



AN **ENERGY INSIDE** PRODUCT

**ENERGY INSIDE – THE SCIENTIFIC BASIS FOR PEPFLY**

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## Summary

**Pepfly**, Energy Inside's flagship product, exists to solve a problem in the world of emotional well-being: *effectiveness*. Psychologists and researchers, in recent years, have developed many new and innovative ways of improving emotional well-being; these treatments are powerful and test well in laboratories, but they sometimes don't translate into the outside world. Even when they have access to them, many people just don't use these treatments, for any number of reasons – because they find them too long; too confusing; too inconvenient; or because they are simply no fun. These treatments therefore do not always make a difference in the lives of people who really need them – in other words, they are not *effective* enough. Pepfly aims to change that.

We start by taking the best research on emotional well-being – ranging from tried and true Cognitive Behavior Therapy (CBT) techniques to promising positive psychology interventions – and then work to translate it into a form that ordinary people can use. This involves, first, stripping the idea down into forms that are simple and easy to digest: we present them as *micro-interventions*, and we call them “pep.” There are two different kinds of micro-interventions:

- “Feel pep” are things we've gathered from the Internet – videos, photos, quotes, interactive toys, or any kind of online media – that we think can make our users feel good. By “feel good”, we mean experience heartfelt positive emotions---like joy, awe, compassion, gratitude and amusement, for example. Positive psychologists have found that feeling lots of positive emotions in day-to-day life can improve your overall attitude and make you mentally healthier. It's kind of like exercise: just as you have to use your muscles and heart to keep yourself strong, so too should you exercise your positive emotions to keep yourself well.
- “Do pep” are interactive exercises derived from well-studied psychological treatments (for example, CBT) and techniques from newer positive psychology research designed to improve overall well-being. They are meant to do a number of things, ranging from helping you to shift negative thinking patterns to helping you calm down through guided breathing.

The next step is to deliver those micro-interventions to our users, in whatever way makes them most likely to be effective. Pepfly is designed to be as effective as possible for everyone who uses it; this means that it's available however you like to be online, whether it's in a standalone program, an app on your phone, or integrated with social networks like Facebook. This also means it's designed to be simple and intuitive; all you need to do to use pepfly is to tell it how you're feeling (through the “Inner Status Update”), and then look at the pep it sends back to you. Simple!

The individual pep are also crafted to be as effective as possible: they are always short, unique, and powerful. Although we don't claim to be perfect, we do think most people will

find our pep helpful– especially after spending a little time with pepfly, so it can learn what kinds of pep are best for each particular user.

Behind all this, of course, is a complicated web of science that makes it all work: we have a *common-sense reasoning* system that translates users' statuses into emotions, an *ontology* that links those emotions to specific types of pep, and an *algorithm* that picks the best pep for any given situation.

All of these tools combine to support one main goal: to help you, in whatever way, feel better.

## Introduction

This paper will detail the roots of **pepfly**, Energy Inside's flagship product, in the context of modern health science; it will explain how pepfly aims to meet the challenge of implementing empirically grounded mental health treatments effectively among the general population.

Energy Inside came into being when its cofounders recognized that the mental health needs of young adults were not being met, despite an ever-growing number of promising treatment studies and opportunities to improve education and access through advances in computing technologies. Seeing that an unconventional and multi-disciplinary approach was critical to identify a solution to this problem, a team of psychologists, designers, computer scientists, software engineers, and business experts convened in 2008 to articulate the nature and scope of the problem and to explore ways to begin to address it. In early 2009, a viable model emerged from this interdisciplinary working group and, with ongoing refinement, pepfly was created: a product that will deliver psychological interventions to the public in a new and innovative way, filling the void of effective and accessible psychological treatments.

This system promises to be one of the most innovative approaches to emotional health and well-being, both at the conceptual and the technical levels. Conceptually, while the advent of computerized psychological therapies has bridged a significant and longstanding gap between the self-help movement and more traditional psychotherapies, the delivery of these interventions is still somewhat inflexible, increasing the likelihood of weak engagement and noncompliance. Energy Inside offers the possibility of increased access to methods and approaches known to bolster emotional resilience, but in ways that maximize convenience and fit seamlessly into the infrastructure of modern life. Moreover, because the product platform functions within mobile and social technologies that have already been adopted by large segments of the population, and because the user experience is immediately engaging by design, Energy Inside has an opportunity to begin cutting through the stigma that prevents so many from pursuing the help that they need. Finally, Energy Inside hopes to invent products that will be not merely a treatment for the distressed or a wellness tool for the resilient. Rather, Energy Inside aims not to classify its users as "ill" or "well", but as individuals with a variety of feelings, thinking styles, behavior patterns, and life circumstances who share with one another, at their core, that basic human desire---to live life and to be well.

