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Tracing the size, reach, impact, and breadth of positive psychology

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This study quantitatively assessed the size, disciplinary reach, impact, and topic breadth of positive psychology (PP), in order to provide a comprehensive evaluation of the growth and significance of the field. Over 1.7 million documents in 700 PsycINFO® journals covering the fields of psychology, psychiatry, neuroscience, management, business, public health, and sport science were analyzed using semantic and bibliographic methods. Results indicate that PP covers many different research topics from a diverse range of disciplines, and that PP literature has been growing rapidly in significance. Over 18,000 documents were identified as belonging to PP, with 2300 published in 2011. These documents represent over 4% of PsycINFO® documents within the data-set published that year, and make PP close to the median size of all disciplines listed in the Thomson Reuters Journal Citation Reports® Social Sciences Edition. The aggregate impact factor for PP in 2011 was 2.64.

Keywords: positive psychology; impact; growth; bibliographic coupling; co-word; semantic analysis; scientometrics; bibliometrics; map of science

Introduction

Positive psychology (PP) is a relatively new field that scientifically studies the flourishing and optimal functioning of individuals, groups, and institutions (Gable & Haidt, 2005; Linley, Joseph, Harrington, & Wood, 2006). It focuses on the strengths, virtues, beneficial conditions, and processes that contribute to well-being and positive functioning. Its origins have been well documented in the literature (e.g. Duckworth, Steen, & Seligman, 2005; Linley et al., 2006), but studies that quantitatively assess the size, reach, impact, and breadth of PP in the academic literature are rare. Hart and Sasso (2011) recently noted:

However, as Hart and Sasso (2011) have noted, the field of PP will benefit from large-scale quantitative evidence of the growth of PP. The current study provides a quantitative assessment of the progress of PP, using bibliographic citation and co-term methodology to trace growth along four key dimensions: size, disciplinary reach, impact, and topic breadth.

Quantitative studies of PP growth

Between 2006 and 2011, eight published studies have attempted to quantify the growth of PP. Five of these studies have been conducted within individual fields. Lopez et al. (2006) analyzed the counseling psychology literature by randomly selecting 1135 articles from four representative journals, and manually coded articles for 59 positive constructs and processes (e.g. hope, optimism, motivation, positive emotions, and well-being), which were identified from a manual review of recent PP-related articles and texts. They found 29% of the articles discussed one or more of these constructs/processes. In health psychology, Schmidt, Raque-Bogdan, Piontkowski, and Schaefer (2011) performed a similar search of 52 positive terms within 3789 articles from four leading journals, and manually coded articles for 59 positive constructs and processes (e.g. hope, optimism, motivation, positive emotions, and well-being), which were identified from a manual review of recent PP-related articles and texts. They found 29% of the articles discussed one or more of these constructs/processes. In education, Froh, Huebner, Youssef, and Conte (2011) manually coded a random selection of 1168

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articles from four educational psychology journals for 76 positive constructs following a similar method, and found 27% of the articles had a positive focus. Year-by-year, this percentage varied between 25 and 33% for over 50 years. In the field of organizational science, Donaldson and Ko (2010) searched for documents using four key terms. Their search returned 1353 studies across 70 different journals, with 172 articles being related to positive organizational psychology and the publication rate of such articles increasing from three articles published in 2001, up to 26 published in 2009 (they did not include results in percentage terms).

Lastly, Schui, Fell, and Krampen (2010) searched for PP-related articles within the fields of behavioral medicine and health psychology, and found the percentage of PP-related articles in these fields increasing from 1990 in a near-linear fashion to about 10% in 2009. Collectively, these studies show that PP-related documents occupy between 10 and 36% of the research in the fields of counseling, education, organizational science, behavioral medicine, and health psychology. Moreover, the bulk of these studies showed that PP-related research was increasing.

