Showing smarts, playing dumb:

Functional displays of intelligence

in mating contexts

by

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ABSTRACT

The current research seeks to examine whether individuals display or downplay intelligence in various mating contexts. I hypothesized that both men and women should display fluid intelligence when attempting to attract a potential long-term partner, and that only men should display fluid intelligence when attempting to attract a potential short-term partner. Contrary to predictions, I find that men perform worse at a fluid intelligence test when motivated to attract a long-term partner. With respect to crystallized intelligence, I predicted that both men and women should display crystallized intelligence when attempting to attract a potential long-term partner, but women should downplay crystallized intelligence when attempting to attract a potential short-term partner. However, there were no effects of mating contexts on displays of crystallized intelligence.

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INTRODUCTION

"You see a lot of smart guys with dumb women, but you hardly ever see a smart woman with a dumb guy."

- Erica Jong

"I may be dumb, but I'm not stupid."

- Rihanna

Across multiple societies and across time, men have been found to value physical attractiveness in a romantic partner more than women do, whereas women prioritize a partner's earning capacity (Buss, 1989; Kenrick, Groth, Trost, & Sadalla, 1993; Li, Bailey, Kenrick & Linsenmeier, 2004). However, that men and women differentially prioritize these traits does not mean that they are the most sought after by either sex. In fact, when asked to rank the desirability of different traits in a partner, men rank physical attractiveness as the 5^{th} most desirable, while women rank earning capacity as 9^{th} (Buss et al., 1990). The two traits most highly ranked by both sexes are, in fact, kindness and intelligence. If these traits are desirable in partners, then one might expect people to display them to the opposite sex.

Suggestive of this, one set of studies has demonstrated that individuals become more creative when mating-minded (Griskevicius, Cialdini & Kenrick, 2006). Specifically, when men imagined themselves on a date with an attractive female, they wrote more creative stories. Women only displayed such creativity when imagining themselves with a male who appeared to have good long-term partner potential (i.e., a male who was seen as committed to her and was liked by family and friends). But creativity is not the same as intelligence. For instance, whereas judgments of creativity overlap with judgments of intelligence, the two independently predict attraction (Prokosh, Coss, Scheib & Blozis, 2009). Also, whereas intelligence is generally ranked as the 2nd most desirable trait in a partner, creativity is ranked significantly lower, between 6th and 7th (Buss et al., 1990).

If intelligence is so valued, advertising one's intelligence should be critical to attracting a mate. However, there is also a belief that women tend to "play dumb" on dates (The New York Times, 2012). Do people display intelligence when trying to attract partners? Under what conditions would people *down*play instead? Are such downplays specific to certain aspects of intelligence? The current research focuses on these questions.

The definition and value of intelligence

What exactly do people mean when they say they are looking for an "intelligent" partner? When asked about behaviors that characterize an ideal intelligent person, laypersons list a range of behaviors, such as "identifies connections among ideas," "is knowledgeable about a particular field," "makes good decisions," and "deals effectively with people" (Sternberg, Conway, Ketron, & Bernstein, 1981). These behaviors overlap considerably with the behaviors listed by research psychologists who do work on intelligence. But Sternberg et al. also found substantial variation in conceptions of intelligence. In the same set of studies, students surveyed at a college library perceived overlap in the behaviors that characterized intelligent and *academically* intelligent people. On the other hand, people surveyed at train stations and supermarkets perceived more overlap between intelligent and *everyday* intelligent behaviors. Conceptions of intelligence also vary depending on who is being considered. When people were asked about the likely behaviors of intelligent individuals at 30, 50, and 70 years old, behaviors that reflect interest and ability to deal with novelty were perceived to be more characteristic of intelligent 30 year-olds than older ages. Conversely, behaviors that reflect verbal competence were perceived to be more characteristic of intelligent 50 and 70 year-olds, than 30 year-olds (Berg & Sternberg, 1992).

Given people's wide-ranging perceptions of what constitutes intelligence, there may be multiple explanations for why people value intelligence in a partner. Such explanations may be classified into two broad types: Intelligence may be valued because of the direct benefits of intelligence *per se*, or because it is a cue to some other desirable trait.

Intelligent people may simply be better able to solve the problems of everyday life. Given the highly social and interdependent nature of our species (Campbell, 1982; Richerson & Boyd, 1995), the ability to solve social problems is likely an essential component of intelligence. Social competence is indeed an aspect of the layperson's conception of intelligence (Sternberg et al., 1981). Facets of social intelligence include the ability to read the intentions of others accurately and to track social relationships between individuals (Byrne & Whiten, 1988). Humphrey (1976) proposed that primate intelligence evolved mainly to deal with the complexities of social life. Primate species with greater social complexity, measured by average group size, also tend to have larger brains (Dunbar, 1998), lending support to the social intelligence hypothesis. If intelligence is very much social in nature, then perhaps the preference for intelligent partners is really a preference for socially intelligent mates.

Intelligence, besides having social benefits, might also be a cue to other desirable traits. For example, intelligence is associated with greater socioeconomic status and success (Gottfredson, 2002; Gottfredson & Deary, 2004), which would in turn lead to greater access to physical resources. If intelligent individuals also tend to have greater access to resources, and resources are required for the successful raising of offspring, then a preference for intelligent partners would have been adaptive, and selected for by evolution.

Another hypothesis is that intelligence—in particular, *fluid intelligence*—cues developmental stability. Fluid intelligence is a latent construct that is posited to underlie performance in a wide range of mental tests, and can be defined as the broad ability to reason and solve problems concerning novel information (Cattell, 1963; Spearman, 1904). Developmental stability is the extent to which individuals are able to resist environmental stressors and disruptors during growth (Prokosh, Yeo, & Miller, 2004). One negative indicator of developmental stability is body asymmetry, which is the extent to which individuals deviate from perfect symmetry on bilateral features such as hands and feet (Gangestad & Thornhill, 1999). Individuals who are more asymmetrical have been found to have poorer health, slower growth, and lower fecundity (Gangestad & Simpson, 2000). Just as physical features can be an indicator of genetic quality, so can mental features. Given that at least 55% of coding DNA is expressed in the brain, an individual's cognitive abilities provide a large window of information into their genes (Keller & Miller, 2006). Individuals with greater fluid intelligence have indeed been found to be more symmetrical (Banks, Batchelor & McDaniel, 2010; Prokosch et al., 2004). Men who score higher on intelligence tests have also been found to have better semen quality (Arden, Gottfredson, Miller, & Pierce, 2009). This lends support to the hypothesis that intelligence serves as an indicator of genetic quality, and would thus be sought after in mates.

