

Emotional Functioning, Socio-Economic Uncertainty, and Cultural Pathology: An
Investigation of the Impact of SES on Momentary and Elicited Emotion

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Running Head: Emotional Functioning, Socio-Economic Uncertainty, and Cultural
Pathology

Abstract

Previous research has shown that the positive relationship between socio-economic status and health is graded, with no apparent threshold. This paper addresses whether the SES-health gradient may hold for a “cultural pathology” known as *Hikikomori*—acute social withdrawal among Japanese youth—whereby individuals seclude themselves from the outside world for an extended period of time and lose many key interpersonal skills, including the ability to properly experience and express emotion. We predicted that *Hikikomori*-like syndrome would not be confined to a clinical subpopulation but instead be manifested even in undiagnosed youth, though in a more moderated form, as a negative function of family SES. Results from an experience-sampling study in which non-clinical student participants reported their emotional states during their daily lives using their mobile phones throughout an entire week, and a laboratory experiment which measured psycho-physiological (salivary Alpha-Amylase) responses to emotional stimuli, supported this prediction. Implications of this “cultural pathology” for developed societies where the middle-class is drifting due to the current global economic crisis are discussed.

Keywords: SES-gradient, culture and social ecology, emotional numbness, cultural pathology, experience sampling, salivary Alpha-Amylase responses

Socio-economic status (SES) refers to an individual's economic and sociological position in society, based on indices such as income, education, and occupation (Coleman, 1990). SES has traditionally been a core concept in the social sciences, and has been studied as a key variable to understand how differential values, cultural tastes, and characteristic language-use persist and are reproduced across generations (Bernstein, 1971; Bourdieu, 1984), along with the succession of unequal economic wealth and opportunity (Arrow, Bowles, & Durlauf, 2000; Bowles, Gintis, & Groves, 2005).

In the area of psychology however, with the exception of early research on social values (Berkowitz & Friedman, 1967; Kohn, 1977/1989; Muir & Weinstein, 1962), SES has typically been treated as a control variable, rather than studied as a key theoretical factor in its own right (Adler, Boyce, Chesney, Cohen, Folkman, Kahn, & Syme, 1994). Recently, however, the notion of SES is gaining a renewed interest in various areas of psychology. For instance, one recent study by Markus and her colleagues (Snibbe & Markus, 2005; Stephens, Markus & Townsend, 2007) has shown that models of agency differ within the United States as a function of SES, whereby the importance of making independent choices is emphasized more strongly in the middle-class than in working-class contexts. Knight and Nisbett (2007) have found that, as compared to middle-class citizens, working-class citizens are not only more interdependent in their social practices but also reason in a more holistic fashion in various cognitive tasks. Kraus and Keltner (2009) have reported a related finding that upper-SES individuals displayed more “disengagement” non-verbal cues (e.g., doodling) and fewer “engagement” cues (e.g., nodding, smiling) than

did lower-SES individuals. Similarly, Kameda, Takezawa and Hastie (2003, 2005; Kameda, Takezawa, Ohtsubo, & Hastie, 2009) have shown that distributive ideologies sharply differ as a function of SES within Japan, whereby communal sharing norms are endorsed more strongly by lower-SES citizens, allowing them to prepare collectively against “twists of fate” in life (Kelley, Holmes, Kerr, Reis, Rusbult, & Van Lange, 2003).

Furthermore, it is well known that socio-economic status affects people’s psychological and physical well-being (Diener, Oishi, & Lucas, 2003). Specifically, evidence is accumulating that the relationship between SES and health is graded with no clear threshold (poverty line); for each increment in SES, there is a comparable health benefit – a relationship known as the “SES-gradient” (Adler et al., 1994; Chen, Matthews, & Boyce, 2002; Cohen, Doyle, & Baum, 2006; Gallo & Matthews, 2003; Sapolsky, 2004).

In this paper, we address whether the SES-gradient, which has been observed in the susceptibility to common diseases (e.g., cancer, heart disease), may also be observed in the manifestation of symptoms of a “cultural pathology” known as *Hikikomori* – acute social withdrawal among the contemporary Japanese youth. Although *Hikikomori* is often portrayed as indigenous to Japanese culture (Zilenziger, 2006), we argue that this pathology has potentially important implications for developed societies that are deeply affected by the current global economic crisis. As examined below, there is reason to believe that *Hikikomori* is caused at least partially by the economic recession that Japan has been experiencing since the early 1990s. Given the similarities between the Japanese economic recession and the current global economic turmoil (Krugman, 2008), investigating the

relationship between this “cultural pathology” and SES may foretell changes to come in the well-being of youth in well-developed, post-industrial societies, where the middle-class is drifting due to economic downturns.

Economic downturn and psychological health: The Japanese case since the early 1990s

Impoverished socio-economic conditions affect not only people’s immediate welfare, but also have an adverse impact on their psychological health (Chen et al., 2002; Gallo & Matthews, 2003). The drastic changes which have taken place in Japan over the last decade, often referred to as Japan’s “lost decade,” may provide a case in point.

Previously buffered by lifetime employment and a seniority-based wage system, the economic recession that began during the early 1990s in Japan has deteriorated employment prospects for future generations and has ultimately led to a gradual erosion of the middle-class (Sato, 2000). The dramatic disappearance of secure, permanent jobs has impacted younger generations (ages 15 to 34) most severely, and has led to the emergence of an unemployed underclass labeled “NEET” (Not currently engaged in Education, Employment or Training; the word was first used among British Government officials but its use has spread to other countries, including Japan, China, and South Korea). Recent statistics compiled by the Cabinet Office of the Japanese Government (2005) suggest that the prevalence of individuals classified as NEET is particularly high among youth who are from families with annual household incomes ranging from two to five million yen (approximately 17,500-43,000 USD by the exchange rate at the time). This figure

suggests that the once-robust Japanese middle-class is dwindling, with the socio-economic conditions for youth from *lower middle-class families* being most at risk (see Kariya, 2001; Okano & Tsuchiya, 1999 for comprehensive reviews).

Although the exact nature of the relationship remains controversial, the emergence of NEET as an underclass has often been linked with a social pathology called *Hikikomori*, a Japanese term denoting acute social withdrawal (Zielenziger, 2006). The Japanese Ministry of Health, Labor and Welfare (2003) provides a *behavioral* definition of *Hikikomori* as individuals who refuse to leave their parents' house and isolate themselves from society for a period exceeding six months. Although the degree of the phenomenon varies on an individual basis, in the most extreme cases, some youths seclude themselves in their bedrooms for years or even a decade (Ogino, Kawakita, Kudoh & Takayama, 2008; Watts, 2002), causing wide concerns in the media as well among the public (e.g., NHK, 2009). Their lifestyles are characterized by reversed sleep-wake cycles – extended periods of sleeping during the day and addictive non-social behavior (e.g., computer gaming and internet browsing) during the night. Because of the lack of social contact, these individuals are reported to have lost many of key interpersonal skills, including proper experience and expression of emotion (Hattori, 2005; Saito, 1998). Media sources from other Asian countries where children frequently remain in the parent's household well into adulthood, including Taiwan, South Korea, and Hong Kong, have reported similar patterns of behavior, although sporadically (Jones, 2006; South China Morning Post, 2005).

Does the SES-health gradient apply to the manifestation of the *Hikikomori* syndrome?

Given the secluded lifestyles of individuals diagnosed with *Hikikomori*, most information about the social pathology has been obtained through case studies and interviews with parents. Thus far, few studies have systematically investigated either the prevalence of, or the root causes contributing to *Hikikomori*. However, if the pathology does indeed reflect the current socio-economic uncertainties faced by young Japanese, as indicated by the sharp increase of individuals classified as “NEET” (see Ogino et al., 2008), it can be predicted that *Hikikomori*-like symptoms, though in a more moderated form, might not be restricted to a diagnosable minority of the youth population. As stated earlier, previous research has shown that the relationship between socio-economic status and health is graded with no clear threshold (poverty line). The most notable evidence for the SES-health gradient was provided by the Whitehall study (Marmot, Smith, Stansfeld, Patel, North, Head, White, Brunner & Feeney, 1991) on the mortality rate among 17,350 British civil servants. These researchers found that the relative risk of mortality over 10 years increased with each decrease in employment grade; compared to the top administrators, relative risk of mortality was 1.6 for the professional-executive grades, 2.2 for the clerical grades, and 2.7 for the lowest grades (e.g., messengers), when controlling for other demographic factors. Similar findings have also been obtained with morbidity rates (e.g., prevalence of chronic disease, hyper-tension, cervical cancer) in several countries including the US, UK, and Japan (see Adler et al., 1994 for review). We infer that, given the potential linkage of *Hikikomori* to the impoverished socio-economic conditions in Japan (Ogino et al., 2008; Saito, 1998), the SES-gradient may also apply for a manifestation of

the *Hikikomori* syndrome; more specifically, a negative relationship between symptom severity and SES may be observed even among *undiagnosed* Japanese youth, whereby those with lower SES exhibit greater *Hikikomori*-like symptoms.

