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Promiscuity, attractiveness, fondness for children, and the postponement of parenthood: An evolutionary (mal)functional analysis

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To my dear parents
Christa and Johann-Jürgen

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Foreword

The current study is an attempt to extend the role of evolutionary theory for studying human fertility behavior. Virtually all evolutionary studies on this subject have used rational choice models that optimize individual fitness returns. Although this approach has been widely criticized on theoretical grounds (see General Introduction), alternative evolutionary approaches with an organismic perspective so far have not been applied to studying human fertility behavior. Here I used the heuristic framework provided by John Tooby and Leda Cosmides (1992) together with the theory of cultural inheritance by Robert Boyd and Peter Richerson (1985, 2004) to investigate one particular component of fertility behavior, namely, the decision of yet childless women and men to (not yet) become a parent. In particular, I asked how this decision relates to reproductively relevant factors like attractiveness and promiscuity, but also to fondness for children, given that we live in an era of effective contraception. My conclusion is that current human fertility behavior is maladaptive (in the evolutionary sense of the meaning) and that future evolutionary research should approach the topic accordingly.

The primary goal of this study was to establish compatibility between evolutionary theory on the one hand and modern human fertility behavior on the other. Thus, the study will primarily be of interest to readers interested in evolutionary research on human behavior in general and on mating and fertility behavior in particular. However, I hope it will also catch the attention of those readers seeking to understand the recent negative demographic trends in Germany and many other countries. Germany's population is on the decline (Statistisches Bundesamt Deutschland, 2003). In recent decades, women's average age at first child in Germany has increased to 29 years in 2001, and of the 1965 cohort, about 30% of the women will remain childless (Bundesministerium für Familie, Senioren, Frauen und Jugend, 2003)[1]. There is no doubt that this trend was made possible only with the development of and supply with modern contraceptives such as “the pill”. However, our understanding of how contraceptive choices are made is still incomplete. With this study I hope to point out some pathways for finding answers to this question.

Readers may note that in the main text, I avoided the use of words that refer to scientific disciplines, that is, words that end on –ology, –nomy, –ological, –nomic, etc. In my view, the use of disciplinary labels hampers scientific progress by reinforcing an “ethnic divide” among researchers and by blurring scientists view on reality. Therefore, I agree with Harmon Holcomb III, who wrote:

> “It is a category mistake to treat disciplinary distinctions as having ontological significance. … Relations among fields are artificial and conventional, not natural kinds. Expectation of deeply revealing answers to questions about disciplinary relations is rooted in the naïve realism that what exists is divided up in the same way in which we organize our thought.” (Holcomb, 1995, p. 307)

Finally, a disclaimer: This study is intended solely as a contribution to scientific descriptions of parts of reality, but not as a guideline to the ethics or morals of reproduction. Even though I sometimes refer to the relationships between social norms and reproduction, these do not reflect my ethical understanding of responsible sexual and childbearing behavior.

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General introduction

The recent years have witnessed a marked rise in the number of studies taking an evolutionary perspective on human behavior (Buss, 1999; Cartwright, 2000; Gaulin & McBurney, 2001; Barret et al., 2002; Palmer & Palmer, 2002). What unites researchers engaging in this new branch of science is the view that the study of human behavior cannot be reasonably excepted from the application of evolutionary theory, which has proved to be so fruitful in the study of other species. This surge of new research was largely a result of new theoretical propositions made in the sixties and seventies that, together with older concepts, were recast into a single overarching framework for studying animal behavior by Edward O. Wilson (1975). Among the theoretical innovations, all of which are extensions of Darwin's (*1859*, 1871) and Wallace´s (Darwin & Wallace, 1858) original theory of evolution by natural selection, the most influential were Hamilton's (1963) theory of kin selection and Trivers´ (1972) theory of parental investment and sexual selection. Hypotheses derived from these theories have been tested and were generally confirmed in studies on both nonhumans and humans (see Segerstråle, 2000 for a historical account; Holcomb III, 1995; 1996; 2001 for a theory of science evaluation of evolutionary research on human behavior).

However, although evolutionary researchers generally share the above mentioned theoretical framework, there is a longstanding controversy between two groups of researchers of human behavior over what constitutes an appropriate evolutionary analysis of behavior. In particular, the controversy centers on what should be the relevant outcome measures when testing evolutionary hypotheses. One party emphasizes the determinants of reproductive success, usually the number of (surviving) children, as an outcome measure and considers mainly environmental factors as determinants. The organism's evolved cognitive and emotional adaptations are largely neglected, but it is assumed that the organism acts in any environment so as to maximize its reproductive success by trading the quantity of offspring for their quality. For this reason, this approach is sometimes referred to as the “Fitness Maximization Approach” (FMA; Tooby & Cosmides, 1992). When reproductive success could not be successfully predicted from the environmental inputs, FMA researchers usually revise their assumptions about the cost/benefit functions or considered variables and then put these revised models to test again. An important drawback of the FMA is that it is unable to recognize maladaptive behavior as such, because such behavior is not assumed to occur.

The other party involved in the controversy prefers the “adaptation execution approach” (AEA; Tooby & Cosmides, 1992) to the FMA. These researchers argue that for explaining current behavior differential reproductive success is relevant only as *past* selective force that shaped the adaptations whose action we observe in organisms today. To advocates of the AEA, successful reproduction is the likely outcome of a long behavioral sequence, during the course of which various specific adaptations guide the organism toward reaching specific proximate goals. Current reproductive outcomes are considered informative only as they throw light on the functional design of particular adaptations. In themselves, however, reproductive outcomes are, as behavioral outcomes, too highly aggregated to be informative within an evolutionary functional analysis of adaptations (Tooby & Cosmides, 1990, 1992, see glossary)[2]. Instead, AEA researchers use evolutionary theory to obtain a better understanding of the natural history and design of these adaptations and to predict behavioral outcomes based on this knowledge. Research progress within the AEA is thus largely independent of the observation of maximized reproductive outcomes and current selection, because any behavioral outcome, adaptive or maladaptive, is regarded as informative as to the interaction between evolved design and current environmental inputs (see Daly & Wilson, 1999; 2000; Smith et al., 2000; 2001 for a recent exchange among advocates of the two approaches). Although the debate seems to be in the process of settling, the demarcations of the two subcultures of evolutionary science are still prominent and, as I shall argue below, have implications for the study of maladaptive behavior in modern humans.

The different views of the two parties are reflected in further details of their research practice. AEA researchers usually study humans (overwhelmingly university students) from modern Western cultures whereas FMA researchers usually prefer to study traditional cultures from nonindustrialized countries. When testing hypotheses derived from sexual selection theory, AEA researchers prefer diverse outcome measures pertaining to the earlier stages of the behavioral sequence that leads to successful reproduction, such as preferences for diverse mate choice criteria, the desire for multiple partners, status striving or past sexual behavior as a measure of differential mating success. In contrast, FMA researchers prefer directly observable outcome measures at the later stages of reproduction, such as the number of wives or, preferably, the number of (surviving) children. There is an overlap at the level of mating success, but FMA researchers tend to view mating success as a proxy to the expected number of offspring, whereas AEA researchers tend to view it as proof for the effectiveness of functionally antecedent adaptations.

The hidden borderline that keeps these two cultures of research practice apart is, I propose, contraception. AEA researchers study the process of mating up to sexual intercourse in cultures with access to effective and easy to use contraceptives, whereas FMA researchers study the observable outcome of unobserved sexual behavior – the number of children – in cultures with little or no contraception practiced. The consequence of this schism is that the closely related topics of contraception, fertility decisions, and fertility behavior of humans in industrialized countries are virtually excluded from evolutionary analysis[3].

Apparently Pérusse (1993) carried out the – to my knowledge – only study that crossed the gulf between the two cultures of research practice. He showed for a sample of Canadian men that – in agreement with sexual selection theory (Trivers, 1972) – male social status was positively correlated with mating success, but that there was no correlation between men's social status and the number of children they had. By recording two different proxies of genic fitness (mating success and number of offspring), Pérusse was able to show that in his sample the mechanisms involved in mating were still functionally coordinated with the environment, but that this coordination broke down between mating and fertilization. As "novel environment explanations" for this finding, Pérusse proposed "modern contraception" and the "social imposition and legal enforcement of monogamy". His study is still frequently cited as the only one to demonstrate the breakdown of the reproductive sequence in a modern environment and to consider this breakdown a phenomenon in need of explanation. What makes his study so convincing is that, unlike most other evolutionary studies, Pérusse assessed not only one, but two consecutive steps in the behavioral sequence of reproduction, namely mating behavior and completed fertility, *in the same sample*.[4] This enabled him to detect and forced him to interpret these apparently contradictory results[5].

To this date, no followup studies have been published in response to Pérusse's study that investigated the processes leading to the disconnection between male social status, or any other fitness trait, and reproductive success[6]. One reason for this may be that, because Pérusse found no correlation between male social status and the number of children, there appears to be no functional pattern worth scrutinizing. Contraception just seems to destroy any systematic link between mating and reproduction. However, this conclusion is premature for the following reason: When basic predictions derived from an otherwise well-supported evolutionary theory fail to be confirmed by the evidence, an evolutionary functional analysis is not completed with the mere identification of the environmental factors involved in causing the predictive failure. Instead, the analysis must include these factors and derive a new prediction based on the knowledge of the functional design of the involved adaptations (Tooby & Cosmides, 1992). In Pérusses study, one environmental factor that was proposed to disrupt the link between male social status and reproductive success is contraception. To be sure, the widespread use of contraception is a central part of, but cannot suffice as an explanation, because the underlying decision rules of contraceptive behavior remain unknown. The conscious control of reproduction is made possible only by means of contraception. Their use shifts the relative significance for causing fertilization from the lustful act of sexual intercourse to the deliberate act of "reproductive intentionality", which is tantamount to the decision to (dis)continue contraception. But what determines the deliberate decision to quit contraception? It is these decision rules that need to be investigated to fully explain the observed maladaptive behavior and to reconcile it with the assumptions of evolutionary theory. In other words, the link between evolutionary theory and behavioral outcomes is adaptive design (Tooby & Cosmides, 1992).

The current study contributes to an evolutionary analysis of modern humans´ reproductive fertility behavior by investigating the roles of promiscuity, attractiveness, and fondness for children. Based on the assumption that the current fertility behavior in Germany is maladaptive (see below), the study is framed within the AEA. The current study is divided into two steps. In Part I, I will investigate the relation between physical attractiveness as a compontent of mate value on the one hand and various measures of sexual behavior and attitudes on the other. I will begin with a short review of the evidence for the perception of facial attractiveness as an adaptation. In the empirical part, the first general prediction is that attractiveness enhances both mating success and promiscuous attitudes, as has been documented before in several other studies. The second general prediction is that within romantic relationships, attractiveness will have a disruptive effect, because of the increased mating opportunities of highly attractive individuals. Part I can be viewed as a study that stands for itself. However, at the same time its results will serve to strengthen the conclusions about the maladaptiveness of postponed parenthood in Part II.

In Part II, I will investigate the effects of promiscuity, attractiveness, and attitudes towards children on the subjects´ willingness to become a parent. I will argue that in our modern society, motivational systems that are relevant during the mating phase still affect – at least potentially – reproductive outcomes, but in opposite direction of what general sexual selection theory predicts, that is, maladaptively. After a general introduction to the study of maladaptive behavior in humans, I will derive criteria for an evolutionary analysis of human maladaptive behavior and apply them to modern contraception as a culturally transmitted behavioral phenomenon. Two features make contraception a candidate for a maladaptive cultural trait. First, at the level of its consequences, contraception is obviously maladaptive because of its extremely negative effects on human reproductive outcomes in the study population. Second, at the level of the underlying mechanisms, contraception is considered maladaptive, because unlike in the evolutionary past, mating decisions are no longer tantamount to childbearing decisions. Instead, for reproduction to ensue, the contraception routine must be ended by conscious deliberation, the outcome of which may be influenced by potentially many motivational factors – including adaptations – the subject may or may not be consciously aware of. For a complete evolutionary analysis of maladaptive behavior these factors need to be identified.

Decisions are based on preferences, and decisions based on conflicting preferences are generally associated with opportunity costs. When preferences differ between individuals, the perceived opportunity costs associated with a particular decision will also differ between individuals. If these general considerations are true, they should apply to fertility decisions, too, including the decision to become a first-time parent. Hence I predicted that both promiscuity and attractiveness should have a negative impact on the willingness to become a parent, because the perceived opportunity costs of parenthood are assumed to be higher for highly promiscuous people compared to less promiscuous people, and are assumed to be higher for highly attractive compared to less attractive people.

As a third predictor of the willingness to become a parent I then introduce fondness for children, which in the evolutionary past probably acted as an adaptation to prepare people (at least women) for their future parental tasks, but which probably did not affect fertility outcomes by motivating people (women in particular) to sire children. Based on these assumptions, I will argue that it is only in the age of effective contraception that interest in children may have become a major motivation for becoming a parent. Again, this effect can be described as maladaptive, even though it has a net positive effect on fertility.

For testing these hypotheses, I introduce a measure of the current individual willingness to become a parent, the so-called "individual tendency to abort an unintended pregnancy". This measure is the rating on a 5-point scale in response to the question what the participant would prefer to do, if they (or their partner) became pregnant today. Figure 1 provides an overview over the research questions and hypothesis addressed in the empirical parts of Part I and Part II.

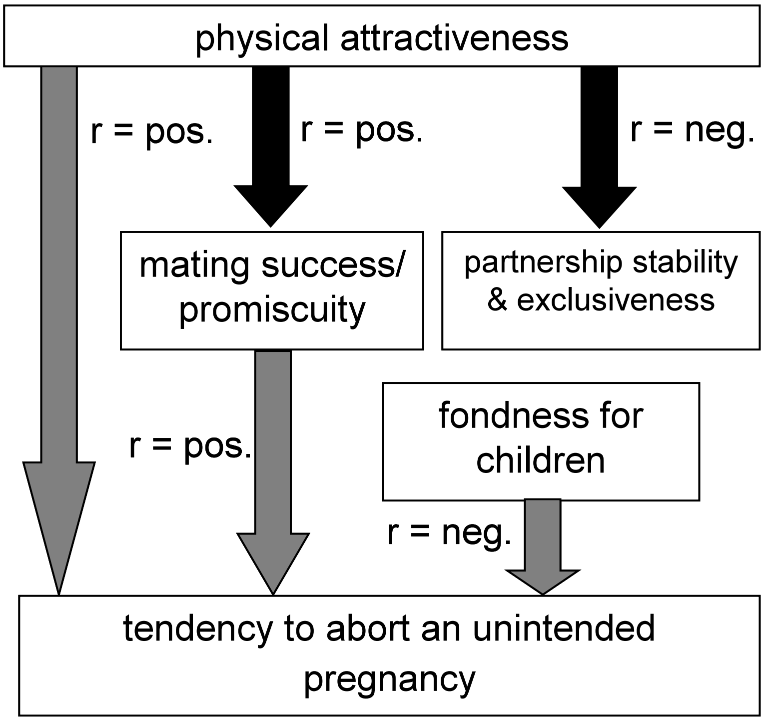

Figure 1. General study design and main hypotheses. – Shown are the predicted relationships (signs of correlation coefficients) between the variables. The black arrows indicate the relationships investigated in Part I, the grey arrows indicate relationships investigated in Part II of the study.

Introduction Part I: Physical attractiveness in the mating context

The aim of this part of the study is to investigate the relationship between three measures of attractiveness (facial attractiveness, self-rated attractiveness, and the bodymass index) and various measures of sexual behavior and attitudes. The assumption is that the mechanisms involved in perceiving and evaluating attractiveness are still functionally linked to the social environment as they were in the evolutionary past. Hence, it is predicted that physical attractiveness should have a positive effect on mating success and promiscuous attitudes and a negative effect on the exclusiveness and stability of romantic relationships. In this introduction I will first provide a brief overview of the evidence that the perception of attractiveness is an evolved adaptation before I turn to the hypothesized effects in the mating context.

Part I can be read as a study in itself by those readers whose interest focuses on attractiveness and mating behavior. At the same time, this part of the study provides the empirical and some of the theoretical precondition for Part II, where I will investigate the effects of attractiveness and promiscuity on the willingness to become a parent.

Components of physical attractiveness as evolved indicators

To humans all over the world attractiveness is an important mate choice criterion (Buss, 1989), and there seems to be a universally shared intuitive concept of at least facial attractiveness (Cunningham et al., 1995; Grammer et al., 2003). In recent years, researchers have addressed the question of which physical traits contribute to physical attractiveness, whether they can count as sexually selected traits (Darwin, 1871; Andersson, 1994) and what the variability in their expression may reveal about their bearers (Fink & Penton-Voak, 2002). As a mate choice criterion, physical attractiveness has been studied intensively in two ways. First, by investigating preferences for variable visual stimuli (e.g., Lavrakas, 1975; Cunningham et al., 1990;

Grammer & Thornhill, 1994; Maisey et al., 1999, Tovée et al., 1999; Streeter & McBurney, 2003; Grammer et al., 2003; Rhodes, & Zebrovitz, 2003) and second by investigating self-reports of desired mate characteristics (e.g., Buss, 1989; Oda, 2002). What evidence is there that not only the perception of attractiveness, but also the processes creating variability in attractiveness are evolved adaptations? In this study, I will use three measures of physical attractiveness, namely expert-rated facial attractiveness, self-rated attractiveness, and the bodymass index (BMI). Of these measures, facial attractiveness as a component of overall physical attractiveness is the most objective and intensively studied one, followed by the BMI. Here I will briefly review the current state of the evidence for facial attractiveness and the BMI as mate choice criteria and for their likely signaling value.

1. Facial attractiveness: An indicator of MHC-heterozygosity?

What makes a face attractive? One well-established feature is averageness (Langlois & Roggman, 1990; Rubenstein et al., 2003). When photographs of faces of variable attractiveness are superimposed, the resulting face is more attractive than most of the original faces. To explain why averageness should be a preferred feature, two potentially compatible explanations have been proposed (Rubenstein et al., 2003). The first is that humans have a general attraction to prototypical exemplars of any category, and that their attraction to average faces is a reflection of this more general preference. The prototype as a cognitive representation is assumed to develop by observation and intuitive “averaging” of encountered exemplars of a category. Rubenstein et al. (1999) found evidence for this learning process in a study on six-months old infants. According to the prototype explanation then, the perception and evaluation of attractiveness is not a specialized mechanism for mate choice, but a general cognitive mechanism that is independent of the context. However, the prototype explanation is also compatible with a second explanation for the fact why average faces are attractive. This explanation is based on sexual selection theory and the assumption of a special significance of attractiveness for adaptive mate choice. Current theory assumes that the adaptive value of sexual recombination lies in decreasing the evolutionary tractability of the organism by parasites (Maynard Smith, 1978; Trivers, 1983). The life cycle of parasites such as viruses or certain protozoans are considerably shorter than the life cycles of their hosts, so that parasites have an evolutionary advantage with respect to potential adaptability to the host's defenses. In this situation, the hosts may be selected to enhance their genic diversity by preferring mates bearing signs of particularly high degrees of heterozygosity (Gangestad & Buss, 1993; Brown, 1997; Foerster et al., 2003; Seddon et al., 2004). Such heterozygous individuals are expected to develop features that are close to the population average because they are best able to cope with developmental perturbations induced by pathogens. In other words, the preference for prototypes may be a reliable guide to finding genically superior partners. The selection pressure for choosing heterozygous partners should be particularly high with respect to those genes that are most directly involved in the immune system. Indeed, there is evidence for several mammalian species that genes belonging to the major histocompatibility complex (MHC, a complex of spatially clumped immunogenic genes) play a role in mate choice, usually mediated by olfactory cues (Penn & Potts, 1999; Penn et al., 2002). And there is also evidence for MHC-dependent olfactory partner preferences in humans where individuals with dissimilar MHC-genes were preferred over more MHC-similar individuals (Wedekind et al., 1995; Wedekind & Füri, 1997; Eggert et al., 1998; Thornhill et al., 2003). Recently, Roberts et al. (2005) for the first time established a link between facial attractiveness and a measure of genic quality, heterozygosity. They found that individual MHC-heterozygosity was associated with both facial attractiveness and skin texture and that this preference was independent of the degree of MHC-similarity between subject and target. Furthermore, if the heterozygosity model of facial attractiveness is correct, we would expect 1. perceived facial attractiveness to be positively correlated with perceived health and 2. facial attractiveness to be positively correlated with variables that are indicative of general health and viability. Indeed, several studies have shown that perceived attractiveness and health are positively correlated (Kalick et al., 1998; Jones et al., 2001; Rhodes et al., 2003), and a recent study found that facial attractiveness was positively correlated with longevity (Henderson & Anglin, 2003). However, taken together the evidence for an association between attractiveness and objective measures of health is mixed (reviewed in Rubenstein et al., 2003).

It seems certain that averageness is an important, maybe the most important, determinant of facial attractiveness. The degree to which deviations from perfect averageness (Rubenstein et al., 2003) and facial symmetry (Perrett et al., 1999) contribute to attractiveness is currently being studied (reviewed in Grammer et al., 2003; Rhodes & Zebrovitz, 2003). For the current discussion it suffices to note that, based on the current state of the evidence, facial attractiveness conveys information about the sender’s health, possibly due to heterozygosity within the MHC or other regions of the genome (Fink & Penton-Voak, 2002). Based on this evidence and the finding that there is a universally shared standard of facial attractiveness (see above), both the mechanisms creating the variability in facial attractiveness and the mechanisms involved in the perception of facial attractiveness can be formulated as an adaptive signaling system (Weaver & Shannon, 1949). From the sender’s perspective, facial attractiveness is the outcome of a reliably developing encoding system that translates the information contained in individually variable degrees of MHC-heterozygosis into an individually variable expression of visible higher-level traits such as skin texture or facial shape. From the receiver’s perspective, perceived facial attractiveness is the outcome of a reliably developing decoding system, specifically designed to decode and evaluate the variable expression of the sender's MHC-linked traits. According to this perspective, the sender's encoding system and the receiver's decoding system are adaptations that coevolved, that is, they acted as each other's selective agency.

2. The bodymass index as a component of physical attractiveness

The bodymass index (BMI) is a measure of body weight controlled for height and is calculated as body weight (kg)/height $(m)^2$. It approximates body fat content and body shape. Attractiveness ratings as a function of BMI peak at intermediate BMI values, but the function is asymmetric, falling more steeply from the most attractive BMI to very low BMI than from the most attractive BMI to higher BMI (Maisey et al., 1999; Tovée & Cornelissen, 2001; Tovée et al., 2002). Compared to facial attractiveness, the BMI is much less studied as a mate choice criterion and even less studied are its effects on actual mating behavior. At least in Western societies, the BMI affects attractiveness of both female and male targets (Singh & Young, 1995; Maisey et al., 1999; Tovée & Cornelissen, 2001; Singh, 2002) and also affects mating success, at least in women (Halpern et al., 1999; Hume & Montgomerie, 2001; Franzen & Hartmann, 2001).

Why should both women and men have a preference for partners with an intermediate BMI? Clearly, the medical literature is replete with evidence for diverse detrimental health effects of both too low and too high body weight (Winkelgren, 1998). Maybe even more important from an evolutionary perspective is the finding that at least women of both very low and very high body weight have a decreased likelihood of conceiving compared to normal weight women (Frisch, 2002). Thus, it is plausible that at least the male preference for women of intermediate BMI represents an adaptation guiding men to a fecund partner.

Physical attractiveness as a predictor of sexual behavior and attitudes

While researchers have fruitfully modeled various physical characteristics as sexually selected traits that signal genotypic or phenotypic (Barber, 1995; Shackelford & Larsen, 1999; Langlois et al., 2000; Jones et al., 2001; Fink & Penton-Voak, 2002; Henderson & Anglin, 2003), there are surprisingly few studies that look at the effect of these traits on individual mating success and sexual attitudes. A recent review of studies on the effect of attractiveness on various behavioral contexts listed only six references relating to sexual behavior (Langlois et al., 2000), and only a few studies have appeared thereafter (see below). In Part I of this study, I will present data on three measures of attractiveness – facial attractiveness, self-rated attractiveness, and the bodymass index – and their effect on various measures of mating behavior and attitudes.

In humans´ evolutionary past, physical attractiveness probably had a positive effect on individual mating success and thereby on reproductive success[7]. Highly attractive individuals were able to mate earlier and with larger numbers of opposite-sex partners than less attractive individuals were. At the same time, attractiveness probably had a disruptive effect on the stability and exclusiveness of romantic relationships, because of the many mating opportunities that present themselves to highly attractive individuals (Gangestad & Thornhill, 1997b).

In modern individualized societies, an individual’s opportunity to choose sex partners according to his or her preferences is still present, if not enhanced by factors like increased mobility, effective contraception, and a change in values as a result of the sexual revolution (Allyn, 2000). Thus, there is no reason to believe that the link between physical attractiveness and mating should be disconnected. Hence, the predictions are the same as they would be for a generalized humankind in an idealized environment of evolutionary adaptedness: physical attractiveness is positively correlated with mating success and promiscuity and has a disruptive effect on the exclusiveness and stability of romantic relationships.

There are at least two processes that may lead to a positive correlation between physical attractiveness and sexual behavior and attitudes. First, highly attractive people obviously should have more mating opportunities than less attractive people should because potential sex partners (Langlois et al., 2000) approach them more often. Second, the perception of having many versus few mating opportunities may have an impact on an individual's sexual experiences and attitudes with the consequence that attractiveness will be positively correlated with promiscuous attitudes. However, it must be noted that a genic correlation between attractiveness and promiscuous attitudes is also possible and cannot be ruled out based on the current study design.

But there are also arguments speaking against the general prediction of a positive correlation between attractiveness and mating behavior or attitudes. For example, there may be sex differences in the strength, direction or shape of the relationship. Walsh (1993) predicted and found that whereas the correlation between self-rated attractiveness and the number of sex partners should be positive for men, it should be negative for women, because "unattractive women (or at least women who see themselves as such) may feel more strongly that they must bend to male demands than will attractive women. On the other hand, male attractiveness should operate to enhance their confidence in the pursuit of their sexual goals." This argument rests on the assumption of a sex difference in promiscuity (see introduction ofPart II). Based on a similar argument Pashos and Niemitz (2003) predicted and found an inversely U-shaped relationship between women's facial attractiveness and number of sex partners.

General hypotheses: A) I predicted that the three measures of physical attractiveness would be positively correlated with measures of mating success and promiscuity. B) Within romantic relationships attractiveness is predicted to have a disruptive effect on the stability and exclusiveness of romantic relationships (Figure 1). (The specific hypotheses are listed in the Results section.)

A note on the use of the terms “mating success” and “promiscuity” is necessary here. Inter-individual variation in mating outcomes like the lifetime number of sex partners is the result of both extrinsic and intrinsic motivational factors. The extrinsic factor explicitely studied here is the sexual response of opposite sex individuals to the participants´ physical attractiveness; the intrinsic factor is inter-individual variation in promiscuous attitude. Inasmuch as mating outcomes are determined by individual attractiveness they will be referred to as “mating success”. On the other hand, when mating outcomes are determined by individual attitudes they will be referred to as “the desire for multiple sex partners” or, for short, “promiscuity”.

Introduction Part II: Promiscuity, attractiveness, and fondness for children as predictors of the willingness to become a parent

In the introduction of Part I, the general prediction was that attractiveness and promiscuity should be positively correlated. This prediction assumes a current adaptive functioning of the adaptations involved in translating mate value into mating success. The aim of this part of the study is to investigate how promiscuity and physical attractiveness, and, in addition, attitudes towards children relate to the willingness to become a parent. The general prediction is that the effects of promiscuity, attractiveness, and interest in children are maladaptive in the sense described further below. Specifically, both promiscuity and attractiveness were predicted to have a negative and thus maladaptive effect on individual willingness to become a parent. Fondness for children was predicted to have a positive effect, but since this is unlikely to be the original function of this trait, this positive effect must be categorized as a mismatch with the modern environment. But before I turn to the details of the second part of this study, it is necessary to provide the reader with a brief introduction on the study of maladaptiveness in general and in humans in particular.

Maladaptive behavior in modern humans

Reproduction is a sequential process of behavioral events that result from an interaction between evolved mechanisms and the ontogenic environment. At each step of this process, different – and more or less modular – adaptations (Tooby & Cosmides, 1990, 1992) that respond to the environmental cue structure are at work. If the current cue structure deviates significantly from the ancestral one, the linkage between adaptations and adaptive outcomes may break down to any degree, thereby creating more or less harmful mismatches. The observed behavior would then be “maladaptive” (Tooby & Cosmides, 1990). In this study I will use the term “mismatch” (Gaulin & McBurney, 2001) to characterize any kind of mismatch between organism and environment irrespective of its somatic or reproductive consequences, whereas I will refer to “maladaptiveness” to mean a mismatch that does affect individual health, longevity, or reproductive output.