A final hypothesis is that intelligence might cue a willingness to invest in children, insofar as it reflects acquired knowledge. Being knowledgeable is considered an aspect of intelligence (Sternberg et al., 1981) and, in my own data, people's preferences for intelligent mates correlate strongly with their preferences for knowledgeable mates (Sng, unpublished). A preference for intelligence might therefore reflect, in part, a preference for knowledge. But why would a partner's knowledge suggest that this person would be willing to invest in children?

Knowledge reflects a tendency to accumulate what might be called "embodied capital" (Kaplan & Gangestad, 2004)—investments into one's own body. People vary in the extent to which they invest in embodied capital, with such individual variation being part of a larger framework in biology called life history theory (Ellis, Figueredo, Brumbach, & Schlomer, 2009; Stearns, 1976). If mortality rates are high and unpredictable, it would not be adaptive to invest as much in embodied capital, because one might die before being able to effectively utilize accumulated knowledge or learned skills. Conversely, a stable environment with low mortality rates would allow such investments to reap their benefits in the long run. The same logic applies to investment in *children*, with such investment being more likely to pay off in stable low mortality environments. Such high investment in embodied capital and offspring is part of a general suite of behaviors termed as a "slow" life history strategy (Kaplan & Gangestad, 2004; Promislow & Harvey, 1990). Hence, substantial accumulated knowledge might serve as a cue that another will invest heavily in parenting, and be sought after for that reason.

In the current study, I focus on displays of intelligence in mating contexts, and presume that the characteristics people display depend on what they think potential mates are looking for. If intelligence is desirable because it reflects genetic quality, then displays of intelligence should employ a wide range of mental abilities to best portray overall genetic fitness. If intelligence is desirable because it cues high parental investment, then accumulated forms of intelligence, such as learned knowledge, should be prominently displayed. These two hypotheses correspond to two forms of intelligence that have been distinguished in the psychological literature: Fluid intelligence has been defined as general problem-solving ability, whereas crystallized intelligence is defined as learned knowledge and skills (Cattell, 1963; Horn, 1985; Lohman, 1989). Measures of each type of intelligence have been established (Horn & Cattell, 1966) and successfully used in subsequent research (Jenkinson, 1983; McArdle, Ferrer-Caja, Hamagami, & Woodcock, 2002).

Downplaying intelligence

Given that both men and women value intelligence in partners, one might expect that both sexes should display intelligence, whether fluid or crystallized, in mating contexts. Yet there is a stereotype that women "play dumb" to attract men (The New York Times, 2012). Indeed, in older research, more than 40% of females have reported playing dumb on dates (Komarovsky, 1946; Wallin, 1950). Playing dumb does not seem to be unique to women, however. A comparable percentage of men also report playing dumb (Dean, Braito, Powers, & Bruton, 1975; Gove, Hughes, & Geerken, 1980), although there is some tendency for women to report having done so more. For example, 47% of females report having ever pretended to be "intellectually inferior", as compared to 33% of men (Dean et al., 1975). On the other hand, that same research revealed no sex difference in having pretended to be "inferior in artistic knowledge." The original explanation for why women play dumb is couched in sex roles theory: Women downplay their intelligence, especially as it is reflected in academic achievement, because it contradicts the "feminine" role in society (Komarovsky, 1946). However, as pointed out by subsequent researchers, this fails to account for why substantial proportions of men also play dumb (Dean et al., 1975; Gove et al., 1980).

One possibility is that some aspect of intelligence might be *un*desirable in specific mating contexts. As mentioned earlier, preferences for intelligence may reflect in part preferences for accumulated knowledge, or crystallized intelligence. A tendency to accumulate knowledge, along with greater parental investment, is part of a slow life history strategy, and another trait associated with a slow life history strategy is sexual restrictedness (Figueredo et al., 2005; Figueredo et al., 2006)—the tendency to require closeness and commitment before having sex with a romantic partner (Simpson & Gangestad, 1991). Such a tendency might not be desirable in all relationships. In particular, it might not be appealing to individuals seeking short-term sexual partners.

Some evidence for this comes from work on mate preferences in relationships of varying commitment levels. When individuals were asked about their minimum acceptable levels of intelligence for different types of partners, both men and women actually had lower preferences for intelligence in a one-night stand partner than for a date (Kenrick, Groth, Trost, & Sadalla, 1993). In my own data, I asked men and women about their preferences for short-term (e.g., one-night stand) versus long-term (e.g., spouse) partners on a set of traits, including several intelligence-related characteristics (Sng, unpublished). I found that men who placed greater importance on sexiness and physical attractiveness in short-term partners placed *less* importance on education and knowledge. Interestingly, this negative relationship between preferences did not apply for female short-term partner preferences or the long-term partner preferences of both sexes. The relationship was also specific to traits that reflect crystallized intelligence: Men who valued sexiness did *not* devalue the importance of other aspects of intelligence like creativity.

Cues of crystallized intelligence might therefore be undesirable to individuals seeking short-term relationships. Particularly, men prioritizing sexual accessibility might avoid women with high crystallized intelligence. These women might be adopting a slower life history strategy and thus be more sexually restricted, thereby impeding the goals of men seeking short-term uncommitted relationships. Following this, from the female perspective, women who are attempting to attract a desirable short-term partner might therefore hide cues of crystallized intelligence to avoid coming across as sexually restricted. Such "playing dumb" behavior should occur less or not at all for women seeking long-term partners.

Overview and measures

Here, I summarize the predictions of the current study. First, I predict that both men and women will display fluid intelligence in mating contexts, but perhaps especially so in a short-term mating one. Cues of genetic quality, such as physical attractiveness, are especially prioritized in a short-term partner (Li & Kenrick, 2006) and if fluid intelligence reflects good genes, then it should be especially important when trying to attract a short-term partner.

One possible exception to the above predictions is that women in a short-term mating context will not display fluid intelligence. Because men are highly selective only when seeking long-term mates (i.e., when high paternal investment involved), women might only need to display fluid intelligence when attempting to attract a male who is a desirable long-term partner. Consistent with this, Griskevicius et al. (2006) found that women only displayed greater creativity under long-term mating motivations—when thinking about an ideal romantic partner who has demonstrated trustworthiness and commitment. In contrast, because women tend to be highly selective about both short and long-term mates, due to a larger obligatory parental investment (i.e., bearing offspring during gestation and weaning them upon birth; Trivers, 1972), men need to display fluid intelligence in both short- and long-term contexts.