Besides the *behavioral* symptoms such as isolating themselves from social contact for an extended period of time and characteristic reversed sleep-wake cycles (Japanese Ministry of Health, Labor and Welfare, 2003), the current scientific knowledge base does not allow us to specify exactly what *psychological* features constitute the syndrome. However, previous observations suggest that blunted emotions seem to be common among individuals suffering from *Hikikomori* (Masataka, 2002; Saito, 1998). For example, in case studies of 35 *Hikikomori* clients (mean age at in-take = 21.5; range = 11-35), Hattori (2005) reported that numbness in both positive and negative emotions was observed in 66% of the clients. Hattori (2005) also maintained that these flattened emotional patterns are distinguishable from those of other psychological disorders including depression and schizophrenia (see also Saito, 1998; Japanese Ministry of Health, Labor and Welfare, 2003, for distinctions of *Hikikomori* from depression or schizophrenia). Given that both positive and negative emotions play a fundamental role in creating and maintaining social relationships (Damasio, 1994; Panksepp, 1998; Keltner & Haidt, 1999; Sanfey, Rilling, Aronson, Nystrom, & Cohen, 2003), such a flattened emotional pattern may further compromise *Hikikomori* clients' ability to function in society.

In this paper, we thus focus on the emotional patterns of non-clinical Japanese student participants who have not been diagnosed with *Hikikomori* as their psychological

features. We predict that the passive emotional patterns, as well as the behavioral tendencies to distance themselves from social contact and to have a reversed sleep-wake cycle, may be more evident with *undiagnosed* Japanese youth from lower middle-class families compared to upper middle-class families. To test the SES-gradient hypothesis, we conducted two studies with the same set of participants: an emotion-sampling study in naturalistic environments (Csikszentmihalyi & Larson, 1987; Reis & Gable, 2000), and a controlled laboratory experiment intended to measure psycho-physiological reactions to anger-provoking stimuli (Nisbett & Cohen, 1996). By combining field and laboratory methods, we aim to show that the manifestation of the *Hikikomori* syndrome, which has often been mystified in Western as well as Japanese media (e.g., Jones, 2006; Rees, 2002; Zielenziger, 2006), may scientifically be understood at least partially in the general context of a graded relationship between socio-economic conditions and psychological health (Adler et al., 1994; Chen et al., 2002).

Study 1: Emotion-Sampling Study in Naturalistic Environments

Participants

Because the design of this research required the same youth samples to participate in two intensive studies (a one-week experience sampling survey using mobile phones in Study 1 and a laboratory experiment measuring activities of salivary Alpha-Amylase in Study 2), we decided to use analogue samples for research feasibility. Forty-two students (21 males and 21 females; mean age = 19.6, range: 18-22) from three institutions (a major national university, a small private college, and a vocational school) in Sapporo, Japan,

participated in the study. According to recent statistics, 73% of 18-year-olds in Japan enter higher education following high school, and sizable differences exist among institutions as to the mean SES of their students' families (Kariya, 2001). The three schools were selected to reflect such variability. In each school, an announcement was made advertising a one-week intensive survey offering 10,000 yen (approximately 85 USD by the exchange rate when the study was conducted) compensation; fourteen students were sampled randomly from 40-60 applicants at each institution. Although these analogue samples were not representative of the Japanese youth in any formal sense, distribution of family SES indices of the participants compared well to the results of a national survey by the Japanese Ministry of Health, Labor and Welfare (2008), as examined in detail in the results section. The proportion of females in each sample was approximately one-half.

A Web-based System for Sampling Emotional Experiences using Mobile Phones

Whereas PDAs are uncommon, the prevalence of web-enabled mobile phones among Japanese youth is around 95% (Cabinet Office of the Japanese Government, 2006). Given the high ubiquity of mobile phones across the wide range of youth population, we developed a web-based system that can be accessed by mobile phones to sample participants' emotional experiences. Participants received an instant message 12 times per day (every two hours on average with $SD = 20$ minutes) instructing them to access our web site immediately and report their current emotional state. Ten emotional categories (happiness, sadness, anger, fear, anxiety, disgust, contempt, envy, shame, and guilt) plus two miscellaneous categories (other emotions [participants needed to specify] and no

emotion) were provided; participants were required to check any number of the 12 categories that fit their current feelings. They were also asked to report where they were and whom they were with. To assure that participants reported their most recent emotional experiences, access to the website was limited to 15 minutes following receipt of each message.

Procedures

The emotion-sampling study was conducted during the summer of 2006 when no classes were scheduled. All participants were first gathered in the laboratory at Hokkaido University. After completing the consent forms, participants were informed about the procedure of the study, and how to access the web-site to report their affective experiences. Participants were also asked for information concerning their family socio-economic background including parents' total number of years of education, their current occupations, and last year's total household income. The emotion-sampling started at noon of the following day and lasted for one week.

Results and Discussion

Family SES index. The previous year's total household income in our student sample ranged from 1.1 to 23 million yen (approximately 9,500 – 198,000 USD; Mean=6.7, Median=6, and Mode=5 million yen, respectively), which was comparable to the results of a national survey by the Japanese Ministry of Health, Labor and Welfare (2008). The national survey indicated that the mean annual income among Japanese households with children was about seven million yen in 2006. Thus, the observed income distribution in

our sample confirmed that most of the participants' families were largely classifiable to the Japanese middle-class, with sizable differences existing between the upper- and lower-ends ($SD=4.3$ million yen).

Because a large number of the participants' families had only one working parent, also comparable to the results of the national survey, we focused on the socio-economic information of the head of household. We followed the standard method in sociology to produce an overall family SES index (Halaby, 2003). We first transformed the householder's occupation into an occupational prestige score (Duncan, 1961). Next, this score, along with the number of years of education and last year's household income, was standardized and then averaged to yield an overall family SES index for each participant. A one-way analysis of variance (ANOVA) confirmed the expected difference in average family SES index among the three institutions, $F(2,39)=4.43$, $p=.02$, $\eta^2=.18$, with students from the national university having significantly higher SES indices compared to the private college and vocational school.

Frequencies of emotions. On average, participants responded to 69% ($SD=9.2\%$) of the 12 instant messages they received each day. No significant difference was observed in overall response rates as a function of family SES ($b=-.40$, ns).

Figure 1 displays the mean proportion of each of the 12 emotional categories that participants reported during the week. To simplify the graphic representation, Figure 1 uses the median index value to divide participants into high vs. low family SES groups. In the analyses reported throughout this paper, however, a continuous SES index variable

was used.

Insert Figure 1 about here.

Because each participant was nested within one of the three institutions, a Hierarchical Multivariate Multiple Regression Analysis (Raudenbush & Bryk, 2002) was used to test the hypothesis that family SES would be negatively related to *Hikikomori*-like emotional blunting. Participant's family SES index (continuous) and sex (categorical) were entered as level 1 predictors, and the school (categorical) was entered as a level 2 predictor; proportions of the 12 emotional categories in participant's overall responses were designated as dependent variables. This analysis yielded a significant SES x emotion-category interaction, $F(12,27)=2.20, p=.04$. No other effects were significant.

Follow-up univariate regression analyses indicated that higher SES individuals were more likely to report experiencing happiness ($b=.11, p=.01$, effect size r [denoted as ESr hereafter] $=.40$) and anxiety ($b=.03, p=.07, ESr=.29$) and less likely to report the two miscellaneous categories (other emotions, $b=-.07, p=.04, ESr=.34$; no emotion, $b=-.07, p=.05, ESr=.32$). About half of the emotions that participants specified in the other-emotion category could be summarized as dull feelings including tiredness, boredom, and sleepiness (the other half of the emotions specified in this category included feeling busy, relaxed, hungry, puzzled, and so on, none of which contributed greater than 5% to the category). These patterns suggest that students with lower family SES may have more

monotonous emotional lives in everyday environments, experiencing both positive and negative emotions *less* frequently while reporting blunted or absent feelings *more* frequently.

