Love, lust, and loss:

Attachment style and relationship preferences of OKCupid users

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LOVE, LUST, AND LOSS:

ATTACHMENT STYLE AND RELATIONSHIP PREFERENCES OF OKCUPID USERS

by

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This thesis was prepared under the direction of the candidate's thesis advisor, Dr. Kevin Lanning, and has been approved by members of her supervisory committee. It was submitted to the faculty of The Honors College and was accepted in partial fulfillment of the requirements for the degree of Bachelor of Arts in Liberal Arts and Sciences.

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Abstract

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In this exploratory study, the responses of nearly 70,000 OKCupid users to a series of questions on the website are assessed to determine a relationship between romantic relationship preferences and attachment style. Specifically, the romantic relationship preferences were monogamy and long-term relationship preference. Four types of attachment styles are looked at in this study: secure, anxious, avoidant, and fearful. Five scales are created from the original 2,600 questions to assess relationship preferences and attachment style, with scores ranging from 0 to 1. Users were then classified into one of the four attachment styles. Attachment style of users was predicted using a k-NN analysis, and ROC curves were plotted for monogamy and relationship scores for each attachment style. A relationship between attachment style and relationship preferences was found. The largest differences were found when comparing securely and fearfully attached individuals.

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Attachment Style

In his well-known paper, Maslow (1943) identified a series of needs required to fulfill one's potential. Commonly referred to as "Maslow's hierarchy of needs," these five basic desires motivate human behavior, as an individual will seek to fulfill the current need before subsequent "higher" needs (Maslow, 1943). The five needs Maslow (1943) identified were physiological needs, safety needs, a need to be loved/belong, esteem needs, and self-actualization. According to Maslow (1943), once a person's physiological and safety needs are met, the person will desire affections and a place in their group, becoming aware of their lack of friends and loved ones. Baumeister and Leary (1995), found that people readily formed bonds with others and identified common interests or experiences, or repeated contact as reasons for the attachment. Additionally, people will try to avoid losing the bond even if there is no reason to maintain it or if maintaining it would be difficult, and when bonds are broken, people will search for another person to have that attachment with (Baumeister & Leary, 1995).

The types of bonds an individual will form, as well as how they form their attachments, are heavily influenced by the individual's childhood and their relationships with their parents/caregivers. In one study, Bell and Ainsworth (1972) found that maternal response to infant crying sets the foundation for the child's attachment style, as the more responsive the mother is, the more likely the child is able to develop other methods of communication. This study suggests that infants with more responsive mothers may be more likely to discuss their issues pertaining to desired proximity and contact with others when they become older. Additionally, a mother's parenting style can affect her child's attachment, with authoritative

parenting styles being related to secure attachment in children, and a lack of warm parental involvement being related to insecure attachment styles (Karavasilis, Doyle, & Markiewicz, 2003). Although these studies focused specifically on mother-child interactions, Diener, Mangelsdorf, Mchale, and Frosch (2002) found that infants used similar behavioral strategies with their fathers as they did with their mothers.

Ainsworth, Blehar, Waters, and Wall (2015) defined three attachment styles: secure, insecure avoidant, and insecure ambivalent. Infants were classified into each of the three attachment styles based on their reactions to the Strange Situation: secure infants used the mother as a secure base to explore and were distressed when she left, insecure avoidant infants show no sign of distress when the mother leaves and is fine when the stranger enters the room, and insecure ambivalent infants show extreme distress when the mother leaves and may resist her affection when she returns (Ainsworth & Bell, 1970; Ainsworth et al., 2015). A fourth attachment style, insecure-disorganized, was eventually added to this classification of attachment styles by Main and Solomon (1986), who found that not all infants could be classified by the three previously identified attachment styles.

Bartholomew and Horowitz (1991) also proposed a four level model for attachment, however, this method utilized a person's self-image and image of others. This classification of attachment styles relies on a person's feelings of trust towards others and opinions of whether they are worthy of love. Securely attached individuals have a positive view of others and themselves, dismissing individuals have a positive view of themselves and a negative view of others, preoccupied individuals have a negative view of themselves and a positive view of others, and fearful individuals have a negative view of both themselves and others (Bartholomew & Horowitz, 1991). Self-reported ratings, as well as ratings by friends and interviewers, have

supported the model and placed individuals in the same quadrant for attachment style (Bartholomew & Horowitz, 1991).

Using the three attachment styles originally developed by Ainsworth, Hazan and Shaver (1991) developed a series of questions to measure attachment in adults, with results that mirrored the attachment studies with infants. Further research using Hazan and Shaver's questionnaire found that secure individuals tended to have positive early family relationships and were trusting towards other (Feeney & Noller, 1990). Avoidant individuals expressed distrust towards others and anxious-ambivalent individuals reported a lack of paternal support in their childhoods and reported a dependence and desire for close relationships (Feeney & Noller, 1990).

While these attachment style models classify people at different ages, attachment style has been found to be largely stable over time. Lewis and Feiring (1989) found that infant sociability at three months was able to predict infant sociability at one year, which was related to whether or not the child would have an avoidant attachment style. Theisen, Fraley, Hankin, Young, and Chopik (2018) also found attachment anxiety to be stable with the mother from ages 9 to 18, although there was an increase in attachment avoidance, which may be due to their increasing independence. However, other studies have found that about 30% of individuals will have a change in their attachment style, and have found that having a personal or family history of psychopathology, coming from a single-parent household, or experiencing stress from romantic or other interpersonal relationships can influence this change (Baldwin & Fehr, 1995; Davila, Burge, & Hammen, 1997).

Collins (1996) found that attachment style plays a role in the perception of scenarios with romantic partners. In one study, participants' responses to an open ended scenario was found to reflect their attachment style, with securely attached individuals providing responses that

expressed confidence in the relationship and their partner, whereas insecurely attached individuals' responses suggested that the relationship was in jeopardy and their partner was untrustworthy and rejecting them (Collins, 1996). Because of the different perceptions to the same scenario, it is not surprising that a person's attachment style has been found to correlate to the way conflicts are dealt with in relationships. Securely attached couples have reported compromising and using other forms of mutually focused conflict strategies when compared to couples with anxiously attached individuals (Pistole, 1989).

A person's attachment style can also affect their relationship satisfaction of both themselves and their partners. In one study, Kirkpatrick and Davis (1994) found that if the woman had an anxious attachment style, then her and her securely attached partner both rated their relationship negatively, but if the man was securely attached, then he would rate his relationship as negative while his securely attached partner would not. Other studies have also supported the finding that anxiously attached individuals report lower relationship satisfaction (Knoke, Burau, & Roehrle, 2010). Additionally, Pistole (1989) found that securely attached couples reported higher relationship satisfaction than avoidant or anxiously attached couples.

But does a person's attachment style affect the length of their relationships, even though it affects the satisfaction of the relationship? Feeney and Noller (1990) found that securely attached individuals had the longest lasting relationships, and the individuals that they classified as anxious-ambivalent had the least enduring relationships of the three attachment styles. In a study by Kirkpatrick and Davis (1994), however, relationships with anxious women and secure men were still stable after three years. Relationships with avoidant men and secure women were also stable one year after the start of the study, where they had originally rated their relationship negatively (Kirkpatrick & Davis, 1994).

Relationships

Humans are known to engage in both short- and long-term relationships, with both styles having benefits and drawbacks. Both men and women can face social stigma or contract sexually transmitted diseases from engaging in a large number of short-term relationships (Conley, Moors, Matsick, & Ziegler, 2012). Additionally, long-term mating strategies allow both men and women to acquire mates with abundant resources, increase the likelihood of the child's survival, and allow women to have protection during pregnancy, when protecting oneself can be more difficult than usual (Buss & Schmitt, 1993). However, a short-term strategy allows men to have a larger number of offspring and allows women to gain immediate resources and have more attractive children (Buss, & Schmitt, 1993; Gangestad, & Simpson, 1990)

Unlike the long-term relationship, where a couple will stay together for a lengthy period of time and is typically exclusive with the possibility of marriage, several types of casual relationships have been identified, ranging in length and exclusivity. Rodrigue et al. (2015) identified five profiles for casual sexual relationships. These profiles included the one time sexual encounter with a stranger, acquaintance or friend; a sexual relationship with an ex-partner; a mostly sex partnership, in which the people involved were not dating and began the relationship as strangers; an intimate and sexual relationship in which the people involved were originally friends; and the friendship first relationship, in which participants began the relationship as friends and engage in sex at a much lower frequency than the intimate and sexual partnership (Rodrigue et al., 2015).