Three studies have also investigated the growth of PP across all fields, as distinct from the studies that focused on only one field. Borrego and Jiménez (2009) performed a year-by-year search of documents in the PsycINFO® database for the key term ‘positive psychology’. They found only eight documents (articles or book chapters) including the term ‘positive psychology’ prior to 2000, but usage of the term increased to 141 PsycINFO® publications (articles or book chapters) in 2008. Schui and Krampen (2010) performed a similar search of the PsycINFO® database using this key term. Their results supported those of Borrego and Jiménez by also showing a clear increase in PP-related literature from less than 20 PP-related documents in 2000 to over 170 PP-related documents in 2008. Recently, Hart and Sasso (2011) searched PsycINFO® for a larger list of PP-related key terms to characterize trends in PP-related literature. They derived their key terms, which covered eight themes, by clustering terms extracted from PP literature and consulting with Canadian PP scholars. Their search returned over 20,000 articles, and indicated that the number of PP-related articles published in PsycINFO® had increased from 4193 articles between 1998 and 2001, up to 10,114 articles from 2006 to 2009.

These seven studies, listed in Table 1, have provided valuable quantitative evidence that PP terms and journal articles are generally increasing in frequency within the academic literature. They have largely focused on the number of PP-related publications (i.e. size), and the number of different topics being researched (topic breadth) within particular fields. Size and topic breadth are two aspects of the growth of a field, but there are two other important elements of growth: disciplinary reach and impact. Disciplinary reach is measured by the number of articles across different academic fields that concern PP concepts. Impact is a measure of the importance of PP-related articles, and is quantified by the frequency with which PP-related documents are cited. The previous studies are critiqued below with respect to each of these four metrics.

**Size**

Although all the previous studies have used the metric of size, the size of the field has still not been adequately quantified. In particular, it has not been quantified as a percentage of psychological literature as a whole. The broad-scope studies of PP across all fields have shown increases in the publication rates of PP-related documents, but publication rates are increasing in many fields, so measuring publication rate alone fails to indicate the broader significance of that growth. Only Schui and Krampen (2010) attempted to quantify the number of PP-related articles as a percentage of all articles within the PsycINFO® database, but their search was limited to the one key term of ‘positive psychology’. The results of the other domain-specific studies have been limited to specific fields and did not assess PP as a whole. Consequently, the size of PP as a percentage of the PsycINFO® database has remained unclear. Questions also remain about the total number of PP-related documents, since the method used by Hart and Sasso (2011) found 20,807 PP-related articles published between 1998 and 2009 – far more than the 537 articles found by Borrego and Jiménez (2009) and the 1128 articles found by Schui and Krampen (2010).

**Disciplinary reach**

Previously, most analyses of the field of PP as a whole have focused upon its size, and they have not explored how the PP literature is distributed within different fields. Only Schui and Krampen (2010) provided a basic analysis within psychology. Conversely, the studies conducted within specific disciplines (counseling, health, organizations, education and behavioral medicine) have not related their findings to the size of PP as a whole. These domain-specific studies have also had limitations. For example, Schui et al. (2010) used only one key term and Donaldson and Ko (2010) used only four key terms, and thus their searches also omitted an unknown number of relevant documents that did not include those particular terms. Studies by Lopez et al. (2006), Froh et al. (2011) and Schmidt et al. (2011) used more key terms, and their manual coding techniques ensured good accuracy, but they only studied three or four journals so the sample size was not large. Moreover, since these discipline-specific studies have also used different methods, it is difficult to compare their results to global studies of the size of PP as a whole, and measures of the reach of PP within other disciplines. Quantitative studies that assessed the reach of PP into the fields of neuroscience, sports science, and
psychiatry have been lacking. A broad-yet-detailed analysis that casts a much wider net to encompass all relevant disciplines is, therefore, required to quantify the disciplinary reach of PP as a whole.

Impact

Regarding the literary impact of PP, knowledge of the number of articles published alone does not provide insight into the impact of those articles. A common measure of the impact of journals is the Thomson Reuters Impact Factor. Only the study by Schui et al. (2010) investigated the average journal impact factors for PP-related material, but their study was confined to the fields of behavioral medicine and health psychology. To date, no studies have quantitatively investigated the impact of articles from the field of PP as a whole across multiple disciplines.