At the heart of this challenge is the fact that psychological treatments' effectiveness—i.e. the ability of said treatments to achieve their intended effect in a real-world setting—today lags far behind their demonstrated clinical efficacy. Energy Inside understands part of this current problem as a **failure to translate good science into a form that people can use**. That is, there are now many excellent empirically supported interventions targeting not just depression, anxiety disorders and other common mental health problems, but also resilience, well-being, and even happiness. Most people don't know about this research or

the availability of these interventions. If they are aware of them, many people do not know where to access them. If they know where to access them, many people are reluctant to do so because of the stigma associated with mental illness and help-seeking. For people who do seek out these interventions in the form of self-guided help, their formats (e.g., books, workbooks, computer and web delivery) often lack an effective engagement model and are abandoned prematurely.

Our solution therefore involves **translating good science into a form that people can use**, an approach that can be broken down as follows:

- **Recognizing the “good science”:** identifying empirically supported treatments and well-studied phenomena that are both scientifically sound and relevant to well-being. This emphasis on empiricism is a growing movement in health science, which pepfly aims to take full advantage of; Energy Inside leverages the best and newest research in psychology in the design of pepfly.
- **Identifying a form that people can use:** understanding the way in which a concept or technique needs to be made available in order for people to learn about it, try it, and adopt it sustainably. This involves a thorough understanding of the user—understanding the architecture of a person’s day-to-day life, identifying commonly used communication channels and technology tools, creating a compelling engagement model, and developing an interaction paradigm that provides adequate support and stimulation. Pepfly focuses on meeting these specific needs of users.
- **Translating the science:** bringing the previously identified information or technique through a transformative process that preserves the essence of the concepts or the experience, but optimizes the presentation, interactivity, and ease of use, among other variables. Pepfly is the vehicle for this translation.

This paper will examine each of these steps in detail, considering their relationship to the specific principles and structures of pepfly, and conclude by considering the changes in individuals and society that Energy Inside hopes to enact by them.

## I. Recognizing good science—looking to the evidence

### Sources of evidence for pepfly

Pepfly identifies empirically supported candidate interventions largely from three sources: the established list of treatments for psychological disorders from the American Psychological Association’s Division 12, the research base from the field of Positive Psychology, and the emerging research base supporting mental illness prevention and mental health promotion. Pepfly draws heavily from these sources of empirical support for interventions targeting recovery from problematic symptoms (clinical psychology), positive

growth and development (positive psychology/health promotion), and prevention of future mental health problems (prevention).

#### APA Division 12 Task Force

The American Psychological Association has worked over the past three decades to build a firm foundation of empirically supported treatments for a wide variety of psychological disorders. Spearheaded by Diane Chambless, the APA Division 12 Task Force on Promotion and Dissemination of Psychological Procedures led the movement to establish a clear infrastructure for the identification of psychological treatments with demonstrable efficacy. This is an ever growing list available to the public, on a centralized website (<http://www.psychologicaltreatments.org>) and in the form of books that review treatments with a strong evidence base (A Guide To Treatments that Work edited by Nathan and Gorman; Clinical Handbook of Psychological Disorders ,edited by Barlow; Evidence-Based Psychotherapies for Children and Adolescents edited by Kazdin and Weisz).

#### Positive Psychology

The Positive Psychology movement, led by Martin Seligman, has also identified the need for sound empirical support. There is already an impressive research base supporting even the very new interventions that have emerged from the field of Positive Psychology over the last decade. Resources detailing interventions with the greatest empirical support include the 2005 paper by Seligman et al (*Positive Psychology Progress. Empirical Validation of Interventions*), Sin & Lyubomirsky's 2009 meta-analysis (Enhancing well-being and alleviating depressive symptoms with positive psychology interventions: A practice-friendly meta-analysis), and Magyar-Moe's 2009 book *Therapist's Guide to Positive Psychological Interventions*.

#### Emerging research

The newest evidence base for pepfly candidate interventions is the research on illness prevention and health promotion. The best review of this evidence base comes from the Institute of Medicine's 2009 report *Preventing Mental, Emotional, and Behavioral Disorders Among Young People*.

#### Identifying sound concepts that merit translation

There are some well-studied concepts that have not yet been applied in the form of specific interventions. Energy Inside regularly surveys the scientific literature for these concepts and is building an infrastructure (Energy Inside Labs) within which new interventions can be tested for efficacy.

