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Toward an Improved Understanding of Anger: A Control Theory Approach

Chon, Kyum Koo[1)] **Kang, Hye Ja**

Rehabilitation Psychololgy Rehabilitation Science
Taegu University

Recent studies have revealed that anger is an important psychological factor to cardiovascular diseases, the most leading cause of death in Korea. In order to understand the role of anger in the prevention, treatment, and rehabilitation of detrimental diseases such as cardiovascular disease, an attempt was made to unravel the nature of anger based on a control theory. To begin with, the rationale on why we need to study anger was provided. Then, an overview of a control theory was provided; first with a simple control system, then with a more complex human control system. With this background knowledge, the basic nature of anger was analyzed from a control theoretical perspective: generation, direction, intensity, type, and mixed emotions. The current model of anger was then compared with Higgins (1987). Finally, conclusions and implications of the present model are discussed.

Recent studies suggest that anger is one of the most critical psychological factors to cardiovascular diseases: hypertension (Everson, Goldberg, Kaplan, Julkunen, & Salonen, 1998), coronary heart disease (Kawachi, Sparrow, Spiro, Vokonas, & Weiss, 1996), and stroke (Sacco, Benjamin, Broderick, Dyken, Easton, Feinberg, Goldstin, Gorelick, Howard, Kittner, Manolio, Whisnant, & Wolf, 1997). Moreover, some other studies even suggest that anger is an important psychological factor to cancer (Kune, Kune, Watson, & Bahnson, 1991) and pain (Kerns, Rosenberg, & Jacob, 1994), suggesting that anger is one of three vital signs of health and disease (Spielberger, Ritterband, Sydeman, Reheiser, & Unger, 1995).

Nationalstatistics on the cause of death in Korea (2000) revealed that in 1999 the most leading cause of death was stroke (72.9 per 100,000), followed by heart disease (39.1 per 100,000), car accident (26.3 per 100,000), stomach cancer (24.0 per 100,000), and liver disease (23.5

1 Correspondence to: Chon, Kyum Koo, Dept. of Rehabilitation Psychology, Taegu University, 2288 Taemyong-dong, Nam-gu, Taegu 705-714. E-mail: kkchon@taegu.ac.kr

per 100,000). These statistics suggest that cardiovascular diseases are the most leading cause of death in Korea.

It is noteworthy that, although stress and coping have been mostly emphasized as critical psychological factors to health and diseases (Dohrenwend & Dohrenwend, 1974; Fisher & Reason, 1988), Lazarus (1993, 1999) strongly argues that we should explore emotions instead of stress and coping, since "[T]he three concepts, stress, emotion, and coping, belong together and form a conceptual unit, with emotion being the superordinate concept because it includes stress and coping" (Lazarus, 1999, p. 37).

The above mentioned empirical findings, statistics, and theoretical comment underscore the role of anger on health, especially on cardiovascular diseases. Unfortunately, with few exceptions (e.g., Averill, 1982), there has been little comprehensive framework on which we comprehend the basic nature of anger, especially in relation to health. Thus, in what follows, an attempt was made to understand human emotions and anger from a control theory, which has been regarded as one of useful meta-frameworks for goal-oriented behaviors such as emotion, motivation, and stress (Chon, 1989). The fundamental rationale underlying this approach is that human beings can be conceived of as highly sophisticated and complex control systems.

For ease of analyses, this paper will be divided into 5 sections: (1) rationale on the study of anger, (2) overview of a control theory, (3) a control theory approach to anger, (4) comparison with other models, and (5) conclusions and implications.

RATIONALE ON THE STUDY OF ANGER

As was described above, anger has been closely associated with cardiovascular diseases, suggesting the dire need to develop a sound theoretical framework on anger, to develop a reliable and valid instrument to assess anger, and to identify the mechanisms of how anger is associated with cardiovascular diseases. There are, however, two additional important reasons why we do need to understand anger: basicness of anger in human emotions and dearth of studies on anger.

Basicness of anger in human emotions

As can be seen below, anger has been listed as one of the basic emotions in both Western and Eastern theories of emotion (Averill, 1987; Hahn & Chon, 1991; Ortony & Turner, 1990; Shaver, Schwartz, Kirson, & O'Connor, 1987; Shweder, 1993). The following provides examples of emotions considered important by different cultures: for example in Confucianism (Hahn & Chon, 1991), 喜(joy), 怒(anger), 哀(sadness), 懼(fear), 愛(love), 惡(disgust), 欲(desire); Indian (Shweder, 1993), bhaya (fear), hasa (amusement), jugupsa (disgust), krodha (anger), rati (sexual passion), soka (sorrow), utsaha (perseverance), vismaya (wonder); Aquinas (1225-1274 A.D., cited in Averill, 1987), amor (love), audacia (courage), desiderium (desire), desperatio (despair), fuga (aversion), gradium (joy), ira (anger), odium (hate), spes (hope), timor (fear), tristitia (sorrow); Arnold (1960), anger, aversion, courage, dejection, desire, despair, fear, hate, hope, love, sadness; Ekman (1992), anger, disgust, fear, joy, sadness, surprise; Gray (1982), anxiety, joy, rage, terror; Izard (1992), anger, contempt, disgust, distress, fear, guilt, interest, joy, shame, surprise; James (1884), fear, grief, love, rage; Kemper (1987), anger, depression, fear, satisfaction; McDougall

(1926), anger, disgust, elation, fear, subjection, tender-emotion, wonder; Oatley & Johnson-Laird (1987), anger, anxiety, disgust, happiness, sadness; Panksepp (1982), expectancy, fear, rage, panic; Plutchik (1980), acceptance, anger, anticipation, disgust, joy, fear, sadness, surprise; Shaver, Schwartz, Kirson, & O'Connor (1987), anger, fear, joy, love, sadness, surprise; Tomkins (1984), anger, interest, contempt, disgust, distress, fear, joy, shame, surprise; Watson (1930), fear, love, rage.

In almost all of the context described above, four emotions--joy, sadness, anger, and fear--have been converged as the most basic and primary emotions. Thus, a variety of theories of emotions proposed in both Eastern and Western cultures suggest that joy, sadness, anger, and fear are the most basic emotions. Interestingly, in the Indian classification (Shweder, 1993) anger, disgust, perseverance, and sexual passion are regarded anger, disgust, perseverance, and sexual passion as primary basic emotions, while the other four emotions, amusement, sorrow, fear, and wonder as secondary basic emotions. Clearly, anger is a fundamental and vital human emotion, the experience of which appears to be universal.

