

Happiness as Surplus or Freely Available Energy

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This paper presents a literature review that indicate happiness as a state of freely available or surplus energy. Happiness is associated with good metabolism and glucose levels, fewer demands (from parenting, work, difficult social relationships, or personal threats), and goal achievement, as well as increased ease of processing, mental resources, social support, and monetary wealth. Each of these either provide or help conserve energy.

Keywords: Happiness; Emotion; Energy; Efficiency

Introduction

A focus on energy could be a powerful psychological perspective. People are organisms made of metabolic energy, and life can be viewed as a process of attaining and managing metabolic energy. Some work indicates that evolution selected on tendencies to attain increasingly larger amounts of energy (e.g., sugar, oil) from the environment and to use that energy efficiently (e.g., modern technology, Gilliland, 1978; Lotka, 1922; Odum, 1995). From this view, having and controlling energy should be associated with feeling good—one is fulfilling an evolved tendency—whereas lacking energy should feel bad.

The current work presents the theory that happiness is a state of having freely available or surplus energy (i.e., when energy availability exceeds demands). Processes that create or sustain this surplus are concomitant with happiness. The paper provides an in-depth review of the relevant literature on happiness and presents an experimental test of one hypothesis derived from the theory—that displays of happiness signal that one has expendable energy. The purpose of the review is to present a novel theory of happiness that advances research on and understanding of the topic and that synthesizes and links disparate research topics.

Energy relevant to happiness can take two forms. One is biological, metabolic energy (e.g., glucose). All cells in the body use metabolic energy. When metabolite supply exceeds demand, there is a surplus. The theory is that people are less happy when metabolic energy is low.

The other forms of energy relevant to happiness are secondary sources of metabolic energy—sources that provide or conserve metabolic energy. These include social relationships (e.g., friends give food to one another and facilitate effortful coping) and technology (e.g., modern transportation conserves mechanical energy used for walking, computers reduce metabolic energy needed for memory because they preserve information). Secondary sources of energy are posited to be associated with happiness because they increase the likelihood of surplus energy.

Happiness as Concomitant with Available Energy—A Review of the Happiness Literature

Many studies link happiness with available energy. People

generally associate happiness more with energy than a lack thereof. Energetic music (e.g., higher pitch tones, faster tempos, ascending scales) has been rated as happier than less energetic music (Collier & Hubbard, 2001a, 2001b). Words indicative of happiness tend to reflect having energy to a greater extent than words less indicative of happiness (Storm, 1996).

Happy people tend to be more energetic, excited, and zestful than less happy people (Block & Kremen, 1996; Csikszentmihalyi & Hunter, 2003; Klohnen, 1996; Park & Peterson, 2006; Peterson, Ruch, Beermann, Park, & Seligman, 2007; Ryan & Frederick, 1997). Happiness is associated with increased activity (Csikszentmihalyi & Hunter, 2003; Veenhoven, 1988). One study found that watching a video that induced joy (v fear or anger) increased the number of activities in which participants wanted to engage (Fredrickson & Branigan, 2004). Men in one study talked more to a female after having seen stimuli that increased positive (v negative) mood (Cunningham, 1988). Another study found that cricket players who were happy (v less happy) displayed more energy, enthusiasm, focus, and confidence (Totterdell, 1999).

Increased extraversion, often associated with energetic behavior, has strong links to happiness (Brebner, Donaldson, Kirby, & Ward, 1995; Cheng & Furnham, 2002; Francis, 1998; Francis, Brown, Lester, & Philipchalk, 1998; Francis & Lester, 1997; Furnham & Cheng, 1999; Hills & Argyle, 2001; Jopp & Rott, 2006; Lu & Shih, 1997), even when making comparisons across nations (Steel & Ones, 2002). Extraversion is associated with increased approach, and likewise happiness has been linked to increased engagement and sociability (Csikszentmihalyi & Hunter, 2003; Peterson et al., 2007).

Depression is strongly and negatively associated with happiness (APA, 1994; Joseph & Lewis, 1998; Kammann & Flett, 1983; Matsubayashi et al., 1992; McGreal & Joseph, 1993). A defining feature of depression is low energy or tiredness (McGillivray & McCabe, 2007; Naarding et al., 2007).

