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**Emerging adults' sibling relationships and inter-sibling communication:
general communication patterns and chronemic expectation violation in
a text-based interaction**

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Abstract

Emerging adults' sibling relationships and inter-sibling communication: general communication patterns and chronemic expectation violation in a text-based interaction

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Given the lack of knowledge on text-based communication between emerging adult siblings, this study was conducted to examine siblings' general communication patterns and observe their online interaction on a text-based real-time chat platform: A dyadic conversation about choosing a gift for a family member. Based on the self-report data from 147 undergraduate students, the current study explored how three dimensions of sibling relationships (warmth, conflict, and rivalry) were related to general communication patterns and geographic distance. Under the frameworks of Expectancy Violation Theory and Social Information Processing Theory, this study further explored the association between the three dimensions of sibling relationships and perceived chronemic expectation violation. In 39 sibling dyads who engaged in an online chat, participants' sibling was required to delay each of their responses for 40s during the interaction. Among the 26 participants who noticed the delay, violation importance and valence were positively related to positive affect towards their sibling's response latency, while violation

expectedness and valence were negatively related to negative affect towards their sibling's response latency. Sibling warmth was negatively related to violation expectedness. This study also examined the influence of attributions and previous communication patterns during this inter-sibling interaction: Attributions (personal characteristics/internal vs. context/external) mediated the correlation between sibling warmth and violation expectedness, and text frequency was positively related to sibling warmth and negatively associated with violation valence.

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Chapter 1: Introduction

As one of the longest, most enduring relationships in an individual's life, sibling relationships may outlast relationships with parents, partners, and friends (Circirelli, 1995). According to the latest report of U.S. Census Bureau and U.S. Bureau of Labor Statistics (2021), 79.8% of children are living with at least one sibling. For those who are living with two parents, the percentage rises to 84.5%. In other words, about 80% Americans are raised in homes with one or more siblings. In spite of the prevalence of sibling relationships, the literature on sibling interactions is relatively sparse. Further, researchers who have studied the nature of sibling relationships (Branje et al., 2004; Furman & Buhrmester, 1985; Gold, 1989), have focused their work on childhood, adolescence, and elderhood (Marotta, 2015). A number of scholars have noted that there is a gap in knowledge about the sibling relationship during emerging adulthood (Cicirelli, 1995; Marotta, 2015; Stock et al., 1997).

The growing independence, separate residences, and establishment of new relationships (e.g., friendships, romantic relationships), make sibling relationships in emerging adulthood more voluntary than they are when individuals are younger (Arnett, 2000; Marotta, 2015). Although people don't have a choice in selecting their siblings, as they age they gain more and more autonomy to decide how, when, and why to communicate with their siblings (Rocca et al., 2010). During emerging adulthood, siblings begin to leave home, establish independence, and have new experiences before they transition into careers and marriage (Arnett, 2007). Facing these significant life transitions, siblings develop unique ways to deal with both relational and communication challenges. However, researchers have not paid a great deal of attention to siblings in this life stage (Marotta, 2015; Stock et al., 1997).

Emerging adulthood, as a time of change and transition for siblings (LeBouef, 2018), may also strengthen the influence of relationship quality on siblings' communication patterns. Researchers have found evidence that the sibling relationship improves as people make the transition from adolescence to emerging adulthood (Cicirelli, 1980; Scharf et al., 2005; Stocker et al., 1997). Though siblings occupy a "prominent position" in each other's lives, it is not until they move towards adulthood that sibling relationships adopt an egalitarian tone (Bedford & Avioli, 2001) and resemble a relationship comparable to a friendship (Cicirelli, 1994). Even though emerging adult siblings often spend less time together, those who are close have more "emotional exchanges, such as discussing personal matters, and feeling more warmth" toward each other (Scharf et al., 2005, p. 82) than siblings at younger ages. Those who do not get along may choose to decrease their contact with one another (Marotta, 2015). In a National Survey of Families and Households sample of 7,730 adults with siblings, nearly 30% of participants reported that despite a decrease in the frequency of exchange, they would still reach out to a sibling first in an emergency (White & Riedmann, 1992).

Although the amount of contact emerging adult siblings have varies, it is clear that most rely on technology and media to maintain their relationships (Barrie, 2019). Text-messaging has become the most frequent way emerging adult siblings communicate with each other (Battestini et al., 2010; Corti, 2009; Johnson & Corti, 2008; Lindell et al., 2015). Almost 100% of 18-29 years old Americans own cell phones and 96% own smartphones (Pew Research Center, 2021). To keep in touch with each other, emerging adult siblings often turn to media alternatives rather than face-to-face contact or phone calls. However, limited by the technological advances of their time, most studies to date have examined face-to-face conversations, emails, letters, and phone calls between siblings (LeBouef, 2018). They also focused more on the frequency of "sibling contact" than the processes

involved in sibling interaction (LeBouef, 2018; Lee et al., 1990; Marotta, 2015; Stocker et al., 1997). To better understand the communication dynamics that take place between siblings, it is important to examine different channels of communication and collect data about actual interactions.

New technologies, especially text-based communication (referred to as text messaging and instant messaging in current study), offer an opportunity to observe actual communication between siblings. When at least one sibling has left for college, information and communications technologies (ICTs) become “paramount in maintaining sibling relationships” (Lindell et al., 2015, p. 573): Only 22.8% of a sample of 250 first-year college students had a face-to-face interaction with their siblings once per week or more, and most students instead relied on technology-based methods (Lindell et al., 2015). To keep in touch with each other and maintain their relationship, emerging adult siblings are likely to establish routines in their text-based communication, including how often they interact or how soon they will receive a response from each other. These routines then create chronemic (or time-related) expectations for their text-based conversations. When one sibling violates these expectations, the other is likely to perceive a difference in the routine and react to the violation.

Among all the characteristics of mediated communication, chronemic cues may have received the most attention (Bernieri et al., 1988; Kalman & Rafaeli, 2011; Walther & Tidwell, 1995). A powerful mechanism has been used by a number of researchers to explain how chronemic cues interact with communicator attributes (Grinberg et al., 2017; Kalman & Rafaeli, 2011; Walther & Tidwell, 1995): Expectancy Violation Theory (Burgoon, 1993). Based on Expectancy Violation Theory, people’s expectations¹ about

¹ It is important to note that some researchers distinguish the term “expectancy” from “expectations.” These researchers suggest that expectancy indicates people’s belief about what will happen, and expectations indicate people’s belief about what should happen. The current study, like Afifi and Metts’ (1998) research, uses the term “expectancy” and “expectations” interchangeably.

others' communication behaviors are related to communicator characteristics, relational characteristics, and context characteristics (Burgoon, 1993). In an in-person conversation, long pauses and silence, both forms of chronemic expectation violations, may arouse people's negative feelings. Individuals' previous interpersonal relationships may also be involved in their evaluation of these pauses and silence. In text-based communication, pauses and silence are presented in the form of longer intervals between two messages (or the delay of a message). With existing communication routines between siblings, siblings are more likely to notice long delays in each other's responses during a real-time text-based chat, especially when their chronemic expectations are violated. Importantly, the quality of sibling relationship may influence how they evaluate these violations and create different emotional outcomes.

Therefore, in the current study, siblings were asked to engage in a casual conversation via text and their real-time chat records were collected. Data about their sibling relationship and general inter-sibling communication patterns also were gathered. Siblings' emotional responses to this interaction, as well as the associations between different dimensions of their relationship and violations of their expectations concerning their siblings' chronemic cues were examined.

Chapter 2: Literature Review

SIBLING RELATIONSHIPS AND INTER-SIBLING COMMUNICATION

Sibling relationships are unique because of characteristics that are both external and internal to the relationship. In brief, four characteristics distinguish sibling relationships from other associations. First, sibling relationships are potentially the longest in one's total life time. "The sibling relationship is one of extraordinary longevity" (Cicirelli, 1995b, p. 7). Second, sibling relationships are involuntary. They are "ascribed" and "obtained by birth" (Cicirelli, 1995b, p. 2) or by legal action like adoption. Third, sibling relationships are exposed to change or disruption in adulthood (Cicirelli, 1995b; Mikkelson, 2014). Siblings who are raised at home together may have intimate daily contact in their childhood and adolescence but as they grow up and separate, intimacy increasingly relies on keeping in touch at a distance via telephone call, periodic visits and text. Finally, siblings have shared experiences (Cicirelli, 1995b; Mikkelson, 2014). Since siblings share the same environment (economic, education, parenting etc.) for a long period of time, these shared experiences may contribute to their similarity.

Unlike the status held by partners in other peer relationships (romantic relationships, friendships), sibling status cannot be ended. Even though people may choose to stay away from their siblings, they cannot dissolve the relationship (Cicirelli, 1995b). This "ascribed" feature also contributes to the internal complexity of the sibling relationship and makes it distinctive from other personal relationships. In other words, sibling "may support each other, but also reveal fierce rivalry and mutual aggression" (Branje et al., 2004, p.1385). There is a "paradoxical nature" to sibling relationships (Myers, 2015, p. 1). Some siblings may state that they love each other but cannot tolerate

each other for too long, while others may engage in conflict with each other and still experience a high level of closeness and cohesions (Mikkelson, 2014).

The inner complexity of sibling relationships has been studied in two different ways (Cicirelli, 1995b). Some researchers prefer the use of typologies, while other researchers think it is better to use a set of dimensions to describe sibling relationships. In 1989, Gold categorized five types of sibling relationships based on interview data from older aged siblings: intimate, congenial, loyal, apathetic, hostile. This typology has been supported by several different datasets of late-life siblings: for instance, Gold, Woodbury, and George's (1990) interview data from 30 males and females, Gold's (1990) sample of 153 dyads, and Scott's (1990) sample including 82 adults with at least one sibling.

