

Smile intensity in photographs predicts divorce later in life

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Abstract Based on social–functional accounts of emotion, we conducted two studies examining whether the degree to which people smiled in photographs predicts the likelihood of divorce. Along with other theorists, we posited that smiling behavior in photographs is potentially indicative of underlying emotional dispositions that have direct and indirect life consequences. In the first study, we examined participants’ positive expressive behavior in college yearbook photos and in Study 2 we examined a variety of participants’ photos from childhood through early adulthood. In both studies, divorce was predicted by the degree to which subjects smiled in their photos.

Keywords Emotion · Positive emotion · Divorce

Introduction

Many contemporary theories in affective science hold that our emotions organize our daily lives and do so throughout our lifespans (e.g., Izard and Ackerman 2000; Keltner and Gross 1999). Such social–functional approaches to emotion posit that individual differences in emotionality lead to systematic and reliable differences in behavioral, cognitive, and physiological responses. These differences are thought to arise both from the *intrapersonal* (Levenson 1999) and the *interpersonal* (Frijda 2007) functions served by emotion

and are thought to lead to differential life consequences (Keltner and Gross 1999).

Based on social–functional approaches to emotion, Harker and Keltner (2001) conducted a study examining women’s yearbook pictures at an elite institution in relation to a variety of life outcomes including health, personality, and marriage. Harker and Keltner calculated the intensity of female students’ smiles in their senior yearbook photo. Throughout their adult lives, subjects completed assessments of their well-being, personality, and marriage.

Harker and Keltner (2001) discovered that the more intense the subject’s positive expression shown in her senior yearbook picture, the more likely that she would be married by age 27 and would have a more satisfying marriage in adulthood. Furthermore, she was more likely to be more organized, content, nurturing, compassionate, and sociable than those women with less intense smiles.¹

These researchers theorized that positive emotionality in photographs could be an index for enduring emotional tendencies that shape personality and the life course through their influence on social, cognitive, and behavioral repertoires (Harker and Keltner 2001). Moreover, these emotional tendencies may have direct consequences on others, such that people displaying more positive displays may evoke positive responses in others thereby facilitating

¹ It should be noted that in a follow-up study, many of these findings were not replicated in a more diverse sample (Freese et al. 2006). However, these researchers employed a different system of coding for the smile intensity of their participants. More specifically, instead of coding the smiles along a continuum like Harker and Keltner (2001), they coded expressions trichotomously (no smile, Duchenne smile, or non-Duchenne smile) which yielded a more gross assessment of smiling behavior. These researchers attempted to adopt Harker and Keltner’s coding procedure, but were dissatisfied with the inter-rater agreement achieved. The discrepancy in coding procedure likely contributed to the lack of replication of Harker and Keltner’s results.

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personal bonds (Scarr and McCartney 1983). According to Keltner (2004), facial expressions play a key role in forecasting an individual's life outcomes. An individual's propensity for certain facial expressions reflects one's interpretation of proximal events, which shapes how life events transpire and influences others' interactions with oneself (Keltner). Thus, there is a sound theoretical rationale on which Harker and Keltner's study was based (Freese et al. 2006).

Harker and Keltner's (2001) investigation falls squarely into the "thin slicing" literature (Ambady et al. 2000). This literature indicates that from very limited segments of nonverbal behavior, one can accurately infer a variety of characteristics including socioeconomic status (Kraus and Keltner 2009), teacher evaluations (Ambady and Rosenthal 1993), sexual orientation (Ambady et al. 1999), and some facets of personality (Albright et al. 1988) to name only a few. A meta-analysis of this literature indicated that (1) "thick" slices of behavior beyond a half-minute, (2) the various channels of the stimuli that are used (face, voice, etc.), and (3) the setting in which the stimuli were presented (lab vs. naturally occurring) did not affect the accuracy with which people could assess a host of characteristics (Ambady and Rosenthal 1992). Like Harker and Keltner's study, the current investigation falls within the thin slicing literature as it examines snapshots in time of expressive behavior in photographs.