Even perceptual biases suggest happiness as a state of surplus energy. Participants induced into a happy (v sad) mood perceived a hill as less steep (Riener, Stefanucci, Proffitt, & Clore, 2003). The idea is that happy participants had sufficient energy to ascend the hill, and so it appeared less steep.

Happiness generally has thus been linked to having available

energy, whereas low happiness (or sadness) has been linked to low energy. This pattern is mirrored in work on primary and secondary sources of metabolic energy.

Primary Energy

Metabolic Energy

Metabolic energy is the primary energy through the use of which all thought and action occur. Evidence indicates that happiness is reduced when the metabolic energy of glucose is low or its use is impaired, whereas happiness is higher when adequate amounts of usable glucose are available.

Bad or depressed moods are more common when glucose is low (Barglow et al., 1984; Benton & Owens, 1993; Hepburn, Deary, MacLeod, & Frier, 1996; Taylor & Rachman, 1988; Wredling, Theorell, Roll, Lins, & Adamson, 1992; Yaryura-Tobias & Neziroglu, 1975; cf. Reid & Hammersley, 1995; Scholey & Kennedy, 2004) and among people with (v without) diabetes, who process glucose less effectively and are prone to experience hypoglycemia (e.g., Eren, Erdi, & Özcankaya, 2003; Fabrykant & Pacella, 1948; Fris & Nanjundappa, 1986; Gonder-Frederick, Cox, Bobbitt, & Pennebaker, 1989; Lustman, Griffith, Clouse, & Cryer, 1986; Mueller, Heninger, & McDonald, 1968; Popkin, Callies, Lentz, Colon, & Sutherland, 1988; Van Pragg & Leijnse, 1965; Wells, Golding, & Burnam, 1989; Wilson, 1951). A glucose clamp (v control device), which reduces glucose levels, has been found to worsen mood (Gold, MacLeod, Deary, & Frier, 1995; McCrimmon, Frier, & Deary, 1999), as has skipping breakfast (Smith, Clarka, & Gallagher, 1999). Conversely, glucose drinks (v placebos) have been found to improve mood (Benton, Brett, & Brain, 1987; Benton & Owens, 1993).

Research on the symptoms of premenstrual syndrome (PMS) provides converging evidence. Metabolic energy use by the ovaries increases during PMS (e.g., Aschoff & Pohl, 1970; Bisdee & James, 1983; Bisdee, James, & Shaw, 1989; Dalton, 1999; Hessemer & Bruck, 1985; Landgren, Uden, & Diczfalusy, 1980; Mayo, 1997; Solomon, Kurzer, & Calloway, 1982; Webb, 1981, 1986), thereby reducing the likelihood of energy surplus. A large body of evidence links conclusively PMS to more negative mood (Bailey & Cohen, 1999; Baker, Best, Manfredi, Demers, & Wolf, 1995; Bloch, Schmidt, & Rubinow, 1997; Dalton, 1999; Evans, Haney, Levin, Foltin, & Fischman, 1998; George, 2009; Hartlage & Arduino, 2002; Limosin, Gorwood, & Ades, 2001; Natale & Albertazzi, 2006; Rapkin, 2003; Rubinow et al., 1986; Symonds, Gallagher, Thompson, & Young, 2004; Zhao, Wang, Qu, & Wang 1998).

Using self-control has been found to decrease glucose in the bloodstream (Fairclough & Houston, 2004; Gailliot et al., 2007a; Gailliot, 2009a). Using self-control therefore might worsen mood. Individual studies have largely failed to find evidence that using self-control worsens mood, yet a meta-analysis of over 600 participants found a small effect of self-control worsening mood (Gailliot & Vohs, 2009).

If metabolic energy improves mood, then people might eat so as to escape negative moods. Indeed, depression increases food cravings (Dye, Warner, & Bancroft, 1995) and eating is a typical response to relieve personal distress (Tice, Baumeister, Shmueli, & Muraven, 2006).