These data help illustrate both the positive and negative features of sibling relationships and this typology has been used in communication research examining siblings' relational maintenance behaviors (Myers & Goodboy, 2010; Myers & Odenweller, 2015) and their affective communication (Myers, 2015). Myers and Goodboy (2010) found that in general, intimate siblings use more relational maintenance behaviors and use several communication channels (Face-to-face, Telephone, Email, Instant messenger and Text-messaging) more frequently than the other types of siblings. Individuals with intimate siblings also perceive more relational maintenance behaviors from their siblings, indicating a "reciprocal relationship" (Myers & Odenweller, 2015, p. 249) between siblings' maintenance strategies. Myers (2015) also found that intimate siblings use more affectionate communication, and consider the use of affectionate communication more important and appropriate than other types of siblings.

However, as Cicirelli (1995b) pointed out, this typology shares problems common to all typologies: It is difficult to classify all cases, and there is a lack of variation within a type when using nominal measurement. In Gold's study (1989b) about siblings in old age,

only 10% of the participants were categorized as hostile. More specifically, as noted by Stocker et al. (1997), this typology does not fully explain the mixed findings about the negative qualities of sibling relationships. In a study of middle-aged adults between 29 and 71 (Cicirelli, 2013), only 4% of the sample reported that they got along with their siblings “poorly” or “not very well” and 12% perceived little or no satisfaction from their sibling relationships. By contrast, 88% reported that they rarely or never argue with their siblings and 93% rarely or never felt competition with their siblings about their accomplishments (Cicirelli, 2013). Different from these self-report data, 71% of a sample aging from 22 to 93 who participated in small-group discussions, reported rivalry feelings towards their siblings at some points in their life (Ross & Milgram, 1982). Ross and Milgram’s work reflects a much higher level of adult sibling rivalry than previous studies. People may find it hard to admit their rivalrous feelings towards their siblings because they perceive such feelings make them appear to be immature (Ross & Milgram, 1982). These studies reflect the potential ambivalence individuals have towards their siblings, which makes the typology particularly difficult to adopt for emerging adult samples where changes and transitions for siblings are prevalent.

To understand people’s perceptions of adult sibling relationships and further explore their paradoxical nature, scholars developed a new measure during the 1990s, the Adult Sibling Relationship Questionnaire (ASRQ; Lanthier et al., 1992). Researchers found experimental evidence that emerging adults do report feelings of warmth, conflict, and rivalry toward their siblings (Stocker et al., 1997). Perceptions of conflict and rivalry and perception of warmth are “not opposite ends of a unitary dimension” (Stocker et al., 1997, p. 217). With two samples including 383 participants, the factor structure of the ASRQ revealed that warmth, conflict, and rivalry are three independent dimensions that characterize sibling relationships in emerging adulthood. Conflict and rivalry were

minimally associated with sibling warmth, providing evidence for people's ambivalent feelings towards their siblings. Since then, this measure has been used in more than 300 studies, showing robust reliability and validity.

Using this measure, researchers have explored the relationship between emerging adults' sibling relationships and their general communication patterns (Stocker et al., 1997; Marotta, 2015). Summarizing all inter-sibling communication as "sibling contact," Stocker et al. (1997) measured how often participants saw their siblings, gathered with them for special occasions, telephoned their siblings, and were telephoned by their siblings. Results showed that the amount of sibling contact was positively related to sibling warmth and negatively associated with sibling rivalry (Stocker et al., 1997). These findings aligned with a previous study which revealed that adult sibling contact (telephone and face-to-face interaction) was positively related to closeness in their relationships (Lee et al., 1990).

In previous studies on sibling contact, it is worth noting that researchers often differentiate obligatory contact motivation from other contact motivation (Lee et al., 1990), the former of which makes family bonds more durable than friendships (Troll & Smith, 1976). As normative expectations, siblings are taught and encouraged to love each other (Myers et al., 1999), feel responsible for the welfare of family members (Lee et al., 1990) and keep in touch with one another, and be informed of each other's overall situation (Allan, 1977). These obligations emphasize "limited but enduring involvement" over the life span (Allan, 1977, p. 182), but more specific involvement in each other's lives is "neither prescribed nor prohibited" (Allan, 1977, p. 183). In other words, siblings can meet these expectations by occasional visits and maintaining a general knowledge of each other's activities and well-being (Lee et al., 1990, p. 143). Considering the potential impact of obligatory motivation on the inter-sibling communication patterns, Stocker et al. (1997)

differentiated family gatherings from other physical contact between siblings. Similarly, the current study also differentiates these two kinds of sibling communication.

Scholars (Lee et al., 1990; Stocker et al., 1997) also point out the practical influence of geographic proximity on inter-sibling communication (telephone and face-to-face interaction), as it provides opportunities for siblings to spend time together, regardless of cultural expectations or other internal feeling states (Lee et al., 1990, p. 137). In both Lee et al.'s (1990) and Stocker et al.'s (1997) studies, there was a negative correlation between sibling contact and geographic proximity, meaning that siblings contacted each other less if they lived far away. Although the researchers included different communication channels in the measure of sibling contact, physical contact was involved in both studies, which may have contributed to this correlation. In a previous study about urban kinship relationships, Adams (1968) found a similar correlation between face-to-face interaction and geographic proximity, and reported that living close made people feel obligated to be in more contact with one another than they might prefer. In Lee et al.'s (1990) study, a greater proportion of sibling contact was perceived as obligatory when siblings were in close proximity and contact (phoning and face-to-face interaction) seemed to be encouraged by proximity. However, as Lee et al. (1990) point out, geographic proximity does not guarantee contact because siblings can either choose to keep contact via other channels even if they live far apart, or intentionally avoid communication if they live a short distance from each other. Current technology has given people even more autonomy with regard to how often they make contact. As such, the present study examines the geographic distance between siblings and explores how it is related to different forms of communication.

Although previous studies describe the general landscape of inter-sibling communication patterns, there is still a lack of knowledge about how different forms of communication (e.g., text, phone call, family gathering, physical contact) are related to the

three dimensions of sibling relationships, and there have been relatively few observations of inter-sibling communication process at a micro level (e.g., dyadic conversational data). Therefore, the current study not only analyzes the correlation between three dimensions of sibling relationships and different forms of communication, but also examines one specific inter-sibling interaction.

CHRONEMIC CUES IN CMC

Except for general communication patterns, little research on emerging adult sibling communication has examined text-based interactions. When one sibling leaves for college, less than 23% of respondents in a survey (Lindell et al., 2015) reported primarily relying on face-to-face interaction with their siblings and instead turned to technology-mediated communication, such as texting. Text-based communication (i.e., instant messaging via apps and text messaging) has become the most frequent way college students contact their siblings (Battestini et al., 2010; Corti, 2009; Johnson & Corti, 2008; Lindell et al., 2015). However, many studies on emerging adult sibling communication (Lee et al., 1990; Myers et al., 2001; Stocker et al., 1997), are limited by the technological advances of their time or their research focus, emphasizing traditional communication between siblings and paying little attention to the prevalence of text-based communication. To better understand inter-sibling communication, the current study incorporates text frequency as part of the measurement of general communication patterns. Aligned with previous studies about other communication channels and sibling relationships (Lee et al., 1990; Stocker et al., 1997), the first hypothesis predicts that:

***H1:** Participants' text frequency to their siblings and their siblings' text frequency to them are positively related to sibling warmth.*

Although some scholars describe messages in CMC as “characteristically impersonal, cold, and unsociable” relative to face-to-face communication (Hiltz et al., 1986, p. 228), some research on sibling communication indicates the opposite: There seems to be some unique advantages of text-based communication that are attractive to siblings who are emerging adults. Social Information Processing (SIP) theory (Walther, 1992) provides some theoretical explanations for the prevalence of text-based communication.

According to the SIP theory (Walther, 1992), communicators exhibit and exchange social information differently when engaged in mediated communication to form impressions or maintain relationships. To compensate for the loss of nonverbal cues which used to exist in multi-modal media or face-to-face interactions, people rely on the previously “neglected” verbal, linguistic, textual cues (Walther, 1992, p. 75) and chronemic cues (or time cues) (Walther & Tidwell, 1995) to perform relational functions. Using linguistic or textual cues as their “stock in trade” (Walther, 1992, p. 75), emerging adult siblings are likely to achieve their desired immediacy levels through the manipulation of verbal immediacy when chatting with each other through text. Their ability to decode and encode relational messages through text may also improve over time and eventually become comparable to their abilities in face-to-face interactions. The interchangeability of nonverbal cues and verbal messages (Walther, 1992, p. 77) creates space for socioemotional expression in text-based communication, making inter-sibling interaction feasible. Therefore, it is important to examine how these previously “neglected” cues interact with verbal messages and influence communication process in siblings' text-based interactions.

Among all the nonverbal cues in mediated communication, chronemic cues play a unique role in text-based communication. As “structural features” of messaging systems, chronemic cues are embedded automatically in a message in the form of time stamps (Walther & Tidwell, 1995, p. 356). In a text-based conversation, people have more direct control of chronemic cues (e.g., the time a message was sent) (Walther & Tidwell, 1995, p. 360). Chronemic behaviors also influence the intimacy and affection exchanged in relational context: A delayed response may indicate receptivity and liking in one relationship, but may be interpreted as unpleasant “withdrawal” in another (Walther & Tidwell, 1995, p. 362). For example, in a closer relationship, communicators who are comfortable with each other don’t need to respond immediately. In less close relationships, this delayed message can indicate that the other person is unimportant or even “disliked.” Walther and Tidwell (1995) found evidence that chronemic cues in emails (the time of day an e-mail message was sent, or the mere delay of a response by 24 hours) alter perceived communicators’ intimacy and dominance. Lew et al. (2018) also found similar results in dyadic online chats with customers. After controlling for conversational contingency, faster response latency (i.e., the amount of time between one message and the next) was associated with higher chat satisfaction and a better organizational relationship with customers by participants. In the present study, the concept of response latency was examined in inter-sibling conversations.

