

CREATING A RECOMMENDATION FRAMEWORK FOR POSITIVE
PSYCHOLOGY EXERCISES: THE NETFLIX MODEL OF POSITIVE
PSYCHOLOGY

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ABSTRACT

CREATING A RECOMMENDATION FRAMEWORK FOR POSITIVE
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PSYCHOLOGY

Stephen M. Schueller

Martin E. P. Seligman (Supervisor)

Treatment research typically examines what works for the average individual. In positive psychology, researchers have shown that diverse strategies such as expressing gratitude, savoring experiences, using strengths, increasing optimism, and practicing kindness all demonstrate the potential to boost an individual's level of well-being. No research, however, aims to help an individual select which of these techniques would most likely benefit him or her. This dissertation addresses this question by creating and validating a system in order to recommend specific positive psychology exercises.

I conducted a series of studies to develop and test a recommendation framework for six positive psychology exercises: active-constructive responding, blessings, gratitude visit, life summary, savoring and strengths. In Study 1, 792 participants received up to six positive psychology exercises. After each exercise, participants indicated their preference for each exercise and how often they engaged in it. A factor analysis of these scores revealed three groupings of subjective preferences: active-constructive responding and savoring; blessings and life summary; and gratitude visit and strengths. Individuals who had high preference for an exercise were more likely to complete the exercise.

In Study 2, I used these groupings to create a recommendation framework. The sample consisted of 127 undergraduate students who participated in the study over a four-

week period. All participants randomly received an initial positive psychology exercise for one week and rated their preference for the exercise. Participants were randomized to either a matched or control group: In the matched group, individuals received a second exercise based on a previously defined matching rule, whereas in the comparison group, individuals received a second exercise by random assignment. Individuals in the matched group preferred the second exercise significantly more and tended to report larger boosts in well-being following the second exercise than those in the control group. I discuss these findings and their implications for adopting idiographic methods to create packages of interventions.

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“Happiness is in the taste, and not in the things themselves; we are happy from possessing what we like, not from possessing what others like.”

-La Rochefoucauld

The more the field learns about the science of happiness, the more evidence mounts that happiness is largely a subjective concept (Diener, 1984; Kashdan, Biswas-Diener, & King, 2008; cf. Keyes & Annas, 2009). So-called “objective” measures of well-being differ considerably depending on who completes (or creates) the measure and their individual values and beliefs related to happiness (see Dolan & White, 2007). Even though general themes emerge with regards to pathways that promote happiness (Seligman, 2010), individual differences still reign supreme. Strategies to increase happiness, therefore, need to account for these individual differences. The journey towards increased well-being is largely a personal one as not everyone will benefit from the same approach.

Unfortunately, intervention research typically evaluates the efficacy of a technique based on the change it produces on average. Few studies that validate an intervention’s efficacy even report simple metrics of the variability of response such as the percentage of people who reliably change as a result of receiving the intervention (cf. Jacobson, Follette, Revenstorf, 1984; Jacobson & Truax, 1991). Intervention research needs to recognize the importance in individual differences to treatment response. Studies

should analyze not just the mean level of response but try to determine who benefits, who does not, and what differentiates these groups.

A closely related issue is that in a large intervention package, some skills or strategies may be useful to a given person whereas others might not. Treatment packages typically do not allow for individual modifications in delivery and instead provide all participants with the same program. For example, Group Positive Psychotherapy, an innovative treatment approach that seeks to relieve symptoms of depression through promoting the positive aspects of individuals' lives, uses a manualized treatment paradigm that leads participants through a set of six positive psychology exercises (Seligman, Rashid, Parks, 2006). Group Positive Psychotherapy leads to significant boosts in well-being and decreases in depressive symptoms, but exactly what elements are responsible for these changes and do the elements vary for different individuals? A meta-analysis of positive psychology exercises found that these "shotgun" approaches that provide a multitude of strategies lead to bigger changes than engaging in a single activity (Sin & Lyubomirsky, 2009). It could be that more is simply better; alternatively, "shotgun" approaches might increase the odds that each individual receives the portions that would be most effective for him or her. In the latter case, interventions could be trimmed to only the essential elements for a given individual and still provide the same benefit. These packages would require fewer resources and benefit participant motivation by leaving out unnecessary aspects.

Manualized packages are useful for research and practice because they ensure delivery of interventions in the same way to different people. Solid empirical investigation of individually tailored packages would require decision rules to select the

components each individual would receive. This approach represents a substantial paradigm shift in intervention research, it creates packages from the bottom up, beginning with validated treatment components and using empirical data to combine these components into the most effective and efficient treatment package. To use this approach, researchers need the empirical data to provide the basis for these combinations. This dissertation aims to develop and validate this framework by gathering the necessary data to construct a recommendation framework and then determine if using this framework leads to more effective packages of interventions. The individual exercises come from Group Positive Psychotherapy; however, I provide each element in isolation in order to maximize individual's enjoyment and benefit.

In Study 1, I create the recommendation framework by providing participants with up to six positive psychology exercises. After completing each exercise, participants rate their preference for the exercise on a variety of dimensions including enjoyment, perceived benefit, and difficulty of the exercise. I analyzed these ratings in order to form an empirical grouping of the exercises that suggests that individuals who like a specific positive psychology exercise also tend to prefer another positive psychology exercise. In Study 2, I test the efficacy of assigning exercises on the basis of this framework. After receiving a randomly selected positive psychology exercise, participants rate that exercise on the same variables used to assess preference in Study 1. Participants in an experimental group receive a second positive psychology exercise on the basis of their reported preference for the first, according to the matching framework constructed in Study 1. This matching framework is compared to random assignment to determine if using this model can improve upon the efficacy of the package of exercises created.

This strategy mimics practices used by popular consumer recommendation programs such as Amazon or Netflix. Part of the appeal of Netflix is its ability to provide movie recommendations on the basis of past viewing tendencies and ratings. Netflix even created a \$1,000,000 cash prize for any research team that could best its matching algorithms preference ratings by 10%. The aim of this dissertation is to create a Netflix model of positive psychology that can provide recommendations to improve a participant's overall experience, including enjoyment and benefit received, of positive psychology exercises.

STUDY 1: PREFERENCES FOR POSITIVE PSYCHOLOGY EXERCISES (Schueller,
2010; *Journal of Positive Psychology*, 5, 192-203)

Abstract

Positive psychologists have developed a variety of techniques to increase well-being. This study explored if preferences for some interventions are linked to preferences for other interventions. 792 participants received up to 6 positive psychology exercises. After each exercise, participants indicated their preference for each exercise and how often they engaged in it. A factor analysis of these scores revealed three groupings of subjective preferences: active-constructive responding and savoring; blessings and life summary; and gratitude visit and strengths. Individuals who had high preference for an exercise were more likely to complete the exercise. Implications for application of positive psychology exercises and future recommendations are discussed including the use of such a framework for tailoring custom programs of interventions.

Preferences for Positive Psychology Exercises

Introduction

One goal of positive psychology is to increase well-being and research suggests this is possible through brief exercises termed "positive interventions" (Sheldon & Lyubomirsky, 2006a; Lyubomirsky, Sheldon, & Schkade, 2005; Seligman, Steen, Park, & Peterson, 2005; see Lyubomirsky, 2008, for a review). Recent meta-analyses confirm that on average, these techniques lead to reliable and sustainable boosts in well-being (Schueller, 2008; Sin & Lyubomirsky, 2009). However, these conclusions overlook the large amount of intraindividual variation in intervention efficacy. One way to address this limitation would be to investigate which exercise or group of exercises provides the best "fit" for an individual. The aim of this study is to develop a structure for recommending new interventions based on individuals' preferences for previous interventions. This would provide a model for positive psychology exercises similar to Netflix for movies or Amazon for books and other products. A further aim of this study is to examine whether preference leads to greater adherence.

Matching Individuals to Treatment

Well-validated treatments exist for a variety of mental disorders. Treatment efficacy, however, examines whether a treatment is on average statistically superior to another form of treatment. The increasing focus on cost-effectiveness (see Smit et al., 2006), resource allocation, and providing individuals with the best treatment for their time investment requires researchers to consider a different question: "What works for whom?"

The most basic form of matching adopts the medical model, selecting an intervention on the basis of the symptoms. For example, practitioners prescribe medication based on a patient's diagnosis. Research has supported similar specific recommendations for psychological

interventions, such as indicating manualized cognitive-behavioral therapies for panic disorder (Barlow, Craske, Cerny, Jerome, & Klosko, 1989; Siev & Chambless, 2007) and prolonged exposure for post-traumatic stress disorder (Foa, Rothbaum, Riggs, & Murdock, 1991). These suggestions, however, fall short of a thorough consideration of “fit.” Instead, recommendations should also consider individual differences of the client or characteristics of the interventions that would contribute to a patient by treatment interaction.

This more nuanced approach of allocating specific interventions for a given individual requires knowledge of variables that differentially predict response between intervention strategies or treatments also known as prescriptive variables. This is akin to Lazarus’ (1967) notion of “technical” eclecticism that selects treatment components from various theoretical traditions on the basis of empirically identified fit between patient characteristics and efficacy of treatment. In Beutler and colleague’s (1991) *Systematic Treatment Matching*, patient characteristics guide treatment decisions such as the type of intervention (cognitive-behavioral versus experiential), the modality of treatment (individual versus group), and the intensity of treatment (in-patient versus outpatient, brief versus long-term).

Empirically based techniques require sufficient data to support treatment decisions. However, the results of matching studies have often been disappointing. For example, Project MATCH, one of the most ambitious studies of matching for alcohol use disorders, found little support for any patient by treatment interactions (Project MATCH Research Group, 1997). Project MATCH, however, had several methodological features that reduced variance on patient characteristics and treatment response including extensive exclusion criteria and in-depth follow-up assessments. These aspects combined with the fact that standard tests of moderation are often underpowered to identify significant effects (Aguinis & Stone-Romero, 1997; Aiken & West,

1991) may have impaired this study's ability to find patient by treatment interactions even if they existed.

More recent studies use more powerful statistical techniques, such as hierarchical linear modeling, to overcome the limited statistical power of previous investigations (Fournier, DeRubeis, Shelton, Hollon, Amsterdam, & Gallop, 2009). Another improvement is using methodologies specifically designed to investigate interaction hypotheses, such as analyzing individual profiles of response across treatments as a main outcome of the study (Lahey & Ondersma, 2008). A review of these studies identifies several prescriptive variables including demographic predictors, previous response to medication, personality characteristics, and nature of disorder (i.e., Barber & Muenz, 1996; Fournier, DeRubeis, Shelton, Gallop, Amsterdam, & Hollon, 2008; Fournier et al., 2009; Joyce et al., 2007; Leykin, Amsterdam, DeRubeis, Gallop, Shelton, & Hollon, 2007; Macias et al., 2008). These findings suggest that the most effective intervention is similar to a patient's characteristics or strengths. For example, cognitive therapy is beneficial if a person has significant life events to provide the basis of behavioral experiments whereas significant personality pathology changes more with a pharmacological treatment that can produce shifts in one's personality (i.e., Fournier et al., 2008).

Although using aspects of the individual to provide recommendations is appealing, it raises the question of how to combine results from multiple studies if they offer inconsistent or conflicting recommendations. For example, the findings from Joyce and colleagues (2007) suggest that for individuals with significant personality pathology, cognitive therapy may be the therapy of choice. Fournier and colleagues (2008), however, found that cognitive therapy was less effective than medication for individuals with personality disorders. A host of variables could predict preferences and no single study considers all possibilities. In psychotherapy

research, investigators have used upwards of 175 different variables (such as gender, intelligence, age, socio-economic status, marital status, personality, and education) to predict response to treatment (Beutler, 1991). Using some aspect of the intervention, such as preference for an activity, may therefore be more useful than individual characteristics for initial attempts at recommending interventions to individuals.

Preference for an exercise is worthwhile to examine because participants may gain more benefit from their preferred intervention (Seligman, 1995). Indeed, a meta-analysis of the clinical literature has found that patient preferences across a variety of clinical interventions leads to small but consistent increases in efficacy of the intervention and reduced drop-out rates (Swift & Callahan, 2009). Individuals may be more willing to invest energy or follow instructions when they receive their preferred intervention. Motivation to follow through on an exercise mediates the benefits received in positive psychology interventions as well (see Sin & Lyubomirsky, 2009). These findings are consistent with Self-Determination Theory, which emphasizes that intrinsically motivated activities are more enjoyable and pursued more diligently (Ryan & Deci, 2000). In a study of positive psychology interventions, intrinsically motivated participants were more likely to continue practicing an exercise and maintain gains in subjective well-being compared to extrinsically motivated participants (Lyubomirsky, Dickerhoof, Boehm, & Sheldon, 2008).