Wentland and Reissing (2011; 2014) also identified four types of short term relationships and have shown that most individuals understand the subtle differences between them. These four types are one night stands, "booty calls", "fuck buddies", and friends with benefits. A one

night stand is a one time sexual relationship between two people who typically do not see each other again, whereas a "booty call" is an acquaintance with whom one will engage in sexual activities with after one has texted or called the other requesting it, and a "fuck buddy" is a person who one meets up with regularly for sex (Wentland & Reissing, 2011; Wentland & Reissing, 2014). A friends with benefits relationship occurs between two friends who decide to form a sexual relationship and is appealing because they provide trust and comfort without the commitment of an exclusive relationship, but can become problematic for those involved if one of the friends involved develops deeper feelings for the other, which is not as common in the other short term relationships (Bisson & Levine, 2007; Hughes, Morrison, & Asada, 2005).

These two categorizations of various types of short-term relationships do share some similarities in their recognized types and definitions. A one-time sexual encounter is featured in both researches, as well as a friend-based sexual relationship. However, unlike Wentland and Reissing (2011;2014), Rodrigue et al. (2015) identified a sexual relationship with an ex as a type of short-term relationship. Additionally, both the "booty call" and "fuck buddy" identified by Wentland and Reissing may both be types of the mostly sex partnership identified by Rodrigue et al. (2015) as these relationships do not usually involve high levels of intimacy. Rodrigue et al.'s (2015) friendship first relationship may be a type of intimate and sexual relationship between friends that they also identified, which can also be a type of friends with benefits relationship identified by Wentland and Reissing (2011; 2014)

Although researchers have identified more types of short-term relationships than long-term relationships, men are more likely to prefer engaging in the various types of short-term relationships whereas women are more likely to prefer long-term relationships. Schmitt, Shackelford, and Buss (2001) identified several gender differences when searching for mates that

contribute to this, which includes men reporting a greater desire for short-term mates, a preference for more sexual partners, and less time to consent to sex. Women, on the other hand, are more likely to engage in short-term relationships as a way to evaluate potential long-term partners, as well as to receive immediate resources, such as money and gifts (Buss, Schmitt, 1993).

Despite the difference in relationship type preference, men and women report desiring similar characteristics for each type of relationship, with preferred characteristics for short- and long-term partners differing only slightly. Across relationship types, a person's personality characteristics are valued over physical attributes, while physical appearance is ranked higher than social status or access to material resources for both genders (Regan, Levin, Sprecher, Christopher, & Gate, 2000). Both men and women also prefer a partner who has a higher than average sex drive and passion, although women rank this higher for short-term partners, which supports research that women have a fairly similar number of sexual desires and partners as men (Conley, Moors, Matsick, Ziegler, & Valentine, 2011; Regan et al., 2000). However, when looking at short-term relationships, both men and women preferred traits related to physical attractiveness (Li & Kenrick, 2006; Regan et al., 2000).

Even if a person is initially interested in a long-term monogamous relationship, many people have difficulty maintaining the exclusive relationship for a lengthy period of time. Each year, approximately 2-3% of married individuals engage in an extramarital affair (Choi, Catania, & Dolcini, 1994; Whisman, Gordon, & Chatav, 2007). Individuals who are African American, have had many previous sexual partners, reported being unfaithful in previous relationships, have had numerous relationships that lasted less than six months, live in a large city, or have

cohabitated with their partner before marriage are more likely to have extramarital sex (Adamopoulou, 2013; Treas, & Giesen, 2000).

Some people, however, have relationships that allow them to have multiple partners while maintaining a potentially long-term relationship. Although most people do not consider it, some individuals engage in consensual non-monogamous relationships. The most common types are polyamory, which involves a deep romantic connection between at least three people, an open relationship, which involves at least one of the partners having a secondary partner, and swinging, which is a type of social sex in which couples will switch partners (Ellington, 2017). Although many people hold negative beliefs and misconceptions of consensual non-monogamous relationships - more so for open and swinging relationships than polyamory - there are still many individuals who engage in these types of relationships (Hutzler, Giuliano, Herselman, & Johnson, 2015; Matsick, Conley, Ziegler, Moors, & Rubin, 2013). However, studies have shown that people report similar levels of relationship satisfaction, sexual satisfaction, intimacy, trust, and closeness for monogamous, open, and polyamorous relationships (Séguin et al., 2016). Mitchell, Bartholomew, and Cobb (2013) also showed that this similarity of relationship satisfaction was true for both the primary and secondary partners in polyamorous relationships

The Present Study

The data used for this study is archival data originally collected by Kirkegaard and Bjerrekær that features nearly 70,000 users of the dating site OKCupid and their answers to over 2,600 questions (2016). This study, however, looked at 144 of the questions, which related to attachment style, relationship history, and current relationship desires. This data is analyzed to

examine the relationship between an OKCupid user's attachment style and preference for a monogamous, long-term relationship.

Methods

Participants

Data for this study was collected from 68,371 OKCupid users. Of the users, 25,144 (38%) identified as female, 38,976 (59%) as male, and 2,151 (3%) as other. The average age of the users was 32 years old (*SD* = 7.8), with the youngest being 18 and the oldest reportedly 100. Of the users, 63,549 reported they were single, 50 reported they were married, 387 that they were seeing someone, and 323 reported that they were in an open relationship.

Question Selection

The original dataset included 2,620 user-created questions 144 of which were looked at in this study. These questions were evaluated by their relevance to attachment styles and relationship preferences, which included questions related to relationship history and current relationship desires. Relationship preferences were examined by a person's answers to questions related to monogamy and to questions related to relationship length. When selecting the questions, Kirkegaard and Bjerrekær (2016) originally used a scraper to randomly select users, but because the average number of responses for each user was low, the scraper was modified to select people who answered at least 1,000 questions. Although most people may not be able or willing to answer over 2,600 questions, the random order that questions are presented in allows for each question to have many responses, which can increase correlations of items and scales in a way that a small set of questions cannot. At least 2,246 people answered each question that was used in this study (*Max* = 66,365; *M* = 20,468; *SD* = 13,784.72).

Attachment Style Question Selection. The questions selected to determine attachment style related to a person's view of themselves and others, how they feel about being intimate and open with others, their satisfaction with their childhood, and their relationships with family members. These questions were used to determine a person's attachment style as secure or one of the three types of insecure attachments: avoidant, anxious, or fearful. Of the original set of questions 51 were selected to assess attachment style.

Relationship Preference Question Selection. The questions selected to assess relationship preference related to both relationship history and to the person's future desires for romantic relationships. The selection of these questions led to a person having one of four preferences: a long-term monogamous relationship, a short-term monogamous relationship, a long-term non-monogamous relationship, or a short-term non-monogamous relationship. Of the original questions, 59 were selected to assess this.

Scale Development

Scales for the scores were developed using the mean of a person's responses to the questions in the scale (Appendix A). This allowed users to have comparable scores since each person answered a different number of questions. It was specified in the code to ignore "NA" values, as this was the only way the scores could be calculated without giving an error message.

Attachment Scales. Three scales were created to determine the attachment style of users. The family/childhood scale used questions such as “How was your childhood?” and “Are you very close to your family?”. The avoidant attachment scale asked questions pertaining to an avoidant attachment style, such as “Are you scared of commitment?” while the anxious attachment style used questions such as “If a close friend doesn't call you for a week, do you start worrying that he hates you?”, which relate to an avoidant attachment style. These three scales will be used to assess which of the four attachment styles each user has. A person with a secure attachment style will score high on the family/childhood scale and low on the avoidant and anxious attachment style scales. A person with an anxious attachment style will score high in the anxious attachment scale and low in the avoidant and childhood scales while a person with an avoidant attachment style would score high on the avoidant attachment scale and low on the anxious attachment and family/childhood scales. A person with a fearful attachment style would score high on the anxious and avoidant attachment scales and low on the family/childhood scale.

An “ifelse()” function was used to determine attachment styles. A person was categorized with a secure attachment style if their family/childhood score was above 0.86. If the score was below this value, then they were categorized as fearful if their avoidant and anxious attachment scores were similar. Those who had yet to be categorized were classified as having either an avoidant or anxious attachment style based on whether their avoidant or anxious scores were higher (see Figure 1).

Relationship Scales. Two scales were created to determine the relationship preference of the users. The monogamy preference scale used questions such as “Have you ever had multiple romantic partners during the same time period?” and “Would you date someone who was only interested in a committed, long-term relationship?” to assess each user’s previous interest in monogamy and their current interest in a monogamous relationship. The relationship length scale used questions such as “Is it important to be friends before being lovers?” and “How long do your romantic relationships usually last?” to assess each user’s previous interest in long-term relationships and their current interest in a relationship that will be long-term.

Scale Assessment. Of the items measuring attachment style, 16 questions were originally selected for the family/childhood scale, 16 questions for the avoidant scale, and 19 questions for the anxious attachment scale. For the relationship preference scales, the monogamy preference scale originally contained 17 questions and the relationship length scale contained 42 questions. The anxious and avoidant attachment scales had only three questions in common. No other items were in more than one scale.