Physiological states, aside from glucose, related to metabolic energy distribution might also relate to mood. Pleasant stimuli

(e.g., odors, pictures) reduced cortisol (Barak, 2006), which functions partly to increase blood-glucose. Another study demonstrated that happiness (v anger or anxiety) predicted lower blood pressure (James, Yee, Harshfield, Blank, & Pickering, 1986). Increased blood pressure can be concomitant with increased metabolite distribution.

Some studies examining energy use in the brain also are consistent with a link between happiness and surplus energy. Neuroscience evidence indicates that sadness can increase brain energy use, whereas happiness can decrease it (Baxter et al., 1989; George et al., 1995).

Self-control allows for emotional coping (e.g., regulating moods so as to increase happiness, Baumeister, Bratslavsky, Muraven, & Tice, 1998; Finkel & Campbell, 2001; Gailliot, Schmeichel, & Baumeister, 2006; Gailliot, Schmeichel, & Maner, 2006; Muraven & Slessareva, 2003; Muraven, Tice, & Baumeister, 1998; Schmeichel, Demaree, Robinson, & Pu, 2005; Schmeichel, Vohs, & Baumeister, 2003; Shamosh & Gray, 2006; Vohs, Baumeister, & Ciarocco, 2005) and is intrinsically tied with glucose metabolism (DeWall, Baumeister, Gailliot, & Maner, 2008; DeWall, Gailliot, Deckman, & Bushman, 2009; Fairclough & Houston, 2004; Gailliot, 2008, 2009a, 2009b, 2009d, 2009e, in press; Gailliot et al., 2007; Gailliot & Baumeister, 2007; Gailliot, Hildebrandt, Eckel, & Baumeister, 2009; Gailliot, Peruche, Plant, & Baumeister, 2009; Masicampo & Baumeister, 2008). A survey across nations indicated that the ability to cope is a primary determinant of happiness (Haller & Hadler, 2006).

Other work further implicates self-control, and hence metabolism, as linking happiness to energy. Noise impairs self-control (Muraven & Baumeister, 2000) perhaps via metabolite depletion (Gailliot & Baumeister, 2007). Likewise, noise pollution predicts reduced happiness (Weinhold, 2008). Others have argued that happiness rests crucially on the regulation and control of drives, impulses, and objects (Furnham & Petrides, 2003; Mukherjee & Basu, 2008), which is akin to self-control.

The composition of neurotransmitters can be used to test whether happiness is associated with increased energy. The prediction is that neurotransmitters associated with happiness contain more useable energy than do other neurotransmitters. Neurons fire via the use of adenosine triphosphate (ATP) derived from breaking carbon-to-carbon bonds. Dopamine is positively associated with happiness (Bressan & Crippa, 2005; Drevets et al., 2001), and it contains more carbon than do other neurotransmitters, such as acetylcholine, γ -Aminobutyric acid (GABA), or glutamate (Wikipedia, 2012), thus supporting the prediction.

Demands on Metabolic Energy

That which uses more energy can be considered a demand on metabolic energy, and that which uses more energy also reduces the likelihood of there being freely available or surplus energy. Numerous studies link increased life demands, therefore entailing increased energy use (Fairclough & Houston, 2004), to reduced happiness. Happiness will often be associated with low energy and high demands because these are times when a surplus of energy is less likely.

Being a parent demands a lot of energy (e.g., obtaining money). It also reduces happiness (Glenn & McLanahan, 1982; Glenn & Weaver, 1978; McLanahan & Adams, 1987; Nicolson, 1999; White, Booth, & Edwards, 1986).