Applying Positive Psychology

Positive psychology interventions are cognitive and behavioral strategies designed to increase well-being (see Fredrickson, 2008; King, 2008; Sin & Lyubomirsky, 2009, for a review). Positive psychology exercises are good resources for investigating tailoring interventions to individuals as these exercises are cost-effective, brief, and often offered with

little variation either online or with no human interaction (i.e., Seligman et al., 2005). By contrast, studies comparing therapies are costly and require expertise of therapists trained in various modalities.

A brief review of the exercises selected for the current study follows:

Active-Constructive Responding Exercise. Participants respond in an active-constructive manner to good news that happen people share with them. An active-constructive response includes genuine happiness and displays of excitement as well as active questioning about the event. This enhances the event by encouraging retelling and re-experiencing. Research suggests that responding in an active-constructive manner is strongly linked to relationship satisfaction and individual well-being (Gable et al., 2004).

Blessings Exercise. This exercise promotes gratitude by asking participants to reflect at the end of each day and write down 3 things that went well on that day and why they went well. Reflecting on moments in a grateful nature can overcome the effects of adaptation by preventing people from taking things for granted (Emmons, 2008). This can also increase the salience of good acts that might have otherwise gone unnoticed. In previous studies this exercise has led to increased well-being (Emmons & McCullough, 2003; Seligman et al., 2005).

Gratitude Visit Exercise: The gratitude visit exercise promotes gratitude by requiring the participant to write a gratitude testimonial to someone who the participant never properly thanked. The participant then meets with this individual to read the gratitude letter to the recipient in person (Seligman, 2002). In a previous study of positive psychology exercises, the gratitude visit exercise showed the largest positive change on happiness and depressive symptoms out of a set of 5 exercises (Seligman et al., 2005).

Life Summary Exercise. In the life summary exercise, the participant writes a short description of how he or she would like to have his or her life relayed to his or her grandchildren. A few days after writing the summary, the participant reviews the summary to take stock of what was missing in his or her life and what changes might be necessary to ensure this summary could be achieved. This exercise was included in positive psychotherapy, a treatment approach developed to decrease depressive symptoms and increase well-being (Seligman et al., 2006).

Savoring Exercise. In the savoring exercise, the participant was asked to reflect each day for at least 2-3 minutes on 2 pleasurable experiences and to make the pleasure last as long as possible. This aims to increase savoring or an attempt to intensify or elongate the positive emotions of an experience through focused attention on the present moment (Bryant & Veroff, 2006). This exercise was also included in positive psychotherapy (Seligman, Rashid, & Parks, 2006).

Strengths Exercise. In this exercise, participants first completed the Values in Action Survey of Strengths (see Seligman & Peterson, 2004) and identified their 5 highest strengths. Each day, participants were asked to find a new way to use 1 of the 5 identified strengths. Use of signature strengths has led to boosts in well-being and decreases in depressive symptoms (Seligman et al., 2005).

Current Study

The aim of this study is to inform the creation of tailored programs of interventions by analyzing if exercises group together on the nature of preferences. Despite the benefits of using positive psychology exercises to test hypotheses of person by intervention, no study has used several interventions to explicitly examine such interactions. A further aim of this study is to investigate if preference for an exercise increases adherence.

Based on the existing literature on treatment matching, is the primary study hypothesis is that like interventions will group together. This grouping could be based on some characteristic of the exercise, i.e., participants who enjoy expressing gratitude would prefer both the gratitude visit and blessings exercise. This grouping could also be based on some aspect of the shared techniques of the exercise, i.e., savoring and active-constructive both keep individuals engaged in the present moment or interaction. Furthermore, it is predicted that preference for an exercise will relate to increased completion and adherence to that exercise.

Method

Participants enrolled in the study via the internet by accessing a web portal of research studies on the Positive Psychology Center at the University of Pennsylvania's website (<http://www.ppresearch.sas.upenn.edu/>). Participants included a sample of 792 individuals who were predominantly female (77.5%), white (45.1%), and average age = 53.5, $SD = 11.98$. Participants were randomly assigned to either receive 2 ($n = 247$), 4 ($n = 254$), or 6 ($n = 291$) different positive psychology exercises. These conditions set a maximum number of exercises each participant could receive. Some participants dropped out before completing the protocol; therefore, each participant completed between 1 and 6 of the possible positive psychology exercises. The exercises included were the active-constructive responding, blessings, life summary, savoring, and strengths exercises. These exercises were selected to mirror the activities in a previous study of group Positive Psychotherapy (Seligman et al., 2006). Due to the fact that 6 exercises could be administered in 720 unique orders, each participant received the exercises in same order. The following administration order was randomly determined at the start of the study: blessings ($n = 792$), strengths ($n = 562$), gratitude visit ($n = 364$), savoring ($n = 329$), active-constructive responding ($n = 142$), and life summary ($n = 122$). Participants

completed each exercise for 1 week, and then returned to the website to complete follow-up questionnaires and dependent measures. Participants also received the instructions for the next exercise, if applicable, at this time. Analyses of the overall efficacy and the comparative dose-response effect of the packages of the exercise are detailed elsewhere (Parks-Sheiner, 2009). This study found that exercises led to a significant decrease in depressive symptoms relative to a control group but not significant increases in life satisfaction or positive emotions.

Data Analytic Strategy

For this study, efficacy was analyzed using change scores on the dependent measures of happiness and depressive symptoms during the period in which each exercise was practiced. These two outcomes were standardized and averaged to create an overall composite of efficacy of the intervention.¹ Although, change scores have the limitation of ignoring baseline differences on a measure, they are valuable in this study because they provide a person-centered metric that relates to the relevant intervention period when each exercise was practiced. The fixed order of exercise administration complicates an analysis of the relative efficacy of exercises using other means. Exercises administered later in the sequence would have less ability to produce change if early exercises were effective. Treatments provided earlier in a sequence of interventions are usually more effective regardless of the type of treatment (Kazdin, 2003). Furthermore, statistical techniques that control for early change have the difficult task of separating true change on latter interventions from error variance (Rogosa, Brandt, & Zimowski, 1982).

This study used common factor analysis to investigate groupings of exercises based on preference for the intervention. Factor analysis was selected because it is variable centered technique, or in this case, focused on the interventions and participants' ratings of them.

¹ Analyses were also run separately for measures of happiness and depressive symptoms and the results were similar. To minimize the likelihood of Type II errors, the composite values are reported.

Common factor analysis was applied with promax rotation to ensure the interpretability of the factors. A factor solution's acceptability would be based on its ability to produce factors that: (a) yield the highest hyperplane count (Gorsuch, 1983); (b) satisfy constraints of scree (Cattell, 1966); (c) account for at least 5% of the total variance in the correlation matrix (McDermott, Leigh, & Perry, 2002); and retain salient ($\geq .30$) factor loadings (Fabrigar, Wegener, MacCallum, & Strahan, 1999).

Missing data was handled in all analyses using pairwise deletion. Pairwise deletion involves excluding missing values only from the variables under analysis. Pairwise deletion was selected because many participants did not receive all of these exercises, yet excluding participants with some missing data would limit analysis to the 6 exercises condition. The use of pairwise deletion for factor analysis will produce unbiased estimators if the data is missing completely at random (Allison, 2002). In this sample, a majority of the missing data is due to the random assignment to condition. In order to verify that pairwise deletion did not bias the estimates, analyses were also run using pairwise deletion of participants whose data was missing due to random assignment to condition and listwise deletion of participants who dropped out of the study. These analyses produced similar results; therefore, results are reported that maintain as much data as possible opting for pairwise deletion.

Preliminary analyses were conducted to examine potential differences between individuals who were randomized to the different intervention conditions. No differences existed between the groups assigned to the 2, 4, or 6 exercise condition on preference ratings (Blessings, $F(2,789) = .36, p = .70$; Gratitude Visit $F(1,362) = 1.14, p = .29$; Savoring, $F(1,327) = 1.56, p = .21$; Strengths $F(2, 559) = .37, p = .69$), any demographic predictors, or dependent measures. Differences for preference ratings for the Active-Constructive Responding Exercise and Life

Summary exercise, however, could not be compared to individuals assigned to the other conditions because only those in the 6 exercises condition received these activities.

Measures

Exercise Follow-up Questions. After each exercise, participants answered 3 questions about their preference for the exercise completed during the previous week: 1) “how much did you benefit from the exercise?”, 2) “how much did you enjoy the exercise?”, and 3) “how difficult did you find the exercise?”. Participants responded to each question on a 7-point Likert-type scale. The three preference questions were highly correlated within each exercise. Table 1 displays the correlations between the preference variables and Table 2 displays the descriptive statistics of the preference variables for each exercise. Given the magnitude of these correlations, these three variables were combined into a single composite to represent overall preference for each exercise. This composite was created by summing the standardized scores for each ranking (ratings on exercise difficulty were reverse coded). These three items showed good internal consistency with Cronbach’s α ranging from .73 to .82 for each exercise. Additionally, participants indicated whether they completed the exercise as instructed and the number of days they did so. This was included to ensure participants were completing the exercises despite minimal experimenter contact due to web delivery. These questions also serve as the measure of adherence in this study.

Authentic Happiness Inventory (AHI; Seligman et al., 2005). The AHI is a 24-item measure of general happiness. Participants select a statement from a list of 5 that mostly closely corresponded to how they felt at that time. For example, A. I am unhappy with myself (1), B. I am neither happy nor unhappy with myself--I am neutral (2), C. I am happy with myself (3), D. I am very happy with myself (4), E. I could not be any happier with myself (5). The AHI has been

found to be less skewed than other measures of happiness (Seligman et al., 2005). Reliabilities on the AHI ranged from $\alpha = .94$ to $\alpha = .96$ for the different time points.

Center for Epidemiologic Studies Depression Scale (CES-D; Radloff, 1977). The CES-D is a 20-item measure of depressive symptoms. Participants rated how often they experienced each symptom over the past week ranging from rarely or none of the time (less than 1 day) to most or all of the time (5-7 days). Sample items include “I felt that everything I did was an effort,” “My sleep was restless,” and “I felt that people dislike me.” Reliabilities on the CES-D ranged from $\alpha = .90$ to $\alpha = .93$ for the different time points.

Results

The results of this study provide initial support for a structure of preferences among the exercises used. Specifically, those who preferred the active-constructive responding exercise also preferred the savoring exercise ($r = .23$), those who preferred the strengths exercise also preferred the gratitude visit exercise ($r = .33$), and those who preferred the life summary exercise also preferred the blessings exercise ($r = .33$). Table 3 displays the correlations between each exercise’s preference ratings. Increased preference for an exercise corresponded to increased adherence for that same exercise as preference ratings showed strong relationships with participant reports of how often they engaged in each exercise (see Table 3).

Pattern of Exercise Preference

A common factor analysis was used to examine whether this preference data revealed any patterns of groupings; that is, would individuals who rated high preference for one exercise also hold high preferences for another exercise. In order to improve the interpretability of the factors, a promax rotation was used ($kappa = 4$). This allows for correlated factors but increases the likelihood of simple structure by reducing the loadings on some factors. The Kaiser-Meyer-Olkin

(KMO) Measure of Sampling Adequacy assesses whether the partial correlations among the variables are small, suggesting that there is enough unique variance to produce separate factors. Values should be over 0.5 for a satisfactory factor analysis to proceed (Tabachnick & Fidell, 1996). The KMO in this study was 0.54. Bartlett's Test of Sphericity tests the null hypothesis that in the population, the variables are uncorrelated (Geweke & Singleton, 1980). Bartlett's Test was statistically significant $\chi^2(15) = 28.69, p = .02$. This suggests that the correlation matrix is not an identity matrix and that in the population these variables are likely correlated. Both of these tests support conducting a factor analysis of these variables.

The promax rotation produced a three factor solution. Table 4 displays the results of the rotated structure matrix. Each exercise loaded on one factor with the exception of the Gratitude Visit that had a small (.30) but salient loading on a second factor. The factor structure suggests that within this group of 6 exercises there are 3 groupings of exercises: active-constructive responding and savoring, strengths and gratitude visit, and life summary and blessings. The gratitude visit also had a small loading on the third factor with the life summary and blessings exercise.

These groupings did not appear to be due to order effects of administration. If order was a strong determinant in the pairing of these exercises those correlations should be highest for the exercises closest in the administration order. This was not the case, which suggests that any relationship that order does not relate to preference.