Training data was extracted from the original dataset to test the scales. This training data included responses from 2,000 random participants (approximately 3% of the total participants) to assess the item correlations of each question in each scale, as well as the alpha level for each of the five scales. This was done using the “psych” package (e.g. “family["alpha"]” and “family["item.cor"]”). Using these results, items with low correlations were removed from their scale until removing questions negatively affected the alpha level. Due to the large number of users, the variance for most questions was 0 and it needed to be specified in the code to not remove questions with no variance. Without this specification, nearly all questions in each scale were deleted and alpha levels dropped substantially. For the measures of attachment style, this

resulted in 13 questions for the family/childhood scales with an alpha level of 0.6, 15 questions for the anxious attachment scales with an alpha level of 0.6, and 13 questions in the avoidant attachment scale with an alpha level of 0.46. For the measures of relationship preference, this resulted in 13 questions in the monogamy scale with an alpha level of 0.75 and 30 questions in the relationship length scale with an alpha level of 0.84.

K-Nearest Neighbor

K-nearest neighbor (k-NN) is an algorithm used in machine learning that uses a similarity measure gained from set of training data to classify new information. This method uses doppelgangers (people who reported similar responses) to predict a response and can be applied to images or numeric or nominal values. Users' attachment styles were predicted given their responses to the demographic and relationship scale response using a k-NN algorithm. The training data was gathered from the random sample of 2,000 users mentioned above.

ROC and AUC

The Receiver Operating Characteristic (ROC) curve plots the probability of a true positive (reporting a result that exists) in relation to the probability of a false positive (reporting a result that does not exist). The area under the ROC curve (AUC) ranges from 0 to 1 and is the probability that a change in one variable is related to the response being analyzed. The ROC curve was plotted for each attachment style classification when looking at each relationship preference scale to determine if certain relationship preferences can predict a person's attachment style.

Results

Attachment Style

A score was created for each user for each scale using the psych package (e.g. "family[["scores"]]"). For the family/childhood scale, scores ranged from 0.12 to 1.0 with a mean of 0.83 and a standard deviation of 0.074. The avoidant and anxious attachment scales ranged from 0.0 to 0.92 (M = 0.049, SD = 0.077) and 0.0 to 0.77 (M = 0.028, SD = 0.062) respectively.

Users were categorized as having one of the four attachment styles based on their scale scores. The ifelse function seen in Figure 1 was created to categorize the attachment style of the users. Because the median of the childhood/family scale was found to be 0.86 in the smaller sample, users who had a score greater than that were labeled as "secure". If a user had a score less than that, then their anxious and avoidant attachment scales were looked at. Users with similar scores on both scales were labeled as "fearful", as they exhibited many characteristics of both anxiously and avoidantly attached individuals. If the scores were not within the specified range, then users were labeled as "avoidant" if their avoidant attachment scale was higher, or as "anxious" if their anxious attachment score was higher. Using this method to classify users, 64% were found to be securely attached, 17% were labeled as avoidant, 18% as anxious, and 1% as fearfully attached.

```
AttachmentCategory <- ifelse (childhoodScores > .86,
                              print("secure"),
                        ifelse
                             ((anxiousScores < 1.2*avoidantScores &
                                 anxiousScores > .8*avoidantScores) &
                             (avoidantScores < 1.2*anxiousScores &
                                 avoidantScores > .8*anxiousScores),
                                print("fearful"),
                        ifelse
                             (avoidantScores > anxiousScores,
                                    print("avoidant"),
                                    print("anxious")
                               )))
```

Figure 1: Code used to classify people as having one of the four attachment styles.

Relationship Preferences

For relationship preferences, scores for monogamy preference ranged from 0.038 to 1.0 (M = 0.86, SD = 0.12), while scores for relationship length ranged from 0.054 to 1.0 (M = 0.81, SD = 0.1). Securely attached individuals had a mean of 0.88 for monogamy preference and 0.84 for relationship length, avoidantly attached individuals had a mean of 0.80 for monogamy preference and 0.76 for relationship length, anxiously attached individuals had a mean of 0.84 for monogamy preference and 0.79 for relationship length, and fearfully attached individuals had a mean of 0.74 for monogamy preference and 0.71 for relationship length. A correlation of 0.65 was found between monogamy and relationship length preference. All mean differences in this study are statistically significant given the large size of the sample.

Effect sizes were calculated to determine the significance of the differences. For monogamy preference, the effect size for anxious versus avoidant was 0.33, which was the same for secure versus anxious. For avoidant versus fearful, the effect size was 0.5 and secure versus avoidant had an effect size of 0.67. Anxious versus fearful had an effect size of 0.83, while secure versus fearful had an effect size of 1.2. For relationship length, the effect size for avoidant

versus fearful was 0.5, which was the same for secure versus anxious. Both anxious versus fearful and secure versus avoidant had effect sizes of 0.8. Anxious versus avoidant had an effect size of 0.3, while secure versus fearful had an effect size of 1.3.

K-Nearest Neighbor

From the demographic and relationship variables, the k-NN analysis predicted that 24,913 users would be secure, 1,062 would be avoidantly attached, 533 would be anxiously attached, and 0 would be fearfully attached. As can be seen in Table 2, of these predictions, 16,536 were accurately predicted as secure, 462 as avoidantly attached, and 154 as anxiously attached, meaning that about 65% of the predictions were accurate. K equaled 70 for this analysis, as this value allowed for the greatest accuracy.

	anxious	avoidant	fearful	secure
anxious	154	172	9	198
avoidant	283	462	33	284
fearful	0	0	0	0
secure	4299	3937	141	16536

Table 1: K-NN table comparing predicted (rows) and actual (columns) results of attachment style classifications when k=70.

ROC and AUC

ROCs were plotted for monogamy and relationship length preferences with each attachment style to assess the extent that attachment security could be accurately classified just from relationship preferences. Secure attachment style had an AUC of 0.61 for monogamy and 0.67 for length, avoidant attachment style had an AUC of 0.61 for monogamy and 0.66 for length, anxious attachment style had an AUC of 0.56 for monogamy and 0.6 for length, and fearful attachment style had an AUC of 0.69 for monogamy and 0.76 for length (see Appendix B).

ROCs comparing the attachment style classifications for each relationship preference variable were also plotted. Figure 2 below shows the ROC for the attachment style comparisons for relationship length preference. When comparing anxiously and avoidantly attached individuals, monogamy and relationship length scores were 0.55 and 0.56 respectively. For monogamy, the AUC for anxious versus fearful was 0.65 and for anxious versus secure was 0.59. For avoidant versus fearful and secure, the AUC for monogamy was 0.60 and 0.63 respectively. Alternatively, for length, anxious versus fearful had an AUC of 0.69, while anxious versus secure had an AUC of 0.63. Avoidant versus fearful and avoidant versus secure had AUCs of 0.63 and 0.69 respectively for length. When comparing securely and fearfully attached individuals, the AUC was 0.72 for monogamy and 0.81 for relationship length.

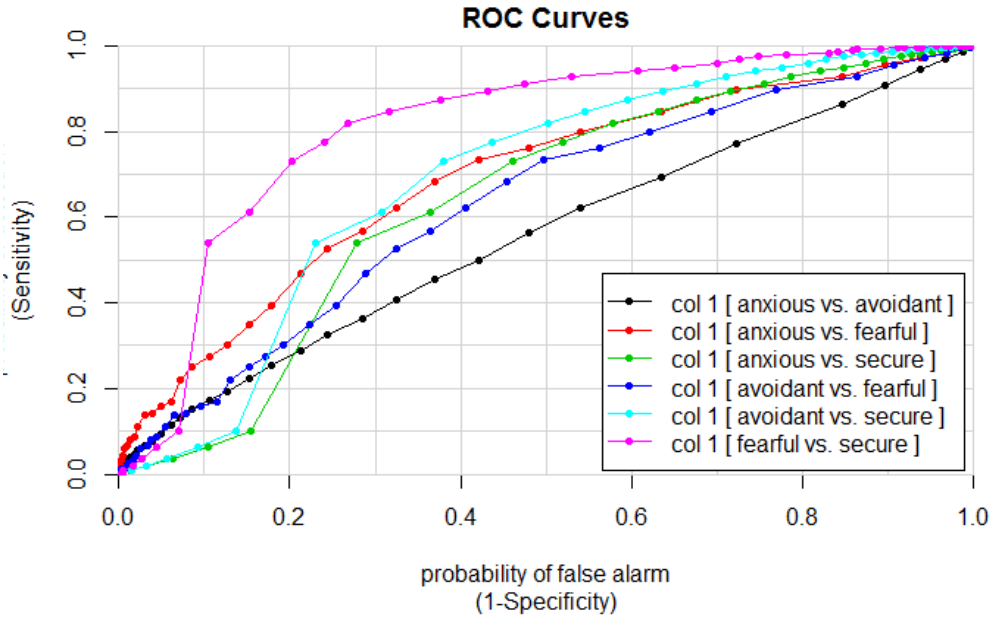


Figure 2: The ROCs are plotted for each attachment style comparison.