I will use the Raven's Progressive Matrices to assess fluid intelligence (Raven, Court, & Raven, 1994). A typical Raven's matrix consists of a 3 by 3 grid in which 8 of the cells have patterns in them, while the 9^{th} is empty. The task is to select the pattern, from several possible options, that best fits the 9^{th} cell. Scores on the Raven's matrices correlate highly with a wide range of intelligence tests and, to perform well at the task, a wide range of cognitive abilities need to be employed, including abstract reasoning, goal management, and analogical reasoning (Carpenter, Just & Shell, 1990).

The second set of predictions involves crystallized intelligence. I predict that both men and women will display crystallized intelligence under long-term mating motivations. If accumulated knowledge cues parental investment, then it should be displayed when seeking high investment, long-term relationships. On the other hand, crystallized intelligence also cues potential sexual restrictedness, which would be perceived as undesirable by men seeking short-term relationships. If so, then women who are seeking short-term mating, or attempting to appeal to desirable short-term oriented men with the hope of eventually developing a long-term relationship, might downplay their accumulated knowledge to avoid cuing sexual inaccessibility.

Crystallized intelligence has predominantly been measured using vocabulary and reading comprehension tests (Hambrick et al., 2010; Horn, 1968; Raz, Moberg, & Millman, 1990). Some analyses have found, however, that such tests overlap substantially with measures of fluid intelligence (Marshalek, Lohman, & Snow, 1983). To create a more independent measure of crystallized intelligence, participants will be asked to read and subsequently summarize the content of a novel news article for an opposite-sex audience. The summary will be coded for number of facts, as an indicator of displayed crystallized intelligence. A memory test will also be constructed to measure recall of facts from the article before individuals summarize it. This enables me to control for memory effects: If women in short-term mating contexts mention fewer facts in their summary, controlling for their memory for these facts, this would suggest a strategic downplaying of crystallized intelligence.

Chapter 2

METHOD

Participants

Three hundred and eighteen students (159 female) were recruited from introductory psychology courses to complete a study for partial fulfillment of course credit. Mean age of participants was 19.3 (*SD* = 1.9).

Materials and Procedure

The design of the experiment was a between-participants 2 (Sex) X 3 (Motivation: control/short-term mating/long-term mating) design. Participants first completed a baseline measure of fluid intelligence and also read a short general science article. Memory for facts described in the article was then tested. Next, participants read the assigned motivation scenario that would activate the relevant mating contexts. After the motivation manipulation, participants then completed a post-manipulation measure of fluid intelligence. Participants also wrote a summary of the science article they read earlier. The written summary was then content-coded for number of facts represented from the original article. Number of facts written was then used as the main measure of crystallized intelligence display.

Fluid intelligence. To assess fluid intelligence, I used the Raven's Progressive Matrices (Raven, Court, & Raven, 1994). Given that the main predictions involve boosts in performance, the more difficult Advanced Progressive Matrices (APM) were used (Raven, Court & Raven, 1994). The APM was split into two parallel sets, one containing odd numbered items and the other even numbered. Baseline performance was measured using the odd set, while post-motivation performance was measured using the even set.

Such splitting procedures have been successfully used in previous studies (Jaeggi, Buschkuehl, Jonides, & Perrig, 2008). The Advanced Progressive Matrices typically takes 45 minutes to complete. Given experimental time constraints and concerns about the duration of the effects of the experimental manipulation, participants were given a time limit of 10 minutes for each of both the odd and even numbered sets. This deviates from the standardized procedure, but past studies find that a timed procedure has little influence on people's relative performance, with correlations between speeded and non-speeded versions averaging at .95 (Frearson & Eysenck, 1986).

Crystallized intelligence article. To measure crystallized intelligence, after completing the matrices, participants first read an article from *ScienceDaily* about research on flight patterns of hummingbirds (The *Journal of Experimental Biology*, 2012). Below is an abstract from the article (see Appendix B for full article):

> Analyzing the three flight styles, Sapir recalls that there were clear differences between forward and backward flight. The hummingbirds' body posture became much more upright as they flew backward, forcing them to bend their heads more to insert their beaks into the simulated flower. In addition, the reversing birds reduced the inclination of the plane of the wing beat so that it became more horizontal. And when Sapir analysed the wing beat frequency, he found that the birds were beating their wings at 43.8 Hz, instead of the 39.7 Hz that they use while flying forward. 'That is quite a lot for hummingbirds because they hardly change their wing beat frequency', explains Sapir.

The article was chosen because it contains recent and unique content and was written in layperson language. To control for individual variation in memory, a set of 14 multiple-choice memory questions were presented to participants after reading the article. These questions were selected through pre-testing from a larger set of questions developed from the article content. The questions were selected to cover a range of difficulties so as to avoid ceiling or floor effects in performance. An example question is “The flight patterns of hummingbirds are highly similar to:” with four possible responses, insects (the correct answer), songbirds, bats and helicopters (see Appendix C for list of questions).

Motivation manipulations. After completing the memory test, participants read one of three possible stories, depending on the assigned experimental condition, and imagined themselves in the scenarios depicted in these stories (Griskevicius et al., 2006; Griskevicius et al., 2009). In the control scenario, participants imagined being at home and realizing their wallet was missing. The scenario then goes on to describe the search for the wallet in the house, ending with participants stumbling upon it. In the short-term scenario, participants imagined themselves on their last day of an island vacation, meeting a highly attractive opposite sex individual, and spending a romantic day together. The scenario ends with a passionate kiss on a moonlit beach. The short-term scenario emphasizes that the two people will likely never meet each other again. Finally, in the long-term scenario, participants imagined meeting a desirable person on the university campus and also spending a romantic day together. The scenario however goes on to describe how subsequent dates have gone extremely well and how the reader is forming an even more positive impression of their date with time. The scenario ends with a description of the reader becoming excited about the coming date, hoping that it would become the first “official” one. The romantic scenarios have been previously tested to cue the said types of romantic partners to a reader, with people perceiving the imagined mate described in the long-term scenario as being more committed and more desirable as a long-term partner than the imagined mate in the short-term scenario (Griskevicius et al., 2006, Study 3).

Fluid/crystallized intelligence displays. After the motivation manipulations, participants completed the even numbered set of the Raven's matrices as a measure of displays of fluid intelligence.