Work often is effortful and entails overriding intrinsic, so as to meet extrinsic, motivations (Gordijn, Hindriks, Koomen, Dijksterhuis, & Van Knippenberg, 2004). When work is less demanding—such as toward the weekend (Csikszentmihalyi & Hunter, 2003; Gallup, 2008; Mihalcea & Liu, 2006) or when more leisure time is afforded (Cameron, 1975; Csikszentmihalyi & Hunter, 2003; Easterlin, 2003; Tella & MacCulloch, 2007; Tkach & Lyubomirsky, 2006; Yu et al., 2002)—happiness is greater. The effort of caring for one with a disability likewise predicts reduced happiness (Easterlin, 2003; Eriksson, Tham, & Fugl-Meyer, 2005; Marinic & Brkljacic, 2008). Demanding marriages reduce happiness relative to those that do not (Lu & Shih, 1997; Orden & Bradburn, 1969; Pina & Bengston, 1993; Rabin & Shapira-Berman, 1997; Ward, 1993), as do difficult social relationships relative to easier ones (e.g., such as through the conflict of worldviews, Burleson, 1994; Ortega, Whitt, & Williams, 1988; Pickford, Signori, & Rempel, 1966; Sutor, 1987; Welsch, 2008).

Other demands have also been linked to reduced happiness. Physical attractiveness among women, for whom good looks especially save energy in pursuit of attracting and attaining high quality mates, but not men has been found to predict increased happiness (Mathes & Kahn, 1975). Homeless people (v people who have a home) are less happy (Biswas & Diener, 2006). Social projects that reduce living demands likewise increase happiness (Moller & Jackson, 1997).

Happiness can be considered the opposite of experiencing personal threat, and threat occurs when demands exceed available resources to cope (Blascovich & Tomaka, 1996; Blascovich & Mendes, 2000). Happiness therefore should involve having resources or experiencing low demands. Mortality is more threatening when metabolic energy is low (Gailliot, 2009b, in press), and mortality salience might reduce glucose (Gailliot et al., 2007). Greater religiosity has been found to reduce the threat, and therefore costs, of mortality salience (Jonas & Fischer, 2006), and therefore should be associated with an increased likelihood of surplus energy (due to reduced costs coping with mortality). Connecting this possibility to happiness, religion is associated with greater happiness (Cameron, 1975; French & Joseph, 1999; Francis & Lester, 1997; Lelkes, 2005; Swinyard, Kau, & Phua, 2001; cf. Lewis, Lanigan, Joseph, & Fockert, 1997; Lewis, Maltby, & Burkinshaw, 2000). Threat occurring from being bullied or sexually harassed among children predict reduced happiness (Gibbs & Sinclair, 2000), as does greater social anxiety (Neto, 2001).

Some theorists have argued that happiness is reduced because life is more demanding due to our living in a world that is radically different from the one in which our ancestors evolved (Buss, 2000; Grinde, 2002). Hence, metabolically expensive (Fairclough & Houston, 2004; Gailliot et al., 2007; Gailliot & Baumeister, 2007) regulation systems are overactive (Nesse, 2004).

Goals

A goal is a metabolic demand ongoing for some time. A goal thus can be represented as a process of metabolic energy attainment and use (e.g., each time a dieter sees a piece of cake, he or she effortfully uses self-control to avoid it, a person with a physical fitness goal regularly expends metabolic energy every workout). When a goal ceases or is relinquished, energy previously committed to the goal becomes freely available,

surplus energy. Such dynamics should influence happiness.

Indeed, meeting a goal, or goals, can increase happiness (Diener & Lucas, 2000; Haybron, 2008; Kasser & Ryan, 1993). Hence, satisfaction with specific life domains predicts increased happiness (Michalos, 1980). Happiness is strongly influenced by discrepancies between what one has and wants (Michalos, 1983; Tsou & Liu, 2001), perhaps because of the extent to which one is motivated or has formed goals to obtain more. The goal of maximizing (v nonmaximizing)—in which people attempt to choose the very best among every option—might also reduce happiness (Schwartz et al., 2002).

Mental Resources and Processing Fluency

Biological resources—metabolic energy—often has been referred to as “mental resources” in the social sciences, though the construct overlaps with actual metabolic energy (Gailliot et al., 2007; Gailliot & Baumeister, 2007; Gailliot, 2009c). Findings on mental resources and ease of processing are consistent with the idea that happiness is concomitant with energy.