#### Pepfly: micro-interventions built on empirical science

The framework of pepfly is developed based on what Energy Inside has identified as the best empirically grounded psychological treatments—which are manifested as **micro-interventions**, brief, fresh, resonant and engaging interventions derived from empirically supported psychological practices and delivered to people where they live their connected lives (web and mobile).

Micro-interventions are of two types: pieces of media content (e.g. photos, videos, text, artwork, etc.) identified by their likelihood of triggering a heartfelt positive emotion in the user (Feel pep), and cognitive or behavioral exercises derived from empirically supported Cognitive Behavior Therapies (CBT) and Positive Psychology interventions (Do pep).

### Feel pep

Feel pep are pieces of media chosen specifically for their capacity to trigger a heartfelt positive emotion (e.g., amusement, curiosity, joy, serenity) in the moment. Feel pep do not require the user to think or behave in a particular way as a part of the experience; instead, the goal is for the user to take in the content (e.g., photo, piece of text, video, audio clip) and allow it to trigger an emotional shift.

Positive emotions are those that typically feel “good” to the person experiencing them. They include but are not limited to: joy, contentment, pride, admiration, love, interest, amusement, and serenity. In her work, Barbara Fredrickson has demonstrated that the experience of positive emotion plays an important role in the cultivation of emotional well-being, beyond the immediate experience of pleasure that these emotions afford in the moment (Fredrickson & Branigan, 2005; Fredrickson, Cohn, Coffey, Pek, & Finkel, 2008; Fredrickson, Emmons, & McCullough, 2004). First, the experience of positive emotions serves to broaden the scopes of attention and allow for creativity, exploration, and flexibility in thinking, causing increased interest in and engagement with an individual’s external environment. This enhanced interest and engagement allows building of personal resources that build over time, functioning as an “upward spiral” and leading to greater levels of emotional well-being. These are Fredrickson’s broaden-and-build and upward spiral theories of positive emotion (Fredrickson, 2004; Fredrickson & Joiner, 2002).

Importantly, Fredrickson has demonstrated, with her colleague Marcial Losada, that the experience of positive emotion confers benefits in a non-linear fashion (Fredrickson & Losada, 2005). They suggest that emotions are “multicomponent systems that simultaneously alter patterns of thinking, behavior, subjective experience, verbal and nonverbal communication, and physiological activity” and that these multicomponent affect systems are dynamic, meaning that they change over time as the various components within the system mutually influence one another. The dynamic systems that characterize affect are nonlinear, which means that outcomes are not always proportional to inputs. Put differently, a relatively limited positive emotional experience can potentially result in disproportionately larger and more significant outcomes. This is what is sometimes referred to as the “butterfly effect”, in which a butterfly's wings might create tiny changes in the atmosphere that may ultimately alter the path of a tornado, due to the fact that in dynamic, non-linear systems, small variations of an initial condition may produce large variations in the long term behavior of the system.

### Do pep

Do pep aim to engage the user in specific psychological techniques that have been demonstrated to enhance emotional well-being. Empirical support is found largely in the literatures of clinical psychology (CBT), positive psychology, social and personality, and

health psychology. In contrast to Feel pep and Do pep are designed to encourage specific thought processes, elicit responses, or support action programs. Do pep are likely to trigger a change in mental state at the time of engagement, but may also cause shifts in attitudes, beliefs, and behaviors over time.

They can be divided into the following subcategories:

- Values, Goals, Actions:** Interventions that facilitate self-knowledge regarding one's values and goals as well as help increase one's effectiveness in mastering actions such that they are aligned with values and goals. Categories include: Goals & Values Clarification; Committed action & Action Planning; Self-Efficacy & Confidence; Problem-Solving Skills; Impulse Control, Discipline, Delayed Gratification; Simplifying & Reducing Options; Identifying and Broadening Application of Personal Strengths (Baumeister, 2002; Baumeister, Gailliot, DeWall, & Oaten, 2006; Baumeister & Vohs, 2007; Baumeister, Vohs, & Tice, 2007; Hayes, 2004; Isaacowitz, Vaillant, & Seligman, 2003; Laura A. King, 2001; L. A. King, Richards, & Stemmerich, 1998; Lyubomirsky, 2008; Lyubomirsky, Sousa, & Dickerhoof, 2006; Masicampo & Baumeister, 2007; Muraven & Baumeister, 2000; Schwartz, et al., 2002; M. E. Seligman, Steen, Park, & Peterson, 2005; Sheldon & Houser-Marko, 2001; Tangney, Baumeister, & Boone, 2004; Tice, Baumeister, Shmueli, & Muraven, 2007; Vohs, et al., 2008; Vowles & McCracken, 2008; Wrosch, Miller, Scheier, & de Pontet, 2007).
- Emotional Well-being:** Interventions that use cognitive-behavioral techniques, mindfulness, or knowledge about emotions to bring relief from distress or improve one's facility with identifying, understanding, or managing emotions. Categories include: Cognitive Defusion; Cognitive Reappraisal; Avoiding Overthinking; Distress Tolerance, Mindfulness, & Acceptance of Feelings; Emotional Exposure; Emotional Expression; Emotional Intelligence; Behavioral Activation, Active Life Engagement, & Flow. (D. H. Barlow, 1985, 2000; David H. Barlow, 2002; Campbell-Sills, Barlow, Brown, & Hofmann, 2006; Mihaly Csikszentmihalyi, 1990, 1997; M. Csikszentmihalyi, 2000; Cuijpers, van Straten, & Warmerdam, 2007; Dimidjian, et al., 2006; Dobson, et al., 2008; Ehrenreich, Fairholme, Buzzella, Ellard, & Barlow, 2007; Evans, et al., 2008; Fava, 1999; Fava & Ruini, 2003; Fava, Ruini, & Belaise, 2007; Harley, Sprich, Safren, Jacobo, & Fava, 2008; Hayes, 2004; Hopko, Lejuez, LePage, Hopko, & McNeil, 2003; Kabat-Zinn, Lipworth, & Burney, 1985; Kabat-Zinn, et al., 1992; Kenny & Williams, 2007; Linehan, 1987; Low, Stanton, & Danoff-Burg, 2006; Mayer, Salovey, & Caruso, 2008; Mayer, Salovey, Caruso, & Sitarenios, 2001; Nolen-Hoeksema, Morrow, & Fredrickson, 1993; Segal, et al., 2004; M. E. Seligman, 1972; M. E. Seligman, et al., 1988; M. E. Seligman, et al., 1984; Teasdale, et al., 2000; Twohig, et al., 2005).
- Social Well-being:** Interventions that support positive interactions with others, strengthen social connections, or help individuals cultivate a capacity for compassion toward others. Categories include: Social Intelligence; Forgiveness;

Kindness, Compassion, Love, & Generosity; Strengthening Social Ties and Relationships. (Cohen, Doyle, Skoner, Rabin, & Gwaltney, 1997; Robert A. Emmons, Shelton, Snyder, & Lopez, 2002; Fredrickson, et al., 2008; Harris, et al., 2006; Hutcherson, Seppala, & Gross, 2008; Lundahl, Taylor, Stevenson, & Roberts, 2008; Lutz, Brefczynski-Lewis, Johnstone, & Davidson, 2008; Lyubomirsky, Tkach, & Sheldon, 2004; M. E. McCullough, Bono, & Root, 2007; Nowak & Roch, 2007; Otake, Shimai, Tanaka-Matsumi, Otsui, & Fredrickson, 2006; C. Peterson & Seligman, 2003; Sastre, Vinsonneau, Neto, Girard, & Mullet, 2003; Thompson, et al., 2005; Tkach, 2006; Toussaint, Williams, Musick, & Everson-Rose, 2008; Worthington, Witvliet, Pietrini, & Miller, 2007).

- Attitude & Perspective:** Interventions that support and cultivate an awareness of, openness to, and appreciation of what is outside of oneself, including one's physical environment (material world), temporal environment (past, future), conceptual environment (ideas, beliefs), and social environment (other people). Categories include: Curiosity, Interest, Love of Learning, Openness to Novelty; Gratitude; Optimism, Hope, and Looking forward to; Perspective & "Seeing the big picture"; and Appreciation of beauty. (Adler & Fagley, 2005; Algoe, Haidt, & Gable, 2008; Armata & Baldwin, 2008; Aspinwall, 2005; Aspinwall & Brunhart, 1996; Aspinwall & Leaf, 2002; Bailey, Eng, Frisch, & Snyder, 2007; Bartlett & DeSteno, 2006; Bono, Emmons, McCullough, Linley, & Joseph, 2004; Brodhagen & Wise, 2008; Carver, Scheier, & Chang, 2001; Cohen, Alper, Doyle, Treanor, & Turner, 2006; Dickerhoof, 2007; Diessner & Lewis, 2007; Diessner, Solom, Frost, Parsons, & Davidson, 2008; Robert A. Emmons, Eid, & Larsen, 2008; R. A. Emmons & McCullough, 2003; Robert A. Emmons & McCullough, 2004; Robert A. Emmons, et al., 2002; Fredrickson, et al., 2004; Freres, Gillham, & Vollrath, 2006; Froh, Sefick, & Emmons, 2008; Gallagher & Lopez, 2007; Gillham & Reivich, 2004; Kashdan, Rose, & Fincham, 2004; Kashdan, Uswatte, & Julian, 2006; Lyubomirsky, 2008; Michael E. McCullough, Emmons, & Tsang, 2002; Christopher Peterson, Park, & Seligman, 2006; C. Peterson & Seligman, 2003; Rasmussen, Wrosch, Scheier, & Carver, 2006; Scheier, Carver, Suls, & Wallston, 2003; Segerstrom, 2001; Segerstrom, Castaneda, & Spencer, 2003; M. E. Seligman, 2000; M. E. P. Seligman, 1990; Snyder, et al., 2005; Snyder, et al., 2000; Steptoe, O'Donnell, Marmot, & Wardle, 2008; Swan & Carmelli, 1996; Szloboda, 2008; Tsang, 2006; Watkins, Grimm, & Kolts, 2004).
- Physical Well-being:** Interventions that support increased physical activity (exercise), improved physical self care (sleep, nutrition, healthcare), and mind-body exercises (mindfulness, relaxation exercises, etc.). Categories include: Physical Activity (Exercise); Physical Self-Care; Mind-Body Exercises (Mindfulness, Relaxation, Breathing) (Adamsen, et al., 2006; Bagheri-Nesami, Mohseni-Bandpei, & Shayesteh-Azar, 2006; Barbour, Edenfield, & Blumenthal, 2007; Bartholomew, Morrison, & Ciccolo, 2005; Blumenthal, 2008; Bots, Tijhuis, Giampaoli, Kromhout, & Nissinen, 2008; Brenes, et al., 2007; J. D. Brown & Lawton, 1986; S. G. Brown,