Dearth of studies on anger

The research trend on human emotions thus far has been more focused on either depression or anxiety, with little attention on anger. For example, there have been a lot of cross-cultural studies on either anxiety or depression: Anxiety (Spielberger & Diaz-Guerrero, 1976, 1983, 1986, 1990; Spielberber & Sharma, 1976); depression (Fabrega, 1974; Kleinman, 1982; Marsella, 1981; Milenkov, 1969; Pfeiffer, 1968; Prince, 1967; Sartorius, 1973; Singer, 1975; cited in Marsella, Sartoruis, Jablensky, & Fenton, 1985). On the other hand, there have been few attempts to cross-cultural

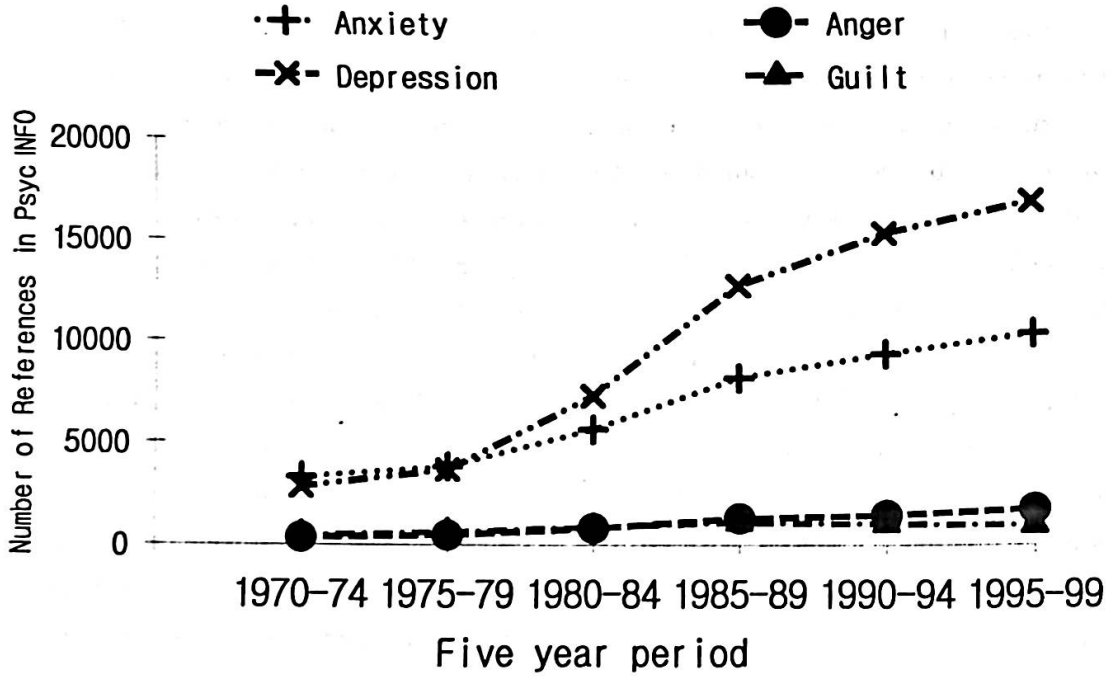

Fig 1. Number of references to negative feeling words in the psychology literature (PsycInfo, 1970-1999)

studies on anger (Chon, Kim, & Ryoo, 2000; Tanaka-Matsumi, 1995). In fact, as can be seen in Figure 1, anger has been far less explored than either anxiety or depression in the psychological literature (Kassinove & Sukhodolsky, 1995; Kassinove, personal communication).

Given its basicness in human emotions, and one of three vital signs to health and diseases, the pattern in Figure 1 suggests that there is a dire need to understand anger for its nature and function in human adaptation and health. As mentioned above, the framework on which our model is based is a control theory since a control theory appears to be a viable approach to human emotions in general and anger in particular.

AN OVERVIEW OF A CONTROL THEORY

Since Wiener's pioneering work, "Cybernetics: Control and communication in the animal and the machine" in 1948, there has been growing interest in control theory in many fields: engineering, biology, economics, psychiatry, communications, sociology, automation, computer science, to name but a few (Rose, 1974). In brief, control theory is concerned with how a system pursues certain purpose(s) through feedback control, and focused on its stability and change over time (Ashby, 1960; Carver & Scheier, 1981; Powers, 1973). To understand control theory, let us first take a look at a simple control system, a room thermostat.

Simple control system--a room thermostat

To begin with, a control system consists of four basic components--motivator, detector, comparator (or controller), and effector. Traditionally, three components, namely, the detector (or sensor), the comparator (or controller), and the effector (or actuator), have been emphasized in engineering control theory (Lerner, 1975; Rose, 1974). However, when it comes to living system such as human control system, another component, the motivator, is also critical (See also Kent, 1981). In a machine, the engineer ordinarily sets the desired state (of the motivator). Thus, the motivator is not generally considered as one of the basic components in engineering. In a living system, however, the motivator, shaped and operated by the system itself, is an important part of the basic components. Stated differently, whereas the desired state of a thermostat is generally and externally set by the operator, the desired state of a human being is in general largely determined and internally operated by a person. Therefore, a comprehensive understanding of human behavior needs to consider four basic components, namely, motivator, detector, controller, and effector. In what follows, the major concepts of a control system will be described, first with a thermostat, then with a more complex human control system.

The main function of the motivator is to provide the desired state of a control system; for example, to maintain the room at a desired temperature (e.g., 20^0C). The detector's main function is to measure the actual state (5^0C) from the environment. The comparator is to compare the actual state (e.g., 5^0C) with the desired state (e.g., 20^0C). If there is large discrepancy between the actual state and the desired state, then the comparator will give a command to the effector. The effector's main function is, here in this case, heater or boiler, to correct the problems in the environment. Stated differently, when the room temperature is too below the desired state, the

