive than their less successful rivals (Buss and Barnes, 1986). Women out of 37 different countries evaluated a high income and financial security of a man, as one of the most important criteria, when choosing a long-term partner (Buss, 1989). A high social status also seems to be much desired, as international studies show (Buss, 1989). A pilot study, made in 1939, illustrated the same fact; the interviewed women reported that the financial prospects of men, they are interested in, are one of the most important things to consider, when getting involved in a long-term partnership. Additional studies confirmed these results (Hill, 1945; Hudson and Henze, 1969; McGinnis, 1958).

Hence, positive financial prospects are not always obvious to recognize immediately. Therefore women tend to seek for certain personality traits which characterize men of a high status, such as

ambition, effort and education (Buss and Barnes, 1986; Buss, 1989). These attributes have a significant value for women, because they guarantee that the man in question can afford to raise a family of his own. Even women with a high social status, tend to choose men with an even higher social status than themselves (Townsend, 1989). As Betzig (1989) showed, women are very likely to abandon men if they turn out to be lazy and unmotivated concerning their careers.

It has also been observed that women tend to choose partners a little older than themselves (in average about three and a half years). This can be explained in connection to social status. In order to reach a certain status and to assure financial security, men have to invest the first years of adulthood in their careers. It is therefore reasonable for women to concentrate their efforts on somewhat more mature men who have already reached a certain social status.

A number of morphological characteristics also play an important role, when women are choosing a partner. Physical characteristics such as body size, wide shoulders and muscles attract women and intimidate other men (Barber, 1995). As several studies showed, a symmetrical face and a symmetrical body are important indicators of the quality of the genes and, therefore, a desired characteristic, which implicates attractiveness and health ("*sexy sons*" theory - Fisher, 1958). A prominent mandible, prominent eyebrows and cheekbones implicate a high testosterone level in the blood and, therefore, an excellent immune system (testosterone is known to suppress the immune system).

Finally, La Cerra described in 1994, that the evaluation of men by women, depends on the affection they show towards children; men who are able to love and care for their partners and offspring, have much better chances of finding a long-term partner (Buss et al., 1990) than other men, who may possess all the other attributes mentioned, yet lack the ability of being committed and bonded to their families.

1.1.3. Men's mating strategies

Men, on the other hand, have to be able to provide resources and protection for their families. Their investment basically includes status, strength and food and is less, than the investment of the women, when raising the offspring (Trivers, 1972). Men have a higher reproductive rate than women; the only limitation for men's reproduction is the access to fertile mating-partners.

Women's reproduction is limited because of their physiological and morphological constraints; as a result, their reproductive rate is independent of the amount of available men. The fact that there was only a certain amount of fertile women in every group forced our ancestors to battle against each other (*male-male competition*), in order to gain access to as many fertile women as possible. Those men, who succeeded in finding more than one sexual partner, were able to increase their reproductive rate (Trivers, 1985) and to genetically "outrival" the other males in the group. That way their genes survived over the centuries and their amount within the gene-pool has constantly increased.

Men show a preference towards young and attractive women, because youth correlates positively with the reproductive potential (Symons, 1979); a clean skin, shiny hair and eyes, white teeth, vitality in motion and mimic and a high energy level (Symons, 1979, 1995; Grammer, 1993) are some of the desired attributes, when choosing a partner. Ford and Beach (1951) showed in their study that these traits are considered to be universally attractive; even infants seem to prefer faces with such characteristics (Langlois et al., 1990). The same study also illustrated that people show a general tendency to prefer average and symmetrical faces. Another important choice-factor is the shape of the female body; waist-to-hip ratio (WHR) is an indicator of the reproductive and the health status of a woman. After adolescence, the WHR should lay between 0.67 and 0.80 in women and 0.85-0.95 in men. The preference for low waist-to-hip ratio seems to be universal (see the studies by Conolly et al., 2000; Furnham et al., 1997; Singh, 2000). Other studies made in 37 cultures (Buss, 1986, 1989) show that not only the attractiveness of the potential partner, but also her youth is one of the most desired criteria for men. Men in their thirties show a preference for women, who are about five years younger than themselves, whereas men in their fifties prefer ten to twenty years younger partners (Kenrick and Keefe, 1992).

Men have also evolved to show a preference for ovulating women because then the probability of conception is at its peak. However, female ovulation is hidden in humans, a fact which makes it difficult for men to predict the exact ovulation-date. As a result of this, men tend to show preferences for features which indirectly indicate ovulation; pale skin (Symons, 1995; van de Berghe and Frost, 1986) and the decrease of the waist-to-hip ratio proportional to the rising of the oestrogen-level (Profet, 1995) are rated as notably attractive. A study of Karl Grammer (1996) in

single-bars showed that women who had been ovulating at that particular time were more frequently touched by men than the other non-ovulating women.

Coyne also seems to play an important role for men when choosing a woman. Virginity guarantees that the chosen woman will only give birth to the children conceived by the man in question and not by any former sexual partners (Grammer, 1993). Premarital virginity is not as important today as it used to be in the past but it is still more important to men concerning their future partner, than to women (Buss et al., 2001). The study of Thompson (1983), as well as the study of Weiss and Slosnerick (1981) have also shown that men and women, who had many sexual relationships before their marriage, tended to repeatedly cheat on their marriage-partners. According to the above, sexual jealousy in men also provides protection against raising the offspring of another man (Daly et al., 1982).

1.1.4. Long- versus short-term relationships

The preferences of both sexes depend on the objectives they have concerning the person of the other sex (Grammer, 1993); short-term relationships have less costs than long-term ones. Kendrick et al. (1990) showed that the minimal demands on one's partner positively correlate with the seriousness of the relationship. Throughout evolution men have developed a very intense desire for sexual access (Symons, 1979). This fact led to a decrease of their demands in short-term relationships concerning their mating partners. Still, even in short-term relationships, men prefer attractive women, whereas women set a higher value on the intelligence of the potential partner, irrespective of the planned duration of the relationship. The study of Buss and Schmitt (1993) shows that in every culture and era, men always seem to desire a greater number of mating-partners (about eighteen), than women do (four to five).

In spite of the above, successful reproduction for both sexes depends on a stable long-term relationship, as the study of Buss and Barnes (1986) shows. The most important criteria, in mate choice for both sexes, are certain personality traits, such as honesty, intelligence, understanding, kindness, loyalty and humour

1.2. Error Management Theory

1.2.1. Introducing the Error Management Theory

Human cognition has always been an object of scientific research. Psychologists often describe cognition as a number of heuristic procedures, which are sometimes effective and sometimes not, depending on the given situation (Kahneman et al. 1982; Miller and Ross, 1975). The Error Management Theory, as known in evolutionary psychology, describes adaptive cognitive biases by Buss, Haselton and Dey (1998). This theory explains the evolution of human cognition as a result of natural selection. There is a lot of uncertainty in human social life, concerning emotions or purposes of others, a fact that makes it necessary to rely on imperfect estimates, when decisions have to be rapidly made (Buss, 2000).

Certain cognitive biases (*rules of thumb* – Tverky and Kahneman, 1974) were designed and managed to survive over time in evolutionary history, because they held reproductive benefits for both sexes. Those cognitive biases were designed to avoid extreme costly errors of estimation and, simultaneously, permit systematic erring in the direction of higher survival chances, or in other cases, in the direction of lower reproductive costs. This approach enables us to explain men's overperception of women's sexual intent, as well as women's underestimation of men's commitment, both errors that have typically been attributed to sex-role socialisation in the past.

1.2.2. Errors Type I and Type II

While having to make a decision, one person can make one of two possible errors of judgment, in terms of dealing with uncertainty; *Type I - or Type II - Error*. In the first case, the subject assumes that a certain state is there, although it is not, in the second case, one fails to recognize a state that actually exists. It is not possible to minimize both errors at the same time; avoiding one error increases the likelihood of committing the other. Therefore, it is reasonable to be biased toward making the less costly error, whenever costs of errors are asymmetrical (Green and Swets, 1966; Cosmides and Tooby, 1996; Nesse and Williams, 1998; Schlager, 1995; Searcy and Brenowitz, 1988; Tomarken et al., 1989).

Errors typically are asymmetrical in certain warning devices, such as fire alarms (*signal detection theory* - Green and Swets, 1966; Wiley, 1994). Type I - Errors (*false-positive errors*) can also be

defined as “playing it safe”, which, in the case of fire alarm systems, means reacting to every alarm signal. Type II - Errors (*false-negative errors*) show a tendency of ignoring the fire alarms, because they are often false. If the alarm turns out to be false, indeed, but has been estimated to be accurate, a Type I - Error has occurred. In case of ignoring an existing fire because of the many possible false alarms, a Type II - Error has been committed. In this specific situation, the Type II - Error is obviously associated with much higher costs than Error - Type I. This cognitive bias increases the number of potential errors, but at the same time minimizes the total costs. This is why engineers design fire alarms to be biased away from the more costly error (Type II – Error), by setting a low threshold for fire detection.

1.2.3. Three hypotheses to explain Error Management Theory

Three hypotheses have been developed to explain the fact that men tend to overestimate women’s sexual intentions. The first one is *the general oversexualisation hypothesis*: Men tend to oversexualise the world, a fact that is a product of their socialisation process (Abbey, 1982, 1991). Women, on the other side, are being taught to be rather coy (Abbey, 1982, 1991). The second hypothesis is *the media hypothesis* (Abbey, 1991): Women in media are presented as initially coy and rather promiscuous in the end, which leads men to overestimate women’s sexual intents towards them. The third hypothesis is *the default-model hypothesis*: According to this assumption, men project their own sexual desires onto women and therefore interpret their sexual intentions to be similar to their own (Shotland and Craig, 1998).

1.2.4. Error Management Theory and evolutionary background

The Error management theory implicates that such errors played an important part through human evolution, concerning intersexual interactions. In males, committing a Type I - Error, while assuming sexual interest in a female, when there is not, is less costly than assuming she is not interested when in fact she is. Results could be rejection, embarrassment or even violence by a current mate. In case of incorrectly assuming the female is not interested, the courting male could loose a potential reproductive partner. In evolutionary terms, this outcome would be very costly for men’s reproductive success.

Women, on the other hand, invest highly in their offspring (Trivers, 1972) and therefore tend to be very cautious in choosing mating partners and in assenting to sex. When women commit a

Type I - Error, they wrongly presume that a certain man is willing to invest commitment and resources in her and her offspring. If he is not, this mistake can turn out to be very costly because she runs danger of being abandoned after providing reproductive access. Error-Type II is, in this case, the less costly alternative of erring; women presume men are not interested, even when they actually are. Negative results in case of erring include the loss of one of many potential partners. This outcome is not excessively costly to women because they are more capable of acquiring sexual opportunities than men are.

Concerning the above, men should be predisposed, in terms of evolution, to overperceive and overestimate female sexual interest, while females should rather be oriented to underperceive and, therefore, underestimate male commitment intentions; the replicative success of one design dominates over the others (Dawkins, 1989). Hence, the error management theory can be seen as an attempt to explain why men tend to misinterpret rather harmless intersexual interactions such as a smile, a touch or even small talk (Abbey, 1982, 1991). A US supermarket-chain made headlines in the 1990s with their “service-with-a-smile policy”; women employees reported an increase of sexual harassment towards them, because men misinterpreted their friendliness as sexual interest.