Morrison, Larkspur, Marsh, & Nicolaisen, 2008; Carmody & Baer, 2008; Carta, et al., 2008; Carter, 2006; Chitkara, Van Tilburg, Whitehead, & Talley, 2006; Colcombe, et al., 2004; Coleman, Washington, & Price, 1985; Cramer, Nieman, & Lee, 1991; Davidson, et al., 2003; DiStasio, 2008; Dittrich, et al., 2008; Dua & Hargreaves, 1992; Galper, Trivedi, Barlow, Dunn, & Kampert, 2006; Greenwood & Fleshner, 2008; Grzywacz & Keyes, 2004; Hassmen, Koivula, & Uutela, 2000; Johnson, et al., 2008; Jorm, Morgan, & Hetrick, 2008; Kelsey, et al., 2006; Kjellgren, Bood, Axelsson, Norlander, & Saatcioglu, 2007; Knapen, et al., 2008; Knubben, et al., 2007; Kreitzer, Gross, Ye, Russas, & Treesak, 2005; Mead, et al., 2008; Morgan & Jorm, 2008; Salmon, 2001; Steptoe & Cox, 1988; Steptoe, Edwards, Moses, & Mathews, 1989; Steptoe, Kimbell, & Basford, 1998; Stewart, et al., 1994; Winbush, Gross, & Kreitzer, 2007)

### Micro-interventions in combination

While sound empirical support for each micro-intervention is important within this system, equally important are general contextual factors influencing how the interventions impact the user in aggregate. First, the system is designed to promote accumulations of small positive experiences, an idea that has been posited by both Lyubomirsky (Lyubomirsky, Sheldon, & Schkade, 2005) and Fredrickson (Fredrickson & Losada, 2005). The system promotes variety, thought to be critical to sustained emotional well-being by Lyubomirsky et al., through the presentation of multiple different types of interventions (Lyubomirsky, et al., 2005). The system also promotes intentionality on the part of the user, both by requiring ratings by the user after each micro-intervention is delivered, but also by delivering a substantial number of interventions that require careful thought and activity (Lyubomirsky, et al., 2005).

## II. Identifying a form that people can, and want to, use

Health science research in the United States, including mental health research, is currently undergoing a sea change. While the past century has seen the development of a robust national infrastructure for scientific research funding and oversight (e.g., NIH, NSF, etc), it has become clear that many of the best research findings never impact the those who were intended to be helped in the first place (Woolf, 2008). Mental health research is no exception (Chorpita & Regan, 2009; Shafran, et al., 2009). This is precisely the concern that has prompted the National Institutes of Health (NIH) to launch a campaign to support *translational research*. In their Roadmap for Medical Research, (NIH, 2004) NIH identified two areas of translation: 1) taking knowledge from basic sciences to produce new drugs, devices, and treatments; and 2) determining how treatments with demonstrated efficacy will best reach patients or populations for whom they are intended and ensuring that they are implemented correctly.