To measure displays of crystallized intelligence, participants wrote a summary of the hummingbird article. A coding sheet was first developed through discussion with a research assistant. The final coding sheet consisted of 30 facts drawn from the original article (see Appendix D). Using the coding sheet, four other research assistants, blind to experimental conditions, independently coded participant summaries for the number of facts in each summary. The order in which the Raven's matrices and summary task were presented was randomized.

Chapter 3

RESULTS

To test the general prediction that men and women differentially display or downplay different types of intelligence in various mating motivations, I first conducted a 2 (Sex) X 3 (Motivation: Control/Short-term mating/Long-term mating) X 2 (Intelligence type: Fluid/Crystallized) ANCOVA with the pre-manipulation Raven's score and the memory test score as covariates. As the two types of intelligence measures were on a different metric (Raven's score vs. number of written facts), to allow the two measures to be comparable, I standardized *P* scores on each measure before conducting the analysis. No main or interaction effects were significant, all *p*s > .46. However, my main hypotheses are specific to each type of intelligence. I therefore proceeded to conduct separate analyses for fluid and crystallized intelligence.

Fluid intelligence

The baseline scores for the Raven's matrices was 9.37 (*SD* = 3.09). There was no sex difference in performance on the baseline matrices (*M* = 9.48, *SD* = 3.17 for men, *M* = 9.25, *SD* = 3.01 for women, *p* = .51). Before using the baseline Raven's score as a covariate, to test for the assumption of homogeneity of regression, I performed a 2 (Sex) X 3 (Motivation) X 2 (Time: Baseline/Post-Motivation Raven's score) ANOVA. No interaction terms with the Time factor were statistically significant. The assumption was therefore not violated. I then performed a 2 (Sex) X 3 (Motivation) analysis of covariance (ANCOVA), with baseline Raven's matrices score as a covariate, and post-motivation Raven's matrices score as the dependent variable. To test the specific hypotheses, three planned comparisons were performed – two for men and one for women – within the

ANCOVA.

For men, I predicted that they would exhibit greater fluid intelligence under both the short and long-term mating motivations, compared to the control, but this might be especially so in the short-term mating condition, due to fluid intelligence indicating good genes. The first contrast compared men in the long-term mating condition with men in the control condition. A significant effect emerged, but in the opposite direction to predictions: men in the long-term mating condition ($M = 8.35$, $SD = 3.50$) exhibited poorer fluid intelligence than men in the control condition ($M = 9.34$, $SD = 3.33$), $F(1, 311) = 4.80$, $p = .029$, partial $\eta^2 = .015$ (see Figure 1). The second contrast compared men in the short-term mating condition with men in the control and long-term mating conditions combined. There was no significant effect, $F(1, 311) = .001$, $p = .98$. Hence, the hypotheses for men were not supported. Men in the short-term mating condition did not exhibit greater fluid intelligence as compared to men in the other conditions. Surprisingly, men in the long-term mating condition exhibited *less* fluid intelligence as compared to men in the control condition.

For women, I predicted that women would exhibit greater fluid intelligence under the long-term mating motivation, compared to the control. The contrast comparison did not find a significant effect, $F(1, 311) = .93$, $p = .34$, partial $\eta^2 = .003$. The hypothesis for women was also unsupported.

In an exploratory analysis, I collapsed the short and long-term mating motivation conditions into a general mating motivation condition. I then ran a 2 (Sex) X 2 (Motivation: Control/General Mating) ANCOVA, with baseline Raven's matrices score as a covariate, and post-motivation Raven's matrices score as the dependent variable.

There was no main effect of sex, $F(1, 313) = .002$, $p = .96$, or interaction effect, $F(1, 313) = .24$, $p = .63$. There was, however, a significant effect of motivation, $F(1, 313) = 4.77$, $p = .03$, partial $\eta^2 = .015$. When collapsing across individuals in both short and long-term mating motivations, mating motivated individuals ($M = 8.60$, $SD = 3.25$) generally did worse on the Raven's matrices as compared to individuals in a control condition ($M = 9.17$, $SD = 3.12$).

Crystallized intelligence

For the facts coding of participant summaries, the four judges showed high interrater reliability (intra-class correlation $\alpha = .97$). As such, I averaged the ratings of the judges to create the main measure of displayed crystallized intelligence – number of facts written by participants in their summaries. Six participants wrote about the motivation manipulation instead of the hummingbird article. Seventeen participants did not write anything at all. These participants were excluded from these analyses.[1] A similar 2 (Sex) X 3 (Motivation) ANCOVA was performed, with article memory score as a covariate, and summary facts score as the dependent variable. To test specific hypotheses, four planned comparisons were performed – two for men and one for women – within the ANCOVA.

For men, my prediction was that men will exhibit more crystallized intelligence under both the short and long-term mating motivations, compared to the control condition, but especially so in the long-term mating condition, due to the potential

[1] There were nine males (seven in short-term mating condition, two in long-term mating) and eight females (four in control, one in short-term mating, three in long-term mating) who did not write summaries. Instead of considering them as errors, not writing summaries could be considered as not displaying crystallized intelligence. I therefore reran the analyses including these individuals, and giving them facts scores of zero. There was no qualitative change in the findings.

association between accumulated knowledge and likelihood of high parental investment. The first contrast compared men in the short-term mating condition with men in the control condition. There was no significant effect, $F(1, 287) = 1.19$, $p = .28$, partial $\eta^2 = .004$ (see Figure 2). The second contrast compared men in the long-term mating condition with men in both the control and short-term mating condition. There was also no significant effect, $F(1, 287) = .76$, $p = .39$, partial $\eta^2 = .003$. The hypotheses for men with regards to crystallized intelligence were unsupported – mating motivations did not seem to affect crystallized intelligence displays.

For women, my prediction was that women in a long-term mating motivation would display greater crystallized intelligence, but downplay it in a short-term mating motivation, as knowledge might cue sexual restrictedness. The first contrast compared women in the long-term mating condition with women in the control condition. There was no significant effect, $F(1, 287) = .22$, $p = .64$, partial $\eta^2 = .001$. The second contrast compared women in the short-term mating condition with women in the control condition. There was also no significant effect, $F(1, 287) = 2.25$, $p = .14$, partial $\eta^2 = .008$, although the trend was in the predicted direction – women in the short-term mating condition seemed to be writing fewer facts in their summary than women in the control condition.