Men possess evolved adaptations, which are designed to minimize the cost of missed sexual opportunities by overestimating women’s sexual intentions (Haselton and Buss, 2000). The limiting factor concerning the reproductive success of men has always been the ability of sexual access to fertile women (Symons, 1979). Those men who tended to misinterpret the sexual intentions of the other sex either paid the rather low costs of failed sexual pursuit, or in case of underestimating the intentions of the potential partner, the high costs of losing a reproductive opportunity (Alcock, 1993).

Different studies support this hypothesis; when men and previously unacquainted women were partnered up and afterwards asked to estimate their interaction-partner’s sexual interest, men tended to rate higher than their female partners, as well as higher than the female third-party viewers of the interaction (Abbey, 1982; Saal et al., 1989). These results could be replicated in studies using photographs (Abbey and Melby, 1986), videos (Johnson et al., 1991), short vignettes (Abbey and Harnish, 1995), ratings of courtship signals (Haselton and Buss, 2000) and

naturally occurring misperception events (Haselton, 2001). There was no evidence of sexual overperception in women (Haselton, 2001; Haselton and Buss, 2000). Studies from the world outside the laboratory (Abbey, 1987; Haselton, 2002) confirm the results above.

According to Haselton and Buss (2000) women should act the exact opposite way. The costs of providing reproductive access to a man, who isn't prepared or willing to invest in his mate are disastrous (Error-Type I), compared to the costs that would arise from failing to recognise commitment that really exists (Error-Type II). Committing Error-Type I could have had serious consequences. The woman could be forced to suffer the costs of an unwanted pregnancy, of raising a child without an investing partner and simultaneously lessen the chances of finding a new partner, because of a reduction in her mate value (Symons, 1979; Buss, 1994). At the same time, the children who were born from such a connection would have had a lower survival chance in comparison with other children with a providing father (Hurtado and Hill, 1992). On the other hand, underestimating the true intentions of a potential partner would only have evoked more displays of commitment by the man; he would have had to show more effort, in order to prove that he really is committed. The costs from such a strategy are significant less for women than overestimating the intentions of the man involved. This is the reason why selection has made women bias towards underestimating men's commitment when it comes to choosing a mating partner.

In several studies, women have described the intentions of their interaction-partners as less honest and willing to commit than men themselves intended to implicate (Haselton and Buss, 2000). Third party surveys from men and women show the same results concerning man's commitment signals in a male-female interaction (Haselton and Buss, 2000). Men's assessments of women's signals provide no evidence of commitment bias (Haselton and Buss, 2000).

As Selekidis (1993) showed, self-ratings are prone to self-enhancement. Women might underestimate their real sexual intention (Einon, 1994) when being asked in order to avoid being accused of sexual promiscuity, a reputation which would lessen their chances of finding a new partner (Buss, 1994; Einon, 1994). On the other hand, female third-party-observers might bias in the opposite direction; aspersing the same sex competitors might give them an advantage, while seeking for a mating partner themselves (Buss and Dedden, 1990; Schmitt and Buss, 1996). Men

might hide their true intentions in order to achieve their goals and create a new mating opportunity. They may also highlight intentions such as love and commitment (Buss and Dedden, 1990) which are very popular with women (Buss, 1994). At the same time, they derogate the commitment intentions of other men, when giving third-party ratings, to gain a mating advantage (Buss and Dedden, 1990; Schmitt and Buss, 1996).

1.2.5. Error Management Theory out of the reproduction-aspect

There are several other cognitive biases that can be explained by Error Management Theory: Snake and spider fear (Seligman, 1971; Tomarken et al., 1989), food preferences and disgust (Garcia et al., 1966; Rozin and Kalat, 1971), auditory looming (Neuhoff, 1998, 2001), allergy, cough and anxiety (Nesse, 2001, 2005), avoiding the ill (Kurzban and Leary, 2001; Park et al., 2003) and the perception of automotive designs (Windhager et al., 2008) among others.

The aim of this study was to examine the over- and underestimation tendency based on a sample of men and women (N=405) of various ages, who had been asked to rate themselves before and after playing with a patience-game. According to the Error Management Theory, we expected differences in the self-estimation rates between those men and women, concerning the game, as well as differences between people belonging to prae- and postreproductive ages (see chapter 2, Methods).

1.3. Menopause and the Grandmother-Hypothesis

1.3.1. Menopause as a biological phenomenon

Menopause is characterised as the cessation of the menstrual function and the irreversible termination of the female reproductive capability (12 months with no menstrual flow). It is a universal biological phenomenon, which affects all middle-aged women. The reason for this physiological event lies in the continuous loss of ovarian follicles until the complete cessation of menstrual cycles and finally, the total breakdown of the pituitary-ovarian system of the hypothalamus (O'Konnor et al., 2001).

The time-period referred to as praemenopause begins about 5 years before the initiation of the menopause, with a significant increase of the serum levels of FSH and LH, whereas the serum levels of estradiol and estrone decrease (Rannevik et al., 1995). The depletion of these hormones, especially estrogen, is associated with several symptoms such as hot flashes, night sweats, psychological effects (insomnia, depressions, anxiety, irritability, mood changes, memory and concentration problems), skeletal symptoms, as well as diseases of the urogenital system (decreased libido, dyspareunia). Those symptoms are principally being treated, in the modern world, with hormonal replacement therapy.

Postmenopause is identified as the permanent (over at least a whole year) absence of monthly menstruation; it begins after the complete cessation of the physiological ovaries function.

The time around menopause is usually being referred to as perimenopause; this term also describes the menopause transition years (climacterium). During this period, fertility can diminish, but is not considered to cease totally, until the official termination of menopause (12 months after the last menstrual cycle). The beginning of perimenopause usually occurs at women in their mid to late forties.

The average age of menopause in the Western world is about 50 years (Gosden, 1985). The physiological age-range for the occurrence of menopause lays between 45 and 55 years. A "late menopause" occurs, when the menopause lies between 55 and 60 years of age, whereas in an "early menopause" the last menstruation occurs between the ages of 45 to 50.

The European Respiratory Health Survey and the Swiss Air Pollution and Lung Disease in Adults Cohort performed a study among 5,288 women, aged between 30 and 60 years who were selected out of nine European countries between 1998 and 2002. 25 % of those women were postmenopausal by the age of 50.8 years. The determinants of earlier menopause were smoking, an increased body mass index (>30 kg/m) and low physical activity, whereas the determinants for later menopause mainly were multiparity. Later birth was also associated with later menopause. There was a secular trend observed that menopause is shifting towards higher ages all across Europe, an effect that could be seen as rather paradox, considering the life style of modern European women. This results implicate that menopause is a complex biosocial and biocultural process (Lock and Kaufert, 2001).

1.3.2. Menopause in terms of Evolution (The Grandmother-Hypothesis)

In biology, menopause is considered to be favoured from natural selection (Darwin, 1859) in many different ways. The fact that menopause mainly occurs in older women, ensures that the women who are reproducing are still young enough and able to survive pregnancy, birth and early childhood (Leidy, 2006). From an evolutionary point of view this fact is very important, because it ensures the survival of the offspring produced and prevents the fertilisation of old oocytes (*chromosomal abnormalities* - Hrdy, 1999) and the waste of maternal energy (Hall, 2004). This hypothesis is known as the “*grandmother-hypothesis*” (Hawkes et al., 1997, 2004; Willians, 2000). According to the grandmother hypothesis, the female reproduction stops early, so that elder women would have the time and energy to rather invest in their grandchildren instead of having more children of their own. That way they become able of contributing more genes to the population gene pool (Alexander, 1974) because the survival chances of at least some of their children and grandchildren get very high, due to the extra care they receive from their mother and grandmother (Lahdenperä et al., 2004). The study of Lahdenperä et al. (2004), who analysed multi-generation records of two populations (one of the eighteenth and one of the nineteenth century) showed that children, both sons and daughters, who had a mother living past menopause, had more children themselves in shorter intervals and more of them reached adulthood. Some studies have identified significant associations between the postmenopausal longevity and the number of the children born (Doblhammer and Oeppen, 2003). When elder women have children, the danger of death during confinement is physiologically increased. If the mother in question still has other children, who are not able of taking care of themselves, then her

reproductive success is endangered. She and her yet unborn child face an increased risk of death during childbirth as a result of a late pregnancy but there is also a high possibility that her other children, who are still too young to survive on their own, might die as well, lacking the care of a mother (Diamond, 1997).

Pregnancy, as well as childbirth is very costly processes for the health and longevity of women. During pregnancy and lactation the caloric intake of women is higher than before and the possibility of coming down with a - sometimes lethal - infection is increased. These dangers are even higher when the mother in question has reached a certain age. Therefore it is a rational compromise that the fertility of women ends long before their life does; this way, elder women become able to spend more time with their younger children and their first grandchildren. This behavioural trait increases the chances of the offspring to reach adulthood and to be able to reproduce themselves (*parental investment* - Trivers, 1972). Menopause in modern women is a remnant of a protective adaptation that our older female ancestors, developed and which helped them to better focus their maternal resources.

In infants in the first years of life, the brain needs 60% of the energy-intake, so both they and their mothers require a dependable, enlarged food supply. Some evidence suggests that hunters contributed less than half of the total food budget in most ancient and modern hunter-gatherer societies, so foraging grandmothers could contribute significantly to the survival of their grandchildren, at times when parents alone were unable to provide enough food.

According to the above, menopausal women with offspring should be highly concerned for the well-being of their children. Therefore, if non-fertile women are looking for a partner, they should be after men with a high social and financial status, as well as someone who would be willing to invest in children who are not his own. Someone like that ought to be intelligent, open hearted, understanding and honest, altogether attributes desired in long-term relationships.

1.3.3. The “Free-at-last” Hypothesis

The “*free-at-last*” *Hypothesis* (Grammer et al., 1999) indicates that postmenopausal women with no offspring would follow another strategy when seeking a partner. Those women do not need a

man who would invest in their children, and are therefore able to choose someone who fulfils their own visions. Since those women are not endangered to become pregnant and to be abandoned with their offspring anymore, they tend to make choices resembling those of males; youth, health and attractiveness become more important to them, similar to the postmenopausal women who have successfully reproduced. Even the duration of the future relationship gets less important; postmenopausal women with no offspring tend to get involved in more short-terms relationships.

In the study performed by Grammer et al. (1999), 2866 women (mean age=33,9) and 4138 men (mean age=33,9), who were members of a Munich video-dating-company (1989-1995) were examined, concerning the profiles of the partners they desired. Several personal and demographical data were collected and videos of the participants were made. Especially in postmenopausal women, the results showed that women with children wished for a partner who was younger and more attractive, but less sexy than postmenopausal women without children of their own hoped for. A high social and financial status seemed to be important in both groups of postmenopausal women - with or without children. Actually, a high status in men seemed to be getting more important to the interviewed women with increasing age. Finding a partner with a high social and financial status seems to be a universally evolved strategy in women, which enables them to gain stability and security for themselves, their children and their grandchildren.

Consequently, it could be possible that women who have reached menopause could show more “male” characteristics in some cognitive biases such as the Error Management Theory (Buss et al., 1998). Since postmenopausal women are not able to conceive a child anymore, the cognitive bias, which led them to underestimate men’s commitment in their fertile years, might no longer be necessary. Referring to the patience-game mentioned above, it is possible that this effect occurs in other cognitive domains, as well.

