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Sperm competition and female procurement of male resources as explanations for a gender-specific time dependent course in the sexual motivation of couples

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Summary

Changes in sexual motivation over the course of a partnership are investigated in a population sample stratified by age. In the subsamples aged 30 and 45 years, male motivation stays at the same level regardless of the duration of the partnership at the time of the interview, while female sexual motivation matches male motivation in the first years of the partnership and then steadily drops to lower levels. In the sample aged 60, male sexual motivation always exceeds female sexual motivation and both are little affected by the duration of partnership. This pattern stands out clearly within some measures of sexual motivation and less clearly or not at all with others. It also parallels the results from an earlier investigation. Interpretations from social constructivism or from mainstream psychology are hard to conceive. The results seem more intelligible from the perspective of evolutionary psychology, as expressing evolved designs for sexual motivation, fine-tuned to the specific life situations of males and females. Male motivation is hypothesized as having been shaped by the benefits of effective mate guarding. A constant frequency of copulation is seen as a safeguard against the risk of cuckoldry through sperm competition. In contrast, female motivation is seen as originating from the reproductive advantage of procuring male resources by establishing the pair bond. In addition the benefits of redirecting sexual desire, the unadvertised estrus, some regulatory functions of copulation, and the risk of sexually transmitted disease are discussed as factors that possibly contribute to an explanation of the findings.

Introduction

In this study changes in sexual motivation over the course of an ongoing partnership will be investigated by an extrapolation of the trajectories from cross-sectional data. The inquiry into this question started with an unexpected finding from a survey-study on sexual behavior in German students, which was based on 1865 respondents (Klusmann 2002). Female sexual motivation declined with the duration of the partnership - in contrast to male sexual motivation, which stayed constant. Some measures of sexual motivation, the desire to have sex often, and (negatively) a lack of sexual interest showed this effect strongly, others, such as the initiative for the most recent sexual act, only weakly or not at all. In the present study the question will be addressed whether this result can be generalized to other samples and measures. The result of the first study could not be explained by social-psychological or cultural factors. An explanation from evolutionary psychology was finally proposed, mainly based on the idea that mate guarding, sperm competition, and female procurement of male resources have shaped human sexual motivation in a way that gives rise to the observed pattern. While in the first study this was a post-hoc- interpretation, here it becomes the leading hypothesis that will be detailed in the following section. The problem of extrapolation from cross-sectional data will be addressed in the discussion.

Sperm competition. In the animal kingdom much of the variation of copulation frequency is associated with the possibility of mate guarding. When a male can effectively keep other males from approaching his mate or his harem, little copulation is needed, as is seen in larks, gorillas, and northern elephant seals. Conversely, when mate guarding is hardly possible, such as is seen in chimpanzees, goshawks, and whales, a high ratio of copulation per fertilization is observed (Birkhead 2000). Frequent copulation can increase the probability of fatherhood when mate guarding fails. It may even be considered as the last resort for mate guarding, but this would perhaps confuse the terminology. In mammals frequent copulation can promote fatherhood in two ways: First by catching the window of fertility and second by blocking the cervix channels for rival sperm or, when already present, removing, defeating, weakening, or destroying it. The mechanisms of sperm competition are well researched in the animal kingdom (Birkhead 2000; Birkhead & Møller 1998), but our knowledge of sperm competition in humans is uncertain. The pioneering work of Robin Baker and Mark Bellis (1995) turned out to be flawed by exaggerated claims and insufficient tests (Birkhead 2000; Simmons et al. 2003). However, there is still much evidence for human sperm competition (Gallup & Burch 2004; Gallup et al. 2003; Pound 2002; Shackelford et al. 2002; Smith 1984), even when killer-sperm probably does not belong to its weaponry (Moore et al. 1999).

In a popularization of his theories Baker (Baker & Bellis 1996) introduced the term “routine sex” to describe sexual acts that are not very passionate but are performed on a regular basis. This would characterize male sexual motivation if it were driven predominately by a need to safeguard against sperm production.
competition. The term implies the idea of sexual motivation deriving its power from different sources that can be distinguished by the problems that must be solved in order to mate successfully. Successfully achieving fatherhood is not the only problem, and for women it is no problem at all.

**Procurement of male resources.** Why should a female copulate regularly with the same male in a pair bond when fertilization could be achieved through a very small number of copulations? Tim Birkhead (2000), referring to birds, gives a tentative answer: A display of female sexual receptivity signals female cooperation with male mate guarding, and in fact it amounts to be an act of cooperation. Therefore male motivation to continue parental investment should be sensitive to signals of female sexual responsiveness. Consequently continual female receptivity in a pair bond might have evolved as the result of a male preference which, when responded to, helped to secure the pair bond and thus furthered female reproductive success. This may also explain why signals of sexual excitement in women are often more dramatic than in males (Miller 2000).

**The pair bond.** When a couple falls in love, emotional mechanisms for the establishment of the bond become engaged, leading to highly selective attention and preoccupation with the loved partner. The desire to be close to another person also involves the desire to have sex, although lovers often are more concerned with the question of whether their choice is reciprocated (Tennov 1999). The bonding system and the sexual system are independent to a certain degree (Fisher et al. 2002; Zeifman & Hazan 1997), and they engage different locations in the brain (Bartels & Zeki 2000). However, in a love relationship they work synergetically. There are limits to studies on the role of copulation for bond formation in humans, but such studies have been performed in prairie voles. Prairie voles start their life-long bond with bouts of frequent copulation for about two days and after that the bond is firmly established. There is much known about the neurobiological mechanisms connecting frequent copulation with bonding (Young & Wang 2004), and these mechanisms seem to be more or less common to all mammals. From this it might be conjectured that copulation is evolutionarily designed to play a role in human bond formation as well. However copulation does not automatically lead to bonding, and sexual motivation can very well act independent of feelings of love - also for reasons of evolutionary contingencies in mating success.