Preference and Adherence

The second aim of this study was to determine whether exercise preference was linked to increased adherence. Correlations were computed between variables related to exercise completion and preferences for each exercise. Individuals who preferred an exercise were more

likely to complete the exercise and spent more days throughout the week engaging in the activity (see Table 3). The correlations between preference and number of days completed for each exercise ranged from $r = .27$ (blessings and life summary) to $r = .60$ (savoring). These correlations are all statistically significant ($p < .001$) and range from medium to large effect sizes (Cohen, 1988). This supports the notion that exercises that are enjoyable are more likely to be completed. For most of the exercise pairs, preference for one exercise related to adherence for the matched exercise. Figure 1 displays the correlations between exercise preference and adherence for every exercise. The figure shows that, with the exception of the gratitude visit exercise, preference for a given exercise is most strongly correlated with adherence for that exercise and is also highly correlated with adherence for the matched exercise.

Preference and Efficacy

Table 5 displays the means of change scores on dependent measures during the period when an exercise was assigned. These results illustrate a statistically significant boost in happiness and decrease in depressive symptoms during the first exercise assigned, the blessings exercise. Although on the whole the results support an upward trend in happiness and a downward trend in depression throughout participation in this study, only the savoring exercise also produced statistical significant increases in happiness and decreases in depression. As previously mentioned these findings should be interpreted cautiously as order effects confound the comparative efficacy of exercises in this study.

Linking preference to efficacy can help determine if participants are accurate in their perceptions of these activities as beneficial and whether exercises participants report enjoying actually relate to increased happiness and reduced depressive symptoms. Table 6 displays correlations between preference ratings for exercises and efficacy of the exercises (as change on

a composite of happiness and depressive symptoms)². In 5 of the 6 exercises, small yet significant correlations existed between the preference ratings for that exercise and the change in happiness and depressive symptoms during the period during which that exercise was practiced (ranging from $r = .18$ for active-constructive responding to $r = .26$ for using your signature strengths). The only exception was the savoring exercise which showed no significant correlation between preference and efficacy ($r = .04$). Although, not statistically different from the other exercises, the savoring exercise did show the highest mean ratings on each of the preference questions. Participants may have enjoyed the savoring exercise whether or not it actually boosted their well-being or reduced depressive symptoms.

Demographic Predictors

Much of the clinical research on matching has utilized individual difference variables of the participant to examine person by intervention fit. In this study, available characteristics of the participants were demographic predictors including ethnicity, gender, marital status, education, and income. Table 7 displays the test statistics examining if relationships exist between each demographic predictor and preference and efficacy of each exercise. Analyses were also run using regression techniques to control for other variables in the model. These analyses, however, produced similar results. Given that the most useful application of these relationships may come from repeated analysis over several studies and meta-analytic techniques to determine the overall impact of a demographic predictor, the correlations are reported without controlling for the other factors. There was a small yet significant relationship between gender and preference for the savoring exercise, such that it was preferred more by females ($M = .22$, $SD = 2.34$) than males ($M = -.74$, $SD = 2.79$). The statistical significance, however, of these results should be interpreted

² These correlations were also computed separately for happiness and depressive symptoms and demonstrated a similar pattern and magnitude of the correlations.

with caution as a large number of tests were run with no adjustment on the alpha level. Suffice to say, these demographic variables do not have large relationships with either preference or efficacy, but further studies may want to give further considerations to these hypotheses.

Discussion

The results of this study provide initial support for a system of recommending new exercises to individuals based on preferences for other exercises. Preferences for the exercises in this study formed 3 groups: active-constructive responding and savoring, strengths and gratitude visit, and life summary and blessings. Furthermore, preference for an exercise was related to adherence to that exercise; participants with higher preference ratings for a given exercise were more likely to complete the exercise and did the activity over more total days. Additionally, preference for a given exercise related to adherence for the matched exercise. That is, if someone enjoyed the active-constructive responding exercise, he or she was more likely to adhere to the savoring exercise once provided. This pattern of cross-group adherence held for 5 out of the 6 exercises (gratitude visit preference demonstrated a higher correlation with adherence for life summary than strengths). Lastly, higher ratings of preference for an exercise also linked to larger increases in happiness and decreases in depressive symptoms during the period when that exercise was practiced for all exercises in this study except for the savoring exercise. Although this data is preliminary due to concerns of possible order effects, it provides further support for the exercise groupings found in this study.

This study revealed three preference groupings of positive psychology exercises: active-constructive responding and savoring; strengths and gratitude visit; and life summary and blessings. One possibility is that the grouping of exercises found in this study is based on the time-orientation of the exercises. The active-constructive responding and savoring exercises both

attempt to build off present experiences, intensifying and elongating either a pleasurable moment or interpersonal interaction. The life summary and blessings exercises both involve reflection on past experiences. Lastly, the strengths and gratitude visit both require future planning. For the strengths exercise, one needs to consider his or her strengths then plan appropriate activities. Similarly, for the gratitude visit, one needs to plan ahead and think about whom he or she wants to thank and how to thank that person (where to meet, etc.). This future planning could create positive anticipation, which is not involved in other exercises. If further research can replicate these groupings, it would also be helpful to investigate features of these exercises that might help explain the pairings.

Another finding of this study was that increased preference for an exercise was linked to better adherence. Investigating how to increase individuals' continued engagement in positive psychology practices could help translate the existing research literature to applied settings. Although it is not surprising that individuals are more likely to follow through with activities that they found enjoyable and beneficial, past studies on positive psychology exercises have often neglected to measure participants reactions to the exercise, focusing instead on increases in well-being or decreases in negative emotions and symptoms of psychopathology.

Limitations

This study has several limitations. Participants were a convenience sample of individuals recruited via the Internet. This sample was likely to be highly motivated to complete the positive psychology exercises and increase their own happiness. Given that this study is attempting to build knowledge that informs the dissemination and packaging of these exercises, this sample may be an accurate representation of the individuals likely to benefit from this research.

This study also relied exclusively on self-report to gauge preference and efficacy of the exercises. Although participants did respond to questions about each exercise at the end of the week after engaging in that exercise, this does not completely mitigate the inherent flaws in self-assessment. People's self-knowledge appears to be limited in a variety of domains (see Dunning, Heath, & Suls, 2004) and prediction of future behavior and emotions is wrought with biases (i.e., Epley & Dunning, 2000; Gilbert & Wilson, 2007). With regards to interventions, participants may be motivated to reduce cognitive dissonance by reporting liking the intervention after investing time and energy in it. As memory is largely reconstructive, biases in self-report are magnified based on the amount of time between the event or symptom in question and the assessment. This can be addressed by using more frequent and real time methods of assessment, assessing objective criteria or specific behaviors, or augmenting self-report with other modes of assessment (Ebner-Priemer & Trull, 2009).

Another limitation of this study is that all exercises were administered in a predetermined order. An ideal study design would provide a large number of interventions and vary the order in which interventions were administered. Unfortunately, properly counterbalancing a large number of exercises would include several possible orderings. Although it is possible that certain exercises may be more beneficial or even more enjoyable after a previous exercise, this remains an unstudied empirical question. Statistical simulations of sequencing effects, however, suggest that unless ordering effects are large, they do not change conclusions drawn from the data (Collins, Murphy, Bierman, & 2004).

Ultimately, psychologists are most interested in recommending exercises that would be the most efficacious. The findings of this study could be bolstered by further research that links preference and adherence to efficacy. Of even greater interest, however, is research that

considers matching with regards to efficacy. Conducting these studies requires large samples to present random orders of exercises and provide enough power to test moderation hypotheses. The difficulties in conducting these studies, however, are far outweighed by their value to the field. The results of the current study will hopefully encourage further research on recommendations that could illuminate these difficult, yet important, questions.

Future Directions

Despite these limitations, this study is a first step to an important new area of research. This study addressed concerns about how to determine which positive intervention would be the best fit for a given individual based on preference for a previous exercise. The results supports that matching individuals to an exercise they enjoy increases use of the activity.

This study provides a start for a program of research addressing how to apply and disseminate techniques once they receive empirical validation. The future of positive psychology rests on helping individuals receive the most benefit possible. Research can aid this goal by moving away from a study of what is likely to work for the average person to what is likely to work for a given individual. Although, this study represents a small step towards this larger goal, hopefully it can motivate both researchers and practitioners to begin to address fit by thinking about similarities between exercises and how such similarities can be used to tailor interventions for a specific person.

STUDY 2: USING PREFERENCE TO SELECT A POSITIVE PSYCHOLOGY
EXERCISE (Schueller, in press; to appear in *Journal of Positive Psychology*)

Abstract

The current study investigates whether using preference to select a matched positive psychology exercise increased preference, adherence, or efficacy compared to random assignment. The sample consisted of 127 undergraduate students who participated in the study over a four-week period. All participants randomly received an initial positive psychology exercise for one week and rated their preference for the exercise. Participants in the matched group received a second exercise based on a previously defined matching rule whereas a comparison group received a randomly determined second exercise. Individuals preferred the matched exercise significantly more and tended to report larger boosts in well-being than those who received an exercise randomly. There were no significant differences between the groups for exercise adherence. Future efforts to construct treatment packages should follow this model of combining individually validated components using empirical data. This technique holds promise to enhance treatment outcomes.

Using Preference to Select a Positive Psychology Exercise

Introduction

A majority of psychological research is based on the average individual. This is especially true in studies of psychological interventions. This approach, however, overlooks individual variation in treatment response. The next stage of intervention research should unpack the characteristics that differentiate those individuals who benefit from a given intervention versus those individuals who do not. Investigations of this nature can improve treatment planning and selection by identifying the techniques that would be most beneficial for a given individual.

Clinicians often consider a client's personality presentation, life situation, and psychological symptoms when selecting a psychological intervention. Ideally, these choices would use research findings to yield the most appropriate and effective strategies. In practice, however, clinicians rely on past experience more than empirical data (Stewart & Chambless, 2007). One factor that contributes to this discrepancy is a lack of appropriate research studies. Treatment studies do not typically address issues of patient-treatment matching.

In the few studies that do address moderators of treatment response, investigators consider large intervention packages rather than smaller components (i.e., Barber & Muenz, 1996; Fournier, DeRubeis, Shelton, Gallop, Amsterdam, & Hollon, 2008; Fournier et al., 2009; Joyce et al., 2007; Leykin, Amsterdam, DeRubeis, Gallop, Shelton, & Hollon, 2007; Macias et al., 2008). These studies, therefore, do not provide information about how to adapt within a given treatment modality or the next step after initial techniques succeed or fail. An alternative to this top down approach is to create interventions from the bottom up by combining the most efficacious independently validated elements. This approach might benefit research on matching because each component may be differentially beneficial for a given individual.

Thus, research on clinical interventions has two substantial limitations. First, they examine only large intervention packages and second they do not understand individual response. This study addresses both of these limitations by adopting a novel approach to treatment planning. Similar to practices of popular websites such as Netflix and Amazon where users receive recommendations based on their selection and ratings of previous movies and products, this study uses preference for a positive psychology activity to select a further intervention. In a previous study, I demonstrated that positive psychology exercises can be grouped based on individuals' preferences (Schueller, 2010). In this study, I seek to replicate and extend those findings by assigning participants to a second positive psychology exercise on the basis of preference for the first. The goal of this investigation is to determine if using this matching framework leads to a sequence of interventions that is more enjoyable and more beneficial than randomly assigning exercises. Thus, participants in the experimental condition will each receive a treatment package that combines previously validated standalone components into an individually tailored sequence. This is an innovative and different approach to the standard development of treatment packages.

Standard Development and Validation of Psychological Interventions

The operative model in clinical research is to establish the efficacy of intervention packages and then determine which aspects are the most effective and critical components for producing change (see Kazdin & Kendall, 1998; Kazdin & Nock, 2003). The development and validation of Beck's cognitive therapy for depression provides an example of this model. Beck developed cognitive therapy based on his recognition that negative views of the self and the future are not merely symptoms of depression, but are causes of the disorder (Beck, Rush, Shaw, & Emery, 1979). Cognitive therapy is a treatment package that uses several strategies to alter

negative cognitions and alleviate depression. Only after establishing that this multifaceted treatment package led to long-term reductions in depressive symptoms (i.e., Elkin et al., 1989; see Dobson, 1989, for a review), did further studies attempt to isolate the important components of change (i.e., Jacobson et al., 1996).