Discussion

This study provided several interesting results. As was predicted, a relationship does exist between a person's attachment style and their preference and history of being in monogamous

and long-term relationships. Securely attached individuals had higher average scores for monogamy and relationship length preferences, meaning these individuals were more likely to have previously engaged and currently are seeking a long term relationship with a singular partner. The lower average scores for avoidantly and fearfully attached individuals compared to anxiously attached individuals is not surprising given that anxiously attached individuals actively desire stable relationships, whereas individuals of the other two groups are more likely to push people away when they get too close, resulting in a greater number of short-term relationships with multiple partners.

Predictions of a person's attachment style can also be gathered from their responses to monogamy and relationship length preference questions. This was most true for fearfully attached individuals, as the scores for the monogamy and relationship length scales predicted 69% and 76% of the variance respectively. When comparing fearfully and securely attached individuals, the accuracy of the predictions from monogamy and relationship length scores increased to 72% and 81% respectively, as a large difference was found for the mean of these scales for the attachment style. The high effect sizes also show that a majority (88 to 90%) of users classified as fearful would score below the mean of the relationship scores of the secure group. This also explains why the prediction for anxious versus avoidant was less than 60% for both scales, as the difference between their average scores was lower.

The relationship length scores were slightly more related to attachment style predictions than monogamy scores in this study. This may be due to the increasing prevalence and acceptance of "hookup culture" in many societies, allowing people to more comfortably report engaging in a larger number of relationships (Garcia, Reiber, Massey, & Merriwether, 2012). Because of the nature of the attachment style in determining how people maintain and their

willingness to be in a relationship, this may be why relationship length scores were more reliable in the prediction.

The output from the attachment style classification function closely resembled previous research on attachment styles, where approximately two-thirds of individuals are securely attached (Ainsworth et al., 2015; Bartholomew & Horowitz, 1991; Kirkpatrick & Davis, 1994). However, this method labeled more people as anxiously than avoidantly attached, while previous research has found the opposite. Also, because only about 1% of individuals were labeled as fearfully attached, the fourth attachment style may not have been necessary for this study. Instead, this attachment style may have been a more extreme insecure attachment. Although the largest differences were found between fearful and secure individuals, this may have been due to the large difference in the number of people with each of the two attachment styles, which may also have had an effect on the similarities between anxious and avoidant attachment styles for the AUCs.

This research had several other limitations. Many missing values were found in the dataset, with some questions having over 90% of responses as "NA." While this difference was not critical in the full dataset, it made collecting representative samples difficult and caused changes in alpha levels and percentage of attachment style classifications from the sample of 2,000 to the full collection of users.

Additionally, the scales had high means and were very skewed. This may be to users only reporting socially desirable answers. When on a dating website, most people have a goal to go on many dates and meet new people and are aware of social stigmas associated with certain answers. Users are aware that it may not look as desirable if they report having cheated on previous partners, and therefore, may be less likely to report it.

Future research should look at the role of commitment as a third variable to consider for relationship preferences. By only looking at long- versus short-term and monogamous versus non-monogamous, this data grouped individuals in polyamorous relationships and individuals who cheated on their partners together, even though there is a difference between a committed polyamorous relationship and an unfaithful monogamous relationship. This may increase the accuracy of the k-NN analysis if it is found that people with certain attachment styles are more likely to report cheating on their partners.

Appendix A

Scales, Scores, and Demographics

Alpha Level for Relationship Questions

Alpha for Monogamy Preference

delete=FALSE needs to be set or all items are deleted for lack of variance

```
myKeys<-list(mono=c( "q1128", "q23233", "q85315", "q41953", "q37772", "q36",
"q325", "q366", "q1121", "q16371", "q18902", "q33107", "q25294")) # "q393", "
q106", "q1158", "q8054",
mono<-scoreItems(myKeys,newdata, delete = FALSE)
mono["alpha"]

## $alpha
##       mono
## alpha 0.76

mono["item.cor"]

## $item.cor
##         mono
## q1128  0.64
## q23233 0.47
## q85315 0.43
## q41953 0.40
## q37772 0.54
## q36    0.66
## q325   0.69
## q366   0.57
## q1121  0.47
## q16371 0.59
## q18902 0.42
## q33107 0.27
## q25294 0.52

MonoScores<-mono["scores"]

#alpha=0.76
#alpha does not exceed 0.76
monogamyScores <- mono[["scores"]]
```

Alpha for Relationship Length

```
myKeys<-list(long=c("q326", "q360", "q1222", "q18691", "q36045", "q12", "q17"
, "q21", "q122", "q144", "q152", "q309", "q322", "q324", "q1447", "q6413", "q
7077", "q8439", "q14913", "q18841", "q69186", "q81307", "q83677", "q35", "q35
2", "q357", "q19874", "q20021"))#"q49053","q444", "q7273", "q323","q15701", "
q19446", "q294", "q204", "q358", "q34536", "q627",  "q57717","q42524", "q149"
long<-scoreItems(myKeys,newdata, delete = FALSE)
long["alpha"]

## $alpha
##       long
## alpha 0.75

long["item.cor"]

## $item.cor
##          long
## q326    0.234
## q360    0.267
## q1222   0.345
## q18691  0.249
## q36045  0.425
## q12     0.541
## q17     0.651
## q21     0.618
## q122   -0.023
## q144    0.257
## q152    0.306
## q309    0.124
## q322    0.279
## q324    0.339
## q1447   0.380
## q6413   0.465
## q7077   0.100
## q8439   0.414
## q14913  0.359
## q18841  0.226
## q69186  0.527
## q81307  0.574
## q83677  0.232
## q35     0.454
## q352    0.427
## q357    0.497
## q19874  0.302
## q20021  0.431

#alpha=0.75
#alpha does not go higher than 0.75
```

I realized I forgot to include "p_explove" when working with Tiny When I included it, alpha dropped from .89 to 0.07 in Tiny Personality variables will be excluded from these calculations of alpha due to their massive effect on (decreasing) alpha, as was also seen in Karly's dataset

Alpha Level for Attachment Questions

The attachment questions will feature three scales: a family/childhood scale (which will ask about parents, childhood experiences, and feelings toward family), an anxious attachment scale (measure anxious attachment style), and an avoidant attachment scale (measure avoidant attachment style). Four types of attachment styles will be assessed in the users. Securely attached individuals will have low scores in the anxious and avoidant scales and a high score on the childhood scale. Anxiously attached individuals will score high in the anxious scale and low in the avoidant and childhood scales. Avoidantly attached individuals will score high in the avoidant scale and low in the anxious and family scales. Fearful (anxious-avoidant) attachment will have high scores on both the anxious and avoidant scales and a low score on the family/childhood scale.

Alpha for Childhood and Family Relations

```
myKeys<-list(family=c("q350", "q401", "q1495", "q15778", "q16288", "q18840",
"q19832", "q43261", "q51155", "q67641", "q68235", "q70968", "q47122")) #"q617
05","q15261","q22991"
family<-scoreItems(myKeys,newdata, delete = FALSE)
family["alpha"]
```

```
## $alpha
##       family
## alpha   0.53
```

```
family["item.cor"]
```

```
## $item.cor
##         family
## q350      0.56
## q401      0.64
## q1495     0.29
## q15778    0.31
## q16288    0.19
## q18840    0.47
## q19832    0.22
## q43261    0.66
## q51155*   0.19
## q67641    0.44
## q68235    0.18
## q70968    0.28
## q47122    0.36
```

```
#alpha=0.53
```

Alpha for Anxious Attachment Style

```
myKeys<-list(anx=c("q15764", "q1688", "q18633", "q18984", "q33870", "q37748",
"q458", "q56163", "q61598", "q62454", "q85272", "q47379", "q59426", "q20424",
"q24682"))#"q61666", "q69429", "q83114"

anx<-scoreItems(myKeys,newdata, delete = FALSE)
anx["alpha"]

## $alpha
##       anx
## alpha 0.6

anx["item.cor"]

## $item.cor
##          anx
## q15764  0.33
## q1688   0.50
## q18633  0.57
## q18984  0.36
## q33870  0.50
## q37748  0.27
## q458    0.30
## q56163  0.21
## q61598  0.33
## q62454* 0.33
## q85272  0.49
## q47379  0.21
## q59426  0.50
## q20424* 0.49
## q24682  0.33

#alpha=.6
```

Alpha for Avoidant Attachment Style

```
myKeys<-list(avoid=c(
  #"q1185",
  "q15701", "q19236", "q20135", "q35660", "q4043", "q444", "q46091", "q57724"
, "q85706", "q20424","q24682", #"q83114",
                     "q83392" #,"q55929"
                     #,"q34207"
                     ))
avoid<-scoreItems(myKeys, newdata, delete = FALSE)
avoid["alpha"]
```

```
## $alpha
##       avoid
## alpha  0.44
```

```
avoid["item.cor"]
```

```
## $item.cor
##         avoid
## q15701   0.28
## q19236   0.48
## q20135   0.51
## q35660   0.41
## q4043    0.25
## q444     0.30
## q46091   0.34
## q57724   0.36
## q85706   0.50
## q20424*  0.42
## q24682   0.35
## q83392*  0.40
```

```
#q55929 had no variance and was deleted
#alpha=.44
```