**Unadvertised estrus.** Another evolutionary origin, which has shaped the design of human sexual motivation is the unadvertised estrus. It has been shown that sexual desire and attraction coincide with the peak of female fertility (Wilcox et al. 2004), albeit the time of ovulation is usually not consciously detected, and women, who believe they did, are often wrong (Sievert & Dubois 2005). The lack of effective advertising selects for a constant high level of sexual motivation, not only for males but also for females, in order to achieve pregnancy. Therefore differences in male and female sexual motivation cannot be traced back to the unadvertised estrus. However concealment of estrus has a bearing on mate guarding since it disperses the necessity of this behavior over a large time-span, widening the stage for sperm competition. Why signals of the estrus disappeared in the evolution of some primates is still an open question (Alexander & Noonan 1979; Pawlowski 1999; Sillén-Tullberg & Møller 1993). A probable explanation is that it benefited female procurement of male resources by making continued presence reproductively advantageous to the male.

**Extra-pair mating.** A short description of the avian sexual system needs only two elements: pair-bond and adultery (Birkhead 1998; Ridley 1993). There is a parallel with the human sexual system, which also ties together a male and a female for the task of providing for their offspring and provides an additional advantage for extra-pair mating. In many birds the female copulates freely with her chosen mate; then, after the first eggs are laid, she grows reluctant and seeks extra-pair copulations. This reluctance may be adaptive because it opens the opportunity for some eggs to be fertilized by other males. If this logic could be applied to human females, this would lead to the expectation of decreased sexual motivation directed towards the resident partner accompanied by an increased readiness to feel sexually attracted to other males. A similar fine-tuning of female sexual motivation has already been asserted to vary with the menstrual cycle (Gangestad et al. 2002; Penton-Voak & Perrett 2000). Thus, female sexual motivation should not decline generally - only with respect to the resident partner, and with this partner it should not decline completely, in order not to compromise the pair bond. Male motivational design should also program for a redirection of sexual desire, but enough motivation should still be left to deal with the risk of sperm competition.
Regulation of fertility. The female body is well tuned to detect the most auspicious constellation for a pregnancy. Sexual motivation seems to be merely a part of this automatic tracking of the environment (Thiessen 1994). The constant presence of a male and regular copulation has been shown to enhance fertility (Miller 1998) and lessen the risk of pre-eclampsia and high blood pressure induced by pregnancy (Robillard & Hulsey 1994), which might be the result of insufficient priming of the female immunoreactive system to the genetic makeup of the male gametes (Robertson et al. 2003). As these processes of fertility enhancement and priming are partly triggered by copulation, they depend on sexual motivation and therefore cannot cause it. Nevertheless these are processes that are completed after 6 to 12 months. After this, female sexual motivation no longer needs to be held up for these reasons.

Risk of sexually transmitted diseases. Even today, when treatment is simple and effective, infertility caused by sexually transmitted diseases is no minor threat (Paavonen & Eggert-Kruse 1999). There is not much known about the reproductive costs these diseases imposed on our ancestors. If there had been any, these costs must have been heavier for females than for males, making it adaptive for a female to abstain from copulation if it could not improve male support, the chance of fertilization, or provide some of the various benefits multiple mating may have for the fitness of females (Jennions & Petrie 2000).

Empirical data. Studies of the course of sexual motivation in committed partnerships are few. In two large surveys the topic is treated briefly (Johnson et al. 1994; Lauman et al. 1994). Both show that coitus frequency is predicted much better by the duration of partnership than by age but do not analyze measures of sexual motivation by gender and duration. A Swedish longitudinal study found decreasing sexual desire in middle-aged women interviewed at two times 6 years apart; unfortunately men were not included in this study (Hällström & Samuelsson 1990). A cross-sectional study using the National Health and Social Life Survey to assess satisfaction with marital sex reported lower satisfaction in married women compared to married men but did not analyze gender-specific time courses (Liu 2003).

The evolutionary hypothesis. Sexual motivation is conceived as resulting from various adaptations, some of which evolved to be specific for males and females. The basic gender difference stems from the presence of an adaptation to the risk of sperm competition in males, which is absent in females, and the greater importance of a stable pair bond to the reproductive success of females. This difference might be further accentuated by the advantages of female promiscuity while still in a pair-bond and by the threat of sexually transmitted disease. Taken all together, in a continuing partnership a fairly constant curve for sexual motivation is expected in males and, after an initial peak, a downward-sloping curve with females.

Method

Three samples for the age groups 30, 45 and 60 were drawn randomly from the lists of local resident registration offices in Hamburg and Leipzig. Trained interviewers conducted 776 interviews, yielding a response rate of 30% (Schmidt et al. 2004; Schmidt et al. 2003). Higher education and committed partnerships without marriage made up a high portion of the sample. The sub-sample analyzed here (Table 1) consists only of those 573 respondents who lived in a committed heterosexual partnership at the time of the interview. As the range of possible durations of partnership is restricted by age, some of the cells of the cross table age x duration are empty (Tab. 2). Therefore the slope for initial changes in sexual motivation can be assessed fairly well for the younger age groups, but not for the group aged 60.