Researchers studying modern humans from an evolutionary perspective have suggested several candidates of maladaptive behavior in modern humans, mostly behaviors that affect health (e.g., Nesse & Williams, 1994). However, a look into the recent textbooks of evolutionary research on human behavior reveals that the vast majority of studies are concerned with the identification of evolved adaptations and adaptive rather than maladaptive behavior (Buss, 1999; Cartwright, 2000; Gaulin & McBurney, 2001; Barret et al., 2002; Palmer & Palmer, 2002). And whereas criteria for the systematic identification of adaptations have been proposed (Tooby & Cosmides, 1992), few guidelines for the systematic identification of maladaptiveness are available (Boyd & Richerson, 1985; Tooby & Cosmides, 1990; Crawford, 1997; Gaulin & McBurney, 2001; Richerson & Boyd, 2004), and none of them is commonly referred to. Similarly, definitions of adaptations are frequently provided in textbooks (with reference to Williams, 1966, and Tooby & Cosmides, 1992), but a commonly shared definition for maladaptiveness seems to be missing. This seeming lack of interest in studying maladaptiveness may be partly explained with a general preference bias among researchers. Adaptive behavior is more directly related to the logic of general evolutionary theory and thus may provide the rewarding feelings of theory confirmation. However, the systematic study of maladaptive behavior should not be much different from an evolutionary functional analysis to identify adaptations; if there are reliable criteria for identifying adaptations, it follows that it should be possible to set up equally reliable criteria for identifying maladaptiveness (Tooby & Cosmides, 1990, 1992). Moreover, setting up hypotheses about maladaptive behavior can also help to understand the architecture of the adaptive design that brings about this behavior, because " . . . every behavior, adaptive or maladaptive, is the product of adaptations (or other linked aspects of underlying design) and hence is patterned by the structure of those adaptations" (Tooby & Cosmides, 1990, p. 401).

After a review of the literature, I identified two main approaches to studying human maladaptive behavior that may be fruitfully combined into a general framework. The first approach is a logical derivation from the already mentioned evolutionary functional analysis of adaptations by Tooby and Cosmides (1990, 1992). Their approach is applicable to any species. The second approach is that of Boyd and Richerson (1985; Richerson & Boyd, 2004). It is specifically applicable to humans and considers human capacity for culture as the primary source of maladaptive behavior. Here I will provide a brief introduction to the two approaches and suggest that they should be integrated into a general framework to studying human maladaptive behavior.

The approach by Tooby and Cosmides for characterizing adaptations (Tooby & Cosmides, 1992, p. 73-75) is centered on the organism and its linkage to the environment. In their approach the past environment is the selective agent that caused the evolution of the adaptation under study. Two assumptions about the environment are important: First, the selectively relevant aspects of the environment are those that are recurrent over many generations. Single short-term changes in the environment cannot lead to genic evolutionary change. Second, it is not explicitly assumed that the study organism itself may have acted to change this environment in a way that affects the linkage between organism and its environmental cue structure.

Although Tooby and Cosmides repeatedly mention the principal applicability of their functional analysis to the study of maladaptive behavior, they do not provide general criteria as they do for the characterization of adaptations. Here I attempt to derive such criteria for the identification and characterization of maladaptive behavior from the logic of Tooby's and Cosmides' "evolutionary functional analysis" (Tooby & Cosmides, 1992, p. 73-75, see glossary):

> To characterize a behavior as maladaptive one must 1. identify the involved adaptations (following the evolutionary functional analysis after Tooby and Cosmides, 1992), 2. identify the involved environmental input and describe its deviation from ancestral environmental inputs, 3. describe the process or history that created the mismatch between adaptation and environment, and 4. show that the mismatch produces an outcome that deviates systematically from the adaptive developmental reaction norm of the study species[8].

The second, and historically earlier, approach to studying maladaptive behavior in humans is that proposed by Boyd and Richerson (1985; Richerson & Boyd, 2004). These authors are dedicated to studying the evolutionary causes of human capacity for culture and the interactions between genic and cultural evolution. Culture is defined as "… the transmission from one generation to the next via teaching and imitation, of knowledge, values, and other factors that influence behavior" (Boyd & Richerson, 1985, p. 2). In brief, the logic of the theory is this: For culture to emerge in the course of human evolution, it must have conferred a reproductive advantage over non-cultural ancestors, and the underlying adaptations must be the result of genic selection. Precultural ancestors were very likely equipped with a reasonable capacity for inferential and associative learning that increased individual adaptability to rapidly changing environments. However, individual learning is associated with costs of trial and error in terms of time, energy, and the risk associated with error. In addition, the individually acquired knowledge is lost with the death of the innovator. Learning by observation (imitation; Bandura, 1977) solves these problems by simply “assuming” that the behavior of conspecifics is adaptive in the current environment. In a process of cultural inheritance innovations can be passed along from the inventors to the following generations to become a cultural trait that is eventually shared by all individuals of the population and possibly over many generations. A second effect is that innovations can accumulate over generations meaning that the process of trial and error learning is not limited to an individual’s lifetime anymore, but is extended over generations generally leading to an ever better fit between a cultural trait and the population’s environment (see also McDougall, 1908). As an example, consider the canoe of the Inuit “Eskimos” (Richerson & Boyd, 2004). It is a sophisticated cultural trait, which evolved in response to the arctic environment and which was almost certainly not the invention of a single early settler, but rather is the result of repeated improvements made over the generations. Each generation’s innovators did not have to start from scratch, because he had already inherited from the older generation the knowledge of how to make a traditional Inuit canoe.

For this process of cultural adaptation to function, there must be specific organismic adaptations at work. The maybe most important component is a human motivation to imitate the behavior of others, that is, to learn by observation (Bandura, 1977), and to choose models whose behavior is particularly likely to confer advantages (McDougall, 1908; Henrich & Gil-White, 2001). However, like individual learning through trial and error, learning by imitation has its potential costs (Boyd & Richerson, 1985; Richerson & Boyd, 2004). As mentioned above, the adaptive value of social learning rests on the individual’s “assumption” that the behaviors displayed by either a critical mass of ingroup individuals or by individuals of particular significance are advantageous to the imitator. There are strong limits to critical checks of cultural traits because this would reintroduce the costs of an individual learning process that made social learning superior, on average, in the first place. In other words, the far-reaching openness of the human individual to adopting cultural variants from ingroup conspecifics makes populations vulnerable to the adoption of cultural variants that are maladaptive. Examples for maladaptive ideas are superstitions of all kinds including ones that are downright harmful to the individual (by modern scientific standards) such as the use of highly toxic arsenic compounds or the practice of blood letting as medical treatment. Very likely maladaptive ideas have been transmitted along with adaptive ones from the very beginning of human culture, but on average the adaptive value of cultural transmission must have been higher than its maladaptive effects. During early human history the rate of innovation was low compared to modern standards so that cultural traits were transmitted predominantly between generations, that is vertically, with the consequence that cultural inheritance generally paralleled genic inheritance. Therefore, cultural transmission increased and maintained the adaptability of genically very similar human populations to ecologically very diverse environments all over the globe. However, comparatively recent developments in cultural evolution have led to an increased significance of horizontal, within-generation cultural transmission compared to vertical transmission that facilitated the spread of maladaptive cultural traits. Among the most important steps in this development were the inventions of writing, and eventually mass printing, as well as transport and communication technologies. The virtually unlimited distribution of printed ideas creates a huge diversity and number of impersonal cultural models whose ideas can be selectively adopted and modified. As a consequence, culture’s original function of increasing a genic lineage’s adaptability to a particular natural environment lost importance. Through intensified cultural evolution, humans increasingly turned their predominantly natural environment into a predominantly cultural environment.

Of the two approaches to studying maladaptiveness, the approach by Tooby and Cosmides more closely reflects the prevailing view among evolutionary researchers of behavior, as indicated by the fact that only one of the five above cited textbooks (Barret et al., 2002) refers to the work of Boyd and Richerson (1985), but all refer to Tooby and Cosmides (1992). However, the two approaches are not mutually exclusive and can be integrated into one. In the current study, I will consider culture as a factor within a framework I will here refer to as "evolutionary malfunctional analysis of human behavior".

In summary, the general approach for identifying adaptations proposed by Tooby and Cosmides (1992) can be usefully applied across species to identify mismatches and maladaptive behavior. However, when applied to humans it is necessary to routinely consider culture as the process that will be almost always involved in causing the mismatches between environment and phylogenically older adaptations (Boyd & Richerson, 1985)[9]. It should be born in mind that the theory of Boyd and Richerson (1985) is itself based on an evolutionary functional analysis of adaptation, if not explicitely so. In the following paragraphs, I will apply the criteria of maladaptive behavior to contraception including induced abortion.

Contraception as maladaptive behavior

Any study of maladaptiveness must identify the mechanism-environment mismatch and then consider the possible consequences for both somatic and reproductive functioning. These consequences may differ from case to case. For example, a mismatch between mechanism and environment may remain without consequences to the functioning and longevity of the soma and without reproductive consequences. An example is the failure of the human visual system to maintain color constancy under sodium vapor lights (Shepard, 1992). In other cases, a mismatch that entails somatic costs may still be without consequences at the level of reproduction. An example may be modern nutritional behavior, which deviates strongly from that of ancestral times, such as the consumption of large amounts of carbonhydrates and fat (Nesse & Williams, 1994). Although detrimental to the longevity of the soma, unhealthy nutritional habits may – within limits – have little effect on the reproductive output, because they exert most of their harmful effects only in the post-reproductive period (Nesse & Williams, 1994). Often, however, a mismatch that entails costs at the somatic level entails consequences at the level of reproduction. For example, many addictive drugs such as alcohol have detrimental side effects at the somatic level that may frequently lead to premature death or directly interfere with reproductive functioning by causing miscarriages. Finally, there may mismatches between the human organism and the environment that entail costs at the level of reproduction but not at the level of somatic functioning and longevity. Modern contraception, I propose, is such a mismatch. Although possible detrimental effects of oral contraceptives continue to be a matter of concern (Nass & Strauss, 2004), it is clear that the very intention underlying all contraceptive efforts is to interfere temporarily with the functioning of the germ line without interfering with somatic functioning (e.g., copulatory behavior) and that human technology has come very close to reaching this goal.

Researchers studying human behavior from an evolutionary perspective disagree on the role contraception plays in human fertility behavior. There seem to be at least two different views on the subject. One group of authors denies that the widespread use of contraceptives prohibits fertility outcomes as measures of reproductive success (e.g., Essok-Vitale & McGuire, 1985, 1988; Kaplan, 1993; Voland, 1998) or even suggests that contraceptives are being used to maximize genic fitness (Dickemann, 1993; Mueller, 1993; Baker & Bellis, 1995, p. 183; Voland, 1998, p. 356; abortion: Essock-Vitale & McGuire, 1985; Hill & Low, 1992; Bereczkei &

Dunbar, 1997; Tullberg & Lumaa, 2001). In contrast, the second group of authors believes that contraception makes it futile to interpret human fertility outcomes as being adaptive. Most of these authors make such statements without presenting or referring to an explicit analysis of why this should be the case (Dawkins, 1989, pp. 117, 332; Pinker, 1997; p. 207; Daly & Wilson, 1999) whereas others have proposed views that are consistent with a maladaptive interpretation (Alexander, 1988; Turke, 1989; Pérusse, 1993; Kaplan et al., 1995; Potts, 1997). Most of these proposed views on contraception remain at the level of plausibility, and there is no scientific progress in the form of systematic cumulation and revision. An exception to this rule is induced abortion, which is the research topic of several studies. However, all of them take a fitness maximization perspective rather than an adaptation execution perspective (Hill & Low, 1992; Bereczkei & Dunbar, 1997; Lycett & Dunbar, 1999; Tullberg & Lumaa, 2001).

Therefore, contraceptive behavior remains a controversial topic within evolutionary interpretations of modern human behavior. However, if the evolutionary malfunctional analysis of human behavior is generally applicable as suggested above, its application to modern contraceptive behavior should help to resolve the controversy. To characterize contraception as a case of maladaptive behavior it is necessary to apply the criteria of an evolutionary malfunctional analysis (see above). Specifically, it is necessary to 1. identify the involved adaptations, 2. identify the involved environmental input and its deviation from the ancestral environmental inputs, 3. identify the process or history that created the mismatch between adaptation and environment, and 4. show that the mismatch produces an outcome that deviates systematically from the adaptive fertility reaction norm of the study species.

Starting with the last criterion – the deviation from the adaptive fertility reaction norm – I will provide a brief description of modern fertility behavior that characterizes Germany as well as many other industrialized countries (Kohler et al., 2002) and contrast it with the fertility behavior of preliterate human societies. The current total fertility rate is below the replacement level with currently 1.36 children per woman in Germany (Council of Europe, 2004) compared to a total fertility of four to six children in preliterate societies (Campbell & Wood, 1988). The average age at first child has increased to 29 years for German women in the year 2000 (Bundesministerium für Familie, Senioren, Frauen und Jugend, 2003) compared to about 19 years in preliterate societies (Kaplan et al., 2000). An increasing number of individuals who remain childless contribute to the very low fertility. In Germany, about 30% of the female cohort born in 1965 are predicted to remain childless (Bundesministerium für Familie, Senioren, Frauen und Jugend, 2003). The numbers are similar for males (Schmitt, 2004; Schmitt & Winkelmann, 2005). Significantly, it seems that the same processes that lead some couples to have low numbers of children lead others to remain childless (Carl et al., 2000; Kemkes-Grottenthaler, 2003). When different populations are compared, fertility is particularly low in the most affluent societies, and within populations it is often the wealthiest (e.g., Kohler et al., 2001), most highly educated (Kohler & Rodgers, 2003) or most intelligent (Lynn, 1996) fraction that has the lowest fertility. Finally, an analysis of a population in New Mexico showed that the modern low fertility rates do not maximize the number of grandchildren (Kaplan et al., 1995). Together these findings are unparalleled by anything we know from human history or of any other species´ fertility reaction norms, and they are incompatible with life history theory's predictions regarding the optimal number of offspring (Barkow & Burley, 1980; Borgeroff Mulder, 1998). Assuming that these fertility trends are not the result of pollution or diseases, it must be concluded that they are maladaptive outcomes that could only be reached with the aid of modern contraceptives.

The next step in the malfunctional analysis of contraception is to ask for the involved environmental input and its deviation from the ancestral environmental inputs. The single most significant novel environmental input involved in the maladaptive fertility behavior described above is the contraceptives themselves as a cultural invention (Potts, 1997). Somewhat paradoxically, contraceptive behavior is the result of a mismatch between the human organism and a component of the environment – contraceptive methods, including induced abortion – which humans have invented exactly for creating this mismatch. This special case of maladaptiveness in relation to a cultural trait means that the analytic steps of identifying the involved adaptations (step 1) and identifying the process that created the mismatch (step 3, see above) overlap to a high degree and must consider cultural transmission as a process involved.

Many of the motivational factors underlying the demand for contraceptives can be inferred from the historic record (Chesler, 1992; Allyn, 2000; Potts & Campbell, 2002; Cook, 2004). One lesson from such a historic perspective is that the motives for using contraception may change over time and with the introduction of improved contraceptive methods. For example, in the 19th and early 20th century, contraceptives were used mostly by married couples to limit the number of children (Potts & Campbell, 2002), whereas during the sixties and seventies the pill and the possibility to abort unwanted pregnancies made premarital sexual experience and postponing parenthood possible (Allyn, 2000; Goldin & Katz, 2002; Potts & Campbell, 2002)[10]. In particular, the pill and the possibility of a low risk abortion enabled women to assume a stronger position in their struggle for sexual equality in carrying the costs of parental care without having to forego sex. Women were now able to approach such equality by either foregoing parenthood altogether or by forcing the male partner to assist in childcare to an extent greater than traditionally common. An equally important and closely related effect of women's nearly complete control over reproduction was that women were able to enter a prolongued educational and vocational career without the prospect of interruption because of an unintended pregnancy[11].

Today, the situation is this: most women and men in Germany practice contraception (75% of all adults between 20 and 30 years of age; Bundeszentrale für gesundheitliche Aufklärung, 2003) and intend to postpone childbearing until they have finished their educational career (author's unpublished data), which means that contraception and female participation in labor are two closely linked cultural traits. Accordingly, women's participation in higher education is widely believed to be the major cause of the current trend towards lowest-low fertility in industrialized countries (Kohler et al., 2002). In this situation, it is less informative to ask why individual women or men *enter* a contraception routine (Oddens, 1997; Oddens & Lehert, 1997), but why and how they decide to *(dis)continue* contraception. Here then is a possible role for individual differences in the expression of adaptations that is the topic of this study.

Motivation and reproduction in mammals and modern humans over the life course: opportunity conflicts between mating and parenting

For an evolutionary understanding of human reproductive decision-making in the age of contraception, it is useful to assume a comparative perspective. I will argue that the evolved ontogenic organization of mammalian motivational systems for mating and parenting interact maladaptively with the specifically human capability of anticipation on the one hand and with modern contraception as a cultural trait on the other to create perceived opportunity conflicts between current mating and future parenting, which are biased towards current mating motivation.

In a generalized perspective, the life course of mammals and many other taxa is divided up into three major phases: 1. the somatic phase, during which the organisms grows and builds up the potential that is later being spent into 2. the mating phase and 3. the parental phase (at least in females). The life history efforts of these life phases are named accordingly (Figure 2). In humans, there is a notable overlap between the mating and parenting phase, and in addition, extraparental nepotistic effort (e.g., grandparental care) plays a significant role (Alexander, 1987). It is the two life phases of mating and parenting that matter here.

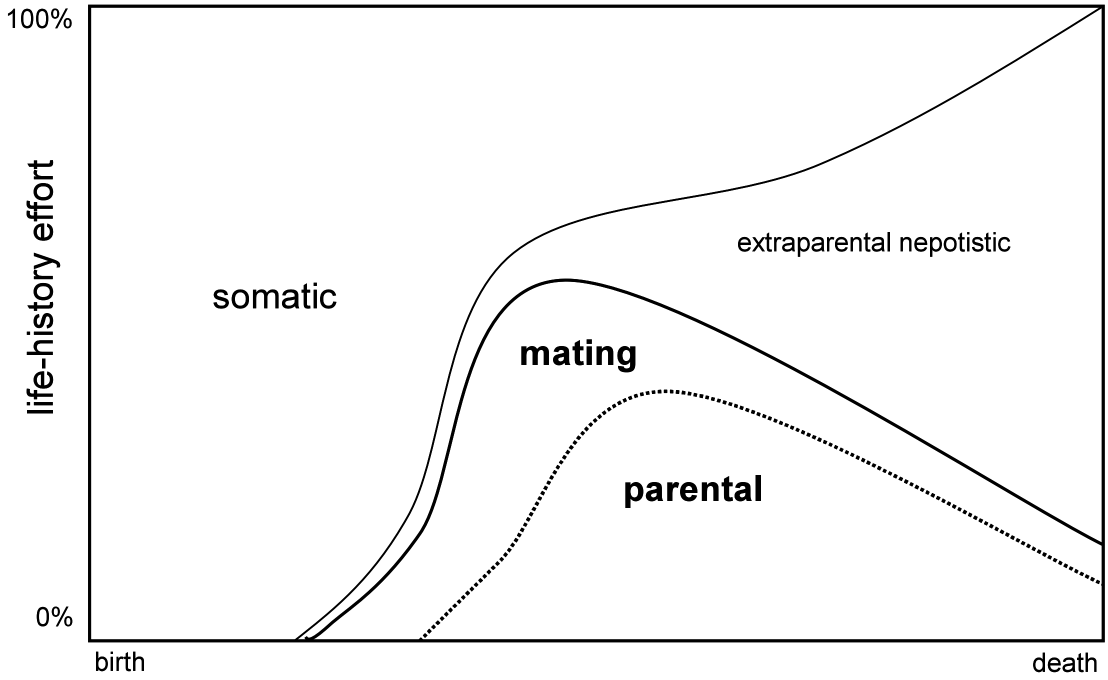

Figure 2. Life-history efforts over the human life span (after Alexander, 1987).

During each of these life phases the organism must reach certain goals that enable it to change into the next phase and finally to reproduce successfully. In reality this generalized model of life history must be supported by corresponding motivational systems that are more or less specifically designed to reach the life phase-specific proximate goals. Motivational systems that correspond to the mating phase function to elicit behaviors such as seeking and choosing (multiple) sexual partners, copulate with and become emotionally attached to them. Motivational systems that correspond to the parental phase function to elicit nurturing behaviors and durable bonds with the offspring. Both the mating motivational system and the parental motivational systems comprise various systems of reward that guide the organism to successful execution of the adaptive behaviors (James, 1892; McDougall, 1908; Panksepp, 1998).

Two important assumptions in this study are that 1. the parental, particularly the maternal, motivational system is fully activated only when the transition to parenthood is taking place and 2. that humans can anticipate their future parental status and are aware that it is a consequence of sexual intercourse. While the second assumption is obviously correct, the first assumption needs to be buttressed by empirical evidence. What evidence is there for a functionally specific parental motivational system in women and men that develops only during the transition to parenthood?[12] First, there are all reasons to assume phylogenically old adaptations that at least women share with other female mammals. Based on the available comparative evidence, Pryce (1992) developed a mammalian model of maternal regulation and motivation, many components of which are likely to apply to humans. Indeed, the available studies on humans provide evidence for such homologies shared with other mammals (see also Numan & Insel, 2003). During the course of pregnancy hormonal changes induce the growth of maternal feelings of nurturance during pregnancy and from pregnancy to postpartum (Fleming, Steiner & Corter, 1997) and also mothers´ higher (relative to nonmothers) sensitivity to infant odors (Fleming, Ruble, Krieger & Wong, 1997). Hormonal changes have also been found in expectant and new human fathers, where they are correlated with the pregnant partner’s hormone changes and induce new fathers´ responsiveness to infant stimuli (Storey et al., 2000). Differences between parents and nonparents have further been demonstrated at the level of brain functions. In a study that employed magnetic resonance imaging, Seifritz et al. (2003) found that parents and nonparents of both sexes responded differently to the sounds of a human baby crying and laughing. Moreover, the hypothesis that nonparents can hardly anticipate parental feelings can be tested by looking at qualitative reports of first-time mothers. If parental feelings develop as a life-phase-specific adaptation, one would expect first-time parents, and mothers in particular, 1. to experience rewarding feelings of yet unknown intensity and/or quality and to realize in hindsight that they were unable to fully anticipate these parental feelings and to be correspondingly surprised, 2. to realize that their feelings are specific to their own child, and 3. to perceive the cost/benefit ratio of parenthood to be pushed more to the benefit side compared to what they had anticipated. All these predictions find qualitative support in unstructured interviews that McMahon (1995) conducted with American first time mothers. Finally, the birth of a child marks the beginning of the attachment process (Bowlby, 1969; Bischof, 1985), which has only recently been studied from the caregiver's perspective (George & Solomon, 1999).

In modern humans, the fact that parental motivation develops only with the birth of the first child may contribute to the strength and direction of bias in perceived opportunity conflicts between current mating and future parenting. Opportunity conflicts between competing *current* activities are common in both humans and nonhuman species and may include conflicts between mating and parenting activities (e.g., Smith, 1995; Magrath & Elgar 1998; Marlowe, 1999; Waynforth, 1999; Székely & Cuthill, 2000; Magrath & Komdeur, 2003). However, nonhuman species are apparently unable to anticipate conflicts between current and *future* activities. Humans, in contrast, have evolved the ability to anticipate future events and longterm developments including their own, provided they have the necessary information. But although capable of anticipating future events, humans seem not to be very good at anticipating the emotional consequences of these events (Loewenstein & Schkade, 1999). This is true of predicting the future effect of emotions that an individual has already experienced in the past (e.g., sexual desire, Loewenstein & Schkade, 1999) and should thus be even more true of future emotions that he or she has not experienced before, such as parental feelings. Women's apparent inability to predict their parental feelings is exemplified by the following statement of a first time mother:

> "The actual reality of having a child in my life wasn't that much of a surprise. I think the only thing that was a surprise was the *intensity* of the emotional side. Not that I didn't expect to care about him, but there is a different level of emotional involvement than I anticipated." (McMahon, 1995, p. 134, italics in original)

The assumption of a perceived opportunity conflict between current mating and future parenting is central to the second part of the study. Modern contraception enables humans to act out these conflicts according to their individual perceptions of the costs and benefits of (not yet) becoming a parent. As a contribution to the evolutionary malfunctional analysis of contraceptive behavior, I hypothesized that both promiscuity and attractiveness, as measured in Part I of this study, will bias participants towards postponing parenthood. In addition, I predicted that a third variable, fondness for children, would have a positive effect on the willingness to become a parent, although it seems unlikely that this effect was present in the evolutionary past.

The tendency to abort an unexpected pregnancy as measure of current willingness to become a parent

The use of contraceptives and the use of induced abortion have common goals. Both are employed to postpone parenthood or to limit the number of children (Potts & Campbell, 2002; Klick & Stratman, 2003; Marston & Cleland, 2003). Furthermore, at a shorter time scale, both are employed to disconnect the pleasures of sex from the possible consequence of childbearing (Allyn, 2000; Cook, 2004). For these reasons, abortion is to be categorized as a contraceptive method. However, the decision to continue a contraception routine and the decision to abort differ in the kind of mental decision rules and their relation to an individual's willingness to become a parent. The decision to practice contraception is necessarily a conscious one[13] and based on the desire to have sex, but not to have children yet. Once the decision to practice contraception is made, contraception soon becomes a habitual routine (James, 1892; Verplanken & Aarts, 1999) that is carried out automatically without deliberation[14].

> "When having children is easily avoidable, and avoided for years, it is plausible to infer that an active decision to have a child and a consequent change in contraceptive behaviour are necessary. … there might be limits to initiate conscious decision-making associated with these behaviours. The absence of a behavioural performance does not need to be interpreted necessarily as the outcome of a negative choice. Instead of regularly evaluating one's decision and at each time concluding that it is best not to have a child at the given moment, individuals might face the absence of decision-making itself, that is the removal of childbearing consideration from consciousness. Individuals do not always face such a choice in terms of weighing its advantages or disadvantages, and what is considered

> to be a delay in a chosen behaviour could actually be a delay in the process of choosing.” (Micheli & Bernardi, 2003, p. 6f)

Thus, the observation that someone is using contraceptive methods today probably reveals little about this person’s positive or negative attitude towards the idea of becoming a parent (Ziebell et al., 1992), particularly if the person is young and has not completed her or his educational career. This is not the case for induced abortion. The experience of an unexpected pregnancy is a result of the failure of the contraception routine and requires an actualization and deliberation (James, 1892) of the involved persons´ willingness to enter parenthood. For many women and for their male partners, induced abortion is an option in this situation, but one that, although fairly safe, is experienced at least as unpleasant and embarrassing and potentially in conflict with basic ethical values. The option to either abort an unexpected and thus currently unwanted pregnancy or to become a parent forces a woman and her partner to weigh the pros and cons before making a deliberate decision, whereby the actual criteria on which the decision is based may or may not be cognitively accessible to the individuals involved (James, 1892).

The determinants of individual willingness to become a parent, I hypothesized, should reveal themselves in a situation where practiced contraception fails unexpectedly, but where there is still an option to avoid parenthood, namely, the option of induced abortion. In the current study I exploited the fact that the option of abortion makes deliberation necessary by confronting participants with a scenario of an unexpected pregnancy, in which they were asked to rate their likely decision on a five-point scale. I call this measure “the individual tendency to abort an unexpected pregnancy” or for short “the tendency to abort”. The responses to this question can then be correlated with hypothesized determinants of abortion decision. This method was used here to address two closely related research goals, both of which rest on the assumption that the differential responses to the abortion decision scenario and their correlates reflect at least qualitatively the behavior of real abortion decisions[15].

The first research goal was to test hypotheses on potential determinants of real abortion behavior that are difficult to assess by directly asking participants for their reasons for a realized abortion decision. In this, the study seeks to contribute specifically to research on abortion decisions (Torres & Forrest, 1988; Bankole et al., 1998). The second research goal is to determine (unconscious) determinants of the decision to become a first-time parent. This research goal rests on the assumption that the determinants of the decision to abort an unexpected pregnancy are the mirror image of the determinants of an individual's decision to quit contraception to become a parent. In this context, the tendency to abort is viewed as an integrating measure of individual willingness to become a parent. Again, the abortion decision scenario has the potential advantage that, if properly used, hypothesized determinants of an individual's willingness to become a parent can be investigated even if the participant has no cognitive access to or would not admit to them.

The research question was how promiscuity, physical attractiveness and attitudes towards children influence women's and men's willingness to enter parenthood. Physical attractiveness and promiscuity are relevant, because they must have been important determinants of reproductive success in the evolutionary past (at least for men in the case of promiscuity). I hypothesized that attractiveness and promiscuity would be negatively correlated with the willingness to become a parent and thus be positively correlated with the tendency to abort an unintended pregnancy. Furthermore, fondness for children was predicted to be negatively correlated with the tendency to abort. Fondness for children is relevant, because it is commonly believed to be a motivator for parenthood today, but probably did not function as such during most of human natural history.

Most studies on human fertility with an evolutionary perspective only use completed fertility as outcome measure, but not timing of reproduction. This is surprising, because it is the number of offspring *per time* relative to that of conspecific competitors that determines reproductive success, not the number of surviving offspring *per se*. The current study focuses on the timing of the transition to parenthood as a component of reproductive success. This focus is justified for the following reasons. First, the decision to have yet another child and the decision to postpone parenthood, respectively, are likely based on partly different motivational sources. Whereas the decision to postpone the birth of the first child will be based only on the motivational systems characterizing the mating phase, the decision not to have additional children will often be based on parental concerns, which consider the well-being of the existing children as well as on motivations related to somatic and mating effort[16] (compare Figure 2). Second, since the 1970s, the primary purpose of contraception has changed from limiting the number of children within marriage to making premarital and preparental sex possible. In the current sample of university students, the median age at first sexual intercourse was 17 years for women and 18 years for men; and 65% of the women were taking the pill at the time of data collection (no other forms of contraception were asked for). According to national statistics, women's current average age at at first birth is 29 (Bundesministerium für Familie, Senioren, Frauen und Jugend, 2003), which means that a large proportion of women and men will have nonreproductive sexual intercourse for a time span of around 10 years and longer. Third and finally, a focus on the timing of parenthood is important, because in populations with very low fertility, completed fertility is becoming ever more a function of the increasing postponement of parenthood (Kohler et al., 2002).