The aim of the current study is to use a different method of designing treatment packages. Instead of relying on a top-down approach, which starts with theory and then proceeds to isolate individual components, selection proceeds from the bottom-up. In this study, participants receive individually-tailored sequences of positive psychology exercises based on empirical groupings of these exercises. This method attempts to increase the acceptability and effectiveness of the package by providing the techniques that represent the best “fit” for a given individual.

Why Match Participants to Treatments?

The evaluation of clinical interventions often focuses on overall treatment effects. Consumers and clinicians, however, are more interested in issues of “fit.” Consumers want to know whether a treatment will work for them and clinicians want to know what to do with each client. These questions are not answered by looking at the overall effect of a treatment, but instead require studying moderator variables that inform differential response to a treatment. By identifying these individual by treatment interactions, we can improve the ways which we select interventions for a given individual. Appropriately matching individuals to treatment can increase treatment efficacy. Matched exercises might be more beneficial due to increased adherence or effort to the techniques or disparate strategies being more appropriate for a given individual.

An individually-selected intervention might be more intrinsically motivating compared to other interventions because it “feels right” to an individual. Self-consistent activities increase an

individual's sense of autonomy, increase enjoyment, boost interest in doing the activity again, and promote a more active role in one's own treatment, which corresponds to increased benefit (Deci & Ryan, 1985; Seligman, 1995). Research suggests that the use of self-consistent activities increases intrinsic interest and follow through (Higgins, Cesario, Hagiwara, Spiegel, & Pittman, 2010). One reason to match individuals to treatments is to improve adherence. In therapy, the more individuals practice techniques outside of sessions, the larger the treatment gains. Several studies of cognitive-behavioral treatments support that homework adherence is positively related to clinical improvement (Burns & Nolen-Hoeksema, 1991; Persons, Burns, & Perloff, 1988). Continued engagement in the assignments facilitates sustained benefits after termination of in-person sessions between therapists and clients (Edelman & Chambless, 1993). Adherence is especially crucial for interventions that lack a face-to-face component such as self-help or internet disseminated techniques because they require self-motivation.

Besides increasing adherence, individuals might benefit more from a matched intervention because it takes advantage of their unique psychological make-up. In this case, two individuals would benefit differentially from a technique even if they were equally diligent in engaging in the activity. If this is true, it offers rich opportunities to learn more about the nature of people and treatments. In a comparison of cognitive and interpersonal therapies, level of cognitive dysfunction and social skills predicted differential benefit between the modalities (Elkin, 1994). In each modality, patients benefited most if they had characteristics that corresponded to each treatment's proposed mechanism of action. Indeed, it is not surprising that lower levels of cognitive dysfunction facilitates benefits in cognitive therapy because it allows patients to learn and use effectively the skills and techniques taught (Barber & DeRubeis, 1989).

It is likely; therefore, that drawing on an individual's strengths will provide additional benefits of treatment (Rappaport, 1977; Seligman & Peterson, 2004; cf., Barber & DeRubeis, 2001).

Past Attempts to Match Participants to Treatments

That matched interventions may prove to be more beneficial is not a new notion. In both research and practice, psychologists recognize that the next phase of research is not one of gross-level validation, but one that considers person-level variation in response. This type of research attempts to answer the more nuanced question of "What treatment by whom is most effective for this individual with that specific problem, and under which set of circumstances?" (Paul 1967, p. 111). Since Freud's (1940/1964) suggestion that psychologically minded patients benefit more from interpretation whereas less sophisticated patients respond better to direct suggestion, psychologists have provided a variety of suggestions for matching clients to interventions. These matching hypotheses are often investigated using hindsight matching. This type of matching relies on the fact that random assignment assures that each treatment group is comprised of some individuals who will benefit from the treatment and others who will not. Researchers then attempt to examine prescriptive factors that are associated with treatment response by identifying these groups and the characteristics that differentiate them.

A review of studies that follow this logic suggests that several prescriptive variables predict treatment outcome. For example, cognitive therapy is more efficacious than antidepressant medications for individuals with a significant number of stressful life events, who are married or cohabiting, or who are unemployed (Fournier et al., 2009), whereas antidepressant medication fares better than cognitive therapy for individuals with significant personality pathology (Fournier, DeRubeis, Shelton, Gallop, Amsterdam, & Hollon, 2008). A complete listing of prescriptive indicators is beyond the scope of this review (see Barber, 2007; Beutler,

Malik, Talebi, Fleming, & Moleiro, 2004; Bühringer, 2006; Project MATCH Research Group, 1997; Roth & Fonagy, 2005, for a more thorough review); however, these studies share the common feature of examining these indicators after the completion of the intervention in order to evaluate matching.

More relevant to the current investigation are studies that use previously identified prescriptive variables to match participants a priori. Unfortunately, not one study has attempted this using empirical data. Instead, studies have used decision algorithms based on expert consensus. In one example taken from the treatment of depression, patients are assigned to receive higher doses of medications, more potent antidepressants (such as monoamine oxidase inhibitors), and eventually, electroconvulsive shock therapy based on patient severity (see Adli, Rush, Möller, Bauer, 2003; Fava et al., 2003). As previously stated, expert consensus fails to produce better results than standard protocols. In fact, empirical data trumps expert opinion at predicting outcome in a variety of domains (Grove, Zald, Lebow, Snitz, & Nelson, 2000). Thus, even though researchers are interested in questions of person-intervention fit, no study has tested matching hypotheses by assigning participants in advance to a “matched” intervention to determine experimentally if they increase efficacy or adherence.

The Need for Empirically Driven Matching

This lack of studies using experimental manipulation to determine person by treatment fit creates a gap between science and practice. Clinicians, therefore, rely on their own judgment and impression of a client’s characteristics to pick a treatment. Several studies have examined therapist-tailored interventions and none have found that clinician flexibility trumps standardized protocols (i.e., Emmelkamp, Bouman, & Blaauw, 1994; Jacobson et al., 1989; Schulte, Künzel, Pepping, Schulte-Bahrenberg, 1992). These results do not suggest that tailoring interventions for

particular patients does not work, but instead indicates that clinicians fail to design the most effective intervention for a given individual. Indeed, in the case of tailored treatment for phobias, the tailored interventions contained less than half as much in vivo exposure as the standardized research protocol, an important active ingredient for treatment of phobias (Schulte et al., 1992). If judgments were replaced with empirical prediction, then tailoring interventions to individuals could boost the effectiveness of treatments.

Individuals do not fare much better than clinicians at selecting interventions. In a study of positive psychology interventions, participants either selected an activity or received an exercise based on a yoked-control pairing (Silberman, 2006). Overall, the interventions led to significant increases in happiness and well-being as well as decreases in depressive symptoms. Participants, however, were no happier or less depressed following a selected intervention than a yoked intervention. It is possible that people picked the most efficacious intervention overall instead of capitalizing on individual differences. Comparative studies, however, do not show that any one type of positive psychology exercise is unequivocally more effective than other techniques (Seligman et al., 2005). This coupled with the previous research illustrates the need for empirically-derived treatment decisions to aid participant-intervention matching.

Current Study

The current study investigates whether using empirically-derived matching rules to create packages of interventions improves intervention efficacy, preference, and adherence. This novel approach expands upon research that investigates prescriptive indicators for treatment by testing a model in which participants receive an intervention on the basis of a previously defined matching rule. This aims to introduce a method of treatment selection for psychological interventions that is analogous to consumer recommendations provided by Amazon or Netflix. I

investigated this paradigm in the context of positive psychology exercises. Positive psychology exercises represent a good starting point to develop this research methodology because they are brief, easily replicable techniques often disseminated via the Internet or in other methods that require minimal participant-experimenter contact. These techniques can also be delivered individually or in the context of a larger treatment package that combines several exercises.

In a previous study, I examined the empirical relationships between 6 positive psychology exercises by conducting a factor analysis of individual preference ratings for these exercises (Schueller, 2010). Results showed that the exercises formed three groups of two exercises. In the current study, I used these groupings to create an a priori matching rule. My primary hypothesis is that individuals who receive a second exercise based on this algorithm will experience enhanced benefit from the exercise and report greater liking of the exercise. To test this hypothesis, I randomly assigned participants to one of two groups: one group received a second exercise on the basis of the previously determined matching rule and the other group receiving a randomly determined second exercise. I investigated the utility of this matching rule by examining if the matched group reported greater liking of the exercise, greater adherence to the exercise, greater increases in well-being, and greater decreases in depression compared to the random assignment group. Exercise groupings based on the previous study were as follows:

Signature Strength and Gratitude Visit Exercises: In the signature strength exercise, participants complete the Value in Actions Survey of Character Strengths to identify their top 5 “signature strengths” (Seligman & Peterson, 2004). These strengths include a variety of dispositional characteristics that are morally valued and inherently beneficial such as kindness, gratitude, social intelligence, or forgiveness. Each day, participants use their strengths in a new way. For example, a participant with the strength of love of learning could visit a museum to

expand their knowledge. Focusing on using one's strengths each day has led to increases in happiness and decreases in depressive symptoms in previous empirical investigations (Seligman et al., 2005). The gratitude visit exercise requires participants to identify someone who has contributed significantly to their lives, but that they have never taken the chance to thank. Participants then write and deliver a gratitude testimonial, outlining the various ways in which that person has contributed to their lives. This is an extremely powerful opportunity to connect with another person. Participants describe the gratitude visit as an emotional moving and engaging activity (Seligman, 2002). In empirical studies, it contributes to increases in well-being and decreases in depressive symptoms (Seligman et al., 2005). Both of these exercises have the common focus of analyzing the past to spur future action. In the strengths exercise, individuals identify their defining and positive characteristics in order to plan future activities. In the gratitude exercise, individuals reflect on past instances that are indicative of another person's support for themselves and their development in order to write a gratitude testimonial to that individual.

Active-Constructive Responding and Savoring Exercises: The active-constructive responding exercise teaches participants to respond to good news in an enthusiastic and capitalizing manner. This style of responding prolongs the conversation and expands upon the sharing of positive events. Active-constructive responding promotes relationship satisfaction and teaching this skill increases well-being (Gable et al., 2004; Seligman, Rashid, & Parks, 2006; Reivich, Seligman, & McBride, 2011). The savoring exercise enhances and elongates a positive experience by promoting an active and present-minded focus. Participants in this exercise savor daily experiences, using strategies such as sharing with others and memory-building through mental snapshots, to enhance focus on the pleasure and experience at hand (see Bryant and

Veroff, 2006). Research demonstrates that the savoring exercise is an effective strategy for promoting well-being when used either individually or in combination with other exercises (Seligman et al., 2006). Both the active-constructive responding and savoring exercises promote well-being through an increased focus on the present experience. The active-constructive responding exercise focuses on the interpersonal domain and the savoring exercise on sensual or emotional experiences.

Blessing and Life Summary Exercises: In the blessings exercise, participants identify three things that went well each day and why. This exercise seeks to promote gratitude and refocus attention to the positive aspects of each day (Emmons, 2008; Emmons & McCullough, 2003). In the life summary exercise, participants review their life and create a positive summary of their life as they want it to be told to their progeny. Both of these exercises promote a review of the good things in one's life, either in the short period of one's day or the grander scope of one's life. These exercises therefore focus on a past-oriented time frame.

The previous study that established these groupings used self-reported preference for these exercises (Schueller, 2010). An untested empirical question is whether using these groupings to assign exercises actually leads to increased benefits over another method of assignment. The goal of this study is to test the benefits of a priori matching by creating a package of two positive psychology exercises in which assignment to the second exercise is either based on preference for the first exercise (matching) or random assignment. I predict that participants who receive the exercises according to the matching rule as opposed to random assignment will enjoy and adhere to the second exercise more, receive larger boosts in well-being, and show larger decreases in depressive symptoms.

Method

Undergraduates ($N=127$) enrolled in this study to receive course credit in their introductory psychology class at the University of Pennsylvania. The sample was predominantly female (70.3%) and Caucasian (65.6%) compared with Asian/Asian-American 20.3%, African-American 3.9%, Hispanic 3.9%, Other 6.3%. The average age of the sample was 19.63 ($SD = 2.97$). Participants completed all of the dependent measures online and received exercise instructions and follow-up reminders via e-mail. This study, therefore, included no face-to-face interaction with participants and minimal experimenter contact.