Insert Tables 1 and 2 about here ------------------

Measures. Sexual motivation is assessed in four different ways. The first measure is drawn from a series of statements about the partnership, introduced by the question: "Which of the following behaviors and feelings are more characteristic of you, and which are more characteristic of your partner?" The statement pertaining to sexual motivation is, "Wants to have sex often" with answer categories (1) more characteristic of me, (2) more characteristic of my partner, (3) characteristic of both of us, (4) characteristic of neither of us. For the present analysis categories are combined to form a dichotomous variable with (1, 3) indicating "high" and (2, 4) indicating "low". The second and third measures are drawn from a list of problems: "I wanted to have sex more often than my partner" (yes/no) and (negatively) "I was rarely in the mood for sex" (no/yes). The fourth measure is the statement, "I initiated the most recent sexual act" (yes/no). These measures are combined into a summary scale (Cronbach’s alpha=.68), which is dichotomized at the median (0-1 vs. 2-4). Additionally the self- cha-
racterization "Just wants to be tender" is used, which is coded in the same way as "Wants to have sex often". The ten variables examined for a possible role as effect modifiers are listed in the sample description (Table 1).

Tests of model fit. The hypothesis in its most simple form predicts a constant level of motivation for males and a level that matches male motivation in the first years and then declines for females. The statistical form of such a model is very simple: the male curve is predicted to be a straight line, and the female curve to be declining. If the data do not fit this model, the hypothesis is not supported. The data are modeled by logistic regression (Hosmer & Lemeshow 1989). The basic model derived from the hypothesis only requires the interaction "duration of partnership by gender". Only female sexual motivation is expected to slope downward with an increased duration of partnership (also shortly referred to as "time"), and male sexual motivation is expected stay at a constant level. Main effects are expected neither for time nor for gender. However time dependent influences impinging on both genders might coexist with the hypothesized relation, as well as general differences between males and females in level of sexual motivation. Thus, the presence of main effects would not necessarily speak against the hypothesis. Only when the expected different trajectory for males and females is absent must the hypothesis be rejected. In order to accommodate interactions, deviation coding is generally used. The logistic model expected to fit the data is:

\[
\hat{Y} = \exp(Z)/(1+\exp(Z)), \text{ where}
\]

\[\hat{Y}\] is the estimated proportion of "yes"-responses (indicating sexual motivation), which entirely depends on Z, the value of the exponent. Z is a linear combination of the variables \(X_T\): Time (T), the duration of the partnership at the time of the interview, \(X_G\), Gender (G), coded (-1) for females and (1) for males and the product \(X_T \times X_G\), representing the interaction. Time in years is transformed by taking the square root in order to reduce the effect of differences at the high end of the time range. This transformation would straighten declining curves with downward slope.

The saturated model is: \(Z = C + B_1^x X_T + B_2^x X_G + B_3^x X_T \times X_G\), denoted \(T, G, T \times G\). The model only including the interaction is: \(Z = C + B_3^x X_T \times X_G\), denoted \(T \times G\). Other models might be \(T, T \times G, T, G, T \times G\), or combinations with third factors, e.g. living arrangement or the presence of children in the household.

The interaction term reflects to what extent the difference between female and male sexual motivation depends on the time elapsed since their partnership began. Due to the square root transformation, the length of untransformed time units stretches when moving from left to right. One unit of time corresponds to the intervals 1, 3, 5, 7, 9, 11, 13 years, depending on location on the scale. When time changes one unit, the estimated odds for a yes-response indicating sexual motivation change for both genders by \(\exp(B_3)\) - which is the main effect of time. The interaction adds a per unit change of \(\exp(B_3)\) for males and of \(\exp(-B_3)\) for females. The difference is only in the sign of the \(B_3\) coefficient (deviation coding).

Fitting models in order to evaluate a hypothesis is not straightforward. Typically many different models fit the data nearly equally well. When the expected model is among them, this cannot not automatically be counted as support, but the model is at least not obviously rejected. In this investigation, model fit is assessed by testing the following requirements:

Test 1. The model should be sufficient: no significant improvement due to main effects after the interaction is already in the equation.

Test 2. The model should be necessary: significant improvement due to the interaction, after the main effects are already in the equation.

Test 3. The model should be optimal: The interaction must be included in a parsimonious model, fitting the data. This model will be generated by a stepwise procedure with the likelihood ratio-test as the criterion for removal.

Of course the interaction model should provide significant improvement above the model containing only the constant. As this is the case in every analysis with only one exception (Tab. 4), this criterion is not informative and will not be considered.

Problems with model fit. The use of model fit for theory testing has drawn criticism on many accounts (Roberts & Pashler 2000). When a model contains a large number of parameters, appropriate tuning can fit many datasets and many different models can be fitted to the data. When the model terms are highly correlated, their predictive contributions are confounded. This is the case with the interaction \(X_T \times X_G\) and the two main effects gender \(X_G\) and time \(X_T\), which are combined by multiplication in the interaction. When no hypothesis
exists, explanatory parsimony is the only criterion for model selection, and this would lead to the conventional rule of using the main factors first, and interactions only if they improve model fit. However this investigation is focused on a hypothesis: For every measure of sexual motivation it predicts constancy for males and decrease for females. It would be rejected when the interaction TxG does not fit the model. As G and TxG are heavily confounded, a ‘main factor first’ rule would run the risk of not detecting an interaction that actually exists; conversely an ‘interaction first’ rule could erroneously attribute parts of the main effects to the interaction.