1.4. The Display-Hypothesis

“A person who has not made his great contribution to science before the age of thirty will never do so.” Albert Einstein (Brodetsky, 1942)

While menopause was the criterion in women, which enabled us to settle the age of fifty as the average age of potential changes in female cognitive biases, there is no comparable physiological event of reproductive cessation in men. The display hypothesis could provide an equivalent in males, which could explain a change in their perception of women's sexual intent over age.

1.4.1. Evolutionary Background

The best way to understand human culture is provided by Charles Darwin and his sexual selection theory (1859, 1871). According to Darwin, evolution depends on reproductive competition rather than on natural selection when it comes to mating strategies. Sexually reproducing species depend on the choices they make when picking out a mating partner who will be parenting their children. The produced offspring is due to inherit the traits - good or bad - of the chosen sexual partner. The choice of a mating partner will, therefore, influence the quality and the very survival chances of all the descendants. This circumstance has led evolution, in several sexually-reproducing species, in the direction of developing displays, communicating attractiveness, health, social status, fertility and other similar qualities which are favoured over others. As often observed in various animal species, females tend to be choosier about picking their mates than males, although males often display more than females.

1.4.2. The Handicap Principle and the Runaway Model

The assumption that mate-choice depends on certain phenotypic qualities, like health or fertility, as well as genotypic characteristics (Cronin, 1991; Andersson, 1994) was generally known but it was the description of the *"Handicap Principle"* from Zivari and Zivari (1997) that presumes that the most reliable way to demonstrate one's genetic superiority during courtship is to present costly signals. The most famous example is the peacock's tail which, although much too heavy to carry and therefore apparently redundant, happens to be a rather popular display with the female birds. The reason for this is that these often extremely costly "handicap"-signals indicate the high quality of the genetic material in their owners and are, therefore, fitness indicators (Zahavi and

Zahavi, 1997). Such indicators - physical attributions or even certain forms of behaviour - influence mating decisions (Andersson, 1994) and, hence, survival itself. It has been described that mental traits show heritability, especially those ones which have been essential for survival such as intelligence or other cognitive skills crucial to cultural behaviour (Jensen, 1997; Plomin et al., 1997; Moller and Swaddle, 1997; Rowe and Houle, 1996; Miller and Todd, 1995, 1997). Although the driving force of evolution is the survival of the fittest (Darwin, 1859) several cultural activities such as art, music, language and rituals which have been practised in the past will, therefore, probably keep on existing in the future.

The model described by R. A. Fisher (1930), called the “*runaway model*”, indicates that sexual selection is a runaway-process; heritable mate preferences tend to associate with the adequate traits so that both of them are being driven to an extreme. This process depends highly on the given circumstances and is therefore not always the same, even in similar species living under comparable circumstances (Miller and Todd, 1995; Todd and Miller, 1997).

1.4.3. Culture and Evolution

Culture can be defined as the sum of typical human behaviours, such as art, music, dance, or even the development of ideas or beliefs. Tooby and Cosmides (1992) suggest that several adaptations were necessary to respond to the continually changing selection pressures in different environments and to constantly compensate various biological needs. According to evolutionary psychology, culture is not just a secondary effect of a constantly growing brain (Pinker, 1997), but indeed contributes to biological fitness as well.

The individuals who are capable of producing high quality cultural products may, in this manner, illustrate their phenotypic and genotypic superiority, comparing to their same-sex rivals. Those relevant traits visualise other more subtle attributes, such as intelligence or creativity and can, therefore, also influence mate choice (Andersson, 1994; Pomiankowski and Moller, 1995; Rowe and Houle, 1996; Zahavi and Zahavi, 1997).

Ritualising cultural displays, a commonly observed phenomenon, could also have found its beginnings in this theory; there is a tendency observed in individuals to draw the attention of the other sex by recombining existing basic cultural skills and, hence, create new cultural products

(Catchpole and Slater, 1995; Miller, 1997; Werner and Todd, 1997). People are often remarkably inventive when it comes to impress a potential partner. “*Standardised cultural elements allow easy comparisons of behavioural virtuosity, while protean cultural patterns allow easy assessment of behavioural creativity (Miller, 1997)*”.

1.4.4. The Courtship-Hypothesis

The “*courtship-hypothesis*” implicates that the sex and the age of an individual relates to the nature and the amount of the produced cultural display. This cultural productivity should increase rapidly after reaching adolescence and reach its highest value at young adulthood, when the sexual competition is at its peak. After finding a long-term-partner and producing offspring, the tendency to achieve cultural goals should decline more and more. Male-male competition is more distinct than the intersexual female competition; therefore, men should generally show a higher productivity level than women (Andersson, 1994; Cronin, 1991; Ridley, 1993). This pattern could, followed across many cultures and epochs, explain homicide, indicating that violence and sexual competition are heavily associated (Daly and Wilson, 1986).

It has also been observed that men are louder, more energetic and motivated than women are, when it comes to courtship displays. Women also perform cultural displays to attract the attention of high-quality mating partners. Still, women produce more cultural displays compared to men even after finding a long-term partner and having children. In case of women, an inconsiderate exaggerated self-display in early years, and without any protection, would be too risky concerning the danger that might arise out of male sexual harassment. Therefore, it is a fact that men tend to be more motivated when it comes to broadcasting their cultural displays.

1.4.5. Former studies

The pioneer study made in 1953 by Lehman showed that the most significant discoveries have been made by young scientists and that the age of the scientist correlates negatively with the significance of his or her discovery. The same results were documented by Cole (1973) as well as Levin and Stephan (1991). Kanazawa (2002) examined the biographies of 280 scientists (97,8% male) from *The Biographical Dictionary of Scientists* (Porter, 1994). Confirming past studies, Kanazawa showed that 23,6% of those scientists made their most important contribution to

science between 25 and 35, 65% before their midthirties and finally, 80% of all the scientists in the sample had their career peaks before their early forties (mean age: 35,4 years).

Miller (1999) performed a study that included all of the commonly known jazz albums documented by Carr et al. (1988). A sample of 1,892 jazz albums (20% of the original sample) was examined and the sex and age of the principle musicians/composers involved was documented. 1800 albums were produced by 685 men, while there were only 92 albums produced by 34 women in a sample of 719 musicians. Men produced jazz albums at a much higher rate than women and with a definite productivity peak at about the age of 30. In the distribution of this study every musician/composer was counted more than once. Yet these results are valid, since Simonton (1988, 1997) showed in his equal-odds rule that the time of the most significant contributions is also the time of the largest amount of contributions made.

In his second study, Miller (1999) examined 3,374 modern paintings from the “*Tate Gallery Collections*” (1984). The sample included all the works of every artist, whose last name was beginning with A through K. There were 2979 paintings by 644 men, while only 395 paintings by 95 female painters were included. In this sample, both the male and the female participants showed productivity peaks in their early thirties.

In the domain of literature, 2,837 English-language books published in the 20th century were examined by Miller (1999). This sample included about 2% of all the books listed in “*The writers’ directory*” (1992). 2,213 of the books were written by 180 male authors and 624 books by 49 women. The productivity peak was registered at about 43 years for men and 50 years for women a fact that implicates a gender difference between the two sexes concerning the highest productivity age.

Strong (1991) examined 2500 rock albums, Sadie (1993) 3,800 prominent works of classical music, 850 old paintings from “*the National Gallery Illustrated general catalogue*” (1986) were also analysed, Crystal (1993) examined 250 plays and, finally, 150 major philosophical tracts were documented from Collinson (1987). All these studies led to the same conclusions; men showed a higher productivity than women (Ellis, 1934; Battersby, 1989; Russ, 1983) and both

sexes showed similar productivity age-peaks. This sort of age-peak-pattern was found in many other forms of display behaviour (Simonton, 1988).

1.4.6. Age, genius and crime

In 1983, Hirschi and Gottfredson presented the invariant age-crime curve. Their study confirmed the assumption that the criminal behaviour of young men peaks in late adolescence and adulthood and decreases around the age of forty. Expanding the homicide theory of Daly and Wilson (1988, 1990), this theory implicates that the criminal behaviour of men shows a peak in late adolescence and early adulthood and then decreases during late adulthood. The evolutionary psychological explanation (Kanazawa and Still, 2000) implicates that all the types of violence and, therefore even crime, are the consequence of males competition for access to fertile females. This fact can be confirmed by the age-crime curve itself; the crime-peak occurs in the reproductive prime of men. There have been no significant data documented that young boys show an increased criminal action, since competing for a mating partner is not important to them at that age. The age-crime curve declines again at men around forty because of the costs and the potentially harmful effects on the existing offspring. Gaining access to more women, in the majority of cases, involves violent fights with other males. Those fights could lead to injury or death of the males involved and could, therefore, endanger their reproductive success since their children would lose their protector. In other words, the reproductive costs of the male-male competition significantly increase after the production of offspring. Ellis (1998) speculates that acts defined as criminal in humans are often being performed by other non-human species as well.

Genius and crime both seem to express the competitive desires of young men, in order to increase their reproductive success, through gaining access to as many fertile women as possible. Crime could, therefore, be the default expression of this phenomenon. In today life the circumstances have drastically changed compared to our ancestors. Men have invented other ways to express their creativity and, therefore, their competitiveness. This could be the reason why the age-genius curve peaks later than the age-crime curve since the performance of criminal acts, in the majority of cases, does not require any special “modern” skills. Arts, music, science and all the other modern forms of creative expression often imply a long education-period and the response to novel evolutionary stimuli before the first outcomes can be produced.

Hence, the desire to reproduce and pass those skills on to the next generations may be expressed later in life as well, in terms of reproduction. This can be illustrated by the study of Glueck and Glueck (1968) among 500 delinquents and 500 nondelinquents in the Boston area; the delinquent men marry on average earlier than the nondelinquent ones. Actually, Laub et al. (1993, 1998) found out that the strongest predictor of desistance from criminal careers is marriage. The studies of Debus (1968) and Gillispie (1970-1980) showed that the age-genius curve applies only to married scientists and not to their single colleagues. Half of the unmarried scientists made their greatest contributions to science in their late fifties and, only the other half in their early twenties. The study made by Hargens et al. (1978) also showed that childless chemists are more productive than their associates with children.

1.4.7. Display-Hypothesis and testosterone-levels

Finally, the unpublished experiment of Gubernick (1997) showed that the testosterone level of expectant fathers dramatically drops after the birth of their children, whereas Mazur and Michalek (1998) showed that marriage decreases the testosterone levels of men and divorce actually causes them to resurge. This could be the final explanation for the theory described above; since high testosterone levels are associated with aggressiveness and competitiveness in men, the decrease in levels after marriage and childbirth is an evolutionary adaptation which aids in increasing their reproductive success.

According to the above mentioned, we set up following hypothesis, which could illustrate gender and age differences between men and women, while performing a patience-game, as well as among the four age-groups (prae- and postreproductional), as defined above. We used a common commercial patience-game because it was easy to transport and handy for our participants to try.

1.5. Hypotheses

According to the studies described above, Error Management Theory (see 1.2.) has mainly been applied to the domain of cross-sex mind-reading. In this study, we applied Error Management Theory in another domain; we used a patience-game, available in several commercial stores, to examine whether there are differences between men and women, while estimating their capacity of playing and mastering this patience-game.

Hypothesis 1: Men tend to overestimate their capability while performing a patience-game, using Error-Management-Theory logic, while women tend to underestimate themselves.

Furthermore, according to the Display-Hypothesis, as well as the Grandmother-and Free-at-last Hypothesis (see 1.3.) in terms of female menopause, we presumed that there might be significant differences concerning the self-estimation, not only between the two sexes but also between younger and older individuals. As determining age we used the age of fifty, which is the current mean menopausal age of middle-European women (see 1.3.).