Happy people appear to have more mental resources than less happy people, such that they are more creative, mindful, and optimistic (Basso et al., 1996; Derryberry & Tucker, 1994; Fredrickson & Branigan, 2004; Isen et al., 1987). They display broader thought and attention and are more open to information (Estrada et al., 1997). Happy (vs unhappy) children have been found to delay gratification longer (Moore, Clyburn, & Underwood, 1976; Schwarz & Pollack, 1977). Negative moods seem to impair self-control (Leith & Baumeister, 1996; Tice, Bratslavsky, & Baumeister, 2001). Positive affect has been found to replenish self-control when it is fatigued (Tice et al., 2006). One contradictory finding was that a happiness induction increased stereotype use (Bodenhausen, Kramer, & Susser, 1994), suggesting reduced mental resources (Devine, 1989). It could be that happy people have more energy and mental resources, though they might not always willingly expend their energy or resources. Hence, when participants were held accountable for their stereotype use, happiness did not increase stereotype use (Bodenhausen et al., 1994).

Stimuli that take less energy to process—such as those that are familiar—should be liked more than stimuli that take more energy to process, consistent with the link between having freely available energy and happiness. In support of this, stimuli that are easier to process and familiar are liked more than other stimuli, and these stimuli have been found to produce less brain activation (i.e., use less energy) (Bornstein, 1989; Cacioppo & Winkielman, 2001; Desimone, Miller, Chelazzi, & Lueschow, 1995; Haber & Hershenson, 1965; Harrison, 1977; Jacoby & Dallas, 1981; Whittlesea, Jacoby, & Girard, 1990; Witherspoon & Allan, 1985; Zajonc, 1968, 2001, 2002). People also like more stimuli that are prototypical or symmetrical (Berlyne, 1974; Halberstadt & Rhodes, 2000; Langlois & Roggman, 1990; Martindale & Moore, 1988; Rhodes & Tremewan, 1996) possibly because they are processed faster and more efficiently (Checkosky & Whitlock, 1973; Johnstone, 1994; Palmer, 1991; Posner & Keele, 1968; Rosch & Lloyd, 1978) which should reduce energy use (Mulder, 1986). Anticipated (v unanticipated) information has been found to be processed faster and hence easier, and to be more pleasant (Whittlesea, 1993). Likewise, factors that facilitate the processing of stimuli have been found to increase liking for the stimuli (Reber, Winkielman, & Schwarz, 1998). Numbers are more easily proc-

essed in Chinese than in English, and math tends to be better liked among Chinese than English speakers (Gladwell, 2009).

Secondary Energy

Factors that provide energy or reduce its use (sources of secondary energy) also suggest a connection between happiness and having energy. Two examples are social support and monetary wealth.

Social Support

Social support can provide energy or reduce its use in several ways. People give one another food. They also save energy in many ways for one another, such as by helping one another, assisting in coping with stress, or providing resources while requiring relatively little work (e.g., parents giving clothing to their children).

Ample evidence demonstrates that people are happier with better social support or more social involvement (Baumeister & Leary, 1995; Booth, 1992; Brim, 1974; Chan & Lee, 2006; Gundelach & Kreinar, 2004; Jopp & Rott, 2006; Kehle & Bray, 2003; Lane, 1994, 2000; Lu, 1999; Lu, Shih, Lin, & Ju, 1997; Natvig, Albrektsen, & Qvarnstrom, 2003; Neto, 2001; North, Holahan, Moos, & Cronkite, 2008; Perneger, Hudelson, & Bovier, 2004; Phillips, 1967; Ryuichi et al., 1999; Singh et al., 2004; Uchida, Norasakkunkit, & Kitayama, 2004). Happiness is positively associated with self-esteem (Baumeister, Campbell, Krueger, & Vohs, 2003), and self-esteem reflects belongingness (Leary & Baumeister, 2000). People report seeking social contact so as to increase their happiness (Tkach & Lyubomirsky, 2006). Married people tend to be happier than unmarried people (Cid, Ferres, & Rossi, 2008; Mookherjee, 1998; Stack & Eshleman, 1998). Religious institutions can serve as a source of social support, and religious involvement predicts increased happiness (Cameron, 1975; Francis & Lester, 1997; French & Joseph, 1999; Lelkes, 2005; Swinyard, Kau, & Phua, 2001; cf. Lewis, Lanigan, Joseph, & Fockert, 1997; Lewis, Maltby, & Burkinshaw, 2000). Likewise, the end of social relationships and death greatly reduce happiness (Ballas & Dorling, 2007; Oswald & Powdthavee, 2008).