Independent variables and hypotheses of Part II

Maladaptive behavior is the consequence of a mismatch between evolved adaptations and the cue structure of their current environment. Therefore, it is part of any evolutionary malfunctional analysis to identify the involved behavioral traits and to analyse how accurately they represent the action of purpose-specific adaptations. This will be done here for each of the three independent variables promiscuity, attractiveness, and fondness for children. At the end of each section, I will state the predicted relationship between the independent variable and the tendency to abort as the dependent variable.

1. The desire for multiple sex partners (promiscuity) as motivational adaptation

Sexual selection theory predicts that, compared to females, males should generally be more strongly motivated to seek sexual contact to multiple partners because male reproductive success is constrained by the number of females they inseminate (Bateman, 1948; Trivers, 1972). Another, less often noted, explanation for the relatively lower female promiscuity is based on the direct costs associated with copulation (e.g., sexually transmitted diseases), which are generally higher for females than males (Gavrilets et al., 2001). The prediction of a relatively higher male than female desire for multiple sex partners is generally supported across species (Dewsbury, 1981) including humans (Symons, 1979), as evidenced, for example, by a recent cross-cultural study (Schmitt, 2003). It thus appears that men universally have on average a stronger desire for sexual variety than women do. However, this sex difference should not be misinterpreted to mean that women, or females in general, are absolutely monogamous (Birkhead, 2000)[17]. To the contrary, there is now ample evidence from diverse taxa that females actively seek sexual contact with several partners including females of pair-bonding nonhumans (Eberhard, 1996; Birkhead, 2000; Jennions & Petrie, 2000; Hrdy, 2003) and humans (Thompson, 1983; Gangestad & Simpson, 1990, 2000; Greiling & Buss, 2000; Allyn, 2000; Cook, 2004; Schmitt, 2003). In addition to the mentioned sex differences, there is considerable within-sex variability in promiscuous motivation in nonhumans (Crews, 1998) and humans (Gangestad & Simpson, 2000; Schmitt, 2003). Explaining within-sex variability and female promiscuity from an evolutionary perspective has recently become a major research focus (Birkhead, 2000; Jennions & Petrie, 2000; Gangestad & Simpson, 2000).

What is the possible adaptive value, if there is any, of female promiscuity in humans? Female promiscuity is particularly striking when displayed by mated females. Why should mated females seek for additional partners? Species previously considered monogamous have been shown to engage in extra-pair copulations with variable frequencies (Birkhead & Møller, 1995), which result in extra-pair paternity (Petrie & Kempenaers, 1998). The currently favored explanation for females seeking extra-pair copulations is that they gain genic benefits by mating with males that are genically superior to the social mate (Gangestad & Thornhill, 1997a, b). The evidence for this hypothesis in vertebrate species is mounting. Females seem to prefer extra-pair partners that are more heterozygous than their social mate (Potts et al., 1991; Foerster et al., 2003) so that their young are endowed with a correspondingly increased immunocompetence (Johnsen et al., 2000). For humans there is evidence that is consistent with the good genes hypothesis of extra-pair matings. Men who acted as extra-pair partners to women are more attractive and more symmetric than men who had never acted as extra-pair partners (Gangestad & Thornhill, 1997a). Because facial attractiveness has been found to be positively correlated to heterozygosity (Roberts et al., 2005) and facial symmetry is perceived as an indicator of health (Jones et al., 2001) it is possible that women gain a genic advantage by choosing partners who are more attractive and more symmetric than their current social partner. In addition to genic benefits, females may also gain material benefits from engaging in extra-pair sex (Gray, 1997), for which there is some evidence for humans (Greiling & Buss, 2001). It must be noted, however, that human extra-pair copulations may often occur during the process of switching from one mate to the other (Greiling & Buss, 2001) and thus do not qualify as extra-pair copulations in the narrower sense.

Beyond this context-specific case of promiscuity of extra-pair mating, women are also intrinsically motivated to seek multiple sex partners and show considerable inter-individual variability in this trait (Gangestad & Simpson, 1990, 2000; Schmitt, 2003). There are several plausible explanations for women's intrinsic promiscuity as a sex-specific trait. First, it may be a result of genic correlation with male promiscuity, that is, genes that are important in the development of a promiscuous motivation were originally selected for in men, but were then transmitted to women by means of sexual recombination (Lande, 1987; Price & Langen, 1992; Rice & Chippindale, 2001). In this case, women's promiscuity may or may not be adaptive or even maladaptive. Second, women's promiscuity may serve to ensure that their children are genically diverse so that the risk of loosing all offspring is lowered (Smith, 1984). This hypothesis is difficult to test, but consistent with this view is the fact that women of hunter-gatherer societies commonly have children fathered by more than one man (Hrdy, 2001). Third, as already mentioned in the context of extra-pair matings, women may offer sex in exchange for immediate resources (Symons, 1979; Greiling & Buss, 1999) or protection (Smuts, 1985).

What explains intrasexual variability in women's and men's intrinsic promiscuous tendencies? Again, there is a possible role for genic correlation, particularly as it has been shown that variability in promiscuity has a genic component in both women and men (Bailey et al., 2000; Cherkas et al., 2004). If there is a novel gene that is conducive to the sex-specific reproductive strategy of one sex, but that is about equally deleterious to the reproductive strategy of the other sex, this gene would not be eliminated by selection as long as sexual recombination ensures that it is transmitted equally often to males as to females. Over time, many such "sexually antagonistic genes" (Rice, 1992) may accumulate and together may be responsible for much of the observed overlap in physical and behavioral phenotypic traits between the sexes (reviewed in Rice & Chippindale, 2001). The existence of sexually antagonistic genes has been convincingly demonstrated for *Drosophila* flies (Rice, 1992), and for humans there exists some preliminary evidence that is consistent with the concept (Manning et al., 2000). Whether or not sexually antagonistic genes underlie intrasexual variability in intrinsic promiscuity is currently unknown, but consistent with the model is the finding that highly promiscuous women differ from less promiscuous women in being more masculine with respect to self-reported gender identity, interviewer-rated physical and behavioral masculinity, childhood-gender noncomformity (Mikach & Bailey, 1999), blood testosterone levels (Lippa & Veira, 1995), and prenatal testosterone (Clark, 2004).

Another model based on the assumption of genic variability suggests that women's intrasexual variability may be stabilized by frequency-dependent selection (Gangestad & Simpson, 1990). It assumes that women face a trade-off between two desirable mate characterisitics: good genes and parental provisioning. Finding a male partner who is willing to invest in a family takes time to test his commitment before mating, so that women will be selected to have a restrained sociosexual orientation, that is, to be of low promiscuity. In contrast, finding a partner who confers a good genes advantage is less time consuming because the indicators of good genes are reliable and can be assessed quickly based on appearance and body odor. Therefore, in the search for men of high genic quality sociosexually unrestrained, that is promiscuous, women have an advantage over restrained women. Because the success of each strategy depends on the relative frequencies in the population, frequency-dependent selection will result that maintains the variability in the population. This model of frequency-dependent selection is extremely difficult to test, and no equivalent model has been suggested to explain intrasexual variability in male promiscuity. However, in accordance with the idea of a trade-off between genic quality and parental quality of a male partner, it has been found that highly promiscuous women tend to choose partners with emphasis on mate criteria considered indicative of genic quality, whereas less promiscuous women put greater emphasis on criteria indicative of a good parent (Simpson & Gangestad, 1992; Gangestad & Simpson, 2000; Hoier, 2003).

In addition to these genic sources of variability, processes of environmentally induced variability have also been proposed (Gangestad & Simpson, 1990; Hoier, 2003 and references therein), but are not discussed here.

In summary, while men's desire for multiple partners very plausibly constitutes an adaptation, the evolution of the same phenomenon in women is more controversial and may have multiple causes. For the purpose of this study, I will assume that promiscuous motivation is either an adaptation in both sexes or that female promiscuity is derived from male promiscuity by means of genic correlation. In both these possible cases, it is parsimonious to assume that the inter-individual variability in this trait has similar genic causes in both sexes.

In the context of the willingness to become a parent, the predicted significance of the desire for multiple partners is that the perceived opportunity costs associated with becoming a parent will be higher for highly promiscuous individuals than for less promiscuous individuals. The reason for the opportunity conflict lies in the responsibilities of parenthood and parental partnership that are difficult to reconcile with a promiscuous life style. Evidence in support of this hypothesis comes from an experimental study on the effects of prolonged exposure to non-violent pornography videos on family values of male and female students and non-students (Zillmann & Bryant, 1988). In this study, male and female subjects who were exposed to daily pornography viewing for a period of six weeks showed a lower desire to have children compared to a control group. Since pornography typically depicts sexual intercourse between individuals who are not romantically involved with each other, prolonged exposure to pornographic scenes seems to enhance the desire for or imply the normality of sexual contacts of this kind.

General hypothesis: I predicted that individual variability in the desire for multiple partners would have a negative impact on individual willingness to become a parent as measured by the tendency to abort an unintended pregnancy, because of a perceived opportunity conflict between promiscuous mating and parenting (Figure 1).

2. Physical attractiveness as a moderator of mating motivation

Physical attractiveness as an adaptation to assess individual mate value was considered in the introduction of Part I. Here I will consider the possible consequences of attractiveness to the willingness to become a parent. The social significance of attractiveness is not restricted to the mating context in the sense it was investigated in Part I. Rather, it is well documented that physical attractiveness is a major predictor of individual social success both within and outside the context of mating, including educational and vocational success, social support, and mating success (reviewed in Langlois et al., 1999), including hypergamy (Elder, 1969; Udry & Eckland, 1984; Franzen & Hartmann, 2001). This differential social success depends on the perception of the social environment's responses to an individual's level of attractiveness, that is, on social feedback. Because of positive social feedback, highly attractive individuals will perceive their social environment as supportive, cooperative, and encouraging, whereas less attractive people will enjoy much less of such positive feedback.

It could be argued that traits correlated with attractiveness mediate the increased social success of highly attractive people, such as health (Kalick et al., 1998) or intelligence (Zebrovitz et al., 2002; Kanazawa & Kovar, 2004). Accordingly, it has been found that rated (facial) attractiveness is positively associated with perceived (sic!) health, intelligence, and several other desirable characteristics (Rhodes & Zebrowitz, 2003; Kanazawa & Kovar, 2004). Furthermore, in controlled experiments with other vertebrate species, manipulations of physical attractiveness have been shown to influence the individual allocations to mating effort versus parental effort (Magrath & Komdeur, 2003), and these findings can only be explained under the assumption of social feedback from conspecifics. Thus, there can be little doubt that humans, like other species, are able to assess their mate value based on social feedback and adjust their behavior accordingly. It is this attractiveness-dependent social feedback process that I will mean to imply in this study when talking of "attractiveness". In the context of the willingness to become a parent, the predicted significance of attractiveness is that the age-specific expected opportunity costs associated with a child will be higher for highly attractive than for less attractive individuals.

General hypothesis: Because of the many social opportunities associated with attractiveness, the perceived costs of becoming a parent as a consequence of an unintended pregnancy are predicted to be higher for highly attractive people than for less attractive people. Thus, attractiveness is assumed to act as a moderator of motivational systems such as the desire for multiple partners or status striving. Hence, I predicted that individual variability in measures of physical attractiveness would have a negative impact on individual willingness to become a parent as measured by the tendency to abort an unintended pregnancy (Figure 1).

3. Fondness for children as a motivational adaptation

Evolutionary theory does not assume that humans or any other animals are endowed with a desire to produce offspring, a kind of reproduction drive (e.g., Miller, 1992; Potts, 1997; Foster, 2000), as some researchers assume[18]. Instead, animals are parsimoniously assumed to be endowed with motivational systems that guide animals to reach certain proximate goals (McDougall, 1908; Tooby & Cosmides, 1990; 1992). These motivational systems are concerted with each other and with the environment in such a manner that usually successful reproduction will be the result. Humans should be no exception here (but see discussion). During most of our evolutionary history, becoming a parent was very likely not dependent on a desire to have children, but on a desire to have sex (Alexander, 1988; Miller, 1992; Potts, 1997). Notwithstanding these truisms, it is an empirical fact that mature but childless humans often desire to have children (e.g., Hoffmann & Hoffmann, 1973; Miller & Pasta, 2002). The question is how this desire originated during the course of natural or cultural history.

Childless humans often respond to stranger children in ways that are in many ways similar to parental responses. Individuals and the sexes differ in their responsiveness to stranger children with women being more responsive than men (Maestripieri & Pelka, 2002 and references therein), a pattern also found in several other primate species (Hrdy, 1976) and implying a common phylogenic origin[19]. How is this interest in stranger children to be understood from an evolutionary perspective? In a recent article, Maestripieri and Pelka (2002) proposed that the observed changes in interest in infants between childhood and adulthood point to a sexually differentiated motivational system that has the function of preparing immature females to the future task of mothering. Again, a similar function has been ascribed to the same phenomenon in other primate species (Fairbanks, 1990). In any case, these comparative findings suggest that the sex differences and individual differences did *not* evolve to motivate humans – and women in particular – to *sire* children. Rather I will assume here that the phylogenically older interest in stranger children interacts with the phylogenically younger human capability to anticipate future developments to create a desire to have children[20]. Whether or not individual differences in the desire to have children have had a significant fertility promoting effect during the course of human history cannot be answered empirically. However, it seems reasonable to assume that such an effect used to be weak at best and that its relative significance rose only recently in proportion to the use of effective contraception methods and with the process of individualization (Triandis, 1995). Indeed, a recent study from the USA found that attitudes towards children had a positive impact on realized fertility behavior (Barber & Axinn, 2003).

General hypothesis: I predicted that fondness for children should be negatively correlated to the tendency to abort. Trivial as this prediction may seem to be, it has rarely been tested by researchers interested in the determinants of induced abortion.

To test this hypothesis, I used a Fondness for Children Scale (FCS, see methods), a scale that measures individual differences in the responsiveness to stranger children (Rohde & Hoier, 2001, unpublished).

Methods

General procedure

Data were collected between June 2001 and March 2002 at the psychology department of the University of Kassel. Participants were recruited at university lectures, on campus by student assistants and the author, or were known as past participants of earlier studies of the psychology department. Participants were selected only with respect to the following criteria: (1) estimated age (maximum 35 years) and (2) parental status (only childless individuals). Participants were informed that they would be administered a questionnaire at the psychology department, that the total procedure would take 45 minutes to an hour and that in return they would be given either 7 Euro or course credit. Participants were told that the questions would relate to personality and behavior in diverse areas. To avoid self-selection on the basis of either preference or avoidance of particular topics such as sexual behavior and attitudes (Trivedi & Sabini, 1998), it was avoided to inform potential participants about the sexual content of the study. The response rate was not recorded and may have differed according to how and by whom the participants were approached. Individuals who agreed to participate were assigned a time to complete the survey.

The realized sample size represents a trade-off between effect size, statistical power, and resources. Considerations of effect size were based on the concept of “practical significance” (Rosenthal et al., 2000) according to which effect sizes of $r = .10$ (or even lower) would be considered practically important, depending on the research question. Consulting a power table for a one-tailed alpha of .05 (Cohen, 1988, p. 101) it became evident that the reliable detection of effects of $r = .10$ requires unrealistically (from the perspective of limited resources) large sample sizes at almost any given power level, but that effects of $r = .20$ may be feasible. To reach the recommended power of .80 (Cohen, 1988) an n of 153 would be required (Figure 3). Taking into account the author’s time, money, and nerves it seemed realistic to interview 125 to 150 women and men, respectively, or a total of 250 to 300 subjects. Also, beyond these numbers the marginal return in terms of power decreases ever more steeply (Figure 3). Altogether 290 subjects were interviewed, 149 women and 141 men. Based on this maximum sample size, the effective power would be .79 for the women sample, .77 for the men sample or .96 for the total sample of 290. However, because of the application of certain selection criteria (see below) and depending on the variables involved, the sample sizes in the various analyses can be considerably smaller. Women and men were always analyzed separately although for many tests the data of the two sexes could arguably be combined. This means that the maximum power for testing most hypotheses is in fact larger than the sex-specific tests indicate.

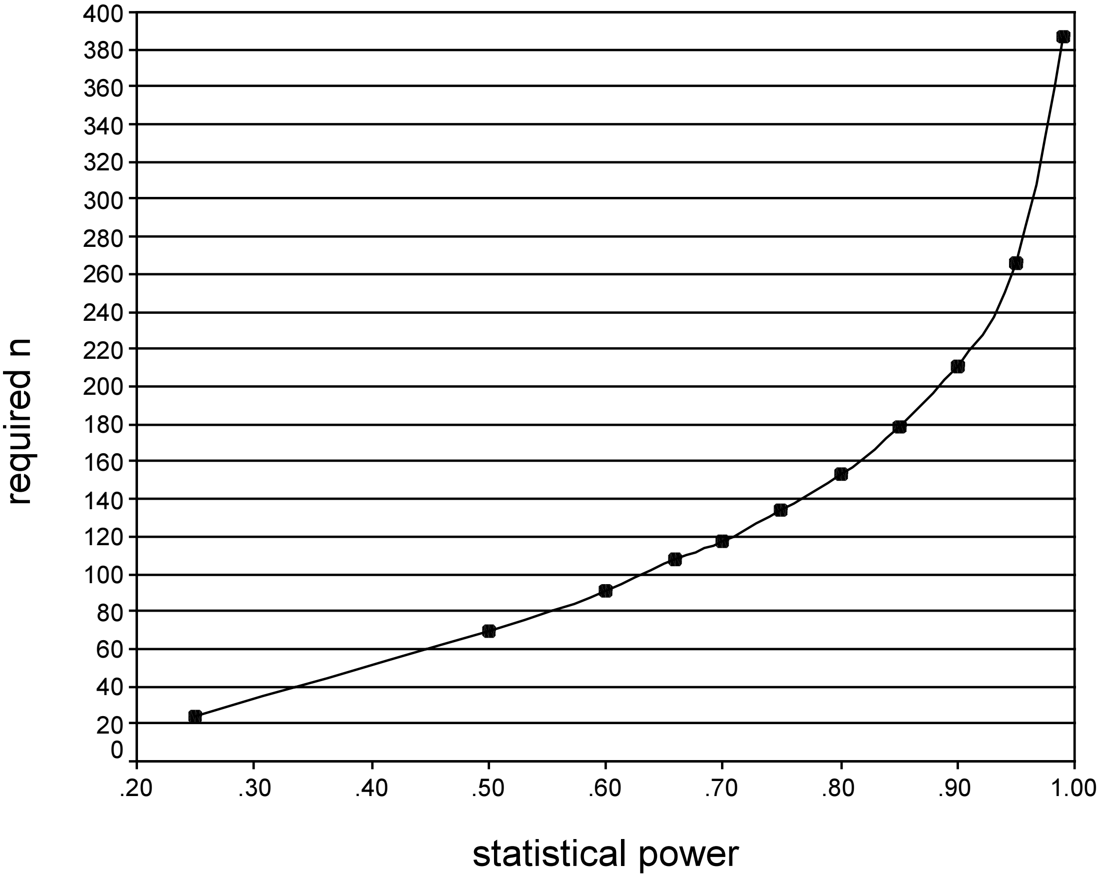

Figure 3. Required *n* and statistical power for $r = .20$ and alpha (one-tailed) = .05. (Data from table in Cohen, 1988, p. 101).

All interviews were conducted by the author in a department office with maximally two subjects at a time. On arrival, subjects were seated at different tables at 3 m distance with their backs turned to each other. Envelopes containing a coded questionnaire and a sheet with a photo coding number (see below) were handed out to them. Subjects were then asked to take out the questionnaire and to read a text, placed on the tables, which reminded them that participation was voluntary at all times, that they did not have to answer questions, if they didn't like and that no names had to be given. Participants were further ensured that nobody – including the author – would ever know what they as individuals had marked or written in the questionnaire (see below). After some further instructions and remarks on the purpose of the study, subjects completed the questionnaires. The author was present during the sessions, sitting behind a desk at a distance of 3 m away from the participants, ready to answer questions concerning the questionnaire. Once both subjects were finished, they put the questionnaires back into their envelopes and slipped them into a cardboard box.

Subjects were then asked to be photographed. If they displayed any signs of uneasiness in this situation, they were immediately reminded that they could always refuse and were encouraged to do so. However, most subjects seemed to be comfortable, and very few declined. Some subjects said that being photographed was fine with them – as long as the photos would not be published. Irrespective of such responses, subjects were ensured that the photographs would not be published or shown in public, but would be used only for ratings and measurements of asymmetry. Almost all subjects seemed to be satisfied with this promise; the remaining few subjects who were still skeptical were informed about the precise measures taken to protect their identity (see below). Finally, subjects were given the opportunity to answer questions concerning the questionnaire and were given the opportunity to contact the author to ask for the results of the study. Participants then made their choice between course credit and a 7 € payment.

Several measures were taken to protect the identity of the subjects´ data. First, a coding system linked questionnaires and the corresponding photographs via pairs of randomly assigned code numbers (ranging between 001 and 999) that were different for the questionnaire and photographs. Second, the author entered demographic data and remaining data separately, demographic data last. This ensured that even subjects the author was familiar with would not be identified on the basis of their demographic data. Third, an assistant who was unfamiliar with both questionnaires and photographs entered code numbers of questionnaires and photographs into the data file. Fourth, at all times, the coding list was under the sole control of the author. Together, these measures ensured that not even the author himself would accidentally identify any of the data as belonging to a particular person.

Measures of attractiveness

Three measures of attractiveness were used in this study: expert-rated facial attractiveness, the bodymass index (BMI), and self-rated physical attractiveness. Expert-rated facial attractiveness is the most commonly used and most intensively studied measure of physical attractiveness (Hassebrauck & Niketta, 1993). Although people often object to the idea that there should be a high inter-individual agreement about attractiveness, the available studies show that attractiveness can be determined quite objectively with a relatively small number of experts and that very similar results are yielded (Hassebrauck & Niketta, 1993).

1. Facial attractiveness was determined as follows. Head-and-shoulder portraits of subjects were taken while subjects were sitting in front of a white wall. Paper sheets with code numbers (handed out together with

the questionnaire, see above) were fixed on the wall close to the subject. A Nikon camera (F-601) was raised on a tripod at standard distance to the wall. A 70 mm lens and color film (Fuji, 200 ASA) were used together with the camera's frontal flash. Subjects were asked to assume a neutral facial expression. One to three photographs were taken of each subject; the one with the most neutral expression was used for ratings. The photos were digitalized onto CD-ROM. Using Photoshop 5.0 (Adobe) the faces were cut out from the original photos at approximately 400 x 583 pixels, and the resulting pictures were reduced to jpg-Format and then converted to BMP-format for presentation.

Photographs were rated for attractiveness using a computer program specially designed for that purpose. The pictures were first presented in random order for two seconds each to familiarize the rater with the task and the range of attractiveness. Then the pictures were presented in the same order as in the preview and were rated on a 7-point scale by using the cursor and mouse. Raters could view each face as long as they pleased. Ratings were automatically saved and entered manually into the data file. Male faces were rated by fourteen female raters (average interrater correlation $r = .39$, effective reliability of the mean of judges´ ratings = .90) and female faces were rated by nine male and five female raters (average interrater correlation $r = .39$, effective reliability of the mean of judges´ ratings = .90). The required number of raters was determined based on a table provided by Rosenthal and Rosnow (1991). This table lists the required number of raters to reach a desired effective reliability of the mean of judges´ ratings with a given mean reliability (average interrater correlation). After the first seven or so ratings the mean reliability was .40 so that 14 raters would be required to reach an effective reliability of .90. Higher effective reliabilities would have required an exponential increase in the number of raters, for example, 24 raters would have been required to reach .94, 32 raters to reach .96. Not all subjects had a neutral expression on the photographs. To test for a possible influence on attractiveness ratings, degree of smiling was rated by the author on a 4-point scale. Smiling had a positive impact on the ratings of male faces, *r*(111) = .29, *p* = .002, but not female faces, *r*(134) = .04, *p* = .68). The effect of degree of smile was therefore removed from male attractiveness scores by regressing attractiveness over degree of smile and saving of the standardized residuals. In the analysis, these z-scores and the z-scores of the female face ratings were used.

2. The bodymass index (BMI) is calculated as body weight (kg)/height $(m)^2$. In this study, participant's self-reproted body weight and height were used. Only one male participant included in the study did not report both measures. The higher the BMI, the less skinny is a person. Attractiveness ratings as a function of BMI peak at intermediate BMI values, but the function is asymmetric. It falls more steeply from intermediate BMI to very low BMI than from intermediate BMI to high BMI (Maisey et al., 1999; Tovée & Cornelissen, 2001; Tovée et al., 2002). Because people with a BMI below the attractiveness maximum are much rarer than people with a BMI greater than the attractiveness maximum, it was justified to treat the BMI as a linear variable with attractiveness increasing linearly from higher to lower BMI values (Hume & Montgomerie, 2001; Franzen & Hartmann, 2001).

3. Self-rated physical attractiveness was rated on a 9-point scale, and the following instructions were given: "Many find this question difficult to answer. Please try it anyway. Here is a suggestion: Imagine a very attractive, a very unattractive, and an intermediate person of your gender, and then try to rate yourself." In women (*n* = 147) the median rating was 6 (*SD* = 1.28); in men (*n* = 135) the median rating was also 6 (*SD* = 1.30). Only 4% of the women and 12% of the men rated their attractiveness as being below average (rank 5 on the rating scale) meaning that both women and men strongly tended to overestimate their attractiveness. Compared to

expert-rated attractiveness, self-rated attractiveness is of course the much less reliable measure, first, because it is typically measured with one item by just one judge, namely the subject, and second because of the self-serving bias. This measure is nevertheless valuable, because it is still positively correlated with both objective measures of attractiveness (Table 1) and because it adds the perspective of self-perception.

Table 1. Intercorrelations between the three measures of attractiveness.

measure of attractiveness	facial	self-rated	BMI
facial	-	.41[a] (115) < .001	-.47[b] (115) < .001
self-rated	.21[a] (98) .02	-	-.43 (127) < .001
BMI	-.16[b] (97) .06	-.32 (122) < .001	-

Note. Shown are partial correlation coefficients (controlled for age), degrees of freedom, and one-tailed p-values. – Cells above the diagonal show results for women; those below the diagonal show results for men.

a, b Fisher's r to z transformation and test for difference of coefficients between the sexes: a $p = .06$; b $p = .006$.

Table 1 shows the intercorrelations between the three measures of attractiveness, expert-rated facial attractiveness, self-rated physical attractiveness, and bodymass index. All correlations have the predicted sign and are significant. Like in two other studies (Rikowski & Grammer, 1999; Hume & Montgomerie, 2001), facial attractiveness was more strongly related to the BMI in women than in men ($z = 2.49$, $p = .006$). Although the three measures of attractiveness are intercorrelated, I decided not to convert them into a single attractiveness scale, because the loss of information would be higher than the gain in reliability. As will become apparent in the results and discussion sections analyzing the attractiveness measures separately makes possible the interpretations of seeming patterns that imply testable hypotheses for future studies.

Table 2 shows that the three measures of attractiveness were only slightly correlated with age.

Table 2. Correlations of measures of attractiveness with age.

measure of attractiveness	women	men
facial	-.17 (118) .03	-.11 (101) .14
self-rated	-.05 (130) .30	-.05 (126) .31
BMI	.13 (130) .07	.12 (125) .09

Note. Shown are partial correlation coefficients (controlled for age), degrees of freedom, and one-tailed *p*-values.

The questionnaire

Separate questionnaires were designed for women and men. Questions relevant to this study included the following groups of items:

Demographic information: Sex, age, height, weight, country of birth, marital status, religion, parental status, sexual orientation (five categories ranging from exclusively heterosexual to exclusively homosexual). Furthermore, churchgoing frequency (never, infrequently, frequently) was assessed.

In Part I of the study, two groups of variables relating to mating behavior were hypothesized to be influenced by attractiveness, namely a) mating success and promiscuity on the one hand and b) relationship stability and exclusivity on the other.

a) Mating success/promiscuity: In an introductory note at the beginning of this section of the questionnaire, sex was defined as consensual intercourse excluding sex with prostitutes. Mating success and promiscuity cannot strictly be separated from each other on the basis of behavioral measures. For example, the number of sex partners depends on the degree to which potential sex partners feel attracted to a person, but also on the person's desire to mate with multiple partners. Because of this overlap in meaning, the same measures of sexual behavior may be used as measures of mating success in the one context and as measures of promiscuity in another context. The following measures of sexual behavior were assessed: age at first sex, lifetime number of sex partners, current pairing status (with or without partner), extra-pair mating success (number of sex partners who had a partner at the time the participant had sexual relations with him/her). Further measures of promiscuity were:

Same-evening sex: This term designates the responses to an item taken from Buss and Schmitt (1993). It asks participants to rate on a 7-point scale how likely they would have sex with an attractive partner whom they have known for an evening. As expected, women rate lower on average than men (Buss & Schmitt, 1993; this study). This measure was used because it constitutes an important part of promiscuity, namely, the time that elapses between first encounter and first sex.