Differences in lifestyle. Figure 2 displays participants' mean response rates to the instant messages as a function of family SES (again dichotomized for graphic representation) and hour (a.m.) when the messages were sent.

Insert Figure 2 about here.

A Hierarchical Multivariate Multiple Regression Analysis was used to determine whether the sleep-wake cycle varied in the sample as a function of family SES. Time slot (six-level repeated measures variable), SES (continuous), and sex (categorical) were entered as level 1 predictors, and the school (categorical) was entered as a level 2 predictor, with the response rate as the criterion variable. Results revealed a marginally significant SES x time-slot interaction, $F(6,33)=2.02$, $p=.09$. No other effects were significant. Figure 2 suggests that students with lower family SES tended to respond more frequently from midnight to 2 a.m. but less frequently early morning through noon than students with higher family SES. The sleep-wake cycle pattern was also found to be correlated with the degree of flattened emotional patterns in Figure 1 (reporting no or other emotions; $r=.29$, $p=.08$). Family SES had no significant effect for the response rates noon through midnight.

A subsequent analysis compared the location of individuals when they responded to the messages. Participants with lower family SES reported being in downtown less frequently and being at home more frequently compared to participants with higher family SES, $b=1.81$, $p=.04$, $ESr=.33$. For the question about whom to be with, participants on average reported being alone more than half (56%) of the time. Although the frequency of reports of being alone was not directly related to participant's family SES, it was highly correlated with the frequency of reporting to be at home ($r=.51$, $p<.001$). Thus, in addition to blunted emotions, lower family SES individuals were also more likely to avoid locations where they would be likely to encounter other people.

Although these overall emotional and behavioral patterns were consistent with our SES-*Hikikomori*-like-symptoms gradient hypothesis, alternative explanations are also conceivable. For example, being at home more frequently may simply reflect more limited monetary resources, rather than the psychological tendency for students with lower family SES to avoid social contact. Also, reversed sleep-wake cycles may mean longer "quiet hours" after midnight, leading to greater frequencies in reports of feeling no or dull emotions. While these alternative interpretations are item-specific and do not necessarily explain the overall patterns observed coherently (e.g., why do lower family SES individuals stay awake later in the first place?), it is true that we cannot rule out these interpretations fully given the correlational nature of the experience sampling survey. We thus conducted an experiment in which participants' psycho-physiological responses to identical emotion-stimuli were measured in a controlled laboratory setting. If the flattened

emotional pattern among lower family SES individuals is replicated, this would provide an evidence that the SES-*Hikikomori*-like-symptoms gradient is observed even when participants receive exactly the same stimuli. In other words, alternative explanations presuming that the differential emotional patterns are directly caused by differential events in everyday life (e.g., less monetary resources, longer “quiet hours” after-midnight among lower family SES individuals) would be less viable.

Study 2: Psycho-Physiological Responses in a Controlled Laboratory Setting

As we have seen, the experience sampling method has obvious merits in that we can address people’s responses in situ. The results reported up to this point reflect participants’ emotional experiences in their natural environment. Yet, some cautions may be in order when interpreting these findings. Besides the aforementioned alternative interpretations, the observed emotional differences could be due to social-class differences in emotional vocabularies rather than experiences per se (see Bernstein, 1971, for social class differences in communication codes). Although we doubt the viability of this interpretation given the overall consistency of the behavioral findings with the *Hikikomori* syndrome (the reversed sleep-wake cycles and the tendency to distance oneself from social situations), a conceptual replication with *non-verbal* measures in a more controlled setting is, nevertheless, desirable. We thus conducted a laboratory experiment with the same set of participants, whereby psycho-physiological activities were examined in response to a set of anger-provoking stimuli (Nisbett & Cohen, 1998).

Given that individuals suffering from *Hikikomori* tend to avoid and respond in a subdued manner to interpersonal conflict (Hattori, 2005; Masataka, 2002; Saito, 1998), the laboratory experiment focused on the experience and expression of anger. Although anger is often considered to be a negative emotion that ought to be controlled in most situations, feeling and expressing anger in certain contexts is an important aspect of our social lives (Frank, 1988). Nisbett and Cohen (1996), for example, demonstrated how the expression of anger in response to provocation is a key element in the “culture of honor” common to the southern US, where historically men had to protect removable personal property (e.g., livestock); a reputation for toughness was effective to discourage potential exploitation by others. Anger is also a useful tool for mobilizing the willingness to punish violators of social norms and restore justice, even if one is not a direct victim of the violation (Henrich, Boyd, Bowles, Camerer, Fehr, & Gintis, 2004; Kameda et al., 2005).¹

Two anger-provoking situations were created in the laboratory, one in which participant’s self-image was challenged by someone, and another in which participants were informed of a serious norm/moral violation. If emotional blunting is more characteristic of students from lower middle-class families as observed in Study 1 (and also as one of the few known psychological symptoms of *Hikikomori* to date: see Hattori, 2005; Masataka, 2002; Saito, 1998), they should exhibit weaker reactions to the identical stimuli than those with higher family SES. We tested this hypothesis by examining participant’s salivary alpha-amylase (sAA) level following provocation; salivary amylase provides a sensitive measure of acute psychological stress in response to emotional events (Rohleder

& Nater, 2009; Rohleder, Nater, Wolf, Ehlert, & Kirschbaum, 2004).

Participants

The same sample of students who participated in the emotion-sampling survey participated in the laboratory study for an additional 2,000-yen (approximately 17 USD). Because salivary amylase fluctuates over the course of the daily cycle, experimental sessions were limited to the hours between 9 a.m. and noon to minimize time of day effects (Rohleder et al., 2004). Participants were instructed to abstain from eating, smoking, drinking any beverages except water, and exercising, for 2 hours prior to the experiment.

Salivary Alpha-Amylase (sAA) Assay

Alpha-amylase is a major salivary enzyme in humans, and is secreted from the salivary glands in response to stimulation from the sympathetic nervous system. There is a strong relationship between the concentration of salivary amylase and blood level catecholamines (Chatterton, Vogelsong, Lu, Ellman, & Hudgens, 1996), and measurement of amylase is a useful measure for assessing activity in the Sympathoadrenal Medullary System (SAM) in response to stressful events. Several recent studies (e.g., Takai, Yamaguchi, Aragaki, Eto, Uchihashi, & Nishikawa, 2004; see also Rohleder & Nater, 2009, for a comprehensive review) have shown that this salivary enzyme may be a more sensitive measure of acute stress than salivary cortisol, a hormone that reflects activity in the Hypothalamus-Pituitary-Adrenal (HPA) axis and has been used as an index of socially-induced stress that can lead to an anger response (Nisbett & Cohen, 1996).

Recently, a hand-held monitor of salivary amylase activity has become available.

The device is equipped with a disposable test-strip, built-in collecting and reagent papers, and an automatic saliva transfer mechanism (cocorometer, Nipro Co. Ltd, Japan: Yamaguchi, Deguchi, Wakasugi, Ono, Takai, Higashi, & Mizuno, 2006). In the present experiment, the test-strip was inserted directly under the tongue for 10-30 seconds to collect approximately 20-30 μ L of saliva. Immediately after saliva collection, the test-strip was placed onto the automatic transfer device. In total, the procedure takes approximately one minute to measure salivary amylase levels.

Procedure

One or two participants were tested in each session. Upon arrival, each participant was escorted to an individual sound-proof room. Participants were informed that they would view two video clips containing emotionally-charged content and that they could withdraw from the experiment at any time with full compensation if they felt uncomfortable. They were also told that they would be providing saliva samples. After signing a consent form, each participant was asked to rate their current emotional state across the same ten emotional categories used in the emotion-sampling study using Likert scales ranging from 1 (do not feel so at all) to 7 (very much). Participants also completed scales measuring depression (Zung, 1965), self-efficacy (Schwarzer, Born, Iwawaki, Lee, Saito, & Yue, 1977), and self-esteem (Rosenberg, 1965), as well as the Affective Neuroscience Personality Scales (ANPS: Davis, Panksepp, & Normansell, 2003; Panksepp, 1998).