Study 1

In Study 1, we examined the potential relationship between smiling intensity in yearbook photos and one major life event of central importance to demographers, sociologists, and psychologists alike—divorce. As Harker and Keltner (2001) have proposed, one's facial expressions shape and forge the environment in which an individual interacts, which should especially include one's more intimate spousal relations. Could it be that in today's society where almost half of all marriages end in divorce, an individual's likelihood to divorce could be predicted simply by examining one's facial displays of emotion in photographs? The current study seeks to determine the relationship between one's propensity to display positive emotionality and divorce.

Harker and Keltner (2001) examined whether positive emotionality in photographs predicts divorce. They did not find a significant relation between the two variables, but their study was limited in a few important respects, most of which Harker and Keltner acknowledge. First, they only asked participants whether they were divorced at age 43, not nearly long enough to determine if participants would, in fact, obtain a divorce later.² Second, the study focused

solely on females, which leaves one to ask how males would fare (Harker and Keltner 2001). There is a long history of documenting gender differences in the displays of emotion in affective science. In general, men smile more than women (LaFrance et al. 2003), though these differences are inconsistent and vary across social, cultural, personality, and situational variables (Brody and Hall 2008). In general, women smile, nod, laugh, and use their hands to communicate emotions more in comparison to men (Brody and Hall). Moreover, women more accurately portray their deliberately posed and spontaneous facial emotions in contrast to men (Hall 1984). Finally, both men and women emit Duchenne and non-Duchenne smiles in approximately the same proportions, indicating that one gender's smiles are no more "artificial" than the other's (Brody and Hall; Hecht and LaFrance 1998). Most relevant to the current investigation was a study conducted by Regan (1982) in which she analyzed university students' smiles in yearbook photos. She found that women smiled more frequently and intensely than did males. In another study, researchers found that men smiled less than women in posed photos, but equally as much in spontaneous interactions (Hall et al. 2001). According to LaFrance et al. (2003), this pattern of results indicates that women's expressive behavior in monitored situations (like photos) reflects gender-stereotyped norms, such as being communal and expressive; whereas, less monitored and evaluative contexts, such as spontaneous conversations, produce less pressure to behave in those gender-stereotyped manners.

Finally, Harker and Keltner (2001) used only one photograph to make their predictions. In the current study, we used all available photos in the yearbooks for all students. The current study addresses these limitations, thus investigating whether one's propensity to display positive emotionality is related to a key life outcome—divorce.

Method

Sample 1

Of the 1,272 psychology alumni contacted, 359 responded to an e-mail inviting them to complete online questionnaires, but 53 individuals were removed from the sample due to no yearbook photos. The remaining sample consisted of 306 (204 female and 102 male). Ranging in age between 23- and 87-years-old ($M = 47$ years, $SD = 14.97$), the participants were Caucasian (96%), African American (2%), Multiracial (1%), and Other (1%). In the fall of 2005, data were collected on graduates from a small Midwestern education institution between 1941 and 2005 ($M = 1981$, $SD = 15.2$).

² The same is true for Freese et al.'s (2006) follow-up study.

Sample 2

In an effort to replicate the previous results in an independent sample and extend the population beyond psychology major alumni, we employed the same methodology and recruited more alumni from the same University, but expanded our criteria to all graduates. In response to an e-mail invitation sent to approximately 18,000 alumni (excluding alumni majoring in psychology), 428 people completed online questionnaires, but 79 individuals were removed from the sample due to no yearbook photos. The remaining sample consisted of 349 alumni (225 female and 124 male) who graduated between 1948 and 2005 ($M = 1981$, $SD = 16.3$). Ranging in age between 21- and 81-years-old ($M = 46$ years, $SD = 16.64$), the participants were Caucasian (96%), African American (1%), Multiracial (1%), and Other (2%). The data were collected in the fall of 2005. These demographics indicate that the sample was roughly equal to the first sample other than the fact that sample 2 did not contain any psychology majors.