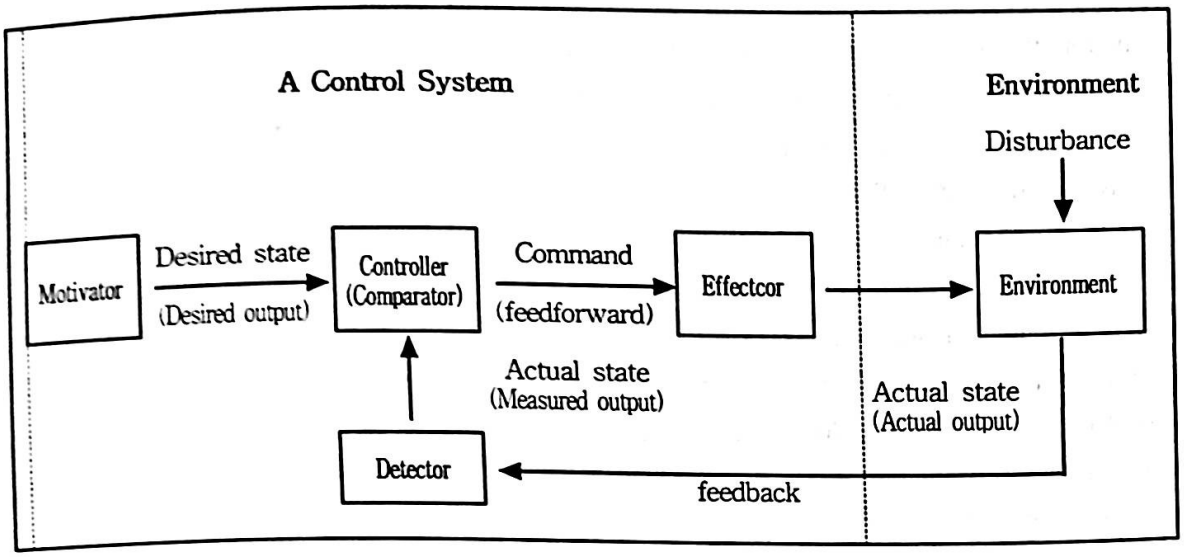

Fig. 2. Basic components of a control system

heater is turned on to make heat in the room. Once the thermosat operates and impacts on the environment by producing heat, information about the room temperature in the environment will be fed back to the system. This process continues until the actual state (actual temperature) is close enough to the desired state (desired temperature). The basic features of a control system is ıgramed in Figure 2.

The above example describes the main ıctions of the basic components of a control system. In order to understand the control system more fully, however, the following concepts need to be explained additionally.

Feedback mechanism

One of the most important concepts in control theory is feedback mechanism. There are two feedback control mechanisms. First, in a negative feedback control, the operation of a system is to reduce the discrepancy between the desired state and the actual state (deviation-reduction). Thus, when the actual temperature is too discrepant from the desired temperature, the whole system is operating to reduce the discrepancy between the two by making heat in the room. However, there is another kind of feedback control mechanism, namely, positive feedback control in which the operation of a system is to amplify the discrepancy between the desired state and the actual state compared to the initial deviation (deviation-amplification).

Traditionally, negative feedback control has been emphasized in applied sciences such as engineering, partly due to the primary concern of the engineers, that is, how to maintain a stable system. As Maruyama (1968) has pointed out, however, positive feedback is ubiquitous. Moreover, as Milsum (1968) aptly points out, "positive feedback is a characteristic feature of another equally universal phenomenon, that of growth in living systems" (p. vii).

As implied above, the major function of negative feedback control is stabilization. Thus, whenever the actual state is considerably discrepant from the desired state, the system will try to restore equilibrium through negative feedback control. On the other hand, the major function of positive feedback control is growth or development (Kuhn & Beam, 1982).

Of greater interest, especially with regard to human emotions, is the condition in which positive (or negative) feedback occurs. In principle, positive feedback control occurs when the actual state is congruent with the desired state, whereas negative feedback control occurs when the actual state is incongruent with the desired state. To put it differently, if the actual state is in the same direction to the desired state, then positive feedback control would occur; on the other hand, if both states are in an opposite direction, then negative feedback control would occur.

To summarize: there are two kinds of feedback: positive and negative feedback. The major function of each feedback control is development (positive) and stabilization (negative). One necessary condition for each kind of feedback is congruence (positive) or incongruence (negative) between the desired state and the actual state.

Steady state, transient state, and equilibrium

The above example of a room thermostat illustrates two different phases of a control system, from steady state to transient state, then from transient state to another steady state over time. To be more specific, if there is little discrepancy between the actual state and the desired state, the system is in a steady state, whereas whenever there is large discrepancy between the actual state and the desired state, the system is in a transient state.

The way a control system functions is that the desired state is not a fixed value but a tolerable range of values. Thus the comparator of the thermostat does not normally give command to the heater when the actual state (e.g., 19.5^{0}C) is not on the exact point of the desired state (e.g., 20^{0}C). On the other hand, the thermostat would starts operating the heater, if the actual state (e.g., 10^{0}C) is far off from the desired state (e.g., 20^{0}C) beyond the tolerable range.

Another important point to note is that a control system normally functions to maintain essential variables but not all variables. By essential variable it refers to critical variable which is directly related to the major purpose of the system. In the case of a thermostat, the essential variable is the temperature in the room. Thus, the other variables such as the color of the furnitures in the room or the price of the room has nothing to do with the operation of the thermostat unless they influence on the room temperature.

In sum, the foregoing analysis suggests that a control system is in a transient (or unstable) state when the actual state of essential variable is beyond the tolerable range of the desired state. In this situation, if a control system reduces discrepancy so that the actual state is inside the tolerable range, then a control system is again in a steady (or stable) state. As will be seen below, anger is characterized by a transient state in which a person is unstable and normally tries to restore another steady state by reducing the discrepancy between the actual state and the desired state.

Complex control system

The primary aim of this paper is to comprehend anger from a control theory perspective. In order to achieve this goal, we also need to understand the characteristics of human control system as a highly complex control system. In brief, human control system, as a living and complex system, embodies several characteristics such as adaptive, multivariable, hierarchical, and

cognitive control system.

The thermostat's desired state (e.g., 20°C) is fixed at a given time, unless external operator changes the desired state to a different level (e.g., 25°C). In contrast, a more complex system needs to meet the environmental demands which are repeatedly or even continuously changing. A well-known example of this is "steering a car." The purpose of the driver is in general to maintain a car in the middle of a chosen lane to drive safely. So whenever there is a discrepancy between the desired state (e.g., desired lane in the road) and the actual state (e.g., actual lane in the road) in varying situations (e.g., the curve of the road), the driver needs to turn the steering wheel to maintain a car in a chosen lane. Thus, compared to the thermostat focusing on a fixed control, the driver continuously modifies his or her performance in varying situations adaptively.

In the case of a thermostat, there is one and only (singular) desired state, namely temperature in the room. In a more complex system, however, there are multiple desired states. For example, driving a car safely needs several variables in check such as speed of a car, change of direction, appropriate pressure to the braking system, the distance from other cars among others. In a sense, the above mentioned adaptive control is a serial control, whereas multivariable control is parallel as well as serial control. In the case of human beings, there are a variety of desired states such as biological needs, psychological desires, social norms, and spiritual precepts.

Unlike a thermostat, a complex control system is normally structured as a hierarchical system. This is in part for pursuing multiple desired states in an orderly fashion. So, there is superordinate goal, and subordinate goals such that the desired state of the subordinate system comes from the superordinate system.

Finally, human beings, thanks to its extraordinally developed cognitive function, are characterized by cognitive control system. Thus, a person do not need to impact on the environment in actuality, instead, a person is able to estimate the possible impact on the environment cognitively. For example, there is no need to be hit by a car to understand the danger of the car accident (Bandura, 1977).