Participants were asked to rinse their mouths with water, then instructed on how to

use the saliva sampling device. Afterwards, they were given test-strips for saliva collection. The remaining instructions and experimental stimuli were all presented on a computer screen.

After a 5-minute calming period, the first saliva sample was taken to measure baseline activity of salivary amylase. Then, one of two video clips was presented on the computer screen with sound, each lasting about two minutes. In one clip, participants were insulted by an animated character using strong language (Nisbett & Cohen, 1996). In the other video clip, participants watched an edited TV program featuring a man who stabbed eight kids to death at an Osaka elementary school and claimed publicly that he would never feel guilty for his act. Immediately after viewing one of the video clips, a second saliva sample was taken. Four more saliva samples were taken every 2 minutes while scenes of mountains, lakes, and flowers were presented on the screen. After a total of 6 samples were collected, the second video clip started with the same procedure for saliva sampling. The presentation order of the two video clips was counterbalanced between participants. After completing both sessions, participants reported their current emotional state using the same materials introduced during the pre-session. Participants were then debriefed and paid their compensation.

Results and Discussion

One participant had a dry mouth, preventing collection of a satisfactory saliva sample; data from the remaining 41 participants was analyzed.

Subjective feelings. Participants rated their current emotional state both before

and after viewing the emotional video clips. Of the 10 emotions listed on the questionnaire, only ratings of self-reported anger increased from the pre-session ($M=2.4$) to the post-session ($M=4.7$), $F(1,33)=44.08$, $p<.0001$. This implies that salivary amylase activity occurring while participants were viewing the video clips, reported below, are likely to have reflected psychological stress related to anger rather than other emotions elicited by the stimuli. The relationship between the family SES index and subjective ratings of anger, however, failed to reach the significance level, $b=.31$, *ns*. Because we administered the subjective questionnaire only twice (before and after participants viewed both video clips), measurement errors associated with the subjective emotion-reports were larger than those in salivary amylase activities that were assessed 5 times (every 2 minutes) for each video clip. We speculate that the larger measurement error may have contributed to the non-significant relationship between the family SES index and subjective ratings of anger. While we believe this explanation to be plausible, we should also emphasize that more research is needed to understand general relations between subjective feelings and underlying physiological activities, as indexed by various biological markers (Panksepp, 1998; Rohleder & Nater, 2009; Sapolsky, 2004).

Salivary Alpha-Amylase (sAA) responses. We measured salivary amylase activity 11 times in total for each participant (once prior to the presentation of the emotional stimuli to establish a baseline, and 5 times after viewing each stimulus). For the analysis, we obtained a peak response to each of the two anger-provoking stimuli (Rohleder & Nater, 2009). This yielded a total of three amylase scores for each participant: baseline, peak

after the personal insult, and peak after viewing the moral violation.² Because distributions of these scores were skewed, we transformed them logarithmically following recommendations of Rohleder and Nater (2009).

Figures 3 and 4 plot the differences between the peak and baseline scores for the personal insult and moral violation respectively against the family SES index. These figures display the acute psychological stress each participant felt toward the emotional stimulus as a function of family SES and sex (see footnote 2 for baseline sAA activities).

Insert Figures 3 & 4 about here.

We used a Hierarchical Multiple Regression Analysis with participant's family SES index (continuous) and sex (categorical) as level 1 predictors, and the school (categorical) as a level 2 predictor. The analysis revealed that, as expected, participant's family SES was a significant predictor of the salivary amylase response to the personal insult ($b=.37, p=.008, ESr=.43$) as well as to moral violation ($b=.30, p=.04, ESr=.34$); the higher the student's family SES, he/she experienced a stronger stress response to the anger-provoking stimuli. Interaction between sex and SES was also marginally significant ($b=-.51, p=.06, ESr=.31$ for the personal insult, and $b=-.51, p=.08, ESr=.48$ for the moral violation), suggesting that the relationship was relatively stronger for male students compared to female students.

These results support our hypothesis that psycho-physiological responses evoked

by anger-provoking stimuli are smaller for individuals with lower family SES. To put it differently, the identical video clips, both of which contained emotionally-charging social events (e.g., personal insult and mass killings of school children), were less “moving” or less “affectively relevant” to participants as a negative function of their family SES. These findings are also consistent with those collected in the emotion-sampling study, which indicated that lower SES individuals experience relatively blunted affect (feeling dull or absent emotions more often) in their everyday lives.

Personality measures. The nature of the relationship between emotional functioning in general and family SES was further explored using the Affective Neuroscience Personality Scales (ANPS; Davis et al., 2003).³ The correlation between scores on the “seeking” subscale of the ANPS and the family SES index was significant, $r=.38$, $p=.01$; individuals with higher family SES were more curious and motivated to explore the world. The “seeking” score was also correlated with the increase in salivary alpha-amylase activities in response to the emotional stimuli, $r=.40$, $p<.01$ (personal insult) and $r=.35$, $p=.04$ (moral violation), suggesting that the behavioral and emotional patterns may constitute a syndrome. None of the other correlations between ANPS subscales and family SES were significant (playfulness, $r=.22$; caring, $r=-.02$; fear, $r=-.16$; anger, $r=.21$; sadness, $r=-.01$; spirituality, $r=.08$). Likewise, no significant correlations were found between family SES and depression ($r=-.12$), self-efficacy ($r=.13$) or self-esteem ($r=.16$).

Intercorrelations between emotional measures across Study 1 and Study 2.

Because we used the same set of participants in Study 1 and Study 2, it is possible to

examine the consistency of their emotional responses across different times/contexts.

Table 1 provides correlations between the emotional measures across the two studies.

Insert Table 1 about here.

Besides the correlations we have already discussed, notice that participants' salivary amylase responses in the laboratory were negatively correlated with the frequency of reporting no emotions in everyday life, $r=-.37$, $p=.02$ (personal insult) and $r=-.33$, $p=.04$ (moral violation). That is, participants who reported feeling no emotion more frequently in the experience sampling survey showed lower psycho-physiological (sAA) responses to the emotional stimuli in the experiment; the emotional responses on verbal measures in everyday setting were coherent with those on the physiological measures in the laboratory setting.

General Discussion

Together, the field study and laboratory experiment revealed a robust relationship between participant's socio-economic background and his/her emotional expression and experiences. To recapitulate, students from lower middle-class families showed more emotional blunting than did students from upper middle-class families; they were more likely to report dull or absent feelings during the course of their everyday lives (Study 1), and demonstrated weaker psycho-physiological reactions to the anger-provoking stimuli in the laboratory (Study 2). Results also suggest a positive relationship between family SES

and involvement in social situations; students from lower middle-class families were more likely to be at home and less likely to be downtown when contacted to report their emotional state, while maintaining reversed sleep-wake cycles (Study 1). Furthermore, they scored lower on the seeking subscale of the ANPS, an indicator of a person's motivation to explore his or her environment (Study 2). Also, participants' emotional patterns were correlated between Study 1 and Study 2, which adopted highly dissimilar measures (verbal vs. physiological). As a whole, these emotional and behavioral patterns observed in students from a lower middle-class family background are consistent with symptoms identified with the *Hikikomori* syndrome albeit in moderated form (Japanese Ministry of Health, Labor and Welfare, 2003; Hattori, 2005; Ogino et al., 2008; Saito, 1998).

Although the analogue sample we used in this research was not representative of the Japanese youth population in any formal sense, we should emphasize that the distribution of family SES indices of the participants compared well to the results of a recent national survey (Japanese Ministry of Health, Labor and Welfare, 2008). We should also note that the participants in our study were normal students who come to school regularly and, therefore, cannot by definition be classified as "NEET" (Not currently engaged in Education, Employment or Training). Also, we are aware of no clinical patterns in the participants' responses to the depression scale, ANPS, and the other scales. Our results then suggest that the *Hikikomori* syndrome may not be limited to clinical subpopulations, but might instead be relevant to the Japanese youth broadly. Given the

socio-economic uncertainties that Japanese youth have endured since the early 90s, differences between individuals diagnosed with *Hikikomori* and those who have not may be matter of degree only. Manifestations of the *Hikikomori*-like behavioral and emotional patterns, as we have observed in this research, may thus be better understood in relation to the general graded relationship between psychological health and socio-economic conditions, in which increments in SES provide comparable increases in health (Adler et al., 1994).