Hypothesis 2: Individuals under the age of fifty, tend to show the effects of the Error Management Theory - men overestimate, while women underestimate themselves - more intensely than older individuals do.

2. Methods

There were **405** test-persons who participated in our study, **203** of them were men and **201** of them women. **104** of the men were young – under the age of fifty – and **99** elder ones, whereas **101** of the women were young (<50) and **100** elder (>50) women.

The test-persons were recruited in two different locations in Vienna, Austria; at the university-campus old AKH (= old general hospital / see Picture 1.1 and 1.2) of Vienna, as well as the Park of the Schönbrunn Palace (Schloßpark Schönbrunn / imperial summer-residence Schönbrunn / see Picture 2.1 and 2.2.). Those locations were chosen, in order to ensure a representative sample of individuals. It was necessary to recruit participants in a second location besides the university-campus, because it was considerably easier to find and question elder people at the palace-park Schönbrunn, a popular excursion-area for retirees, than at the university-camp, where we mainly interviewed young students.

The data were collected in the months of May - June 2008, always during daylight and sunshine. The temperature, as well as the % degree of cloud-occultation was documented, along with the exact calendar-date and the time of each interview.

The procedure for each interview was standardized; the two examiners approached each potential test person, asking him or her whether he or she would be interested to try and, perhaps, solve a specific patience-game. It was of great importance that the recruited persons were sitting alone, mostly on a park bench, so that there would be no influence due to the presence of a friend or a partner. After the person agreed on performing the game, several general demographic data were collected. The questionnaire we used (see Appendix 6.1. and 6.2.) included items concerning age, gender, sexual orientation, current partner and current condition of the participants. The social and financial status was calculated on the basis of education, employment and clear monthly income. Further, the pharmaceuticals consumption, as well as the consumption of alcohol within the past 5 hours were documented, both factors that could influence the self-estimation of the test-persons. In order to include the changing hormonal blood-levels at women, there were relevant data collected which concerned the menstruation-cycle as well as the consumption of hormonal contraceptives. Finally, the height and the weight of each participant were inquired.

After documenting the above, the actual patience-game was presented to each test-person. Firstly, the participant was asked whether he or she had any experience with patience-games in general (1=none, 7= a lot of experience) and whether he or she ever played this particular game before. It turned out that none of the participants ever played the game we used in this study. The game itself was a common patience-game (see Picture 3). The assignment was to separate the star from the ring. The person in question was asked whether he or she thought it was possible to be successful at this task within 2 minutes. The answer varied from sure (1) up to definitely not (7). After evaluating themselves, the test-persons were given the game, in order to try it for themselves for a time-period of 2 minutes. A stop watch was used to define the exact time. If the person in question actually managed to separate the star from the ring, the time in seconds he or she needed to complete that task was documented as well. If, on the other hand, the person was not able to solve the game in the given time-limit, which was the most common outcome, he or she had to estimate themselves concerning the patience-game again; we asked those “lesser successful” participants, whether they thought it would be possible to be successful when there was no time-limit given to manage the same game (*sure*=1 up to *definitely not*=7). In addition, in order to collect further data for another master thesis performed by Mrs. Emanuela Stockinger, the length of the digits 2 and 4 were measured, each of them twice. At the end of the interview, a chocolate-bar was given to every participant, to compensate his or her efforts for our study.



Picture 1.1.: The University Campus old AKH



Picture 1.2.: The University Campus old AKH



Picture 2.1.: The Palace-Park of Schönbrunn



Picture 2.2.: The Palace-Park of Schönbrunn



Picture 3: The Patience-Game

3. Results

3.1. Social and Financial Status

The social and financial status of the participants was calculated on the basis of education, employment and clear monthly income. An important factor which can describe the social status of various professions, is the social reputation of each employment (Schmitt and Atzwanger, 1995). The different professions that occurred in the sample, were evaluated by 40 independent participants, according to a 7-part Likkert-Scale. The mean of each value characterises the social reputation of the profession given. The Likkert-Scale and the reputation-value of each profession are presented in the appendix (see 6.3.).

3.2. Calculation of the conception-likelihood

The conception-likelihood of each participating woman was calculated on the basis of the receptivity-table of Jöchle (1973 / Table 1). This way the hormonal status of each woman during the performance of the game could be estimated. The necessary data (mean duration of the menses-cycle, first day of the last menstruation, hormonal contraceptives) were collected during the interviews. The day of the menses-cycle was standardised to a cycle-duration of 28 days, according to the following formula:

$$\text{cycle-day} / \text{mean duration of menses-cycle} \times 28 = \text{standard cycle-day}$$

On the basis of the receptivity-table of Jöchle (1973), it was possible to calculate the conception-likelihood of each woman involved, at the time of the interview. Women, who consumed hormonal contraceptives, had a receptivity-likelihood of zero (0).

Cycle-day / p _E in %	Cycle-day / p _E in %	Cycle-day / p _E in %	Cycle-day / p _E in %
1-4 -	11 32,6	16 4,8	21-22 4,7
5-6 17,2	12 40,8	17 2,5	23-24 1,9
7-8 29,9	13 28,3	18 3,1	25-30 -
9 23,7	14 26,5	19 2,8	
10 30,0	15 10,5	20 2,0	

Table 1: Conception-likelihood (p_E in %) depending on the cycle-day (Jöchle, 1973). Day one of the cycle is the first menses-day.

3.3. Descriptive Statistics

The data were collected between the 7th of May 2008 and the 18th of June 2008. There were **405** test-persons who participated at our study. **204** of them were men aged between 19 and 82 (mean age = 48,86 +/- 1,431), whereas **201** test-persons were women between 18 and 89 years old (mean age = 47,14 +/- 1,567). As “*younger men*” we defined all men under 50 years of age (**105** participants), whereas men over the age of 50 were defined as “*older men*” (N = **99**). Comparably, there were **101** women under 50, who took part at our study (*younger women*), whereas **100** women, who were over 50 years of age, were defined as “*older women*”.

The game was mastered by **43** men and **7** women, whereas **20** of the successful men were under 50 and **23** of them were older than 50 years of age. All the successful women were under the age of 50 years.

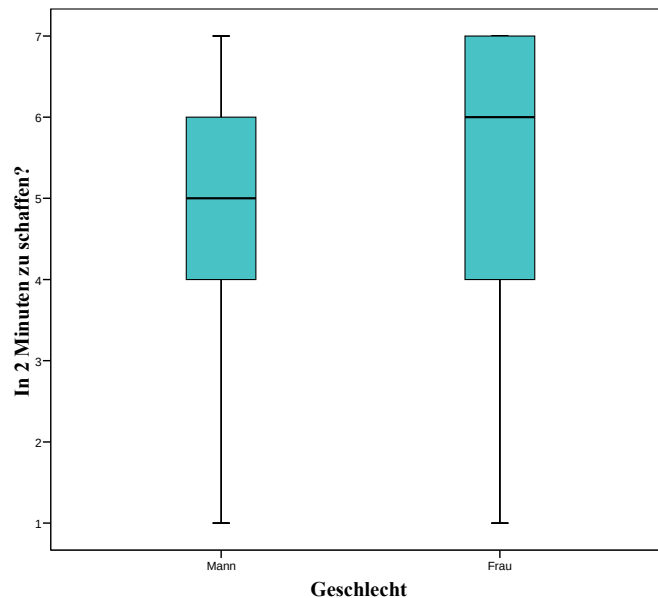
	Under 50 years	Over 50 years	Total
Men	105	99	204
Women	101	100	201

Table 2: Descriptive statistics of the four defined age-groups

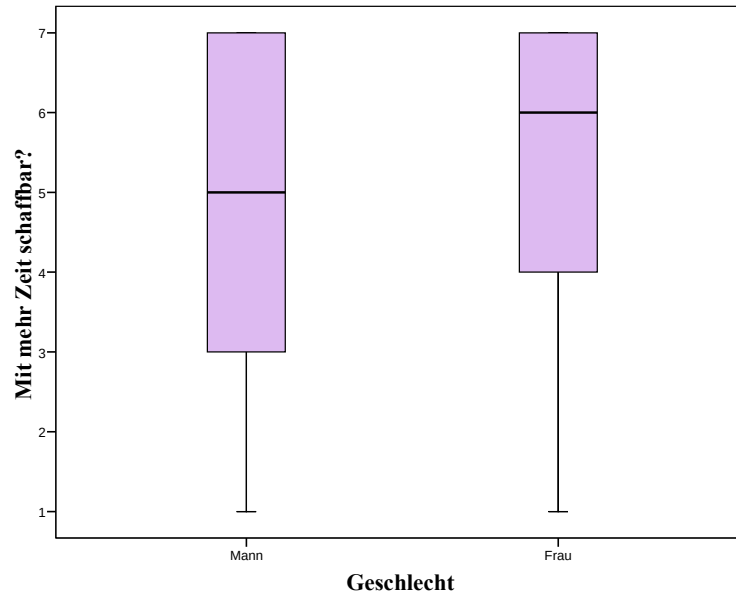
3.4. Results concerning Hypothesis 1 (Men rather overestimate, whereas women rather underestimate themselves / Error Management Theory)

According to the Error Management Theory (see 1.2.) we expected a significant difference between men and women, while estimating whether they would be successful at performing the patience-game in 2 minutes or with no time limit at all. In both cases we performed the Mann-Whitney Test, which led to the following results:

- ad “*Do you think you can separate the star from the ring within 2 minutes?*”, there was a significant result with $p = 0,000$ (see Graph 1). According to the ranges (men=179,71 / women=226,63, $U=15751,50$, Wilcoxon- $W=36661,50$, $Z=-4,145$) given, men tend to overestimate themselves, when being asked whether they thought they could solve the game in 2 minutes, significantly higher than women do.
- ad “*Do you think you can separate the star from the ring if there is no time limit given?*”, there was also a significant result with $p = 0,003$ (see Graph 2). Even with no time limit, men still tend to overestimate their abilities, in comparison with the tested women (ranges men=160.88 / women=192,21, $U=12860,50$, Wilcoxon- $W=25091,50$, $Z=-2,933$).



Graph 1: Gender versus “managing the game in 2 minutes”



Graph 2: Gender versus “managing the game with no time limit”

3.5. Confounding variables concerning Hypothesis 1 (Men rather overestimate, whereas women rather underestimate themselves / Error Management Theory)

There were several variables which showed significant results when examined in correlation with the two questions which captured the self-perception of the two sexes (item 13 and 14, see questionnaire, appendix 6.1. and 6.2.). Concerning male participants, there was a significant correlation between “*being able to master the game within 2 minutes*” and “*having a life-partner or not*” (Mann-Whitney Test, N=204 (Yes=138 / No=66, U=3638,00, Wilcoxon-W=13229,00, Z=-2,367, p=0,018), as well as “*alcohol consumption in the past 5 hours*” (Mann-Whitney-Test, N=204 (Yes=12 / No=192), U=546,00, Wilcoxon-W=19074,00, Z=-3,114, p=0,002). “*Having experience with patience games*” seems to correlate significantly with “*being able to master the game within 2 minutes*” in both sexes (males: Kruskal-Wallis Test, N=204, Chi-Quadrat= 12,824, df=6, p=0,046 / females: Kruskal-Wallis Test, N=201, Chi-Quadrat= 36,233, df=6, p=0,000). *Body-height* correlates in men with both items which describe their self-estimation (see questionnaire, appendix 6.1. and 6.2. / Item 13: Spearman Correlation, N=204, correlation coefficient= -0,166, p=0,018) / Item 14: Spearman Correlation, N=204, correlation coefficient=-0,278, p=0,000). *Women’s weight* seems to correlate significantly with “*being able to master the game within 2 minutes*” (Spearman Correlation, N=201, correlation coefficient=0,227, p=0,001).