Sociosexual orientation (or sociosexuality): A German translation of the Sociosexual Orientation Inventory (SOI) by Simpson and Gangestad (1991) was used here as an index measure of promiscuity. This scale consists of seven items relating to both behavior and attitudes. Sample items are "Did you ever have sex with someone once and only once?" and "Sex without love is o.k.!" The data were z-transformed for men and women separately, and the index was then calculated. Cronbach's alpha for the scale was .73 for women and .77 for men.

b) Partnership stability and exclusivity: Four items related to this second group of items:

Ever been unfaithful?: Subjects were asked whether they had ever had extra-pair sex. This item was used as a measure of partnership exclusivity. It is imperfect in that it allows only for a binary response format (yes or no), but does not consider the total time spent paired.

These following three items were used as measures of partnership stability.

Duration of current partnership: Paired subjects were asked how long their current relationship had lasted (in months).

Partnership asymmetry: To assess the degree of asymmetry of feelings within couples, the following item was used: "Who of the two of you, you think, feels more attached to the other?" This question was answered using a bipolar 7-point scale ranging from "I very much stronger" to "Him/her very much stronger".

Initiator of breakup: Subjects were asked who was responsible for the breakup of their last relationship. Again, this question was answered using a 7-point bipolar scale, ranging from "only me" to "only him/her".

Fondness for children: The Fondness for children Scale (FCS) was developed together with Sabine Hoier, University of Kassel (Rohde & Hoier 2001, unpublished). This scale consists of originally seven items to be rated on a 7-point scale and assesses how much a person develops feelings of caring towards stranger children (sample items: "I regularly melt away at the sight of a cute child.", "Small children are nerve-wracking." (inverted). In this sample, the internal consistency (Cronbach alpha) was .85 for women and .78 for men. As has been found in previous studies (Maestripieri & Pelka, 2002 and references therein), women tended

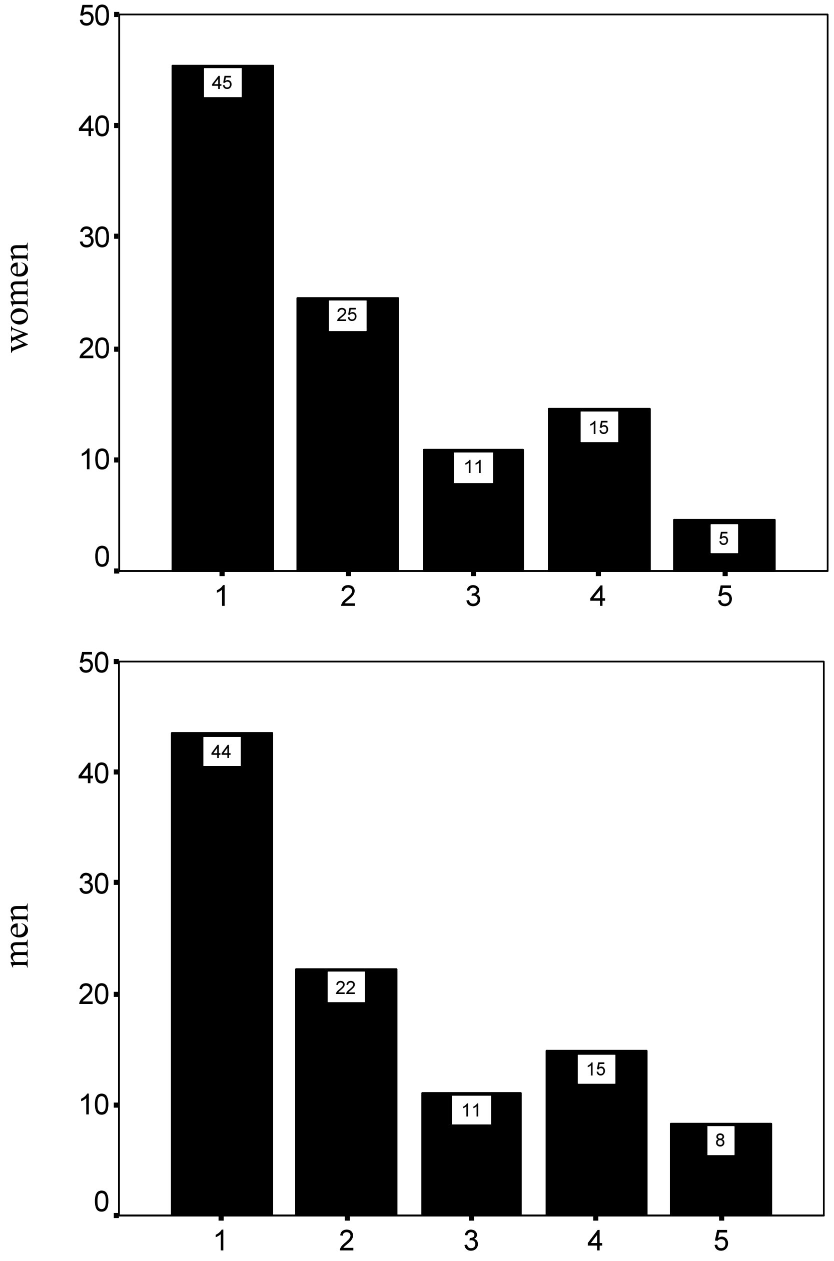

Figure 4. Participants′ tendency to abort. – Shown are the percentages with which women and men rated the five-point scale (inverted).

to show a stronger fondness for children than men, $r_p(215) = .24, p < .001$. The FCS was positively correlated with desired number of children in both women, $r_p(108) = .17, p = .03$, and men, $r_p(104) = .30, p = .001$.

Current desire to have children: Two items were employed to assess participants′ current desire to have children. “Do you wish to have a child in the next 12 months?” (7-point scale) and “At what age would you like to have your first child?”. In response to the latter question, some subjects gave an age range (e.g., 25-30) instead of a particular age. In these cases, the lowest age was entered into the data table.

The individual tendency to abort an unintended pregnancy: The question for unintended pregnancy had to be formulated differently for men and women. Women: “If you learned today that you are pregnant, would you decided to continue the pregnancy (“das Kind austragen”) or not”? Men: “If you learned today that your partner was pregnant, would you prefer her to continue the pregnancy or not?” (5-point scale: *certainly not continue, rather not, absolutely undecided, rather continue, certainly continue pregnancy.*) The inverted ratings constitute the “individual tendency to abort an unintended pregnancy” or, for short, “the tendency to abort”. Figure 4 shows the distributions of the inverted ratings on the scale for women and men. The two distributions are very similar, and a U-test confirmed that there is no sex difference in the tendency to abort, U = 5665.50, n = 110 women, 108 men, p = .53. The mean tendency to abort was 2.08 (±1.25 SD) for women and 2.22 (±1.36 SD) for men.

Social desirability: A subsample of men (n = 50) and women (n = 75) filled in a social desirability scale (Stöber 2001) to check for possible biases. Because the exclusion criteria for Part I and Part II differ slightly, the internal consistency of the scale was calculated separately for the two subsamples. Based on all 17 items Cronbach’s alpha for the subsample used in Part I was .68 (n = 68) for women and .71 (n = 49) for men; Cronbach’s alpha for the subsample used in Part II was .56 (n = 58) for women and .72 (n = 41) for men. Because the scale was to be used as control variable, a large alpha was desirable. To maximize alpha, I conducted an item analysis and deleted all items whose total item correlation was below .20. For men, alpha could not be further enhanced for either Part I or II. For women, alpha rose to .72 for Part I (6 items deleted) and to .66 for Part II (9 items deleted), and after deletion of 9 items, the alpha for women rose to .72 (Part I) and .66 (Part II), respectively. I used these sex-specific social desirability scales in the analyses. Correlations between these scales and key variables of this study are shown in the Appendix.

The questionnaire included several other measures of personality and self-reported behavior which are not relevant to this study but which probably helped to ensure that subjects were unaware of the hypotheses under test.

Validity of the tendency to abort as a measure of the willingness to become a parent

For an evaluation of the results, it is important to consider the construct validity (Cronbach & Meehl, 1955) of the measures used to determine the individual willingness to become a parent. This measure is the tendency to abort an imagined unintended pregnancy. The following hypotheses were tested primarily as cross-validations of this measure.

Hypothesis: The tendency to abort will be positively correlated with the time from now at which the participants wish to have their first child

Because the tendency to abort is used as a measure of the current willingness to become a parent it is important to show that this measure is positively correlated with the time from now at which the participants wish to have their first child. This hypothesis was confirmed for both women, $r_p(110) = .36$, $p < .001$, and men, $r_p(103) = .35$, $p < .001$. These results confirm an important assumption of this study, namely, that abortion is regarded as a means to postpone reproduction.

Hypothesis: Age will be negatively correlated with the tendency to abort among unpaired, but not among paired women.

Because future fertility decreases with age, willingness to invest in offspring should increase over lifetime (Pärt et al., 1992; Stearns, 1992). If this holds for modern humans, the effect of age on parental motivation should reveal itself in abortion behavior. However, this correlation is to be expected only or should be stronger for unpaired women, because for them the parental costs are much higher than for paired women. Data from national statistics support the hypothesis at the level of real abortion behavior. For unmarried women, the likelihood to abort a pregnancy decreases up to age 35 (Lycett & Dunbar, 1999; Tullberg & Lumaa, 2001). It is, however, not clear whether these abortion decisions are a result of conscious deliberation (James, 1892) or, as evolutionary considerations imply, whether they depend on phylogenically older adaptations that function independently of conscious reasoning.

Based on the entire sample of women, there was no correlation between the tendency to abort and age, $r(110) = -.02$, $p = .44$. However, when paired and unpaired women were analyzed separately, there was still no correlation for paired women, $r(77) = .02$, $p = .44$, but a negative correlation for unpaired women, $r(31) = -.25$, $p = .09$). For men, age was negatively correlated with the tendency to abort $r(108) = .31$, $p = .001$). This trend was independent of men's mating status (paired men: $r(60) = -.36$, $p = .003$; unpaired men: $r(46) = -.25$, $p = .05$.

Hypothesis: The tendency to abort decreases with growing age difference between women and their partners.

This hypothesis was confirmed. The older the partner was relative to the female subject, the weaker was the women's tendency to abort, $r_p(72) = -.24$, $p = .02$. In a US national survey, Darroch et al., (1999) had found that women younger than 18 who became pregnant, those with a partner who was six or more years older were less likely to have an unintended pregnancy or to terminate an unintended pregnancy than were those whose partner was no more than two years older.

Hypothesis: The tendency to abort will be negatively correlated with the level of involvement with the partner.

In the questionnaire, the tendency to abort was posed as a question under the assumption that the subject had a partner. However, a large percentage of men and women in this sample (42.6 and 27.9%, respectively) were not paired at the time the study was conducted. This makes it necessary to check for a possible effect of mating status on the tendency to abort.

The tendency to abort was higher among paired than among unpaired participants, women: $r_p(105) = .18$, $p = .03$; men: $r_p(103) = .11$, $p = .14$. However, when paired subjects were divided into those staying and those not staying with their partner, a more detailed picture and larger effects sizes emerged (Figure 5). Paired women who were not living with their partner had a significantly higher abortion tendency than both unpaired women and paired women who were living with their partner (Figure 5). This quadratic effect was confirmed when the three levels of involvement were recoded as a contrast (-1, 2, -1) and correlated with the tendency to abort, $r_p(105) = .28$, $p = .002$. A possible interpretation is that unpaired women imagine an ideal partner while rating their choice whereas many of the paired women are not sufficiently satisfied with their partner to found a family with him (Schwab Zabin et al., 2000).

In men, the tendency to abort was less strongly correlated with mating status, but a graphic analysis points to a curvelinear relationship similar to the one in women. Indeed, a correlation of the tendency to abort with the curvelinear contrast yielded a slightly larger effect than the previous correlation with assumption of linearity and was statistically significant, $r_p(103) = .18$, $p = .03$.

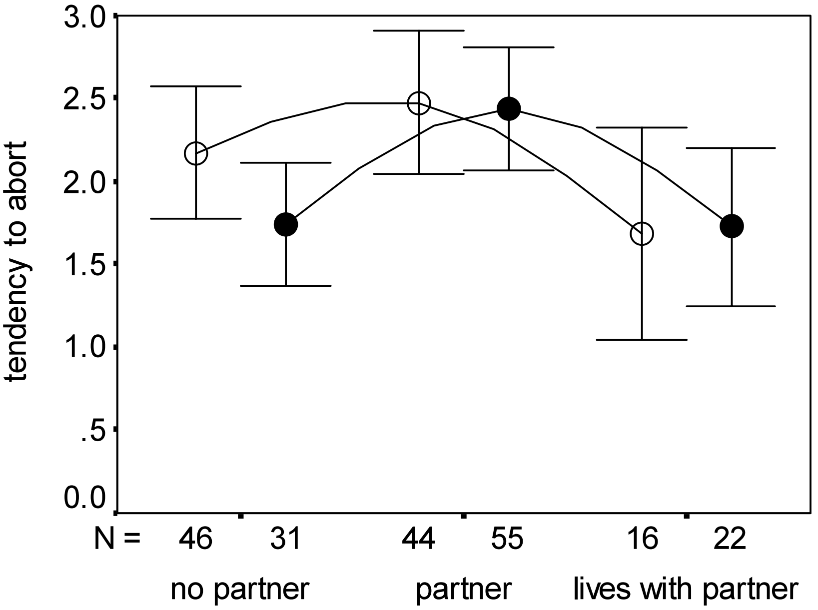

Figure 5. The tendency to abort and level of involvement in a relationship. – Shown are means and 95%-confidence intervals. Open dots indicate men, filled dots women. The numbers below the categories indicate the number of subjects in each group.

Because these results indicate a possible impact of the level of involvement on the results of this study, all correlations were repeated with the curvelinear contrast added as control variable. The curvelinear effect of the level of involvement with a partner on the tendency to abort had no substantial impact on the results of Part II and was therefore not considered in this report.

Another measure of involvement with the partner is the duration of the current relationship which was negatively correlated with the tendency to abort in women, $r_p(74) = -.18$, $p = .06$, but not in men, $r_p(57) = -.02$, $p = .44$).

Statistical analysis

Statistical analyses were carried out using SPSS 10.1. As principal measure of effect size, I chose correlation coefficients. Specifically, I used the coefficients after Pearson, Spearman, and the standardized regression coefficients (β) as obtained from multiple regression analysis. These coefficients have been shown to be mathematically equivalent to each other (Rosenthal & Rosnow, 2000) so that they can be compared with each other without further transformation. A further advantage of the correlation coefficient is that it can easily be transformed into other measures of effect size such as the variance explained (coefficient of determination, r^2) or Cohen's effect size measure d using formula compiled in Rosenthal et al. (2000). If not otherwise indicated, partial correlation coefficients (r_p) are controlled for age.

The Tables show correlation coefficients, sample sizes (in parentheses), and *p*-values. *P*-values are all one-tailed, because specific hypotheses about the direction of covariations were made.

Hypotheses on sex differences in correlations between two variables were tested using Fisher's *r* to *z* transformation procedure. The analyses were carried out using an online-calculator provided by Richard Lowry, College, Poughkeepsie, New York, USA, at http://faculty.vassar.edu/lowry/rdiff.html. For this type of analysis, only results with *P*-values < .10, (one-tailed) are reported.

All correlations that were tests of hypotheses were graphically checked for outliers and recalculated excluding these outliers. Because the number of available data varies slightly for some variables and because of different selection criteria for different hypotheses (see below), samples sizes vary between analyses.

Some variables in this study are used several times to test various hypotheses. Many would argue that to avoid spurious correlations adjusting the alpha-level is necessary (e.g., Rice, 1989; Cabin & Mitchell, 2000). However, I chose not to do so for the following reasons: First, the Bonferroni method is blind to patterns in the results that make logical sense when interpreted from a theoretical perspective. Second, I think that the Bonferroni method overestimates the value of a single study (and the value of *p*-values at that). The present study comprises a mixture of quasi-replications, explorative analyses, and tests of novel hypotheses. Its aim is to point to future directions of research. None of the results reported here should be regarded as definite truth, but should be subjected to replication and refinement by other researchers. For these reasons, I agree with D. Bem's perspective on the problem:

> "Yes, there is a danger. Spurious findings can emerge by chance, and we need to be cautious about anything we discover in this way. In limited cases, there are statistical techniques that correct for this danger. But there are no statistical correctives for overlooking an important discovery because we were insufficiently attentive to the data. Let us err on the side of discovery." Bem, D. J. (2002), p. 3.

Selection criteria

The data of six participants were excluded from all analyses. Two of these six participants made unrealistic or logically inconsistent self-report regarding their sexual behavior; two participants were parents; one was an observant Muslim and did not fill in the section on sexual behavior; and one participant put crosses only at the extreme ends of the rating scales and reported that he did not want to have sex at all. After the exclusion of these six participants, the sample comprised 147 women and 136 men with mean ages of 23.37 years (±3.07 SD) and 24.68 (± 3.20 SD), respectively.

For the analyses of hypotheses regarding sexual behavior (Part I) the selection was further restricted to heterosexual participants of a maximum age of 35 years, because the theoretical background of this study is relevant only to sex with possible reproductive consequences. After applying these exclusion criteria the final subsample of Part I comprised 130 women and 126 men with mean ages of 24.40 years (± 3.52 SD) and 24.40 (± 3.52), respectively.

The selection criteria applied to the analyses of hypotheses regarding conscious reproductive decision making (Part II) include further restrictions. Because abortion is here conceptualized as a means to postpone reproduction, all individuals who did not want to have any children at all were excluded (10 women and 5 men). Also excluded were women who had been pregnant before (6 women). Finally, the maximum age of the women (not men) was restricted to 30 years (35 years in the previous chapter), because pregnancies above this age are increasingly risky for both mother and child – a fact which seems to be reflected in the rising abortion rates in this age group as reported in national statistics (e.g., Lycett & Dunbar, 1999; Tullberg & Lumaa, 2001). After applying these exclusion criteria the final subsample comprised 111 women and 108 men with mean ages of 23.02 years (±2.63 SD) and 24.56 (± 2.91 SD), respectively.

Results of Part I: Physical attractiveness and mating behavior

a) The role of attractiveness for mating success and promiscuity

Hypothesis 1.1: Physical attractiveness will be negatively related to the age at first sexual intercourse.

One component of genic fitness is timing of reproduction (Fisher, 1930). Usually, early reproduction will be favored by natural selection. In the context of mate choice, highly attractive individuals should be found to be selectively favored by mating earlier (e.g., Udry & Billy, 1987).

In tendency, this hypothesis was confirmed for women with respect to all three measures of attractiveness, but only the correlation with facial attractiveness was statistically significant (Table 3). In men, however, all three correlations coefficients were small, nonsignificant, and two of them did not have the predicted sign.

Hypothesis 1.2: Physical attractiveness will be positively correlated with the total number of sex partners[21].

This hypothesis was confirmed in the overall tendency (Table 3). The correlation coefficients were not generally stronger in men than in women as may be predicted on the basis of sexual selection theory. The correlation coefficient for facial attractiveness was stronger for women than for men, whereas the coefficient for self-rated attractiveness was stronger in men. A graphic analysis of the regression plot of number of sex partners over the three measures of attractiveness (controlled for age) gave no indication of an inverse U-shaped relationship as found by Pashos and Niemietz (2003)[22].

Hypothesis 1.3: Physical attractiveness will be higher among participants with a steady partner compared to participants without a partner.

This hypothesis was confirmed for both sexes and with respect to all three measures of attractiveness (Table 3).

Hypothesis 1.4: Physical attractiveness will be positively correlated to the number of sexual partners for whom the participant acted as an extra-pair partner.

Pair-bonding species are known to engage in extra-pair copulations (humans: Broude & Greene, 1976; hominoid primates: Reichard, 1995; birds: Birkhead & Møller, 1995). For males, this is only to be expected because the number of mates is critical to male mating success. For females, however, it is more difficult to explain how reproductive success should benefit from copulating with partners other than their social partner. Recent evidence on humans and other vertebrates is consistent with the idea that females gain a genic fitness advantage when their extra-pair partner is of superior genic quality relative to the social partner (Potts et al., 1991; Gangestad & Thornhill, 1997a; Johnsen et al., 2000). It follows that if physical attractive traits signal underlying genic quality, then highly attractive individuals should tend to be preferred as extra-pair copulation partners. These hypotheses are, however, not mutually exclusive, and this study is not designed to differentiate between the two. Gangestad and Thornhill (1997a) carried out the first test of this hypothesis in humans and found it supported, but only for men's extra-pair mating success as the theory of sex-specific mating strategies predicts. Such a sex difference is to be expected when one considers sex-specific mating strategies[23].

In men, this hypothesis was confirmed with respect to facial and self-rated attractiveness (Table 3). In women, however, none of the three measures of attractiveness predicted the number of paired sex partners (Table 3). The fact that the objective measures of attractiveness are better predictors for extra-pair mating success in men than in women is consistent with the idea that women, as the choosier sex, should engage in extra-pair copulations only when the extra-pair partner is of particularly high attractiveness (Jennions & Petrie, 2000).

Hypothesis 1.5: Physical attractiveness will be positively correlated to the Sociosexual Orientation Inventory.

The Sociosexual Orientation Inventory (SOI) by Simpson and Gangestad (1991; 1992) is a personality scale that includes both behavioral and attitudinal measures. Sociosexual orientation, or sociosexuality, refers to individual differences in willingness to engage in sexual relations without closeness, commitment, and other indicators of emotional bonding. Individuals who have demonstrated an unrestricted sociosexual orientation tend to engage in sex in the absence of such indicators, whereas those who have demonstrated a restricted sociosexual orientation typically do not (Gangestad & Simpson, 1990). Simpson and Gangestad (1992) predicted that the SOI should be positively correlated to physical attractiveness, because of the mating opportunities highly attractive people enjoy. These mating opportunities are assumed to affect mating behavior directly and through an adjustment of attitudes to these opportunities that is mediated by attractiveness. Again, considering sex-specific mating strategies one might expect this hypothesis to be supported for men rather than for women. But current evidence does not show such sex difference in the relationship between attractiveness and the SOI (Simpson & Gangestad, 1992).

This hypothesis was confirmed, in tendency, for both sexes (Table 3). Because in men sociosexuality was highly correlated with social desirability (see Appendix, Table 1), the analysis was repeated for all three measures of attractiveness with age and social desirability as control variables. The resulting correlations were $r_p(36) = .09$, $p = .29$; $r_p(40) = .34$, $p = .01$; and $r_p(40) = -.07$, $p = .33$. Table 4 shows the correlations between the single items of the SOI and the three measures of attractiveness.

Table 3. The role of attractiveness in mating behavior.

	women			men		
	facial	self-rated	BMI	facial	self-rated	BMI
age at first sex	-.19	-.15	.14	.10	-.08	-.09
	(105)	(117)	(117)	(80)	(100)	(99)
	.03	.06	.07	.20	.22	.18
number of sex partners	.27	.06[a]	-.05	.11	.29[a]	-.02
	(113)	(125)	(125)	(95)	(118)	(117)
	.002	.25	.29	.14	.001	.40
current pairing status[1]	.27	.18	-.21	.23	.27	-.16
	(112)	(124)	(124)	(97)	(121)	(120)
	.002	.02	.009	.01	.001	.04
extra-pair mating success[2]	.01	.04	-.04	.17	.18	-.04
	(114)	(126)	(126)	(95)	(120)	(119)
	.47	.32	.33	.05	.02	.33
SOI[3]	.13	.00[b]	.06	.24	.19[b]	-.05
	(112)	(124)	(124)	(88)	(107)	(106)
	.08	.49	.28	.01	.02	.30
same evening sex	-.04[c]	-.14[d]	.12[e]	.16[c]	.17[d]	-.14[e]
	(115)	(127)	(127)	(98)	(123)	(122)
	.35	.06	.08	.06	.03	.05

Note. Shown are partial correlation coefficients (controlled for age), degrees of freedom, and one-tailed *p*-values. – The definition of sex excluded sex with prostitutes and coercive sex.

1 Unpaired subjects were coded with 0, paired subjects with 1.

2 Number of sex partners who were mated at the time the subject had sex with them.

3 Sociosexual Orientation Inventory (Simpson & Gangestad, 1991).

a to e Fisher's *r* to *z* transformation and test for difference of coefficients between the sexes: a $p = .03$; b $p = .07$; c $p = .07$; d $p = .007$; e $p = .02$.

Hypothesis 1.6: Physical attractiveness will be positively correlated to the readiness to have sex with an attractive person one has only known for an evening.

One component of promiscuity is how quickly a person engages in sexual relations with a new acquaintance. The reasons why attractiveness should promote this aspect of promiscuity are the same as for sociosexuality.

This hypothesis was supported for men, but not for women (Table 3). In men, all three measures of attractiveness were at least marginally significantly correlated in the predicted direction. The seeming sex difference in the readiness for same evening sex is noteworthy, because sexual selection theory implies that males in particular should allocate their sexual effort according to their mate value.

Table 4. Correlations between the items of the SOI and the three measures of attractiveness in women and men.

SOI[1] items	women			men		
	facial	self-rated	BMI	facial	self-rated	BMI
number of sex partners in past year	.23	.19	-.03	.20	.27	-.11
	(97)	(127)	(127)	(83)	(122)	(121)
	.01	.02	.38	.03	.001	.11
number of partners with whom … only one sexual encounter	.17	.25	.06	.12	.17	.03
	(96)	(125)	(125)	(82)	(119)	(118)
	.05	.002	.26	.13	.03	.37
estimated number of sex partners in the next five years	.09	.02	.03	.15	.15	-.08
	(97)	(126)	(126)	(78)	(114)	(113)
	.18	.40	.36	.09	.05	.21
“Sex without love is okay.”	.08[a]	-.01	.02	.30[a]	.13	-.06
	(97)	(127)	(127)	(83)	(123)	(122)
	.21	.46	.41	.003	.07	.26
„I can imagine having sex with many partners.“	.12	-.08	.07	.19	.08	-.05
	(97)	(127)	(127)	(83)	(123)	(122)
	.11	.18	.22	.04	.17	.30
„I have to feel close to the person ….“ (reverse coded)	.13	.10	.02	.00	.05	-.02
	(97)	(127)	(127)	(83)	(123)	(122)
	.10	.12	.39	.50	.29	.41
frequency of extra-pair sex fantasies	-.02[b]	-.00	.08	.22[b]	.15	.08
	(97)	(126)	(126)	(79)	(116)	(115)
	.41	.49	.19	.02	.05	.21

Note. Shown are partial correlation coefficients (controlled for age), degrees of freedom, and one-tailed *p*-values. – The definition of sex excluded sex with prostitutes and coercive sex.

a, b Fisher’s *r* to *z* transformation and test for difference of coefficients between the sexes: a $p = .07$; b $p = .06$.

1 Sociosexual Orientation Inventory (Simpson & Gangestad, 1991).

b) The role of attractiveness in romantic relationships

Hypothesis 1.7: Physical attractiveness will be positively correlated to having been unfaithful.

This may be because a) highly attractive people are exposed to a larger number of opportunities for extra-pair copulations or b) highly attractive people are more strongly motivated to seek extra-pair copulations, because due to imperfect assortative mating (Vandenberg, 1972; Grammer, 1995; Alvarez, 2004) they are more likely to be of higher mate value than their partner. Gangestad and Thornhill (1997a) found that men's, but not women's, numbers of extra-pair partners were positively correlated with their facial attractiveness.

The hypothesis was confirmed, at least in tendency, with respect to facial and self-rated attractiveness. The BMI did not predict men's nor women's infidelity (Table 5).

Hypothesis 1.8: Physical attractiveness will be related to the duration of the current romantic relationship.

This hypothesis may apply particularly to men, because they are predicted to use their attractiveness to achieve short-term mating goals. That is, although highly attractive men easily attract a female partner, they should also be more inclined to leave them in favor of other women. Highly attractive people of both sexes should also be exposed to more mating opportunities than less attractive people, so that for them breaking up with a partner would be associated with smaller opportunity costs than for less attractive people.

This hypothesis was confirmed for both sexes (Table 5). However, a graphical analysis of the data revealed an outlier in the female sample. Repeating the analysis under exclusion of this outlier yielded slightly weaker correlations with facial attractiveness and self-rated attractiveness (Table 5, note 2.).

Table 5. The role of attractiveness in romantic relationships.

	women			men		
	facial	self-rated	BMI	facial	self-rated	BMI
ever been unfaithful?[1]	.25 (111) .004	.15 (123) .05	-.04 (123) .32	.20 (94) .03	.19 (118) .02	-.05 (117) .28
duration of current partnership[2]	-.27 (80) .006	-.14 (90) .09	.05 (90) .30	-.20 (53) .07	-.24 (63) .03	.20 (62) .05
partnership asymmetry[3]	-.10 81 .19	.02 91 .41	-.09 91 .19	.11 53 .22	.16 63 .11	.08 62 .28
initiator of breakup[4]	-.10 96 .15	.03[a] 106 .36	-.12 106 .12	-.15 81 .08	-.23[a] 102 .01	.02 101 .42

Note. Shown are partial correlation coefficients (controlled for age), degrees of freedom, and one-tailed *p*-values.

1 Coded as 0 *never* and 1 *at least once*.

2 After the exclusion of an outlier the correlations for men were: $r_p(79) = -.17$, $p = .07$; $r_p(89) = -.09$, $p = .19$; and $r_p(89) = -.05$, $p = .33$.