Upon enrollment in the study, participants received 1 of 3 randomly determined positive psychology exercises (active-constructive responding, $n = 43$; blessings, $n = 43$; gratitude visit, $n = 42$). At the same time, I randomly assigned each participant to either a matched group ($n = 64$) or randomized unmatched group ($n = 63$). In the matched group, participants would receive a second positive psychology exercise assigned on the basis of a matching rule created in a previous study (see Schueller, 2010). Participants who liked the first exercise would receive the matched exercise as follows: active-constructive responding and savoring exercises, blessings and life summary exercises, and gratitude visit and signature strengths exercises. Participants who reported dislike of the first exercise would receive an exercise from the least correlated factor as follows: active-constructive and blessings, blessings and gratitude visit, gratitude visit and active-constructive. In the randomized unmatched group, participants received a randomly determined second positive psychology exercise (excluding the possible matched exercises). I selected random assignment for the control group to provide a comparison group that is more representative of the standard practice of treatment selection. Although this represents a more rigorous test than comparing individuals in the matched group to a mismatched intervention (one that the matching rule would predict they would not like), it is preferable to test if this matching

system can improve over current assignment techniques. Figure 1 displays the matching rule and assignment for all participants in this study.

Participants completed dependent measures at 3 time points: immediately after exercise 1 (T1), immediately after exercise 2 (T2), and 2 weeks after exercise 2 (T3). All participants completed the first exercise for one-week and then returned to the website to complete dependent measure questionnaires. At this point, each participant received the second positive psychology exercise. In the matched group, participants received the second exercise on the basis of reported preference for the first, which was calculated as a composite of enjoyment, perceived benefit, and perceived difficulty of the exercise. If participants scored higher than the mean³ of the previous sample ($M = 14.73$ active-constructive, 15.77 blessings, 14.19 gratitude visit), then participants “liked” the exercise and received the corresponding linked exercise. If participants scored below the mean, they “disliked” the exercise and received the exercise of the least correlated factor as previously outlined. Participants in the unmatched group received a randomly assigned second exercise. Participants then completed this second exercise for a week before returning to the website to complete the dependent measures. Lastly, participants returned to the website 2 weeks after using the second exercise to complete follow-up questionnaires and receive debriefing regarding the primary study hypotheses.

Data Analytic Strategy

Primary statistical analyses investigated differences between the matched and unmatched groups. Given that these groups did not differ within the first stage of the study (when both groups received randomly assigned exercises), analyses focus on preference and adherence after the completion of the second exercise as well as changes in well-being and depression once a participant began the second exercise (from T1 to T3).

³ This corresponds to participants responding above the midpoint on each scale on average.

Analysis of preference and adherence data used linear regression to investigate the main study hypotheses. Each regression used preference or adherence as outcome variables. I included individual differences in a participant's likelihood to report preference or comply (preference or adherence to the first exercise), the exercise received, and assignment to either the matched or randomly assigned group as predictors in the model. By including preference and adherence for the first exercise in the model, these analyses control for individuals biases to report general liking of things (or tendency to follow instructions). Any detected difference, therefore, can be attributed to real differences based on whether the exercise received was matched or not.

To determine differences in efficacy, I examined changes in dependent measures of well-being and depression in the period after participants received the second exercise (from T1 to T3). I used analysis of covariance that included prior levels of well-being and depression at T1 as a covariate for subsequent change. In order to reduce the number of tests and the likelihood of Type II errors, I first conducted analyses using an overall composite of the dependent measures including happiness, life satisfaction, positive emotions, negative emotions, and depressive symptoms. I combined standardized scores using equal weighting of measures to form this overall composite.

Missing data is a common problem in clinical research and often exacerbated in web-based research (Hollis & Campbell, 1999; Muñoz et al., 2006; 2009). One common approach to working with missing data is listwise deletion, or completers analysis, which excludes any participant who has missing data at any time point. This approach can lead to inaccurate conclusions, particularly when dropout participants systematically differ from completers (Allison, 2002). Even if non-completers do not differ from completers based on available data, one still cannot be certain that they do not differ in some systematic way (Allison, 2002). An

alternative to listwise deletion is to impute predicted values for missing data. Common imputation procedures include last observation carried forward (LOCF), which fills in missing data cells with the last reported score for each measure. LOCF analyses are likely to be overly conservative in their estimate of study effects. In the current study, I ran two sets of analyses using both listwise and LOCF procedures; these analyses produced a similar pattern of results. I therefore report the results for completer analyses, which are more likely to include the individuals who are likely to seek out and benefit from this type of intervention.

Measures

Exercise Preference Questions. After each exercise, participants answered 3 questions about their preference for the exercise completed during the previous week: 1) “how much did you benefit from the exercise?”, 2) “how much did you enjoy the exercise?”, and 3) “how difficult did you find the exercise?”. Participants responded to each question on a 7-point Likert-type scale (i.e., 1 = “I did not enjoy it at all” to 7 = “I enjoyed it a great deal”). These three questions formed a composite of preference with difficulty reverse coded to match the scaling of the other two items. The same measure of preference was used in the previous study (Schueller, 2010).

Authentic Happiness Inventory (AHI; Seligman et al., 2005). The AHI is a 24-item measure of general happiness. Participants select a statement from a list of 5 that mostly closely corresponded to how they felt at that time. For example, A. I am unhappy with myself (1), B. I am neither happy nor unhappy with myself--I am neutral (2), C. I am happy with myself (3), D. I am very happy with myself (4), E. I could not be any happier with myself (5). The AHI has been found to be less skewed than other measures of happiness (Seligman et al., 2005). Reliabilities on the AHI ranged from $\alpha = .95$ to $\alpha = .97$ for the three time points.

Center for Epidemiologic Studies Depression Scale (CES-D; Radloff, 1977). The CES-D is a 20-item measure of depressive symptoms. Participants rated how often they experienced each symptom over the past week ranging from *rarely or none of the time (less than 1 day)* to *most or all of the time (5-7 days)*. Sample items include “I felt that everything I did was an effort,” “My sleep was restless,” and “I felt that people dislike me.” Reliabilities on the CES-D ranged from $\alpha = .90$ to $\alpha = .95$ for the different time points.

Positive and Negative Emotions Scale (Fredrickson, 2009). This scale asks participants to consider the previous week and indicate how often they experienced several positive emotions (e.g., “How often have you felt joyful, glad, or happy,” “How often have you felt inspired, uplifted, or elevated?”) and negative emotions (e.g., “How often have you felt sad, downhearted, or unhappy,” “How often have you felt stressed, nervous, or overwhelmed?”) on a 1 (none of the time) to 5 (all of the time) rating scale. Reliabilities ranged from $\alpha = .90$ to $\alpha = .93$ for positive emotions and $\alpha = .85$ to $\alpha = .90$ for negative emotions.

Satisfaction with Life Scale (SWLS; Diener, Emmons, Larsen, & Griffin, 1985). The SWLS is a 5-item measure of general life satisfaction (e.g., “I am satisfied with my life,” “If I could live my life over, I would change almost nothing.”). Participants rated themselves on a 7-point Likert-type scale (1 = *strongly disagree*, 7 = *strongly agree*). I averaged the items to produce a summary score, with higher scores representing higher levels of general life satisfaction. This scale had reliabilities ranging from $\alpha = .88$ for the pretest and $\alpha = .89$ for the various time points.

Results

Preference

I used regression analysis to investigate if group status (matched assignment or random assignment) predicted preference for the second exercise controlling for the participant’s

preference rating of the first exercise and dummy codes representing which exercise the participant completed second. Preference rating in this case is a linear composite of the three preference variables: enjoyment, perceived benefit, and difficulty. The reliability of this composite was $\alpha = .55$ for Exercise 1 and $\alpha = .67$ for Exercise 2. This overall regression was significant $F(3,99) = 2.92, p = .04$, with an R^2 of .08. Receiving a matched exercise did not significantly predict preference for the second exercise, $t(99) = 1.74, p = .08$, although there was a trend favoring the matched group.

I conducted a second linear regression replacing the linear composite of the preference ratings with a linear composite using only the enjoyment and benefit questions. It is possible that enjoyment and benefit are more indicative of the individual's subjective experience of the exercise than difficulty ratings. Furthermore, participants might find an exercise difficult yet still find it rewarding and therefore enjoy it and benefit from it. To support this notion, I calculated an intra-class correlation coefficient and compared variance due to exercise received on each of the follow-up questions to the total variation. These values were enjoyment = .29, benefit = .20, difficult = .45. This indicates that more of the variance in ratings of difficulty is due to the exercise assigned compared to the enjoyment and benefit questions. These findings advise use of a composite based on enjoyment and benefit and the exclusion of difficulty. The reliability of this composite was $\alpha = .75$ for Exercise 1 and $\alpha = .76$ for Exercise 2, which was higher than the reliability of the three-item composite including difficulty. Given that I based exercise assignment on ratings of enjoyment, perceived benefit, and difficult, excluding difficulty would have led to 5 individuals receiving different exercises. I therefore excluded these 5 individuals from the second regression analysis. The overall regression was significant $F(3, 94) = 4.32, p =$

.007, with an R^2 of .12. Receiving a second exercise according to the matched rule was a significant predictor of liking the second exercise, $t(94) = 2.67, p = .009$, incremental $R^2 = .08$.

A significant regression predicting the overall composite justifies examination of the individual variables of enjoyment and perceived benefit. These analyses clarify if benefit or enjoyment is driving the effect. I conducted two separate regressions again controlling for enjoyment or perceived benefit of the first exercise as well as the exercise completed. For enjoyment, the overall regression was significant, $F(3,94) = 3.83, p = .01$, with an R^2 of .11. Receiving a matched exercise was a significant predictor of enjoyment of the second exercise, $t(94) = 2.86, p = .005$, incremental $R^2 = .09$. I calculated estimated least square means for both the matched (4.98, $SE = .19$) and unmatched (4.29, $SE = .18$) conditions showing that participants receiving the matched second exercise enjoyed it more than participants receiving the unmatched exercise. Perceived benefit showed similar results. The overall regression was significant, $F(3,94) = 3.40, p = .02, R^2 = .10$ and receiving a second exercise according to the matching rule significantly predicted perceived benefit of the second exercise, $t(94) = 2.02, p = .046$, incremental $R^2 = .04$. Again, I calculated estimated least square means indicating higher perceived benefit in the matched group (4.78, $SE = .18$) compared to the unmatched group (4.43, $SE = .16$). In short, participants in the matched group reported greater enjoyment and perceived benefits from the second exercise compared to participants who received a randomly assigned exercise. Table 8 displays descriptive statistics on each of the preference ratings for the matched and unmatched groups.

Within the matched group, participants who liked the first exercise did not significantly differ from those who disliked the first exercise on enjoyment ($t(50) = -.10, p = .92$; like: $M = 4.77, SD = 1.20$; dislike: $M = 4.81, SD = 1.29$), or perceived benefit ($t(50) = .92, p = .36$; like: M

= 4.77, $SD = .84$; dislike: $M = 4.57$, $SD = .68$). This indicates that recommendations provided were as useful for those who liked the first exercise as those who disliked it. Overall, these findings replicate and extend the utility of the matching rule into a new sample and a using the rule for assignment rather than evaluating linkages post hoc.

Adherence

I examined adherence using the number of days that participants reported engaging in the exercise. Participants in the treatment group were no more likely to adhere to their matched intervention than participants in the control group ($t(94) = .83$, $p = .41$). This sample, however, was an undergraduate sample that completed this study for course credit. It is possible that there would be higher rates of adherence in this sample than other self-help seeking samples. Indeed, attrition rates in this study (T1: $n = 127$; T2: $n = 115$, attrition rate = 9.4%; T3: $n = 111$, attrition rate = 12.6%; T4: $n = 105$, attrition rate = 17.3%) were much lower than past internet studies conducted by our lab using self-help seeking populations (Parks-Sheiner, 2009). Attrition rates were also quite similar across the groups assigned either using the matching rule (T2: 7.9%, T3: 11.1%, T4: 12.7%) or random assignment (T2: 10.9%, T3: 14.0%, T4: 21.9%), again indicating no benefit on follow through with the matched exercise. Within the matched group, participants who liked the first exercise did not differ on adherence to the second exercise from those who disliked the first exercise, $t(50) = .32$, $p = .75$.

Efficacy

Lastly, I evaluated whether completing a matched exercise increases the efficacy of the exercise. Table 9 displays the means and standard deviations of each outcome measure for the matched and unmatched groups. To reduce the likelihood of Type II errors, an overall composite of well-being was created including positive emotions, satisfaction with life, happiness, negative

emotions, and depressive symptoms. I used a univariate analysis of covariance to determine if changes in this composite variable differed between the two groups from the period of time after participants received the second exercise until the end of the follow-up period (T1 to T3). In order to control for participants' level of well-being after completing the first exercise, I included the well-being composite immediately prior to receiving the second exercise (T1) as a covariate. I included condition as a fixed effect to evaluate differences between the matched (treatment) group and unmatched randomly assigned (control) group. Receiving a matched exercise did not lead to significant differences between the groups on changes in well-being, $F(1,99) = 1.92, p = .17, d = .28$.