What does it mean to say an interaction really exists? Consider an artificial data set where a measure is decreased over time in one category, but not in the other. Both categories start at the same level and the only causal process influencing the data is the time dependent decrease in one category. If the decrease factor is large, the categories would differ in the mean and this would produce a main effect even when the causal process that generated the data was exclusively dependent on a specific combination of time and category and no process to generate a common trajectory or different base levels for the categories was involved. A strong interaction effect would still be present, but if the error term were to become large and if it were to be biased, a point might be reached where the interaction no longer stands out against the main effects. The procedure cannot be reversed: When an artificial data set is generated exclusively to represent main effects, no interaction will occur. Thus main effects may appear even when the causal process generating the data was completely contingent on category, that is, interactive.

**B-Coefficients.** Each estimated coefficient depends on the other variables in the stock of candidate predictors. It provides an estimate of the log odds adjusting for all other variables included in the model. When two candidate predictors are highly correlated, each of these variables can be considered a proxy for the other. Then the B-coefficient no longer reflects the independent contribution in a simple way and often its standard error grows so large that none of the highly correlated candidate predictors seems to provide any significant improvement when judged solely by a test of the B-coefficient - even if each variable produces a highly significant B when introduced alone. As Frederick Mosteller and John Tukey (1977) have stated in their chapter "Woes of regression coefficients": "We must (...) worry in particular (about), whether the proxy’s coefficient siphons off some of the coefficient we would like to have on the proper variable, or whether a variable serves us well only because it is a proxy" (p. 331). B-coefficients are valuable when the model is not hampered by multicolinearity, but this is nearly always the case when an interaction is introduced together with the main factors of which it is composed. Therefore as a rule B-coefficients of the saturated model are not considered, and significance testing relies solely on model fit improvement.

**Confounders and effect modifiers.** A confounder is a covariate that is associated with both the outcome variable of interest and a primary independent variable. When there is no interaction, confounding is simply controlled by taking out the effect of the confounder from both the remaining stock of independent variables and the target variable. For example, in World War II a positive correlation was found between bombing accuracy and the intensity of enemy fighter opposition. This contra-intuitive result was explained by a confounding variable: weather condition, which facilitates both, the presence of enemy fighters, and target visibility. A confounder for the interaction TxG would be a variable that diminishes or accentuates the interaction. This is more adequately expressed with the term "effect modifier" (Hosmer & Lemeshow 1989, p. 63). In the given context an effect modifier for the interaction is a variable, which leads to the different courses of male and female sexual motivation, depending on its value. There is no limit to the imagination in defining factors to fulfill this role. In this study 12 candidate effect modifiers are investigated (listed in the sample description, Table 1.).

**Results**

The time for measures of sexual motivation and tenderness is displayed separately for males and females in different age groups (Figures 1a-f). Data points are estimated by logistic regression, using the saturated model (shown exemplarily in Table 3a). Due to empty cells, the trajectories of the age groups cannot extend over the full length of the time scale ranging from 1 to 36+ years. A condensed statistical evaluation of the data displayed in Figures 1a-f is given in Table 4.

**Summarizing result.** In order to present a summarizing result and at the same time describe the analytic procedure used repeatedly, a logistic regression analysis of aggregated data is presented (Tables 3a and 3b). Only age groups 30 and 45 are combined; age...
group 60 is not included for reasons explained in the discussion section. For the aggregation of measures the dichotomized sum of the four measures of sexual motivation is used. Detailed results are given only for this aggregate analysis; the results for other groups and variables, obtained by the same procedure, are depicted in condensed form in Table 4.

Insert Tables 3a and 3b about here

Results in detail. In Table 4 logistic regression models are analyzed using the three age groups and the total sample with four measures of sexual motivation as independent variables. This amounts to sixteen evaluations, each of which is represented by the three tests for model fit, explained in the method section: (1) is the interaction effect sufficient?, (2) is it necessary?, (3) is it included in a parsimonious model? In Table 4 the results for tests 1 and 2 are coded with 1 for "yes" and 0 for "no"; test 3 can be answered by looking at the parsimonious model, which should include TxG. If the result contains at least one code 1 and TxG is included in the parsimonious model, the hypothesis is rejected. Some results are in-between, suggesting weak support, or weak rejection. For example: With variable (a) in age-group 30 the result is 10 TxG. This is shorthand for: After TxG has been entered into the equation no significant improvement is achieved with the introduction of G or T or both (first code=1); however, when G, T is entered first, TxG will provide no further improvement (second code=0). The forward selection procedure with the likelihood ratio criterion chooses TxG as the most parsimonious model. The analysis for the combined group 30 and 45, listed in Tab. 3a, corresponds to 01 T, TxG.