A CONTROL THEORY APPROACH TO ANGER

Generation of anger

According to the present model, anger is generated or elicited when there is discrepancy between the actual state (detector) and the desired state (motivator), entering in a transient state. However, there are two additional conditions to be met. First, the actual state needs to be sufficiently discrepant from the desired state. As noted earlier, a control system enters a transient state only when there is sufficient discrepancy between the desired state and the actual state. Second, as a multivariable control system, the desired state needs to be considerably important in the hierarchy. In general, the degree of discrepancy is inversely associated with the importance (or significance) of the desired state to the individual for the generation of anger. Stated differently, if a certain desired state is highly important to the individual, even a small discrepancy might trigger anger. In contrast, if a certain desired state is less important, then a larger discrepancy might be needed to trigger anger. Thus there are one necessary condition (discrepancy between the

desired state and the actual state), and two sufficient conditions to be met for the generation of anger in a following fashion.

$$\text{Generation of anger} = f[\,|\,DS - AS\,|\,,\ I]$$

where DS is the desired state, and AS is the actual state, and I is the importance of the desired state. The reason why we put | | is that, as will be seen in the next section, the same formula can be applied to both positive emotion (e.g., joy) and negative emotion (e.g., anger). Importance is described as a subscript to denote the secondary function to the generation of anger.

To illustrate: Suppose that you have an appointment with your friend at 6 pm, and somehow your friend doesn't appear even after 6 pm without any call or notice. In this situation, you may feel angry. Why is that? You may feel angry, (1) because the present situation is discrepant from what you wanted or expected (e.g., your friend should have been in time, or if late, your friend should have called you). In general, however, (2) you would feel angry only when your friend is quite late; you may not feel angry for two or three minutes late. It is also likely that (3) you may become angry even one minute late, if appointment with your friend is very important to you.

Direction: Positive vs. negative emotions

The present model posits that negative emotions, including anger, occur if the actual state (detector) is incongruent with the desired state (motivator). On the other hand, positive emotions such as joy occur when there is a congruence between them. Thus the necessary condition for the direction of emotion, whether it be positive or negative, is the congruence or incongruence between the desired state and the actual state.

$$\text{Positive emotions (e.g., joy)} = f[DS \approx AS)]$$
$$\text{Negative emotion (e.g., anger)} = f[(DS \not\approx AS)]$$

where DS and AS refer to the same notations as above.

According to this model, you would feel angry if your friend's late is incongruent with what you wanted or expected. What if, however, you wanted your friend to be late, for a particular reason? For example, you may make appointment with your friend to return the money you have borrowed from him. Let's suppose that, unfortunately, you have not prepared for it yet. So you may wish that he won't come to meet you. Then, you got his call that he in fact won't be able to see you today. What would you feel? Anger? Perhaps not. Instead, you may feel relief or some kind of positive emotions since the actual state is congruent with what you wanted. In fact, theories of emotion have proposed that goal congruence would lead to positive emotions, whereas goal incongruence to negative emotions, including anger (Lazarus, 1991; Roseman, 1984; Scherer, 1984; Simonov, 1970).

Intensity

Intensity of anger involves with the following three factors: (1) intensity of anger is proportional to the importance (or significance) of the desired state (motivator); the more significant the desired state is to the individual, the more intense the emotion is. (2) Intensity of anger is also

proportional to the degree of discrepancy between the desired state (motivator) and the actual state (detector); the greater the difference, the more intense anger is. (3) Intensity of anger is inversely proportional to the degree of the controllability (effector) to correct the problems in the interaction between the system and the environment; the more controllable, the less intense anger is.

Intensity of anger = f[IxD/C]

where I, D refer to the same notations as above, while C is the controllability of the effector over problems.

Thus, the intensity of anger in the above example would be increased, (1) if the meeting with your friend is more important, (2) if your friend comes later; others things being equaled, the intensity of anger will be stronger in 30 minutes late than in 10 minutes late. On the other hand, (3) if you could handle the situations (e.g., by replacing your friend with other friend, or by tracing him utilizing mobile phone etc), the intensity of anger will be deceased. Parenthetically, the validity of the above formula was examined, and supported (Chon, 1999). More specifically, intensity of anger was positively associated with the importance of the anger episodes and with the discrepancy between the actual state and the desired state, but negatively associated with controllability over anger episodes.

Type

According to Averill (1975), there are about 550 different words connoting different human emotions in English. In what follows, however, we will focus on the anger and some of the basic emotions related to anger, instead of dealing with a multitude of emotions experienced in everyday life.

Three standards in the motivator

As mentioned earlier, human beings are characterized by a multivariable control system in which a person is pursuing a variety of the desired states. All these desired states, however, can be grouped into three distinguishable, but not mutually exclusive, categories of standards.

A person is born to be regulated by existential (or necessary) standard for the survival. Stated differently, a person needs to fulfill minimal level of essential variables for existence or survival. For example, there are certain levels of glucose or water for the survival of a person at the biological level. In a similar fashion, there are certain minimal levels of essential variables at a personal, societal, or national level.

A person is also geared to pursue desirable standard for a better life. Desirable standard is a similar concept to ideal standard proposed by Higgins (1987). Since the concept of ideal connotes something unrealistic or impossible in life, desirable standard is adapted in our model to emphasize something realistic and possible which can be accomplished in life.

Finally, a person, in addition to existential standard and desirable standard, learns and internalizes imperative standard composed of a lot of Dos and Don'ts in a given culture. Imperative standard refers to "should do" or "should not do," similar concept to "ought" standard by Higgins (1987), and 'sodangyeon (所當然)' proposed in Neo-Confucianism (Hahn, 1997).

Anger, sadness, fear, and joy

How could we explain four basic emotions, namely, joy, anger, sadness, and fear? To begin with, as was explained above, whenever there is incongruence between the actual state and the desired state, negative emotions will be elicited. In contrast, whenever there is congruence between the actual state and the desired state, positive emotions will be elicited.

Thus, as can be seen in Figure 3, when the actual state is congruent with desirable standard, joy will be ensued. On the other hand, when the actual state is incongruent with desirable standard, sadness will be ensued. Note that sadness is located in the opposite side of joy.

How about two other negative emotions, anger and fear. As was noted above, anger will be ensued when the actual state is incongruent with the imperative standard. Note that anger is located on the opposite side of fulfill, which is the positive emotion when the actual state is congruent with the imperative standard. Finally, fear will be ensued when the actual state is incongruent with existential standard; when the actual state is congruent with the existential standard, relief, located on the opposite side of fear, will be ensued.

You may noticed that compared to four basic emotions, fulfill or relief have been seldomly listed as representative emotional words. Part of the reasons why people normally do not experience fulfill as basic emotion is that the congruence of the actual state with imperative standard is proper, so fulfillment of any imperative standard in general does not provide any prize for that. Instead, if not fulfilled, there may be sanctions against this, ensuing anger and/or aggression. In a similar fashion, congruence between the actual state and existential standard is necessary for the survival of a person. If not satisfactory, however, it may lead to threats to the existence of a person, ensuing fear.