Similar to fluid intelligence, an exploratory analysis was also conducted collapsing the two mating motivations into a general mating condition. A 2 (Sex) X 2 (Motivation: Control/General Mating) ANCOVA was performed, with article memory score as a covariate, and summary facts score as the dependent variable. There were no significant main or interaction effects (all *p*s > .13). When collapsing across both mating conditions, the number of facts written in article summaries did not vary by participant sex or motivation condition.

Additional analyses

Do students think Raven's matrices performance reflects intelligence?

It is unclear what undergraduate students perceive the Raven's matrices to be a reflection of. If participants had thought that performance on the Raven's matrices does not cue intelligence, or even that it cues the lack thereof, then it would not be surprising that performance on the Raven's did not increase.

At the end of the study, participants were asked about their stereotypes of two hypothetical individuals, one who scored 5 out of 18 on the Raven's matrices, and another who scored 15 out of 18. They were told that the average score for an ASU student was 10 out of 18. Participants rated these two hypothetical individuals on a series of traits, including *intelligent*, *knowledgeable, healthy* and *physically attractive,* on a scale of 1 (*Not at all*) to 9 (*Extremely*). Participants stereotyped the 15/18 scorer to be significantly more intelligent, knowledgeable and healthy (all ps $< .001$) than the 5/18 scorers, but no more physical attractive ($p = .73$). The same pattern held for both male and female participants. It seemed that people did judge performance on the matrices as a reflection of intelligence, but interestingly, also of knowledge. In relation to the idea that fluid intelligence might reflect good genes, the evidence seems mixed: people stereotyped high scorers on the Ravens as healthier but not as more physically attractive.

Subjective judgments of article summaries

The fact coding scheme might not have adequately captured participants' displays of crystallized intelligence. This trait might have been displayed through other aspects of the writing, such as its language structure. To test this, the four raters who coded the participant summaries also made subjective judgments of each participant after reading their summaries. Specifically, they were asked how *knowledgeable, intelligent* and *creative* they thought the writer was, on a scale of 1 (*Not at all*) to 7 (*Extremely*). Interrater reliability for each of items was high (all αs > .75). A composite rating for each trait was therefore created by using the average rating of all four raters on that trait. A 2 (Sex) X 3 (Motivation) ANOVA was then performed on each of the three trait judgments. There were no significant main or interaction effects in all three ANOVAs (all ps > .34).

Trying to impress by quantity not quality – fluid intelligence

A possibility is that mating motivated individuals displayed fluid intelligence not by trying to have more accurate answers but by trying to attempt more matrices. To test this, a 2 (Sex) X 3 (Motivation) ANOVA was performed on the numbers of matrices answered in the post-motivation matrices set. There were no statistically significant effects, although it is noteworthy that the effect of motivation was trending towards significance, $F(2, 311) = 2.41$, $p = .091$ (see Figure 3). It seemed that men under short and long-term mating motivations were attempting more matrices post-motivation than men in the control condition. Women on the other hand were attempting more matrices in the long-term mating condition than in the control or short-term mating condition. This trend matches the original predicted pattern for performance on the matrices. It is possible, then, that people were displaying intelligence by *attempting* more matrices in the limited time frame, rather than trying to get more correct responses on the matrices. This interpretation should however be treated with caution given the lack of statistical significance of the motivation effect.

Trying to impress by quantity not quality – crystallized intelligence

The number of facts coded in participant summaries might not have been the best measure of displays of knowledge. One could give the *illusion* of being knowledgeable by simply writing more in their article summaries. The article summaries were therefore also coded for number of words and a 2 (Sex) X 3 (Motivation) ANOVA was performed using number of words as the dependent variable. There were no significant main or interaction effects, all *p*s > .41. An alternative measure of word rate was also calculated by dividing the number of words in summary by time taken to write it. A similar ANOVA on this measure also did not show any significant effects, all *p*s > .71. The mating motivations did not affect the number of words that participants wrote or their writing rate.

Sociosexuality and matching mating contexts

It is possible that our predicted effects will hold only for individuals who are presented with a motivational condition that fits with their chronic sexual strategies. In other words, perhaps intelligence is displayed or downplayed by short-term mating oriented individuals who are also presented with the short-term mating context, or long-term oriented individuals who are also presented with the long-term mating context. Participants' sociosexuality—the tendency to be able to have sex without relationship commitment (Simpson & Gangestad, 1991)— was measured in the current study using recently developed scales (Jackson & Kirkpatrick, 2007). However, analyses testing whether sociosexuality moderated the effect of mating motivations on intelligence displays did not reveal any effects.

Chapter 4

DISCUSSION

With respect to fluid intelligence, I predicted that both men and women would display greater fluid intelligence under a long-term mating motivation. Instead, I found that men performed more poorly on a fluid intelligence test under a long-term mating motivation whereas women did not change in their performance. Under a short-term mating motivation, I predicted that men specifically would still display fluid intelligence. That prediction was not borne out.

For crystallized intelligence, I predicted again that both men and women would display crystallized intelligence in the long-term mating motivation. In the short-term mating motivation, women might downplay crystallized intelligence instead. There were no significant effects of either short or long-term mating motivations on crystallized intelligence displays, although there was a non-significant trend for women in a short-term mating motivation to be downplaying knowledge by writing fewer facts in their summary.

In general, my predictions did not hold. It seemed that mating motivations were actually negatively influencing performance in both fluid and crystallized intelligence. With respect to fluid intelligence, a closer look at performance on the Raven's matrices seems to hint of potential display through another aspect of performance: number of matrices attempted. There was a trend for men in both the short and long-term mating motivations to be attempting more matrices than men in a control scenario. Women in the long-term mating motivation, but not short-term, were also exhibiting a similar trend of attempting more matrices within the given time limit. If individuals are trying to complete more matrices under the same time restrictions, the amount of time allocated to each individual matrix will be reduced. This might account for why performance on the matrices was generally poorer under mating motivations. Future work might tease apart the various aspects of cognitive performance through which individuals attempt to display their desirability as a mate.

With respect to crystallized intelligence, it did seem that women were potentially "playing dumb" when in a short-term mating context, although the effect was not statistically significant. By presenting fewer facts when asked to summarize material they just learned, they may have strategically downplayed how knowledgeable they come across to a potential male short-term partner.