This view may have important implications for cultural interpretations of the *Hikikomori* phenomenon as well. Some authors have suggested that the social pathology may be indigenous to and is also indicative of Japanese culture in general (“insularity, homogeneity, and lockstep conformity”, Zielenziger, 2006, p.20). It is true that at least some of the manifestations of *Hikikomori* observed in Japan (such as locking oneself into a bedroom for an extended period of time) could only be possible in cultures where children continue to live with their parents after reaching adulthood. Yet we do not believe that this parenting practice is the main cause for the phenomenon, even though it may surely facilitate its occurrence. For example, these cultural factors cannot explain domestic variation within Japan, where similar parenting practices apply to both upper and lower middle-class families equally (Azuma, 1982). From this perspective, we speculate that manifestation of *Hikikomori* is principally governed by the general graded-relationship between SES and health (Adler et al., 1994; Marmot et al., 1991). At the same time, it is moderated by the cultural practice that more or less allows children to remain at home even

after reaching adulthood, a parenting practice which is prevalent in Japan and some other Asian countries. If this interpretation is correct, a similar SES-gradient may be observed in other Asian countries as well, including Taiwan, South Korea, and Hong Kong, where media sources have reported *Hikikomori*-like patterns of behavior, albeit sporadically, among their youths (Jones, 2006; South China Morning Post, 2005). It seems promising to test the SES-*Hikikomori* gradient hypothesis with these Asian youth populations in future studies.

This interpretation also suggests that, even in Japanese society, the *Hikikomori* syndrome may be observed much less frequently among *lower-class* families who cannot afford the practice allowing adult children to stay home, due to poor economic and living conditions. Indeed, all the participants in our study are from middle-class families, and are among the advantaged 73% of the 18-year-old population (Kariya, 2001) whose families could afford to provide their children with a higher education after high school. If we extended the scope of our study to encompass the remaining, disadvantaged 27% of the population, we might observe an inverted-U function between SES and manifestation of *Hikikomori*-like symptoms.

The predicted pattern is also important to illuminate the following point. One alternative explanation for the emotional results in Study 1 (see Figure 1) may be that students from upper-middle class families are more Westernized than students from lower-middle class families and are better at articulating positive and negative emotions in their verbal reports (Kitayama, Mesquita, & Karasawa, 2006; Mesquita & Karasawa, 2000).

Although the behavioral results in Study 1 (e.g., reversed sleep-wake cycles) and the physiological results in Study 2 do not seem to cohere with this interpretation, we also believe that this explanation is worth of further tests in contrast to our *SES-Hikikomori* gradient hypothesis. It seems that the Westernized hypothesis would predict a monotonous relationship between SES and more assertive expressions of affect for the entire range of the Japanese youth population (i.e., the more Westernized assertive expressions should be found among youth from more Westernized, higher SES families), whereas our hypothesis predicts an inverted-U shape. Future research might address this prediction using a more representative youth sample via social survey methodology, and would certainly be an important contribution toward the better understanding of the ecological and cultural underpinnings of this phenomenon.

In conclusion, we argue that differential socio-economic uncertainties are experienced by youth as a function of their family background, and that these socio-economic factors may be the key to understanding the often-mystified “indigenous pathology” of *Hikikomori* in Japan. Paul Krugman, who was awarded the Nobel Prize in Economic Sciences in 2008, has suggested that the current economic crisis occurring in the world shares many similarities with the Japanese economic turmoil which occurred after the collapse of economic bubble in the early 1990s (Krugman, 2008). If this is the case, the seemingly indigenous cultural pathology may have important implications for the well-being of youth in many well-developed, post-industrial societies where the middle-class is drifting.

References

- Adler, N. E., Boyce, T., Chesney, M.A., Cohen, S., Folkman, S., Kahn, R.L., & Syme, S.L. (1994). Socio-economic status and health: The challenge of the gradient. *American Psychologist*, 49, 15-24.
- Arrow, K., Bowles, S., & Durlauf, S.N. (2000). *Meritocracy and economic inequality*. Princeton, NJ: Princeton University Press.
- Azuma, H. (1982). Current trends in studies of behavioral development in Japan. *International Journal of Behavioral Development*, 5, 153-169.
- Berkowitz, L., & Friedman, P. (1967). Some social class differences in helping behavior. *Journal of Personality and Social Psychology*, 5, 217-225.
- Bernstein, B.B. (1971). *Class, codes and control. Volume 1: Theoretical studies towards a sociology of language*. London : Routledge & Kagan Paul.
- Bourdieu, P. (1984). *Distinction: a social critique of the judgment of taste* (translated by Richard Nice). Cambridge, MA: Harvard University Press.
- Bowles, S., Gintis, H., & Groves, M.O. (2005). *Unequal chances: Family background and economic success*. Princeton, NJ: Princeton University Press.
- Cabinet Office of the Japanese Government (2005). *A survey on the unemployed youth (an interim report)*. In Japanese.
- Cabinet Office of the Japanese Government (2006). *Monthly consumer confidence survey covering all of Japan (Summary)*. In Japanese
- Chatterton, R. T., Vogelsong, K.M., Lu, Y., Ellman, A.B., & Hudgens, G.A. (1996).

- Salivary α -amylase as a measure of endogenous adrenergic activity. *Clinical Physiology*, 16, 433-448.
- Chen, E., Matthews, K.A., & Boyce, W.T. (2002). Socio-economic differences in children's health: How and why do these relationships change with age? *Psychological Bulletin*, 128, 295-329.
- Cohen, S., Doyle, W.J., & Baum, A. (2006). Socioeconomic status is associated with stress hormones. *Psychosomatic Medicine*, 68, 414-420.
- Coleman, J. (1990). *Foundations of social theory*. Cambridge, MA: Harvard University Press.
- Csikszentmihalyi, M., & Larson, R. (1987). Validity and reliability of the Experience-Sampling Method. *Journal of Nervous and Mental Disease*, 175, 526-536.
- Damasio, A. (1994). *Descartes' error: Emotion, reason, and the human brain*. New York: Putnam.
- Davis, K.L., Panksepp, J., & Normansell, L. (2003). The affective neuroscience personality scales: Normative data and implications. *Neuro-Psychoanalysis*, 5, 57-70.
- Diener, E., Oishi, S., & Lucas, R.E. (2003). Personality, culture, and subjective well-being. *Annual Review of Psychology*, 54, 403-425.
- Duncan, O.D. (1961). A socio-economic index for all occupations. In A. Reiss, O.D. Duncan, P.K. Hatt, & C.C. North (Eds.), *Occupations and social status* (pp. 109-138). New York: Free Press.

- Fehr, E., & Fischbacher, U. (2004). Third-party punishment and social norms. *Evolution and Human Behavior, 25*, 63-87.
- Frank, R.H. (1988). *Passions within reason: The strategic role of the emotions*. New York: Norton.
- Gallo, L. C., & Matthews, K.A. (2003). Understanding the association between socio-economic status and physical health: Do negative emotions play a role? *Psychological Bulletin, 129*, 10-51.
- Halaby, C.N. (2003). Where job values come from: Family and schooling background, cognitive ability, and gender. *American Sociological Review, 68*, 251-278.
- Hattori, Y. (2005). Social withdrawal in Japanese youth: A case study of thirty-five hikikomori clients. *Journal of Trauma Practice, 4*, 181-201.
- Henrich, J.P., Boyd, R., Bowles, S., Camerer, C., Fehr, E., & Gintis, H. (Eds.) (2004). *Foundations of human sociality: Economic experiments and ethnographic evidence from fifteen small-scale societies*. New York: Oxford University Press.
- Japanese Ministry of Health, Labor and Welfare (2003). *Guidelines on regional mental health activities regarding socially withdrawn, with special attention to teenagers and twenty-or-more-year-olds. How to care and help in municipalities' mental health welfare centers and health care centers?* In Japanese.
- Japanese Ministry of Health, Labor and Welfare (2008). *Comprehensive survey of living conditions of the people on health and welfare*. In Japanese.
- Jones, M. (2006). Shutting themselves in. *New York Times*, January 15.