Topic breadth

Topic breadth is measured by the number of different topics being researched in a field. All domain-specific analyses have investigated the topics and themes of the PP literature within specific fields, so their results cannot be generalized to PP as a whole. Of the three previous broader scope analyses, Hart and Sasso (2011) and Schui and Krampen (2010) provided some measure of topic breadth. However, their assessments were relatively coarse. No studies have yet quantified the major topics around which PP research as a whole has focused, to assess topic breadth in more detail.

Summary

Despite the valuable knowledge provided by past attempts to quantify the field of PP, the current systematic analysis is needed to more accurately assess the claims being made about the growth and significance of PP. The present study differs from the previous research in that it covers a much larger scope of over 1.7 million journal documents in detail and uses semantic and bibliographic analysis methods to quantify the size, disciplinary reach, impact, and topic breadth of PP-related research over the last two decades. These methods will provide a comprehensive “big picture” of this developing field.

Quantitative literature analysis methods

Methods of citation-based and textual analysis have been widely used to analyze academic literature (see, for example, the journal *Scientometrics*), and these methods are particularly well suited to quantify the size, reach, impact, and breadth of PP. Two commonly used methods are **co-word analysis** and **bibliographic coupling**. In co-word (or co-term) analysis, the strength of the link between two terms is related to the frequency with which the two terms appear within the same documents. Co-word analyses have been used since the 1980s to map and analyze specific research specialties such as biotechnology (Rip & Courtial, 1984) and acidification research (Whittaker, 1989), to name only a few. More recently, co-word analyses have been used to analyze entire fields, such as ecology (Neff & Corley, 2009), library and information science (Milojević, Sugimoto, Yan, & Ding, 2011), and strategic management (Ronda-Pupo & Guerras-Martin, 2012). The technique has also been used to assess the history and changes of ideas within academic literature. For example, Rooney, McKenna, and Barker (2011) used it to assess the history of ideas within the *Management Communication Quarterly* journal. In the present work, co-word analysis allows terms distinctive of PP research to be derived more directly from the literature, rather than assumed a priori as in previous studies.

Bibliographic coupling was first proposed by Kessler (1963) to estimate how similar a document is to another based on how many references those documents share. Bibliographic coupling has become widely used to
identify related documents in online databases, such as Scopus® and Web of Science®. Porter and Youtie (2009) used bibliographic coupling to identify emerging trends within nanotechnology research, and others have used it to explore the links between academic documents (e.g. Chang & Huang, 2012; Schiebel, 2012), academic institutions (Grauwin & Jensen, 2011; Yan & Ding, 2012), and patents (Chen, Huang, Hsieh, & Lin, 2011). The present analysis uses bibliographic coupling to generate maps of the literature, to identify where PP documents are located with respect to other fields and to determine the central topics within the field of PP. This feature of the present work distinguishes it further from the other analyses listed in Table 1. This study aimed to quantitatively assess the size, disciplinary reach, impact, and topic breadth of PP, in order to provide a comprehensive evaluation of the growth and significance of the field.

**Methodology**

The four key steps in the method were: (a) selection of documents, (b) identification of PP documents, (c) impact factor calculation, and (d) document mapping. The computational processing required was performed using MATLAB®. Each of these steps is summarized below.

**Selection of documents**

To quantify the size, reach, impact, and breadth of PP, the present study analyzed bibliometric data of documents from 700 representative English journals listed in the Psy-cINFO® database. The 1.7 million documents analyzed represented approximately 50% of the total number of documents in the database. Journals were selected manually from the fields of psychology, education, sports science, psychiatry, organizational science, public health, and neuroscience. General journals relevant to these fields of all 1.7 million records. To reduce computation time, the analysis ignored common stopwords (conjunctions, prepositions, pronouns, etc.) and verbs, except for 16 hand-picked verbs such as ‘hope’, ‘flow’, ‘thrive’, ‘cope’, ‘love’, and ‘trust’. Words in a regular plural form were changed into singular forms, and UK spellings were converted to US spellings. Multiple-word phrases, such as ‘trait gratitude’ were also constructed from any words not separated by an ignored word. A total of 2.2 million unique terms (words or phrases) were identified in the corpus, out of a total of 55 million nonunique terms. To again reduce computational cost, this list was further reduced by ignoring terms that occurred less than 10 times within the corpus of documents, giving a total of 180,227 unique terms.