When studying personal relationships, many scholars use Expectancy Violation Theory (Burgoon, 1993) to explain how chronemic cues interact with communicator attributes and relational variables (Grinberg et al., 2017; Kalman & Rafaeli, 2011; Walther & Tidwell, 1995). The theory and its components are related to the concepts of norms and rules in interpersonal communication. In an early study examining the construct of expectancy, Burgoon and Walther (1990) conducted an experiment focused on

participants' expectedness and evaluation of three nonverbal variables: touch, conversational distance, and posture. As noted by Burgoon and Walther, communicators' interactions are associated with a series of norms and rules for enacting roles. These norms and rules form the basis of expectations of others' behaviors (p. 233). If people expect "regularities in nonverbal behavior" and recognize and assign meaning to violations of such expectations, it is likely that violations have significant communicative impact (Burgoon & Walther, 1990, p. 234). This early study found that several behaviors were expected and positively valenced while others were considered as positive or negative violations of expectations. With experimental evidence like this, Burgoon (1993) summarized Expectancy Violation Theory as a theoretical model that attempts to "predict and explain the consequences of expectancy confirmations and violations in interpersonal communication" (both nonverbal and verbal behaviors) (p. 31).

Based on Expectancy Violation theory, people's expectations about others' communication behaviors derive from three factors: communicator, relationship, and context characteristics (Burgoon, 1993). Communicator characteristics refer to salient features of individual actors including but not limited to demographics and communication styles. These features help communicators to anticipate how this individual will act. Relationship factors are the description of the relationship between communicators, such as the level of liking, attraction, or familiarity. Context characteristics focus more on the environment and situation, such as its privacy and task orientation, that "prescribe or proscribe certain interaction behaviors" (Burgoon, 1993, p. 32).

With existing communication routines and established expectations between siblings, it is more likely for them to perceive longer than usual delays in their siblings' responses during a real-time inter-sibling text-based chat, especially when chronemic expectation violations happen. Through examination of these violations, this study can not

only gain a better understanding of regularities in inter-sibling communication (e.g., general communication patterns), but also explore the potential impact of violations themselves on a specific inter-sibling interaction. As indicated by previous studies (Lew et al., 2018; Walther & Tidwell, 1995), violations like unexpected pauses and silence in response messages, may be interpreted differently based on the expectations that siblings hold. These expectations may be created from previous sibling text-based communication interactions and shaped by the quality of sibling relationships.

Under the framework of Expectancy Violation Theory, the current study examined both peoples' expectations for their sibling's communication and the subsequent communication outcomes (e.g., emotional reactions) during inter-sibling interactions. To investigate how the quality of sibling relationships is involved in both general inter-sibling communication patterns and the process of one specific sibling interaction, the present study employed a survey and an experiment that manipulated the delay in siblings' response time during a text-based interaction (violation in chronemic cues). To control for communicator and context characteristics, all student participants were invited to chat with their closest-to-age adult sibling in the same online text-based chat platform and were assigned the same discussion task (choosing a gift for a family member). All participants' and their siblings' demographic data were also collected.

HYPOTHESES AND RESEARCH QUESTION IN ONLINE INTER-SIBLING INTERACTION

Following the development of Expectancy Violation Theory, scholars recognized limitations in previous conceptualizations of expectancy violations and improved the operationalization of the relevant concepts with a new measure (Afifi & Metts, 1998). In 1998, Afifi and Metts examined the conceptual framework of expectancy violation and

challenged the previous narrow conceptualization of violations as behaviors or events that are “highly negative, important and uncertainty-increasing” (p 367). They argued that violations differ in relational importance, unexpectedness, and valence on a day-to-day basis. In their definition, violation importance refers to how the violation will impact the relationship between two communicators. Violation expectedness, by contrast, indicates the extent to which the violation diverges from a predictable action (the degree to which it is unexpected). Violation valence deals with how much the violation is considered as positive (i.e., the degree to which it exceeds expectations) or negative (i.e., the degree to which it falls below expectations).

In Afifi and Metts’ research (1998), an expectation violation was defined as “a behavior that a receiver notices as different from the behavioral display that (s)he expected” (p. 367). Although these kinds of behaviors are theorized to “produce cognitive arousal” and “trigger an interpretation-evaluation sequence that helps individuals cope with unexpected outcomes” (p. 367), the cognitive arousal can be positive. Actually, most reported violations in this study were positively valenced (Afifi & Metts, 1998). Therefore, people may have positive feelings when perceiving longer latency in their siblings’ response messages, especially if they consider the latency to be beyond their expectations. The current study adopts Afifi and Metts’ definition of expectation violation and offers the following hypothesis and research question: When perceiving the manipulated delay in their sibling’s responses,

***H2:** Participants’ positive affect is positively related to violation valence. The more positively they evaluate the violations, the more positive feelings they have towards this violation.*

RQ1: *Are there associations between the positive affect experienced by participants and violation expectedness(a)/violation importance(b)?*

Using the scale from Afifi and Metts' research (1998), Bennett et al. (2020) found evidence that people who experienced expectation violations in others' response messages feel surprised, hurt, and angry. These negative emotions were negatively associated with violation expectedness and violation valence, and positively associated with violation importance (Bennett et al., 2020). When responses are received after the expected latency or when no response is received, the possibilities for misunderstanding and distrust increase and feelings of frustration and anxiety are aroused (Kalman & Rafaeli, 2011). Therefore, the following predictions are put forth: When perceiving the manipulated delay in their siblings' responses,

H3: *Participants' negative affect is positively related to violation importance. The more important they consider these violations in their relationship, the more negative feelings they have towards this violation.*

H4: *This negative affect experienced by participants is negatively associated with violation expectedness(a) and violation valence(b). The more unexpected and negative they evaluate the latency, the more negative feelings they have towards this violation.*

Afifi and Metts (1998) further found that participants reported a wide variety of violations when asked to report a most recent unexpected event in their current relationship, including both significant and mundane events. The researchers predicted that in stable and ongoing relationships, there may be empirical evidence that "relationships are constructed

of daily events and routine talk” (p. 369) instead of one-time major events. Based on this perspective, although violations in chronemic cues during online communication may not be interpreted as relationally significant events by all participants, the way the participants react to and interpret this event can be an important reflection of the quality of their sibling relationship. Previous text-based communication patterns (e.g., text frequency, usual response latency) may have an impact on how they interpret this chronemic violation in their inter-sibling interaction.

Although it is highly possible that people pay attention to chronemic cues in synchronous online chat due to the lack of other nonverbal cues, there is not enough evidence to support the claim that people place a great deal of value on chronemic cues. In Lew et al.’s (2018) research about online chat with customer support agency, the data failed to indicate that a faster response led to perceiving a responder as more attractive than a slower response, but suggested that contingency played a more important role. However, this scenario was based on a one-time interaction between two individuals without any previous interpersonal relationship. In an existing long-term relationship, emerging adult siblings are likely to have established some rules or routines for instant messaging. Individuals may have established expectations for how their sibling will interact with them in terms of chronemics and may be more likely to notice the chronemic violations when they happen. Presumably, if they have a closer relationship with their sibling, such expectations are easier to form with frequent online interaction. Therefore, the following predictions were made:

***H5:** Sibling warmth is negatively related to violation expectedness.*

***H6:** Sibling conflict(a) and sibling rivalry(b) are positively related to violation expectedness.*

Chapter 3: Method

PARTICIPANTS

Participants were recruited from a public southwestern university through the SONA system (i.e., an online research participation system which the school uses to manage extra credit research participation). Eventually, 147 completed questionnaires were collected, and 39 sibling dyads participated in the online chat.

The 147 effective questionnaires all came from undergraduate students at the university, aged from 18-23 ($M = 20.18$, $SD = 1.17$) including 30 (20.4%) males, 116 (78.9%) females, and 1 (0.7%) genderfluid individual. The ethnicity breakdown was: 79 White (53.7%), 9 Black or African American (6.1%), 1 American Indian or Alaska Native (0.7%), 28 Asian/Asian American (19.0%), 37 Hispanic/Latino(a) (25.2%), and 1 multiracial (0.7%). These participants all had at least one emerging adult sibling, and their closest-to-age adult siblings' age ranged from 18 to 25 ($M = 21.45$, $SD = 2.34$), including 60 males (40.8%), 86 females (58.5%), and 1 gender-fluid individual (0.7%). The 147 emerging adult sibling dyads included 127 biological siblings (1 with divorced parents), 11 twins, 2 step siblings, 3 half siblings, 2 involved one adopted sibling, and 2 unspecified.

For those who successfully finished the chat, 39 student participants were all undergraduate students from this university, aged from 18-22 ($M = 20.26$, $SD = 1.19$) including 10 (25.6%) males, 28 (71.8%) females, and 1 (2.6%) genderfluid individual. The ethnicity breakdown was: 23 White (59.0%), 1 American Indian or Alaska Native (2.6%), 9 Asian/Asian American (23.1%), 5 Hispanic/Latino/Latina (12.8%), and 1 mixed race or multiracial (2.6%). These participants all had at least one adult sibling, and their cooperating sibling's (thereafter, referred as "sibling participant") age ranged from 18 to 31 (Mean = 22.03, $SD = 3.25$). There were 15 male siblings, 23 female siblings, and 1 non-

binary sibling. The online chat included 17 opposite sex dyads, 21 same-sex dyads (17 female-female, 4 male-male), and 1 gender-fluid dyad. Among the 39 sibling dyads, 34 were biological siblings (1 with divorced parents) and 3 were twins. One dyad included an adoptive sibling (the other one is parents' biological child), and 1 dyad did not specify.