3 Shown are the correlations with the original 7-point scale for partnership asymmetry, in which low values mean that the subject is more in love with the partner than vice versa and high values mean that the partner is more in love with the subject than vice versa. In women, the correlation with facial attractiveness was repeated with a quadratic contrast: subjects whose partnerships are balanced are contrasted with the two unbalanced groups, coded as 2 versus -1, -1. This correlation yielded $r_p(81) = .17$, $p = .07$. In men, the correlation with facial attractiveness was repeated with a two-group contrast: subject is more strongly or equally attached versus partner is more strongly attached, coded as 0 and 1, respectively. This correlation yielded $r_p(53) = .26$, $p = .03$.

4 Shown are the correlations with the original 7-point scale for break-up initiation. In women, the correlation with facial attractiveness was repeated with a quadratic contrast: subjects who broke up with their partner consensually are contrasted with the two other groups, coded as -2 versus 1, 1. This correlation yielded $r_p(96) = .26$, $p = .005$. In men, the correlation with facial attractiveness was repeated with a two-group contrast: break-up was predominantly initiated by subject versus the combined two other categories, coded as 0, 1. This correlation yielded $r_p(81) = -.17$, $p = .06$.

a Fisher's *r* to *z* transformation and test for difference of coefficients between the sexes: $p = .03$.

Hypothesis 1.9: Attractiveness will be related to partnership asymmetry such that highly attractive participants will tend to feel less attached to their partner than their partner feels towards them.

Although there is a tendency for assortative mating with respect to attractiveness (Vandenberg, 1972; Grammer, 1995; Alvarez, 2004), assortative mating is not always perfect. That is, a certain proportion of highly attractive people will be mated to relatively less attractive partners. The resulting imbalance in relative mate value may lead to an equivalent imbalance in the relative level of attachment between the partners in which the more attractive partner feels less attached to the partner than vice versa. Accordingly, Critelli and Waid (1980) found that men and women in dating relationships who described their partner as more attractive than themselves also tended to profess greater love for and submissiveness to their partners than did men and women who described their partners as less attractive than themselves.

This hypothesis was confirmed, in tendency, only for men. In women, none of the three measures of attractiveness correlated meaningfully with partnership asymmetry (Table 5). In men, however, facial and self-rated attractiveness was correlated with partnership asymmetry in the predicted direction (Table 5).

After these tests with the assumption of linearity, the data from all three measures of attractiveness were graphically checked for possible non-linear relationships with partnership asymmetry. In Figure 6, the facial attractiveness of both sexes is plotted over the trichotomized variable “partnership asymmetry”. In women, the plotted data indicate a quadratic relationship (Figure 6). It would appear that women living in asymmetric relationships are of average attractiveness, but women in perfectly balanced relationships are the most attractive group – significantly more attractive than average. Indeed, if the three categories are coded as a quadratic contrast (-1, 2, -1) and correlated with female facial attractiveness, the coefficient becomes slightly larger than in the linear correlation and close to significance (Table 5). In men, too, it would appear that there is a non-linear relationship between facial attractiveness and the three categories. When the category "partner is more strongly attached" was contrasted with the combined two other categories the difference became more pronounced and significant (Table 5).

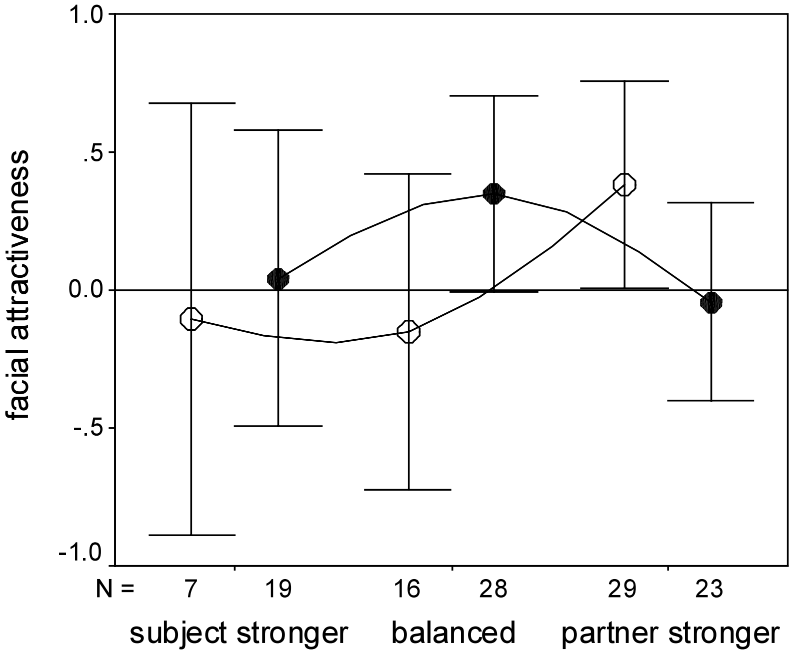

Figure 6. Facial attractiveness (z-values) and partnership asymmetry (trichotomized). – Shown are means and 95%-confidence intervals. Open dots indicate men, filled dots indicate women. The numbers below the categories indicate the number of subjects in each group.

In summary, the hypothesis was partly confirmed for men, but not for women. Future replications will have to show whether the quadratic effects can be repeated and deserve further investigation. It should be noted that because the partner's attractiveness is not known, the approach used here bears a relatively high risk of committing a Type II error (that is, a risk of failing to find an effect where there really is one) and that any positive findings will likely underestimate the true effect size.

Hypothesis 1.10: Participants who initiated the break-up of the last relationship will tend to be more attractive than participants whose partner was the initiator of the last relationship.

This hypothesis follows the same logic as the previous one. When there is an imbalance in mate value in a couple, the more attractive one is more likely to initiate break-up than his or her partner (Bechinie, 1998).

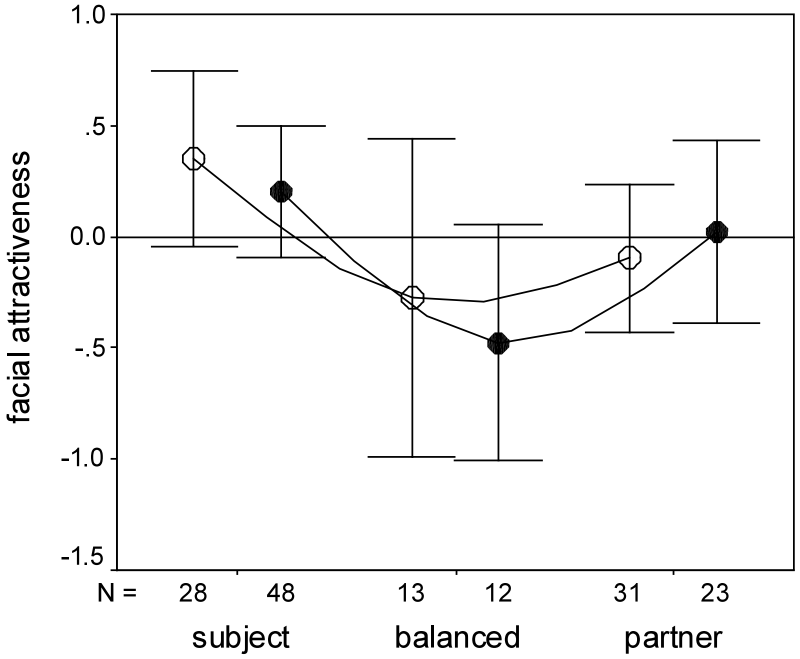

Figure 7. Facial attractiveness (z-values) and initiator of break-up of last relationship (trichotomized). – Shown are means and 95%-confidence intervals. Open dots indicate men, filled dots indicate women. The numbers below the categories indicate the number of subjects in each group.

When the original 7-point scale of the break-up question was correlated with the three measures of attractiveness, the hypothesis was supported, in tendency, for men with respect to facial and self-rated attractiveness. In women, facial attractiveness correlated negatively with initiation of break-up, as predicted, but the correlation with the BMI was opposite to prediction (Table 5). In men, however, facial and self-rated attractiveness were correlated with partnership asymmetry in the predicted direction (Table 5).

After these tests with the assumption of linearity, the data from all three measures of attractiveness were graphically checked for possible non-linear relationships with initiation of break-up. In Figure 7, the facial attractiveness of both sexes is plotted over the trichotomized variable “initiator of break-up”. It appears that in women there is a non-linear relationship between facial attractiveness and the three categories in which women who had broken up consensually were of lowest facial attractiveness whereas the other two groups were equally attractive. When the category “consensual break-up” was contrasted with the combined two other categories the correlation became stronger and significant for women (Table 5).

In summary, the hypothesis was confirmed for men, but not for women. As in the case of partnership asymmetry, the partner’s attractiveness is not known, so that the approach used to test the break-up hypothesis bears a relatively high risk of committing a Type II error and that any positive findings will likely underestimate the true effect size.

Discussion of Part I:

In Part I, it was generally found that, as predicted, the three measures of physical attractiveness were 1. positively correlated to measures of mating success and 2. negatively correlated with measures of exclusivity and stability of romantic relationships in both men and women. The association between attractiveness and mating success was most consistent with respect to pairing status. In both men and women, all three measures of attractiveness were significantly correlated and with similar effect sizes: Participants with a partner tended to be more attractive than participants without partner. Pairing status as a component of mating success is important in the theoretical context of this study because the likelihood of conception increases with the duration of a sexual partnership (Wood, 1994; Linton et al., 2001). Self-rated attractiveness was more often a significant predictor of mating success for men than for women. It was correlated to only one measure of mating success in women (pairing status), but to five of the altogether six measures in men. Extra-pair mating success was positively related to facial attractiveness, but only for men, implying that women, being the choosier sex in shortterm-mating contexts (Buss & Schmitt, 1993; Buss, 2003), tend to have sex with paired men only when they are particularly attractive.

There was also evidence in support of the hypothesis that attractiveness has a disruptive impact on romantic relationships. First, compared to their less attractive counterparts highly attractive participants tended to be less faithful. It must be noted, however, that this effect may be explained solely by the fact that more attractive individuals are more likely to have a partner, so that this fact alone may give them more opportunities to be unfaithful than less attractive individuals. Second, the duration of the current relationship tended to be negatively correlated with attractiveness. Considered together with the finding that paired participants tended to be more attractive than unpaired ones, this suggests that highly attractive people change partners at a higher rate than less attractive people. Less attractive people on the other hand find it somewhat more difficult to find a partner, but tend to have relationships that last longer than those of their more attractive counterparts do. Third, there was some evidence that compared to less attractive men, highly attractive men 1. are more likely to have initiated the break-up of the previous relationship and 2. to see themselves less attached to their partner than their partner feels attached to them. However, among women it was found that those participants who perceived the initiation of the last break-up as balanced between the partners tended to be *less* attractive than women who reported that the break-up was initiated by one of the couple. On the other hand, women who perceived their current relationship relationship as balanced between the partners, tended to be facially *more* attractive than women who perceived an imbalance towards either side. It may be speculated that highly attractive women use the power associated with their attractiveness to create stable relationships, whereas highly attractive men use their mate value to create relationships in which they have the power to opt for a change of partners. From the perspective of current evolutionary theory (Trivers, 1972), both strategies would be in the respective reproductive interest of the sexes. Future studies must show whether the seeming sex differences found here are repeatable before these speculations deserve further scrutiny.

The bodymass index (BMI) is much less studied than facial attractiveness, both as a component of overall physical attractiveness (Rikowski & Grammer, 1999; Thornhill & Grammer, 1999; Tovée et al., 1999; Maisey et al., 1999; Kurzban & Weeden, 2005) and with respect to its sexual consequences (Halpern et al., 1999; Hume & Montgomerie, 2001; Franzen & Hartmann, 2001). Compared to the similarly objective but more complex trait of facial attractiveness, the BMI yielded fewer significant results. Only paring status (both sexes) and the duration of the current relationship (only in men) were significantly correlated. This may be because the BMI is a less important component of overall attractiveness or because of low variability in the BMI data. The distribution of the BMI is highly skewed towards the lower, more attractive group so that individuals with high BMI will tend to be underrepresented in samples of limited size. Nevertheless, the result that BMI was negatively correlated to the likelihood of currently having a steady partner corresponds to the study by Halpern et al. (1999) who found that the amount of body fat in adolescent girls was negatively related to the likelihood of dating. The direction of causation underlying the positive correlation between male BMI and the duration of the relationship cannot be determined with certainty. Perhaps, men gain weight as a consequence of a lasting relationship. A study from Poland (Lipowicz et al., 2002) found that married men and women had higher BMIs compared to unmarried men and women of the same age. However, since in this study male and female facial attractiveness were similarly related to the duration of the current relationship, it seems more plausible that overall attractiveness causes partnerships to break up sooner.

Based on current theory of mating strategies (Trivers, 1972), one would predict sex differences for some of the correlations between attractiveness and measures of mating success. Compared to female reproductive success, male reproductive success is much more limited by the number of sex partners than by their genic quality. One would thus expect male physical attractiveness to translate into larger numbers of sex partners. On the other hand, women may use their attractiveness to obtain partners of particularly high quality in terms of attractiveness, devotion, resources, etc. It is thus possible that female attractiveness is not or is less strongly correlated with quantitative measures of mating success. However, the pattern of correlation coefficients displayed in Table 3 is not entirely consistent with this theory. On the one hand, age at first sex was negatively correlated with attractiveness in women but not in men. In addition, the correlation between number of sex partners and the most objective and complex measure of attractiveness, facial attractiveness, was higher in women than in men. The reverse patterns would have been implied by theory. On the other hand, consistent with the theory of sex-specific mating strategies, extra-pair mating success depended on attractiveness only in men, but not in women (Table 3). This result suggests that paired women have particularly high attractiveness standards for extra-pair partners, and may have extra-pair copulations only with partners who are at least as attractive as their own partner. If future studies should confirm that facial attractiveness signals genic quality, then female preferences for extra-pair partners may be ultimately designed to endow their offspring with the best available genes.

However, does sexual selection theory necessarily predict that the correlation between attractiveness and mating success is stronger in men than in women? Maybe this is not so. The interpretation of the results is limited by the fact that the results are based on outcome measures, which permit only limited conclusions as to the underlying social processes. It is possible that the correlation between attractiveness and mating success in men is largely a consequence of female mate choice, whereas in women it is a consequence of men's strong sexual interest, which may rise disproportionately with women's attractiveness. In other words, the number of actual sex partners must be considered in relation to the number of sexual opportunities offered by individuals of the opposite sex. From this perspective, it may be that highly attractive women are intrinsically still less promiscuous than less attractive women are[24].

In conclusion, Part I contributes to a still small number of studies addressing the relationship between attractiveness and measures of mating success or promiscuity (references in Langlois et al., 2000; Hughes & Gallup, 2003; Pashos & Niemitz, 2003; Rhodes et al., 2005). Overall, the predictions were met, but the results varied according to which measures of attractiveness and mating behavior were used.

Results of Part II: Promiscuity, attractiveness, and willingness to become a parent

a) Bivariate analyses

Hypothesis 2.1: Promiscuity will be positively correlated with the tendency to abort.

Promiscuity, measured as the lifetime sex partners, was positively correlated with the tendency to abort in women, but the same correlation was very low and not significant in men (Table 6).

The two other measures of promiscuity, the SOI and same evening sex, were both positively related to the tendency to abort in both women and men (Table 6). Table 7 shows the correlations between the seven items of the SOI and the tendency to abort.

Table 6. Correlations between measures of promiscuity and the tendency to abort in women and men.

measures of promiscuity	women	men
number of sex partners[a]	.27 (105) .002	.09 (100) .19
SOI[1]	.31 (106) .001	.34 (91) <.001
same evening sex	.17 (107) .04	.18 (105) .03

Note. Shown are partial correlation coefficients (controlled for age), degrees of freedom, and one-tailed *p*-values.

a Fisher's *r* to *z* transformation and test for difference of coefficients between the sexes: $p = .09$.

1 Sociosexual Orientation Inventory (Simpson & Gangestad, 1991).

Table 7. Correlations between the items of the SOI and the tendency to abort in women and men.

SOI[1] items	women	men
number of sex partners in past year	.09 (107) .18	.15 (104) .07
number of partners with whom participant had only one sexual encounter	.17 (106) .04	.01 (101) .46
estimated number of sex partners in the next five years	.18 (107) .03	.23 (97) .01
“Sex without love is okay.”	.28 (107) .002	.26 (105) .004
„I can imagine having sex with many partners.“ [a]	.30 (107) .001	-.16 (105) .05
„I have to feel close to the person I have sex with.“ (reverse coded)	.16 (107) .04	.18 (105) .03
How often do you fantasize about having sex with someone else than your partner?	.19 (107) .03	.37 (99) < .001

Note. Shown are partial correlation coefficients (controlled for age), degrees of freedom, and one-tailed p-values.

[a] Fisher’s r to z transformation and test for difference of coefficients between the sexes: $p < .001$.

[1] Sociosexual Orientation Inventory (Simpson & Gangestad, 1991).

Hypothesis 2.2: Physical attractiveness will be positively correlated with the tendency to abort.

With respect to expert-rated facial attractiveness, this hypothesis was confirmed for women (Table 8). I consider now some potentially confounding factors. Earlier it was found that the tendency to abort was lower in women who had no partner compared to women who had a partner, but did not live with him. On the other hand, paired women were more facially attractive compared to unpaired ones. It may therefore be possible that the positive correlation between attractiveness and abortion tendency is caused by differences between women of different pairing status. To test this hypothesis, the analysis was repeated, now restricted to women who were either unpaired or did not live with their partner. In this subsample of women, the partial correlation between facial attractiveness and abortion tendency was $r_p(75) = .30$, $p = .004$. When I added mating status as a control variable, the size of the correlation coefficient was only slightly smaller, $r_p(74) = .24$, $p = .02$. Finally, I examined the whole sample of women for a possible social desirability bias, but found no evidence for this, $r_p(49) = .28$, $p = .02$. I conclude that the correlation between facial attractiveness and the tendency to abort is not substantially confounded by the variables considered above.

In men, too, a positive correlation between facial attractiveness and the tendency to opt for abortion was found (Table 8). As in the analysis of women, confounding factors have to be considered. Restricting the analysis to men who do not live with a partner, the effect size is almost the same, $r_p(67) = .22$, $p = .03$, and adding mating status as a control variable had little influence, $r_p(66) = .19$, $p = .06$. I also did a partial correlation that controlled for social desirability. The resulting effect size was lower in this subsample, $r_p(29) = .11$, $p = .28$. Note, however, that the size of the sample for which the necessary variables are available is particularly small in this analysis, so that the estimation of the correlation coefficient may be highly unreliable.

Self-rated physical attractiveness was not correlated with the tendency to abort for either sex (Table 8), indicating that subjects were not consciously opting for abortion, *because* they perceived themselves to be highly attractive.

Table 8. Correlations between measures of physical attractiveness and the tendency to abort in women and men.

measure of attractiveness	women	men
facial	.28 (96) .002	.21 (83) .03
self-rated	.09 (107) .19	.01 (105) .45
BMI	-.13 (107) .09	-.14 (104) .08

Note. Shown are partial correlation coefficients (controlled for age), degrees of freedom, and one-tailed *p*-values.

The third measure of physical attractiveness was the BMI. As predicted, in both men and women there was a negative, though small, correlation between the BMI and the tendency to abort (Table 8).

In summary then, the hypothesis that highly attractive participants would show a higher tendency to abort than less attractive ones was supported – not only for women, but also for men.

Hypothesis 2.3 Subjects´ tendency to abort will be negatively related to their fondness for children.

As predicted, the FCS was negatively related to the tendency to abort in both women, $r_p(107) = -.31$, $p < .001$, and men, $r_p(104) = -.27$, $p = .002$. Because the FCS was positively correlated with social desirability in both men and women (see Appendix, Table 3), the analysis was repeated with social desirability as a control variable. For women, the correlation between tendency to abort and the childcare scale remained nearly unchanged, $r_p(53) = -.29$, $p = .02$, and for men it was lower, but still in the predicted direction, $r_p(36) = -.15$, $p = .18$.[25]

b) Multiple regression analysis

In the preceeding correlational analyses, three major predictors of the tendency to abort were identified: promiscuity, attractiveness, and fondness for children[26]. Here I will subject these variables to a simultaneous analysis in a multiple regression[27]. The purpose of this analysis is threefold. First, the standardized regression coefficients of the three variables can be compared with each other to draw preliminary conclusions about the variables′ relative significance. Second, the analysis tested the interaction hypothesis that individuals who are both highly attractive and highly promiscuous will show the highest tendency to abort. Third, it serves to determine in how far the effect of attractiveness on the tendency to abort is mediated by promiscuity (Baron & Kenny, 1986).

Table 9. Intercorrelations between the three predictors of the tendency to abort: SOI, facial attractiveness, FCS, and age for the subsamples entering the multiple regression analysis.

	1	2	3	4	5
1. tendency to abort	-	.35 < .001	.30 .001	-.30 .001	.02 .41
2. SOI[1]	.47 < .001	-	.17 .04	-.23 .01	.04 .33
3. facial attractiveness	.23 .02	.31 .003	-	.01 .47	-.11 .15
4. FCS[2]	-.28 .007	-.02 .44	.03 .39	-	-.06 .28
5. age	-.24 .02	-.01 .47	-.10 .18	-.03 .42	-

Note. Shown are Pearson correlation coefficients and one-tailed *p*-values. – Cells above the diagonal show results for women ($n = 98$); those below the diagonal show results for men ($n = 77$).
1 Sociosexual Orientation Inventory (Simpson & Gangestad, 1991).
2 Fondness for Children Scale.

First, I ran a multiple regression in which SOI, facial attractiveness, the FCS, and age were simultaneously entered as independent variables. The bivariate correlations for all variables involved in the analysis are shown in Table 9, and the results of the regression analysis are shown in Table 10. Apart from men's facial attractiveness, all predictors that were significant at the bivariate level remained significant in the multiple regressions. This means that they all contribute independently to explaining the variance in the tendency to abort.

Table 10. Multiple regression analyses. Promiscuity, facial attractiveness, fondness for children, and age as predictors of the tendency to abort.

a) women[a]	β	t	p[1]
constant	-	3.27	.008
SOI[2]	.25	2.6	.009
facial attractiveness	.26	2.79	.006
FCS[3]	-.25	-2.63	.01
age	.02	.24	.81
b) men[b]			
constant	-	5.23	< .001
SOI[2]	.43	4.34	< .001
facial attractiveness	.09	.85	.40
FCS[3]	-.28	-2.93	.005
age	-.23	-2.46	.02

Note. Independent variables were entered simultaneously.
a corrected $R^2 = .21$, $df = 97$, $F = 7.36$, p(two-tailed) < .001.
b corrected $R^2 = .32$, $df = 77$, $F = 9.86$, p(two-tailed) < .001.
1 two-tailed.
2 Sociosexual Orientation Index.
3 Fondness for children Scale.

Next, I looked for a possible interaction effect between the SOI and facial attractiveness. The expectation here was that individuals who are both high on promiscuity and attractiveness have a disproportionately higher tendency to abort compared to individuals who are high on only either variable. An interaction term was calculated as the product of the *z*-standardized SOI and facial attractiveness data. Then, a hierarchic multiple regression was run in which SOI and facial attractiveness were entered in step one and the interaction term was added in step two. However, no significant change in the variance explained was found for either women, $p = .34$, or men, $p = .63$.

Finally, I conducted a mediational analysis. The multiple regression analysis (Table 10) indicated that in men, the effect of facial attractiveness on the tendency to abort might be mediated by promiscuity. The necessary preconditions for a mediational analysis were met with the finding that 1. the predictor (facial attractiveness) was correlated with the hypothesized mediator (promiscuity), 2. that the latter was correlated with the criterion (the tendency to abort) and 3. that the predictor was correlated with the criterion (Baron & Kenny, 1986, see Table 9). Mediation would be established if it were found that the relation between the predictor and the criterion were eliminated or significantly reduced when the criterion was regressed simultaneously on the predictor and the mediator. Consequently, the next step in the mediational analysis was to regress SOI and facial attractiveness simultaneously on the tendency to abort. If it were found that the SOI suppresses the effect of facial attractiveness on the tendency to abort relative to the bivariate correlation between facial attractiveness and the tendency to abort, it could be concluded that the SOI is a significant mediator of the effect of attractiveness on the tendency to abort.

For women, in a multiple regression including the SOI and facial attractiveness, there was no evidence for a mediational effect of the SOI. Both SOI and facial attractiveness remained significant predictors, and the β–weights were similar to the bivariate correlation coefficients, SOI: $\beta = .31$, $p = .001$; facial attractiveness: $\beta = .24$, $p = .01$. For men, however, there was seeming evidence for mediation, SOI: $\beta = .44$, $p < .001$; facial attractiveness: $\beta = .10$, $p = .36$. To test whether the effect is significant, the bivariate coefficient of the correlation between facial attractiveness and tendency to abort (.23, see Table 9) has to be compared to the β–weight of the SOI in the multiple regression by means of Fisher's r to z transformation and test for difference of coefficients. However, it was found that the difference between the two coefficients was not significant, $p = .21$.

Discussion of Part II:

The second part of this study tested some hypotheses relating to childless women's and men's willingness to become a parent as measured by the tendency to abort. It was predicted that the tendency to abort an unintended pregnancy would be positively correlated with promiscuity and attractiveness and negatively correlated with fondness for children. These hypotheses were tested to reach two research goals. The first research goal was to find evidence for determinants of the decision to abort that are difficult to assess in face-to-face interviews. The second research goal was to contribute to an evolutionary malfunctional analysis (see introduction of Part II) of modern humans´ contraceptive behavior. Generally, the hypotheses were supported by the results.

The current study is one of very few studies to investigate male abortion attitudes (Betzig & Lombardo, 1991; Walzer, 1994; Holmberg & Wahlberg, 2000). Here, it was generally found that that the predictors of abortion attitudes were the same and of similar magnitude for women and men. In addition, there was no sex difference in the tendency to abort. This is surprising as far as one might have expected men to be less emotionally affected by a dilemma that would affect them only indirectly through their partner. It also means that the tendency to abort as a measure for the willingness to become a parent can be fruitfully used to study men as well as women, at least in modern Germany.

Promiscuity and the tendency to abort

As predicted, promiscuity was positively correlated with the tendency to abort in both sexes. For women, comparable findings have been reported in earlier studies (Niemelä et al., 1981; Granberg, 1982; Costa et al., 1987; Helferich and Küppers-Chinnow, 1996). For example, Niemelä et al., (2003) found that the likelihood of repeated abortion was positively correlated with the number of past romantic relationships. Helferich and

Küppers-Chinnow (1996) reported that first-time aborters were characterized by an unwillingness to commit to the current partner. Furthermore, one study of intentionally childless couples in Germany found that these were characterized by a larger number of previous partners, by relatively relaxed attitudes towards faithfulness, and by viewing sexuality as something hedonic rather than emotional (Rost & Schneider, 1996). All these findings are consistent with the hypothesis that highly promiscuous individuals have a stronger tendency to abort because they anticipate a future conflict between a hedonic desire to mate with multiple partners on the one hand and parenting on the other (introduction of Part II). However, alternative interpretations have to be considered. First, it has been proposed that the correlation between promiscuity and (attitudes towards) abortion is simply revealing of generally permissive attitudes (Niemelä et al., 1981; Granberg, 1982; Costa et al., 1987). This is different from the hypothesis offered in the current study that abortion is not seen as being caused by promiscuity. Here both promiscuity and positive attitudes towards abortion were shown to represent two independent expressions of a general permissiveness. Unfortunately, neither the current study nor any of the above-mentioned studies were designed to differentiate between the two interpretations. Possibly, promiscuity really *does* cause women and men to opt for abortion, but not via a hedonic preference of mating to parenting as was assumed here. Instead, highly promiscuous individuals may be unable to become emotionally attached to a partner strongly enough to form long-lasting relationships (e.g., Simpson, 1990). Consequently, they may anticipate that they will not be able to live out the parental role as required by their own or by prevailing standards. Again, the current data do not allow for a critical test here. However, this alternative interpretation, if true, would only constitute yet another maladaptive case of anticipation that can become effective only in times of effective contraception. The results of one study imply that the significance of attachment style as a cause of promiscuity may differ between women and men. Gangestad and Thornhill, (1997a) found that attachment style predicted the number of partners for whom participants acted as extra-pair mating only in women, but not in men.

Physical attractiveness and the tendency to abort

An important result of this study was that both women and men of high physical attractiveness showed a higher tendency to abort than their less attractive counterparts did. This was true for facial attractiveness as well as for the BMI, though not significantly so when each sex was considered separately. In contrast, self-rated attractiveness was not correlated with the tendency to abort, indicating that participants did not base their rating on an awareness of their level of attractiveness. Instead, it seems that participants´ attractiveness becomes relevant to their tendency to abort via a self-concept of social opportunity, which builds up over time through social feedback. If this interpretation is correct, it should apply to determinants of social opportunity other than attractiveness as well. A plausible candidate is intelligence (Jensen, 1998). Indeed, intelligence is a predictor of educational success (Jensen, 1998; Rowe et al., 1999; Deary et al., 2004) and is currently negatively correlated with fertility in Western industrialized countries (Vining, 1986; Lynn, 1996; Rodgers et al., 2000). Furthermore, there is some evidence that women’s level of education is positively correlated with abortion rates (Krishnan & Krotki, 1999). Like high levels of promiscuity and attractiveness, a high level of intelligence may create perceived opportunity conflicts between future educational or vocational success and future parenting. That this latter opportunity conflict really exists and constitutes a major cause of the recent fertility decline is generally accepted, at least for women (Shaumann & Xie, 1996; Kemkes-Grottenthaler, 2003; Kohler and Rodgers, 2003). Hence, the evidence for the negative effect of intelligence on fertility corresponds well to the evidence and proposed causal processes related here with respect to promiscuity and attractiveness[28].