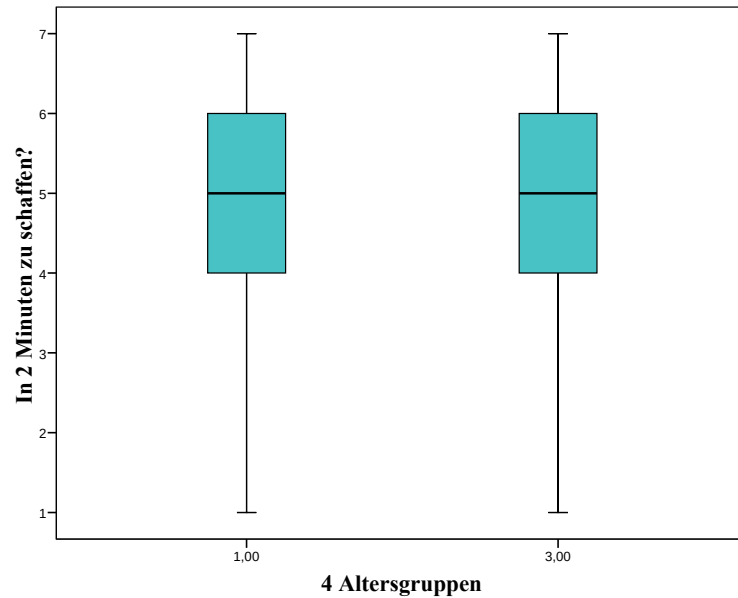
3.6. Results concerning Hypothesis 2 (Individuals under the age of fifty tend to show the effects of the Error Management Theory more intensely than older individuals do / Grand mother-Hypothesis, Display-Hypothesis)

According to the Error Management Theory (see 1.2.), the Grandmother-Hypothesis (see 1.3.) and the Display-Hypothesis (see 1.4.), we expected a significant difference between younger and older men (over and under the age of 50), as well as younger and older women (over and under the age of 50), while estimating whether they would be successful at performing the patience-game within 2 minutes or with no time limit at all. In both cases we performed the Mann-Whitney Test, which led to the following results:

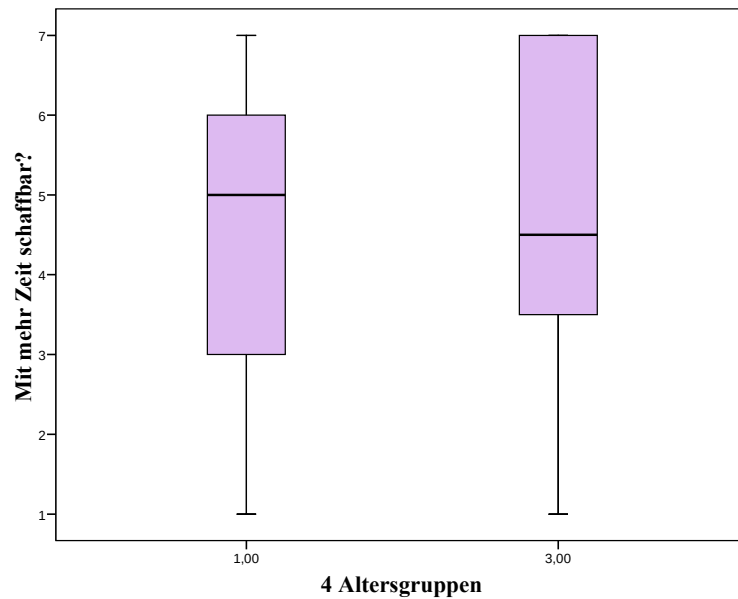
- ad “*Do you think you can separate the star from the ring within 2 minutes?*”, there was no significant result (N=105/99, Ranges: younger men=104,19 / older men=100,71, U=5020,50, Wilcoxon-W=9970,50, Z=-0,428, p= 0,669), concerning the comparison between younger and older men (see Graph 3), nor between younger and older women (N= 101/100, Ranges: younger women=95,59 / older women=106,46, U=4504,0, Wilcoxon-W=9655,00, Z=-1,38, p=0,167 – see Graph 4).
- ad “*Do you think you can separate the star from the ring if there is no time limit given?*”, there also was no significant result between younger and older men (N=85/76, Ranges: younger men=80,62 / older men=81,42, U=3198,00, Wilcoxon-W=6853,00, Z=-0,110, p=0,912 – see Graph 5), nor concerning younger and older women (N=94/100, Ranges: younger women=97,15 / older women=97,83, U=4667,50, Wilcoxon-W=9132,50, Z=-0,086, p= 0,932 – see Graph 6).

Regarding the ranges given, there is a tendency in men of overestimating themselves less with increasing age, when being asked whether they thought they would be able to master the patience-game with no time limit given. Concerning item 13 of the questionnaire (*Do you think you can separate the star from the ring within 2 minutes?* – see Appendix 6.1 and 6.2) the tendency goes in the exact opposite direction; men tend to overestimate, whereas women tend to underestimate themselves even more with increasing age. The same results were observable regarding women and item 14 (“*Do you think you can separate the star from the ring if there is*

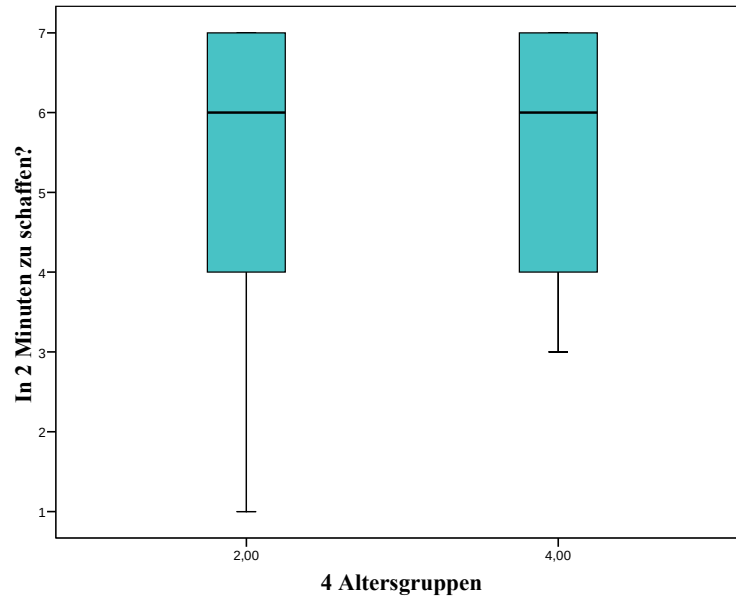
no time limit given?); women tend to underestimate themselves more with increasing age, a fact which confutes hypothesis 2 (see 1.5.).



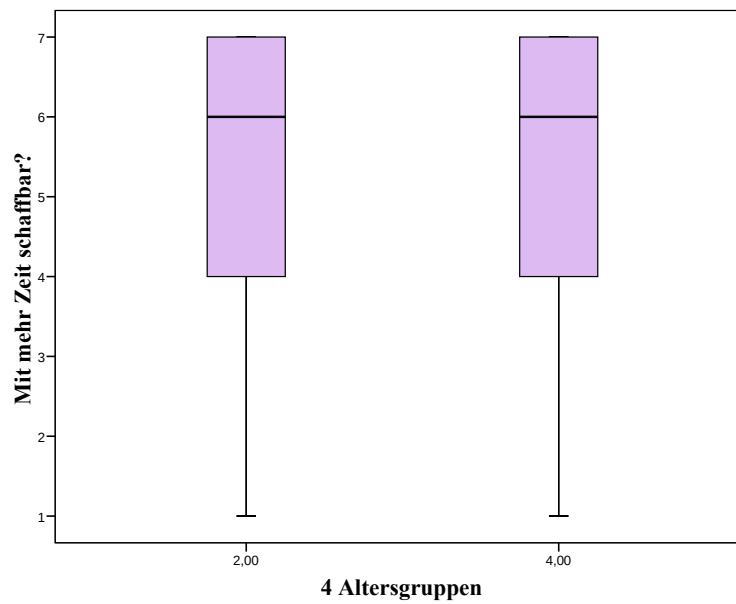
Graph 3: Younger men compared to older men versus
“managing the game in 2 minutes”



Graph 4: Younger men compared to older men versus
“managing the game with no time limit”



Graph 5: Younger women compared to older women versus
“managing the game in 2 minutes”



Graph 6: Younger women compared to older women versus
“managing the game with no time limit”

3.7. Confounding variables concerning Hypothesis 2 (Individuals under the age of fifty, tend to show the effects of the Error Management Theory more intensely than older individuals do / Grandmother-Hypothesis, Display-Hypothesis).

There were several variables which showed significant results when there were examined in correlation with the two questions which captured the self-perception of the four age and gender groups (item 13 and 14, see questionnaire, Appendix 6.1 and 6.2.). Concerning younger male participants, there was a significant correlation between “*being able to master the game with no time limit*” and “*Body-height*” (Spearman-Correlation, $N=85$, correlation coefficient= $-0,215$, $p=0,049$), as well as a significant correlation between “*being able to master the game within 2 minutes*” and “*the social and financial status*” (Spearman-Correlation, $N=105$, correlation coefficient= $-0,226$, $p=0,021$). Elder men showed significant results concerning the fact of “*having a life-partner or not*” and “*being able to master the game with no time limit*” (Mann-Whitney Test, $N=76$ (Yes=61 / No=15), Ranges: Yes=35,47 / No=50,83, $U=272,50$, Wilcoxon- $W=2163,50$, $Z=-2,474$, $p=0,013$), as well as concerning *Body-height* (Spearman-Correlation, $N=76$, correlation coefficient= $-0,337$, $p=0,003$). *Body-height* also correlated with Item 13 (“*being able to master the game within 2 minutes*”, / Spearman-Correlation, $N=99$, correlation coefficient= $-0,229$, $p=0,023$), as well as “*alcohol consumption in the past 5 hours*” (Mann-Whitney-Test, $N=99$ (Yes=6 / No=93), Ranges: Yes=80,00 / No=48,06, $U=99,00$, Wilcoxon- $W=4470,00$, $Z=-2,685$, $p=0,007$) in elder men.

In younger women, there was a significant result concerning the “*experience with patience games*” and “*being able to master the game within 2 minutes*” (Kruskal-Wallis Test, $N=101$, Chi-Quadrat=14,995, $df=5$, $p=0,010$), as well as a significant correlation with “*Bodyweight*” (Spearman-Correlation, $N=101$, correlation coefficient= $0,217$, $p=0,030$). We calculated the *BMI* (Body Mass Index) in order to objectify the Bodyweight and there still was a significant result (Spearman-Correlation, $N=101$, correlation coefficient= $0,272$, $p=0,006$). In elder women there was a significant result observable concerning item 13 (*being able to master the game within 2 minutes*) and “*having consumed pharmaceuticals*” (Mann-Whitney Test, $N=100$ (Yes=59 / No=41), Ranges: Yes=45,70 / No=57,40, $U=926,50$, Wilcoxon- $W=2696,50$, $Z=-2,091$, $p=0,037$), as well as “*having experience with patience games*” (Kruskal-Wallis Test, $N=100$, Chi-Quadrat=30,773, $df=6$, $p=0,000$).