In order to understand the differences among anger, sadness, and fear, let's take a look at an

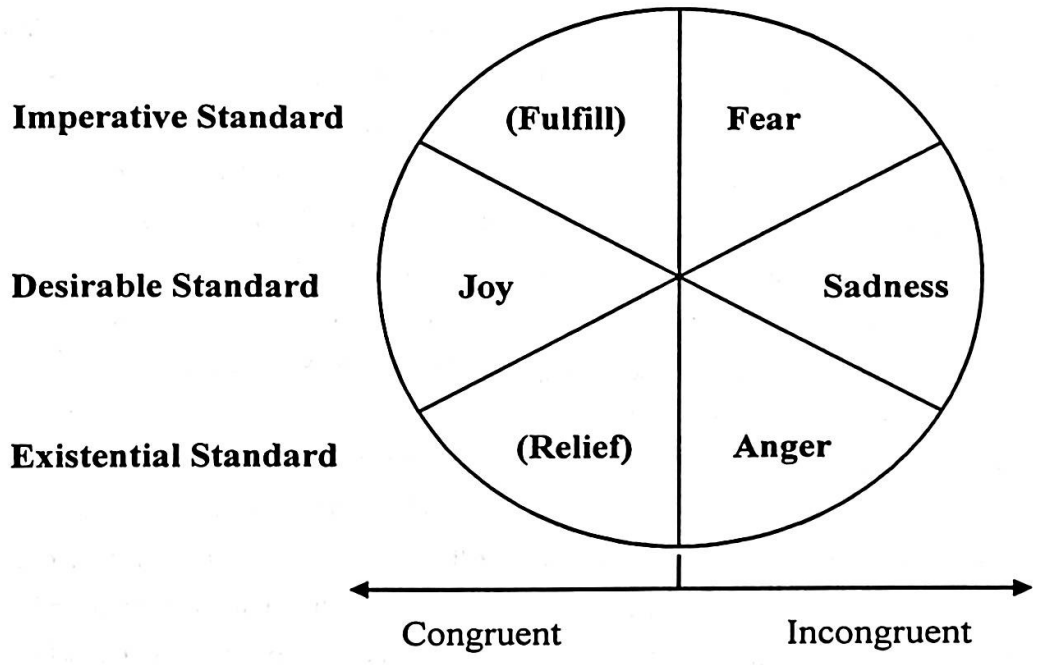

Fig. 3. Four basic emotions from three standards

anger episode based on Roseman, Antoniou, and Jose (1996):

> "In doing laundry at my sister's I had left my clothes there and asked her to finish them. I'd told her I would come and get them later that night. When I called to tell her I was coming, I got her answering machine telling me she'd gone out, but I could get my clothes at 8 the next morning! I was angry because I had virtually no clothes this week and was depending on my clean clothes for the next day. I was also not about to get up early to do something that she *should have been* around for me to that night. I was angry with her for not staying in an extra half an hour to wait" (p. 249, italic added).

Why did the protagonist experience anger in this situation? Our model would argue that she thought that her sister "should have been around" that night at least an hour to wait (imperative standard), but her sister was not there (actual state), or she should have cleaned clothes that night (imperative standard), but her clothes were not ready because her sister went out (actual state) etc.

What if the actual state is violating against other standards? For example, what if she has valued a strong bond among family members including sister relationship. If she felt that her sister's action was a sign of breaching the strong relationship between her and her sister, then she may feel sadness, instead of anger.

What if she really has no other clothes to put on to go to her office next morning? What if she has no other people to resort on or means to handle the situations? In this case, she may feel fear, instead of anger.

Lutz (1988, cited in Tanaka-Matsumi, 1995) analyzed the social conditions when "song," a similar concept to "justifiable anger" in English culture, is provoked among the Ifaluk of Micronesia: "(1) there is a rule or value violation," (Tanaka-Matsumi, 1995, p. 82), consistent with our notion of violation against imperative standard a person hold.

According to Harris (1993), children about two to three years old assume that the emotions they experience "will be a function of the match between reality and their goals" (p. 238). Furthermore, children realize that "one person may be pleased to be given milk if that was what he or she wanted, whereas another person may be sad to be given milk if he or she wanted juice instead" (p. 238), supporting our model in the elicitation of joy and sadness based on congruence or incongruence between the actual state and the desirable standard.

In our model, fear is supposed to be elicited when existential standard is violated or threatened. In fact, the major function of fear is "to motivate escape from dangerous situations" (Izard, 1993, p. 636). Moreover, "the threat may be psychological as well as physical. Threats to one's self-concept, one's integrity, or one's psychological well-being can elicit fear" (p. 636), suggesting that people experience fear when the actual state is threatening their existence or on the verge of threatening at various levels.

Four selves in the controller

Self is "dynamic cultural creation; individuals' self-views, emotions, and motivations take shape and form within a framework provided by cultural values, ideals, structures, and practices" (Cross & Madson, 1997, p. 6). Therefore, the understanding

of self is the royal road to emotion, cognition, and motivation. A person, however, can be conceptualized to consist of more than two selves. To be more specific, a person is composed of physical self, personal self, social self, and spiritual self.

It should be pointed out that self in the present model is not focused on a target, but on a referent (Markus & Kitayama, 1991) or standpoint (Higgins, 1987). Stated differently, borrowing concept from James (1890) or Cooley (1902), self as "I" but not "Me" is focused in the present framework. Cooley (1902, cited in Kemper, 1993, p. 46) depicts this process by an analogy of "looking glass": "[I am] standing before a 'looking glass,' giving rise to the idea of the 'looking-glass self'" (p. 46, [ ] added). Cooley also describes elements and mechanisms of how we view things from different perspectives: "In imagination we perceive in another's mind some thought of our appearance, manners, aims, deeds... and are variously affected by it. A self-idea of this sort seems to have three principal elements: the imagination of our appearance to the other person; the imagination of his judgment of that appearance; and some sort of self-feeling, such as pride or mortification" (p. 184, cited in Kemper, 1993, p. 46). Let us explore some possible selves below.

A person is equipped with physical self. For example, although an obese person tries to reduce the amount of food consumption at the conscious level, he or she may easily succumb to temptation of delicious foods such as ice cream or fat meat by physical self. Head (1920, cited in Markus & Kitayama, 1991) acknowledged "the existence of a universal schema of the body that provided one with an anchor in time and space" (p. 225).

A person is also equipped with personal self. This personal self has been described as "own," (Higgins, 1987)" private self," (Snyder, 1987) or "personal standard" (Bandura, 1982, cited in Higgins et al., 1986). It has been predominantly emphasized in an individualistic or independent culture (Markus & Kitayama, 1991).