Monetary Wealth

Money is another source of secondary energy. Money can be used to acquire metabolic energy (e.g., buy food) and it can also save energy (e.g., paying for a taxi rather than walking, hiring an accountant to do one's taxes, using air conditioning rather than sweating in the heat). People with money can have a more leisurely, effortless life than can those without. Money therefore should be associated with a greater likelihood of having available energy.

Ample research demonstrates a positive correlation between wealth and happiness. Across both nations and individuals, wealth predicts happiness (Biswas-Diener & Diener, 2006; Cid, Ferres, & Rossi, 2008; Diener, Horwitz, & Emmons, 1985; Easterlin, 1995, 2001; Gardner & Oswald, 2001; Gerdtham & Johannesson, 2002; Hagerty & Veenhoven, 2003; Johnson & Krueger, 2006; Mookherjee, 1998; Namazie & Sanfey, 1998; North, Holahan, Moos, & Cronkite, 2008; Rogers & DeBoer, 2001; Saunders, 2009; Schyns, 1998; Stack & Eshleman, 1998; Steel & Ones, 2002; Tella & MacCulloch, 2007; Tella, MacCulloch, & Oswald, 2003; Tella, New, & MacCulloch, 2007;

Shin & Johnson, 1978; Veenhoven, 1991, 1995; World Bank, 1997; cf. Easterlin, 2005). Likewise, unemployment might lead to unhappiness (Booth & Ours, 2007; Di Tella, MacCulloch, & Oswald, 2001; Frey & Stutzer, 2000; Graham & Pettinato, 2001).

When people aspire for more than they have, however, money might not lead to happiness (Hagerty, 2000; Stutzer, 2004; Tsou & Liu, 2001). This is consistent with the idea that happiness is reduced with increased demands or goals—in this case, to acquire more wealth.

An Experimental Test—Displays of Happiness as Energetically Inefficient

If happiness is concomitant with having available or surplus energy, then its expression may signal that one has expendable energy. Expressions of happiness may entail reduced efficiency.

Past work has found that depressed individuals conserve energy in their movements—they move relatively little (Fisch, Frey, & Hirsbrunner, 1983; Griesinger, 1876; Kraepelin, 1913). Upon recovering from depression, people move more, more complexly, and more rapidly. This suggests that happiness might be negatively associated with the conservation of mechanical energy.

An experimental study showed that more participants who received a positive comment (e.g., “I like your shirt.”) from an experimenter lifted their feet less efficiently while walking upstairs than did participants who received a neutral comment (i.e., “This is Hall C.”), $\chi^2 = 2.78, p < .05$ (one-tailed; see **Figure 1**).

General Discussion

A review of the literature on happiness and an experimental test provided general support for the idea that happiness is a state in which one has freely available or surplus energy. This pattern emerged from work on a variety of topics, including metabolism, demands (parenting, work, difficult social relationships, personal threat), goals, ease of processing and liking,

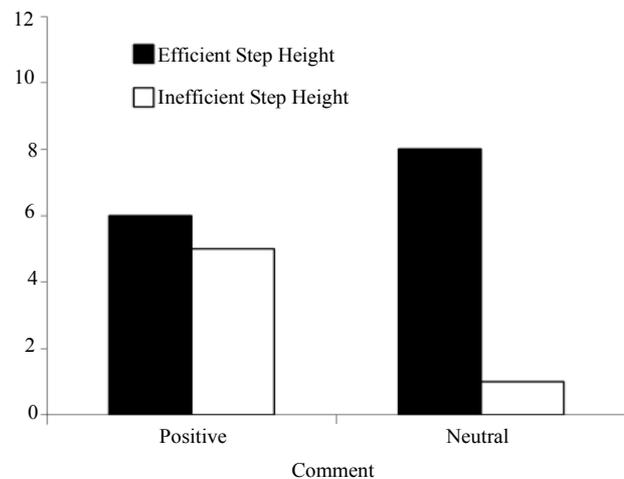


Figure 1. Number of people who exhibited either efficient or inefficient step height as a function of having received either a compliment or neutral statement.

mental resources, social support, and monetary wealth. The theory brings together work across several different disciplines, including neuroscience, endocrinology, social psychology, economics, sociology, and biology.