One might question the face validity of the current measures in tapping displays of fluid and crystallized intelligence. When participants in the current study were asked about their perceptions of people who performed well on the Raven's matrices, they stereotyped these individuals as more intelligent, but also as more knowledgeable. It seems then that the Raven's matrix test might have been seen by participants as a test diagnostic of both fluid and crystallized intelligence. Therefore, it might not have been an ideal test for distinguishing between displays of fluid and crystallized intelligence. As for number of summarized facts as a measure of crystallized intelligence display, it is atypical of more commonly used crystallized intelligence measures, which often consist of vocabulary tests or general knowledge questions. The current method was used because of a need to obtain a relatively distinct measure of crystallized intelligence; the more typical measures have often been found to correlate with measures of fluid intelligence.

Issues of measurement validity aside, a second potential problem is that there was no audience when participants were completing the intelligence tasks. If individuals display intelligence to attract desirable partners, the predicted effects would have been strongest if desirable opposite-sex individuals were present when participants completed the intelligence tests. I expected the motivational scenarios to have primed the relevant audience to participants, by having them imagine themselves interacting with desirable opposite-sex individuals. Indeed, past studies that have used similar motivational scenarios did find displays of creativity when individuals imagined themselves in the scenarios (Griskevicius et al., 2006). Nonetheless, this was perhaps not the case here. Future studies might attempt to explicitly manipulate audience effects.

The proposal that individuals strategically display or downplay intelligence to desirable potential partners rests on an assumption that people *do think* that these partners value or devalue intelligence, whichever type it might be, in a mate. An earlier analysis demonstrates that individuals perceived good performance on the Raven's matrices to reflect intelligence. Whether the same individuals perceived the performance to be something that a potential mate wants in a partner, however, is a separate thing. Future work could measure meta-mate preferences – what people think opposite-sex others look for in a partner. Meta-mate preferences should moderate mating displays of intelligence. For example, the more a man thinks that knowledge is what women find attractive in a partner, the more he should attempt to display knowledge in a mating context. The more a woman thinks that men find knowledge *un*attractive in a partner, the more she should attempt to downplay knowledge in mating contexts.

With respect to the idea that women "play dumb" in mating contexts, previous research reviewed earlier does not demonstrate strong supporting evidence. The current study examines this by utilizing a direct measure of knowledge display instead of self-reported experiences of playing dumb, and also does not find strong supporting evidence. It is possible that the idea of women playing dumb in romantic contexts is indeed no more than a myth. However, an alternative possibility is that knowledge downplays, or displays, are domain specific. From a gender roles perspective, women might downplay knowledge in domains that are traditionally associated with men, in order to fit the gender role expectations of society. Consistent with this idea, women, but not men, for whom romantic goals were made salient reported less preference for majoring in math or science relative to other disciplines (Park, Young, Troisi & Pinkus, 2011). In the same vein, women might play dumb in romantic contexts, but only in male-stereotyped domains of knowledge.

The importance of physical attractiveness and resources in mate preferences is undeniable, but the importance of intelligence is just as great. The broad construct of intelligence presents the possibility that each aspect of intelligence is differentially valued in different types of mating relationships. If so, there should be a wide repertoire of strategies that serve to display or downplay these different intelligences in specific circumstances. The current study examines the conditional display and downplay of two of these intelligences. Although the findings do not support the hypothesized forms of intelligence display, they hint of potential display through other aspects of performance. The many types of intelligences portrayed in mating contexts and the form which they take remains a relatively unexplored area of research that would benefit from future work.

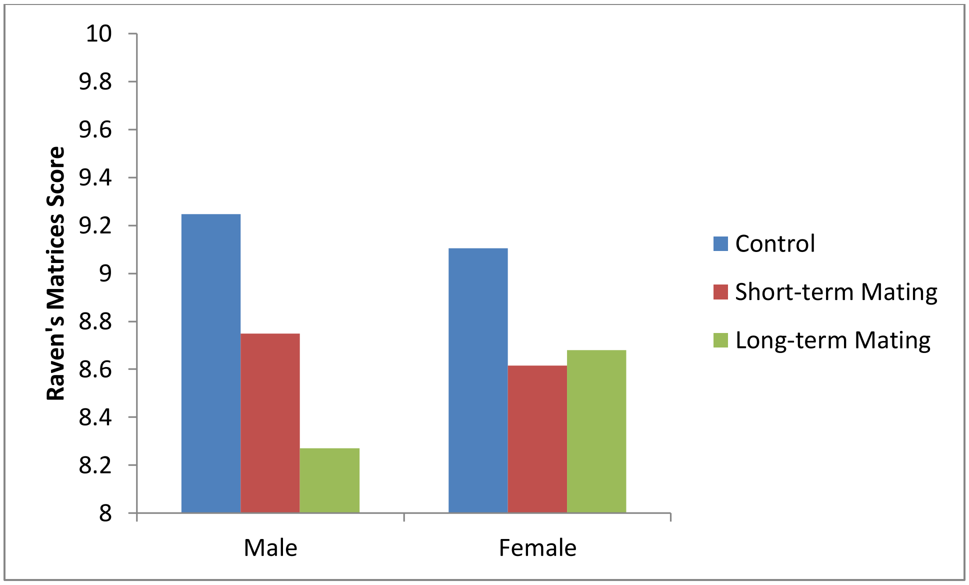

Figure 1. Performance on the post-manipulation Raven's matrices by participant sex and motivation manipulation condition. Scores have been adjusted for pre-manipulation Raven's score.

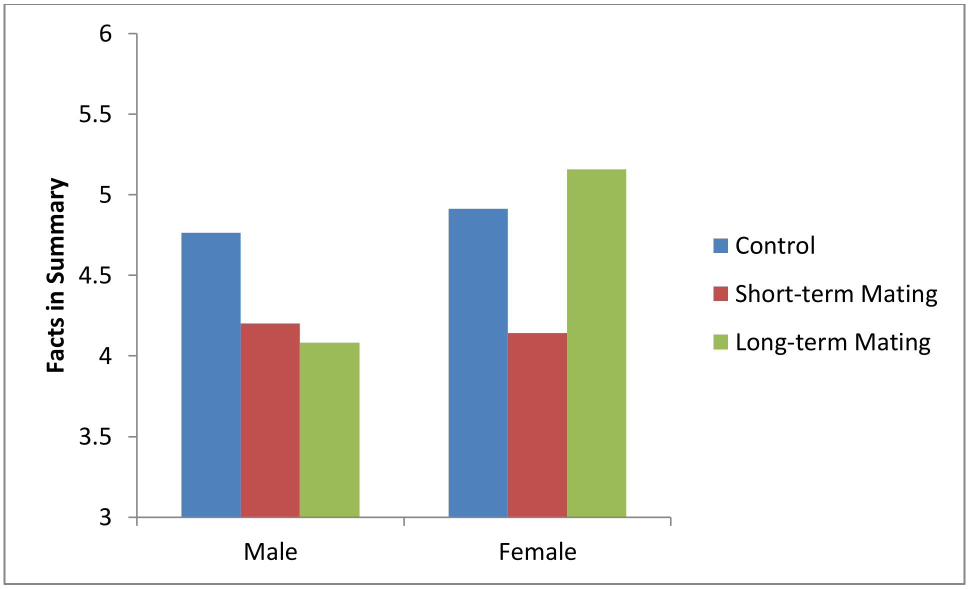

Figure 2. Number of article facts summarized by participant sex and motivation manipulation condition. Scores have been adjusted for memory of article.