The best model fit is achieved with variables (a) and (b), both using the words "want to have sex often" in different contexts of questioning. Except for the group aged 60, the interaction TxG always appears with these variables; in 3 of 4 cases it gives enough model fit to render the main effects unnecessary, and with the main effects already present, it can improve model fit significantly. Variable (c) "I was rarely in the mood for sex" does not behave this way in the two younger groups, but surprisingly an interaction effect occurs for age group 60. From visual inspection variable (d) "Initiation of sex" seems to display the predicted pattern, but the interaction effect closely fails to achieve statistical significance in age group 30, and in no group it is chosen by the forward step procedure as a parsimonious model. The summary variable for sexual motivation mainly mirrors the results for variables (a) and (b), being highly determined by these components. Results for the total group are only included for the sake of completeness. As will be discussed later, they should not be used for hypothesis testing. So the results are mixed, leaning toward a support of the predicted pattern, but not unanimously. As an asi-
...the desire for tenderness is also analyzed, yielding an inverted trajectory with respect to gender for age groups 30 and 60, but not for age group 45.

**Effect modifiers.** The influence of 12 possible effect modifiers (listed in Table 1) is investigated in the combined sample of age groups 30 and 45. A forward step analysis with the LR criterion is performed for each variable, starting with the full model including the candidate effect modifier with all its interactions. For example, adding the factor C, presence of children in the household, yes/ no, generates the saturated model T, G, C, TxG, TxC, GxC, TxGxC. The parsimonious model generated by the forward step procedure reduces the model to T, TxG. From this it can be concluded that no term including C further improves the fit achieved by T and TxG, which are the factors with the largest initial contribution to the model. The exhaustive procedure would have been to examine all improvements provided by different variable sets entered in permuted sequence as in the exemplary analysis shown in Tab. 3b and also apply a backward step procedure; however, this would generate more detail than is reasonably presentable. The chosen procedure places high demands on the explanatory power of the candidate variables. In order to surpass T, TxG, the interaction TxC or TxGxC would have to improve model fit by replacing, supplementing, or conditionally changing it. This is not the case with C, "Children in the household", but 4 of the 12 candidate effect modifiers produce such a pattern (Figures 2a-c):

1. Living arrangement A (separate vs. together) with model A, TxGxA. Due to scarce data on couples living separately for more than 9 years, the full time scale is not used.

2. Difference in educational achievement between respondent and partner E (partner higher, same, partner lower) with model GxE, TxGxE

3. Feelings of love L (very often vs. often and less), with model T, GxL, TxG.

4. Quality of sex life Q (good or very good), with model GxQ, TxG

Insert Figure 2a-c about here ..........................
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When the effect modifier is associated with the interaction TxG, the slope changes for some subgroups of males or females (Figures 2a, b): less decline in males and females living separately, no decline in females committed to males with an educational level exceeding the own level, and some decline in males with the reverse difference. The variable "Feelings of love" is associated with a higher level of sexual motivation when present, but would not modify the gender-specific trajectory (Figure 2c). "Quality of sex life" is not included in Figure 2, because its relation to sexual motivation is obvious - it roughly parallels the pattern shown in Figure 2c.

Age (30 vs. 45) and the other 8 candidate variables are dismissed by the forward step procedure, which in every case yields just the T, TxG model. These variables are: married (yes, no), having any children with the partner (yes, no), presence of children living in the household (yes, no), preschool children living in the household (yes, no), high school equivalent - self (yes, no), high school equivalent - partner (yes, no), feeling much at ease in the present partnership (yes, no), ever had an affair (yes, no).

**Prediction.** Model fit is always stronger than prediction since it exploits chance associations that will disappear with a next sample ("overfitting"). Prediction can be assessed at least approximately by comparing the parsimonious model equation derived for the subsample of 267 students aged 29-31 from the preceding study (Klusmann 2002) with the one derived for age group 30 in the present study. It is \(\hat{Y}_{\text{students}} = .95 - .37 X_T + .35 X_T X_G\) compared to \(\hat{Y}_{\text{present sample}} = 1.04 - .36 X_T + .23 X_T X_G\). The general shapes of the curves are similar with the interaction effect standing out more clearly in the present sample. A more accurate assessment would be achieved by applying the coefficients from the student sample to the sample of the present study; however, this was not possible for technical reasons.

**Discussion**

Results for age groups 30 and 45 are amazingly similar to those found in the preceding study of a student sample (Klusmann 2002). The predicted pattern emerged with the two measures referring to the wish to have sex, but less so or not at all in the other two measures. Why did the item "Who initiated sex at the most recent occasion?" fail to show the predicted time dependent course? It might be because this effect shows up only for specific variables, such as, "I want to have sex often", and this for specific reasons that do not have much to do with the real course of sexual motivation. It might also be because the validity of this variable as a measure of sexual motivation is insufficient. Initiative to have sex might be determined by gender specific...
role expectations. There may also be reactivity: Males who are rejected often grow grudgingful and cautious with the initiation of sex. This line of reasoning would also apply to the stated problem, "I was rarely in the mood for sex." After repeated rejection males perhaps enter this mood as a self-defense. However the same argument would apply to females and also to the first two items, directly referring to the desire to have sex. Consequently these items must be assumed to be less troubled by defensive mechanisms when they still show the expected pattern.