I conducted a second set of analyses using a composite constructed to assess aspects of subjective well-being. Diener's (1984) defines the gold standard measure of well-being as high subjective evaluations of one's life (such as high life satisfaction and happiness) as well as frequent experience of positive emotions and a lack of negative emotions. The subjective well-being composite, therefore, included the measures of positive and negative emotions, satisfaction with life, and happiness. Although results were not statistically significant, there was a trend supporting that individuals in the matched condition reported higher changes in subjective well-being following the second exercise compared to individuals in the random assignment condition, $F(1,99) = 3.29, p = .07, d = .36^4$. These results indicate increased efficacy of a matched program but require further support. Within the matched group, participants who reported liking the first exercise did not differ from participants who disliked the first exercise on changes in well-being corresponding to the second exercise, $F(1,48) = .58, p = .45$.

Discussion

⁴ Excluding the 5 individuals "misassigned" by using difficult produced similar results, $F(1,94) = 3.13, p = .08, d = .36$

The results of this study provide additional support for a system of recommending new exercises on the basis of past exercise preference. Findings support that using this matching paradigm increases preference for a second exercise. The groups assigned to an intervention either using the matching system or random assignment did not significantly differ in terms of adherence to the exercise. Lastly, although receiving a matched exercise corresponded to slightly increased efficacy, this difference was not statistically significant. This investigation replicates previous findings that grouped these exercises into the following pairs: active-constructive responding and savoring, gratitude visit and strengths, and blessings and life summary (see Schueller, 2010). These results, however, extended past findings by using an experimental method to compare individuals assigned to a second exercise on the basis of preference with those receiving a randomly assigned exercise. Random assignment is a useful comparison group as it mimics common selection procedures. I will first discuss the findings for each outcome measure and then outline implications and future directions of this research program.

Preference

Using preference for a first positive psychology exercise to guide selection of a second exercise led to significantly higher ratings of preference for the second exercise. These findings do not merely identify individuals who have a tendency to report liking things. Instead, the matching rule provided useful recommendations for individuals who both report liking as well as those who report disliking the first exercise. These findings support the applied goal of this investigation –using a previously identified matching system in a new sample led to increased preference for the second exercise. Although, the ultimate goal in intervention research is find ways too boost efficacy, a consideration of preference is important as well. Preference may link to increased efficacy. A meta-analysis of clinical trials found small but consistent boosts in

efficacy for individuals matched to their preferred intervention compared to those who received a non-preferred choice (Swift & Callahan, 2009). One of the mechanisms by which preference might influence efficacy is through the effort invested in the preferred intervention. Results of this meta-analysis indicated that participants engage in a preferred treatment more diligently as they were about half as likely to drop-out compared to participants who did not receive their preferred treatment.

An important direction for future research would be to understand why these exercises are linked together. It is possible that characteristics associated with the individual or the intervention itself drives this grouping. For example, a person who likes active-constructive responding also likes savoring (by virtue of some psychological characteristics or individual differences) or active-constructive responding and savoring share similar characteristics that make these techniques enjoyable and beneficial to the same group of individuals. Both of these techniques focus on increasing awareness in the here and now. Future investigations into the similarities between these techniques can help illuminate the active ingredients that promote preference in certain individuals. This could also determine which exercise to provide first in a sequence.

Adherence

In the current study, the matched and randomly assigned groups did not differ in their adherence to the exercises. Drop-outs were similar across the two groups, which further supports that receiving the matched exercise did not lead to increased involvement in this study. The sample, however, was collected from the university subject pool and received course credit for their participation, based on the number of follow-up measures completed. This provided an extrinsic incentive to engage in the study and complete the assessments. In practice, people are

more likely to drop out if they find the exercises boring or useless. Studies should strive to examine factors that facilitate adherence, especially for the use of internet disseminated techniques.

The current findings suggest that any difference in efficacy is not due to further investment in the intervention, but instead due to some psychological characteristic of the individual or an individual by intervention “fit” that produces more benefit to the individual. In many ways, findings such as these are psychologically more interesting as they hint at something internal to a person (an aspect of that person’s psychology) that makes a particular strategy or exercise more beneficial per unit of time (or energy) invested. Future research should use the exercise groupings supported in this study as a starting point to identify psychological mechanisms underlying these interventions.

Efficacy

This study found preliminary support that receiving a second exercise based on the previously determined matching rule increased efficacy. Indeed, as Figure 2 displays, the change trajectories look similar for the two groups similar after receiving the first exercise when participants in both the treatment and control group received randomly assigned exercises. After receiving the second exercise and into the follow-up period, the two groups diverged on the dependent measures. Although this effect did not reach statistical significance in this sample, it is useful to frame the effect size ($d = .36$) of the change scores in relation to comparable studies. In a meta-analysis of treatment studies, the effect size between receiving one’s preferred treatment and increased efficacy corresponded to a $d = .30$ (Swift & Callahan, 2009). Previous studies (Parks-Sheiner, 2009; Seligman et al., 2006) found support for a combined package of the individual components included in this intervention with an effect size corresponding to a $d = .60$

for life satisfaction and .65 for depressive symptoms. These studies provided all six of the individual exercises in a treatment package deemed group positive psychotherapy. Meta-analyses of a variety of different positive psychology techniques find that these strategies on average lead to small boosts in well-being (with d of .41 in one estimate and .44 in another) and larger changes in depressive symptoms (Schueller, 2008; Sin & Lyubomirsky, 2009). These studies suggest that the overall boost in effectiveness due to selecting exercises using preference is on par with differences typically found in studies of positive psychology exercises.

Using preference to guide selection and create individually-tailored sequences could improve the efficacy of existing protocols. In these intervention packages all participants receive the same components irrespective of their individual strengths or weaknesses. Tailored sequences might be able to select only the components that would most benefit a given individual which could produce more efficient packages. These packages could increase effort of the participants and reduce wasted time, effort, and resources devoted to less effective or irrelevant components.

An important strength of the current study is that it does not compare an active treatment to an inert control group but instead compares two groups receiving previously validated exercises. This study also did not attempt to increase the variance between the two groups by comparing a matched to a mismatched group, i.e., one that would receive an exercise that the previously constructed matching framework would predict that the participant would not like. Instead, this study put the recommendation system head-to-head with the current best practice in positive psychology, random assignment of positive psychology exercises. Given these aspects of the study, a difference in changes in dependent measures of well-being that is on par with previous studies is quite promising.

Limitations

This study was not without its limitations. First, this study used an undergraduate student sample. Using this sample limits the likelihood of differences on certain outcomes, such as adherence or changes in depressive symptoms. As previously mentioned, participants completed this study for course credit and therefore were motivated to complete the study and the exercises even if the exercises were not intrinsically motivating. This limitation, however, also is a strength as it tested the matching rule in a sample with very different characteristics than the sample that served to create the matching rule (undergraduate sample versus a self-help seeking sample recruited via the Internet). This suggests stability of the framework of exercise groupings. Another limitation of this sample is restricted range on some variables such as depressive symptoms. Depressive symptoms showed little change within both treatment and control groups, and the mean and range of scores on depressive symptoms were both smaller than the self-help seeking Internet sample. It is possible that in a clinical or self-help seeking sample, this matching framework would lead to increased reduction of depressive symptoms. Further research should continue to apply this framework in various populations and settings to replicate its utility.

The dependent measures pose another limitation. For the measure of depressive symptoms, I selected the CES-D, which is less sensitive to short-term changes in depressive symptoms. This study also relied exclusively on self-report measures of subjective well-being. These measures do not capture aspects of eudaimonic well-being that take into account aspects of virtue and character or other conceptions of well-being that include the importance of social relationships, significant achievements, or adaptive life functioning (Schueller, 2009; Seligman, 2010). Determining that these exercises lead to more than just subjective increases in an individual's well-being would help to improve the confidence in the current findings, but well-

validated measures of eudaimonic well-being do not exist yet. This study adopted subjective measures because they are well-validated and accepted within the field (Ong & van Dulmen, 2007). As the field progresses, studies of interventions should examine the effects on character, social networks, and life goals.

One underlying assumption of the current work is that treatment packages should be constructed by combining individually validated components. Although this uses an additive mode, components could have interactive effects (a component is more effective if delivered with another specified component) or catalytic effects (a component is more effective only if it follows another specified component). In the case of these complex interactions, individual preference alone would be limited at constructing the most efficacious packages. Further studies should address this by comparing exercises provided in isolation and combined to study whether particular elements are more effective when given in combination with other components or in a specific sequence.

A final limitation of this study is that the larger package of interventions only included two positive psychology exercises. Treatment packages often contain a variety of different techniques. Programs of positive psychology exercises that contain more strategies lead to larger boosts in well-being than individual components or smaller packages (Sin & Lyubomirsky, 2009). Further studies should examine the usefulness of this recommendation framework for creating packages that include more than just two exercises. A related issue is whether individual components should be varied or repeated. In the current study, individuals received a different positive psychology exercise despite their reported liking of the first. Past research suggests that adaptation to life events or circumstances diminishes the influence that these factors have on well-being (Fredrick & Loewenstein, 1999; Lyubomirsky, 2011). In a study of the benefits of

performing acts of kindness, only individuals who had freedom to vary the kind acts each week experienced significant boosts in their well-being (Tkach, 2006). These results, support the approach adopted in this study to vary treatment components, however, there could be an optimal timing of repeated activities that balances repeated use of beneficial components and variety and flexibility. Longer studies that examine these variables and complex interactions between specific techniques can shed light on these questions.

Future Directions

This study provides an important step for future intervention research. Adopting this model to intervention research more generally can aid development of larger treatment programs by guiding selection of future exercises on the basis of past preferences. It provides evidence for a manner of selection in psychological interventions similar to guided recommendations used by Netflix or Amazon.

The results of this study support a framework for moving from individual components to larger treatment packages. This study used a bottom-up approach that integrated several stages of research in positive psychology exercises to create an individually-tailored treatment sequence. First, basic research links specific skills to well-being (i.e., active-constructive responding; Gable et al., 2004) and researchers adopted these skills for intervention techniques tested in isolation to show that they led to boosts in happiness (i.e., counting one's blessings; Emmons & McCullough, 2003). Further research validated these exercises both as stand-alone components and in larger treatment packages (Parks-Sheiner, 2009; Seligman et al., 2006). Although these studies answered important questions regarding the average effect of these strategies, they overlooked individual differences in treatment response. I previously addressed the issue of individual variation by developing the recommendation framework used in the current study and

creating groups of exercises based on individual preference ratings (Schueller, 2010). The current study found that this recommendation framework was useful for creating a larger package of interventions and increased preference and efficacy compared to random assignment. This technique is vastly different from previous methods that combined these exercises in a haphazard manner (i.e., Seligman et al., 2006). The current study represents state of the art advances in constructing treatment packages from the ground up.

An underlying benefit of working from the bottom up is the ability to isolate individual treatment components and achieve a better understanding of their mechanism of action. It is easier to isolate the mechanisms of action in smaller more specified interventions rather than larger packages. The findings of this study stress the importance of understanding the mechanisms responsible for change. From the current findings, it appears that difference in efficacy were not due to differences between the groups in adherence to the exercises. This suggests that an aspect of the person by exercise fit is responsible for the increased boosts in preference and well-being. Future research can help understand the psychological mechanism underlying this matching.

One possible explanation for person by exercise matching is that linked exercises share an intervention characteristic that is preferred by certain types of people. A previous conjecture is that these groupings of exercise conform to a past, present, and future perspective. The blessings exercise requires reflection on a given day whereas the life summary promotes such thinking over one's life. Active-constructive responding is similar to an interpersonal version of savoring and both exercises promote a present orientation by focusing on increasing awareness of positive events or good news in the present and elongating and intensifying that positive experience. Lastly, the strengths exercise primes an individual to their strengths to promote

future strengths-related behavior whereas the gratitude visit exercise requires an expression of how another individual helped shape the participant in such a way to promote future success and positive traits. A past, present, and future perspective provides a theoretical rationale for the grouping of these exercises. Promoting positive re-experiencing of past events, increasing positive emotions in the moment, or creating more positive expectations for the future are all pathways to increasing well-being. A number of studies have found individual differences on emphasis of various time perspectives (Strathman & Joireman, 2005). Although this theoretical framework requires more empirical support, future research should consider individual differences in time perspectives and its relation to these and other exercises. For example, positive reminiscence interventions focus on replaying past positive events (Bryant, Smart, & King, 2005) and optimism interventions aim to promote positive expectations for the future (Lyubomirsky et al., 2008; Sheldon & Lyubomirsky, 2006b).