PROCEDURE

To examine the study's hypotheses and research question, two sets of data were collected. First, participants filled out an online questionnaire hosted by Qualtrics.com, a highly equipped, web-based survey, and research software. Participants were initially asked whether they had any siblings after consenting. If they clicked "No," they were redirected to the end of the survey. If they indicated that they had an adult sibling(s), they were prompted to think of their current sibling relationship with the closest-to-age sibling and finish a questionnaire about the CMC platform they most frequently used with their sibling, their sibling relationship, and both their own and their sibling's demographic information. Only the questionnaires from student participants in sibling dyads who were both emerging adults were included in the first section of this study.

After filling out the questionnaire, participants were given the opportunity to contribute to the second data set. More specifically, they were invited to complete another online survey on the same SONA system that required both the student participant and their sibling to join an online chatroom. The data were collected anonymously, so to match the siblings in the online chat, students were required to create a unique nickname for their sibling and share it with them. Once both students and their sibling agreed to participate in the online chat, the student participants started the second survey in the SONA system. In the chat section, as long as the student participants were emerging adults and they invited an adult sibling, their data were collected.

Online chat

After consenting, participants were provided a link specifically for their emerging adult sibling to join the online chat. When the sibling opened the link, they were given guidance that was different from the student participants. Both the participants and their siblings were asked to talk about choosing a gift for one of their family members. To create an expectation violation in chronemic cues, the participants' sibling was given separate instructions to wait for 40 seconds (refer to Lew et al.'s study in 2018) before sending out their response message. They were also told to keep silent when the student participants actively asked about the delay. After they finished the online chat, siblings answered a few questions about the equipment they used, whether they were able to finish the task, and whether the student participants asked relevant questions. Meanwhile, student participants were required to complete a questionnaire about their perceptions and feelings related to the online chat. The questionnaire consisted of six sections: (a) chat information, (b) reactions towards their siblings' response speed, (c) perceived expectation violation, (d) attributions, (e) their sibling's usual response latency, and (f) data validity check.

Experiment

Adopting a quasi-experimental design, this study required participants to engage in an online interaction with their sibling. Because the online chat system automatically matched the first two participants who entered in one room, there was a chance that siblings would not be matched. To solve this problem, the participants were asked to try to join the online chat session with their sibling at a similar time and to make up a unique nickname to identify their sibling. When they were not matched, a new link was provided to both of them in the survey.

As stated previously, this study required siblings to deliberately delay their response for 40 seconds in order to assess student participants' reactions towards an expectation violation in chronemic cues. The specific response delay was based on a previous study of response latency in customer service (Lew et al., 2018) that used a similar online synchronic chat program. Lew et al. (2018) conducted informal trials with actual customer support agents and decided to design two responses conditions. In the *quick responses* condition, the interval between the time when the customer finished typing (and hit the enter key to post the chat message) and when the agent's response showed up in the chat was 8 seconds. In the *slow responses* condition, this time was set as 40 seconds. In the trials, the researchers found customers often stopped paying attention or dropped out when response exceeded 40 seconds. These 8s and 40s conditions included the typing time of the customer support agents. In the current study, the typing time could not be controlled for the sibling or student participants, only the time each sibling waited before they sent out the message and after they finished typing was counted. In informal trials with some sibling dyads, participants reported perceiving a clear delay when their sibling was required to wait for 40 seconds. Although student participants subjectively may not have considered the "response time" (response latency) of their sibling as an expectation violation, they were more likely to perceive a difference when experiencing a longer waiting time in an online text-based chat room, which encouraged synchronic interaction. Therefore, the current study defined the siblings' response latency (including the manipulated latency) as an expectation violation as long as the student participants perceived the manipulated delay in their sibling's responses.

In cases when the participant asked about the delay, the sibling was instructed not to respond and to continue the conversation. After the chat was finished, the sibling was asked whether they followed the instructions and whether the participant asked about the

delay. The participant was asked whether they perceived the delay and how they interpreted it. At the end of the survey, the participant was informed of the manipulation and asked for their permission to use their chat data.

MEASURES

Perceived adult sibling relationship

Participants' perceptions of their adult sibling relationship were measured by Stocker et al.'s (1997) Adult Sibling Relationship Questionnaire (ASRQ). It is worth noting that only participants completed this measure (their sibling did not). The 81-item scale was designed to assess three dimensions within the adult sibling relationship – warmth, conflict, and rivalry (Stocker et al., 1997). This scale not only includes respondents' perception of their own behavior and feelings towards their sibling, but also covers respondents' perception of their sibling's behavior and feelings towards them. For the warmth and conflict dimensions, participants rated the degree to which they engage in warm interactions or conflictual interactions with their siblings. Examples of the sibling warmth subscale items include, "How much does this sibling think of you as a good friend?" and "How much does this sibling try to cheer you up when you are feeling down?" Examples of the sibling conflict subscale items include, "How much does this sibling irritate you?" and "How much does this sibling put you down?" All questions assessing warmth and conflict dimensions used a 5-step Likert-type scale, from 1 (*Hardly At All*) to 5 (*Extremely Much*).

For the rivalry dimension, participants rated how much they and their sibling differ in terms of maternal and paternal attention. Questions include, "Does this sibling think your mother is closer to him/her or you?" and "Do you think your father supports you or

this sibling more?” Although these questions were assessed with a 5-step Likert-type scale (e.g., 1 = *I am usually favored*; 2 = *I am sometimes favored*; 3 = *Neither of us is favored*; 4 = *This sibling is sometimes favored*; 5 = *This sibling is usually favored*), the rivalry scales were scored as the absolute value of deviations from the mid-point of the scale. Resulting scores for these scales range from 0-2 with 0 indicating absence of rivalry and a 2 indicating maximum rivalry.

The ASRQ measure has been reported to have high internal consistency coefficients and reliability coefficients in multiple studies (e.g., Marotta, 2015; Stocker et al., 1997). Stocker et al. reported 0.97, 0.93, and 0.88 as the internal consistency coefficients for the Warmth, Conflict, and Rivalry subscales and reported 0.95, 0.89, and 0.87 as two-week test-retest reliability coefficients. In Marotta’s study, Cronbach’s alphas were respectively, .98, .92, and .84 for the warmth, conflict, and rivalry subscales. Stocker et al. did not find a significant correlation between the warmth and rivalry subscales and the social desirability scale, or with the impression management scale. They found a weak but significant correlation between sibling conflict and the social desirability scale. The convergent validity of the ASRQ has been demonstrated by the significant agreement between subjects’ ASRQ responses and their siblings’ ASRQ responses. In the current study, Cronbach’s alphas for the warmth ($M = 161.71$, $SD = 36.84$), conflict ($M = 54.57$, $SD = 16.03$), and rivalry ($M = 9.33$, $SD = 6.21$) subscales for the 147 participants were .97, .93, and .89 respectively. Cronbach’s alphas for the warmth ($M = 172.09$, $SD = 32.50$), conflict ($M = 52.19$, $SD = 14.38$), and rivalry ($M = 9.03$, $SD = 6.60$) subscales for the 39 student participants in sibling dyads were .97, .92, and .91 respectively. For cases with missing data, the missing data were replaced by the average score of other items in the same subscale (e.g., quarreling, or similarity) under each dimension. In this study, such cases only had one or two missing data.

General communication patterns and geographic proximity

Several general communication items and a geographic proximity item from Stocker et al. (1997) were examined. Using 5-point Likert-type scales from 1 (*Hardly At All*) to 5 (*Extremely Much*), participants rated how often they saw their sibling, got together with their sibling on special occasions, telephoned their sibling, and were telephoned by their sibling. These items formed an internally consistent scale ($\alpha = .78$) that showed high test-retest reliability over a 2-week period ($r = .85$) (Stocker et al., 1997). Siblings' geographic proximity was assessed by asking participants to indicate how many miles they lived from their sibling (*1 = same city; 2 = different city, less than 100 miles; 3 = more than 100 miles; 4 = more than 200 miles; 5 = more than 500 miles; 6 = more than 1,000 miles*). Of the 147 participants, 45 lived in the same city with their siblings and 102 lived in a different city (24 less than 100 miles, 32 more than 100 miles, 17 more than 200 miles, 15 more than 500 miles, and 14 more than 1000 miles). For the purpose of this study, each item was measured and analyzed separately. In other words, the measure was categorical. A 7-point Likert-type scale measuring for text frequency from LeBouef's (2018) study also was included. Responses to this item ranged from 1 (*Never*) to 7 (*Several times a day*). The mean for the 147 participants' self-text frequency (to their sibling) and sibling-text frequency (to the participant) were 4.42 ($SD = 1.49$) and 4.37 ($SD = 1.53$), meaning that they texted each other between once a week and a couple times a week.

Expectation violation in Chronemic cues

Expectation violation in chronemic cues was measured by Afifi and Metts' (1998) expectation violation scale. This 7-point semantical differential scale assesses three aspects of participants' perceived expectancy violations: 3 items measure violation expectedness

(e.g., “my sibling’s response time was completely expected” and “not at all expected”), 5 items measure violation valence (e.g., “my sibling’s response time made me feel a lot better” and “a lot worse about the state of our relationship”), and 2 items measure violation importance (e.g., “my sibling’s response time was a very important” and “very unimportant relationship event”). Higher scores indicate greater expectedness/lower unexpectedness (7 = “completely expected” or “only very slightly unexpected”), positive valence, and more importance. Previous research has demonstrated the reliability of this measure. The Cronbach reliability coefficients for Afifi and Metts’ (1988) study for violation expectedness was .71, violation valence was .94, violation importance was .79. Bennett et al. (2020) also reported the Cronbach’s alphas were respectively, .88, .95, and .84 for the expectedness, valence, and importance subscales. In the current study, the Cronbach’s alphas for expectedness ($M = 4.90$, $SD = 1.92$), importance ($M = 3.40$, $SD = 1.69$), and valence ($M = 4.46$, $SD = 1.58$) among the 39 student participants in sibling dyads were .81, .80, and .94.