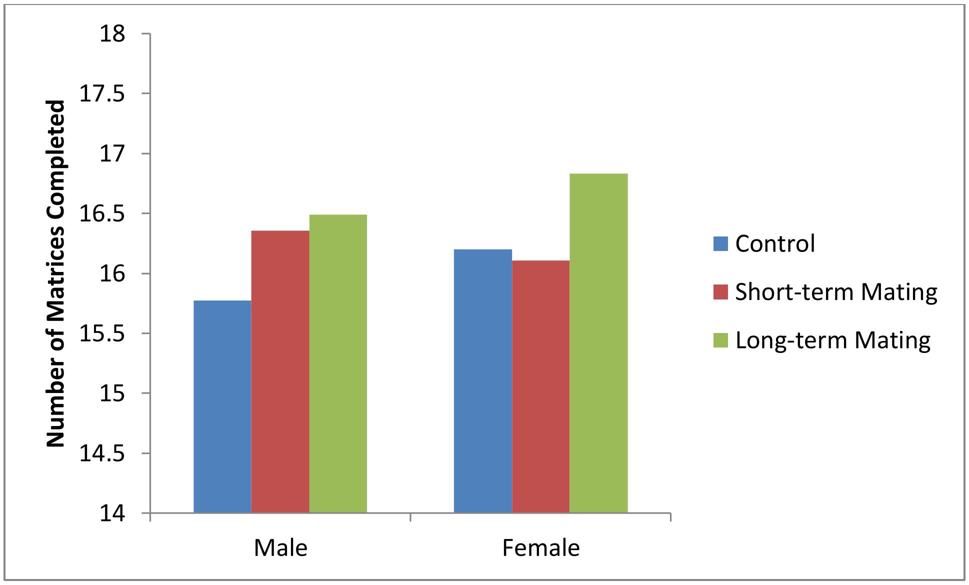

Figure 3. Number of post-motivation Raven's matrices completed, by participant sex and motivation condition.

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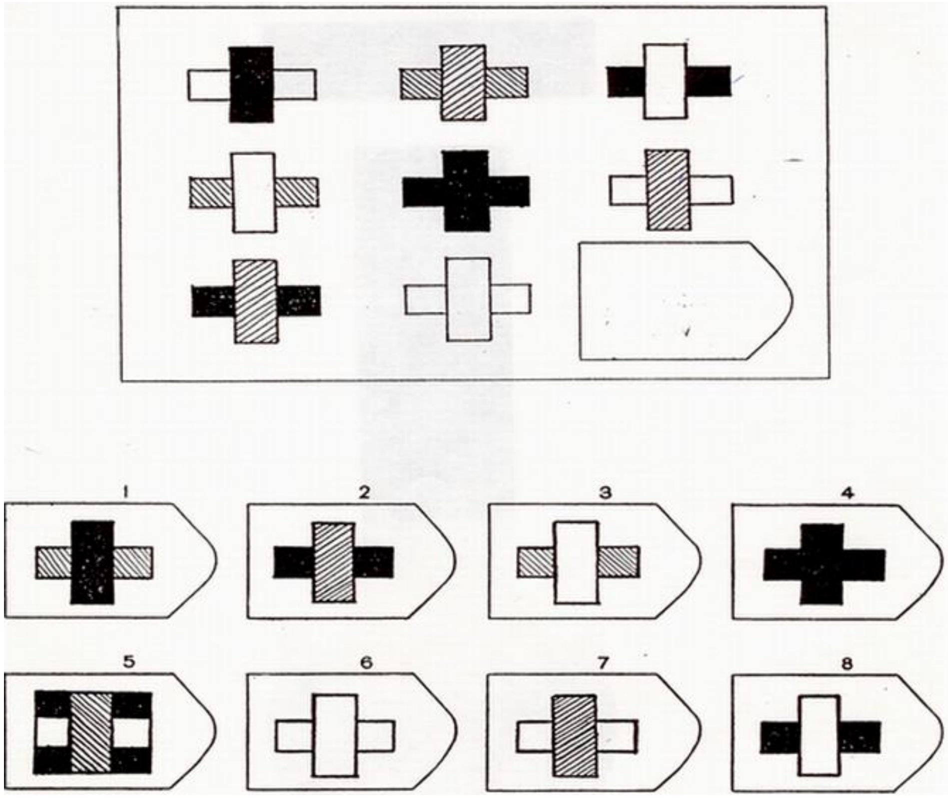
APPENDIX A

SAMPLE RAVEN'S ADVANCED PROGRESSIVE MATRIX



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APPENDIX B

CRYSTALLIZED KNOWLEDGE TEST ARTICLE

Backing up usually isn't easy, yet when Nir Sapir observed agile hummingbirds visiting a feeder on his balcony in Berkeley, California, he was struck by their ability to reverse. 'I saw that they quite often fly backwards', he recalls, adding that they always reverse out of a bloom after feasting. However, when he searched the literature he was disappointed to find that there were hardly any studies of this particular behaviour.

'This was a bit surprising given that they are doing this all the time', Sapir says, explaining that the tiny aviators visit flowers to feed once every 2 min. 'I thought that this was an interesting topic to learn how they are doing it and what the consequences are for their metabolism', Sapir says, so he and his postdoc advisor, Robert Dudley, set about measuring the flight movements and metabolism of reversing hummingbirds and they publish their discovery that reversing is much cheaper than hovering flight and no more costly than forward flight for hummingbirds in *The Journal of Experimental Biology.*

Capturing five Anna's hummingbirds at a feeder located just inside a University of California Berkeley laboratory window, Sapir trained the birds to fly in a wind tunnel by tricking the birds into feeding from a syringe of sucrose disguised as a flower. He then filmed each bird as it hovered to feed before returning to the perch when satisfied. Knowing that the bird would return to the feeder again soon, Sapir turned on the air flow when the hummingbird arrived, directing the 3 m s flow so that the bird had to fly backwards against the wind to remain stationary at the 'flower'. Then he repeated the experiment with the syringe feeder rotated through 180 deg while the hummingbird flew forward into the wind to stay in place.