The co-term analysis was then performed using these 180,227 terms. All the terms within the same document co-occurred once, and the co-occurrence counts were summed over all documents. The number of co-occurrences was divided by the total number of times each term occurred in the corpus to give the conditional probability for each term combination (see Equation (1)), so that the co-occurrence data were independent of how frequently each word appeared.

\[ P(i|j) = \frac{n_{ij}}{N_j} \] (1)

In Equation (1), \( P(i|j) \) represents the conditional probability of term \( i \) being present in a document given that term \( j \) is present, \( n_{ij} \) is the total number of documents in which \( i \) and \( j \) co-occur, and \( N_j \) is the total
number of documents that contain term \( j \). Equation (1) is similar to the *inclusion index*, which has been widely used in co-word analysis to normalize co-occurrence data (e.g. Sternitzke & Bergmann, 2009; van Eck & Waltman, 2009).\(^1\) Conditional probability tables created using Equation (1) were constructed for all 180,227 selected terms in the corpus, giving a total of 243 million unique probabilities for all nonzero term combinations.

In the final step, terms used in similar contexts were identified by calculating the *cosine similarity* between all 180,227 terms, as defined in van Eck and Waltman (2008).\(^2\) The cosine similarity was used to estimate how relevant different terms were to each other. Terms relevant to each other had similar conditional probability tables. The resulting similarity values allowed the terms most relevant to ‘positive psychology’ to be quickly identified by investigating the 50 most relevant terms in the ‘positive psychology’ similarity table. Not all of these 50 terms were selected for subsequent use in the analysis, since some were too general and were not concepts particular to PP (e.g. ‘psychology’, ‘psychology intervention’, ‘productive worker,’ and ‘positive’). Other terms were excluded because they were not positive in nature (e.g. ‘whining’), or names (e.g. ‘Mirowsky’, ‘Haworth,’ and ‘Bickhard’). In uncertain cases, such as ‘private prayer’ and ‘psychological detachment’, the terms were excluded. In total, 27 key terms were identified, which are listed in Table 2. The similarity tables for these 27 terms were then investigated to find other distinctive PP terms. The same guidelines as above were followed when selecting terms, except all terms related by a cosine similarity of more than 0.05 (out of a possible 1.0) to these 27 terms were considered. A further 343 terms were identified, giving a total of 370 terms.

**Term-based identification**

The 370 terms from the above analysis were used to identify documents that belonged to the field of PP using a term search method. This kind of automated identification is less accurate than the manual methods employed by Lopez et al. (2006), Schmidt et al. (2011), Froh et al. (2011) and Donaldson and Ko (2010). However, the automated method allows for coding of much larger data-sets of the size used in this study, where manual coding would have been impractical. A total of 106,751 documents in the data-set mentioned at least one of the 370 PP terms, but inspection revealed that many such documents were not focused on PP-related concepts. Rather, they mentioned the terms in passing, or, in some cases, the results were spurious because the term was used with a different meaning (e.g. cellular ‘resilience’ rather than psychological ‘resilience’). To deal with this problem, documents were only identified as PP related if they included *two or more different* PP terms. This more conservative criterion was chosen because it returned far fewer spurious results. Some terms from the 370-term list were removed so that any occurrence of a PP-related term registered as only one match, rather than several. The resulting list comprised 233 terms, none of which were subsets of any other terms, which are illustrated in Figure 1. As an additional check of these 233 terms, twelve experts in PP were contacted and invited to critique the list. Nine experts provided feedback, providing further confidence that the 233 PP terms were appropriate and sufficient in scope to effectively identify PP literature.

Documents including two or more of these 233 terms were deemed to belong to the field of PP. The resulting list of PP documents can be considered somewhat conservative, since it did not retrieve relevant documents that mentioned only one of the 233 key terms. This method identified 18,401 documents as PP related. Manual investigation of a random sample of 30 documents suggested that the percentage of falsely-identified articles (13%) was lower than previous research (e.g. the searches by Donaldson & Ko, 2010; Schmidt et al., 2011, yielded large falsely-identified percentages of 87 and 77%, respectively).