- Kameda, T., Takezawa, M., & Hastie, R. (2003). The logic of social sharing: An evolutionary game analysis of adaptive norm development. *Personality and Social Psychology Review*, *7*, 2-19.
- Kameda, T., Takezawa, M., & Hastie, R. (2005). Where do social norms come from? The example of communal sharing. *Current Directions in Psychological Science*, *14*, 331-334.
- Kameda, T., Takezawa, M., Ohtsubo, Y., & Hastie, R. (2009). Are our minds fundamentally egalitarian? Adaptive bases of different socio-cultural models about distributive justice. In M. Schaller, S. J., Heine, A. Norenzayan, T. Yamagishi, & T. Kameda (Eds.), *Evolution, Culture, and the Human Mind*. New York: Psychology Press.
- Kariya, T. (2001). *Stratification in Japan and educational crisis: From reproduction of inequality to "incentive divide."* Tokyo: Yushindo. In Japanese.
- Kelley, H. H., Holmes, J. G., Kerr, N. L., Reis, H. T., Rusbult, C. E., & Van Lange, P. A. M. (2003). *An atlas of interpersonal situations*. Cambridge, UK: Cambridge University Press.
- Keltner, D., & Haidt, J. (1999). Social functions of emotions at four levels of analysis. *Cognition and Emotion*, *13*, 505-521.
- Kitayama, S., Mesquita, B. and Karasawa, M. (2006). The emotional basis of independent and interdependent selves: Socially disengaging and engaging emotions in the US and Japan. *Journal of Personality and Social Psychology*, *91*, 890-903.
- Knight, N., & Nisbett, R. E. (2007). Culture, class and cognition: Evidence from Italy.

- Journal of cognition and culture*, 7, 283-291.
- Kohn, M. (1977/1989). *Class and conformity: A study in values, with a reassessment, 1977*. Chicago: University of Chicago Press.
- Kraus, M.W., & Keltner, D. (2009). Signs of socioeconomic status: A thin-slicing approach. *Psychological Science*, 20, 99-106.
- Krugman, P. (2008). *The return of depression economics and the crisis of 2008*. New York: Norton.
- Marmot, M.G., Smith, G.D., Stansfeld, S., Patel, C., North, F., Head, J., White, I., Brunner, E., & Feeney, A. (1991). Health inequalities among British civil servants: The Whitehall II study. *Lancet*, 337, 1387-1393.
- Masataka, N. (2002). Low anger-aggression and anxiety-withdrawal characteristic to preschoolers in Japanese societies where *Hikikomori* is becoming a major social problem. *Early Education and Development*, 13, 188-199.
- Mesquita, B. and Karasawa, M. (2002). Different emotional lives. *Cognition and Emotion*, 16, 127-141.
- Muir, D., & Weinstein, E.A. (1962). The social debt: An investigation of lower-class and middle-class norms of social obligation. *American Sociological Review*, 27, 532-539
- NHK (Japan Broadcasting Corporation) (2009). *The voice of your heart*. <http://www.nhk.or.jp/fnet/hikikomori/> In Japanese.
- Nisbett, R.E., & Cohen, D. (1996). *Culture of honor: The psychology of violence in the South*. Boulder, CO: Westview Press.

- Ogino, S., Kawakita, M., Kudoh, K., & Takayama, R. (Eds.) (2008). *Sociological approaches to Hikikomori*. Tokyo: Minerva Shobo. In Japanese.
- Okano, K., & Tsuchiya, M. (1999). *Education in contemporary Japan: Inequality and diversity*. Cambridge, UK: Cambridge University Press.
- Panksepp, J. (1998). *Affective neuroscience: The foundations of human and animal emotions*. New York: Oxford University Press.
- Raudenbush, S.W., & Bryk, A.S. (2002). *Hierarchical linear models* (2nd ed.). London: Sage.
- Rees, P. (2002). Japan: the missing million. *BBC News: world edition*, October 20.
- Reis, H.T., & Gable, S.L. (2000). Event-sampling and other methods for studying everyday experience. In H.T. Reis & C.M. Judd (Eds.), *Handbook of research methods in social and personality psychology* (pp.190-222). Cambridge, UK: Cambridge University Press.
- Rohleder, N., & Nater, U.M. (2009). Determinants of salivary α -amylase in humans and methodological considerations. *Psychoneuroendocrinology*, 34, 469-485.
- Rohleder, N., Nater, U.M., Wolf, J.M., Ehlert, U., & Kirschbaum, C. (2004). Psychosocial stress-induced activation of salivary alpha-amylase: An indicator of sympathetic activity? *Annals of the New York Academy of Sciences*, 1032, 258-263.
- Rosenberg, M. (1965). *Society and the adolescent self-image*. Princeton, NJ: Princeton University Press.
- Saito, T. (1998). *Social withdrawal*. Tokyo: PHP Publisher. In Japanese.

- Sanfey, A.G., Rilling, J.K., Aronson, J.A., Nystrom, L.E., & Cohen, J.D. (2003). The neural basis of economic decision-making in the Ultimatum Game. *Science*, 300, 1755-1758.
- Sapolsky, R.M. (2004). Social status and health in humans and other animals. *Annual Review of Anthropology*, 33, 393-418.
- Sato, T. (2000). *Japan as an unequal society*. Tokyo: Chuko-shinsho. In Japanese.
- Schwarzer, R., Born, A., Iwawaki, S., Lee, Y. M., Saito, E. & Yue, X. (1997). The assessment of optimistic self-beliefs: Comparison of the Chinese, Indonesian, Japanese, and Korean versions of the general self-efficacy scale. *Psychologia*, 40, 1-13.
- Snibbe, A.C., & Markus, H.R. (2005). You can't always get what you want: Educational attainment, agency, and choice. *Journal of Personality and Social Psychology*, 88, 703-720.
- Stephens, N.M., Markus, H.R., & Townsend, S.S.M. (2007). Choice as an act of meaning: the case of social class. *Journal of Personality and Social Psychology*, 93, 814-830.
- South China Morning Post (2005). *Teen hermits are a growing concern for Hong Kong parents*. October 5.
- Takai, N., Yamaguchi, M., Aragaki, T., Eto, K., Uchihashi, K., & Nishikawa, Y. (2004). Effect of psychological stress on salivary cortisol and amylase levels in healthy young adults. *Archives of Oral Biology*, 49, 963-968.
- Watts, J. (2002). Public health experts concerned about "hikikomori". *Lancet*, 359, 1131.
- Yamaguchi, M., Deguchi, M., Wakasugi, J., Ono, S., Takai, N., Higashi, T., & Mizuno, Y. (2006). Hand-held monitor of sympathetic nervous system using salivary amylase

activity and its validation by driver fatigue assessment. *Biosensors and bioelectronics*, 21, 1007-1014.

Zielenziger, M. (2006). *Shutting out the sun: How Japan created its own lost generation*. New York: Nan A. Talese.

Zung, W. W. (1965). A self-rating depression scale. *Archives of General Psychiatry*, 12, 63-70.

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Footnotes

¹ Using the terminology of behavioral economics (Fehr & Fischbacher, 2004), these two situations correspond to “second-party punishment”, whereby one’s own reputation or property is directly threatened, and “third-party punishment”, whereby someone else’s property, or the community’s moral values, are threatened. In both cases, anger is the motivating force to sanction the transgressor (Sanfey et al., 2003).

² The mean baseline amylase was 25.4 (\pm 2.2) kU/L. The baseline was not related to the family SES index, $b=-.09$, *ns*, which means that differential responses to the anger-provoking stimuli, to be examined below, reflected differential acute stresses that participants felt toward the emotional stimuli (Rohleder et al., 2004; Rohleder & Nater, 2009). The two acute stress indices (see Figures 3 & 4) were highly correlated, $r=.86$, $p<.001$.

³ Based on the evidence that brain affective systems may be parceled into six distinct groups (Panksepp, 1998), ANPS estimate personality variability as to the putative influences of the six neural networks on behavior (PLAY, SEEK, CARE, FEAR, ANGER, and SADNESS systems) along with a Spirituality scale.

Table 1

Intercorrelations between variables in Study 1 (experience sampling) and Study 2 (psycho-physiological experiment).