The current study did not address the goal of recommending a first exercise to an individual based on demographics or other individual difference variables. An examination of the mechanisms that underlie the links between the groupings could provide hypotheses for investigating these aspects of person-intervention fit. At some point, an individual's age, gender, ethnicity, marital status, and personality might guide treatment selection, however, this remains a question that future research will need to address.

This study is a stepping-stone into a larger system of treatment selection. Ideally, the future of psychological interventions will involve knowledge of the best practices for a given individual. Although this study is a small step in that direction, future research can construct and validate recommendation frameworks to expand evidence for a priori treatment matching and improve individualized packages.

Conclusions

Individuals who received a package of interventions using a past preference based recommendation system reported significantly greater preference for a second positive psychology exercise compared to those who received a randomly assigned second exercise. Receiving the matched exercise also led to slightly higher boosts in subjective well-being following the second exercise. This represents a novel and promising new direction for intervention research. This study represents the culmination of a research program that suggests a Netflix or Amazon model to psychology which emphasizes individual response rather to interventions rather than average response can promote the effectiveness of intervention techniques. A continued focus on similar methods can shed light on psychological mechanisms underlying change in interventions and help promote the creation of individually-tailored psychological interventions drawing from basic science and empirical evidence. This represents a substantial advance in the knowledge of intervention selection and allows positive psychologists to provide specific and personalized recommendations.

GENERAL DISCUSSION

These two studies demonstrate the benefit of shifting psychological research from a focus on the average to the individual. Although past research has demonstrated the importance person-intervention “fit,” this is the first research program that goes further by demonstrating that using “fit” to guide intervention select can actually improve upon the efficacy of intervention packages. This research advances both practical and theoretical knowledge with regards to positive psychology exercises. First, it helps practitioners and consumers know which techniques to select on the basis of past techniques. If someone completes the active-constructive responding exercise and finds this technique valuable, then the results of these studies suggests the savoring exercise would be another good strategy. Several prominent positive psychology researchers have discussed their own propensities towards certain techniques based on their individual personalities (Lyubomirsky, 2008; Peterson, 2006; Seligman, 2010). Lyubomirsky (2008) even suggests that the most beneficial techniques are those that address idiosyncratic sources of unhappiness, build off individual’s strengths, or fit the flow of one’s lifestyle.

This dissertation represents an advancement for intervention research more generally by demonstrating that building packages from the bottom up, combining individually validated treatment elements into a large package, can be a viable method of constructing packages. This represents a significant departure from intervention research as usual that develops interventions from the top down. Top down construction starts with creating large scale interventions guided by psychological theory, follows with testing whether the new intervention is superior to a placebo-control or treatment as usual, and ends with searching for the causal mechanisms that produce change. The current studies drew from a previously created and validated top down intervention, Group Positive Psychotherapy, and used the individual treatment components to

build a package of individually-tailored interventions. An important question for future research is whether this bottom up approach can pare packages to the essential components and thus be shorter and more direct. Further investigations could compare the briefer, selected program to the more time-intensive untailored package. If tailored packages are as effective, it could save time and resources in delivering these interventions.

Further research should investigate the mechanisms that explain matching. For example, personality and demographic variables and intervention characteristics might explain why groups of individuals benefit more from a specific intervention. This would help establish which intervention to give to someone first. The results of Study 1 hint that women may prefer the savoring exercise more than males ($d = .32$) and this pattern was also present in Study 2 ($d = .32$), albeit with a much smaller sample (Study 1 $n = 329$, Study 2 $n = 13$). Findings such as these illustrate the need for large datasets, replications of findings, and increased methods to share results (even when non-significant) among different research groups. To address questions of individual differences, researchers need to recruit large samples to allow for a full range of the variance in treatment response. As more research accumulates, this can promote better recommendations built on personality characteristics in addition to aspects of the exercises.

Overall this research highlights the benefits of introducing novel techniques in psychological research. The current state of research in social and clinical psychology relies strongly on null hypothesis testing to determine if results are unlikely assuming that populations come from a Gaussian distribution. In the future, psychological research should take advantage of data mining and modeling techniques used in other disciplines, such as collaborative filtering, k-means nearest neighbor clustering, neural network modeling (see Rogers, 2010). These methods can help spread the Netflix model beyond this dissertation, beyond these six exercises,

beyond positive psychology, and revolutionize psychological research by replacing general guidelines with specific, personalized recommendations of what will provide the most benefit.

TABLES

Table 1. Correlations of follow-up questions within each exercise and reliabilities of three-item scale

	$r(\text{enjoy, benefit})$	$r(\text{enjoy, difficult})$	$r(\text{benefit, difficult})$	α^a
Active-Constructive	.66	-.56	-.42	.78
Gratitude Visit	.70	-.62	-.48	.82
Blessings	.57	-.42	-.31	.73
Life Summary	.74	-.49	-.49	.80
Savoring	.69	-.55	-.46	.80
Strengths	.65	-.50	-.46	.78

Note: all correlations are significant at $p < .001$ level. ^a α = reliability of the three item composite measure within each exercise.

Table 2. Means and standard deviations of follow-up questions for each exercise

	Benefit		Enjoy		Difficult	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Active-Constructive (<i>n</i> = 142)	4.89	0.99	5.23	1.33	4.87	1.71
Gratitude Visit (<i>n</i> = 364)	4.64	1.50	4.28	2.12	3.27	1.92
Blessings (<i>n</i> = 792)	5.19	0.97	5.46	1.18	4.68	1.59
Life Summary (<i>n</i> = 122)	4.44	1.35	4.44	1.71	3.80	1.67
Savoring (<i>n</i> = 329)	5.40	1.15	5.77	1.32	5.31	1.65
Strengths (<i>n</i> = 562)	4.59	1.20	4.41	1.72	3.54	1.70

Table 3. Correlations between exercise preference and completion of the exercise

	<i>n</i>	<i>r</i> (PREF, COMPLETED)	<i>r</i> (PREF, DAYS COMPLETED)
Active-Constructive	142	.44	.48
Savoring	329	.47	.60
Strengths	562	.45	.50
Gratitude Visit	364	.58	.41
Life Summary	122	.38	.27
Blessings	792	.30	.27

Note: all correlations are significant at $p < .001$ level. PREF = Preference Composite Measure, COMPLETED = Did you complete the exercise as assigned?, DAYS COMPLETED = How many days during the past week did you use the assigned exercise?

Table 4. Structure matrix of exercise preference using a promax rotation (k = 4)

	Factor 1	Factor 2	Factor 3
Active-Constructive	.54	.21	.12
Savoring	.54	.05	.20
Strengths	.11	.65	.11
Gratitude Visit	.26	.37	.30
Life Summary	.09	.04	.45
Blessings	.14	.17	.33
Eigenvalues	1.54	1.11	1.06
Percent of Variance	25.62	18.56	17.70
Explained by Factor			

Table 5. Means and significance of change scores on dependent measures during each exercise

Exercise	<i>n</i>	Happiness (AHI)				Depressive Symptoms (CES-D)			
		<i>M</i>	<i>SD</i>	<i>t</i>	<i>p</i>	<i>M</i>	<i>SD</i>	<i>t</i>	<i>p</i>
Blessings	792	3.17	8.03	11.11	<.001	-3.12	8.34	-10.52	<.001
Strengths	562	.58	8.30	1.65	.10	.04	7.78	.12	.91
Gratitude Visit	364	.78	8.75	1.70	.09	.37	9.04	.78	.43
Savoring	329	1.36	8.25	2.99	.003	-1.29	8.71	-2.69	.007
Active- Constructive	142	-.43	8.18	-.63	.53	.22	9.24	.28	.78
Life Summary	122	1.52	9.08	1.84	.07	-.47	8.78	-.59	.56

Note: Exercises are listed in order of administration

Table 6. Correlations between preference ratings for exercises and efficacy

	Blessings Efficacy	Strengths Efficacy	Gratitude Visit Efficacy	Savoring Efficacy	Active- Constructive Efficacy	Life Summary Efficacy
Blessings Preference	.24** <i>n</i> = 792	.00 <i>n</i> = 562	.04 <i>n</i> = 364	-.01 <i>n</i> = 329	.06 <i>n</i> = 142	.20* <i>n</i> = 122
Strengths Preference	-.13 <i>n</i> = 562	.26** <i>n</i> = 562	.03 <i>n</i> = 364	.09 <i>n</i> = 329	-.11 <i>n</i> = 142	.05 <i>n</i> = 122
Gratitude Visit Preference	.04 <i>n</i> = 364	-.15** <i>n</i> = 364	.24** <i>n</i> = 364	.01 <i>n</i> = 329	-.05 <i>n</i> = 142	-.22* <i>n</i> = 122
Savoring Preference	.06 <i>n</i> = 329	-.03 <i>n</i> = 329	-.10 <i>n</i> = 329	.04 <i>n</i> = 329	.02 <i>n</i> = 142	.15 <i>n</i> = 122
Active- Constructive Preference	-.22** <i>n</i> = 142	-.05 <i>n</i> = 142	-.20* <i>n</i> = 142	-.01 <i>n</i> = 142	.18* <i>n</i> = 142	-.14 <i>n</i> = 122
Life Summary Preference	.06 <i>n</i> = 122	-.01 <i>n</i> = 122	-.04 <i>n</i> = 122	-.14 <i>n</i> = 122	-.12 <i>n</i> = 122	.24** <i>n</i> = 122

Note: Values in boldface type represent correlations between preference for and efficacy of a given exercise.

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

Table 7. Prediction of preference and efficacy of each exercise by demographic characteristics

	Test Statistic	Blessings (<i>n</i> = 792)		Strengths (<i>n</i> = 562)		Gratitude Visit (<i>n</i> = 364)		Savoring (<i>n</i> = 329)		Active- Constructive (<i>n</i> = 142)		Life Summary (<i>n</i> = 122)	
		Pref	Eff	Pref	Eff	Pref	Eff	Pref	Eff	Pref	Eff	Pref	Eff
Ethnicity	<i>F</i>	1.17	1.27	1.24	1.54	1.02	.92	1.21	1.21	2.23	.24	.93	.94
Gender	<i>T</i>	.37	1.24	.29	-.11	1.54	.83	-2.91*	-1.51	.46	.24	.21	-.61
Marital Status	<i>F</i>	1.18	.67	.54	.73	.70	1.15	.60	1.12	1.98	1.58	.94	2.11
Education	<i>F</i>	1.72	1.75	.86	.77	1.21	.24	1.82	.42	1.39	.31	.75	.47
Income	<i>F</i>	.42	.59	.78	.28	.56	.28	1.28	.95	1.40	.31	.94	1.17

Note: Pref = Composite of enjoyment, benefit, and difficulty, Eff = composite of happiness and depressive symptoms.