Photo coding procedure

We adopted the same coding procedure used by Harker and Keltner (2001) which was published in the *Journal of Personality and Social Psychology*. Drawing upon Ekman and Friesen's Facial Action Coding System, FACS, (1976, 1978), two muscle action units, AU6 and AU12, were analyzed for each photo. The combination of these actions units are used to reflect positive facial expression because AU6 (orbicularis oculi) causes one's cheeks to raise as well as bagging around the eyes while AU12 (zygomatic major) causes the corners of the mouth to move upward forming a smile. The intensity of each action unit was scored utilizing a 5-point intensity scale (ranging from 1-minimal to 5-extreme). A smile intensity score was created by adding together the scores of Action Unit 12 and Action Unit 6 (2 meaning no smile and 10 being the highest smile intensity score available; Ekman and Friesen). Once all photos for an individual subject were scored, all of that participant's smile intensity scores were averaged to provide a total smile intensity score. It should be noted that the coding system used in the present study and by Harker and Keltner is not identical to FACS. In Ekman and Friesen's scheme, scores could range from 0 to 12 as zeros are given to muscles that demonstrate no contraction. However, because the present study was meant as a follow-up to Harker and Keltner's investigation, we adopted their coding scheme.

For sample one, all photos (847 total photos) were coded by one author (S.H.) and a random subset (10%) was coded by another author (A.B.). Neither coder had access to any other information regarding the participants when coding. Following Harker and Keltner's protocol for creating an

intercoder reliability ratio, the number of unanimous action units were multiplied by two and then divided by the total number of scored action units rated by the two coders. The intercoder reliability ratio was 0.82. For sample two, all photos (968 total photos) were coded by one author (A.B.) and a random subset (10%) was coded by another author (S.H.). The intercoder reliability ratio was 0.82. For both studies, final analyses were based on the author who coded 100% of the data.

Measures

Participants answered three questions to assess their relationship status. The alumni were asked if they were currently in a committed relationship, if they had ever been in a committed relationship, and if they had ever been divorced (Due to university constraints, subjects were not directly asked whether they were married, but were instead asked if they had ever been in a committed relationship). These variables were coded dichotomously (Yes/No). By using the answers to these questions, data were filtered to provide only those subjects who had ever been in a committed relationship. These data were then analyzed as to whether they had divorced or not. Other measures were administered as part of a larger research project, but only those that are pertinent to the present report are described.

Results

For the first sample, the mean score for smile intensity (the sum of the AU6 and AU12 scores) was 5.73 ($SD = 1.65$). The scores ranged from the lowest possible score of 2 through a high score of 9 (the highest score possible was 10). Confirming our hypothesis, as a whole, smile intensity predicted whether or not participants divorced at some point in their lives. The less intensely participants smiled, the more likely they would be divorced later in life. This effect was strongest amongst females, but was somewhat evident amongst males as well. For the second sample, the mean score for smile intensity (the sum of the AU6 and AU12 scores) was 5.76 ($SD = 1.67$). The scores ranged from the lowest possible score of 2 through a high score of 8. Like sample 1, as a whole, smile intensity predicted whether or not participants divorced at some point in their lives. The less intensely participants smiled, the more likely they would be divorced later in life. Contrary to the first sample, this effect was strongest amongst males, but was somewhat evident amongst females as well. Please refer to Table 1 for descriptive and inferential statistics (p values are one-tailed given the directional hypotheses of the studies).³

³ We also analyzed the data using logistic regression techniques entering the dichotomous variable (divorce) as the criterion variable