Variable	1	2	3	4	5	6	7	8	9
1. Happiness	–	-.22	-.49**	-.64**	-.21	-.24	.28 ⁺	.26 ⁺	.30 ⁺
2. Anxiety		–	.02	-.21	-.07	-.07	.17	.11	-.10
3. Other emotions			–	.03	.25 ⁺	.21	-.20	-.23	-.28 ⁺
4. No emotion				–	.17	.07	-.37*	-.33*	-.21
5. Reversed sleep-wake cycle					–	.11	-.18	-.03	-.14
6. Being at home						–	.00	-.08	-.05
7. Personal insult (sAA)							–	.86**	.40*
8. Moral violation (sAA)								–	.35*
9. Seeking (ANPS)									–

Note. $N=42$ in Study 1 (variables 1-6) and $N=41$ in Study 2 (variables 7-9). N for cross-study correlations is 41.

** $p<.01$, * $p<.05$, + $p<.10$

Figure Captions

Figure 1. Mean proportions of reported emotions as a function of participant's family SES. Participants received instant messages 12 times a day on their mobile phones and answered their momentary feelings on our website over a week.

Figure 2. Mean response rates to the instant messages, as a function of family SES and time slot (a.m.) when the messages were sent.

Figure 3. Salivary Alpha-Amylase (sAA) response to the personal insult (log peak amylase after the personal insult – log baseline amylase) as a function of participant's family SES and sex.

Figure 4. Salivary Alpha-Amylase (sAA) response to the moral violation (log peak amylase after viewing the moral violation – log baseline amylase) as a function of participant's family SES and sex.

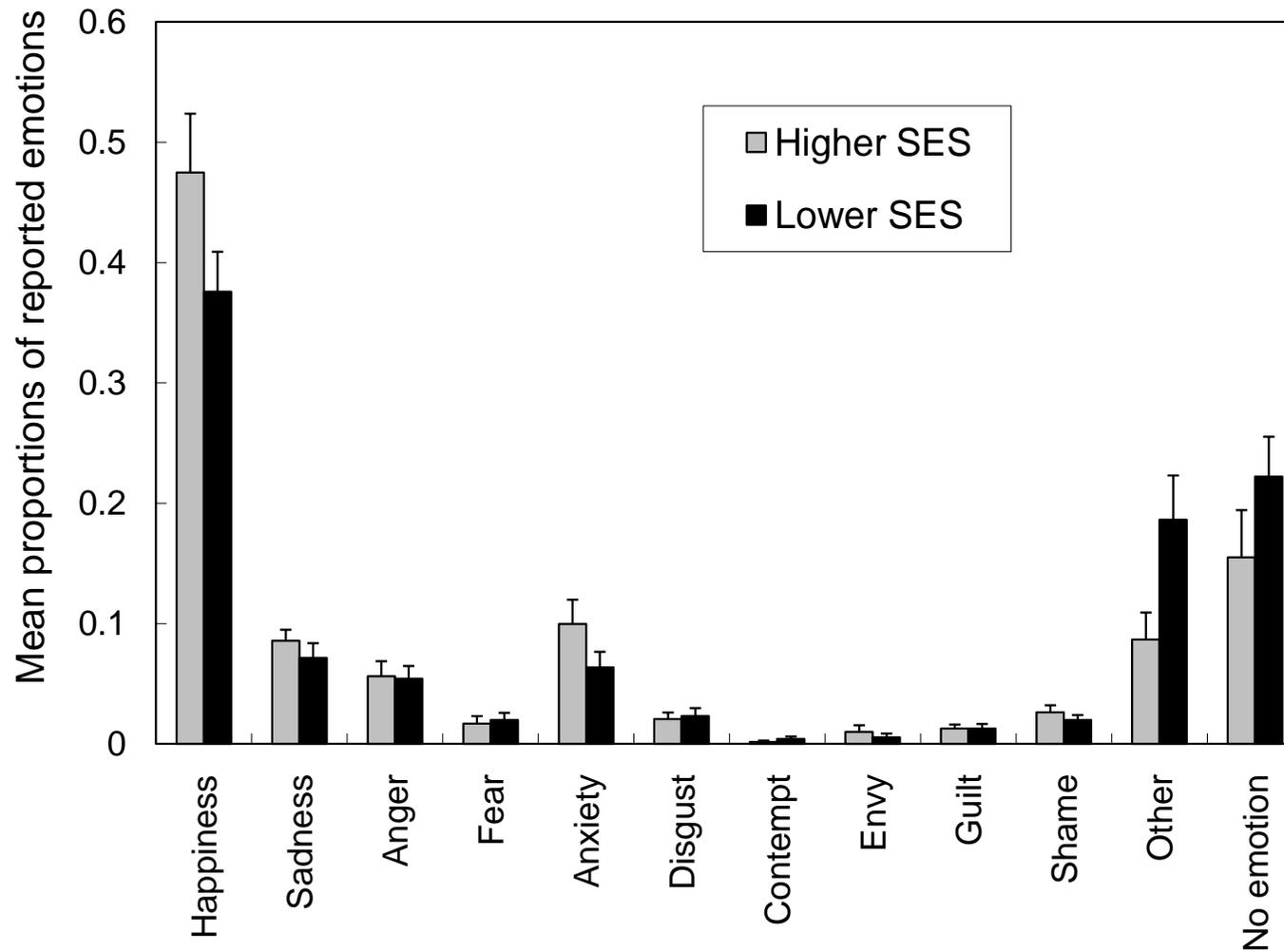


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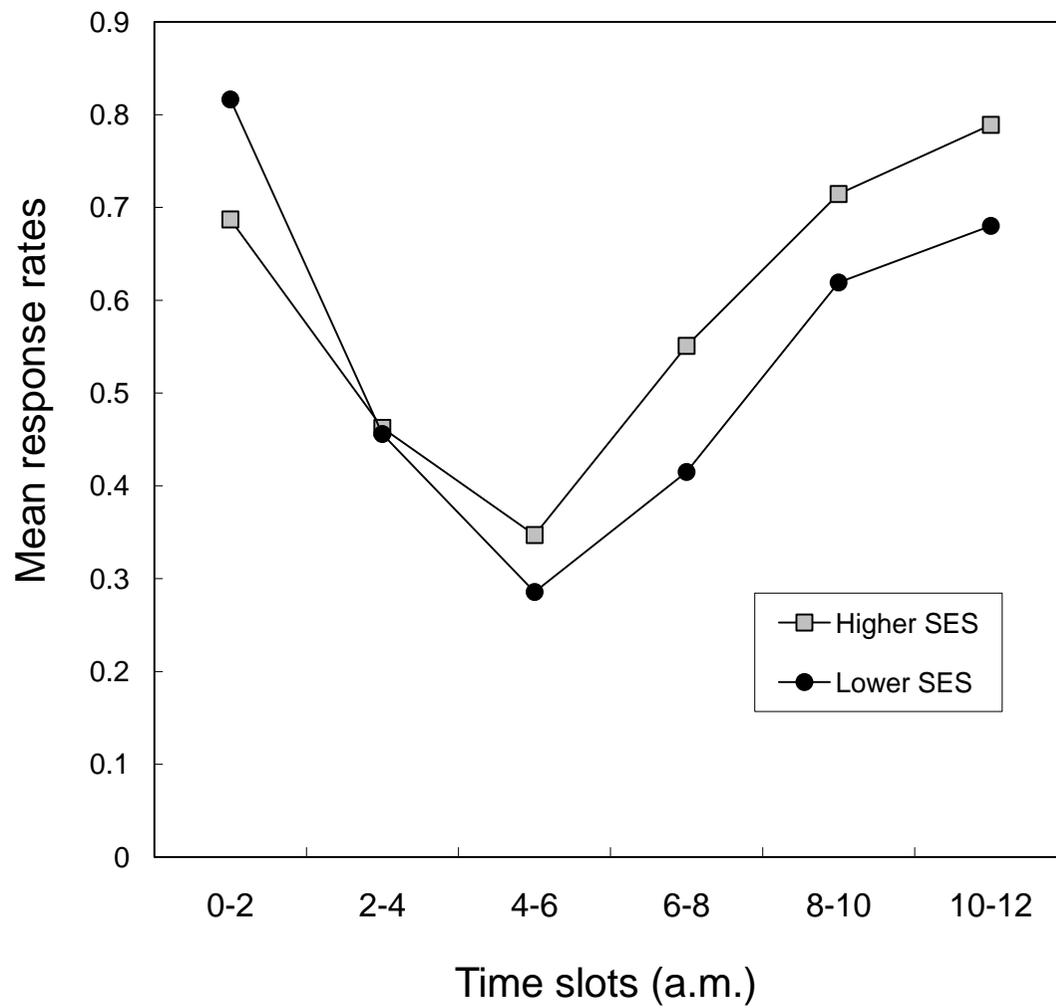