The theory of happiness and energy should help explain findings on happiness other than those reviewed. Happiness has been found to predict future success (e.g., in marriage, friendship, wealth, work, and health, Lyubomirsky, King, & Diener, 2005). To the extent that happiness represents having energy, then being capable of energy-demanding activities (e.g., resolving difficulties with a spouse) should lead to future success.

One seemingly inconsistent finding may be that hyperglycemia (i.e., when blood-glucose levels are especially high) is not associated with happiness, though there is ample energy in the bloodstream. Hyperglycemia might not be linked to happiness because it may reduce the flow of glucose to the brain.

One might conclude that people should rarely expend energy (e.g., sit on the couch all day) because they generally seek happiness. Though this can occur (e.g., passivity is increasingly common in modern society), people clearly expend their energy on a regular basis. Conservation might be reduced because one must use energy to obtain energy (e.g., work 40 hours each week to ensure an adequate food supply) and because people have goals less clearly related to energy (e.g., reproductive goals). Happiness is having surplus energy in the context of other meanings and values in life.

One strength of the proposed theory is that it suggests many novel hypotheses. All else being equal, events that provide energy will tend to produce greater happiness than will events that provide less energy or take away energy. People are happier if there exists the potential to use taxi rides rather than to always walk. The inefficient acts in which happy people engage (e.g., play behavior) might be more likely to be perceived as pointless or wasteful to others. Happy people expend energy more liberally, and so others might not perceive the value of these behaviors. The relationship between happiness and energy could be cyclical. Having energy allows one to more easily ensure future happiness. For example, a happy person at work might cheer up another coworker by giving flowers, increasing the likelihood that the coworker will reward the person in the future. Approaches to increasing happiness should include those that free up metabolic resources or provide resources, such as those that alleviate demands. Chronically unhappy individuals might have tendencies to overcommit themselves and rarely experience energy surplus.

In demanding situations, people might expect happy people to be less happy and to use their energy to help. Displays of happiness should be perceived negatively when energy is wasted. Factors should influence happiness partly to the extent that they create metabolic demands. For example, an argument that brings to mind new challenges should decrease happiness, whereas an argument that ends a demanding and draining relationship should reduce happiness to a lesser extent or even increase happiness. Diabetes and problems with glucose are linked to being less happy (see above). Other metabolic disorders might therefore be related to happiness. Factors that might increase the use of glucose include high processing loads, novelty, time pressure, and multitasking (Mulder, 1986). These same factors might reduce happiness. Happiness might arise from having too much information to process, being overwhelmed with novelty or experiencing too much change, lack-

ing sufficient time to complete goals, or trying to do too much.

Happiness should be higher across the lifespan during times when people have more energy. Some studies have found that younger people tend to be happier than older people (Chang, 2007; Easterlin, 2006; Gerdtham & Johannesson, 2002; Holahan, Holahan, Velasquez, & North, 2008; Selim, 2008; cf. Fugl-Meyer, Branholm, & Fugl-Meyer, 1991), and they also tend to have more (primary) energy. Whether energy is available for use might be key in determining happiness. Fat people have more stored energy than thin people, yet they might not be happier partly because good physical fitness enhances the distribution of metabolites throughout the body.

Happiness might increase from terminating goals and not only from achieving them. Abandoning a failed goal, for instance, might eventually increase happiness because one is able to use energy that otherwise would have been used toward goal pursuit.

Energy is concomitant with happiness. Happy people may signal their happiness by being less energetically efficient or expending more energy than needed. The happy person sings in the shower. Typical smiles may use more energy than typical frowns. And, as demonstrated—happiness puts an inefficient “pep in one’s step”.

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