Desire for Tenderness. Baker's idea to associate the specific component of male sexual motivation originating from an adaptation to sperm competition with a specific style of behavior - sex on a regular basis (routine-sex), requires sexual motivation still to prevail when passion and tenderness is no longer at its heights. Therefore a decline in male desire for tenderness is expected to coexist with a relatively high level of sexual motivation - this is found in age groups 30 and 60. Female desire for tenderness stays at the same high level in all stages of the partnership. This might be understood as reflecting the importance of keeping male resources as a factor that shaped motivational dispositions guiding female mating to value signs of commitment, and it is tempting to recognize here a symmetry to the importance of paternity as a factor having shaped male motivational design.

Special conditions. Female sexual motivation does not slope downwards (1) when the female is not living together with her mate or (2) when the male's educational level exceeds the female's. In the first instance the partnership might be experienced as not fully established and in the second the male partner might be (more or less non-consciously) identified as a good choice. Both exceptions from the rule of female motivation declining with time may tell an evolutionary story, but they may tell other stories as well. The evolutionary story would be: If the desire to keep the partner is strong, sexual motivation will be strong too, not as an effect of conscious calculation but because the evolved design of female sexual motivation was shaped by the reproductive success of this fine tuning. Slightly contradictory to this line of thought is the fact that relatively strong "feelings of love" do not keep female sexual motivation from declining; however, the decline occurs on a higher level, closer to the level of male motivation. The factors age, presence of children, and being more or less at ease with the relationship are often thought to influen-
Sexual scripts. Before the sexual revolution the traditional sexual script expected a more subdued expression of sexual motives from females than from males. In the old chivalry game a man was expected to cope more easily with sexual rejection than a woman would. Therefore he should never put a woman in a position where she has only the alternative of openly expressing or hiding her sexual desire. Her cues of sexual desire should be subtle and her partner’s sensitivity to these cues should be high. Especially the large gender differences in avowed sexual motivation found in the cohort aged 60 may be explained from an adherence to this way of feeling. Downplayed female sexual desire can also be thought of as a harmonizing device, protecting a male, who needs assurance of his sexual prowess, courtesy to tactical female retreat, which leaves the active part to him. The egalitarian sexual script, which emerged from the sexual revolution, conceived of the emotions governing sexual behavior as to be largely symmetric, reversible and gender unspecific. Still there might be a residual bias in the direction of the chivalry script even in the younger groups, making it harder for a female to admit when her sexual desire exceeds that of her partner than vice versa. However, once again this does not explain variation with duration of partnership.

Combining age groups. When the three age groups are combined into a single data set, the first part of the curve relating sexual motivation to duration is assessed from the younger groups and the later part is assessed from the group of 60. Then the interaction stands out more clearly than in any other sample and the data seem to speak plainly in favor of the hypothesis (Table 4). However this combination is hampered so much by problems of method, that it is almost useless. Theoretically it would be possible for an interaction not to be present in any single age group, but to emerge for the combined sample simply because the level of male and female sexual motivation differs increasingly with age. There is certainly a cohort difference in the way males and females perceive sexual motivation, originating from the historically different conditions of socialization. Therefore the total group is not considered to evaluate the hypothesis.

Sexual motivation after menopause. In the group aged 60 sexual motivation can no longer have a reproductive function for almost all couples. Natural selection could in theory have selected against a motivation to engage in sex any longer if there were no reproductive benefits, or if the cost was substantial, or both. A good candidate for a reproductive benefit, which might be powerful enough to preserve a selective advantage for sexual motivation in older age, seems to be the expression and stabilization of the pair bond, facilitating effective prolonged care for children and grandchildren as well as fostering social cohesion of the greater kinship. In the sample of 60 sexual behavior and more so avowed sexual motivation in males does not seem to have declined very much, compared to the younger cohorts. The comparatively low level of female motivation may be attributed to the traditional sexual script mentioned and perhaps more so to the lack of data for the first years. Without these data, it cannot be assessed if there hasn’t been a time when a female’s avowed sexual motivation equaled that of her male partner. The logistic regression procedure, knowing nothing of these early years, estimates a nearly flat line.

Self selection. If women who are highly motivated to have sex with their partner were particularly prone to cause an early end to their partnerships, in later stages only women with a low level of sexual motivation would be left in the sample. This would generate a picture of decline produced by the selective drop out of women who are strongly motivated to have sex with their mate - a logically possible but contra-intuitive scenario: Why should high sexual motivation in women hasten the end of a partnership? Applied to men this line of reasoning may be more in accordance with intuitive understanding: If men whose sexual motivation declines tend to bring the partnership to an early end, the remaining men would be high on sexual motivation and this would produce the constant level we see. As there is no limit to conceiving of confounding factors like these, this should caution against the risk of putting too much trust into longitudinal interpretations of cross sectional data. An example is the relation between age and intelligence which, when extrapolated from cross-sectional studies would lead to an overestimation of intelligence decline because the secular increase of intelligence level with every generation (Flynn-effect) would not be distinguishable from a truly age-related decline within a cohort. The evolutionary explanation was a post hoc interpretation of the preceding study. With the present study this explanation is raised to the status of an initial hypothesis. However it still has a post hoc feeling to it, perhaps because there is no alternative hypothesis, which could be tested against, except for the
null-hypothesis. Therefore not only the question remains, whether the now fairly established findings from the cross-sectional studies will also emerge in a longitudinal study, but also the question, whether other explanations could successfully compete with the evolutionary explanation.