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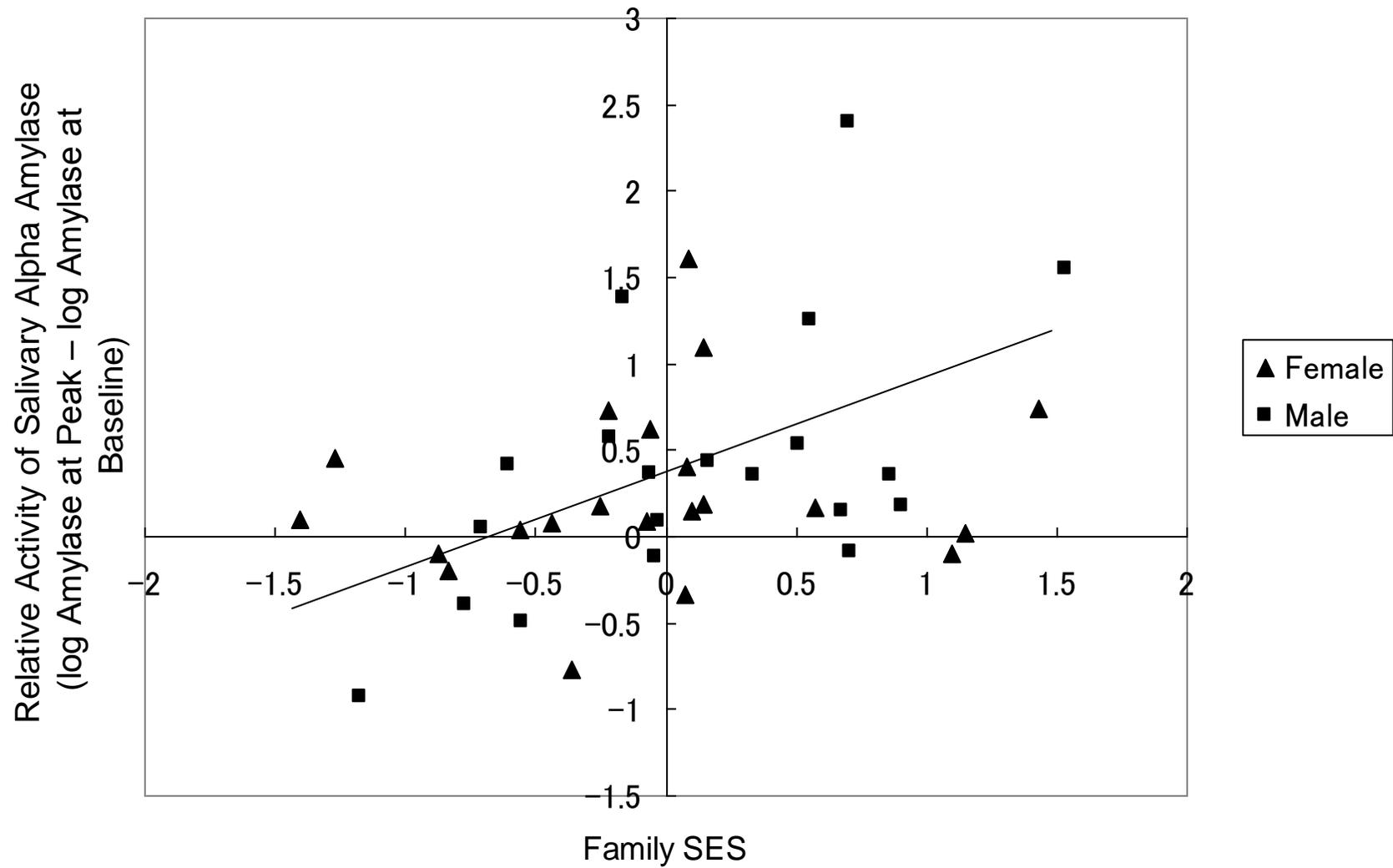


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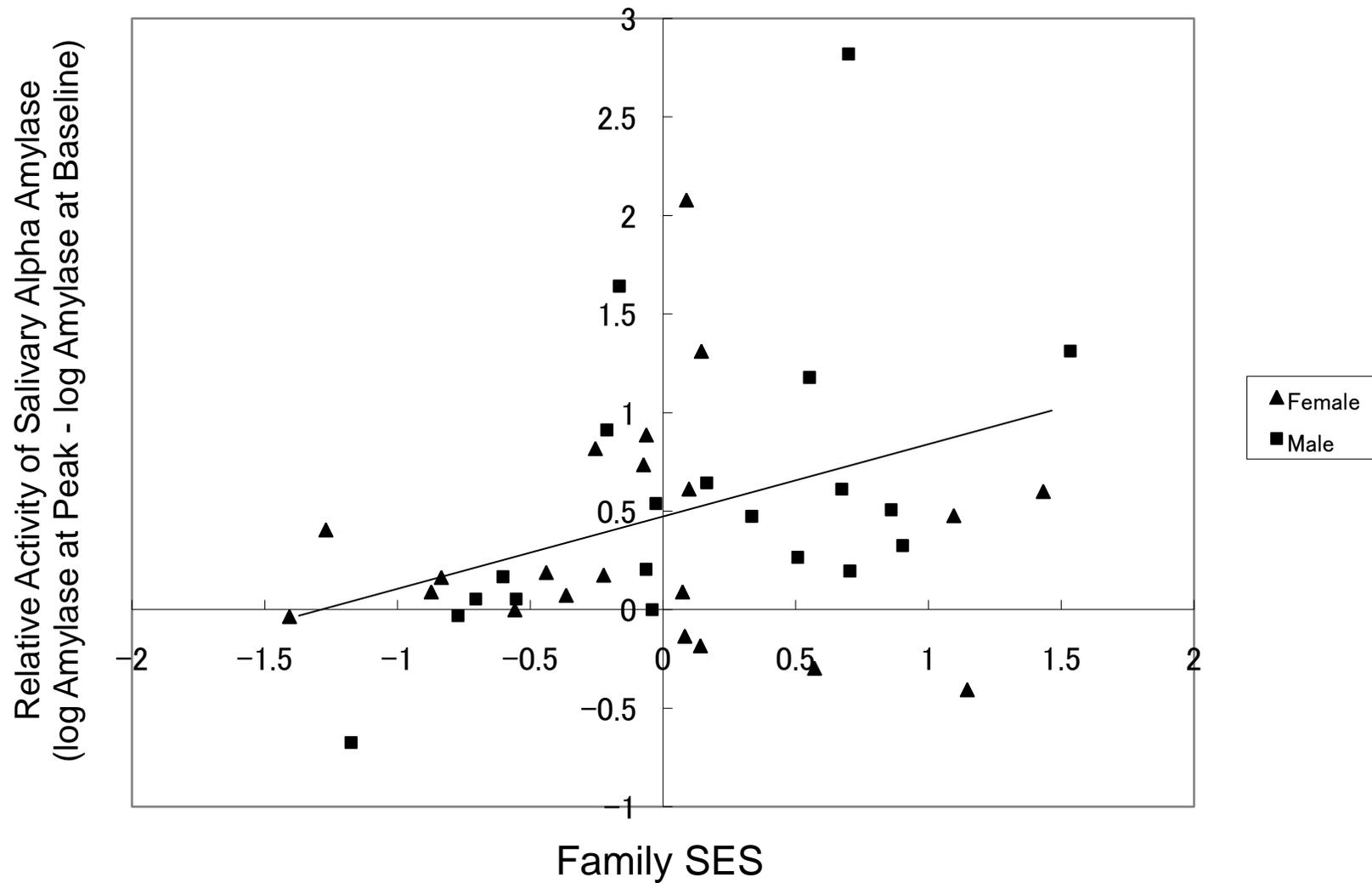


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