However, should one really expect promiscuity and physical attractiveness to have a negative effect on fertility at the population level as the results of this study seem to imply? After all, promiscuity should raise the risk of conception, and so should attractiveness by raising the likelihood of being currently sexually active (Kohler and Rodgers, 2003). Indeed, it is possible that the net effect of promiscuity and attractiveness on fertility is still positive, but the results of the current study imply that both promiscuity and attractiveness may simultaneously have a negative influence on fertility. In other words, there are two opposed processes involved – one adaptive, the other maladaptive – through which promiscuity and attractiveness may influence the age at first child, namely, 1. conception risk and 2. the desire to postpone parenthood because of perceived opportunity conflicts. The relative strength of these processes remains to be determined and will depend much on the effectiveness of the contraceptive methods used, as well as on the opportunity structure of the environment.

In a multiple regression analysis with the tendency to abort as dependent variable, women's facial attractiveness turned out as a significant predictor independent of promiscuity and fondness for children. This implies that highly attractive women experience advantages in social contexts other than mating that they seek to protect by abortion and that were not assessed in this study. Possibly, these women have a higher tendency to abort because they perceive their future career chances as more favorable than their less attractive counterparts do. In male participants, in contrast, prosmicuity reduced the effect of facial attractiveness in a multiple regression analysis, implying that highly attractive men favor abortion mainly because the perceived loss in mating opportunities is largely predicted by their attractiveness. However, a mediational analysis revealed that this conclusion is not supported by statistical criteria.

To my knowledge, attractiveness has not been described as a predictor of abortion attitudes or abortion behavior before. However, one other study claimed to have found a positive correlation between a component of female mate value and induced abortion. In their study of national statistics of England and Wales, Lycett and Dunbar (1999) found that among unmarried women in the age between 16 and 40 years, the age-specific probability of abortion was strongly and positively correlated with women's age-specific probability of future marriage. The authors concluded that with increasing age, women's mate value decreases so that their acceptance of single motherhood rises with the decreasing likelihood to find a long-term partner. However, the risk of falsely inferring causation from correlation is particularly high when the correlated variables are themselves correlated with age, as is the case with age-specific probabilities of abortion and future marriage. In other words, any variables that vary linearly with age classes will necessarily be correlated with each other, making conclusions on causation impossible[29]. This problem was circumvented in the present study by using physical attractiveness as a measure of mate value while controlling for age in all correlations. In this way, it was possible to support the conclusion of Lycett and Dunbar (1999) – unsupported by their data – that women's mate value is positively correlated with their tendency to abort. However, Lycett and Dunbar frame their study – although only implicitely so – within the FMA, implying that the negative correlation between women's mate value and abortion decisions represents an adaptive life-history trade-off. Based on the theory presented in the introduction to this study, this interpretation is not necessarily to be agreed with.

Fondness for children and the tendency to abort

The third general hypothesis of this second part was that the tendency to abort should be negatively correlated with the Fondness for Children Scale (FCS), a scale that measures the liking of and responsiveness to stranger children (Rohde & Hoier, 2001, unpublished). Although it is known that individual women and men differ in their responsiveness to children (Rohde & Hoier, 2001; Maestripieri & Pelka, 2002; Seyfritz et al., 2003; this study), this personality component has, to my knowledge, never been considered before as a predictor of abortion[30]. The finding of a positive correlation between the FCS and the tendency to abort may come as no surprise, but it is important for two reasons. First, it fills an empirical gap within research on the determinants of abortion. When women who had an abortion are asked in open questions for their reasons, they are unlikely to admit to or may not be aware of their low fondness for children playing a role. Hence, a low fondness for children is not listed in two frequently cited large-scale studies on women's reasons to abort (Torres & Forrest, 1988; Bankole et al., 1998). Second, this result was predicted within an evolutionary malfunctional analysis of contraceptive behavior. As explained in the introduction to Part II, fondness for children very likely played no role as a determinant of conception during the greater part of human natural history. However, with the development and widespread use of increasingly effective contraceptives this personality trait is predicted to be of increasing importance to human fertility behavior. This novel significance of the fondness for children as a possible adaptation thus represents a mismatch in the sense outlined above (Introduction of Part II); if one that has a positive effect on reproductive success rather than a negative one. Third, as revealed in the multiple regression analysis, the predictive value of the FCS, as measured by β, was similar to that of promiscuity and facial attractiveness, thereby putting the latter two predictors into scale. If one considers attitudes towards children an important predictor of abortion behavior, as would seem plausible to most, then promiscuity and attractiveness as the maybe less intuitive predictors are to be considered as equally important and as deserving of equal attention in future research. On the other hand, the similarity in effect size of the three measures shows that a liking of children is not paramount to a motivation to reproduce (compare Miller, 1995), as further, unrelated traits play an equally strong role in determining willingness to become a parent.

Implications for research on abortion and fertility behavior

The current study used an abortion scenario to assess women’s (and men’s) tendency to abort an unintended pregnancy. Although the results presented here imply that the scenario is likely to reflect at least qualitatively real abortion decisions (of women), it remains to be shown that this is really the case. If the tendency to abort could be validated by a sufficiently high correlation with real abortion behavior, it would provide a valuable means for studying abortion decisions. First, it can be easily administered to larger samples and circumvents the problems of social desirability (Stöber, 2001) and limited cognitive access to one’s own motives (McClelland et al., 1989). Such limitations are clearly implied in the existing research on women’s reasons to abort. These reasons are generally studied using standardized or open question format. In an oft-cited study from the USA of women who had an abortion (Torres & Forrest, 1988), one of the most common reasons women mentioned was “I can’t afford a baby now.”, implying that women share a minimum financial threshold, above which they are all equally likely to give birth to a child. Of course, a minimum financial standard is needed to raise a child. However, the current finding of a positive correlation between attractiveness and the tendency to abort implies that even above this minimum standard, women do not necessarily decide against abortion. Rather it appears that women may base their abortion decisions on their expected future social mobility and thus future financial gains, which partly depend on their level of attractiveness (Elder, 1969; Udry & Eckland, 1984; Franzen & Hartmann, 2001). Consistent with this view, it has been found in earlier studies that the likelihood of abortion was positively associated with women's level of education (Krishnan & Krotki, 1999) and income (Costa et al., 1987)[31]. But why then are financial reasons named so often by women who had an abortion? Maybe social desirability is the answer. By naming financial reasons, women attribute the abortion decision to external factors, thereby directing the attention away from intrinsic motives, while at the same time signalling concern about the welfare of their future children. Furthermore, the plausibility of a financial shortage as a reason to abort is hard to prove by outsiders and is unlikely to be seriously questioned. Constistent with this view is the finding that couples who have decided to remain childless report that of all possible reasons financial ones are best accepted by the social environment (Faux, 1984; Lang, 1992). However, this explanation should be regarded with reservations, as it requires further investigation.

Another direction for future research is the role individual (and cultural) differences in hedonism may play in the decision (not yet) to become a parent. An important assumption in this part of the study was that adaptations organized as reward systems related to the mating phase should make people wish to postpone parenthood. The desire for multiple sex partners, for example, constitutes such a reward system, whereas attractiveness acts as a moderator determining the frequency and level of expected rewarding social feedbacks. If this logic were generalized, one would predict that in a contracepting world, individual differences in the ability to enjoy hedonic pleasures generally should have an effect on the willingness to become a parent. Hedonism (Kahnemann et al., 1999) is capable of interfering with reproduction because of an evolutionary constraint. Sexual intercourse – the final behavioral act of a longer sequence of behaviors introducing reproduction – is designed as a hedonic reward system (Panksepp, 1998), but the actual sexual act, the merging of sex cells, is not – and cannot be, because germ cells are not part of the soma, but are distinct organisms.

The suggestion that hedonism is opposed to the willingness to become a parent is by no means novel. For example, Boone and Kessler (1999) cite several references dealing with the fertility decline among the elites of the Roman Empire. The Romans saw children as costly and burdensome, and contemporary critiques saw the cause of declining fertility in greed, vanity, desire for material wealth and the habit of indolence. Furthermore, William McDougall, in his book from 1908, concluded that with the rise of human intelligence "egoistic impulses must have tended to suppress the working of the parental instinct", so that continued reproduction could only be ensured by imposing culturally inherited social sanctions (see endnote 27)[32]. Later, in the 1970s, when induced abortion was hotly debated in Germany and other Western countries, hedonic attitudes were proposed as a major cause of declining fertility rates (e.g., Münz & Pelikan, 1978). And recently it has been proposed that a modern "runaway consumption" (Frank, 1999) may be partly responsible for the current fertility decline far below the replacement level (Kaplan et al., 2002; see also Becker, 1983). However, few studies have investigated the role of hedonism at the individual level, although the results of some studies are consistent with the idea that people sometimes forego parenthood for hedonic reasons (Carl et al., 2000; Hobcraft, 1996). The hedonistic interpretation of the current results is further supported by the following post-hoc tests. For purposes not relevant to this study, the questionnaire contained the Zuckerman's Sensation Seeking Scale (Zuckerman et al., 1964). The two items that – by the author's judgement – most directly reflect a hedonistic attitude were from the disinhibition subscale: "I like wild parties." and "At parties I like to get drunk". The hedonism hypothesis of reproductive restraint predicts that the tendency to abort should be positively correlated with hedonism. Indeed, the two hedonism items were positively correlated with the tendency to abort in women, $r_p(107) = .22$, $p = .009$ and $r_p(107) = .18$, $p = .03$, respectively. In men, the coefficients were positive, too, but did not reach significance, $r_p(105) = .12$, $p = .07$ and $r_p(105) = .13$, $p = .10$, respectively. This explorative analysis is encouraging with respect to more focused future tests of the hedonism hypothesis[33].

This part of the study also has implications for research on current population decline. Based on the results of this and previous studies, I propose that the following runaway process may provide a partial explanation for the ever-increasing age at first child and ever-lower numbers of children per woman (Rohde, 2003). Consider the following as given: First, because attractiveness is highly valued (and possibly because it is positively correlated with intelligence; Zebrovitz et al., 2002), highly attractive people tend to be socially more successful in the contexts of mating, vocation (Langlois et al., 2000; Saporta & Halpern, 2002), and social mobility (Elder, 1969; Udry & Eckland, 1984; Franzen & Hartmann, 2001) than less attractive people are. Second, the current study suggests that the more attractive people are, the more they tend to postpone reproduction for hedonic reasons or to ensure upward social mobility (Banks, 1954). Third, humans imitate each other's behavior (McDougall, 1908; Bandura, 1977; Cavalli-Sforza & Feldman, 1981; Rogers, 2003) including fertility behavior (Bongaarts & Watkins, 1996; Kohler, 2000, 2001; Bernardi, 2003, overview in Casterline, 2001). Fourth, humans preferentially imitate the behavior of high status individuals (Veblen, 1899; McDougall, 1908; Cavalli-Sforza & Feldman, 1981; Henrich & Gil-White, 2001; Rogers, 2003). Given these preconditions, a runaway process may be set in motion. The correlation between attractiveness and social success would lead people to adopt the lifestyle of the most attractive individuals in the population. Since this lifestyle is also characterized by postponed parenthood, the average age at birth of the first child would rise in this population. When the next cohort reaches this age, its most attractive individuals will again postpone parenthood a bit longer than the average population does, thereby setting the new standards. After repeated iterations, this process would lead to an ever-increasing age at reproduction and as a consequence to ever-smaller numbers of children per woman. Hence, the effect sizes reported in the results section of Part II may appear small when interpreted as the percentage of explained variance within a static system. However, their potential practical significance as driving factors in the hypothesized dynamic runaway process is anything but small.

General discussion

The current study was divided into two parts. First, in Part I some hypotheses regarding the influence of physical attractiveness on mating behavior and promiscuous attitudes were tested to contribute to a still small number of studies on that topic. The results showed that attractiveness and mating were qualitatively associated with each other as predicted by theory under the assumption of an adaptive linkage between organism and the environment. Second, in Part II I applied the criteria of an evolutionary (mal)functional analysis (Tooby & Cosmides, 1992) that considers the cultural process (Boyd & Richerson, 1985; Richerson & Boyd, 2004) to modern human reproductive decision making. Three hypotheses of maladaptiveness were derived and tested and involved promiscuity, attractiveness, and fondness for children. In this general discussion, I will evaluate the merits and limits of the study as well as some of its implications for the study of human fertility behavior in an evolutionary perspective.

At the center of the argument that modern humans´ fertility behavior is maladaptive lies modern contraception as a maladaptive cultural trait (Introduction of Part II). Its effectiveness and widespread use made the current below-replacement fertility possible. In fact, contraception virtually created the option of deliberate "fertility *decisions*". However, as was argued in the introduction of Part II, the malfunctional analysis of reproductive behavior is not complete with this observation. The contraception routine turns parenthood from being an inevitable consequence of sexual intercourse into the deliberate decision to discontinue this routine or, in the case of an unintended pregnancy, into the deliberate decision to have an abortion. Hence, in an analysis of modern reproductive behavior that includes an evolutionary perspective the following questions must be answered to make the picture complete: What motivational adaptations are involved in the decision (not yet) to become a parent and how are they involved? In particular, what role, if any, do adaptations related to mating effort play in the decision to become a parent? How does the deliberate transition to parenthood differ from the cognitively uncontrolled transition to parenthood? What role do cultural traits play in the decision-making process and what are the motivational roots that drove their cultural evolution?

The current study provides some answers to these questions. It was shown that physical attractiveness, a trait that probably conferred a reproductive advantage in the evolutionary past, still confers a mating advantage in a modern society (Part I). However, in Part II it was predicted and found that promiscuity has a potentially negative effect on the willingness to become a parent – a trait whose effectiveness depends very much on the availability of contraceptives and induced abortion. Similarly, physical attractiveness was positively related to the tendency to abort an imagined unintended pregnancy. Finally, it was found, as predicted, that fondness for children was negatively correlated with the tendency to abort, implying that – like promiscuity and attractiveness – fondness for children plays a historically novel role for fertility decisions, but one that has a *positive* effect on the willingness to become a parent.

The general theme underlying the predictions concerning the effect of promiscuity and attractiveness on the tendency to abort is that of perceived opportunity conflicts between current mating and future parenting. In this, the evolutionary malfunctional analysis of modern fertility behavior converges with the theory and findings of nonevolutionary researchers. For example, perhaps the most famous example of an opportunity conflict as a cause of fertility decline is the one many women face between becoming a mother and pursuing an extended educational or vocational career (Kemkes-Grottenthaler, 2003; Kohler and Rodgers, 2003). Furthermore, Becker (1983) proposed an opportunity conflict between earning money, spending money, and parenting. Because money creates opportunities to consume spare-time luxuries, those who work longer earn more and hence have more opportunities in terms of money – but not in terms of time needed to consume these luxuries. In this situation, the time necessary for rearing children is paradoxically scarcest for wealthier couples, who consequently will tend to have fewer children than less-affluent couples. Further examples for opportunity conflicts have been listed in the section on hedonism (see Discussion of Part II).

Such explanations, although they have long been with us, have not aroused much interest among evolutionary researchers of human fertility behavior. On the one hand, researchers following the "Fitness Maximization Approach" (FMA) would consider them too proximate in nature or regard them as irrelevant rationalizations of an unconsciously fitness-maximizing organism. On the other hand, researchers following the "Adaptation Executer Approach" (AEA), so far, have not shown any interest in explaining human fertility behavior at all. Possibly, since they have expended much effort in rejecting the significance of reproductive success as a relevant measure for testing evolutionary hypotheses (see General introduction), studying fertility behavior in general became taboo to them. However, as I hope to have demonstrated with this study, modern human fertility behavior has more aspects worth studying than just "counting offspring".

For how much of human natural history could the opportunity conflict between current mating desires and future parenting activities have existed? Several authors think that at least for women the anticipation of parturition and parenthood has aroused negative feelings ever since humans became aware of the causal relationship between sex and childbearing (e.g., McDougall, 1908; von Reitzenstein, 1923; Burley, 1979; Hobcraft, 2003). Surely, there are reasons to assume that the perceived opportunity conflict between mating and parenting was not nearly as pervasive and intense as it is today. In the absence of effective contraceptives postponing or forgoing parenthood for hedonic reasons probably was a thinkable, but not a realistic option and thus hardly worth considering. However, the assumption made so far that preliterate human cultures have (had) no sufficiently effective means of contraception is correct only in disregard of infanticide. The most efficient and apparently most widely used means of “contraception” in preliterate hunter-gatherer or horticultural societies is, and probably has always been, the killing of newborn babies by their mothers immediately after parturition (Daly & Wilson, 1984). Van Reitzenstein (1923) reports that in some traditional cultures abortions have been induced because of the couples desire to continue sexual intercourse, because of laziness or because women wanted to avoid the loss of beauty. Considering this case in conjunction with the reported results of this and earlier studies, it appears that the seemingly unrelated behavioral phenomena of infanticide (Daly & Wilson, 1984), postponment of parenthood (this study), induced abortion in yet childless women (Niemelä et al., 1981; Granberg, 1982; Costa et al., 1987; Helferich and Küppers-Chinnow, 1996; this study), and the decision to remain childless (Carl et al., 2000) all share a common hedonic motivational component.

The predictions tested in this study were derived within the “adaptation execution approach” to organisms (Tooby & Cosmides, 1990; 1992), and the results regarding abortion decisions were interpreted as being maladaptive. But are the findings regarding abortion decision really maladaptive or would they also be compatible with models of current fitness maximization? The most important argument against a fitness maximizer interpretation is that it is hard to see why, in the same data set, those individuals who showed all signs of fertility at the level of mating (in terms of promiscuity and attractiveness) should be the ones who would refrain from reproduction at the level of abortion. For example, highly attractive women tended to have their first sexual intercourse earlier than less attractive women did, but at the same time, as a group they showed a stronger tendency to abort, that is, to postpone parenthood. It might be possible to propose a plausible FMA explanation for either finding, but the FMA is incapable of integrating both findings when they appear in the same study. In comparison, then, the AEA is the relatively more potent approach to account for these results. This is not to say that people do not postpone reproduction in the hope to find a maximally attractive mate (e.g., Lycett & Dunbar, 1999). There is some evidence that such a "trade-off" is really taking place. For example, Gould and Paserman (2003) found that single women of all age groups wait longer to get married when faced with a higher local level of male income inequality. However, to conclude that this waiting strategy is currently adaptive (as implied by Lycett & Dunbar, 1999) would be precipitate, because individual compromises cannot automatically count as adaptive life history trade-offs. First, the early onset of reproduction is a component of reproductive success and has been found to be associated with physical attractiveness in nonhuman species (e.g., Møller, 1990). Significantly, in several studies on humans, early onset of reproduction has been identified as the most important component of female reproductive success (Gubhaju, 1983; Borgeroff Mulder, 1989; Low, 1990, 1991; Käär et al., 1996). Second, it appears that in modern humans postponing parenthood is not compensated by a larger number of children. To the contrary, age at first child and completed fertility are negatively correlated, and many economically successful individuals remain childless (see introduction of Part II for references). Third, once again, the waiting game in mating is made possible only by modern contraception, which was identified as maladaptive per se (see Introduction of Part II). In conclusion then, the idea that postponing reproduction maximizes individual fitness returns seems highly implausible. The apparent lack of any nonhuman case of adaptive postponement of reproduction in face of generally favorable conditions suggests that the whole idea is a post hoc response to the special case of modern humans and of the intrinsic problems associated with the FMA.

At the end of this general discussion, I will consider the merits and limits of the current study. First, one obvious limitation of the study is that instead of realized abortion behavior I used an abortion scenario. Even though the tendency to abort had a reasonably good internal validity, it remains unknown whether promiscuity, attractiveness, and fondness for children demonstrably affect real abortion behavior in German students or their partners, respectively. Second, the study is based on a sample that consisted overwhelmingly of university students. Whether the same effects would be found in less-educated groups remains unknown. Third, the cross-sectional perspective taken here puts limits to the interpretation of a postponement of parenthood. All participants included in Part II said that they eventually wanted to have children. In addition, it can be assumed that a large proportion of the sample still childless individuals will finally become parents. However, the data cannot tell us what factors will at what time eventually override the postponing effects of high promiscuity, high attractiveness, and low fondness for children. Therefore, it seems desirable that future studies exchange the cross-sectional perspective of the current study for a developmental, that is, longitudinal perspective.

Among the merits of this study are, I think, the following: First, to my knowledge this is the first explicit application of the evolutionary functional analysis of behavior (Tooby & Cosmides, 1992) to fertility decision making in a contracepting society. Although the analysis is far from complete, I hope to have succeeded in generating a framework for future studies on human fertility behavior that apply the AEA. Second, with the application of the AEA I hope to have argued convincingly that the low fertility rates displayed by post-war human populations are compatible with evolutionary theory, but only if a maladaptive explanation is invoked.

Future research can be expected to identify further adaptations that produce maladaptive behavior in the context of fertility decisions.

Conclusion

In current research on human fertility behavior, there are relatively few studies taking an evolutionary perspective. Of these, virtually all follow the FMA, while I know of none explicitely employing the AEA. One reason for this bias may be that the FMA is methodologically very similar to – or actually represents a variety of – the so-called “rational choice” approach (Becker, 1960; 1981;1983), which currently plays an important role in the study of human populations. Both evolutionary and non-evolutionary rational choice models assume that humans optimize certain outcomes – fitness in the case of the FMA – by rationally considering environmental factors. In this situation, the current study may be seen as one of the first attempts to apply the AEA to human fertility behavior. By strictly following criteria derived from Tooby’s and Cosmides′ (1992) evolutionary functional analysis and by considering culture as a relevant process (Boyd & Richerson, 1985; Richerson & Boyd, 2004), this study characterized contraception (including induced abortion) as a maladaptive cultural trait and predicted and found evidence for maladaptive reproductive decisions. Reproductive success is a highly aggregated measure with potentially many causes, some of which may be adaptive, some maladaptive; some may be positive, some negative, and some neutral predictors. Only the decomposition of reproductive outcome into its potentially manifold proximate determinants will enable us to fully understand human reproductive behavior.

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Summary

Recent advances in the theory of evolution by natural selection have caused a new research impetus in the study of animal behavior, including human behavior, from an evolutionary perspective. Among researchers of human behavior, a controversy developed over what constitutes an evolutionary analysis of behavior. Two major approaches can be distinguished. The first approach, here referred to as the "fitness maximization approach" (FMA), holds that testing evolutionary hypotheses involves predicting differential reproductive success from a rational choice perspective that maximizes genic fitness. The second approach is here called the "adaptation executer approach" (AEA). It holds that reproductive success is of theoretical importance only with respect to the selective forces of the past and to the effect they are assumed to have had on the current design of adaptations. One important difference between the two approaches lies in their implications for the study of maladaptive behavior. Whereas the FMA assumes that behavioral dispositions are acted out adaptively under all environmental conditions, the AEA acknowledges that extreme novel environments may cause mismatches between the environment and organism, which may in turn cause organisms to behave maladaptively.

Contraception behavior has not been subjected to an evolutionary analysis. However, doing so is important for understanding current human reproductive behavior and constitutes a test case for the relative heuristic value of AEA and FMA. In the current study, I argued that contraception is maladaptive and therefore should be studied within the AEA.

Although the study of maladaptive behavior is strongly implied in the principles of the AEA (conceptualized by Tooby & Cosmides, 1992, and referred to as "evolutionary functional analysis"), the published evolutionary studies are almost completely dedicated to identifying adaptive mechanisms and adaptive behavior. In addition, an important theoretical framework for the genesis of maladaptive behavior in humans

has not been widely received by evolutionary researchers. This theory, proposed by Boyd and Richerson (1985), considers the evolutionary causes of human capacity for culture and the interactions between genic and cultural evolution. The authors define culture as "… the transmission from one generation to the next via teaching and imitation, of knowledge, values, and other factors that influence behavior" (Boyd & Richerson, 1985, p. 2). The capacity for culture evolved to increase the adaptability of populations to diverse environments. However, the indiscriminate openness with which cultural traits are adopted also made it possible for maladaptive traits to spread within a population. For example, certain superstitions may be harmful to survival and reproduction. Based on these theoretical considerations, I conclude that for studying maladaptive behavior, the AEA can be usefully applied to animal behavior in general. However, when applied to humans, one must consider culture as the process that will almost always be involved in creating mismatches between current environment and adaptations. I called this extended AEA "evolutionary malfunctional analysis" (after Tooby & Cosmides, 1992) and applied it to contraception behavior.

Contraception behavior arguably qualifies as a maladaptive cultural trait because it has detrimental effects on reproductive success as evidenced by birth rate data from countries with unrestricted access to contraceptives (including abortion). Furthermore, contraception is potentionally maladaptive because it shifts reproductive decision-making from the immediate context of partner choice and sexual intercourse to conscious decision-making based on deliberation. The two major research questions then become 1. why humans enter a contraception routine and 2. why they ever (or never) decide to quit contraception in order to become parents. Answers for the first questions can be partly inferred from the historic record of, for example, the contraception movement. Providing some answers to the second question was one major aim of the current study, which consists of two parts.

In Part I of the study, I looked at the relationship between three measures of physical attractiveness (facial, self-rated, and the bodymass index, BMI) as independent variables and a) various measures of sexual behavior and attitudes (age at first sex, number of sex partners, current mating status, Sociosexual Orientation Inventory, extra-pair mating success) and b) measures of partnership exclusivity and stability (duration of current partnership, extra-pair sex, partnership asymmetry, initiation of break-up) as dependent variables. Part I can be regarded as a self-contained study on the relationship between physical attractiveness and mating behavior, but at the same time, it serves as a contrast to the hypotheses and results of Part II (see below). In Part I, I predicted that a) the three measures of physical attractiveness would be positively correlated with measures of mating success and promiscuity, and b) within romantic relationships attractiveness would have a disruptive effect on the stability and exclusiveness of romantic relationships. These hypotheses assume a generally adaptive link between organism and current environment.

In general, the hypotheses were supported by the data for both women and men. Current mating status was the only measure of mating success that yielded significant correlations with all three measures of attractiveness in both sexes. All other correlations varied by measures of mating success and measure of attractiveness and between the sexes. For example, age at first sex was negatively correlated with attractiveness only in women, but not in men, whereas attractiveness predicted extra-pair mating success and sociosexual orientation only in men. With respect to exclusiveness and stability of relationship, it was found that attractiveness has a negative impact on the duration of relationships and on faithfulness. Furthermore, the more facially attractive men were more likely to indicate that their partner was more in love with them than vice versa. Similarly, the more facially attractive men were, the more likely they had initiated the last break-up. These effects were not found for women.

In Part II, I asked how the measures of promiscuity and attractiveness of Part I and a measure of fondness for children related to the participants´ willingness to become a parent. As a measure of the willingness to become a parent, I assessed the participant's tendency to abort an unintended pregnancy. This measure is the rating on a 5-point scale in response to the question, "What would you prefer to do if you (or your partner) became pregnant today?" The tendency to abort was employed, because, like contraception, abortion is used to postpone parenthood or to limit the number of children. An unexpected pregnancy is often a result of the failure of the contraception routine and forces a woman and her partner to weigh the pros and cons of a transition to parenthood before they decide. The actual criteria for the decision (not) to become a parent may or may not be cognitively accessible to the individuals involved, but should reveal themselves in being correlated with the tendency to abort.

In the introduction to Part II, I argued that the three independent variables promiscuity, attractiveness, and fondness for children reflect individual variability in species-specific adaptations. The following three hypotheses were proposed. First, I predicted that promiscuity would be positively correlated with the tendency to abort. Although promiscuity may have enhanced the reproductive success at least of men, it is difficult to reconcile with family life and thus acts to enhance a perceived opportunity conflict. Second, I predicted that attractiveness would be positively correlated to the tendency to abort. Because attractiveness is a strong determinant of all kinds of social success including vocational success, mating success, and social mobility, individuals of high attractiveness will perceive a stonger opportunity conflict between current social success and future parenting than less attractive individuals. Third, I predicted that fondness for children (measured with a Fondness for Children Scale, FCS), would be negatively correlated to the tendency to abort. While this relationship may seem obvious, it has not previously been considered in abortion research. Fondness for children probably evolved as a sexually differentiated motivational system that prepares immature females for the future task of mothering, but in the evolutionary past is unlikely to have had a positive effect on reproductive success at the level of conception and age at first child.

All three hypotheses were supported by the data for both women and men in partial correlations that controlled for age. Of the three measures of attractiveness, facial attractiveness yielded the strongest correlations, followed by marginally significant correlations with the BMI and very low and nonsignificant correlations with self-rated attractiveness. A multiple regression analysis with promiscuity (Sociosexual Orientation Inventory), facial attractiveness, FCS, and age as independent variables and the tendency to abort as dependent variable was run for women and men, respectively. Apart from men's facial attractiveness, all predictors that were found to be significant in bivariate correlations remained significant in the multiple regression. However, a mediational analysis showed that the effect attractiveness had on the tendency to abort was not significantly mediated by promiscuity. No interaction effect between promiscuity and facial attractiveness was found.