Table 1 Descriptive and inferential results: smile intensity and divorce

Study	Group	Not divorced			Divorced			<i>df</i>	<i>t</i>	<i>p</i>	<i>r</i>
		<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>				
Study 1: sample 1	All	235	5.9	1.6	49	5.0	1.6	282	3.34**	0.01	-0.20
	Male	70	4.7	1.7	22	4.1	1.4	90	1.51 [†]	0.07	-0.16
	Female	165	6.4	1.3	27	5.8	1.3	190	2.17*	0.02	-0.16
Study 1: sample 2	All	258	5.9	1.7	68	5.3	1.7	324	2.79**	0.01	-0.15
	Male	84	5.2	1.7	30	4.6	1.6	112	1.79*	0.04	-0.17
	Female	174	6.2	1.5	38	5.8	1.5	210	1.52 [†]	0.07	-0.10
Study 2	All	31	5.2	1.6	20	4.4	1.5	49	1.78*	0.04	-0.25
	Male	7	4.5	1.4	2	3.6	2.2	7	0.75	0.24	-0.27
	Female	24	5.4	1.6	18	4.5	1.4	40	1.86*	0.04	-0.28

* $p < 0.05$, ** $p < 0.01$, [†] $p < 0.10$

Study 2

To replicate the findings in study 1 as well as assess generalizability to other populations, we recruited a community sample of adults over the age of 55 years. Participants provided photographs of themselves between the ages of 5- and 22-years-old, which constitutes a larger age span for the photos than the other two samples that focused solely on the college years. In addition, participants in this study were allowed to include any photos of their choice, including school photos, wedding photos, photos taken with family members, etc. Indeed, Harker and Keltner (2001) acknowledged the need for a variety of photographs taken in different contexts. As they pointed out, basic principles of personality and statistics dictate that more indices of assessment over time and across contexts yield a more reliable index of emotionality (Bem and Allen 1974). Here, we assessed emotionality in photographs taken in a variety of situations and contexts over a span of years.

Method

Participants

Sixty-one people from a small, Midwestern town responded to the invitation to participate in a photo study, which included completing questionnaires. Six individuals were removed from the sample due to their photos not being clear enough to code. The remaining sample consisted of 55 mature adults (44 female and 11 male). Ranging in age between 59- and 91-years-old ($M = 73$ years, $SD = 7.37$),

the volunteers were Caucasian (87%), African American (9%), and Other (4%). Individuals from this sample did not overlap with the previous samples.

Participants were recruited by disseminating materials in areas of the community where individuals were most likely to be aged 55 years and older. Each participant was given a packet which included instructions, a consent form, multiple questionnaires, and envelopes for each photo. Upon completion of the consent form and questionnaires, participants were asked to provide up to eight photographs of themselves between the ages of 5- and 22-years-old. The mean age at which photos were taken in the study was 10.15-years-old ($SD = 5.36$). Any photos were allowed including school photos, wedding photos, photos taken with family, etc. Participants placed each photo in one of the return envelopes and marked the envelope with their age in the photograph. When all the photos were collected, the subject placed all of the envelopes with photos, the consent form, and questionnaires inside a large envelope and then contacted the lab for someone to retrieve the package. Upon receipt of the completed questionnaires and photos, all portraits were scanned for each participant and the originals returned within 1 week. Participants were offered a small monetary gift card for a retail store.

Photo coding procedure

The same coding procedure was employed as in Study 1. All photos (217 total) were coded by one author (S.H.) and a random subset (10%) was coded by another author (A.B.). The intercoder reliability ratio was 0.82.

Life outcome measures

Participants answered three questions to assess their relationship status, but these questions were slightly altered

Footnote 3 continued

and the average smiling score as the predictor variable. Overall, the analyses yielded the same pattern of results as those presented in Table 1.

from Study 1. The modification was to ask directly about marriage and not just if they had been involved in a committed relationship. The mature adults were asked if they were currently married, if they had ever been married, and if they had ever been divorced. By using the answers to these questions, data were filtered to provide only those subjects who had ever been married. These subjects who had been married were then compared to determine whether they had divorced or not.