An adequate amount of term data in the source records was only available for documents published after 1991, so the analysis was limited to documents published from 1992 onward, since this was the earliest date for which accurate results could be obtained.

**Document categorization**

Documents were categorized into different disciplines using the *Web of Science*® subject categories. Articles multi-assigned to more than one category were counted as one full article in each of the assigned categories.

**Impact factor calculation**

The journal impact factor (Althouse, West, Bergstrom, & Bergstrom, 2009) calculation provides a standard method to assess the impact of the documents in a given journal for a given year. The impact factor is a measure of
the average number of citations per article per year. An aggregate impact factor can be calculated for any grouping of documents, such as those identified here as belonging within PP. Only ‘cite-able’ documents (articles, reviews, conference proceedings and research notes) were included when calculating the impact factor. Equation (2) shows the calculation of the 2011 impact factor.

$$IF(2011) = \frac{\text{Citations in 2011 to PP documents in 2009 & 2010}}{\text{PP documents in 2009 & 2010}}$$

2

Document mapping
Maps of the documents were created in order to group together similar documents and visualize the reach and subject breadth of PP. Bibliographic coupling was used to establish measures of similarity between documents. The similarity between two documents was calculated as the number of shared citations divided by the maximum of the number of citations in each of the two documents. An open-source software called Gephi (see Bastian, Heymann, & Jacomy, 2009) was used to visually map the similarity data, using a layout algorithm called Force Atlas 2. Gephi has been used to create similar maps by Grauwijn and Jensen (2011), and the layout algorithm is similar to the VOS algorithm used by van Eck, Waltman, Dekker, and van den Berg (2010). The algorithm works to pull similar documents (i.e. ones that share many of the same citations) closer together, while pushing dissimilar documents further apart. Stronger similarities between documents result in stronger attraction between them. The result is a natural clustering of similar documents within a two-dimensional space. Document clusters were calculated within Gephi using the Louvain algorithm developed by Blondel, Guillaume, Lambiotte, and Lefebvre (2008).

Two maps were created with this method. The first included all documents within the data-set for the year 2011 to help visualize the disciplinary reach of PP. A second map included only the documents identified as PP related, to determine the topic breadth of PP.

Results
Results are discussed below in terms of the four key domains that assist in providing a ‘big picture’ view of PP research: size, disciplinary reach, impact, and topic breadth.

Size
The number of documents identified as PP-related each year, as a percentage of all documents that year in the data-set, has been growing since at least 1992, as shown in Figure 2. The establishment of PP has seen the number of PP-related documents increase from 216 cite-able journal documents in 1992 (0.94% of all such documents in the data-set that year) to 2300 in the year 2011 (4.4%).
Disciplinary reach

The PP-related documents identified in four different years are listed according to their Thomson Reuters subject category in Table 3. Note that any multi-assigned documents have been counted in several categories (whereas they were counted only once for measurements of the size of PP). Other categories with high percentages of PP articles in 2011 included hospitality, leisure, sport, and tourism (18.61%); multidisciplinary humanities (14.75%); music (13.43%); religion (11.88%); industrial relations and labor (11.66%); economics (8.11%); political science (7.02%); gerontology (6.07%); and science education (6.59%). Within the field of PP, 49% of PP-related documents published between 1991 and 2011 came from fields outside of psychology, and on a year-by-year basis, this percentage fluctuated within a narrow band since 1991 (46–55%). Significant proportions of PP-related documents belonged to other fields, such as management, psychiatry, neuroscience, education, public health, interdisciplinary social sciences, sport science, and business.

The bibliographic mapping showed the location and disciplinary reach of PP visually, without constraining documents by the academic fields to which they had been assigned. Figure 3 shows an abstracted representation of the map, in which the areas populated by documents are shaded. The most common Thompson Reuters subject category within each cluster was identified, which highlighted the six main labeled regions in Figure 3. Areas with a high density of documents identified as PP-related are indicated by the black regions. It can be seen that PP-related documents span across a large part of the psychology region, but they also have representation in management, public health, psychiatry, and neurosciences.