Feelings towards the Violation

Participants’ feelings towards their sibling’s response time were measured using the 20-item positive and negative mood scale from the Positive and Negative Affect Scale (PANAS) (Watson et al., 1988). The PANAS scale measured the intensity of both positive and negative feelings participants perceived after the online chat with their sibling, using a 5-point Likert-type scale, ranging from 1 (*very slightly or not at all*) to 5 (*very much*). Previous research has shown satisfactory psychometric properties of this measure. Among the 39 student participants in sibling dyads, the Cronbach’s alpha was .90 for Positive

Affect ($M = 26.10$, $SD = 9.42$) and .90 for Negative Affect ($M = 16.49$, $SD = 7.74$). No missing data were found in this measure.

Attributions

To differentiate the influence of communicators' characteristics from context characteristics, a 3-item attribution measure from Afifi and Metts' (1998) study was adopted. The items were rated by participants on a 7-point Likert-type scale. Higher scores indicate that participants attributed the violation more to their sibling's characteristics (e.g., "was very typical of his/her personality," "very typical of how he/she acts in our relationship") and lower scores reflect that participants attributed this violation more to contextual characteristics (e.g., "completely due to the situation"). In Afifi and Metts' (1998) study, the Cronbach's alpha was .77. The Cronbach's alpha for this measure ($M = 4.16$, $SD = 1.50$) among 39 student participants in sibling dyads was .72.

Chapter 4: Results

PRELIMINARY ANALYSES

Perceived Sibling Relationships and General Communication Patterns

Using the data provided by student participants in the first portion of the present study, Pearson correlations among the three dimensions of sibling relationships for the 147 emerging adult sibling dyads were conducted (as presented in Table 1). There was a significant negative association between sibling warmth and sibling rivalry ($r(147) = -.34$, $p < 0.01$). However, sibling warmth was not significantly associated with sibling conflict ($p = 0.71$), and sibling conflict was not significantly related to sibling rivalry ($p = 0.35$). For the 39 participants who were the focus of the study's analyses, a similar correlation between warmth and rivalry was found ($r(39) = -.32$, $p < 0.05$). Sibling conflict and sibling rivalry were positively correlated ($r(39) = .41$, $p = 0.01$).

	1	2	3
1. Warmth	1	-.03	-.34**
2. Conflict		1	.08
3. Rivalry			1

** $p < .01$

Table 1: Pearson Correlations Between Three dimensions of Sibling Relationships – General Group (N=147)

To test whether general inter-sibling communication patterns are related to perceived sibling relationships, zero-order bi-directional Spearman correlations (2-tailed) between all forms of communication and the three dimensions of sibling relationships, as well as geographic distance (see Table 2), were conducted. H1 was supported by the data:

Sibling warmth was positively related to both siblings' text and phone frequency, physical contact, and family gathering, while conflict was not positively related to any forms of sibling contact. Meanwhile, sibling rivalry was negatively associated with both siblings' phone frequency, text frequency, and physical contact, but not related to family gathering ($p = 0.59$). Geographic distance was negatively associated with physical contact and family gathering, but positively related to sibling conflict.

	Warmth	Conflict	Rivalry	Geographic Distance
Geographic Distance	-0.10	.22**	0.06	1
Self Text	.63**	0.08	-.21**	-0.14
Sibling Text	.62**	0.06	-.20*	-0.16
Physical Contact	.42**	-0.11	-.25**	-.45**
Family Gathering	.29**	-0.06	-0.04	-.20*
Self Phone	.72**	0.09	-.32**	-0.05
Sibling Phone	.68**	0.08	-.26**	-0.07

Geographic Distance: How far this sibling lives from participant

Self Text: How frequently participant texts this sibling

Sibling Text: How frequently this sibling texts participant

Physical Contact: How much participant and this sibling sees each other

Family Gathering: How much participant and this sibling sees each other for holidays and family gatherings

Self Phone: How much participant phones this sibling

Sibling Phone: How much participant phones this sibling

** $p < .05$. * $p < .01$

Table 2: Spearman Correlations Between Three dimensions of Sibling Relationships – General Group (N=147)

Perceived Sibling Relationships and Sibling Online Interaction

Among the 39 sibling dyads who finished the online chat, only 26 out of the 39 student participants reported that they noticed the delay during the chat. Considering that all sibling participants followed the instructions to make the 40s delay, the results are presented in terms of the chat group (N=39) and the noticed group (N=26) based on the specific hypothesis and research questions.

Pearson correlations

Before testing the hypotheses and research questions, bi-directional Pearson correlations (2-tailed) were conducted between all of the main variables using SPSS.

	PA	NA	Warmth	Conflict	Rivalry	Expectedness	Importance	Valence
PA ^a	1	-.16	-.09	.04	.14	.20	.53**	.57**
NA ^b		1	.01	.28	.12	-.61**	.02	-.58**
Warmth			1	-.030	-.32*	-.37*	.18	-.31
Conflict				1	.41*	.06	-.10	.10
Rivalry					1	.18	-.04	.17
Expectedness						1	-.16	.75**
Importance							1	.22
Valence								1

^aPA = Positive affect

^bNA = Negative affect

** $p < .05$. * $p < .01$

Table 3: Pearson Correlations Between Variables – Chat Group (N=39)

Table 3 includes all of the student participants' data (N = 39) from sibling dyads who participated in the chat. The correlations in Table 4 only include the student participants (N = 26) who noticed the delay in their sibling's response. In comparing the two tables, some correlations were slightly stronger when the entire chat group was used than when only the noticed group was used.

	PA	NA	Warmth	Conflict	Rivalry	Expectedness	Importance	Valence
PA ^a	1	-.26	-.10	.03	.25	.15	.43*	.54**
NA ^b		1	.07	.33	.13	-.63**	.03	-.63**
Warmth			1	-.20	-.30	-.48*	.28	-.35
Conflict				1	.45*	.02	-.05	.12
Rivalry					1	.22	-.02	.24
Expectedness						1	-.29	.72**
Importance							1	.06
Valence								1

^aPA = Positive affect

^bNA = Negative affect

** $p < .05$. *** $p < .01$

Table 4: Pearson Correlations Between Variables – Noticed Group (N=26)

Mean differences

At the end of the survey, participants were notified that their sibling was required to delay their response for 40 seconds each time and asked whether they noticed the delay. The data of those who noticed the delay and those who did not were compared. As evidenced in Table 5, there was a significant difference in their negative feelings ($p < 0.01$).

Those who noticed the delay reported more negative feelings ($M = 18.65$) than those who did not ($M = 12.15$).

Using one-sample t -tests to compare data from the noticed group to a neutral response of 4, the sibling's response latency was considered moderate expectedness ($M = 4.58$, $t(25) = 1.44$, $SE = .40$, $p = .16$), slightly less than moderate in importance ($M = 3.27$, $t(25) = -2.19$, $SE = .33$, $p = .04$), and neutral valence ($M = 4.19$, $t(25) = .61$, $SE = .31$, $p = .55$). Comparing with a neutral response of 4, those who did not notice the delay considered their sibling's response latency as more than expected moderately ($M = 5.54$, $t(12) = 1.44$, $SE = .42$, $p < .01$), moderately important ($M = 3.65$, $t(12) = -.73$, $SE = .47$, $p = .48$), and positively valenced ($M = 5.00$, $t(12) = 2.50$, $SE = .40$, $p = .03$).

Scale	Noticed	Unnoticed	p
Warmth	171.02 (33.26)	174.23 (32.14)	.78
Conflict	53.60 (15.09)	49.38 (12.96)	.40
Rivalry	9.08 (6.79)	8.92 (6.45)	.95
PA ^a	26.88 (8.82)	24.54 (10.71)	.47
NA ^b	18.65 (8.40)	12.15 (3.44)	< .001
Expectedness	4.58 (2.04)	5.54 (1.52)	.14
Importance	3.27 (1.70)	3.65 (3.65)	.51
Valence	4.19 (1.60)	5.00 (1.44)	.13
Attributions	3.85 (1.57)	4.79 (1.17)	.06

^a PA = Positive Affect

^b NA = Negative Affect

Note. Standard deviations are presented in parentheses.

Table 5: Mean difference between two groups (Noticed the delay or not)

Two one-sample *t*-tests were conducted comparing the mean score of the measure of attribution and a neutral response of 4. The results indicated that attribution was neutral (middle point between contextual characteristics and communicator characteristics) in the noticed group ($M = 3.85$, $t(25) = -.50$, $SE = .31$, $p = .62$), and slightly higher (leaning towards sibling characteristics) for those who did not perceive the delay ($M = 4.79$, $t(12) = 2.44$, $SE = .33$, $p = .03$).

Contextual analysis

The text in the chat records of all sibling dyads in the chat group also were analyzed and some general conversational patterns were found for those who did not notice the delay. Among the 13 dyads, 5 sibling participants edited very long messages to respond and 7 student participants kept sending multiple messages when their sibling did not respond. 1 student participant actually asked “hello?” during the conversation but still chose “not noticed the delay,” which may be relevant to the final message from her sibling participant - “I have a meeting soon, I will call you later.”

MAIN ANALYSES

Testing hypotheses and research question

To test the hypotheses and research question put forward in the current study, only data from participants who perceived the delay in their siblings’ responses ($N = 26$) were analyzed.

The first hypothesis was that when perceiving the manipulated delay in their sibling’s responses, people’s positive feelings towards the violation would be positively

related to violation valence. This hypothesis was supported by a significant Pearson correlation ($r = .54, p < 0.01$) in the noticed group. A paired sample t -test between participants' positive affect and negative affect also was conducted. The results indicated a significant difference ($t(25) = 3.07, p < 0.01$), such that participants had more positive feelings ($M = 26.88, SE = 1.73$) than negative feelings ($M = 18.65, SE = 1.65$) towards their siblings' response latency (or the violation).