It is this latter form of translational research that is in need of development within the field of psychology. Now that the movement to develop and promote empirically supported psychological treatments is well underway and a great variety of treatments are

demonstrated to be efficacious (i.e., the treatments work in a controlled research setting), it is time to get these treatments to those who need them. We now understand that as important as efficacy is, *effectiveness* (i.e., the treatment achieves its intended effect within a real-world setting) is just as critical. However, in contrast to the now flourishing efficacy literature, effectiveness research is fairly new and only just now being recognized as an important area of study. The academic discipline focused on understanding how a treatment goes from a successful laboratory intervention to a well-integrated and natural part of real world practice called *implementation science* (Tansella & Thornicroft, 2009). What becomes clear in learning about implementation science is that while strong psychological research can offer “treatments that work” to a small number of people, much is needed beyond just psychology to extend these treatments to the general public. This is a critical point because extending the fruits of good science to the general public is precisely the enormous task that is now at hand.

Although infrastructures do exist today to provide valuable psychological treatments to the public, that help routinely fails to reach the people who need it exactly when and where they need it. When that happens, the existing help becomes altogether unhelpful. Failure to access an existing treatment that may have been effective is a woefully inadequate explanation for death by suicide or binge drinking, or even the significant distress experienced by people with depression and anxiety, or the impressive number of lost days, weeks, and years of workplace productivity.

The best way to ensure that these treatments can successfully reach their audience is, of course, to maximize the extent to which users actively and sustainably take advantage of them. Pepfly does this in four ways: it manages **accessibility, appeal, scope, and personalization**.

### **Accessibility: leveraging technology to reach daily life**

The ways in which people are interacting with technology and media in our society is changing quickly. Workbooks will most likely become obsolete in the near future and the knowledge and technique currently delivered in a workbook format will be expected to be offered in an interactive, multi-media format. Particularly young people are going to expect that information will be delivered to them in an interactive format and be accessible using mobile devices.

Pepfly, a web service powered by multimedia and interactive exercises which can be reached through the conventional Internet, through social networks like Facebook and MySpace, through instant messaging software, and most importantly through mobile phone application technology, meets that need. This use of widely adopted devices allows the system to integrate seamlessly into a person’s daily life, increasing the likelihood of use, and of effectiveness. Moreover, leveraging these personal technologies decreases the problem of stigma (to be discussed shortly), as they allow the user’s experience to be private.

### Appeal: using user-centered design to attract and retain an audience

User-centered design refers to an approach to design that prioritizes the needs, wants, strengths, and limitations of a user throughout the planning, design and development of a product. Don Norman, one of Apple's chief designers, is well known for taking a user-centered approach to his work and, not surprisingly, Apple's products are widely regarded as designed with human beings in mind (Norman, 2009). At the present time, it does not appear that most self-guided psychological interventions are implemented with a user-centered design approach. Yet, people are becoming increasingly accustomed to interacting with products that have been designed with their needs in mind. The locus of experience needs to fall squarely within the path of the user's day-to-day life.

Pepfly employs user-centered design to ensure that the process of receiving micro-interventions is smooth and natural; users of pepfly never feel as though they are completing an arduous task. Rather, the process is fun and intuitive.

In addition, pepfly uses two new concepts to bridge the gap between users' natural language and the abstract terms of psychological treatment:

- **Inner Status Update:** The Inner Status Update (ISU) is a means to elicit information about a user's current internal state. The ISU window presents the phrase "I feel...", which prompts the user to type something about his or her current internal experience (e.g., "I feel down"). The user is permitted to use any English word or phrase to describe him or herself.
- **Common Sense Reasoning (CSR):** The user's self-description in his or her own terms (i.e., natural language) is then matched to terms within an ontology of psychological state descriptors using Common Sense Reasoning methodology. CSR is a branch of artificial intelligence concerned with the understanding and manipulation of information about the everyday world. As applied to pepfly, CSR plays the role of connecting everyday descriptions of internal states (e.g., "I feel down", "I'm pissed off", "I'm totally psyched") to more formal terms denoting psychological states (e.g., down=sad, pissed off=angry, psyched=excited).

### Scope: ensuring that interventions are brief, small, and digestible

Micro-interventions are brief, and delivered in multiple forms; this allows for variety and novelty, keeping the user engaged and curious. This is made possible within the ordinarily elaborate and multifaceted framework of psychological treatment by advances in *treatment components research*.

- **Treatment components research:** Chorpita and colleagues are currently the leaders in the area of youth-focused CBT treatment components, with their development of the distillation and matching model (Chorpita & Daleiden, 2009; Chorpita, Daleiden, & Weisz, 2005), designed to characterize strategies making up evidence-based treatments. Within this model, they identified *practice elements*, which they define as discrete clinical techniques or strategies used as part of a larger intervention.