To better visualize which topics have been typically investigated within each field, an additional map was created. This map was created using the set of PP-related documents published between 2007 and 2011, and the most-common 100 PP key terms. The documents containing each term were counted, and the totals were apportioned into each of the fields shown in Table 3. The within-field counts for each term were divided by the total number of documents containing that term to give a percentage figure for every term-field combination. These percentages were then used as the weights in a full network that linked every term to every field (1500 links in total). This network was mapped in Gephi using the Force Atlas 2 layout algorithm, and is shown in Figure 4. In general, terms near the center are common to several fields, while research into the terms at the periphery is dominated by their nearby fields. This map shows that PP seems to be most central to the fields

![Figure 2. Number of PP-related journal documents per year, as a percentage of all journal documents that year in the data-set (cite-able documents only).](image)

![Table 3. The number of PP-related journal documents identified within the data-set in four different years.](table)

<table>
<thead>
<tr>
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<tbody>
<tr>
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<td>60</td>
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<td>8.76</td>
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<td>10.28</td>
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<td>10.98</td>
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<tr>
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<td>2.95</td>
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<td>90</td>
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<td>10.88</td>
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<td>1.59</td>
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<td>1.98</td>
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<tr>
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<td>281</td>
<td>n/a</td>
<td>750</td>
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</table>

Note: The number of documents within 15 Thomson Reuters categories are shown both as totals (count) and as percentages of the total documents in each category (%).
of multidisciplinary psychology, social science, and clinical psychology compared to other disciplines, which research fewer PP constructs.

Impact
The aggregate impact factor for PP-related documents is shown in Figure 5, in which three-year trailing averages have been shown for clarity. Results are only shown where more than 500 cite-able documents were identified for the calculation. It is clear that the impact of PP-related research has been growing along with the impact of psychology research as a whole. The aggregate impact factor for PP in 2011 was 2.64, a higher value than that of many other well-established academic fields listed in Table 3, including management, education, public health, interdisciplinary social sciences, sport sciences, and business. The impact factors calculated here for all fields were compared with the aggregate impact factors calculated from the much larger Thomson Reuters Journal Citation Reports® database. For neuroscience, public health, and sport sciences, the 2011 impact factors in the present analysis were 30–50% lower, suggesting poor representation of these fields. Excluding these fields, however, the ratios of aggregate impact factors differed by a standard deviation of only 14%, providing a degree of confidence in the impact factor for PP calculated here. However, caution should be used when making detailed comparisons of the impact factors, since differences in citation and publication practices between disciplines also affect impact factor (see Althouse et al., 2009).

Topic breadth
Of the 233 PP terms, the prevalence of the most common terms is shown in Figure 6. To clarify the trends, these figures show the average number of documents containing a given term per year for the preceding five years. The appearance of the term ‘positive psychology’ in 1999 is visible in Figure 6(d). Sixty-one PP-related terms studied (30%) were new to the field since 1999. Examples include: positive psychology, mental toughness/mentally tough,
forverness, self-concordance, posttraumatic growth, affective forecasting, psychological capital, positive religious/spiritual coping, savoring, empowering leadership, and capability belief. Approximately, 52% of all occurrences of PP-terms were within documents identified by the analysis as PP related.

Figure 7 maps the topic breadth of PP research to date. Positive organizational scholarship and positive organizational behavior (POB) research grouped into one cluster, which included topics of organizational citizenship, fairness, authentic leadership, transformational leadership, work engagement, and work–family enrichment. Documents about motivation and achievement merged into another major cluster, since documents on these two topics shared many citations in common. The motivation/achievement cluster was linked to another major document cluster concerning happiness, well-being, and life satisfaction, which all melded together because these documents also drew on a similar set of citations. Adjacent to the happiness/well-being/life satisfaction
Figure 5. Trailing three-year average aggregate impact factors within the data-set, calculated according to Thomson Reuters subject categories, including the aggregate impact factor for PP-related documents. The non-averaged 2011 impact factors are shown in brackets beside each discipline name.

Figure 6. Usage of the most common PP key terms, as indicated by the trailing five-year average number of cite-able PP-related documents per year containing each term.
cluster lay another large cluster concerning optimism, which was strongly interconnected with the happiness cluster, indicating many academics have linked happiness/well-being/life satisfaction with optimism. In total, the analysis identified 21 distinct subjects of inquiry within PP, around which the documents in the field are organized.