Scale Scores

```
monogamyScores <- mono[["scores"]]
lengthScores <- long[["scores"]]
relationshipScores <- relationships[["scores"]]
childhoodScores <- family[["scores"]]
anxiousScores <- anx[["scores"]]
avoidantScores <- avoid[["scores"]]
SFscaleScores <-cbind(monogamyScores,
                      lengthScores,
                      relationshipScores,
                      childhoodScores,
                      anxiousScores,
                      avoidantScores)
```

```
#Monogamy Scores
  min(monogamyScores)
## [1] 0.038
  max(monogamyScores)
## [1] 1
  median(monogamyScores)
## [1] 0.92
  mean(monogamyScores)
## [1] 0.86
  sd(monogamyScores)
## [1] 0.12
#Length Scores
  min(lengthScores)
## [1] 0.054
  max(lengthScores)
## [1] 1
  median(lengthScores)
## [1] 0.86
  mean(lengthScores)
## [1] 0.81
  sd(lengthScores)
## [1] 0.1
cor(monogamyScores, lengthScores)
##      long
## mono 0.65
#Attachment Scores
min(childhoodScores)
## [1] 0.12
  max(childhoodScores)
## [1] 1
  mean(childhoodScores)
## [1] 0.83
  sd(childhoodScores)
## [1] 0.074
min(avoidantScores)
## [1] 0
  max(avoidantScores)
## [1] 0.92
  mean(avoidantScores)
## [1] 0.049
  sd(avoidantScores)
## [1] 0.077
min(anxiousScores)
## [1] 0
  max(anxiousScores)
## [1] 0.77
  mean(anxiousScores)
## [1] 0.028
  sd(anxiousScores)
```

```
## [1] 0.062
```

Attachment Style Classification

```
#median(childhoodScores)=.86 for 2000sample

#A basic way of looking at attachment from three classifications:
#AttachmentCategory <- ifelse(childhoodScores > .86, print("secure"), ifelse(
anxiousScores > avoidantScores, print("anxious"), print("avoidant")))

#If I want to include a fearful attachment style, I should use something like
this:
AttachmentCategory <- ifelse (childhoodScores > .86,
                              print("secure"),
                      ifelse
                           ((anxiousScores < 1.2*avoidantScores &
                               anxiousScores > .8*avoidantScores) &
                           (avoidantScores < 1.2*anxiousScores &
                               avoidantScores > .8*anxiousScores),
                              print("fearful"),
                      ifelse
                           (avoidantScores > anxiousScores,
                              print("avoidant"),
                              print("anxious")
                             )))

## [1] "secure"
## [1] "fearful"
## [1] "avoidant"
## [1] "anxious"

#Secure attacchments are usually 50-70% of population, depending on study
#prevelance of each type of insecure attachment varies depending on study and
number of insecure attachments identified
#Generally, more people have an avoidant attachment style than anxious, and m
ore people have an anxious attachment style than a fearful attachment style
#The difference between each insecure attachment style prevalence varies base
d on the study
colnames(AttachmentCategory)[colnames(AttachmentCategory)=="family"] <- "Atta
chmentStyle" #rename column

#Calulate percentage of each attachment style
(sum(AttachmentCategory=="secure"))/66271 #percent securely attached
## [1] 0.64
(sum(AttachmentCategory=="avoidant"))/66271 #percent avoidantly attached
## [1] 0.17
(sum(AttachmentCategory=="anxious"))/66271 #percent anxiously attached
## [1] 0.18
(sum(AttachmentCategory=="fearful"))/66271 #percent fearfully attached
## [1] 0.0071
```

Using this function on the data, approxiamately 63.3% of people are securely attached, 18% are avoidantly attached, 17.2% are anxiously attached, and 1.5% are fearfully attached, which is similar to what other researchers have found.

Means of Scale Scores

```
SFscaleScores %>%
  as.tibble() %>%
  summarise_all(funs(mean))
## # A tibble: 1 x 5
##    mono  long   family   anx  avoid
##   <dbl> <dbl>   <dbl>   <dbl>  <dbl>
## 1 0.859 0.815   0.833  0.0280 0.0490
```

Demographics

Below is demographic information about users and certain preferences they are looking for in their potential matches.

```
attach(demographics)
mean(d_age, na.rm=TRUE)
## [1] 32
min(d_age, na.rm = TRUE)
## [1] 18
max(d_age, na.rm = TRUE)
## [1] 100
sd(d_age, na.rm=TRUE)
## [1] 7.8
sum(d_gender=="Man", na.rm=TRUE)
## [1] 38976
sum(d_gender=="Woman", na.rm=TRUE)
## [1] 25144
sum(d_relationship=="Single", na.rm=TRUE)
## [1] 63549
sum(d_relationship=="Seeing Someone", na.rm=TRUE)
## [1] 387
sum(d_relationship=="Married", na.rm=TRUE)
## [1] 50
sum(d_relationship=="Open relationship", na.rm=TRUE)
## [1] 323
sum(lf_single=="Who are single", na.rm=TRUE)
## [1] 64312
sum(grepl("long-term dating", lf_for))
## [1] 46134
sum(grepl("short-term dating", lf_for))
## [1] 37750
sum(grepl("casual sex", lf_for))
## [1] 8803
sum(grepl("For  new friends", lf_for))
## [1] 55148
```

Appendix B

K-NN, ROC, AUC

Recoding Categorical Variables

```
attach(soniaScales)

soniaScales$d_orientation<-recode(soniaScales$d_orientation,
"'Hetero_male'=1;'Hetero_female'=1; 'Bisexual_male'=2;'Bisexual_female'=2;
'Gay_male'=3;'Gay_female'=3;'Straight'=1;'Bisexual'=2;'Asexual'=4;'Gay'=3;
'Sapiosexual'=1;'Pansexual'=2;'Questioning'=2; 'Heteroflexible'=2;'Queer'=3;
else=4")

soniaScales$d_gender<-recode(soniaScales$d_gender,"'Man'=1;'Cis Man'=1;'Woman
'=2;'Cis Woman'=2; 'Androgynous'=3; 'Non-binary'=3; 'Gender Nonconforming'=3;
'Genderqueer'=3; 'Trans Woman'=3;'Transfeminine'=3;'Transgender'=3;
'Trans Man'=3;'Other'=3; else=3")

soniaScales$d_ethnicity<-recode(soniaScales$d_ethnicity,"'White'=1; 'Black'=2
;'Mixed'=3; 'Pacific Islander'=4; 'Hispanic / Latin'=5; 'Indian'=6; 'Asian'=7
;'Middle Eastern'=8; 'Native American'=9; 'Other'=3; else=3")

soniaScales$d_country<-recode(soniaScales$d_country,"'US'=1;'United States'=1
; 'AK'=1;'AZ'=1; 'AR'=1; 'CA'=1;'CO'=1;'CT'=1; 'DE'=1;'FL'=1;'GA'=1;'HI'=1;
'ID'=1;'IL'=1;'IN'=1;'IA'=1;'KS'=1;'KY'=1;'LA'=1;'ME'=1;'MD'=1;'MA'=1;'MI'=1;
'MN'=1;'MS'=1;'MO'=1;'MT'=1;'NE'=1;'NV'=1;'NH'=1;'NJ'=1;'NM'=1;'NY'=1;'NC'=1;
'ND'=1;'OH'=1;'OK'=1;'OR'=1;'PA'=1;'RI'=1;'SC'=1;'SD'=1;'TN'=1;'TX'=1;'UT'=1;
'VT'=1;'VA'=1;'WA'=1;'WV'=1;'WI'=1;'WY'=1;'AS'=1;'DC'=1;'FM'=1;'GU'=1;'MH'=1;
'MP'=1;'PW'=1;'PR'=1;'VI'=1;'AE'=1;'AA'=1;'AE'=1;'AE'=1;'AE'=1;'AP'=1;
'Canada'=2;'Alberta'=2;'British Columbia'=2;'Manitoba'=2;'New Brunswick'=2;
'Newfoundland and Labrador'=2; 'Nova Scotia'=2;'Ontario'=2;'Prince Edward Isl
and'=2;'Quebec'=2; 'Saskatchewan'=2;
'UK'=3;'United Kingdom'=3;'MX'=4;'Mexico'=4;else=5")

soniaScales$d_relationship<-recode(soniaScales$d_relationship, "'Single'=1; e
lse=2")

soniaScales$Friends <- grepl("For  new friends", lf_for)
    soniaScales$Friends <- as.numeric(soniaScales$Friends)
soniaScales$STDate <- grepl("short-term dating", lf_for)
    soniaScales$STDate <- as.numeric(soniaScales$STDate)
soniaScales$CSex <- grepl("casual sex", lf_for)
    soniaScales$CSex <- as.numeric(soniaScales$CSex)
soniaScales$LTDate <- grepl("long-term dating", lf_for)
    soniaScales$LTDate <- as.numeric(soniaScales$LTDate)
soniaScales<- soniaScales[,-c(4,7:9)]
```