References


### Tables

#### Table 1. Sample description

<table>
<thead>
<tr>
<th></th>
<th>Age 30</th>
<th>Age 45</th>
<th>Age 60</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Men</td>
<td>Women</td>
<td>Men</td>
</tr>
<tr>
<td>1 Married to partner</td>
<td>29.1</td>
<td>33.3</td>
<td>65.4</td>
</tr>
<tr>
<td>2 Lives together with partner</td>
<td>64.0</td>
<td>72.7</td>
<td>81.5</td>
</tr>
<tr>
<td>3 Has children with partner</td>
<td>20.9</td>
<td>26.3</td>
<td>63.3</td>
</tr>
<tr>
<td>4 Children in household</td>
<td>24.4</td>
<td>32.3</td>
<td>79.0</td>
</tr>
<tr>
<td>5 Children of less than school-age in household</td>
<td>16.3</td>
<td>25.3</td>
<td>27.2</td>
</tr>
<tr>
<td>6 High school and above (self)</td>
<td>62.8</td>
<td>67.7</td>
<td>48.1</td>
</tr>
<tr>
<td>7 High school and above (partner)</td>
<td>43.3</td>
<td>71.7</td>
<td>42.0</td>
</tr>
<tr>
<td>8 Own educational level above partner’s</td>
<td>15.1</td>
<td>11.1</td>
<td>14.8</td>
</tr>
<tr>
<td>9 Own educational level below partner’s</td>
<td>15.1</td>
<td>15.2</td>
<td>8.6</td>
</tr>
<tr>
<td>10 Feelings of love experienced very often</td>
<td>73.6</td>
<td>73.7</td>
<td>63.3</td>
</tr>
<tr>
<td>11 Quality of sex-life judged as good or very good</td>
<td>74.4</td>
<td>63.7</td>
<td>67.9</td>
</tr>
<tr>
<td>12 Ever had an affair</td>
<td>20.9</td>
<td>26.3</td>
<td>33.3</td>
</tr>
<tr>
<td>Median frequency of coitus within last 4 weeks</td>
<td>8</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Median age of partner</td>
<td>28</td>
<td>31</td>
<td>42</td>
</tr>
</tbody>
</table>

#### Table 2. Age by duration, cell frequencies

<table>
<thead>
<tr>
<th>Age group</th>
<th>Duration of partnership (years) at the time of the interview</th>
<th>0-1</th>
<th>2-4</th>
<th>5-9</th>
<th>10-16</th>
<th>17-25</th>
<th>26-36</th>
<th>37+</th>
<th>total</th>
</tr>
</thead>
<tbody>
<tr>
<td>30 years</td>
<td></td>
<td>38</td>
<td>60</td>
<td>57</td>
<td>30</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>185</td>
</tr>
<tr>
<td>45 years</td>
<td></td>
<td>13</td>
<td>24</td>
<td>17</td>
<td>35</td>
<td>76</td>
<td>28</td>
<td>0</td>
<td>193</td>
</tr>
<tr>
<td>60 years</td>
<td></td>
<td>1</td>
<td>5</td>
<td>10</td>
<td>19</td>
<td>23</td>
<td>63</td>
<td>74</td>
<td>195</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>52</td>
<td>89</td>
<td>84</td>
<td>84</td>
<td>99</td>
<td>91</td>
<td>74</td>
<td>573</td>
</tr>
</tbody>
</table>
Table 3a. Logistic regression with a dichotomized summary measure of sexual motivation\(^1\) as the target variable, dependent on time, gender, and the interaction time \(\times\) gender with the combined sample of age groups 30 and 45.

<table>
<thead>
<tr>
<th>Model</th>
<th>B</th>
<th>(P(\text{Wald}))</th>
<th>Exp(B)(^2)</th>
<th>CF1 lower</th>
<th>CF1 higher</th>
</tr>
</thead>
<tbody>
<tr>
<td>Saturated model (T, G, TxG)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time (T)</td>
<td>-.17</td>
<td>.028</td>
<td>0.84</td>
<td>.72</td>
<td>.98</td>
</tr>
<tr>
<td>Gender (G)</td>
<td>.22</td>
<td>.379</td>
<td>1.25</td>
<td>.76</td>
<td>2.04</td>
</tr>
<tr>
<td>Time (\times) Gender (TxG)</td>
<td>.16</td>
<td>.049</td>
<td>1.17</td>
<td>1.00</td>
<td>1.37</td>
</tr>
<tr>
<td>Constant</td>
<td>.95</td>
<td>.000</td>
<td>2.59</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Parsimonious model (T, TxG)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time (T)</td>
<td>-.17</td>
<td>.035</td>
<td>.85</td>
<td>.72</td>
<td>.99</td>
</tr>
<tr>
<td>Time (\times) Gender (TxG)</td>
<td>.22</td>
<td>.000</td>
<td>1.25</td>
<td>1.16</td>
<td>1.34</td>
</tr>
<tr>
<td>Constant</td>
<td>.93</td>
<td>.000</td>
<td>2.53</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\(^1\) defined in Tab. 4 as variable (e)

Table 3b. Model \(X^2\) improvement\(^1\) for all sequences of entering the factors shown in Tab. 3a