Positive affect is positively related to violation valence ($r = .54, p < 0.01$), so H2 was supported. In addition, there was a positive correlation between positive affect and violation importance ($r = .43, p = 0.03$). This finding provided a response to RQ1(b): The more important participants perceived the violation was to their relationship, the more positive affect they experienced (b). In response to RQ1(a), there was no significant correlation between positive affect and expectedness ($p = 0.46$).

To test whether people's negative feelings were associated with violation importance (H3), expectedness, and valence (H4), Pearson correlations again were conducted for the noticed group. As seen in Table 4, the correlation between negative affect and violation importance was not significant ($r = .03, p = 0.16$). Both violation expectedness ($r = -.63, p < 0.01$) and valence ($r = -.63, p < 0.01$) were negatively correlated with negative affect, which means the more unexpected and negative participants evaluated the response latency, the more negative feelings they perceived. Therefore, H3 was not supported, and H4 was supported.

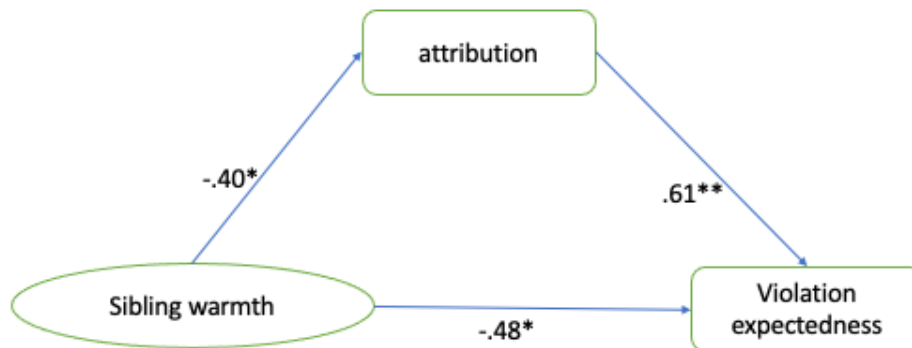
The purpose of H5 and H6 was to see whether sibling warmth, sibling conflict, and sibling rivalry were related to violation expectedness. Pearson correlations showed a significant negative correlation between sibling warmth and violation expectedness ($r = -.48, p = 0.01$), but not between sibling conflict ($r = .02, p = 0.94$) or sibling rivalry ($r = .22, p = 0.28$) and violation expectedness. That is to say, H5 was supported, but H6(a) and

H6(b) were not. The more warmth participants perceived in their sibling relationships, the more they perceived their sibling's response latency as unexpected.

POST-HOC ANALYSES

Several post-hoc analyses were conducted to further explore the data. To better understand the role of attributions in the outcomes of inter-sibling chats, a mediation model was tested. Considering the influence of previous text-based communication patterns on the main variables, some analyses involving text frequency and the sibling's usual response latency were conducted.

Mediation effect of Attributions



* $p < .05$. ** $p < .01$.

Figure 1: Standardized Regression Coefficients for the Relationship Between Sibling Warmth and Violation Expectedness as Mediated by Attribution

After examining the correlations between attributions and the main variables, the present study proposed a potential simple mediation model, such that sibling warmth (X)

leads to a decrease in violation expectedness (Y) as a result of the attributions (M) such warmth creates, which in turns leads to a decrease in violation expectedness. More specifically, sibling warmth results in less attribution to the sibling and more attribution to the context, and the more such attributions exist, the less individuals expect the violation. Attributions were hypothesized as a mediator of the effect of sibling warmth on violation expectedness.

The simple mediation model was tested using bootstrapping procedures - PROCESS (Hayes, 2018; Preacher & Hayes, 2009). Unstandardized indirect effects were calculated for each of 10,000 bootstrapped samples, and the 95% confidence interval was computed by determining the indirect effects at the 2.5th and 97.5th percentiles. The proposed mediator, attribution (M), was regressed on sibling warmth (X) to produce *a*, and violation expectedness (Y) was regressed on both attribution (M) and sibling warmth (X), which yields *b* and *c'*, respectively.

		Consequent						
		M (Attribution)			Y (Violation Expectedness)			
Antecedent		Coeff.	SE	<i>p</i>		Coeff.	SE	<i>p</i>
X (Sibling Warmth)	<i>a</i>	-.02	.01	.04	<i>c'</i>	-.02	.01	.11
M (Attribution)		---	---	---	<i>b</i>	.64	.22	.01
constant	<i>i_M</i>	7.09	1.53	.00	<i>i_Y</i>	5.06	2.29	.04
$R^2 = 0.162$				$R^2 = 0.440$				
$F(1, 24) = 4.63, p = .04$				$F(2, 23) = 9.03, p < .01$				

Table 6: Model Coefficients

PROCESS output was summarized in Table 6. As can be seen, $a = -0.02$, $b = 0.64$, and $c = -0.02$. In the form of two OLS regression models,

$$M = 7.09 - 0.02X$$

$$Y = 5.06 - 0.02X + 0.64M$$

Multiplying a and b yields the indirect effect, $ab = -0.02(0.64) = -0.01$. Therefore, sibling warmth was related to attributions, which was linked with violation expectedness. Those with relatively more sibling warmth to attribute less to their sibling, which in turn translated into less violation expectedness. This indirect effect was significant, as the confidence interval did not include zero (-.027 to -.001).

The direct effect of sibling warmth, $c' = -0.02$, was the estimated difference in reported violation expectedness between two participants having the same attribution tendency but who differed by one unit in their reported sibling warmth. The coefficient was negative, meaning that the person feeling more sibling warmth but who had the same attribution was estimated to be 0.02 units lower in his or her reported violation expectedness. However, based on the PROCESS output, this direct effect was not significant, $t(23) = -1.66$, $p = .11$, with a 95% confidence interval from -0.039 to 0.004 .

The total effect of sibling warmth on violation expectedness was derived by summing the direct and indirect effects, or by regressing withdrawal intentions on economic stress by itself: $c = c' + ab = -0.02 - 0.01 = -0.03$. Two people who differ by one unit in sibling warmth were estimated to differ by 0.03 units in their reported violation expectedness. The negative sign means the person with greater sibling warmth reported lower violation expectedness. This effect was statistically different from zero, $t(24) = -2.70$, $p = .01$, or between -0.052 and -0.007 with 95% confidence.

In summary, the results supported that the relationship between sibling warmth and violation expectedness was mediated by attribution.

Influence of Previous Text-based Communication Patterns

Text frequency

In the noticed group, there also were correlations between general communication patterns and the three dimensions of sibling relationships. The associations between sibling warmth and both siblings' text frequency were significant (students': $r = .63$, $p < 0.01$; siblings': $r = .60$, $p < 0.01$). Considering the same text-mediated communication environment, the current study explored how these text frequencies were related to violation expectedness, violation importance, and violation valence during this inter-sibling interaction reported by participants.

		Expectedness	Importance	Valence
Self Text	Coefficient	-0.22	0.23	-.39*
	Sig. (2-tailed)	0.28	0.26	0.05
Sibling Text	Coefficient	-0.21	0.12	-.43*
	Sig. (2-tailed)	0.32	0.56	0.03

Table 7: Spearman Correlations between three aspects of Expectation Violation and Text frequency

As seen in Table 7, there were significant correlations between both siblings' text-frequency and violation valence. The more they texted each other, the less positively they perceived the violation. A paired sample t-test was conducted between students' text frequency to their siblings ($M = 4.58$, $SE = .30$) and their siblings' text frequency to the students ($M = 4.54$, $SE = .30$). No significant difference was found ($t(25) = .440$, $p = 0.67$), so the frequency (reported by the participants) the siblings texted each other was similar.

Usual response latency

To better understand the participants' evaluation of response latency, additional post-hoc analyses were conducted. First, among the 26 student participants who noticed the 40s delay, only 12 (46.2%) considered their sibling's response time during this chat as longer than their usual response time, with 11 (42.3%) considering it to be similar and 3 (11.5%) reporting it to be "shorter."

The siblings' usual response time as reported by the student participants also was examined. For those who felt the response time was "longer," 11 (91.7%) reported that their siblings usually respond immediately ($n = 5$) or within 5 minutes ($n = 6$). Only one (8.3%) chose "10 to less than 15 minutes." For those who felt the response time was "similar," 6 (54.5%) reported that their siblings usually respond immediately ($n = 3$) or within 5 minutes ($n = 3$). Four (36.4%) reported time ranges from 5 minutes to 1 hour and 1 (9.1%) reported that the response time "depends on the time of day." For the 3 participants who felt the response time was "shorter," 2 reported that their siblings usually respond between 5 and 10 minutes and 1 chose "about 3 or 4 hours."

Finally, a one-way ANOVA was calculated to test if there were significant differences in participants' feelings (negative affect and positive affect) among these three groups ("shorter," "similar," and "longer"). The results showed that negative affect varied by how they perceived the response latency ($F(2, 23) = 3.81, p = 0.04, \eta^2 = 0.25$). Post-hoc tests with a Bonferroni correction showed that people who chose "longer than usual" had significantly more negative feelings ($M = 23.08, SE = 2.19$) than those who reported "similar to usual" ($M = 14.64, SE = 2.29$). There was no significant difference in negative affect between the "shorter" group ($M = 15.67, SE = 4.38$) and the other two groups. Positive affect did not vary by how participants perceived the response latency ($F(2, 23) = .14, p = 0.87, \eta^2 = 0.01$).

Chapter 5: Discussion

The current study was conducted to examine siblings' general communication patterns and to observe their text-based interactions. First, the quality of sibling relationships and their general communication patterns were explored. The data indicated that frequency of text, phone, and physical contact was positively related to sibling warmth and negatively associated with sibling rivalry. Then several hypotheses developed from Expectancy Violation Theory and Social Information Processing Theory were tested. Results from an inter-sibling chat showed that participants' perception of violation importance and valence were positively related to positive affect towards their sibling's response latency while violation expectedness and valence were negatively related to negative affect towards their sibling's response latency. Perhaps most importantly, sibling warmth was found to be negatively related to violation expectedness. Post-hoc analyses indicated that attributions mediated the correlation between sibling warmth and violation expectedness, and text frequency was positively related to sibling warmth and negatively associated with violation valence.