Number of levels for each variable is as follows: ethnicity = 11, gender = 2, marital status = 5, education = 7, income = 6

**p* < .05

Table 8. Descriptive statistics for preference and adherence during each exercise period

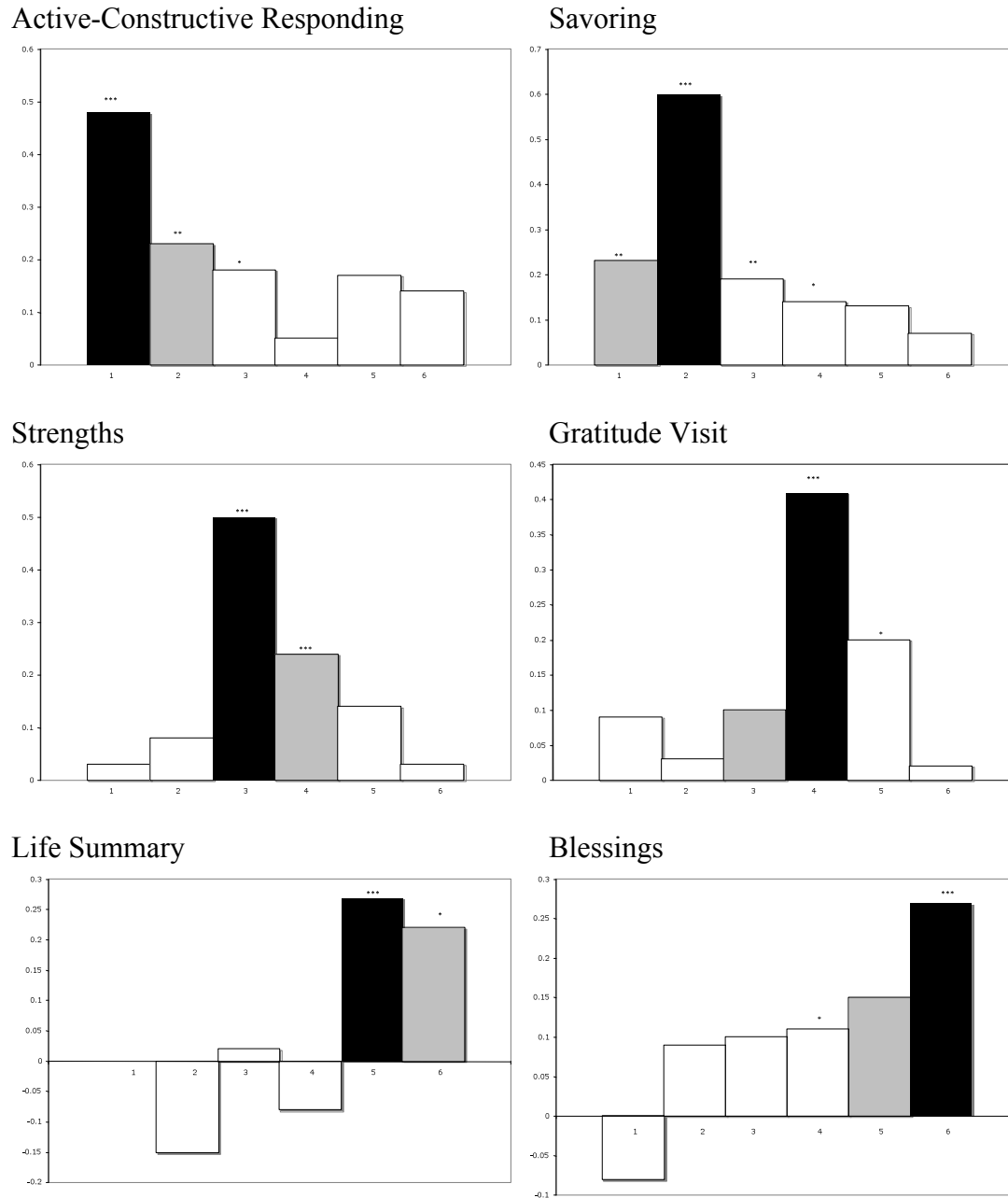
	Benefit		Enjoy		Difficult		Benefit + Enjoy + Difficult		Benefit + Enjoy		Adherence	
	Exercise 1	Exercise 2	Exercise 1	Exercise 2	Exercise 1	Exercise 2	Exercise 1	Exercise 2	Exercise 1	Exercise 2	Exercise 1	Exercise 2
Matched (<i>n</i> = 64)	4.83 (0.86)	4.66 (.77)	4.86 (1.16)	4.79 (1.19)	4.64 (1.38)	4.21 (1.44)	14.32 (2.53)	13.66 (2.58)	9.69 (1.86)	9.45 (1.76)	5.10 (2.02)	4.59 (2.01)
Active- Constructive Responding (<i>n</i> = 21)	4.89 (0.88)	4.79 (0.79)	5.11 (0.99)	4.84 (0.83)	5.11 (1.29)	4.05 (1.31)	15.10 (2.31)	13.68 (2.29)	10.00 (1.63)	9.63 (1.46)	5.68 (1.86)	5.21 (1.99)
Blessings (<i>n</i> = 20)	4.71 (0.78)	4.37 (0.60)	4.76 (1.00)	4.42 (1.43)	4.67 (1.56)	3.58 (1.26)	14.14 (2.50)	12.37 (2.73)	9.47 (1.69)	8.79 (1.84)	5.86 (1.65)	3.79 (2.04)
Gratitude Visit (<i>n</i> = 22)	4.89 (0.96)	4.83 (0.86)	4.72 (1.49)	5.11 (1.18)	4.11 (1.13)	5.06 (1.39)	13.72 (2.72)	15.00 (2.09)	9.61 (2.30)	9.94 (1.83)	3.61 (1.82)	4.78 (1.80)
Unmatched (<i>n</i> = 63)	4.70 (0.98)	4.31 (1.03)	4.56 (1.13)	4.16 (1.21)	4.68 (1.59)	4.31 (1.73)	13.95 (2.74)	12.78 (3.30)	9.26 (1.85)	8.47 (2.04)	4.52 (2.10)	4.84 (1.80)
Active- Constructive Responding (<i>n</i> = 21)	4.57 (0.98)	4.14 (1.28)	4.81 (1.12)	4.19 (1.33)	5.29 (1.62)	4.86 (1.56)	14.67 (3.07)	12.33 (3.84)	9.38 (1.91)	8.33 (2.42)	5.48 (1.63)	4.86 (1.56)
Blessings (<i>n</i> = 22)	4.84 (1.02)	4.44 (0.70)	4.42 (1.07)	4.28 (1.36)	4.58 (1.54)	4.67 (1.82)	13.84 (2.57)	13.39 (3.22)	9.26 (1.88)	8.72 (1.93)	5.32 (2.14)	5.39 (1.94)
Gratitude Visit (<i>n</i> = 20)	4.71 (0.98)	4.38 (1.02)	4.41 (1.23)	4.00 (0.89)	4.06 (1.44)	4.31 (1.58)	13.18 (2.40)	12.69 (2.65)	9.12 (1.83)	8.37 (1.67)	2.47 (0.80)	4.19 (1.83)

Table 9. Descriptive statistics for outcome measures pre and post during each exercise period

	Happiness (AHI)			Satisfaction with Life (SWLS)			Positive Emotions (PE)			Negative Emotions (NE)			Depression (CES-D)		
	T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3
Matched (<i>n</i> = 64)	70.78 (13.57)	75.25 (15.51)	76.69 (14.69)	24.31 (5.78)	25.21 (6.39)	26.53 (5.69)	20.81 (6.28)	20.71 (7.58)	20.64 (7.29)	10.60 (5.15)	8.57 (5.48)	8.42 (6.19)	12.06 (8.91)	8.39 (8.02)	7.94 (9.07)
Active- Constructive Responding (<i>n</i> = 21)	72.38 (14.06)	75.00 (13.84)	77.00 (14.64)	24.43 (6.18)	24.63 (6.34)	26.53 (4.56)	22.38 (6.78)	20.95 (8.17)	20.16 (7.05)	10.28 (5.13)	8.26 (5.39)	7.89 (5.10)	12.71 (9.06)	7.42 (6.56)	7.37 (8.74)
Blessings (<i>n</i> = 20)	70.55 (13.04)	71.52 (17.37)	72.42 (16.25)	23.85 (5.76)	24.33 (7.62)	25.79 (7.15)	19.75 (6.04)	20.57 (7.32)	19.47 (7.33)	10.60 (5.28)	9.19 (5.66)	9.26 (7.15)	11.50 8.83	9.76 (9.51)	8.81 (10.13)
Gratitude Visit (<i>n</i> = 22)	69.36 (13.62)	79.61 (15.00)	81.06 (12.82)	24.68 (5.36)	26.78 (4.75)	27.33 (4.91)	20.32 (5.98)	20.61 (7.21)	22.44 (7.48)	10.95 (5.04)	8.22 (5.37)	8.06 (6.11)	12.00 (8.84)	7.89 (7.61)	7.59 (8.13)
Unmatched (<i>n</i> = 63)	70.64 (12.25)	74.42 (15.86)	72.16 (15.36)	25.77 (5.88)	25.49 (5.70)	24.91 (5.34)	20.20 (6.34)	21.20 (5.86)	19.78 (6.72)	9.45 (4.38)	8.66 (5.39)	8.57 (5.69)	10.75 (9.19)	10.17 (8.23)	10.62 (8.32)
Active- Constructive Responding (<i>n</i> = 21)	72.73 (14.18)	74.50 (17.47)	73.15 (18.92)	27.32 (6.55)	24.86 (6.03)	25.48 (5.77)	20.04 (6.57)	22.36 (4.84)	21.30 (7.06)	9.13 (4.08)	9.00 (5.22)	10.05 (6.57)	8.95 (8.66)	10.10 (10.35)	11.14 (10.36)
Blessings (<i>n</i> = 22)	69.47 (10.18)	73.18 (14.94)	71.94 (11.61)	25.31 (5.16)	25.91 (5.64)	25.00 (4.96)	21.18 (7.03)	18.83 (7.14)	17.74 (7.44)	9.54 (5.32)	9.32 (6.38)	9.56 (5.47)	12.37 (10.47)	11.10 (6.46)	10.61 (7.72)
Gratitude Visit (<i>n</i> = 20)	69.75 (12.15)	75.70 (15.05)	71.36 (14.81)	24.65 (5.87)	25.70 (5.39)	24.21 (5.26)	19.30 (5.21)	22.59 (5.24)	20.44 (5.41)	9.70 (3.42)	7.59 (4.27)	5.93 (4.89)	10.85 (8.16)	9.23 (7.43)	10.07 (6.32)

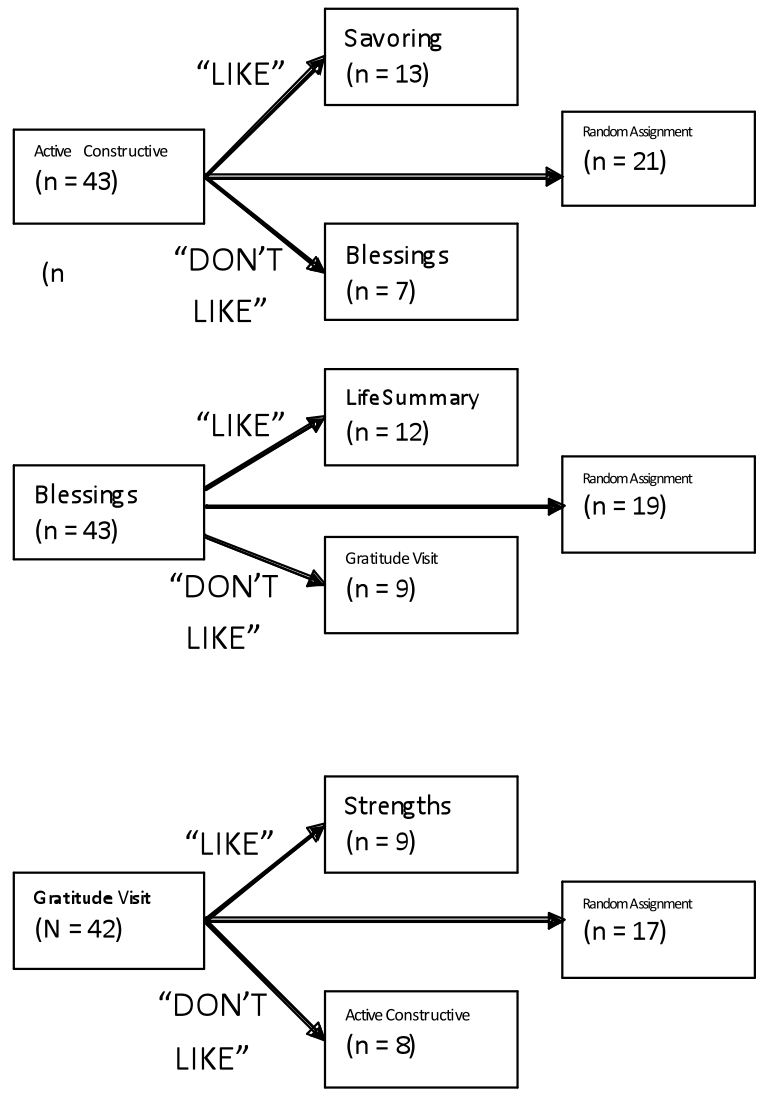
FIGURES

Figure 1. Correlations Between Exercise Preference and Completion of All Exercises



Note: 1 = Active-Constructive Responding, 2 = Savoring, 3 = Strengths, 4 = Gratitude Visit, 5 = Life Summary, 6 = Blessings. The black bar is the correlation of an exercise preference with adherence for that exercise, the gray bar is preference for the exercise with the other “matched” exercise. * denotes $p < .05$, ** denotes $p < .01$, and *** denotes $p < .001$.

Figure 2. Matching Rule and Exercise Assignment for All Study Participants.



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