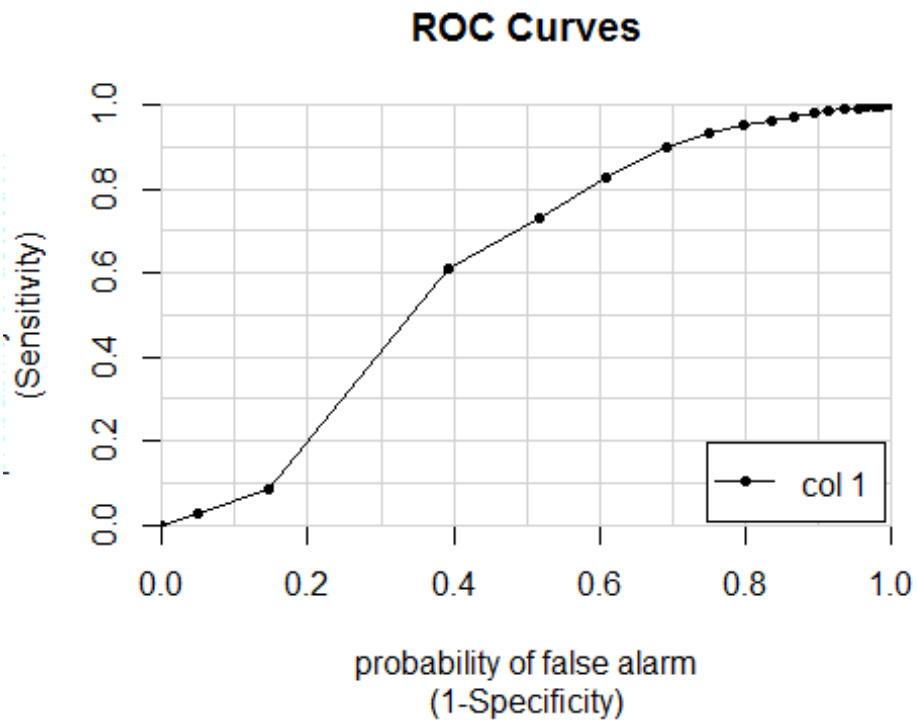
K-NN

```
soniaScales$AttachmentStyle <-as.factor(soniaScales$AttachmentStyle)
n <- nrow(soniaScales)
trainIndex <- sample(1:n, size = round(0.6*n), replace=FALSE)
trainOKC <- soniaScales[trainIndex ,]
testOKC <- soniaScales[-trainIndex ,]

#Getting rid of columns to predict attachment style
trainOKCNoA <- trainOKC[,-c(9:13)]
testOKCNoA <- testOKC[,-c(9:13)]

knnres <- knn(trainOKCNoA, testOKCNoA, trainOKC$AttachmentStyle, k=70)
table(knnres) # predicted outcomes

## knnres
##  anxious avoidant  fearful   secure
##      533     1062        0    24913

table(testOKC$AttachmentStyle) # actual outcomes

##
##  anxious avoidant  fearful   secure
##     4736     4571      183    17018

table(knnres,testOKC$AttachmentStyle)

##
## knnres     anxious avoidant fearful secure
##   anxious      154      172       9    198
##   avoidant     283      462      33    284
##   fearful        0        0       0      0
##   secure      4299     3937     141  16536
```

AUC and ROC for Monogamy

Secure

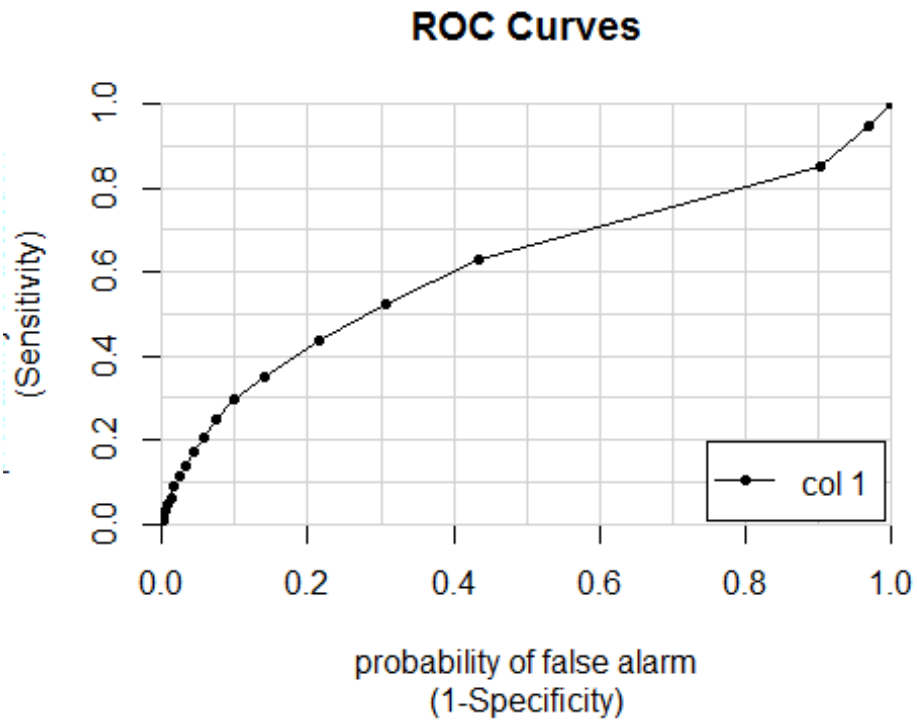
```
AUCModelSECM<-colAUC(testOKCNoA$mono, testOKC$AttachmentStyle=="secure", plot
ROC = TRUE)
```




```
AUCModelSECM

##                [,1]
## FALSE vs. TRUE 0.61
```

Avoidant

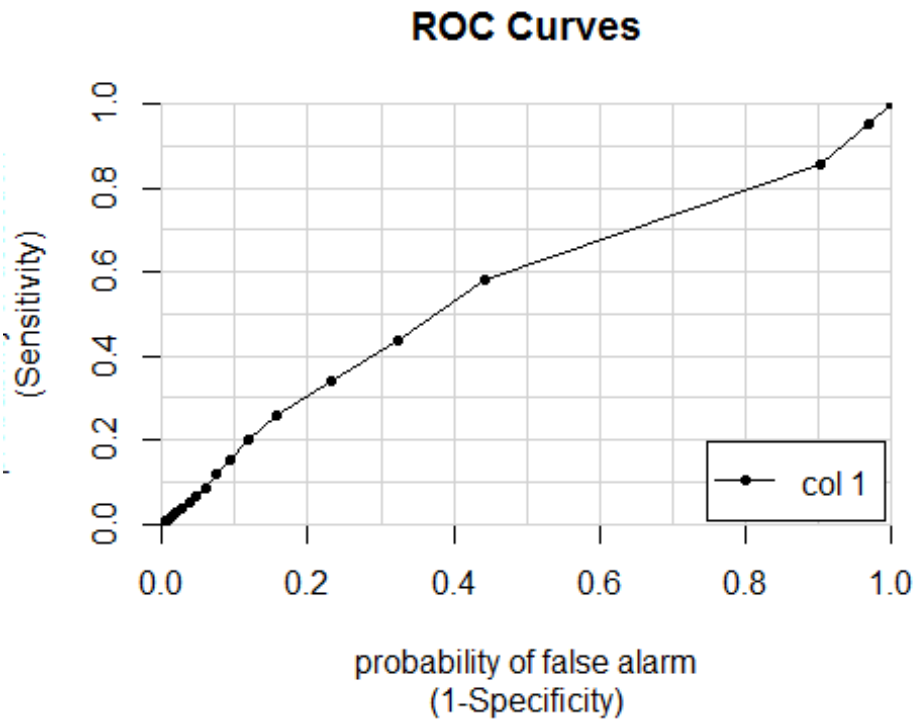
```
AUCModelAVDM<-colAUC(testOKCNoA$mono, testOKC$AttachmentStyle=="avoidant", pl
otROC = TRUE)
```




```
AUCModelAVDM

##                [,1]
## FALSE vs. TRUE 0.61
```