Results

The mean score for smile intensity (the sum of the AU6 and AU12 scores) was 4.82 ($SD = 1.56$). The scores ranged from the lowest possible score of 2 through a high score of 10 (the highest score possible was 10). Continuing the same pattern, smile intensity predicted whether or not participants divorced at some point in their lives. The less intensely participants smiled, the more likely they would be divorced later in life. This was only evident, however, amongst females. The group sample size ($n = 7$) was insufficient to examine whether divorce could be predicted amongst males. Please refer to Table 1 for descriptive and inferential statistics. It should be noted that smile intensity scores were collapsed across several different types of photos (e.g., school photos, wedding photos, family photos). There are likely different demand characteristics for smiling in these various contexts. However, the goal of this study was to average smiling behavior across contexts to derive a more reliable index of smiling behavior (Bem and Allen 1974). Moreover, given the fallibility of subjects' memories, we thought it impractical to ask them the specific context in which a photo was taken, especially when some photos were taken when subjects were as young as 5-years-old.⁴

General discussion

For the first time, the current studies provide evidence that the degree to which one smiles in photographs taken in early life predicts the likelihood that a person will be divorced later in life. In Study 1, photographs taken in early adulthood predicted this life outcome; whereas, Study 2 demonstrated that photographs throughout early life predicted divorce. Our findings are consistent with researchers' contentions that emotional tendencies influence the life course through social, cognitive, biological,

and behavioral processes (Harker and Keltner 2001; Izard and Ackerman 2000; Keltner 2004; Malatesta 1990). Yearbook photos, which are extremely thin slices of behavior, may reflect participants' stable emotional tendencies and these tendencies seem to forecast some life outcomes, such as divorce. This is consistent with Fredrickson and her colleagues' broaden-and-build theory of positive emotion, which holds that positive emotions strengthen interpersonal bonds throughout the lifespan (e.g., Fredrickson and Losada 2005). It is also consistent with social-functional accounts of emotion which hold that emotions shape our lives throughout the lifespan via behavioral, physiological, and cognitive processes (e.g., Izard and Ackerman 2000; Keltner and Gross 1999).

The current investigation extended the literature on the predictiveness of early positive emotion on life outcomes, particularly divorce, in several ways. First, male participants were included in the sample. Male and female developmental processes are not the same (Carstensen et al. 2003), thus the current study's inclusion of males is an important contribution when examining divorce. Second, the current investigation examined whether participants divorced throughout their lifetime (or, at least, before they participated in the study), not just before their middle age as was done in previous research (Harker and Keltner 2001). Third, participants in Study 1 were from a number of different cohorts. Harker and Keltner focused on only women who graduated from college in the late 1960s. Thus, the current investigation extends the findings of previous work by including a number of different birth cohorts. Fourth, Study 2 included a community sample rather than a sample of convenience as has been done in almost every previous study. Fifth, participants in the last study were allowed to include photos beyond just their yearbook photos. Thus, the predictiveness of early emotion in photographs is not limited to yearbook photos, but other types of photos as well, such as wedding photos and family photos. Finally, Study 2 employed pictures taken from childhood through early adulthood rather than relying solely on photos taken in early adulthood. In fact, the average age of participants in the photos was 10-years-old. Thus, divorce can not only be predicted by photographs taken in early adulthood, but in childhood as well. As mentioned, basic principles of personality and statistics dictate that more indices of assessment over time and across contexts yield a more reliable index of emotionality (Bem and Allen 1974). Here, we assessed emotionality in photographs taken in a variety of situations and contexts over a number of different years.