A person is also shaped to develop social self in a given society and culture. Social self has been described as "others," (Higgins et al., 1986) "public self," (Snyder, 1987), "social referential comparison," (Bandura, 1982) "ideal social self" (James, 1890/1948, cited in Higgins, Strauman, & Klien, 1986). Social self has been more emphasized in collectivists or interdependent culture. In fact, interdependent self is likely to think, feel, and motivate from other's standpoint (Markus & Kitayama, 1991), inhibiting the "personal" standpoint in favor of "other" standpoint (Hsu, 1981, cited in Markus & Kitayama, 1991).

Finally, a person can be thought of possessing spiritual self. In general, spiritual self has been less explored compared to other aspects of self in psychology. Spiritual self, however, has been described as "superego" in Freud (1923/1961), and "spiritual self" in James (1890/1948, cited in Higgins, 1987). Although both social self and spiritual self are adapting other's standpoint beyond personal self, these two selves can be distinguishable. In brief, spiritual self perceives the situations from supernatural being's standpoint or one's internalized morality largely influenced by (people believe) supernational being's standpoint. On the other hand, social self perceives the situations from societal standpoint, especially from normative reference group.

Anger, shame, and guilt

In the previous section, anger was described to

be ensued when the actual state is violated against imperative standard. To be more exact, however, the violation against imperative standard could bring shame or guilt as well as anger, depending on which perspective a person stands. As can be seen in Figure 4, if a person perceives the actual state violating against imperative standard from a personal standpoint, anger will be ensued. However, if a person perceives the situation from a social perspective or spiritual perspective, shame or guilt will be brought out respectively. In a similar fashion, joy (personal), pride (social), and bliss (spiritual) will be ensued depending on the perspective a person stands. Parenthetically, all these negative emotions may be developed primarily from distress, whereas all positive emotions from contentment (Lewis, 1993). You may also noticed that, for a brevity, either sadness and fear were not depicted in Figure 4.

In Figure 4, there is a tunnel in which a circle could move up and down, and move around from left to right or vise versa. A circle stands for a particular self processing information from a particular standpoint at a given time and place. Stated differently, a person perceives situation or processes information from a personal standpoint at one moment, then from a social standpoint at the other moment, etc. It is noteworthy in Figure 4 that there is a solid line and a dotted line between a personal self and social self. In this diagram, dotted line refers to a loose demarcation line between a personal self and social self, predominant in interdependent culture. In contrast, solid line refers to a distinctive demarcation line between two selves, salient in independent culture (Markus & Kitayama, 1991).

There are two information processing; serial and parallel processing. In general, personal self, social self, and spiritual self are in the process of serial processing so that a person is able to perceive the situations from any of three perspectives at a given time. Thus, as will be seen below, a person would experience different emotions one by one even in a short period of time. On the other hand, physical self may be in the process of parallel processing with other three

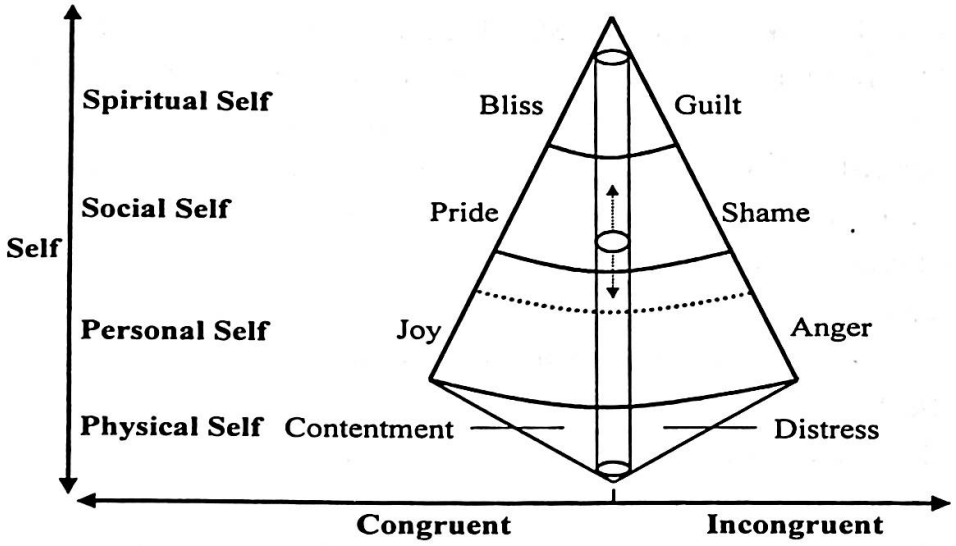

Fig. 4. Different types of emotions from four selves

selves, preserving desired states such as glucose level or body temperature within a permissible range so that a person is able to survive in a homeostatic way (Cannon, 1932).

Let us explore the differences among anger, shame, and guilt borrowing the anger episode presented above. What if the protagonist began thinking about the possible gossip about this happening among her neighbors. What if her neighbor became aware of this events, despite the fact that she has been telling them that there has been a strong bond between her and her sister. In this situation, she may feel shame, instead anger.

Now what if she is a devoted christian. So, although she felt angry at the beginning of this episode, a verse in the bible may occurred to her: "In your anger, do not sin. Do not let the sun go down while you are still angry" (Ephesians, 4: 26). If she reminds of this verse, and if she perceives the situation from a spiritual standpoint, she may feel guilt, instead of anger.

The above analyses seem to be comparable with other frameworks. For example, according to Averill (1982), a common cause of anger episode is "loss of personal pride," suggesting that anger is generally derived from personal standpoint. In fact, Markus and Kitayama (1991) listed anger as ego focused emotion emerging from personal standpoint.

In contrast to anger, shame is labelled as other focused emotion resulting from other's standpoint (Markus and Kitayama, 1991). Shame is in fact normally brought out and regulated by from a social perspective: "Persons who fail to fulfill their responsibility in the community may become the subjects of ridicule and contempt-strong stimuli for shame. Thus shame acts as a force for social conformity and social cohesion, and the anticipation of shame or shame avoidance motivates the individual to accept his or her share of responsibility for the welfare of the community" (Izard, 1993, p. 636). In a similar fashion, shame compared to anger is a more interpersonal emotion: "anger and shame were very similar in terms of activation and pleasantness, but shame was much higher than anger in the extent of interpersonal engagement" (Markus & Kitayama, 1991, p. 238).

In line with the current model, guilt is likely to occur "from acts that violate ethical norms, principles of justice, feelings of responsibility, religious codes, or moral values" (Wicker, Panyne, & Morgan, 1983). It also "accompanies moral transgressions, acts that violate ethical standards appropriated, metaphorically, by the superego as conscience" (Liem, 1997, p. 365).

Mixed emotions

Sometimes we may experience more than two emotions simultaneously or sequentially. For instance, we might feel angry at the beginning, then it might turn into guilt, or vise versa. How could we explain this phenomenon?