Several topics appeared to cluster quite independently from the others. The most notable of these is the mindfulness cluster, which is at the bottom of Figure 7. The independence of this cluster invites more research linking mindfulness with other concepts in PP research. The large distance between the mindfulness and organizational clusters, for example, suggests that comparatively little research linking mindfulness with organizational outcomes has been undertaken. Posttraumatic growth also clustered independently from the main group. Thus, there is potential for more research connecting posttraumatic growth to other PP concepts, such as positive emotion and self-efficacy. However, the independence of literature on this topic could also indicate that it involves mechanisms which differ fundamentally from other PP research topics. Topics concerned with emotion recognition also grouped very independently from the other clusters, with few references in common, and this could prove to be an interesting field for stronger integration with PP topics such as resilience and Fredrickson’s (2001) theory of positive emotion.

Discussion
One of the primary aims of PP has been to legitimize the scientific investigation of positive functioning (Duckworth et al., 2005). Prior to 1998, the science of psychology had become largely preoccupied with healing illness and pathology (Seligman & Csikszentmihalyi, 2000). Despite the valuable progress it made towards understanding and treating the negative aspects of human

Figure 7. Map based on the bibliographic coupling of shared citations and a force-directed layout for PP-related documents only, from all years (simplified view). Darker areas contain more densely concentrated documents, while lighter areas are more sparsely populated with documents. The predominant themes shown for each cluster were determined manually.
existence, there was comparatively little research into what is right in individuals, families, groups, and institutions. PP was inaugurated in 1998 (Duckworth et al., 2005; Peterson & Park, 2003) to correct this imbalance by legitimizing and promoting the scientific investigation of positive functioning (Gable & Haidt, 2005; Linley et al., 2006; Seligman & Csikszentmihalyi, 2000).

The call to legitimize the scientific study of positive functioning has been accompanied by the call to adopt a new paradigm for how to understand well-being. Specifically, positive psychologists argue that merely relieving disease is not sufficient in creating well-being. The cultivation of well-being requires the presence of factors above and beyond those that alleviate distress, such as positive emotion, engagement, positive relationships, meaning, and accomplishment (Duckworth et al., 2005; Seligman, 2011). PP encouraged a ‘sea change in perspective’ (Peterson & Park, 2003, p. 144), by inviting psychologists to adopt different assumptions about human nature and to pose different questions from those associated with a disease model of well-being. This paradigm provides new answers to the age-old question of how well-being can be cultivated (Peterson & Park, 2003). According to Linley et al. (2006) and Maddux (2009), this new paradigm focuses on well-being, health, and optimal functioning, and is antithetical to the paradigm centered around distress, disorder, and dysfunction that dominated psychological inquiry in the late twentieth century. Importantly, while PP has encouraged a new paradigm for understanding well-being, the same rigorous scientific methods applied in traditional psychology are used to study PP topics.

This current bibliographic analysis of the size, reach, impact, and breadth of PP publications provides quantitative evidence to suggest significant progress has been made toward both of the above aims. The large number of PP-related documents (18,401) identified in this dataset demonstrates that the scientific community has accepted the legitimacy of positive functioning as a topic worthy of investigation. This large number also suggests that prior attempts to quantify the field of PP using only one search term (e.g. ‘positive psychology’) have significantly underestimated the number of published PP-related documents (Borrego & Jiménez, 2009; Schui & Krampen, 2010), and it is more consistent with the results of Hart and Sasso (2011).

The increasing acceptance of positive functioning as a legitimate area of research is also seen in the remarkable growth of studies concerned with PP-related topics since the inauguration of the field, with 86% of the 18,401 documents published after 1998. Significantly, this growth is not only in terms of the number of PP documents published each year; it is also growing as a percentage of literature published each year in the PsycINFO database, indicating that research into positive functioning is growing much faster than psychological research as a whole. The legitimacy, value and importance of studying positive topics is also supported by the high aggregate impact factor achieved by PP as a whole, and the growing breadth of topics studied within PP.