3.8. Confounding variables concerning Hypothesis 2 and Oneway Anova (Individuals under the age of fifty tend to show the effects of the Error Management Theory more intensely than older individuals do / Grandmother-Hypothesis, Display-Hypothesis)

In order to investigate which of the confounding variables actually played a role concerning the results of hypothesis 2, we also used the Oneway Anova including age, gender and all the significant confounding variables we found (see 3.7.). Concerning item 13 (*being able to master the game within 2 minutes*), there were no significant results regarding *Age* (mean squares: among groups=0,444, within the groups=0,248, $F=1,792$, $p=0,099$). Yet, there was a tendency observable that with increasing age there is a decreasing “Error-Management-Theory” effect in both genders. *Gender* led, as expected (see 3.4.) to a significant result (mean squares: among groups=1,114, within the groups=0,238, $F=4,688$, $p=0,000$), as well as “*having a life-partner*” (mean squares: among groups=0,551, within the groups=0,240, $F=2,296$, $p=0,034$) and “*having experience with patience-games*” (mean squares: among groups=14,074, within the groups=1,736, $F=8,108$, $p=0,000$). *Body-height* (mean squares: among groups=231,810, within the groups=71,225, $F=3,255$, $p=0,004$), *Bodyweight* (mean squares: among groups=358,320, within the groups=125,996, $F=2,844$, $p=0,010$) and the *BMI* (mean squares: among groups=31,626, within the groups=8,456, $F=3,740$, $p=0,001$) also played a significant part in the results.

Concerning item 14 (*being able to master the game with no time limit*), there also was no significant result regarding *Age* (mean squares: among groups=0,417, within the groups=0,248, $F=1,684$, $p=0,124$). Still, there also was a tendency in the direction of hypothesis 2 (see 1.5. / *with increasing age there is a decreasing “Error-Management-Theory” effect observable*). *Gender* (mean squares: among groups=0,553, within the groups=0,443, $F=2,273$, $p=0,036$) was significant again (see 3.7.) according to hypothesis 1, as well as “*having experience with patience games*” (mean squares: among groups=6,053, within the groups=1,863, $F=3,248$, $p=0,004$) and the *Body-height* (mean squares: among groups=250,933, within the groups=74,631, $F=3,362$, $p=0,003$).

4. Discussion

4.1. Men rather overestimate, whereas women rather underestimate themselves

Using Error Management Theory (Buss, Haselton and Dekay, 1998), our hypothesis declared that men would overestimate themselves when performing a patience-game, whereas women would rather underestimate themselves. This hypothesis could be confirmed; men significantly overestimated themselves when there were asked whether they thought they could master the patience-game within 2 minutes. Even if they could not solve the game within those 2 minutes, men still declared that they would be able to master the game when there was no time limit given. Women, on the other side, rather underestimated themselves when being asked whether they would be able to solve the game within 2 minutes, and did not change their self-estimation after not being able to separate the star from the ring (see Picture 3). A point of discussion could surely be the patience-game itself. We used a 3-D patience game (see Picture 3), commonly found in commercial stores, a fact that could possibly have effected women's self-estimation. It is known, that men have a better 3-D perception and better spatial abilities than women do (*hunters-gatherers hypothesis* / R. O'Gorman, 1999). Thus, it is possible that the reason women underestimated themselves could partly be associated with the fact that women tend to reject 3-D games more intensely than men do, because of those commonly known differences in spatial ability between the two genders. In order to avoid any influences from third parties, we only recruited test-persons in the study who were sitting alone, mostly on a park bench, both at the university campus old AKH and the palace-park Schönbrunn. That way we could guarantee no influences from others, and only included participants who had enough time to devote to the game and would not give up to quickly out of impatience. Another factor which could have influenced the overestimation tendency of men could also have been the two female interviewers. Hence, men could have been influenced in the direction to show off even more, than they would have if they had been interviewed by another man instead.

Hypothesis 1 (men overestimate and women underestimate themselves concerning the patience game) had several limitations. Men with no life partner at the time of the interview, overestimated themselves significantly lesser than those men who had a relationship at the time of the study, concerning the question whether they would be able to manage the game within 2

minutes or not. An explanation could be that men who had a relationship had already found someone to potentially reproduce and had, therefore, been successful in evolutionary terms (*The selfish gene* / Dawkins, 1978). Those men could have had lesser pressure to succeed in that direction, as well as more self-confidence, because they already knew that there was at least one person to prove that their estimation of women's sexual intent was correct. Men, on the other hand, who had no sexual partner when they were interviewed, might have been less self-confident, when being asked if they could manage the game, especially when those men had been out of a relationship for some time and therefore, might have recently been rejected by some women.

Having experience with patience games in general, seemed to have been a significant factor for more self-confidence, when being asked whether they thought the game could be accomplished within 2 minutes or not. Both men and women evaluated their capacities higher, when they already had some experience with similar games. Still, none of the participants had ever tried this particular patience-game before. This result is also a rational one; more practise leads to better results and more confident in ones own abilities.

The question whether the test-person had consumed alcohol in the past 5 hours or not, also led to a significant result in men, concerning the ability of mastering the game within 2 minutes. Yet, there were only 12 men out of 204 who answered this question positively, so that those results could not lead to representative conclusions.

The body height also correlated significantly with both items which described the self-estimation of men concerning the patience-game. Taller men seemed to overestimate themselves even more than shorter ones did. According to Pawlowski et al. (2000) taller men have a greater reproduction success than shorter men do. Therefore, and according to Error Management Theory, taller men tend to overestimate themselves even more often and more intensely and, hence, create more mating opportunities. As a result of that, taller men have a greater reproduction-success than shorter men do.

At women, concerning the question whether they thought they could master the game within 2 minutes, there was a significant correlation between bodyweight and self-estimation. Heavier

women seemed to underestimate themselves even more than slimmer women did. According to the present ideal-beauty-concept and the evolutionary established criteria of finding mating partners (see 1.1.), the above results could be explained. Yet, the bodyweight alone was not related to the body-height, since it is rational that higher women should weight more than shorter ones. To solve this problem, we also calculated the BMI (Body Mass Index) which allowed a statement of the relative bodyweight of each woman. Even, now the results remained significant, which indicates that “heavier” women tend to underestimate themselves even more.

$$\text{BMI} = \text{Bodyweight (kg)} / (\text{Body-height (cm)})^2$$

4.2. Individuals under the age of fifty tend to show the effects of the Error Management Theory more intensely than older individuals do

Using the Error Management Theory, as well as the Display- and the Grandmother-Hypothesis, we assumed that there would be significant differences between younger and older men, as well as younger and older women concerning their self-perception. Thus, individuals under the age of fifty, should tend to show the effects of the Error Management Theory more intensely than elder individuals, which means that elder men should overestimate and elder women should underestimate themselves lesser than younger people would. This hypothesis could not be confirmed. There were no significant results when comparing younger with older men, as well as younger with older women. Yet, there was a tendency in that direction in men concerning item 14 (*Do you think you can separate the star from the ring if there is no time limit given?*); the intensity of overestimation decreased with increasing age. This tendency can be explained with the display-hypothesis (see 1.4.): Men show an achievement-peak in their early thirties, when sexual competition is at its peak as well. Hence, there could be a correlation to the Error Management Theory; overestimating oneself could become less important with increasing age, because reproduction has already been completed. Yet, this hypothesis could not be confirmed. It is possible that the age of fifty, which was the age-limit between the groups in our study, was defined to globally. If there were more age-groups defined and compared which each other, the results might have been more explicit. Another factor we did not include in our research and, which might have also been important in this regard, is the existence of children. It might have played a role, whether the person interviewed already had children or not, regardless of the fact whether he or she was younger or older than fifty years of age. It is thinkable that people with no

offspring at all, would show the effects of the Error Management Theory more intensely, even at an older age.

There were several confounding factors which showed significant results concerning hypothesis 2. At young men body-height correlated significantly with the question whether one could manage the game with no time limit at all, at older men body-height correlated significantly with both our self-estimation questions (items 13 and 14, see Appendix 6.1. and 6.2.). This correlation was significant at hypothesis 1 as well, and can be explained on the basis of Pawlowski et al. (2000). According to Pawlowski, taller men have a greater reproduction-success than shorter men do, probably because they tend to overestimate themselves more often and more intensely (also see 4.1.). Currently having a life-partner or not, also led to a significant result in young men (also see 4.1.). Young men with a higher social- and economical status seemed to overestimate themselves even more than “poorer” men. According to Symons, 1979, Sadalla et al., 1987 and Hill, 1984, one of the most important criteria in women, when seeking for a mating partner, is a high social- and economical status. Thus, men who fulfilled this criterion, would probably have been the ones who took more chances, because they had been more successful in the past and overestimated their own abilities and women’s sexual intent more than men with a lesser social- and economical status.

It appeared that older men with a sexual partner tended to overestimate themselves more when being asked whether they thought they could master the game with no time limit given, probably because of their higher self-esteem at the time of the interview, as well as the fact that they had already been successful at reproduction from an evolutionary point of view (also see 4.1.). Alcohols also led to a significant result in elder men, concerning the mastering of the patience-game within 2 minutes, but as described in hypothesis 1 (see 3.7.), the number of the positive answers was too small (N=99, Yes=6 / No=93) in comparison to the negative ones, to be used for reliable statements.

At women, both younger and older ones, tended to underestimate themselves less concerning the “2 minutes question”, when they already had some experience with patience games. This conclusion was the same as in hypothesis 1, where both men and women with “patience-game experience” tended to estimate themselves better than the participants who had never played any

of those games before (see 4.1.). At younger women body weight seemed to be playing a significant role when being asked whether they would be able to manage the game within 2 minutes. “Heavier” women tended to underestimate themselves even more than slimmer ones. As discussed in 4.1., the reasons could be found in the present beauty-ideals and the coexistent reduced self-esteem, if those ideals can not be fulfilled. Even after examining the BMI (Body Mass Index), this results remained significant (see 4.1.).

At older women, there was a significant result concerning the consumption of pharmaceuticals; elder women who were consuming pharmaceuticals at the time of the interview, tended to overestimate themselves more than women who did not, concerning the question whether they would be able to master the game within 2 minutes. Yet, it was not possible to interpret that result properly, because, although we documented the different pharmaceuticals the participants were using at that time, we were not able to standardise the outcome, basically due to the fact that many of the participants could not name the exact medicinal product they were consuming.

4.3. ONEWAY ANOVA with confounding variables

In order to combine the above, we also used the ONEWAY ANOVA, including age, gender, our two self-estimation questions (see appendix 6.1 and 6.2. / item 13 and 14) and all the confounding variables we discovered. Although age did not correlate significantly with the self-estimation items, there was a tendency in the direction we assumed in our hypothesis 2. Increasing age led to decreasing “Error-Management-Theory” effects in both genders, which means that the overestimation tendency in men and the underestimation tendency in women declines. Gender correlated significantly with over- and underestimation, as shown in hypothesis 1, which could be verified (see 4.1.). Having a life partner, having experience with patience-games, as well as the body height and weight, seemed to be playing an important part concerning over- and underestimation in men and women (also see 3.8., 4.1. and 4.2.).