Others are beginning to identify the need to study interventions at the level of single techniques and have proposed the creation of a taxonomy and scientific method for studying interventions in this way (Abraham & Michie, 2008; Michie, Fixsen, Grimshaw, & Eccles, 2009). Identifying core ingredients of efficacious interventions allows practitioners to more flexibly meet the treatment needs of individuals. In the context of self-guided interventions, treatment components may offer a more sustainable engagement model for implementation and use in day-to-day life. Flexible use of self-guided treatment components, in contrast to administration of whole treatment protocols, may also be more amenable to algorithms that support personalization and tailoring.

Although brevity is a watchword of pepfly, the principle is not taken so far as to limit the access of users to the help they need or desire—opportunities and resources are built into the system for interested users to explore other sources of more full-scale, intensive psychological treatment.

### **Personalization: optimizing for the preferences of the individual user**

Pepfly builds a psychological model of each user, informed by a number of variables including: self-reported descriptions of current psychological state (Inner Status Update), user input from interactive interventions (Do pep), emotional impact ratings of previously viewed pep, self-generated user content (pep moments), and responses to intermittent assessment measures of psychological symptoms, energy levels, productivity levels, etc. (Metric pep).

This is powered by the new capabilities of personalization through mathematical modeling. The last few years has seen an emergence of personalized, tailored web-based experiences stemming from the development of mathematical representations of user preferences within the context of enormous databases. Algorithms driving these types of recommendation engines are likely to become ubiquitous over time, such that static representations of knowledge or techniques will become less engaging next to the dynamic complex of moving components that quietly and effortlessly adapt to a person's needs and preferences.

### **Different entry routes**

An important additional factor that allows pepfly to meet users' individual needs is its multiple points of entry. The system may be engaged either through the input of the user's psychological state, any word or phrase to describe how they feel (Inner Status Update or ISU), or through input of a recent positive experience that the user wishes to log using pepfly (Pep Moments system). These different entry routes into the system serve a critical purpose: they allow the system to be relevant to users in a broad range of psychological states, including those looking for support or specific tools to cope with a problematic situation and those seeking to bolster their own resources as a preventative effort or as a means to promote flourishing. So, this system seeks to meet the needs not only of those who wish to diminish their suffering or improve their ability to cope with problems, but

also those who strive to grow and build. (Sometimes these users will be distinct groups, but there will certainly be some overlap, as many people who seek help also strive to expand their resources, and vice versa.)

### The special challenge of young users

Young adults pose a unique challenge when it comes to increasing access to help. Half of all lifetime cases of diagnosable mental illnesses begin by age 14, and three-fourth by age 24. (Kessler, et al., 2005). Suicide is the third leading cause of death among 15 to 24 year olds and the second leading cause of death among college students (CDC, 2007). Yet, there is much that can be done to prevent suicide in this population. What has become clear in recent years is that we cannot rely on young people to do the active and often frustrating work of seeking out resources at the time that they need them. Typically the time that they need the support is precisely when they do not have what it takes to mount the necessary search. Therefore, it is time to take a more proactive approach—to go where the young adults live their lives, understand how they view the world, watch how they consume information and transform what they need to know into a form that will be meaningful to them. The Internet is absolutely central to that worldview, a fact that pepfly recognizes and leverages.

## III. Translating the science

The remaining task is to link the previously identified best treatments—implemented as micro-interventions—with the aforementioned engaged users, in a way which is conceptually seamless for the users but which retains the demonstrated efficacy of the treatments. Pepfly employs a complex and evolving system of bringing this science to users—through the efforts of psychologists, designers, and computer scientists, Energy Inside has developed methods whereby a written description of a psychological intervention can be transformed into a digital entity that is dynamic, self-guided, and interactive.

### Ontology: linking scientific concepts with real-world experience

Pepfly employs a complex ontology of terms, which serves as a framework for the application of psychological treatments to real-world situations. It includes:

**Psychological state terms:** a list of terms denoting what are likely to be the most relevant and commonly experienced distinct internal states by pepfly users (e.g., sad, overwhelmed, content, excited). Psychological state terms are both negative and positive, given that users are likely to engage the system in a variety of different psychological states, both positive and negative.

**Intervention ingredient terms:** distinct “active ingredients” thought to contain the inherent potential of each micro-intervention. This ontology of intervention terms was also developed by Energy Inside specifically for use within the pepfly system. The intervention ingredient terms were also chosen based on an extensive literature review of empirically

supported treatments and other strong evidence thought to be amenable to translation into micro-intervention format.

**State-Ingredient Matrix:** a set of associations between the aforementioned specific psychological states and specific intervention ingredients.