The present investigation is limited in a few respects, all of which call for future investigation. First, this study did not account for the attractiveness of the participants. We opted not to examine this variable because previous

⁴ Like study 1, we also analyzed the data using logistic regression techniques entering the dichotomous variable (divorce) as the criterion variable and the average smiling score as the predictor variable. Overall, the analyses yielded the same pattern of results as those presented in Table 1.

research examining life outcomes and positive emotional displays in photographs found that attractiveness played little, if any role (Harker and Keltner 2001). Nevertheless, attractiveness is a possible alternative explanation for our findings, though given previous data, we do not think this to be the case. Second, due to university constraints, the relationship status was more ambiguous for the alumni than the local community members. The alumni were asked if they were ever in a committed relationship; whereas, the local community members were asked if they had ever been married. Although, by asking all of the subjects if they had ever divorced, it was implied that they must have been married before they could technically be divorced. Future research should refine the committed relationship variable by separating out those individuals who have been in a marriage versus those who have been in a committed relationship without marriage. In addition, future studies should assess the number of times that people have been divorced, rather than asking participants if they had been divorced or not. Third, it is very possible that our findings and those of others who employ similar methodologies are limited to US culture. Obviously, some cultures may not smile as much in photographs compared to those in the US. Moreover, their smiles may be displayed and interpreted differently.

Finally, like Harker and Keltner (2001), our data do not reveal the specific process(es) that may account for the relation between smiling in early life and divorce. Given the complexity of the smile in terms of its situational specificity, it does not yield to any overarching and complete framework to explain its relation to life outcomes (LaFrance et al. 2003). However, a number of interesting and potentially important mechanisms can be posited between smiling behavior and divorce given existing theoretical insights and data. First, our findings accord with the enduring dynamics model of marriages (e.g., Huston and Houts 1998) which holds that personality dispositions, especially those closely related to emotionality, shape the quality of exchanges between partners and these dispositions have a stable effect on relationships. Smiling behavior in photographs may reflect peoples' stable personality dispositions (Keltner 2004). A significant body of research demonstrates that people with greater levels of positive emotionality take advantage of opportunities, are more open to social relationships, are more capable of "undoing" sporadic negative emotions, and appraise ambiguous events more positively (Fredrickson and Losada 2005). Our findings are congruent with researchers who find that lack of positive emotionality in marriages predicts divorce (Gottman et al. 2001). It's likely that the aforementioned consequences that come from individual differences in positive emotionality likely affect long-term relationships, including marriage, over a lifetime (Huston and Houts).

A second related mechanism by which smiling behavior may influence divorce relates to Scarr's (1992) and Bandura's (2006, 2008) theories of gene-environment interaction. Research indicates that individual differences in positive emotionality are inherited to some degree (McCrae and Costa 1991). According to Scarr's and Bandura's theories, one of the ways in which our behavioral tendencies operate over the lifespan is through niche-picking—seeking out environments consistent with one's genetic tendencies. People high in positive emotionality may be more likely to seek out environments more conducive to happy marriages and may even seek out partners who are higher in positive emotionality themselves.

A third mechanism by which smiling behavior may influence divorce relates the signal value of emotional displays. Fridlund's (1994) behavioral ecological perspective holds that emotional displays signal to others the behavioral intent of the emoter. Thus, smiling conveys a readiness to affiliate (i.e., "Let's be friends") with the other. If smiling behavior in photographs reflects a general tendency to smile toward others in naturally occurring situations (this is an empirical question), the emoter profits from a lifetime of displayed affiliative cues. Such cues, according to Scarr's (1992) genotype-environment theory, evoke more positive eliciting circumstances in one's life which likely play an important role in marriage.

A final mechanism comes from work that indicates that displays of emotion can elicit congruent reactions in perceivers (Dimberg et al. 2000). Perceivers who view facial displays, including smiling behavior, demonstrate a congruent facial display at unconscious levels. In addition, perceivers will smile at almost imperceptible levels when exposed to pictures of smiling stimuli, even at unconscious levels. This emotional contagion effect may be playing out throughout one's life with a long-term partner.

In sum, the current investigation demonstrates that from extremely thin slices of behavior, the divorce status of individuals can be ascertained. The effect was replicated in three separate samples, comprised of several cohorts and for both genders. Future research should examine process oriented variables that underlie the relationship between smiling and life outcomes in general, and divorce specifically.

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