This study contributes to the literature on sibling relationships and inter-sibling communication in two important ways. First, it extends our knowledge about sibling relationships over the life span by examining the qualities of sibling relationships and communication during emerging adulthood. Second, it also incorporates the use of text-messaging into general communication patterns between emerging adult siblings. Not only does this study analyze the correlations between different forms of communication and sibling relationships, it also examines siblings' communication during a specific inter-sibling interaction in terms of chronemics using the framework of Expectancy Violation Theory.

INTER-SIBLING COMMUNICATION PATTERNS DURING EMERGING ADULTHOOD

In examining the correlation between three dimensions of sibling relationships (warmth, conflict, and rivalry) and various forms of communication, findings indicated that the frequency of siblings' text, phone, and physical contact was positively related to sibling warmth, but negatively associated with sibling rivalry (see Table 2). The strength of the correlation between physical contact and sibling warmth was moderate ($r = .42$) while the strengths for text and phone (both how frequently the sibling contacted the participant and how frequently the participant contacted the sibling) were relatively strong with coefficients greater than 0.5. Text-based communication is extensively used by emerging adults to keep in touch with their siblings (Battestini et al., 2010; Corti, 2009; Johnson & Corti, 2008; Lindell et al., 2015) and in the current study, their texting frequency was strongly associated with the quality of their sibling relationships. The more warmth emerging adults felt in their sibling relationship, the more they texted each other. The more rivalry emerging adults perceived in their sibling relationship, the less they texted each other. Meanwhile, participants who reported higher warmth in their sibling relationships not only used several communication channels (text, phone, physical contact) to contact their siblings more frequently, but also perceived more frequent texts and phone calls from their siblings. This evidence indicates the reciprocal nature of siblings' communication strategies when they have a warm relationship – a finding that also is reflected in siblings' use of relational maintenance behaviors (Myers & Odenweller, 2015). In other words, feeling good about a sibling is a rewarding experience (Bedford, 1995), and it brings more inter-sibling connections.

Although previous studies (Lee et al., 1990; Stocker et al., 1997) have already supported this positive correlation between sibling warmth and general sibling communication, the current study highlights the importance of incorporating text-based

communication and of examining siblings' contact in relatively specific ways. Lee et al. (1990) argued that although there is evidence that siblings' contact was associated with their closeness, some siblings with high levels of conflict or rivalry may still maintain contact out of obligation. After separating family gatherings from other types of communication, the results of the present study partially supported this claim. There were positive associations between most forms of sibling contact (text/phone/physical contact/family gathering) frequency and warmth in sibling relationships, but there were no significant correlations between any of the forms of sibling contact and the conflict in sibling relationships. However, different from previous studies, some weak negative associations were found between sibling rivalry and text, phone calls, and physical contact, mostly with low effect sizes ($r < 0.3$).

It is also worth noting that there were no significant correlations between family gathering frequency and conflict or rivalry in sibling relationships, meaning that the frequency of attending family gatherings remained relatively stable for siblings, no matter how negative their relationships were. This finding supports the validity of the obligatory contact motivation mentioned in previous studies (Allan, 1977; Lee et al., 1990; Stocker et al., 1997): That is, "limited but enduring involvement" (Allan, 1977, p. 182) is required in the normative expectations of the "ascribed" sibling relationships (Cicirelli, 1995b, p. 2). The finding also helps explain why a similar correlation between sibling rivalry and sibling contact was not found in previous studies, as family gatherings are likely considered an important component of siblings' obligation to their family.

More clues about this obligatory motivation in sibling communication were revealed when geographic distance was examined. Although positively related to sibling conflict, geographic distance was negatively associated with physical contact and family gatherings. These results suggest that inter-sibling communication via text or phone was

not encouraged by the geographic proximity, but physical contact was. One potential explanation is that living close may make people feel obligated to have more physical contact (including family gatherings) than they might prefer (Adams, 1968), so those who are in high conflict with their siblings may tend to live far apart to avoid such contact. Further, with the development of new technologies like social media and instant messaging, emerging adults have more autonomy to decide on when, how, and with whom they can communicate. Especially during a period with lots of changes and transitions, they can easily avoid sibling communication (e.g., ignoring a text or missing a call) without further consequences, or reach out to intimate siblings any time via text. For non-obligatory sibling communication (communication other than family gatherings and physical contact), the argument that geographic proximity does not guarantee contact (Lee et al., 1990), still holds true in the current study.

Although the present study examines the associations between the quality of sibling relationships and general communication patterns during emerging adulthood, future research should further explore how family structures may influence these patterns. For example, Stocker et al. (1997) found that the number of children in the family was negatively associated with sibling warmth (Stocker et al., 1997). It is possible that siblings from a bigger family are less likely to text each other frequently and less likely to notice the delay in their sibling responses than those from a smaller family.

CHRONEMIC EXPECTATION VIOLATION IN SIBLING INTERACTION

In addition to examining sibling relationships and communication, the present study also explored a specific sibling online interaction. Participants' actual reactions and evaluations of their sibling's chronemic expectation violations were observed. Overall, the

results were aligned with previous studies of Expectancy Violation Theory (Afifi & Metts, 1998; Bennett et al., 2020). There was evidence from the siblings' online interactions that chronemic expectation violations had significant communicative impact. For those who noticed the 40s delay, violation importance and valence were positively related to positive affect towards sibling's response latency while violation expectedness and valence were negatively related to negative affect towards sibling's response latency (H4). Those who did not notice the delay had relatively less negative feelings towards their sibling's response latency than did those who noticed. In other words, the more important and positive the participants perceived the violations, the more positive feelings they felt towards their sibling's response latency. There also was a positive correlation between violation expectedness and violation valence. It is possible that the more unexpected people perceive a chronemic expectation violation, the more negatively they evaluate it, regardless of whether it is faster or slower than they expected.

These results about negative emotional reactions were in accordance with Bennett et al. (2020)'s findings about expectancy violations in people's response messages. In other words, negative feelings related to expectancy violations can happen not only in the content of the text messages, but also in terms of the timing of the messages. When participants interpreted the violations as unexpected and negative, they tended to have more negative feelings about their sibling's response latency. However, different from Bennett et al.'s (2020) study, there was not a significant correlation between negative feelings and violation importance (H3). Although people noticed the delay in their sibling's response, they still considered their sibling's response latency as moderately expected and neutrally valenced. They also saw it as slightly less than moderately important. Also, it is worth acknowledging that the overall low average negative affect and the relatively small sample size may create barriers to observing this relationship.

More importantly, empirical evidence was found for the connection between people's chronemic expectations about their sibling's communication behaviors and relational characteristics. Sibling warmth was negatively associated with violation expectedness (H5), meaning that those who have more warmth in their sibling relationships, tend to find the violation more unexpected. The post-hoc analysis of attributions as a possible mediator provides a potential explanation for this finding: The more participants attributed the delay to their sibling, the more they expected the violation. However, the more warmth they shared with their sibling, the less they made internal attributions of the delay to their siblings (rather, they made more external attributions). Instead, they tended to perceive the violation as "uncharacteristic of the individual's character" (Afifi & Metts, 1998, p. 387), and more likely due to contextual characteristics (e.g., "due to the situation"). In other words, those with more sibling warmth were less willing to see the delay as part of their sibling's true characteristics and perhaps as a consequence, experienced lower expectedness of such events. Aligned with previous studies (Afifi & Metts, 1998, p. 387), the current study indicates that people may tend to perceive positive behaviors in relationships as reflective of the individual's "true characteristics" (p. 387), and exclude the negative violations as such clues.

Although there were no significant correlations between the three aspects of perceived expectation violations and sibling conflict or rivalry, the post-hoc analyses suggested that conflict may have some influence on how siblings feel about expectation violations. After controlling for violation expectedness or violation valence in the noticed group, there was a correlation between sibling conflict and participants' negative affect. There are two potential explanations for this finding: First, it may be that sibling conflict has such a strong emotional impact that it directly interferes with how people feel about their sibling's response latency no matter how they perceived the expectation violation.

This direct correlation between sibling conflict and negative affect was not significant because of the relatively large standard error related to the small sample size ($N = 26$). After adding the control variable(s), the standard error decreased, so the correlation became significant. Second, it could be that sibling conflict has a moderating effect on the negative correlation between two aspects of perceived expectation violation (expectedness, valence) and negative affect. When people perceive the exact same violation, those who have more conflict in their sibling relationships may tend to feel more negative about their siblings' response latency. Regrettably, given the small sample size, the current study was not able to verify either of these explanations. The data also indicated a potential moderating effect of rivalry on the correlation between violation valence and positive affect. Sibling rivalry changed the direction of this correlation among those who noticed the delay and thought their siblings' response latency was "longer than usual" ($N = 12$), such that those who reported high rivalry tended to feel more positive when they viewed the violation as more positively valenced while those who had low rivalry tended to feel more positive when they viewed the violation as more negatively valenced (see Appendix). Although substantial conclusions cannot be drawn due to the small size of this group, current data indicate a potential moderation effect related to rivalry and conflict that should be further explored in the future.