Anxious

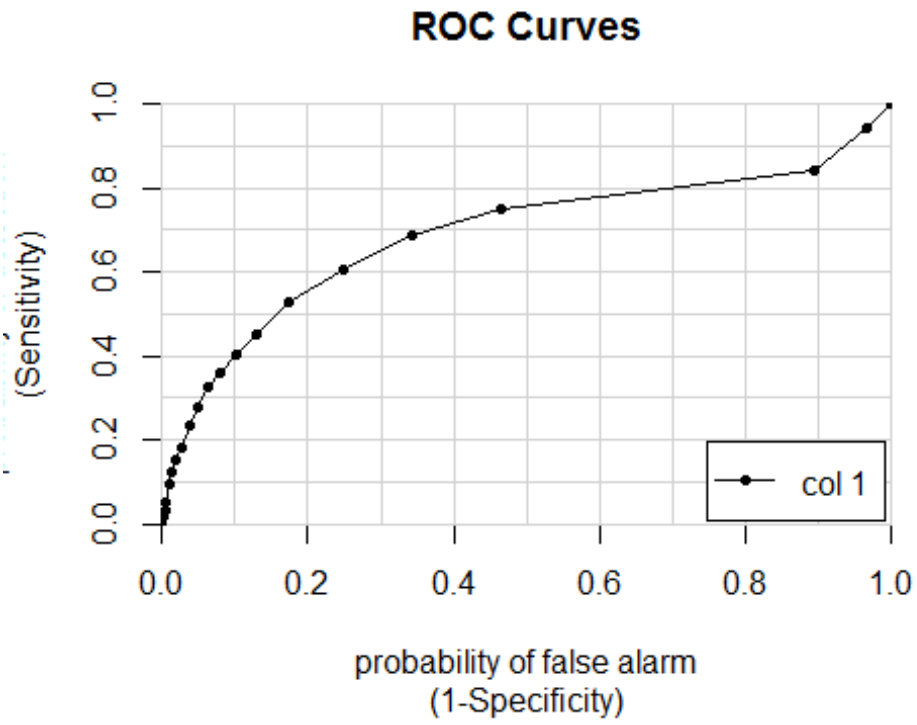
```
AUCModelANXM<-colAUC(testOKCNoA$mono, testOKC$AttachmentStyle=="anxious", plo
tROC = TRUE)
```




```
AUCModelANXM

##                [,1]
## FALSE vs. TRUE 0.56
```

Fearful

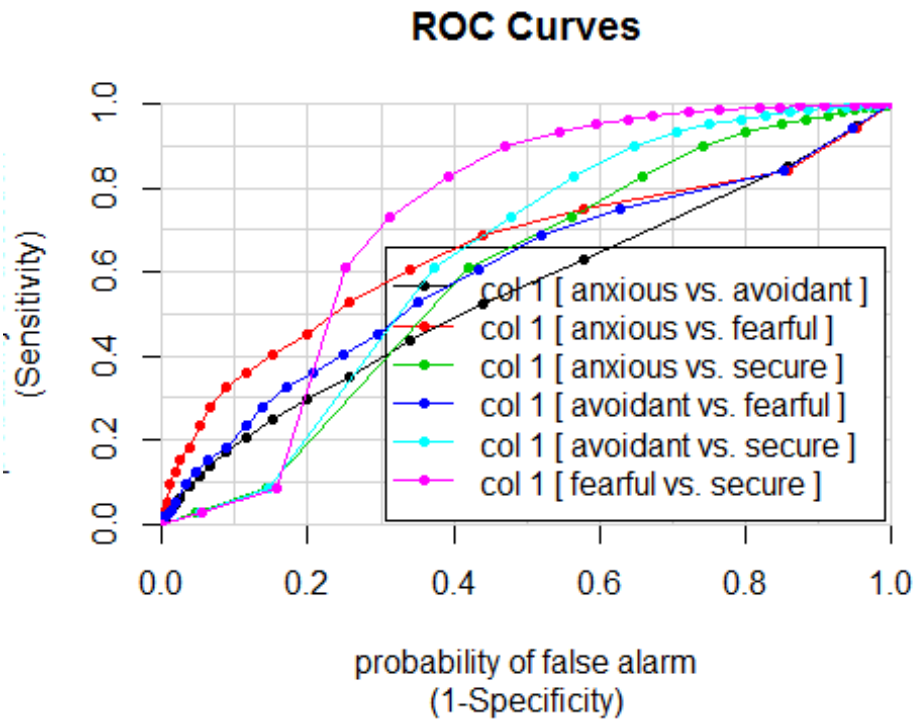
```
AUCModelFEARM<-colAUC(testOKCNoA$mono, testOKC$AttachmentStyle=="fearful", pl
otROC = TRUE)
```




```
AUCModelFEARM

##                 [,1]
## FALSE vs. TRUE 0.69
```

Comparisons

```
AUCModelM<-colAUC(testOKCNoA$mono, testOKC$AttachmentStyle, plotROC = TRUE)
```

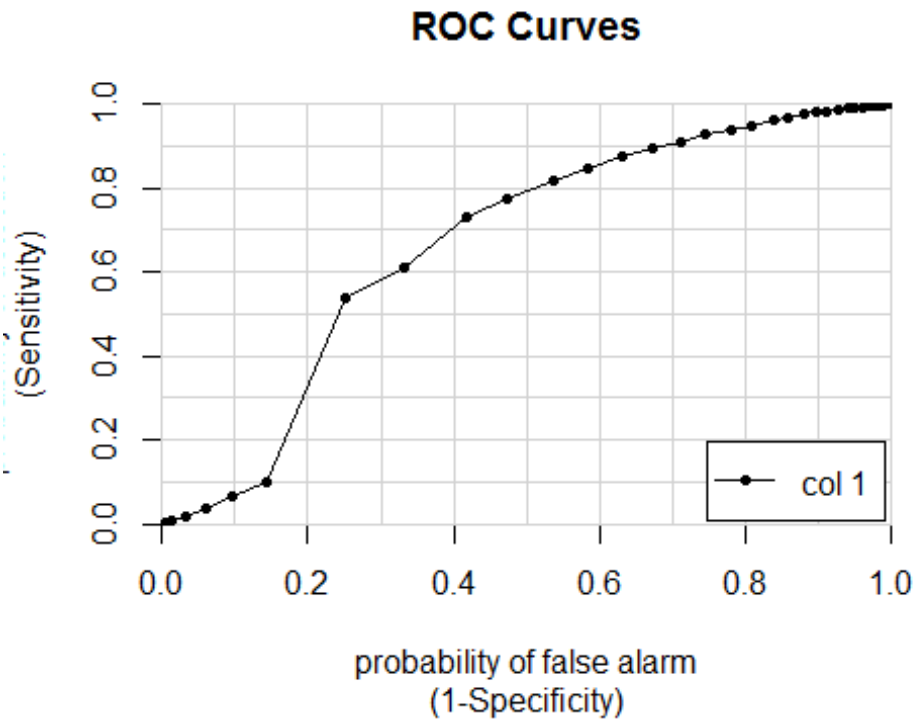



```
AUCModelM
```

```
##                       [,1]
## anxious vs. avoidant 0.55
## anxious vs. fearful  0.65
## anxious vs. secure   0.59
## avoidant vs. fearful 0.60
## avoidant vs. secure  0.63
## fearful vs. secure   0.72
```

AUC and ROC for Relationship Length

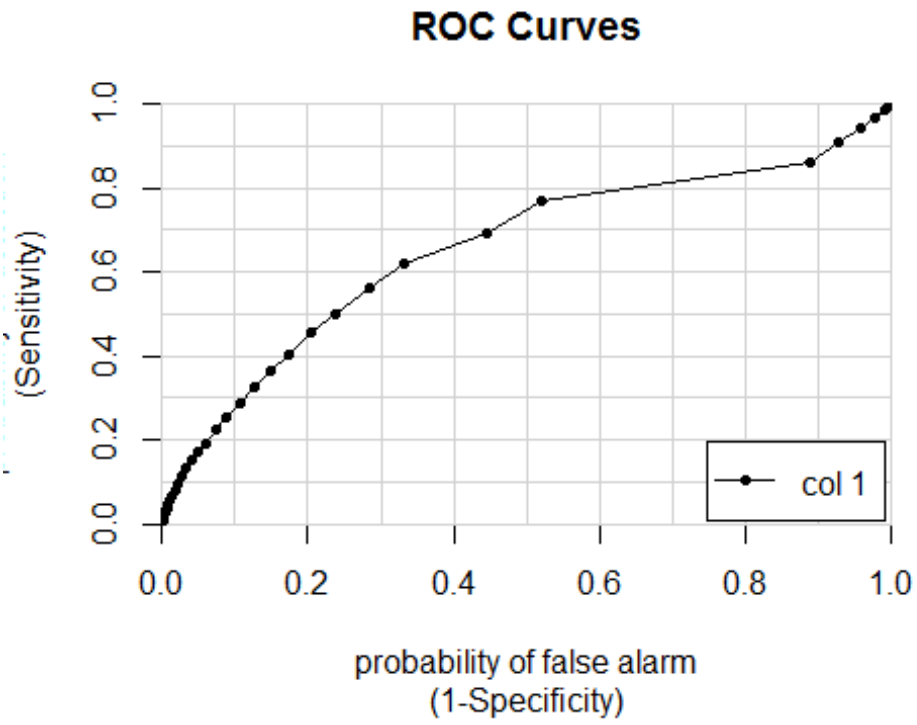
```
AUCModelSECL<-colAUC(testOKCNoA$long, testOKC$AttachmentStyle=="secure", plot
ROC = TRUE)
```




```
AUCModelSECL

##                [,1]
## FALSE vs. TRUE 0.67
```