The discussion considers some of the implications of the results for research on attractiveness and mating on the one hand and reproductive decision-making on the other. However, the major aim of the current study was to make a case for an analysis of maladaptive behavior within the AEA. The hypothesis of maladaptive reproductive decision-making was supported in two ways. First, it was shown in Part II that attributes that in our evolutionary past would have promoted reproductive success (mating success and attractiveness) seem to have the opposite effect in the modern context of conscious decision-making. Furthermore, fondness for children – as a disposition that in the evolutionary past was probably neutral with respect to onset of reproduction – had a negative effect on the tendency to abort. Second, the argument for maladaptive reproductive decision-making was further supported by the finding that, in the same sample (Part I), attractiveness was positively and thus adaptively related to mating success. This suggests a breakdown of the species-specific behavioral sequence that leads to successful reproduction and makes an adaptive explanation highly unlikely. I conclude that the low fertility rates displayed by post-war human populations are compatible with evolutionary theory, but only if a maladaptive explanation is invoked that considers cultural transmission. Future research may identify further adaptations that produce maladaptive behavior in the context of fertility decisions.

Zusammenfassung

In jüngster Zeit haben Fortentwicklungen in der Evolutionstheorie die Forschung zu einer Vielzahl von Studien angeregt, in denen das Verhalten von Tieren – den Menschen eingeschlossen – aus evolutionärer Perspektive betrachtet wird. Unter den Forschern, die sich speziell mit menschlichem Verhalten beschäftigen, herrscht jedoch bis heute Uneinigkeit darüber, was genau eine evolutionäre Verhaltensanalyse ausmacht. Hierbei stehen sich zwei Ansätze gegenüber. Der erste Ansatz wird hier als „Fitness Maximization Approach" (FMA, deutsch: Ansatz der Fitness-Maximierung) bezeichnet. Er geht davon aus, dass die Überprüfung evolutionärer Hypothesen die Voraussage differenziellen Fortpflanzungserfolges beinhaltet, wobei eine „rational choice"-Perspektive zugrunde gelegt wird, in der genische Fitness maximiert wird. Der zweite Ansatz wird hier als „adaptation execution approach" (AEA, deutsch: Ansatz der Anpassungsausübung) bezeichnet. Diesem Ansatz zufolge besteht die theoretische Relevanz des Fortpflanzungserfolges nur in den Selektionskräften der naturgeschichtlichen Vergangenheit und nur insofern diese zur Herausbildung des Designs heute beobachtbarer Anpassungen beigetragen haben. Ein wichtiger Unterschied zwischen diesen beiden Ansätzen besteht in ihren Implikationen für die Betrachtung maladaptiven Verhaltens. Während der FMA unterstellt, dass evolvierte Verhaltensdispositionen unter allen möglichen Umweltbedingungen adaptiv sind, geht man beim AEA davon aus, das extreme, neuartige Umwelten zu Fehlkopplungen zwischen Umwelt und Organismus führen, und damit maladaptives Verhalten bewirken können.

Kontrazeptionsverhalten ist bislang nicht Gegenstand einer gezielten evolutionären Analyse gewesen. Ein solches Unterfangen ist jedoch wichtig für das Verständnis heutigen menschlichen Fortpflanzungsverhaltens und stellt einen Testfall dar, in dem der relative heuristische Wert von FMA und AEA deutlich werde sollte. In der vorliegenden Studie

führe ich Argumente für die These an, dass Kontrazeption maladaptiv ist und daher mit dem AEA erforscht werden sollte.

Obwohl die Betrachtung maladaptiven Verhaltens durch die Prinzipien des AEA nahe gelegt wird (konzepualisiert von Tooby & Cosmides, 1992, und dort bezeichnet als „evolutionary functional analysis“), so befassen sich doch fast alle publizierten evolutionären Studien mit dem Nachweis adaptiver Mechanismen und adaptiven Verhaltens. Dazu kommt, dass ein wichtiger theoretischer Ansatz für die Genese maladaptiven Verhaltens von evolutionär arbeitenden Forschern bislang kaum rezipiert worden ist. Diese Theorie, vorgestellt von Boyd und Richerson (1985), betrachtet den evolutionären Ursprung menschlicher Kulturfähigkeit und die Interaktionen zwischen genischer und kultureller Evolution. Die Autoren definieren Kultur als „ … die Weitergabe von Wissen, Werten und anderen Faktoren, die Verhalten beeinflussen, von einer Generation zur nächsten durch Lehren und Imitation“ (Boyd & Richerson, 1985, p. 2). Die Kapazität für Kulturfähigkeit konnte diesen Autoren zufolge deshalb evolvieren, weil sie die Anpassungsfähigkeit menschlicher Populationen an verschiedenartigste Umwelten gestattete. Doch die relativ indiskriminative Offenheit, mit der kulturelle Information aufgenommen wird, brachte unweigerlich die Möglichkeit mit sich, dass auch maladaptive Information übermittelt und innerhalb einer Population weitergegeben wird. Ein Beispiel stellen manche Formen des Aberglaubens dar, die dem Überleben und der Fortpflanzung abträglich sind.

Aufgrund dieser theoretischen Überlegungen schlussfolgere ich, dass der AEA in der Erforschung aller Tierarten von Nutzen ist, dass er aber im Spezialfall Mensch der Faktor Kulturfähigkeit besonderer Berücksichtigung bedarf, weil dieser fast immer an der Entstehung von Fehlkopplungen zwischen Gegenwartsumwelt und Anpassungen beteiligt sein dürfte. Diesen um den Faktor Kulturfähigkeit erweiterten AEA bezeichne ich hier als „evolutionary malfunctional analysis“ (nach Tooby

& Cosmides, 1992, deutsch: evolutionäre Dysfunktionsanalyse“), und wende ihn auf Kontrazeptionsverhalten an.

Dass Kontrazeption ein maladaptives Kulturprodukt ist, wird bereits durch seine negativen Auswirkungen auf den Fortpflanzungserfolg nahegelegt, die sich aus den Geburtenraten all jener Länder ablesen lassen, in denen uneingeschränkter Zugang zu Kontrazeptiva (induzierte Abortion eingeschlossen) besteht. Darüberhinaus ist Kontrazeption auch deshalb potentiell maladaptiv, weil durch sie die Fortpflanzungsentscheidung vom Kontext der Partnerwahl und des Sexualkontaktes verschoben wird hin zu einem Kontext bewusster Abwägung. Daraus ergeben sich folgende zwei Forschungsfragen: 1. Warum entscheiden sich Menschen für eine Kontrazeptionsroutine? 2. Warum entscheiden sie sich jemals (bzw. niemals) für den Bruch mit dieser Routine, um Eltern zu werden? Für die erste Frage liefern historische Studien Antworten, die beispielsweise die Motivation der Kontrazeptionsbewegung behandeln. Antworten auf die zweite Frage zu finden, war vorrangiges Ziel der vorliegenden Studie, die aus zwei aufeinander aufbauenden Teilen besteht.

Im Teil I der Studie betrachtete ich den Zusammenhang zwischen drei Maßen körperlicher Attraktivität (Gesichtsattraktivität, selbsteingeschätzte Attraktivität, Bodymass-Index) als unabhängige Variablen einerseits und zweier Gruppen unabhängiger Variablen andererseits: a) verschiedene Maße sexuellen Verhaltens und sexueller Einstellungen (Alter beim ersten Sex, Anzahl Sexpartner, derzeitiger Paarungsstatus, Soziosexueller Orientierungs-Index, „extra-pair mating success“), b) Maße der Partnerschaftsexklusivität und –stabilität (Dauer der bestehenden Partnershaft, Untreue, Partnerschaftsasymmetrie, Initiation der letzten Trennung). Teil I kann als eigenständige Studie über den Zusammenhang zwischen Attraktivität und Paarungsverhalten betrachtet werden. Gleichzeitig aber dient er dem Vergleich mit den Resultaten von Teil II (siehe unten). In Teil I sagte ich voraus, dass a) die drei Attraktivitätsmaße positiv mit den Maßen des Paarungserfolgs bzw. der Promiskuität korreliert sein würden, b) sich Attraktivität negativ auf die Stabilität und Exklusivität von Partnerschaften auswirken würden. In den Hypothesen dieses ersten Teils unterstellte ich eine adaptive Kopplung zwischen Organismus und Umwelt.

Die Hypothesen wurden im Allgemeinen bestätigt, sowohl für Frauen als auch Männer. Der derzeitige Paarungsstatus (also das Bestehen einer heterosexuellen Beziehung) war das einzige Maß von Paarungserfolg, das für beide Geschlechter signifikant mit allen drei Attraktivtätsmaßen korreliert war. Alle anderen Korrelationen variierten mit dem Maß der Attraktivität oder des Paarungserfolges sowie mit dem Geschlecht. Zum Beispiel war das Alter beim ersten Sex nur bei Frauen negativ mit Attraktivität korreliert, nicht aber bei Männern, wohingegen Attraktivität nur bei Männern positiv mit „extra-pair mating success" und soziosexueller Orientierung korreliert war. Hinsichtlich der Exklusivität und Stabilität der Partnerschaft wurde der erwartete negative Effekt der Attraktivität auf die Dauer der bestehenden Partnerschaft sowie auf die Untreue bestätigt. Darüberhinaus tendierten Männer – nicht aber Frauen – mit hoher Gesichtsattraktivität mehr als weniger attraktive Männer dazu, anzugeben, dass ihr Partner stärkere Gefühle für sie hegt, als umgekehrt. Entsprechend wurde die Trennung der vorherigen Partnerschaft umso wahrscheinlicher von Männern eingeleitet, je attraktiver deren Gesicht war.

Im zweiten Teil der Studie untersuchte ich, wie Promiskuität, Attraktivität und – als neu hinzukommende Variable – Kinderliebe mit der Bereitschaft in Zusammenhang stehen, Mutter bzw. Vater zu werden. Als Maß für die Bereitschaft zur Elternschaft wählte ich die Tendenz, eine ungewollte Schwangerschaft abzutreiben. Diese „tendency to abort" (deutsch: Abtreibungstendenz) besteht aus den Ratings auf einer bipolaren 5-Punkte-Skala, die den Teilnehmern zur Beantwortung der Frage diente, wie sie reagieren würden, wenn sie selbst bzw. ihre Partner heute eine

Schwangerschaft feststellten. Die Abtreibungstendenz wurde gewählt, weil Abtreibung – ähnlich wie andere Formen der Kontrazeption – für den Aufschub der Elternschaft bzw. zur Limitierung der Anzahl der Kinder eingesetzt wird. Eine ungewollte Schwangerschaft ist häufig die Folge des Versagens einer Verhütungsroutine und zwingt die schwangere Frau und ihren Partner dazu, die Vor- und Nachteile eines Eintritts in die Elternschaft abzuwägen, bevor eine Abtreibungsentscheidung getroffen wird. Die dieser Entscheidung zugrunde liegenden Kriterien können, müssen aber nicht den betroffenen Personen kognitiv zugänglich sein, sollten aber – so die Annahme – in einer messbaren Beziehung zur Abtreibungsneigung stehen.

In der Einleitung zum Teil II argumentiere ich, dass die drei unabhängigen Variablen – Promiskuität, Attraktivität und Kinderliebe – individuelle Unterschiede in artspezifischen Anpassungen darstellen. Folgende drei Hypothesen wurden getestet: 1. Promiskuität sollte positiv mit der Abtreibungsneigung zusammenhängen. – Obwohl Promiskuität in der naturgeschichtlichen Vergangenheit wohl den Fortpflanzungserfolg zumindest von Männern erhöht haben durfte, so ist eine promiske Neigung heute doch schwer mit einem Familienleben vereinbar, sodass sie den mit der Elternschaft verbundenen Opportunitätskonflikt verstärkt. 2. Attraktivität sollte positiv mit der Abtreibungstendenz korreliert sein. – Attraktivität ist eine wichtige Determinante von sozialem Erfolg wie z.B. in den Bereichen Beruf, Sexualität oder soziale Mobilität. Sie sollte daher bewirken, dass hochattraktive Individuen sich in einem stärkeren Opportunitätskonflikt zwischen gegenwärtigem sozialen Erfolg und zukünftiger Elternschaft befinden, als weniger attraktive Individuen. 3. Kinderliebe (erfasst mit einer Kinderliebe-Skala) sollte negativ mit der Abtreibungsneigung zusammen hängen. – Obwohl dies offensichtlich erscheint, so wurde diese Frage in der Abtreibungsforschung bislang so nicht gestellt. Kinderliebe evolvierte wahrscheinlich als geschlechtlich differenziertes Motivationssystem, das Mädchen auf ihre zukünftige Mutterschaft vorbereiten soll. Es scheint jedoch unwahrscheinlich, dass Kinderliebe in der evolutionären Vergangenheit den individuellen Fortpflanzungserfolg auf der Ebene der Konzeption und des Alters beim ersten Kind jemals positiv beeinflusst hat.

Alle drei Hypothesen wurden bestätigt, sowohl für Frauen als auch für Männer. Von den drei Attraktivitätsmaßen erzielte die Gesichtsattraktivität die höchsten Korrelationskoeffizienten, gefolgt von marginal signifikanten Korrelationen mit dem BMI und sehr kleinen, nicht signifikanten Korrelationen mit der selbsteingeschätzten Attraktivität. Schließlich wurde für Frauen und Männer je eine multiple Regression berechnet, in die Promiskuität, Gesichtsattraktivität, Kinderliebe und Alter als unabhängige Variablen und Abtreibungsneigung als abhängige Variable eingingen. Mit der Ausnahme der Gesichtsattraktivität bei Männern blieben all jene Variablen signifikante Prädiktoren, die auch auf bivariater Ebene signifikant mit Abtreibungsneigung korreliert waren. Eine Mediationsanalyse zeigte, dass der Effekt der Attraktivität auf die Abtreibungsneigung nicht signifikant von der Promiskuität mediiert wurde. Ein Interaktionseffekt zwischen Promiskuität und Attraktivität wurde nicht gefunden.

In der Diskussion werden einige Implikationen der Untersuchungsergebnisse für die Forschung im Bereich Attraktivität und Sexualität einerseits und im Bereich Fortpflanzungsentscheidungen andererseits aufgezeigt. Allerdings bestand das vorrangige Ziel der Untersuchung darin, ein Fallbeispiel für eine Analyse maladaptiven Verhaltens innerhalb des AEA zu liefern. Die Hypothese maladaptiver Fortpflanzungsentscheidungen wurde in zweierlei Hinsicht gestützt. Erstens wurde in Teil II gezeigt, dass Eigenschaften, die sich in der evolutionären Vergangenheit fortpflanzungsfördernd ausgewirkt haben müssen (nämlich Promiskuität und Attraktivität), im heutigen Kontext einer bewussten Fortpflanzungsentscheidung scheinbar einen gegenteiligen Effekt haben. Daneben hatte

Kinderliebe – als eine Disposition, die früher hinsichtlich des Alters beim ersten Kind neutral war – eine negative Auswirkung auf die Abtreibungsneigung und bekommt so in moderner Zeit eine neue Bedeutung. Zweitens wird die Annahme einer maladaptiven Fortpflanzungsentscheidung ebenso gestützt von dem Befund, dass in derselben Stichprobe in Teil I der Untersuchung Attraktivität positiv mit Paarungserfolg korreliert war und damit mit ihm in einem adaptiven Verhältnis stand. Zusammengenommen suggerieren die Befunde von Teil I und Teil II die Entkopplung einer artspezifischen Verhaltenssequenz, die zu einer erfolgreichen Fortpflanzung hinführt und lassen damit eine adaptive Erklärung kaum haltbar erscheinen. Schlussfolgernd wird festgestellt, dass die derzeitig vorherrschenden geringen Fertilitätsraten vieler Länder zwar mit der Evolutionstheorie vereinbar sind, jedoch nur dann, wenn eine maladaptive Erklärung herangezogen wird, die kulturelle Transmission als einen wichtigen Faktor berücksichtigt. Zukünftige Studien mögen weitere Anpassungen identifizieren, die sich im Kontext bewusster Fortpflanzungsentscheidungen maladaptiv auswirken.

Appendix

Correlations of key variables with social desirability

The tables below show the bivariate correlations between the key variables of Part I and II and social desirability and agreeableness, respectively.

Appendix Table 1: Correlations of selected variables of Part I with the Social Desirability Scale.

	women	men
age at first sex	-.06 (61) .31	.19 (38) .12
number of sex partners	-.03 (64) .42	-.23[1] (45) .06
current pairing status	-.04 (62) .38	-.08 (44) .30
extra-pair mating success	-.13 (64) .14	-.05 (46) .36
unfaithful	.02 (63) .43	-.06 (43) .34
SOI	-.27[2] (63) .01	-.61 (41) < .001
partnership asymmetry	-.18 (46) .11	-.25 (27) .09
initiator of break-up	-.16 (59) .11	.06 (38) .35

Note. Shown are partial correlation coefficients (controlled for age), degrees of freedom, and one-tailed *p*-values.

1 A graphic plot of the data revealed an outlier. After exclusion of the outlier the correlation is $r(44) = -.16$, $p = .14$.

2 A graphic plot of the data revealed three outliers. After exclusion of these outliers the correlation is $r(60) = -.09$, $p = .24$.

Appendix Table 2: Correlations of measures of attractiveness with the Social Desirability Scale.

	women	men
facial attractiveness	-.15 (60) .13	-.29 (37) .04
self-rated attractiveness	-.02 (65) .41	.12 (46) .22
BMI	.03 (65) .41	-.00 (46) .49

Note. Shown are partial correlation coefficients (controlled for age), degrees of freedom, and one-tailed *p*-values.

Appendix Table 3: Correlations of key variables of Part II with the Social Desirability Scale.

	women	men
tendency to abort	-.20 (57) .07	-.32 (41) .02
FCS	.20 (55) .07	.34 (37) .02
desired number of children	.25 (58) .03	.26 (41) .05
ideal time from now to have first child	-.27 (58) .02	-.08 (39) .31

Note. Shown are Pearson coefficients from bivariate correlations, sample sizes, and one-tailed *p*-values.

Attractiveness and parents´ socioeconomic status

An important assumption made in Part II was that the advantage attractiveness confers in the mating context should generalize to other social contexts. A large number of studies confirm that attractiveness is positively correlated to all kinds of social benefits (see Langlois et al., 2000 for a review). As a result one would expect highly attractive people to accumulate in the upper classes of a stratified, but permeable society. Available evidence supports this view (Elder, 1969; Udry & Eckland, 1984; Franzen & Hartmann, 2001). Assuming that facial attractiveness and the BMI are both heritable components of individual attractiveness, I hypothesized that participants´ attractiveness would be positively correlated to the educational and socioeconomic status of their parents. In Appendix Table 3 the correlations between the three measures of attractiveness and the three measures of parental social status are shown. For men, all correlations are in the predicted direction. Of the three measures of social status, social class consistently yields correlations in the predicted direction, and of the three measures of attractiveness BMI yields the highest correlation coefficients, all of which have the predicted sign. Some of the correlations become significant when the sexes are combined while statistically controlling for sex: facial attractiveness and social class: $r_p(240) = .10$, $p = .05$; self-rated attractiveness and father's education: $r_p(273) = .12$, $p = .02$; BMI and social class: $r_p(275) = -.15$, $p = .006$; BMI and mother's education: $r_p(273) = -.11$, $p = .04$.

Appendix Table 4. Attractiveness and parents´ social status.

measure of attractiveness	women			men		
	social class	mother's education	father's education	social class	mother's education	father's education
facial	.15	.08	-.02	.12	-.05	-.11
	(118)	(116)	(115)	(101)	(101)	(101)
	.05	.21	.43	.11	.31	.14
self-rated	.06	.02	.08	.04	-.15	-.01
	(147)	(144)	(143)	(133)	(134)	(134)
	.25	.43	.19	.33	.04	.45
BMI	-.12	-.03	-.01	-.17	-.19	-.14
	(147)	(144)	(143)	(132)	(133)	(133)
	.08	.38	.46	.03	.02	.05

Note. Shown are Spearman correlation coefficients, sample sizes, and one-tailed p-values. The measures of attractiveness are controlled for age. – Social class was rated on a nine-point scale. Education is the highest educational level reached.

Hedonism and attractiveness

The assumption that opportunity costs in hedonism are higher for highly attractive than for less attractive people (discussion Part II) is supported by the following explorative correlations between the three measures of attractiveness and the ratings of two hedonism items (Zuckerman et al., 1964).

Appendix Table 5. Correlations between hedonism items (from Zuckerman et al., 1964) and the three measures of physical attractiveness.

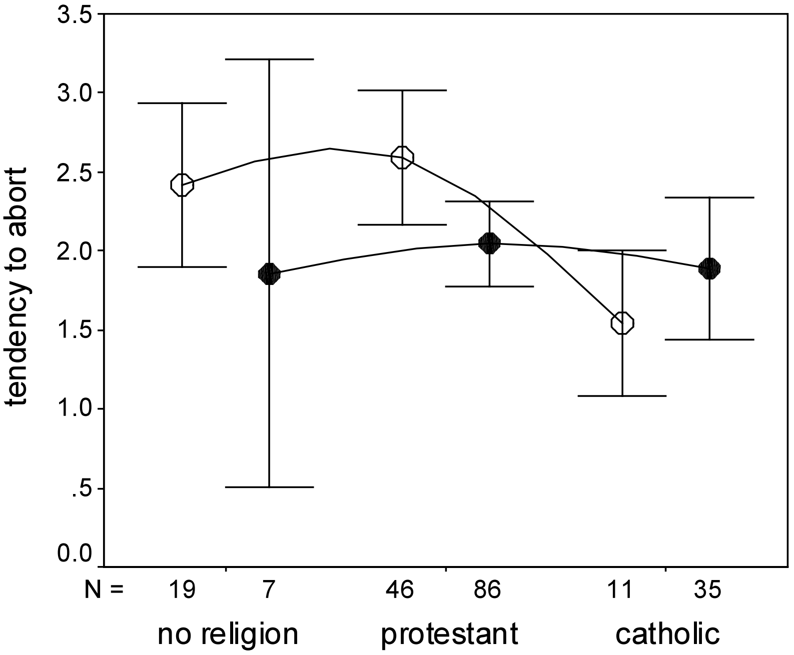
	women		men	
measure of attractiveness	likes wild parties	likes to get drunk at parties	likes wild parties	likes to get drunk at parties
facial	.14 (97) .08	.16 (97) .06	.22 (83) .02	.26 (83) .009
self-rated	.29[a] (108) .001	.25[c] (108) .005	.06[a] (105) .25	05[c] (105) .29
BMI	-.27[b] (108) .002	-.12 (108) .10	.03[b] (104) .37	.04 (104) .34

Note. a to c Fisher's r to z transformation and test for difference of coefficients between the sexes: a $p = .04$; b $p = .01$; c $p = .07$.

Pill use, religion and the tendency to abort

Of the 118 women in this sample for whom the information is available, 70 (63.1 %) were using oral contraceptives at the time the study was conducted. Pill use did not influence women's tendency to abort, $r_p(107) = .10$, $p = .16$.

Attitudes towards abortion have often been found to be linked to religious affiliation (e.g., Granberg, 1982; Costa et al., 1987). The following analysis is restricted to the religious groups that were represented by a statistically reasonable number of subjects; these were non-religious persons, Protestants, and Catholics. I further reduced the originally three levels of religious attendance (*never*, *occasionally*, and *regularly*), to two levels ("non-churchgoers" and "churchgoers"), because only very few subjects attended religious services regularly. Across the groups of non-religious subjects, Protestants and Catholics, the frequency of church-going was negatively correlated with the tendency to abort, but not strongly so, women: $r_p(106) = -.10$, $p = .16$; men: $r_p(104) = -.15$, $p = .07$. Appendix Figure 1 shows the abortion tendency of non-religious, protestant, and catholic subjects by frequency of churchgoing. It would seem that in the group of catholic subjects, non-church-goers were not different from church-goers, whereas in the larger group of Protestants there is a significant difference.



Appendix Figure 1. Religious affiliation, church going and the tendency to abort. – Shown are means and 95%-confidence intervals. Open dots indicate participants who never go to church, filled dots participants who go to church sometimes or regularly. The numbers below the categories indicate the numbers of subjects in each group.

Glossary

adaptation (German: Adaptation, die; Anpassung, die): Any trait that in the evolutionary past promoted reproduction and was therefore preserved by natural selection. The design of adaptations may be of relatively simple (e.g., skin pigmentation as a response to solar uv-radiation) or complex (e.g., the vertebrate eye) design. – It is important to note that the term *adaptation* is here used to mean a structural feature of an organismic design, whereas the related terms *adaptive* and *maladaptive* refer to the quality of the current linkage between organisms and environment and its effects at the level of reproduction.

adaptive (German: adaptiv, angepasst): 1. Currently promoting reproductive success. 2. Currently functioning in the context in which an adaptation evolved. – The first meaning is emphasizes outcome, the second emphasizes the linkage between organism and environment.

assortative mating (German: selektive Paarung, die): In a population in which the sexual partners are similar with respect to certain variable traits, positive assortative mating has taken place. Assortative mating may be the results of preferences for particular traits or the indirect result of processes other than preference. For example, the arrival date at a common mating site of a bird species may depend on body size, so that earlier arriving larger males tend to pair up with larger females and later arriving smaller males with smaller females.

BMI: See bodymass index.

bodymass index (BMI): A measure of obesity that is calculated as BMI = body weight (kg)/height $(m)^2$. The higher the BMI, the more obese a person is. In this study, the BMI is used because obesity affects attractiveness. Attractiveness ratings as a function of BMI peak at intermediate BMI values, but the function is asymmetric; it falls more steeply from intermediate BMI to very low BMI than from intermediate BMI to high BMI (see introduction of Part I and Methods).

contraception (Kontrazeption, die; Verhütung, die): Contraception is the *soma's* ingratitude towards the *germ line*. – Modern contraception is here used to include the use of the pill and other modern contraceptives as well as induced abortion.

developmental reaction norm (German: Entwicklungsreaktionsnorm, die): The set of *ontogenies* that can be produced by a single *phenotype* when it is exposed to internal or external environmental variation (Schlichting & Pigliucci, 1998).

evolutionary functional analysis: A system of heuristic tools proposed by Tooby and Cosmides (1992) to study presumed adaptations from an evolutionary perspective. According to the authors, an evolutionary functional analysis involves the following steps:

1. *An adaptive target*: a description of what counts as a biologically successful outcome in a given situation. Out of the infinite set of potential behavioral sequences, which small subset would count as a solution to the adaptive problem? Here, one wants to know which behavioral outcomes will have the property of enhancing the propagation of the psychological designs that gave rise to them. For example, out of all the substances in the world, which should the organism eat and which should it avoid? With whom should the organism join a coalition? What inferences should be drawn on the basis of the retinal display about the location of various surfaces? In defining an adaptive target, the goal is to ascertain whether the proposed behavioral outcome, in combination with all the other activities and outcomes produced by the organism, will enhance design propagation under ancestral conditions.
2. *Background conditions*: a description of the recurrent structure of the ancestral world that is relevant to the adaptive problem. One wants to know what features of the ancestral world were sufficiently stable to support the evolution of a design that could produce an adaptive target. This could be a part of the external environment, another part of the standard design of the organism, or a combination of the two. This includes the information available to solve the problem, the environmental and endogenous obstacles to solving the problem, and so on. So for example, the regular spatial orientation of human eyes with respect to each other, the face, and the ground constitute background conditions for the evolution of the face recognition mechanisms in infants. Often, but not always, the ancestral world will be similar to the modern world (e.g., the properties of light and the laws of optics have not changed). However, one needs to know something about hunter-gatherer studies and paleoanthropology to know when ancestral conditions germane to the adaptive problem diverge from modern conditions. Of course, when there is a difference between the two, ancestral conditions are the applicable ones for the purpose of analyzing the functional design of an adaptation because they are the cause of that design. Modern environments are relevant to the analysis of the ontogeny of mechanisms and their calibration. It is important to keep in mind that a mechanism that was capable of producing an adaptive target under ancestral conditions may not be capable of doing so under modern ones. Our visual system fails to maintain color constancy under sodium vapor lamps in modern parking lots …, and attempting to understand color constancy mechanisms under such unnatural illumination would have been a major impediment to progress.
3. *A design*: a description of the articulated organization of recurrent features in the organism that together comprise the adaptation or suspected adaptation. A design description of the eye, for example,

would include a specification of its species-typical parts and the manner in which they interact to produce an adaptive target.

The design – or even the existence – of a proposed information-processing mechanism is frequently unknown. Indeed, an appropriate functional description of a design is often what one is trying to discover. When this is the case, this step in an evolutionary functional analysis would be the construction of a hypothesis about the existence and design features of a psychological adaptation. This might include what environmental cues the mechanism monitors, what information it draws from other mechanisms, how it categorizes and represents this information, what procedures or behaviors it produces as output, which mechanisms is its output for further processing, how its output is used by other mechanisms to generate behavior, and so on. The more causally explicit one can make the design description at the cognitive level, the better. Eventually, one hopes to have a description of the neurobiological implementation of the adaptation as well.