Analysing the three flight styles, Sapir recalls that there were clear differences between forward and backward flight. The hummingbirds' body posture became much more upright as they flew backward, forcing them to bend their heads more to insert their beaks into the simulated flower. In addition, the reversing birds reduced the inclination of the plane of the wing beat so that it became more horizontal. And when Sapir analysed the wing beat frequency, he found that the birds were beating their wings at 43.8 Hz, instead of the 39.7 Hz that they use while flying forward. 'That is quite a lot for hummingbirds because they hardly change their wing beat frequency', explains Sapir.

Repeating the experiments while recording the birds' oxygen consumption rates, Sapir says, 'We expected that we would find high or intermediate values for metabolism during backward flight because the bird has an upright body position and this means that they have a higher drag. Also, the birds use backward flight frequently, but not all the time, so we assumed that it would not be more efficient in terms of the flight mechanics compared with forward flight.' However, Sapir was surprised to discover that instead of being more costly, backward flight was as cheap as forward flight and 20% more efficient than hovering. And when Sapir gently increased the wind flow from 0 m s in 1.5 m s steps for a single bird, he found that flight was cheapest at speeds of 3 m s□ and above, although the bird was unable to fly backwards faster than 4.5 m s.

Describing hummingbirds as insects trapped in a bird's body, Sapir adds that the fluttering flight of hummingbirds has more in common with insects than with their feathered cousins and he is keen to find out whether other hovering animals such as small songbirds and nectar-feeding bats can reverse too.

APPENDIX C

MEMORY QUESTIONS

Please answer the following questions.

mem1 Sapir is from:
- California (1)
- Texas (2)
- Washington (3)
- Florida (4)

mem2 Hummingbirds fly in reverse when:
- After feasting from a bloom (1)
- Attempting to court a mate (2)
- Trying to trick predators (3)
- Trying to conserve energy (4)

mem3 Hummingbirds visit flowers to feed once every:
- 1 min (1)
- 2 mins (2)
- 3 mins (3)
- 4 mins (4)

mem4 The flight pattern that costs the least energy is:
- Flying backward (1)
- Flying forward (2)
- Hovering (3)

mem5 The type of hummingbird that Sapir observed was:
- Anna's (1)
- Allen's (2)
- Albino (3)
- Xantus' (4)

mem6 How many hummingbirds did Sapir study?
- Five (1)
- Ten (2)
- Fifteen (3)
- Twenty (4)

mem7 What is the wingbeat frequency of the hummingbirds when flying backward?
- 43.8 Hz (1)
- 40.4 Hz (2)
- 41.2 Hz (3)
- 42.6 Hz (4)

mem8 The hummingbirds were tricked to feed from a:
- Syringe of sucrose (1)
- Plastic flower (2)
- Petridish (3)
- Bird feeder (4)

mem9 Hummingbirds generally do not change their wing beat frequency.
- True (1)
- False (2)

mem10 The hummingbird's body posture becomes more upright when:
- Flying backwards (1)
- Flying forwards (2)
- Hovering (3)

mem11 _____ flight is ____% more efficient than _______
- Backwards; 20; Hovering (1)
- Hovering; 20; Backwards (2)
- Forward; 30; Backwards (3)
- Backwards; 30; Forward (4)

mem12 Backwards flight is cheapest at:
- 3 m/s and above (1)
- 2 m/s and above (2)
- Between 2 and 3 m/s (3)
- 1.5 m/s and above (4)

mem13 The hummingbirds were unable to fly backwards faster than:

- 4.5 m/s (1)
- 6 m/s (2)
- 7.5 m/s (3)
- 9.5 m/s (4)

mem14 The flight patterns of hummingbirds are highly similar to:

- Insects (1)
- Songbirds (2)
- Bats (3)
- Helicopters (4)

APPENDIX D

FACT CODING SHEET

Italicized phrases are guidelines for rater coding

1. The experimenter's *name is Nir Sapir*
2. Experimenter is from *Berkeley/California*
3. He observed *hummingbirds*
4. Hummingbirds *reverse out of a bloom* after feeding off the nectar
5. There are *hardly any studies of reverse flight* in hummingbirds.
6. Hummingbirds visit flowers to *feed once every 2 minutes*
7. Sapir's research partner was his *postdoc advisor Robert Dudley*.
8. *Reversing is (20%) more energy-efficient/cheaper than hovering flight*
9. *Reversing is also just as energy-efficient as/no more costly than forward flight*
10. Their finding was published in *The Journal of Experimental Biology*.
11. Sapir/he captured/studied *5 hummingbirds*.
12. The hummingbird species that was studied is called *"Anna's hummingbirds"*
13. The birds were *captured/studied at a University of California Berkeley lab*.
14. Sapir trained the birds to fly in a *wind tunnel*.
15. They fed from a *syringe of sucrose*.
16. The *syringe was disguised as a flower*.
17. *Each bird was filmed* as it fed.
18. The *air flow in the tunnel was also manipulated* so that the birds had to fly backward.
19. The *syringe was also rotated/The setup was changed* so that the *birds had to fly forward*.
20. Hummingbirds' *body posture is more upright during backward flight*
21. *Reversing birds reduced the inclination of the plane of the wing beat* to become more horizontal/Wings became more horizontal
22. Hummingbirds' wing beat frequency when *flying backwards is 43.8 Hz.*
23. Hummingbirds' wing beat frequency when *flying forwards is 39.7 Hz*.
24. Hummingbirds *hardly change their wing beat frequency*.
25. Sapir analyzed *3 different flight styles*: hovering, forward flight, and backward flight.
26. Flying in an *upright position would mean higher drag*.
27. *Backward flight was most efficient/cheap at 3 ms*
28. Birds were *unable to fly backwards faster than 4.5 ms*
29. Sapir described *hummingbirds as "insects trapped in a bird's body"*/Hummingbirds are like insects trapped in a bird’s body
30. *Hummingbirds' flight has more in common with insects* than other birds