According to our model, it can happen because we process adaptive or multivariable control in a very short time. To illustrate: If your friend made bad remarks on you, you may experience anger, but possibly with sadness or shame as well. These mixed emotions, in a more exact analysis, can be explained by different comparisons between the actual state and the desired state sequentially. For example, at the beginning, if compared to the standard that my friend should have respected me, then anger may be ensued. In contrast, if compared to the standard that I wish my friend would have respected me, then sadness may more likely be ensued. Finally, if compared to the

standard that my friend should have respected me but other people knew that I was not respected, then shame may more likely be ensued (see Figure 4). Thus, although mixed emotions appear to be happening simultaneously, it is serial processing with more than two comparisons between the actual state and the desired state in a short period of time, resulting in different emotions as described in the model we presented above.

To make it clear, let's take a look at two other scenarios. Suppose that a businessman is going to merge another company in an illegal way. In this kind of situation, he may feel happy but also guilty. The reason is that the situation is congruent with one of his desired states (e.g., expanding the company). At the same time, it is also incongruent with one of his desired states, namely imperative standard (e.g., "expansion should be accomplished in an appropriate measure").

Let's also suppose that a mother has an imperative standard that people should be honest. What would happen if she found that one of her children told a lie? According to our model, she may be angry since the actual state is incongruent with her imperative standard. Let's further suppose that, as a consequence, she went to his room and scolded her boy, who was chatting with his friends. Then, she may feel shame because she has been brought up with the social rule that parents should not scold their children in front of friends. Finally, on her way back to the kitchen, religious teaching occurs to her that "Fathers, don't scold your children so much that they become discouraged and quit trying" (Colossians 3; 21). Now, she may begin to feel guilt.

The above examples suggest that mixed emotions can be a result of a multivariable and adaptive control mechanism, thus seemingly parallel processing but serial processing in principle.

COMPARISON WITH OTHER MODELS: WITH SPECIAL REFERENCE TO HIGGINS (1987)

In preparing for this paper, we were aware that there have been several attempts to explain human emotions, including anger, based on a control theory or systems theory (Carver & Scheier, 1981; Heise, 1989; Lazarus, 1999; Scheier & Carver, 1977, 1982; Simonov, 1970, 1986; Stein & Levine, 1987). Comparisons of the present model with other models are beyond this paper, largely due to space limitations, and will be made in another separate paper. It may be worthwhile, however, to compare the current model with Higgins (1987).

There seems both similarities and differences between the two models. To begin with, there appears to be common elements between the two models in the following ways: (1) Both models emphasize that specific self-discrepancies are linked to different types of emotions. (2) Two important aspects of self are domains and standpoints. Although similar in these aspects, there are differences between the two: (1) The current model provides a more comprehensive framework on human emotions, including generation, direction, intensity, and types among others. In contrast, Higgins is more confined to types of emotions, with some comments on intensity. (2) The current model supposes a more specified classification of standards; imperative, desirable, and existential standards, whereas Higgins suppose two types of standards, ideal and ought. (3) The current model also supposes a more extended categories of standpoints; (physical),

personal, social, and spiritual. On the other hand, there are only two standpoints, namely own versus other, espoused in Higgins. (4) In addition, the current model espouses another important emotion, namely, anger, together with agitation-related emotion and dejection-related emotion explained in Higgins. (5) Higgins' model predicts that the comparison between actual self and ought self would lead to agitation-related emotions such as fear, threatened, resentment, guilt, self-contempt, and uneasiness. In contrast, the current model predicts that the comparison between the actual state and imperative standard would lead to anger (if viewed from personal standpoint), shame (if viewed social standpoint), and guilt (if viewed spiritual standpoint). (6) Higgins also predicts that the comparison between the actual self and the ideal self would lead to shame, whereas the comparison between the actual self and the ought self would resulted in guilt. In contrast, both shame and guilt would be ensued as a result of the comparison between the actual state with imperative standard in our model.

In order to understand the above mentioned major differences between the two models, we need to deal with concepts, rationale, and theoretical background adapted by each model. Due to space limitations, however, we will just confine to one major difference, namely the different conceptualization of standpoint below.

One major difference between the two models is the meaning of the standpoint. To be more specific, in Higgins' model, the comparison between actual/own and ought/other refers that "the current state of his or her actual attributes, *from the person's own standpoint*, does not match the state that the person believes some significant other person considers to be his or her duty or obligation to attain, . . . vulnerable to agitation-related emotions" (Higgins, 1987, p. 323, italic added). In a similar fashion, the comparison between actual/own and ideal/other refers that "the current state of his or her actual attributes, *from the person's own standpoint*, does not match the ideal state that the person believes some significant other person hopes or wishes that he or she would attain" (Higgins, 1987, p. 322, italic added). On the other hand, in our model, the comparison between the actual state and the desired state from other's standpoint refers to "should do/should not do," or "Do's/Don'ts" from other's perspective. As can be noted, standpoint in Higgins' model is anchored on personal standpoint, regardless of own or other, whereas the current model adopts broad spectrum of standpoints, including personal, social, and spiritual perspectives. To put it differently, "standpoints on the self" was focused in Higgins' model (Tangney, Niedenthal, Covert, & Barlow, 1998), while "standpoints of the self" was emphasized in our model.

CONCLUSIONS AND IMPLICATIONS

Recent studies revealed that anger is an important psychological factor to cardiovascular diseases, the number one cause of death in Korea. Moreover, although anger has been listed as one of the most fundamental and basic emotions in major theories of emotions in East and West, the studies on anger have been far less conducted in psychological literature. Thus, the primary purpose of the paper is to understand anger for its nature and function based on a control theory. More specifically, the present model attempts to delineate the following issues. What distinguishes emotional

states, including angry, from non-emotional states? What is the necessary condition for distinguishing between positive emotions (e.g., joy) and negative emotions (e.g., anger)? What determines the intensity of anger? How could we explain the presence of a variety of emotions in everyday life, say anger, sadness, fear, shame, and guilt? How could we explain mixed emotions? The forgoing analyses led us to the following conclusions:

1. Anger can be conceived of as transient state. The transformation of transient state from the steady state may arise when the actual state is largely discrepant from the desired state. For example, anger may arise when the actual state is largely discrepant from the imperative standard. The current transient state will be terminated if the actual state is close enough to the desired state, at which point the system is transformed into another steady state.

2. With respect to the direction of emotions, negative emotions, including anger, would occur when the actual state is incongruent with that of the desired state; on the other hand, when the actual state is congruent with the desired state, the positive emotions would ensue.

3. The intensity of anger is determined by three factors in the following fashion: Intensity of emotion is proportional to the importance of the desired state, and to the degree of discrepancy between the desired state and the actual state. On the other hand, the intensity of emotion is inversely proportional to the degree of controllability over problems in the environment.