5. FUTURE DIRECTIONS

We examined Error Management Theory in another domain than the classical one, which describes the cross-sex mind-reading biases Haselton et al. described (2000). Thus, there were several limitations to this study, which could have influenced our results.

Firstly, we interviewed our test-persons in a rather standardised framework. Since the data were all collected during May and June 2008, the weather was always sunshine with a mean temperature of 24,34 degrees Celsius and 19,61 % degree of cloud occultation. Those homogeneous conditions, as well as the fact that we only recruited test-persons during sunlight, did not allow us to examine the influence of temperature and light on the self-estimation tendency of our participants. The locations we chose for our study were homogeneous as well; the younger participants were mainly recruited at the university campus of the old AKH, whereas the older ones we mostly interviewed at the palace-park Schönbrunn. Both spots have park-character; there are a lot of trees and grass for the visitors to relax or to learn. According to Oberzaucher et al., 2000, there is a significant correlation between cognitive performances and plants (*Phytophilia* / Orians, 1986). It would therefore be interesting to compare the efforts of participants under different environmental conditions as well. Being two female interviewers might have also influenced our results (see 2). In order to eliminate the effect third persons might have had on the motivation and the efforts of our participants, we only interviewed persons who were sitting alone mostly on a park-bench.

In regard to the recruiting of subjects, there is an important limitation as well. The people we recruited in the university campus basically were students, whereas the elder participants were, in the majority of cases, retirees. This fact limited the validity of our results and could be one of the reasons why the social- and economical status barely played a significant part concerning the outcomes. Future studies should focus on different social groups and try to recruit more “mixed up” data, concerning age as well as the occupation of the participants.

Although we questioned 405 people, all of them declared to be heterosexual. This fact made it impossible to compare the self-estimation tendencies of people with different sexual orientations.

It is thinkable that there could be an effect in the self-perception of homo- or bisexual people, because their goals, from an evolutionary point of view, might be different ones.

Having a sexual partner at the time of the interview played a significant role concerning our results (see 4.1.), yet it would also be interesting to examine whether having offspring or not, would also influence the results. Error Management Theory declares that the overestimation in men and the underestimation in women are psychological mechanisms designed to advance evolution in the direction of the higher fitness (see 1.2.). Thus, having children or not should, compared to having a life-partner or not, play a significant part in the self-perception in both sexes.

The present condition of the participants did not show significant results, when tested with the self-estimation items. As mentioned above, the condition of the interviewed persons could be influenced by a number of environmental parameters and a fact which should be included and diversified in future studies.

The question concerning the consumption of pharmaceuticals led to significant results in elder women. Yet, because of the incomplete documentation of the exact medicinal products (see 4.2.), we could not make any precise predictions on which product could have had which exact influence on the results. A future study should try to standardise the documentation of the exact pharmaceutical products as well.

Concerning the consumption of alcohol, there were significant results in men, especially older ones. Thus, because of the small sample of participants who had consumed alcohol within 5 hours before the interview (Yes=12 / No=192), the results could not be valued as representative. A future study should focus on the effects of alcohol to self-perception, concerning the performing of a task (Error Management Theory).

Having experience with patience games effected the results significantly. Thus, there was no participant who had experience with the patience-game we used. The game itself was a 3-D (three-dimensional) game, a fact which might have influenced the self-perception of women (*spatial abilities and gender* - see 4.1.).

The two items, which documented the self-estimation of the participants, were the questions whether the test-persons thought they would manage the patience-game within 2 minutes or with no time limit at all. We used two different questions, one with a time limit, so that we could actually have the participants try the game in an acceptable time period and the other one with no time limit given. Thus, the question with no time limit followed the performance of the game, only at those test-persons who had not been able to separate the star from the ring. This means that the participants who responded to the second question, did this under the influence of a very recent failure concerning that game and could therefore underestimate their abilities more. On the other hand, many participants commented that since the game can generally be solved and with not having a time limit at all, they would be able to solve it someday. This is a rational conclusion, which might have influenced their self-estimation as well. We had a problem with formulating the correct questions in this case; although we initially needed a time limit to allow our test-persons to perform the game, we could not eliminate the influence of the time factor in a satisfactory way.

Having managed the game or not did not correlate significantly with the two self-estimation questions; although we documented the time-period the “successful” participants needed to manage the game, we did not use that information in our further calculations.

The conception–likelihood did not associate significantly with the self-perception of the participants concerning the patience-game. It appears that there is no connection between the Error Management Theory and the hormonal status of the women in question. This statement also matches the results we had concerning the four different age-groups; there did not seem to be a significant increase of the self-under-perception in women with increasing age regarding menopause, which is a hormonally operated process (see 1.5. / Hypothesis 2).

Body height in men and body weight in women seemed to be playing a significant part in the results. As mentioned in 4.1 and 4.2., the fact that larger men overestimate themselves can be explained according to Pawlowski et al., 2000. Regarding the significant correlation between women and bodyweight, we also calculated the BMI which only confirmed our results. “Heavier” women tended to underestimate themselves even more than slimmer ones did. It would be interesting to investigate this correlation, regarding other parameters as well.

6. Appendix
6.1. Fragebogen

Nummer:
Datum:
Ort:
Zeit:
Versuchsleiter

Outdoor →
Temperatur:
% Bedeckung:

FRAGEBOGEN

1. Alter: _____

2. Geschlecht: ☐ männlich ☐ weiblich

3. Sexuelle Orientierung: ☐ heterosexuell ☐ homosexuell ☐ bisexuell

4. Haben Sie derzeit einen Lebenspartner?

- 1. Ja
- 2. Nein

5. Höchste abgeschlossene Schulbildung:

- 1. Hochschule
- 2. Matura
- 3. Berufsschule
- 4. Pflichtschule
- 5. Volksschule

6. Beruf/Studienrichtung: _____

7. Einkommensklasse (Nettoeinkommen in €):

- 1. < 1000.-
- 2. 1000 – 1500.-
- 3. 1500 – 2000.-
- 4. 2000 – 2500.-
- 5. > 2500.-

8. Wie ist ihr derzeitiges Befinden?

sehr gut 😊 ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☹️ sehr schlecht

9. Stehen Sie unter dem Einfluss von Medikamenten?

- 1. Wenn Ja, welche? _____
- 2. Nein

10. Haben Sie in den letzten 5 Stunden Alkohol konsumiert?

- 1. Wenn Ja, wie viel? _____
- 2. Nein

11. Haben Sie Erfahrung mit Geduldsspielen?

viel ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ keine

12. Haben Sie dieses Geduldsspiel schon einmal gespielt?

1. Ja
2. Nein

13. Schätzen Sie, dass Sie es in den nächsten 2 Minuten schaffen werden?

sicher ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ sicher nicht

SPIEL

14. Glauben Sie, Sie hätten es mit mehr Zeit schaffen können?

sicher ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ sicher nicht

Wenn weiblich:

• ***Hatten Sie bereits Ihre Menopause?***

1. Ja
2. Nein

Wenn Ja:

Nehmen Sie Hormonersatzprodukte ein?

Welche? _____

Wenn Nein:

- Wie lange dauert Ihr durchschnittlicher Menstruationszyklus?

25 26 27 28 29 30 31 32 33 34 35 Tage

- Wann hat Ihre letzte Menstruation begonnen (Datum)? _____

- Nehmen Sie hormonelle Verhütungsmittel?

1. Ja, welche? _____
2. Nein

☐ **Geschafft:** Zeit _____

☐ **Nicht geschafft**

MESSUNG:

Körpergröße: _____

Körpergewicht: _____

2D/4D:

LINKS: **2D** _____ **4D** _____

2D _____ **4D** _____

RECHTS: **2D** _____ **4D** _____

2D _____ **4D** _____

6.2. Questionnaire

Number:
Datum:
Location:
Time:
Interviewer:

Outdoor →
Temperature:
% CC:

QUESTIONNAIRE

1. Age: _____

2. Gender: ☐ male ☐ female

3. Sexual Orientation: ☐ heterosexual ☐ homosexual ☐ bisexual

4. Do you have a life-partner at present time?

1. Yes
2. No

5. Education:

1. University
2. Secondary School
3. Professional School
4. Compulsory School
5. Elementary School

6. Occupation/Major: _____

7. Income (Clear Monthly Income in €):

1. < 1000.-
2. 1000 – 1500.-
3. 1500 – 2000.-
4. 2000 – 2500.-
5. > 2500.-

8. How is your present condition?

very well 😊 ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☹️ very bad

9. Do you consume any pharmaceuticals?

1. If yes, which ones? _____
2. No

10. Have you consumed alcohol in the past 5 hours?

1. If yes, how much? _____
2. No

11. Do you have any experience with patience-games?

much ☐ ☐ ☐ ☐ ☐ ☐ ☐ none

12. Have you ever tried this particular patience-game?

1. Yes
2. No

13. Do you think you can separate the star from the ring within 2 minutes?

surely ☐ ☐ ☐ ☐ ☐ ☐ ☐ surely not

GAME

14. Do you think you can separate the star from the ring if there is no time limit given?

surely ☐ ☐ ☐ ☐ ☐ ☐ ☐ surely not

If female:

- ***Did you already have your menopause?***

1. Yes
2. No

If yes:

Do you consume hormonal surrogates?

Which ones? _____

If no:

How long is your mean menstruation-cycles?

25 26 27 28 29 30 31 32 33 34 35 Days

- When did your last menses begin (calendar date)? _____
- Do you consume contraceptives?
 1. Yes, which ones? _____
 2. No

☐ **Game accomplished:** Time _____

☐ **Game not accomplished**

MESSUREMENT:

Body-height: _____

Bodyweight: _____

2D/4D:

LEFT: **2D**_____ **4D**_____

2D_____ **4D**_____

RIGHT: **2D**_____ **4D**_____

2D_____ **4D**_____

6.3. Berufstabelle

Alter:		
Geschlecht: o männlich o weiblich		
Bitte bewerten Sie die im folgenden angeführten Berufe mit Hilfe der rechts stehenden Skalen (durch Ankreuzen): 1...entspricht geringer gesellschaftlicher Reputation 7...entspricht sehr hoher gesellschaftlicher Reputation		Aus den Reputationswerten nach 40 unabhängigen Bewertern errechnete mittlere Reputation.
Angestellter		
- im Bankwesen	1 2 3 4 5 6 7	3,13
- im Büro	1 2 3 4 5 6 7	2,84
- im medizinischen Bereich	1 2 3 4 5 6 7	3,61
- im kaufmännischen Bereich	1 2 3 4 5 6 7	2,89
- in leitender Funktion	1 2 3 4 5 6 7	3,70
- im technischen Bereich	1 2 3 4 5 6 7	3,55
Anwalt	1 2 3 4 5 6 7	4,13
Apotheker/Pharmazeut	1 2 3 4 5 6 7	3,98
Arbeitssuchend	1 2 3 4 5 6 7	1,29
Architekt	1 2 3 4 5 6 7	3,84
Arzt	1 2 3 4 5 6 7	4,43
Bäcker/Konditor	1 2 3 4 5 6 7	2,84
Beamter	1 2 3 4 5 6 7	2,59
Chemiker	1 2 3 4 5 6 7	3,46
Dachdecker	1 2 3 4 5 6 7	2,52
Dreher	1 2 3 4 5 6 7	2,39
Elektriker	1 2 3 4 5 6 7	2,71
Elektroniker	1 2 3 4 5 6 7	3,25
Elektrotechniker/Installationstechniker	1 2 3 4 5 6 7	2,96
Florist/Gärtner	1 2 3 4 5 6 7	2,38
Flugbegleiter	1 2 3 4 5 6 7	2,96
Friseur	1 2 3 4 5 6 7	2,45
Graphiker	1 2 3 4 5 6 7	3,21
Hausfrau/-mann	1 2 3 4 5 6 7	1,95
Immobilienmakler	1 2 3 4 5 6 7	2,73
Informationstechniker	1 2 3 4 5 6 7	3,25
Ingenieur	1 2 3 4 5 6 7	3,55
Installateur	1 2 3 4 5 6 7	2,57
Journalist	1 2 3 4 5 6 7	3,21
Kellner	1 2 3 4 5 6 7	2,23
KFZ - Mechaniker	1 2 3 4 5 6 7	2,57