4. *A performance examination*: a description of what happens when the proposed adaptation mechanistically interacts with the world. What range of outcomes does the design actually produce? Like putting a new aircraft prototype in a wind tunnel, what one is looking for is a good causal or "engineering" analysis of how the proposed design routinely faced, and how it performs under present conditions as well. For a proposed language acquisition device, for example, one wants to model how its information processing procedures perform when they encounter normal linguistic environments, in order to see whether the interaction of procedures and environment assembles an increasingly elaborated computational system capable of producing intelligible and grammatical sentences. Similarly, one wants to model how psychological mechanisms in women or men interact with their social and informational environments to produce mating preferences. We want to emphasize that we are looking here for a mechanistic or causal description of how the system generates output given input. Statements like, "the human child learns its culture through imitation and generalization" are not models of how input generates output. They are too unspecified to qualify as hypotheses or explanations; we should have ceased treating them as such a long time ago.
5. *A performance evaluation*: a description or analysis of how well (or how poorly) the design, under circumstances paralleling ancestral conditions, managed to produce the adaptive target (the set of biologically successful outcomes). The better the mechanism performs, the more likely it is that one has identified an adaptation.

   It is just as important, however, to see whether the proposed mechanism produces the behaviors one actually observes from real organisms under modern condition. If it does, this suggests that the researcher is converging on a correct description of the design of the mechanism involved, whether they are producing behavior that is currently adaptive or not. The Westermarck incest avoidance mechanism, for example, passes both tests. It produces adaptive outcomes under ancestral (and many modern) conditions (e.g., distaste for sex between siblings who co-resided as children), and it also explains the nonadaptive outcomes that are observed under certain modern conditions (e.g., distaste for sex between kibbutz crèche mates who co-resided as children …; distaste for sex with spouses who were adopted into one's family at a young age and with whom one was raised …).

In short, an evolutionary functional analysis consists of asking a series of engineering questions: Would the proposed design have interacted with properties of the ancestral world to produce target adaptive outcomes? Does the proposed design interact with properties of the modern world to produce outcomes that one actually observes in real organisms, whether these outcomes are adaptive or not? Is there an alternative design that is better able to generate adaptive targets under ancestral conditions? If so, then are there any background conditions that one has overlooked that would have prevented the alternative design from evolving? And so on. (Transcription from: Tooby, J., & Cosmides, L. (1992). The psychological foundations of culture. In J. H. Barkow, L. Cosmides, & J. Tooby (Eds.), *The Adapted Mind* (pp. 19-136). New York: Oxford University Press, pp. 73-75.)

fitness, genic (German: Fitness, genische, die): 1. Relative prevalence of gene variants in a population. 2. The ability of an individual organism to pass along alleles to the next generation relative to conspecifics competitors of the same population.

gamete (German: Gamet, der; Geschlechtszelle, die): Sex cell. Specialized haploid cell that fuses with another gamete to form a diploid zygote. In most species, gametes are differentiated into two different kinds: sperms (small and *motile*) and eggs (large and immotile). In sexually reproducing higher animals, the gametes are the only type of cells that are potentially immortal and who will pass their genes on to future generations. Compare *soma*.

genic (German: genisch): Related to genes (as opposed to "genetic" which refers to the science of genes).

genome (German: Genom, das): The total genic information an individual inherits from its parents.

genotype (German: Genotyp, der): The genic constitution of an organism, with respect to either particular gene variants or to the genome as a whole.

germ line (German: Keimbahn, die): Cells (belonging to a multicellular species) from which *gametes* are derived. The word *germ line* highlights the fact that its cells are potentially immortal as they are passed along from generation to generation while their carrying *somas* are bound to die.

homology (German: Homologie, die): Evolved similarity due to common descent. A trait found in various taxa is homologous if it evolved from the same trait of a common ancestor taxon. Examples for homologous organs are the forelimbs of bats and whales, which both evolved from the forelimbs of terrestrial mammals. Because behaviors are ultimately expressions of nervous systems, the criteria of homology are also applicable to categories of behavior. In cross-species comparisons, homologies are of interest when common descent is likely to explain similarities.

hypergamy (German: Hypergamie, die): longterm mating with a partner of a socioeconomic status higher than oneself.

FCS: Fondness for Children Scale (see methods).

maladaptiveness (German: Maladaptivität, die; Fehlangepasstheit, die): Not *adaptive*, currently malfunctioning.

mate value (German: Partnermarktwert, der): The value of a potential mate relative to others, measured as his or her potential to promote a mate-choosing subject's genic fitness. Components of mate value may be health, resources, social status, age, etc.

mating success (German: Paarungserfolg, der): An individual's number of sex partners per time unit. – In this study, it is important to consider the use of the term *mating success* in relation to *promiscuity*. Inter-individual variation in mating outcomes like the lifetime number of sex partners is the result of both extrinsic and intrinsic motivational factors. The extrinsic factor explicitly studied here is the sexual response of opposite sex individuals to the participants´ physical attractiveness; the intrinsic factor is inter-individual variation in promiscuous attitude. Inasmuch as mating outcomes are determined by individual attractiveness they will be referred to as *mating success*. Inasmuch as mating outcomes are determined by individual attitudes they will be referred to as "the desire for multiple sex partners" or, for short, *promiscuity*.

motile (German: motil): Able to move. – Compare *mobile*, which means movable.

motivation (German: Motivation, die): propensity to act in pursuit of a functional goal (e.g., sexual motivation, parental motivation). Motivation may be intrinsically or extrinsically caused.

malfunctional (German: malfunktional): Not functioning properly. Synonymous with *maladaptive.*

ontogeny (ontogenesis; German: Ontogenie, die): The development of individual organisms.

ontogenic (German: ontogenisch, ontogenetisch): Related to individual organismic development.

opportunity costs (German: Opportunitätskosten, die): When there is a choice between two or multiple options (e.g., between different activities), a decision for one option often means a decision against other options. The choice of one option therefore produces opportunity costs with respect to another option.

parturition (German: Gebären, das): Giving birth.

personality (German: Persönlichkeit, die): The sum of the dispositional characteristics of a person in which he or she differs from other conspecific individuals.

phenotype (German: Phänotyp, der): The observable manifestation of a specific *genotype*.

phylogeny (German: Phylogenie, die): The relationships of groups of organisms (*taxa*) as reflected by their evolutionary history.

phylogenic (German: phylogenisch, stammesgeschichtlich): Related to phylogeny.

promiscuity (German: Promiskuität, die): The desire to mate with or the behavior of having mated with many partners (compare *mating success*, *sociosexual orientation*).

reaction norm: See *developmental reaction norm.*

reproductive success (German: Fortpflanzungserfolg): An individual's output of a large number of viable and fertile offspring. Compare *genic fitness*.

runaway process: A process taking the form of a repeated positive feedback loop.

secondary sexual (signaling) trait (German: sekundäres Sexualmerkmal, das): Typically, but not necessarily, sex-specific conspicuous trait that is assumed to function primarily or exclusively as a signaling trait in the context of intrasexual competition and/or mate choice (see *sexual selection theory*). Examples are antlers in hoofed mammals and certain plumage patterns in birds (e.g., peacock's tail). Examples in humans are female breasts and fat deposits on hips and male muscularity.

sexual selection (German: sexuelle Selektion, die): A special case of natural selection, caused by competition over mates or by female choosiness. See *sexual selection theory*.

sexual selection theory (German: sexuelle Selektionstheorie, die): Theory originally introduced by Charles Darwin to explain the evolution of seemingly dysfunctional *secondary sexual signaling traits*. The theory was later elaborated by Robert Trivers (1972) and others. – By definition, males are those individuals of a species that develop to produce sperm – small, nutrient-poor and *motile gametes* that are produced in large numbers. Females are defined as those conspecifics that produce the eggs – large, nutrient-rich and immotile gametes that are produced in smaller numbers. The two sexes represent the most widespread example of an alternative reproductive strategy. Because a single male produces sufficient sperm to fertilize far more than only one female, female gametes are constantly in short supply. Correspondingly, for females there is an oversupply of males willing to mate. In response to this sex difference, selection has produced higher-level *adaptations* that aid the female and male strategies of gametic differentiation. Males have evolved adaptations to succeed in intrasexual competition over access to females (or indirectly over access to resources that attract females); and females have evolved adaptations to choose just one or few of the many males with superior genes or resources (Darwin, 1871; Trivers, 1972). Given the simultaneous action of female choice and male-male competition, one would expect most species to show a polygynous mating system in which a large number of females mates with a small number of males so that some males obtain only few or no mates at all. In other words, one would expect male mating success and reproductive success to be more variable than female mating success and reproductive success (Bateman, 1948), and this expectation is supported by available data (nonhumans: Bateman, 1948; references in Trivers, 1972; Clutton-Brock, 1994; Whittingham & Lifjeld, 1995; humans: Daly & Wilson, 1983; Lindqvist Forsberg & Tullberg, 1995; Rohde & Schmitt, 2004, this study). This evolutionary scenario suggests that, in polygynous mating systems, males should more often show sexually selected traits and that their mating success depends more strongly on their expression than does female mating success. A broad view across all taxa confirms this prediction (Andersson, 1994). However, in many species mutual mate choice evolved, typically together with monogamous mating systems with biparental care (Wittenberger & Tilson, 1980). Although much less studied, such species often develop female secondary sexual signaling traits (Jones & Hunter, 1993) that are subject to male mate choice (references in Rohde et al., 1999). In humans – a species that is often described as mildly polygynous but usually pairbonding- mutual mate choice with respect to secondary sexual characters is certainly taking place (Grammer et al., 2003).

social desirability (German: soziale Erwünschtheit, die): Perceived pressure to conform to social norms that are believed to be supported by an individual's social environment. Social desirability is a potential confounding factor in studies that rely on self-report. Socalled Social Desirability Scales are therefore sometimes used in order to control for such biases. However, critiques have noted that social desirability is not – or not entirely – a confounding bias, but may partly represent individual levels of conformity, which may have real effects on behavior.

sociosexuality (German: Soziosexualität, die): See *sociosexual orientation*.

sociosexual orientation (German: Soziosexuelle Orientierung, die): Individual differences in willingness to engage in sexual relations without closeness, commitment, and other indicators of emotional bonding. Individuals with an unrestricted (or unrestrained) sociosexual orientation tend to engage in sex in the absence of such indicators, whereas individuals with a restricted sociosexual orientation typically do not. In this study used synonymously with *promiscuity*.

SOI Sociosexual Orientation Inventory by Simpson and Gangestad (1991), used in this study (see methods) as a measure of *sociosexual orientation* or *promiscuity*.

soma (German: Soma, das): The sum of cells of an individual organism that are not destined to become a gamete and whose genes will not be passed on to future generations. During the early embryonic development of higher animal species, the hither to undifferentiated embryonic cells first differentiate into somatic cells and *gametes*. While the cells of the soma undergo further differentiation into organs and are bound to die, the gametes remain single cells and are potentially immortal. Functionally, the soma is the *germ line*'s means to secure its transgenerational survival.

somatic (German: somatisch): Related to the *soma*.

taxon (plural taxa; German: Taxon, das): A group of organisms of any taxonomic rank (e.g., family, genus, or species) within a *phylogeny*.

Endnotes

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[1] These statistics, however, must be treated with caution as they are almost certainly overestimating childlessness in Germany. The reason is the way in which the number of children is determined. Only children of married couples are reported to the Federal Bureau for Statistics, with the result that divorced mothers who marry again count as childless. And in the socalled microcencuses women are not asked directly for the number of children they have, but for the number of children living in their household (Kreyenfeld, 2004).

[2] Here AEA researchers would disagree with Barret et al., (2002) who hold that "There is no a priori reason to suppose that current behaviour shouldn´t be adaptive. It is instead, an empirical issue that can only be tested by measuring current fitness differentials." (Barret et al., 2002, p. 12). However, although differential reproductive success is one indicator of maladaptive behavior, it does not suffice as a complete evolutionary analysis of maladaptiveness. This is because when there are several mismatches working at the same time, it may be impossible to detect the effect of a particular mismatch at the general level of reproductive success.

[3] Another important reason why fertility behavior is little studied by AEA researchers is the conventient availability of students in their early twenties as subjects who are overwhelmingly childless.

[4] The only other evolutionary studies I know of that contain data on two reproductive measures, mating behavior and number of children are those by Essock-Vitale and McGuire (1985), Müller & Mazur (2001), and Nettle (2003). Only in the study by Nettle contraception is mentioned as a factor, but only to note that the contraception destroys the predicted link between an attractive trait (body height) and male reproductive success.

[5] It should be noted that in his target article Pérusse (1993) himself did not interpret his results as a successful application of the AEA, but Daly (1993) argued in his comment that such an interpretation best fits his data.

[6] Kanazawa (2003) repeated Pérusse´s analysis of the relationship between male mating success and income in a much larger representative national sample from the U.S.A. and included several control variables in a multiple regression analysis. He found the predicted positive relationship, but the effect size, the standardized beta coefficient, was very small, β (8, 3172) = .046, p = .01 (personal communication).

[7] What evidence is there for a positive correlation between physical attractiveness and reproductive success in traditional societies? To my knowledge, the only study that considers one of the three measures of attractiveness occurring in the current study is that reported by Hill and Hurtado (1996). They found the hypothesized correlation for facial attractiveness in a population of Ache women in Paraguay.

[8] For a more recent proposal of guidelines for an adapationist analysis, see Andrews et al. (2002).

[9] For the readers who are unfamiliar with the cultural approach to maladaptive behavior, I wish to clarify three important implications that the cultural approach by Boyd and Richerson has for understanding of human maladaptive behavior and thus for understanding the current study:

1. *The evaluation of reproductive success.* Human culture has important implications for how we are to evaluate human reproductive success and thus to distinguish reproductively adaptive from maladaptive reproductive behavior. It is currently mainstream thinking among evolutionary researchers to regard individuals or single genes as the unit of selection (Mayr, 2001). However, in recent years theorists have convincingly argued that group selection may play a role for some species under specific circumstances (Sober & Wilson, 1998). Among the most plausible candidates for group selection are humans (Boyd & Richerson, 1982, 1985; Soltis et al., 1995; Sober & Wilson, 1998). One major reason for the role of group selection in human evolution is the evolution of human capacity for culture. An important effect of cultural transmission is that it tends to reduce intragroup variability and to increase intergroup variability. Inasmuch as cultural traits represent adaptive strategies, groups of variable culture are in reproductive competition with each other in much the same way as are individual humans within a cultural group. It follows that human reproductive success must be considered at two levels: the level of individual reproductive success within a cultural group and at the level of reproductive success compared to other cultural groups. This point is so important to make because selection at the individual and group level do not necessarily work in the same direction. For example, self-sacrificing altruism may be selected against – and thus be

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maladaptive – at the individual level, but still be selected for – and thus be adaptive – at the group level if self-sacrificing enhances the group's success in competing with other groups (Sober & Wilson, 1998).

2. *The role of the environment*. The second implication of the cultural approach to maladaptiveness concerns the relation between humans and the environment. In mainstream evolutionary thinking the environment is the source of selective forces acting on the organism, but the organism is not assumed to significantly alter the environment, nor is it assumed that such changes create novel selection pressures. This view, however, is unrealistic for many species (Odling-Smee et al., 2003), including humans who are capable of transforming their environment through the cultural process (Laland et al., 2001, Odling-Smee et al., 2003). For the study of maladaptive human behavior this means that the distinction between the behavior to be examined and the environment will frequently become blurred. For example, alcohol, violent and x-rated movies, and contraceptives are all part of modern human's environment, but they are simultaneously intentional products of the human mind and the result of a cultural process. It also means that we should expect the greater part of all mismatches between humans and their environment to be caused under the strong influence of the cultural process.

3. *The role of precultural adaptations in cultural explanations*. The third and final implication of human cultural capacity that I would like to list here concerns the role human precultural adaptations play in the cultural area. There is no reason to assume that the evolution of learning by observation and other adaptations, on which the cultural process rests, was accompanied by the simultaneous loss of any of the adaptations that characterized the immediate precultural human ancestors. Rather there is every reason to assume that the preference biases implied by precultural adaptations on the one hand will contribute to determining the content and success of cultural traits and thereby to the shaping of the human environment and that on the other hand precultural adaptations will often be in conflict with cultural traits (McDougall, 1908; Boyd & Richerson, 1985). This point is essential to the current study, the aim of which it is to examine how selected precultural adaptations interact with the modern environment in a reproductively maladaptive way.

[10] It is sometimes argued that humans have had access to effective contraception for a long time so that modern developments of contraceptives cannot explain the modern fertility decline (e.g., Baker & Bellis, 1995). My suspicion is that researchers today may often be ignorant of the immense perceived advantages that the pill and other highly sophisticated contraceptives had over older methods to the generation that witnessed the revolution of the pill. The following excerpts from Allyn (2002) are cited as they give an impression of the difference the pill made:

> "The pill" […] gave women a greater sense of sexual freedom than any contraceptive device that had come before. Just as the availability of penicillin in the 1940s had seemed to separate sex from the danger of venereal disease once and for all, the invention of the birth control pill finally appeared to break-up sex from the danger of unwanted pregnancy. It was not that the condom, the pessary, the diaphragm, and the spermicide, all of which prededed the pill, were ineffective, but the pill, a synthetic estrogen taken once a day, at any time of the day, separated the act of intercourse from the use of birth control. With the pill, contraception became "clean".
>
> … No matter what the motives of pharmaceutical executives may have been, the pill was a major breakthrough in women's emancipation. Since the pill can be taken at any time of day, and since it does not involve contact with the genitals, and since it is taken on a regular schedule whether one plans immediately to make love or not, it can be used without full awareness that one is preparing oneself for intercourse. …
>
> … The pill promised to erase fear and anxiety, to make sex simple and contraception discreet. The only real reservation anyone expressed about the pill in the midsixties was that it might make women more independent and consequently make men feel more insecure." (Allyn, 2000, p. 33-34)

[11] The genesis of the women´s rights movement could itself be subjected to an analysis that includes an evolutionary perspective (see for example Buss & Malamuth, 1996), but doing so is beyond the scope of the current study.

[12] Humans are exceptional among mammals in that fathers provide parental care (Woodroffe & Vincent, 1994), although in lesser quantity and different quality than mothers do (Brown, 1991). In how far the proximate mechanisms are homologous and how they differ is not yet known.

McDougall (1908) proposed that male human parental care might have evolved through genic correlation between the sexes that was simultaneously promoted by natural selection. Current theory suggests that male parental care evolved as a component of mating effort directed at the female partner (Marlowe, 1999; Anderson et al., 1999a,b). Male parental care probably became a valuable resource to mothers as humans evolved to have larger brains and thus gave birth to increasingly underdeveloped infants (Westermarck, 1929; Marlowe, 2001, but see Hawkes, 1991).

[13] In this assumption I disagree with Baker and Bellis (1995) who write:

> „It is unfortunate, but typically human, that the phrase `family planning´ has such strong overtones of conscious strategy. In this book, to avoid confusion, we persist with the use of this familiar phrase despite arguing that over the course of human evolution the major part of family planning has derived from subconscious mechanisms.“

[14] In this I disagree with Miller and Pasta (2002) who made a statement to the opposite:

> „For many couples, proceptive behavior simply involves discontinuing the use of a contraceptive method, whereas contraceptive behavior almost always involves complex behaviors and constant vigilance.“ (p. 2).

Possibly, this view is correct with regard to older methods of contraception, but with the advent of the pill and more recent methods the continued use of contraception can hardly be called a complex matter.

[15] It should be noted for non-German a reader that in Germany induced abortion is no longer subject to a heated public debate as it is in some other countries like the U.S.A.

[16] Because the role of hedonic reasons for continued contraception practice is emphasized in this study, I should note here that an important concern of political activists advocating free access to contraceptives was the well-being of mothers and their (existing) children. The main goal was to provide married couples with the means to adjust their number of children to the couple´s economic capacities and the parents´ and children´s health, but not to so much to postpone or even forgo parenthood (e.g., Chesler, 1992). The social movements for contraception were logically part of the greater women´s rights movement, because marital sex – and thus fertility decisions – at that time still was largely under men´s control. This changed only with the introduction of the pill and the women´s rights movement during the 1970ies (Watkins, 1998; Allyn, 2000).

[17] It is not true that men, or males in general, never reject fertile females as sexual partners, even in polygynous species and even when females express their interests to males (see for example Sapolsky, 2002; Preston et al., 2005). However, I know of no systematic study on this subject nor of any theory that addresses inter-specific or intrasexual variation in male rejection of females. However, as in the case of female promiscuity it can be hypothesized that male choosiness is partly attributable to genic correlation or to sexually antagonistic genes.

[18] Miller & Pasta (2002) claim that humans are a special case with respect to willingness to become a parent: "… when our ancestors had evolved to the point that they could grasp the connection between sexual intercourse and conception and could, therefore, anticipate the possibility of pregnancy and childbearing, preconception childbearing motivation began to affect sexual behavior." This argument is reminiscient of an article by Burley (1979) who proposed that the awareness of the pains of birth constituted a selection pressure that led to the evolution of concealed ovulation.

[19] As in the case of the desire for multiple sexpartners, the partial overlap between the sexes with respect to interest in children may be a result of genic correlation.

[20] A general fondness for children is certainly not the only possible reason for a desire to have children. For example, within the concept of a more general generativity (e.g., Peterson & Stewart, 1993), children may serve the proximate function to create a feeling of immortality, to find a life task, and to feel competent.

[21] Larger numbers of sex partners may not necessarily reflect mating success, but rather failure. If humans are seen as predominantly monogamous animals that compete for longterm partners of high quality, then individuals who had particularly many sex partners may have been repeatedly rejected as longterm partners after one or few sexual acts. To my knowledge, this possible process has not been investigated yet. It is, however, only under very specific conditions that this process would override the positive effects of attractiveness on mating success.

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[22] Sexual selection theory assumes that in mammals (and most other taxa) female and male reproductive success should on average be equal, but that male reproductive success should vary more strongly than female reproductive success. The same pattern should be expected at the level of mating success. This is what was found in the current data set. The number of sex-partners was correlated with age, women: $r(128) = .35, p < .001$; men: $r(121) = .15, p = .05$. To remove these age effects, the residuals from a regression of number of sex-partners over age were used in this analysis instead of the original data. The distribution of these residuals deviated significantly from normality and was positively skewed. However, the Levene-test for equality of variances is robust when applied to long-tailed distributions (Rosenthal & Rosnow, 1991, p. 340). The data from 121 men and 128 women were available for this analysis. As predicted, women and men did not differ in their mean number of sex-partners ($M = 0.06$ and -0.06, respectively), $t(213.53) = 0.22, p = .83$ (two-tailed), but the variance was twice as large in men than in women (27.98 and 13.69, respectively), $F = 8.79, p = .003$.

[23] As was noted for the lifetime number of sex-partners in the previous footnote, the sex differences in extra-pair mating success also followed the rules of sexual selection theory. Of the 123 men, 41 (33.3%) had acted as an extra-pair partner at least once, of the 129 women 37 (28.7%) had done so. To remove these age effects, the residuals from a regression of number of sex-partners, for whom the participant acted as epc-partner over age were used in the following analysis instead of the original data. Men and women did not differ in the mean number of sex partners for whom they acted as an extra-pair partner (residuals from a regression over age, $M =$ -0.05 and 0.05), $t(235.56) = 0.95, p = .34$ (two-tailed), but the variance was significantly higher in men than in women, $F = 8.35, p = .004$.

[24] For example, consider two women, one of low, the other of high attractiveness. Suppose the less attractive woman is offered sex by five men per year and seizes each (100%) of these opportunities. In contrast, the highly attractive woman is offered sex by one hundred men per year and has sex with only ten (10%) of them. The highly attractive woman would then have had more sex partners per time unit than the less attractive woman would, and yet the less attractive woman could be said to be the more promiscuous one.

[25] The sexes differed significantly with respect to fondness for children, $r_p(215) = .27, p < .001$. When I restricted the analysis to the individuals who filled in the Social Desirability Scale, the correlation was $r_p(95) = .33$, $p = .001$, with only age as control variable and $r_p(94) = .31$, $p = .001$, with social desirability added as control variable.

[26] Partnership asymmetry, which was used as a dependent variable in Part I, was not used as independent variable in Part II on theoretical grounds: unlike the variables attractiveness, promiscuity, and fondness for children partnership asymmetry is not assumed to be a trait that is based on an evolved adaptation. Still, the question whether partnership asymmetry is a determinant of the tendency to abort is of empirical interest. The partnership asymmetry item was rated on a 7-point scale, in which low values mean that the subject is more in love with the partner than vice versa and high values mean that the partner is more in love with the subject than vice versa. One would therefore expect a positive correlation between the tendency to abort and partnership asymmetry. I found that for women there was no significant correlation between the tendency to abort and partnership asymmetry, $r_p(75) = .07$, $p = .26$, but for men the correlation was positive and significant, $r_p(57) = .36, p = .003$.

[27] A graphic analysis of the residuals of the models revealed that the ideal preconditions for a multiple regression were not given (Tabachnick & Fidell, 1996). As an alternative approach, I ran a logistic regression, because this model makes no assumptions about the distributions of the data. To carry out the analysis the dependent variable, the tendency to abort, was dichotomized into 1. participants who completely rejected an abortion and 2. all other participants. However, the results of the logistic regression and of the multiple regression were qualitatively so similar that I decided to present the multiple regressions here, assuming that most readers are more familiar with this procedure and the effect size measures (standardized coefficients, β) than with logistic regression.

[28] Almost a century ago, William McDougall (1908) proposed that the evolution of human intelligence has always been in an evolutionary conflict with phylogenically older adaptations. He proposed that this conflict has been mitigated only by the cultural evolution of procreative social norms:

> "The use of reason and intelligent foresight modifies profoundly the operation of all the instincts, and is especially apt to modify and work against the play of the reproductive and parental instincts. Among the higher animals these instincts suffice to secure the perpetuation of the species by their blind workings. And we may suppose that the same was true of primitive human societies. But, with the increase of the power and of the habit of regulating instinctive action by intelligent foresight, the egoistic impulses must have tended to suppress the working of the parental instinct; hence the need for the support of the instinct by strong social sanctions; hence also the almost universal distribution of such sanctions. For those societies in which no such sanctions became organized must have died out; while only those in which, as intelligence became more powerful, these sanctions became more formidable have in the long-run survived and reached any considerable level of civilization. There has been, we may say, a never-ceasing race between the development of individual intelligence and the increasing power of these social sanctions; and wherever the former has got ahead of the latter, there social disaster and destruction have ensued." (McDougall, 1908).

And Hobcraft (2003), apparently unaware of McDougall´s thoughts, asked:

> “Were humans, perhaps especially women, who disproportionately bore the physical and emotional costs of childbearing and child rearing, always wont to limit reproduction once their brains evolved enough to enable free choice? And is modern family limitation simply a reflection of the increased ability (and social tolerance) to control fertility?” (p. 349).

[29] A further problem with the study by Lycett & Dunbar (1999) is that the use of data aggregated into age classes leads to an overestimation of the variance explained. The effect sizes obtained from data of individual women would be much lower. Moreover, although Lycett and Dunbar claim in their methods to have considered women´s number of children, they seem not to have included these data in their analysis. Consequently, it is not known whether they deal with abortions by yet childless women or by mothers.

[30] Only Fischman (1977) reported that pregnant teenage women were more likely to abort when they disliked babysitting. Unfortunately, Fischman did not reveal the data for this qualitative result. Another study (Miller, 1994) investigated the relationship between attitudes towards own (future) children and attitudes towards abortion in a sample of married couples, half of which were childless wheras the other half had one child. He found that both positive and negative attitudes towards own children influenced the attitudes towards abortion. However, although attitudes towards own future children and towards stranger children are positively correlated with each other (Rohde & Hoier, 2001), they can still be differentiated from each other by means of factorial analysis (unpublished data). Hence, the current study seems to be the first to relate general liking of children to abortion.

[31] It should be noted that there is evidence for culturally shared minimum standards for child provisioning and that these standards affect fertility behavior. For example, Kaplan & Lancaster (2003) report that Albuquerque fathers of Hispanic origin see themselves confronted with increased standards relative to what they experienced when they were children themselves. While as kids they were sharing their bedrooms with several siblings, they now live in a social environment in which it is standard to provide each child with a bedroom of his or her own. It thus appears that child provisioning has become part of a process of runaway consumption (Frank 1999), which contributes to the decreasing fertility. If this is true, this process of social competition in the area of child provisioning may represent another maladaptive component of modern human´s reproductive behavior.

[32] Indeed, from a perspective of cultural selection one may ask for what other reason such social sanctions should ever have evolved and have been characteristic for highly successful cultures (e.g., of the ancient Romans) than to counter a widespread unwillingness to become a parent.

[33] Interestingly, the two hedonism items „I like wild parties.“ and “At parties I like to get drunk.” also tended to be positively correlated with the three measures of attractiveness (see Appendix Table 5).

[34] Available at: http://www.bmfsfj.de/RedaktionBMFSFJ/Broschuerenstelle/Pdf-Anlagen/PRM-24195-Kurzfassung-Familie-im-Spiegel,property=pdf.pdf

[35] Available at http://www.sexualaufklaerung.de/bilder/verhuetung_2003.pdf

[36] Available at http://www.diw-berlin.de/deutsch/produkte/publikationen/materialien/docs/papers/diw_rn04-01-34.pdf

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[37] Available at http://www.google.de/url?sa=t&ct=res&cd=1&url=http%3A//www.diw.de/deutsch/produkte/publikationen/diskussionspapiere/docs/papers/dp473.pdf&ei=HWv3QsOvObqEwQGgidmHDg

[38] Available at http://www.destatis.de/presse/deutsch/pk/2003/Bevoelkerung_2050.pdf