4. People experience a variety of emotions, primary because a person possesses and pursues different types of standards against which the actual state is compared. Thus, if the actual state is incongruent with a person's imperative standard, anger is likely to be ensued, whereas if it is incongruent with a desirable standard or existential standard, sadness or fear will be ensued, respectively. Different types of emotions are also determined by the standpoint on which a person views. For example, the incongruence between the actual state and imperative standard would lead to anger, shame, or guilt, depending on the standpoint a person views. More specifically, anger will be ensued when a person views the incongruence between the actual state and imperative standard from a personal standpoint, whereas shame and guilt will be ensued when a person views it from a social standpoint or spiritual standpoint respectively.

5. People would experience more than two emotions in a short period of time, primarily because a person is equipped with multivariable and/or adaptive control system. Although mixed emotions appear to occur simultaneously, each emotion in principle is in the process of serial processing, say anger, then into sadness or vise versa.

What may be the implications of the present model to human emotions in general and anger in particular? To begin with, control theory seems to provide a useful framework as a process model as well as a structural model. To be more specific, it suggests that there are three phases in the experience and expression of emotions; steady state, transient state, then another steady state. As a structural model, control theory suggests that there are four components, namely motivator, detector, effector, and controller. As described above, control theory appears to provide a useful framework on the basic natures of anger (e.g.,

generation, direction, intensity, and type) in a systematic way, which is rare in the previous models.

In addition to its contribution to the understanding of human emotions and anger, the present model also seems to provide a useful framework on how to understand the relations between anger and health. For example, as was noted earlier, anger has been closely associated with cardiovascular diseases. However, the relation between anger expression mode (i.e., anger-in vs. anger-out) and cardiovascular diseases has been inconsistent. More specifically, regarding the relation between anger expression mode and cardiovascular diseases, there are two opposing camps: anger-in camp (Everson, Goldberg, Kaplan, Julkunen, & Salonen, 1998; Gentry, Chesney, Gary, Hall, & Harburg, 1982; Johnson, Spielberger, Worden, & Jacobs, 1987; Spielberger, Johnson, Russell, Crane, Jacobs, & Worden, 1985; Spielberger, Krasner, & Solomon, 1988) and anger-out camp (Engebretson, Matthews, & Scheier, 1989; Everson, Goldberg, Kaplan, Julkunen, & Salonen, 1998; Siegel, 1985, 1986; Siegman, 1994, 1997; see also Keinan, Ben-Zur, Zilka, & Carel, 1992). Each camp has been supported by theoretical frameworks and empirical findings, creating confusion in this field.

One of the possible resolutions may be to consider the congruence or incongruence between the actual state (actual expression mode of anger) and the desired state (standard of anger expression). To begin with, a person is apt to adopt a particular style of anger expression, whether it be anger-in or anger-out, as standard of anger expression. Thus, once a person establishes standard of anger expression, incongruence between the actual state (i.e., anger expression mode) and the desired state (i.e., standard of anger expression) is likely to lead to deleterious effects on health, including cardiovascular diseases. On the other hand, congruence between these two states is not likely to result in any ill effects on health. In fact, anger was shown to be deleterious only if the anger expression mode was incongruent with the standard of anger expression for blood pressure (Chon, Hann, Lee, & Spielberger, 1997) or CHD (Chon, Han, Chang, Kim, & Oh, 1998).

The above explanation seems to be in line with other comments and empirical findings. In brief, anger-in has been shown to be associated with cardiovascular diseases in independent or individualistic culture where anger expression is more allowable (Stephan, Stephan, & De Vargas, 1996), and more frequently experienced (Chon, Kim, & Ryoo, 2000; Grazzani-Gavazi & Oatley, 1999; Roseman, Dhawan, Rettek, Naidu, & Thapa, 1995). On the other hand, anger-out appears to be more associated with cardiovascular diseases in interdependent or collectivists culture where anger expression is not likely to be conveyed to others (Triandis, 1994). In short, anger expression mode, whether it be anger-in or anger-out, appears to lead to deleterious effects on cardiovascular diseases only when it is incongruent with the standard of anger expression (i.e., desired state).

Furthermore, even in the same independent or individualistic culture, the relation between anger-in and cardiovascular diseases was not salient among women, probably because women compared to men are more likely to suppress anger (Powch & Houston, 1996) and less likely to express rage even in anger-provoking situations (Harburg, Blakelock, & Roeper, 1979; cited in Spicer & Chamberlain, 1996, p. 366). In a similar

fashion, in older people who are expected to suppress anger, anger-out may be a more detrimental factor to cardiovascular diseases (Leon, 1992; see Chon, 2000 for more detailed information on this issue). Thus, the incongreuence between the mode of anger expression and the standard of anger expression seems to be the crux of the matter in the relation between anger expression and cardiovascular diseases.

Finally, our model can be used as a useful framework for the prevention, treatment, and rehabilitation of chronic diseases such as cardiovascular diseases. As was noted above, anger may arise when (1) a person views the situations from his or her own perspective, and (2) the actual state is incongruent with the imperative standard. One important component of anger management in cardiac and stroke rehabilitation, then, may be to view the situations from other's perspective. In a similar fashion, the modification of unrealistic, unreasonable, or impractical (imperative) standard (Beck, 1976; Ellis, Gordon, Neenan, & Palmer, 1997) would be very helpful to reduce the detrimental effects of anger on health.

As a broad analysis, our model suggests that if we know what the individual wants (motivator), perceives (detector), and can do (effector), then we might unravel the basic determinants to the prevention, treatment, and rehabilitation of such chronic diseases as cardiovascular diseases more efficiently. Much of what was proposed in this paper is theoretical, so its validity and usefulness remain to be seen in future studies. However, we believe that our model may shed lights on human emotions in general and anger in particular, especially on health.

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분노의 개선된 이해를 위한 시도: 제어이론적 접근

전겸구 **강혜자**

대구대학교 재활심리학과 대구대학교 대학원 재활과학과

최근 연구에 의하면, 한국에서 가장 치명적인 사망원인으로 나타나고 있는 심혈관계 질환에 대하여 분노가 중요한 심리적 요인으로 나타나고 있다. 심혈관계 질환을 비롯한 치명적인 질병에 대한 예방, 치료, 및 재활에서의 분노의 역할을 이해하기 위하여, 제어 이론에 기초하여 분노의 속성을 규명하기 위한 시도가 이루어졌다. 보다 구체적으로는 첫 부분에서 왜 분노를 다루어야하는 가를 살펴보았다. 이어서 제어 이론에 대한 개관을 위하여 단순 제어 시스템과 보다 복잡한 인간 제어 시스템을 통하여 살펴보았다. 이러한 배경 지식을 소개한 후, 분노의 기본적 속성을 제어 이론적 관점에서 분석하였다: 발생, 방향, 강도, 종류 및 혼합 정서. 이어서 본 논문에서 제안된 제어 이론과 Higgins 모형을 비교하였다. 끝으로, 제어 이론 모델의 결론과 시사점을 추후 연구를 위하여 논의하였다.