<table>
<thead>
<tr>
<th>Initial Model(^2)</th>
<th>Model (X^2)</th>
<th>Added factor(s)</th>
<th>Improvement (X^2)</th>
<th>Resulting model</th>
<th>Model (X^2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(T)</td>
<td>9.4</td>
<td>G</td>
<td>35.6</td>
<td>(T,G)</td>
<td>45.0</td>
</tr>
<tr>
<td>(T)</td>
<td>9.4</td>
<td>(TxG)</td>
<td>38.9</td>
<td>(T, TxG)</td>
<td>48.2</td>
</tr>
<tr>
<td>(T)</td>
<td>9.4</td>
<td>(T, TxG)</td>
<td>39.6</td>
<td>(T,G, TxG)</td>
<td>49.0</td>
</tr>
<tr>
<td>(G)</td>
<td>38.2</td>
<td>T</td>
<td>6.8</td>
<td>(T,G)</td>
<td>45.0</td>
</tr>
<tr>
<td>(G)</td>
<td>38.2</td>
<td>(TxG)</td>
<td>6.0</td>
<td>(G, TxG)</td>
<td>44.2</td>
</tr>
<tr>
<td>(G)</td>
<td>38.2</td>
<td>(T, TxG)</td>
<td>10.8</td>
<td>(T,G, TxG)</td>
<td>49.0</td>
</tr>
<tr>
<td>(TxG)</td>
<td>44.7</td>
<td>T</td>
<td>4.5</td>
<td>(T, TxG)</td>
<td>48.2</td>
</tr>
<tr>
<td>(TxG)</td>
<td>44.7</td>
<td>G</td>
<td>0.5</td>
<td>(G, TxG)</td>
<td>45.2</td>
</tr>
<tr>
<td>(TxG)</td>
<td>44.7</td>
<td>(T, G)</td>
<td>5.3</td>
<td>(T,G, TxG)</td>
<td>49.0</td>
</tr>
<tr>
<td>(T,G)</td>
<td>45.0</td>
<td>(TxG)</td>
<td>4.0</td>
<td>(T,G, TxG)</td>
<td>49.0</td>
</tr>
<tr>
<td>(T, TxG)</td>
<td>48.2</td>
<td>G</td>
<td>0.8</td>
<td>(T,G, TxG)</td>
<td>49.0</td>
</tr>
<tr>
<td>(G, TxG)</td>
<td>44.2</td>
<td>T</td>
<td>4.8</td>
<td>(T,G, TxG)</td>
<td>49.0</td>
</tr>
</tbody>
</table>

\(^1\) An improvement \(X^2\) of 4.0 corresponds to \(p(X^2)\) = .048, df = 1

\(^2\) Effects for: \(T\) Time elapsed since the partnership began in years, square root transformed, \(G\): Gender, \(TxG\): Interaction Time \(\times\) Gender
Table 4. Condensed Evaluation of logistic regression models for the effect of duration of partnership and gender on measures of sexual motivation and desire for tenderness

<table>
<thead>
<tr>
<th>Variables</th>
<th>Age 30</th>
<th>Age 45</th>
<th>Age 60</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) I want to have sex often – more than or same as my partner (self-characterization).</td>
<td>10 TxG</td>
<td>01 T, TxG</td>
<td>10 G</td>
<td>01 T, TxG</td>
</tr>
<tr>
<td>(b) I wanted to have sex more often than my partner (stated as a problem)</td>
<td>11 TxG</td>
<td>11 T, TxG</td>
<td>10 G</td>
<td>11 TxG</td>
</tr>
<tr>
<td>(c) I was rarely in the mood for sex (stated as a problem).</td>
<td>00 T, G</td>
<td>10 G</td>
<td>11 TxG</td>
<td>11 TxG</td>
</tr>
<tr>
<td>(d) I initiated the most recent sexual act.</td>
<td>00</td>
<td>01 G</td>
<td>01 G</td>
<td>11 TxG</td>
</tr>
<tr>
<td>(e) Sum of items a-e dichotomized at the median</td>
<td>00 T, TxG</td>
<td>10 TxG</td>
<td>10 G</td>
<td>01 T, TxG</td>
</tr>
<tr>
<td>(f) I just want to be tender – more than or same as my partner (self-characterization).</td>
<td>10 T, TxG</td>
<td>00 G</td>
<td>10 TxG</td>
<td>00 T, G</td>
</tr>
</tbody>
</table>

The evaluation of model fit improvement is coded by two numbers, which represent the results of two tests followed by the abbreviation for a model that is the result of the third test.

**Test 1:** Is the interaction sufficient? Code for first number = 1, if interaction TxG, when entered first, cannot be improved by main effects T, G, otherwise 0.

**Test 2:** Is the interaction necessary? Code for second number = 1, if T, G, when entered first, can be improved by interaction TxG, otherwise 0.

**Test 3:** Is the interaction included in a parsimonious model? Model resulting from of a forward selection procedure with the likelihood ratio test as the criterion of removal

This table corresponds to Figures 1a-f.
Figures

Figure 1a-f. Five measures of sexual motivation and one measure of desire for tenderness as dependent on duration of partnership (time) and gender in three age groups.

Y-axis: Percentage of "yes"-responses, X-axis: Duration of partnership in years
Curves estimated by logistic regression, saturated model
Figure 2a-c. Factors modifying the relation between gender, time, and sexual motivation.

Sample: Age groups 30 and 45 combined.
Measure: Sexual motivation: Sum of items a, b, c, d (see Fig. 1), dichotomized (≤ 1 vs. > 1).
Y-axis: Percentage of responses in the "high" category of sexual motivation,
X-axis: Duration of partnership in years
Curves estimated by logistic regression, saturated model