Kindergärtner	1 2 3 4 5 6 7	2,86
Koch	1 2 3 4 5 6 7	2,68
Kraftfahrer	1 2 3 4 5 6 7	2,27
Krankenpfleger	1 2 3 4 5 6 7	2,75
Landwirt	1 2 3 4 5 6 7	2,52
Lehrer	1 2 3 4 5 6 7	2,98
Maler	1 2 3 4 5 6 7	2,48
Maurer	1 2 3 4 5 6 7	2,29
Mechaniker	1 2 3 4 5 6 7	2,57
Musiker	1 2 3 4 5 6 7	3,02
Öffentlich Bediensteter	1 2 3 4 5 6 7	2,70
Optiker	1 2 3 4 5 6 7	3,20
Pensionist	1 2 3 4 5 6 7	2,18
Physiotherapeut	1 2 3 4 5 6 7	3,04
Projektleiter	1 2 3 4 5 6 7	3,48
Psychologe	1 2 3 4 5 6 7	3,61
Physiologe	1 2 3 4 5 6 7	3,41
Rezeptionist	1 2 3 4 5 6 7	2,20
Schneider	1 2 3 4 5 6 7	2,34
Schreiner	1 2 3 4 5 6 7	2,39
Schüler	1 2 3 4 5 6 7	2,11
Selbstständig	1 2 3 4 5 6 7	3,34
Sozialarbeiter	1 2 3 4 5 6 7	2,59
Straßenkehrer	1 2 3 4 5 6 7	1,61
Student	1 2 3 4 5 6 7	2,55
Tanzlehrer	1 2 3 4 5 6 7	2,54
Taxilenker	1 2 3 4 5 6 7	2,13
Tierarzt	1 2 3 4 5 6 7	3,98
Tourismus/Fremdenverkehr	1 2 3 4 5 6 7	2,96
Unternehmer	1 2 3 4 5 6 7	3,71
Veranstaltungstechniker	1 2 3 4 5 6 7	3,02
Verkäufer	1 2 3 4 5 6 7	2,21
Zahntechniker	1 2 3 4 5 6 7	3,39
Zivildienr	1 2 3 4 5 6 7	1,91

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8. Abstract

The aim of our study was to examine the Error Management Theory (Haselton, Buss and DeKay, 1998) which proposes that certain cognitive biases, such as men overperception of women's sexual interest (*Type I – Error*), as well as women's underestimation of men's commitment (*Type II – Error*) are designed in the direction of the lesser evolutionary cost for each sex. The Error Management Theory is based on the parental investment theory of Trivers (1972). According to Trivers, the sex with the greater obligatory biological investment concerning reproduction (women), should be choosier when it comes to selecting a mating partner (*female-choice*), than the sex with the lower obligatory investment (men), who should be highly competitive when it comes to gaining access to mating partners (*male-male competition*). That cognitive bias of men to rather err on the side of Type I – Errors and the tendency of women to underlie Type II – Errors, was investigated here in another context besides reproductive strategies (*patience – game / interview*).

In order to accomplish not only a comparison between the two sexes but also between differently-aged people of the same sex, we split our sample of 405 participants into persons younger and older than 50 years of age. Our prediction was that the elder participants would show a decrease of the Error-Management-Theory effect, meaning that men would overestimate and women would underestimate themselves less. We based this hypothesis on the grandmother-hypothesis at women and the display-hypothesis at men. The Grandmother-Hypothesis (Hawkes et al., 1997, 2004; Willians, 2000) proposes that menopause in women has an evolutionary background; women stop being able to reproduce after a certain age, in order to assist their sons or daughters with their own offspring. The Display-Hypothesis in men indicates that most of the scientific and artistic achievements have been performed by younger men with a peak at their early thirties (Miller, 1999). The reason for this fact is reproduction success; being successful in one domain, rises the market-value of men and, hence, his mating opportunities. The age of 50 was chosen, because it is the mean menopausal-age of middle European women nowadays.

We chose following study design: Using a specially for this study created questionnaire (see 6.1. and 6.2.) and a common patience-game (see Picture 3), we interviewed 405 heterosexual test-persons (204 men / 105 <50 years and 99 >50 years and 201 women / 101 <50 years and 100 >50

years) and had them estimate their efficiency in mastering a patience-game before and after being able to try it. Several other demographically data were documented as well. The interviews took place at two different parks in Vienna, Austria (see chapter 2) under standardised conditions.

Hypothesis 1, that men would over- and women would underestimate themselves while performing a patience-game, could be confirmed. Men tended to overestimate their abilities regarding our game, whereas women underestimated themselves, independently of a time limit given to the game or not. The second hypothesis – younger individuals would show the Error Management-Theory effects more intensely than older ones – could not be confirmed. There was a tendency observable toward this direction in men, probably based on the Display-Hypothesis logic. A future study with more age-groups to be compared with each other should be performed.

9. Zusammenfassung

Ziel dieser Studie war es, die Error Management Theorie (Haselton, Buss and DeKay, 1998) in einem anderen Kontext als den klassischen partnerwahlbezogenen zu untersuchen. Die Error Management Theorie (EMT) besagt dass bestimmte kognitive biases (Neigungen), wie etwa die Tendenz der Männer die sexuellen Intentionen der Frauen zu überschätzen (*Fehler Typ-I*), wie auch die der Frauen die Investitionsbereitschaft der Männer zu unterschätzen (*Fehler Typ-II*), evolutionärpsychologisch verankert sind, um im Rahmen der Partnerwahl und Reproduktion, beide Geschlechter in die Richtung der geringeren Fitnesskosten zu manövrieren. Die EMT basiert auf dem elterlichen Investment, beschrieben von Trivers (1972). Laut Trivers konkurriert jenes Geschlecht welches weniger in die Nachkommenschaft investiert (Männer / *male-male competition*) stärker um die Gunst des anderen höher investierenden Geschlechts (Frauen / *female-choice*). Die Tendenz der Männer Fehlern Typ-I zu unterliegen, wie auch die der Frauen sich eher in Richtung Fehler Typ-II zu irren, wurde in dieser Studie anhand eines Geduldspiels und eines Fragebogens untersucht.

Um neben der Geschlechts- auch Altersvergleiche anstellen zu können, wurde das erhobene Kollektiv von 405 Studienteilnehmern in 2 Altersgruppen aufgeteilt. Grenzalter war das fünfzigste Lebensjahr der beteiligten Testpersonen. Wir nahmen an dass ältere Studienteilnehmer die Effekte der Error Management Theorie in abgeschwächter Form vorweisen würden, aufgrund der unterschiedlichen biologischen und sozialen Umstände im Alter. Bekanntlich liegt das Menopause-Alter bei Mitteleuropäischen Frauen um das fünfzigste Lebensjahr. Die Menopause kann aus evolutionärbiologischer Sicht anhand der Großmutter-Hypothese (Hawkes et al., 1997, 2004; Willians, 2000) erklärt werden. Diese Hypothese besagt dass die Reproduktionsfähigkeit der Frauen ab einem gewissen Alter vollständig sistiert, damit die betroffenen Frauen sich der Aufzucht der Enkelkinder widmen können. Diese Taktik ist evolutionär gesehen die günstigere Variante; während ältere Frauen während einer Geburt stärker mit Komplikationen konfrontiert werden können, erhöht sich die eigene Fitness auf ungefährlichere Art und Weise, wenn die Großmütter bei der Aufzucht der Enkel assistieren, die genauso Träger der selben Gene sind. Um ein Äquivalent in der Männerwelt zu schaffen, welches die Überschätzungstendenzen der Männer mit höherem Alter schrumpfen lassen könnte, wurde die Display-Hypothese herangezogen. Diese Hypothese besagt dass die Mehrzahl der wissenschaftlichen und kulturellen Errungenschaften

von jungen (Peak: Anfang 30) Männern stammen. Als Grund dafür dient wiederum der Reproduktionserfolg der Männer; erfolgreich sein und sich in einem bestimmte Bereich hervorzutun, steigert den Marktwert der betroffenen Männer und, demnach, auch die Paarungsgelegenheiten.

Um die oben gestellten Hypothesen zu verifizieren, wurde folgendes Studiendesign auserwählt: Ein speziell für diese Studie angefertigter Fragebogen (siehe 6.1. und 6.2.), sowie ein handelsübliches Geduldspiel wurden verwendet (siehe Bild 3), um damit 405 heterosexuelle Testpersonen für die Studie zu rekrutieren. Die 204 männlichen Teilnehmer (105 <50 Jahre und 99 >50 Jahre alt) sowie die 201 für die Studie gewonnenen Frauen (101<50 Jahre und 100>50 Jahre alt) wurden dazu angehalten sich selbst, in Bezug auf das dargebotene Geduldspiel einzuschätzen. Anhand des Fragebogens wurden noch andere demographische Daten erfasst. Die Interviews wurden an zwei verschiedenen Orten (Campus altes AKH und Schlosspark Schönbrunn) in Wien, Österreich und unter standardisierten Bedingungen durchgeführt.

Hypothese 1 – Männer überschätzen sich und Frauen unterschätzen sich in Bezug auf das Geduldspiel- konnte, unabhängig von der Zeit, bestätigt werden. Hypothese 2 –mit zunehmenden Alter nimmt der EMT-Effekt ab- führte zu keinem signifikanten Ergebnis. Dennoch war eine Tendenz in diese Richtung bei Männern zu beobachten. Es wäre denkbar, dass sich durch die Unterteilung des Samples in mehrere Altersgruppen, die Ergebnisse mehr präzisieren lassen würden. Dieses Unternehmen muss aber zukünftigen Studien überlassen werden.

Curriculum vitae

EDUCATION

Since 2008 Master thesis (Error Management Theory, Age and Gender) at the Department of Anthropology; University of Vienna, Austria

2006 Degree in nursing; Nursing School Lainz, Vienna, Austria

Since 2005 Studies in anthropology (focusing on human ethology) and additional courses in psychology, philosophy and nutritional sciences; University of Vienna, Austria / additional courses in psychiatry; Medical University of Vienna, Austria

2005 Doctor of Medicine (Dr. med. univ.); Medical University of Vienna, Austria

1998-2005 Clinical courses in medicine; Medical University of Vienna, Austria

1994-1998 Basic courses in general medicine; University of Vienna, Austria

1989 First Certificate of Cambridge University in Thessaloniki, Greece

Languages: German, Greek, English

TEACHING

at the Medical University of Vienna

2003-2008 Tutorial at the Institute of Clinical Pathology (general hospital of Vienna, Austria / AKH-Wien): Histological-pathological exercise course I, II and for postgraduates