Secure

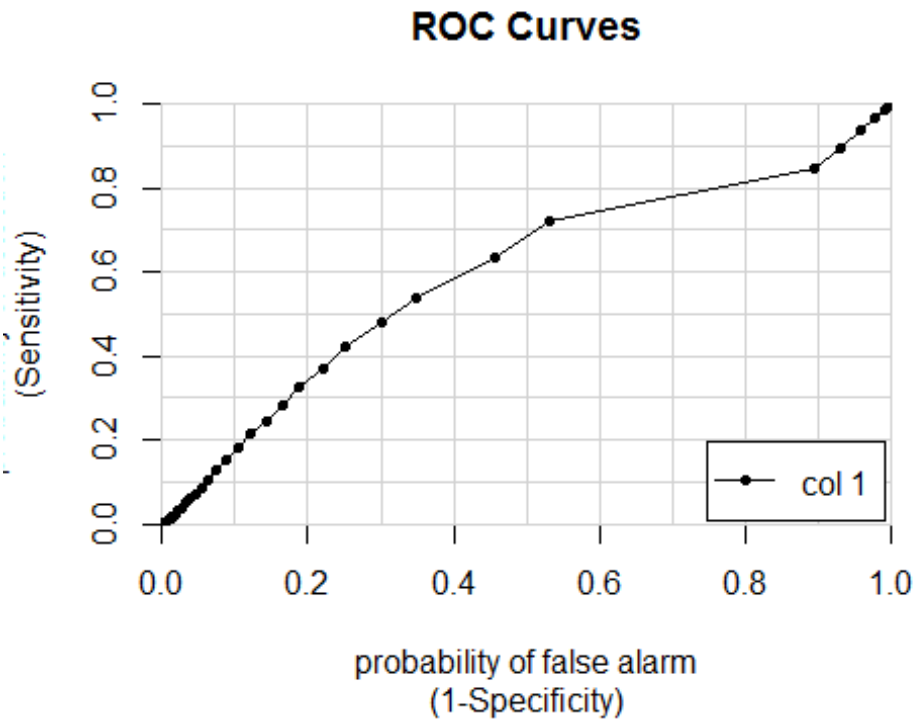
```
AUCModelAVDL<-colAUC(testOKCNoA$long, testOKC$AttachmentStyle=="avoidant", pl
otROC = TRUE)
```




```
AUCModelAVDL

##                [,1]
## FALSE vs. TRUE 0.66
```

Anxious

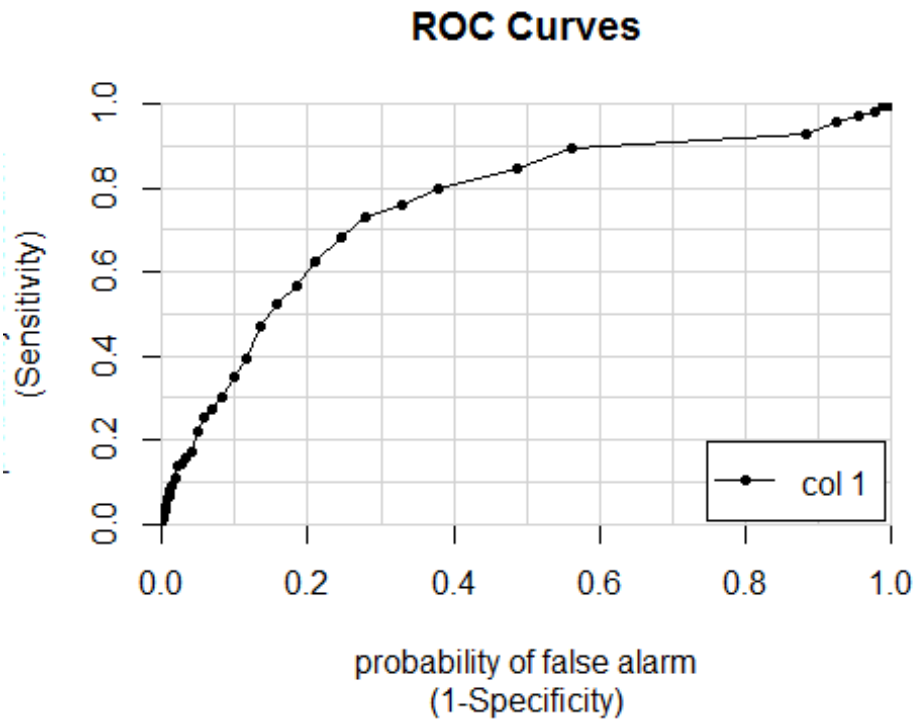
```
AUCModelANXL<-colAUC(testOKCNoA$long, testOKC$AttachmentStyle=="anxious", plo
tROC = TRUE)
```




```
AUCModelANXL

##                [,1]
## FALSE vs. TRUE  0.6
```

Avoidant

```
AUCModelFEARL<-colAUC(testOKCNoA$long, testOKC$AttachmentStyle=="fearful", pl
otROC = TRUE)
```

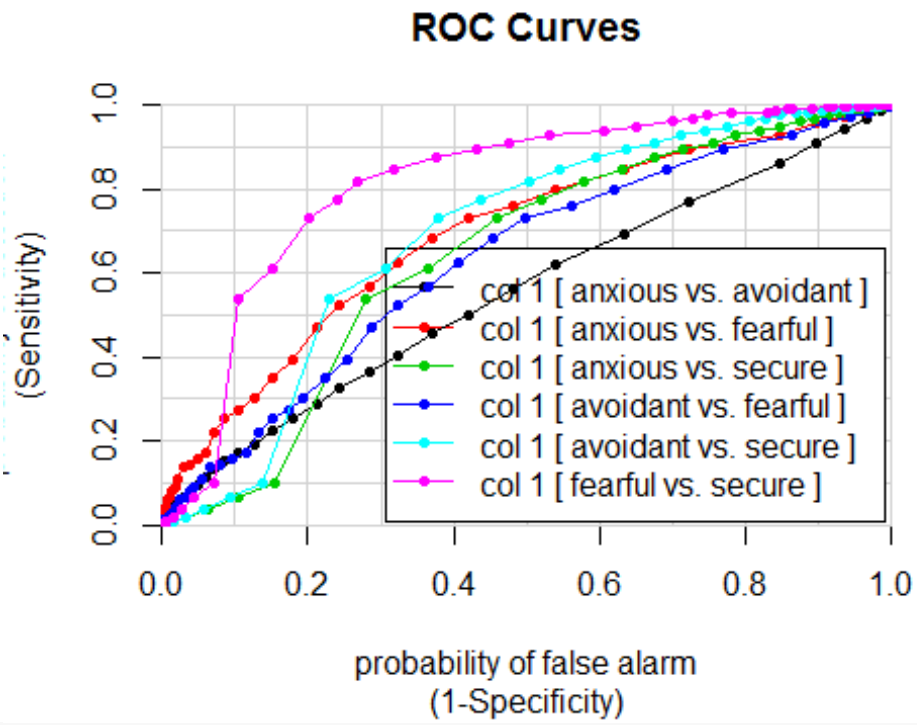



```
AUCModelFEARL
```

```
##                [,1]
## FALSE vs. TRUE 0.76
```

Comparisons

```
AUCModelL<-colAUC(testOKCNoA$long, testOKC$AttachmentStyle, plotROC = TRUE)
```




```
AUCModelL
##                       [,1]
## anxious vs. avoidant 0.56
## anxious vs. fearful  0.69
## anxious vs. secure   0.64
## avoidant vs. fearful 0.63
## avoidant vs. secure  0.69
## fearful vs. secure   0.81
```

Means and Effect Sizes

```
aggregate(soniaScales[-c(1:5, 9:12)], list(AttachmentStyle), mean)
##    Group.1 mono long relationships Friends STDate CSex LTDate
## 1  anxious 0.84 0.79          0.79    0.81   0.67 0.14   0.78
## 2 avoidant 0.80 0.76          0.76    0.80   0.63 0.18   0.76
## 3  fearful 0.74 0.71          0.70    0.81   0.65 0.25   0.79
## 4   secure 0.88 0.84          0.83    0.85   0.52 0.12   0.65

sd(soniaScales$mono)
## [1] 0.12

sd(soniaScales$long)
## [1] 0.1
```

Works Cited

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