Another contribution of this study is that it provides an illustration of how previous communication patterns (e.g., text frequency, usual response latency) influence specific inter-sibling interactions. As a long-term communication characteristic, text frequency was not only related to sibling warmth, but also to participants' evaluation of chronic expectation violation valence. The more warmth participants perceived in their sibling relationship, the more frequently they texted their sibling. And the more frequently participants texted their sibling (or they texted each other), the more negatively they

perceived their siblings' chronemic violation. For those who have more warmth in their sibling relationships, texting may become part of their "daily event and routine talk" (Afifi & Metts, 1998, p. 369). Siblings who interact with each other more are more likely to establish some regularities like the rules and norms for subtextual interaction (e.g., how soon they will receive a response from each other). Participants in the noticed group were required to compare their sibling's response latency during this interaction with their sibling's usual response latency. Although these participants all perceived the 40s delay, only about half of them (12 out of 26) perceived that their siblings' response latency was "longer than usual." This finding provides further evidence for the existence of such regularities. Also, people who chose "longer than usual" had significantly more negative feelings towards their sibling's response latency than did those who reported "similar to usual" ($M = 14.64$, $SE = 2.29$) when positive affect did not vary among the three groups. No significant difference in negative affect was found between the "shorter" group ($M = 15.67$, $SE = 4.38$) and the other two groups. However, considering the small number of participants in this group ($n = 3$), this may be a statistical error.

Finally, and perhaps most importantly, the present study advances knowledge concerning online interaction between emerging adults and provides experimental evidence in support of Social Information Processing theory. Not only do people rely on verbal, linguistic, textual cues and chronemic cues (Walther & Tidwell, 1995) to perform relational functions in text-based communication, they also interpret the violation of some cues differently based on their attributions about their sibling's use of other cues. People may actively rationalize their sibling's chronemic violations through the attribution process. In the current study, those who noticed the delay and who reported higher sibling warmth tended to attribute the delay to contextual characteristics instead of their sibling's characteristics. A close inspection of the data yielded another possibility: One student

participant's "ignorance" of her sibling's obvious delay seemed to have been related to a contextual clue provided by her sibling ("have a meeting soon"). Although her text indicated she noticed the delay ("hello?") at one moment, she did not choose the "noticed the delay" option following the whole interaction.

When exchanging text messages, people may also keep adjusting their communication strategies not only to compensate for the lack of nonverbal cues, but also to reciprocate their partner's moves. When participants did not notice the delay, the sibling dyads sometimes engaged in interaction patterns including long messages from their sibling and multiple messages sent by the student participants. Such patterns could be a representation of their normal conversational habits, or an indicator of a dynamic adjustment process. It is possible that siblings intentionally adjusted the length of their message to compensate for the long silence. Also, student participants may unconsciously act as communication "helpers" by asking more questions to cover for the silence. Similar "helpers" exist in the intensifying stage of relationship development: One's partner increasingly acts as a helper in the daily process of understanding what the other is all about (Knapp & Vangelisti, 2005, p. 156), engaging in behaviors such as finishing the other's sentences. As Walther (1992) points out, failure to reciprocate one's partner's expressions of these moves in CMC over time may signal a less affiliative relationship (p. 77). In the current study, sibling participants in the noticed group made comments that seem to back up this argument. For instance, one noted that her sibling "asked a few times (about the delay), but once we kept talking, she eventually stopped asking and then ultimately didn't respond to my last response." Another said that her "older sister is a little impatient and the oldest, so she's hard-driven and doesn't like to waste time doing anything. She double texted a lot and that was scary." The interchangeability of nonverbal cues and verbal messages

(Walther, 1992, p. 77) may become even more complicated with the reciprocal nature of both communication and personal relationship in inter-sibling communication.

Although real-time response latency is not a content-specific variable like verbal context or language immediacy, it still generates meaning through the “interrelationships” of message exchange (Lew et al., 2018, p. 214). In the present study, the meaning was influenced by the existing sibling relationship and previous communication patterns. Those who had more warmth in their relationships tended to view their sibling’s delay as more unexpected. As their text frequency increased, they viewed their sibling’s delay as more negatively valenced. For those who noticed the delay, their negative feelings about the delay were relevant to their sibling’s usual response latency.

LIMITATIONS AND FUTURE WORK

One limitation of this research is the use of a relatively small sample for the analysis of the inter-sibling online interaction. Although more than 200 students indicated their intent to join the online chat section, only 39 eligible dyads successfully finished the chat and followed all the instructions. There was some variance in the main variables among these 39 dyads and some theoretical implications based on the current data, however, there were not enough participants in each sub-group to achieve sufficient power in the analyses. This made some post-hoc tests untenable, including tests involving the moderating effect of some relational variables. The way personal relationships and chronemic violations interact with each other and their associations with emotional outcomes, provides directions for future studies exploring the micro level of online interactions and relational variables.

Another limitation of this research involves the procedures. More specifically, reactions from sibling dyads were accessed and their response latency in the online interactions was manipulated. Although this approach made it possible to collect data from actual interactions and observe the associations between the quality of sibling relationships and communication patterns that influenced these interactions, some experimental control was sacrificed. For example, although all the sibling participants made the 40s delay, student participants' perception of the 40s delay may have been related to their siblings' usual response latency or other communication habits (e.g., the tendency to send long messages). While it involved a common inter-sibling communication scenario, the current dataset may include substantial variance in both personal relationships and communication, making it difficult to identify all the variables that may have influenced our manipulation. Also, peoples' exact expectation for their sibling's response latency was not fully estimated or measured, and it may have been influenced by their sibling's usual response latency or the experimental setting (one student participant commented that "the response time was probably very quick because this is a study.") If participants' expectations were assessed after the interaction, the assessment may not have reflected participants' actual expectation directly at the time they experienced the manipulated delay. If their expectations were measured in advance, this probably would interfere participants' subsequent communication behaviors. Further, although the 40s delay in siblings' responses was created to increase the likelihood that participants would perceive an expectation violation, it did not guarantee a violation. In the most extreme scenario, those who expected their siblings to respond exactly 40s later than their sibling's actual response time may not have perceived a violation at all. In addition, even though the sibling participants were required to delay their response by 40s (and not to change their answer while counting), and even though they were provided with a common discussion task to recreate their typical

conversation, the 40s delay still caused difficulties for some of the participants in maintaining the conversation. For instance, one participant noted, “That was incredibly difficult and painful to do. I hate being on such a delay, my response seemed out of date by the time I sent it.” The 40s delay not only created a change in response latency, but also had the potential to influence the conversational contingency, which has been found to moderate the latency effect in dyadic online chats with customers (Lew et al., 2018). At the same time, the disturbance in conversational contingency may have been perceived as a clue by student participants, indicating that their sibling’s response was “late.” The current study suggests the need for expanded attention to how contingency and latency interact with each other, as two important dimensions of interactivity in interpersonal online interactions.

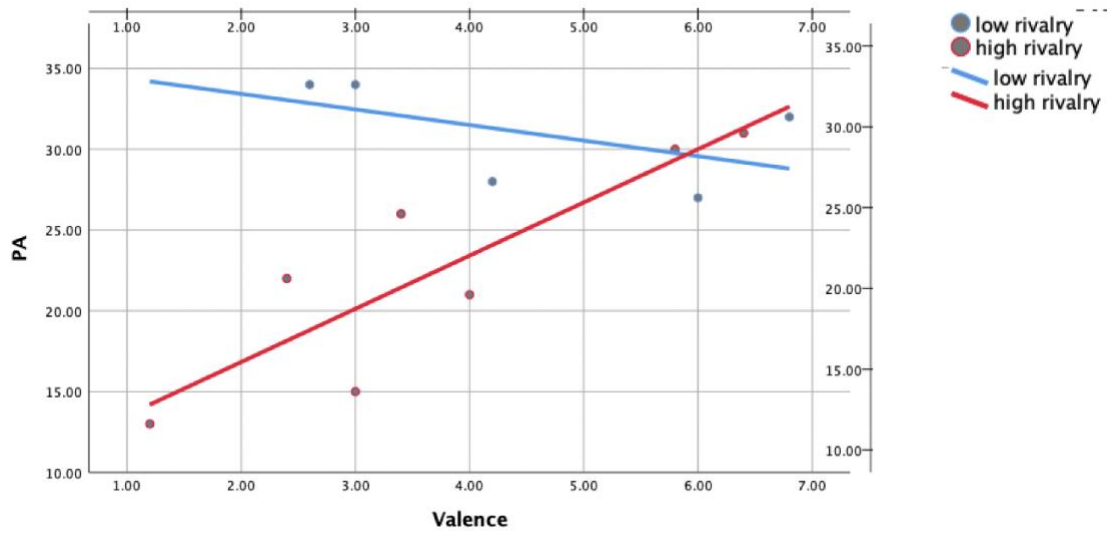
There are also methodological implications that might be considered in future research. In sibling communication, some previous studies have summarized different types of communication as general “sibling contact.” While these studies contribute to our knowledge of sibling communication, the findings of the current study indicate that it is also important and necessary to examine different forms of inter-sibling communication (e.g., text, phone call, family gatherings, physical contact). The unique obligatory motivation in sibling interactions makes some forms of communication (e.g., text, phone) more strongly related to the quality of their sibling relationships than others (e.g., family gathering). While people can easily find excuses to ignore text and phone calls from their siblings, they can also choose to contact their siblings more frequently on these channels. Although people have more autonomy to contact others via text and phone calls, they still need to gather with their family to fulfill their obligation to keep in touch with the family. The more mandatory nature of family gatherings makes them less predictive of the quality

of sibling relationships. As such, texting, as an important component of sibling communication, should be further studied in connection with sibling relationships.

The findings of the present study also suggest that using a dimensional approach (warmth, rivalry, and conflict) instead of a typological approach to measure the quality of sibling relationships during emerging adulthood may be particularly fruitful. During this period, changes and transitions in siblings' relationship and their communication patterns occur. By exploring the influence of various dimensions of relational quality on siblings' communication patterns, the current study was able to find significant associations between warmth and communication outcomes, as well as the influence of attributions on the association.

Appendix

The moderating effect of sibling rivalry was found in the correlation association between violation valence and positive affect ($N = 12$).



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