This ontology, in combination with algorithms that predict user preferences based on both an individual user's responses to pep over time and on observed similarities between users of pepfly, serves to match a user's emotional state with the micro-intervention that will be most effective and valuable for the user at that moment. This is the central process by which pepfly bridges the gap between science and application.

### Effectiveness research

Currently there is a wide gap between the individuals who create and study psychological interventions and those who deliver and use them in real world settings. A bidirectional, dynamic feedback loop connecting researchers and intervention users within their real world contexts will be critical to sustainable development and implementation of treatments that work. Participatory research, which allows input from multiple stakeholders throughout the process, may be one useful model. One of the benefits of participatory research is that it allows disempowered stakeholders to influence the way in which research is conducted and research findings are used. Given the increasing emphasis on reducing health disparities by funding agencies, this may be an important consideration. It will likely also be important to consider the use of newer communication technologies (texting, email, web-based interactive surveys, social networking) in the collection and distribution of information and interventions, as this allows for integration with individuals' everyday, real-world experience. Pepfly, which plays a unique and unprecedented role as a large-scale exercise in the observation and management of real-world mental health, expects to contribute greatly to this field—and improve its own treatments accordingly.

## IV. Outcomes: the ultimate goals of pepfly

### Individual user effects

Pepfly is expected to promote change within two different time-frames: the near-term and the long-term.

In the near-term, the matching algorithm will facilitate the delivery of relevant and timely micro-interventions, promoting rapid access to experiences that will:

- aim to cause a shift in the user's psychological state, or
- provide tools to help the user better understand his or her current psychological state.

Over the long-term, the matching system will provide tools that:

- help the user work towards a shift in his or her psychological state over time;
- build skills that cause downstream effects on well-being;
- increase the number of positive emotional experiences in the user's day-to-day life.

### Sociocultural effects

More broadly, pepfly hopes to promote and contribute to a greater social sea-change in attitudes toward mental health, the first stirrings of which are becoming visible today.

### A role for prevention of mental illness and promotion of mental health

It is really only within the past decade that serious efforts have been made to understand whether prevention is a viable strategy for addressing the increasing burden of mental illness in the U.S, and globally. In 2009 the Institute of Medicine and the National Research Council published *Preventing Mental, Emotional, and Behavioral Disorders Among Young People: Progress and Possibilities (IoM, 2009)*. This report drew several important conclusions that have spurred new interest by funding agencies and researchers alike in the areas of illness prevention and health promotion. These conclusions are as follows: mental, emotional, and behavioral disorders are common and begin early in life; prevention is most effective among young people; effects of prevention strategies can be seen in hard to treat conditions such as substance abuse, conduct disorder, antisocial personality disorder, and schizophrenia; prevention and promotion strategies can change the impact of poverty on a developing child; some prevention benefits outweigh costs, particularly in the case of early childhood interventions.

Mental health promotion, meanwhile, is closely tied to the emergence of the field of positive psychology in the late 1990s led by Martin Seligman (M. E. Seligman & Csikszentmihalyi, 2000). Among other effects, positive psychology presents an opportunity for all persons invested in mental well-being, not only those with identified mental illnesses, to explore the benefits of applied psychological research.

### Breaking the stigma barrier

Perhaps one of the benefits of prevention and promotion that has not yet emerged is the possibility that it will impact stigma associated with mental illness in the same way that the physical wellness movement impacted stigma associated with physical illness. Many people recall how the names of physical illness were whispered among family and friends (e.g. "He's got *diabetes*") or they were replaced with abbreviations (e.g. "She's got the C-word"). Hopefully mental illness prevention and health promotion strategies, in combination with ongoing improvements in treatment of mental illness, improvements in education about mental illness, and the debunking of myths will cause a shift in attitude for the public at large. With greater awareness and understanding, they may go from viewing major mental illness as a frightening, uncontrollable state of affairs over which one has no control to seeing them as recognizable conditions that are often responsive to treatments and amenable to the effects of early prevention and health promotion strategies. It is important for the public to see that many mental illnesses are becoming increasingly more

manageable with effective treatments and people are often able to live their day-to-day lives without significant disruption.

#### **Cultivating mental wellness**

Just as people now spend their time day-to-day at the gym to cultivate physical fitness---and not their cardiologists' office, there needs to be a mainstream, normalized way of cultivating mental wellness, outside of visits to the psychiatrist or therapist. Just as routes to physical wellness in day-to-day life are just as likely to be accessed by the well as by the ill, routes to mental wellness in day-to-day life should be similar. Currently mental wellness resources are currently mainly geared toward the ill end of the spectrum. Mental wellness needs to be associated with effort and intentionality, rather than fate.

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