According to Maddux (2009), the change in ideology brought forward by PP had to begin with a change in the language used to talk about human behavior and experience. The current bibliographic analysis shows that language is indeed changing as PP terms become increasingly common. The appearance of several new research topics within the umbrella of PP suggests that PP may have also helped to promote research into new areas of inquiry such as mindfulness, gratitude, flourishing, and posttraumatic growth. PP seems to have provided a valuable conceptual paradigm, which has encouraged and assisted research within psychology and the social sciences more broadly to conduct more scientific study into the positive, or strength-based, qualities of individuals, groups, and communities.

Lopez and Gallagher (2009) claimed that PP has had a unifying effect on psychology, and the bibliographic results of the present study support this claim. The concepts within PP literature traverse the traditional boundaries between disciplines. An increasing number of researchers from different fields are becoming unified in their investigation of positive functioning, and hence there is an increasing alignment in paradigmatic approach across these fields. Furthermore, some PP concepts (e.g. optimism, strengths, engagement, virtues, resilience, and hope) are being studied in many fields, creating considerable common ground for researchers in different disciplines. These quantitative results illustrate the ‘taxonomic influence’ of PP (Linley et al., 2006, pp. 6–7), which has helped to connect and integrate research in previously separate areas. In contrast, other terms were present in only some individual fields of research. For example, mindfulness research is common within clinical psychology, but uncommon in organizational science and education. This observation invites more cross-disciplinary approaches to take PP concepts currently popular in one field and use them to inform the research in other areas. These results suggest that the paradigms and concepts of PP have already help to lay the groundwork for this cross-disciplinary and theoretical integration, which could fuel advancements across the broad range of disciplines influenced by PP research.

Within the 15 years since the establishment of PP, the field has grown substantially in size, reach, impact, and breadth, and hence, it has become notable in its own right. The set of 2300 PP-related documents published in 2011 found through this analysis roughly equals the median size of all disciplines listed in the Thomson Reuters Journal Citation Reports®, Social Sciences Edition, for the same year. As is typical of established academic fields, PP encompasses many different research topics. This diversity of topics within PP supports the view of Hart and Sasso (2011), who argued that monolithic and
homogeneous portrayals of the field are far from accurate. Many PP concepts were categorized with the label of ‘multidisciplinary psychology’, but the common approach, concepts and terminology of documents identified here as PP-related suggests the field deserves to be recognized as distinct from multidisciplinary psychology in general. Distinct clusters of research are now devoted to optimal functioning (e.g. optimism, gratitude, and kindness), which includes strength through adversity (e.g. forgiveness, resilience, and posttraumatic growth), and these topics have not simply been integrated into existing lines of psychological inquiry. Hence, the present results indicate that PP is becoming more established, in contrast to the possibility identified by Gable and Haidt (2005) and Linley et al. (2006) that its growth may make it obsolete.

Note, however, that most concepts within PP, such as mindfulness, are not exclusive to the field but are researched within other disciplines also, suggesting that an open and multidisciplinary view of PP research is appropriate. Diener (2009) argued that the perception of PP being an exclusive and closed field should be countered, and the present results reinforce this argument by showing quantitatively that PP is a highly open field with diverse connections to many different academic fields.

The results help to quantify the strong historical roots of the field. This analysis showed that many PP key terms were in use prior to the inauguration of the field in 1998, thus refining the similar results of Hart and Sasso (2011). Other quantitative studies by Borrego and Jiménez (2009) and Schui and Krampen (2010) did not trace the academic history of PP prior to 2000, and hence did not show the continuity of the field from previous research. Collectively, the current results support the views of Peterson and Park (2003) and Linley et al. (2006) that PP has functioned as an umbrella term to consolidate and highlight the importance of several preexisting, independent lines of research. The data provided by this study also help to address the call made by Peterson and Park (2003) that the intellectual ancestry of PP must be acknowledged. PP did not begin as a small, isolated field of research, but instead was highly multidisciplinary from the outset, highlighting the remarkable scale of the efforts made by the founders of PP to legitimize and promote research into positive functioning.

This analysis has several strengths. It was the first study to use a co-term analysis to examine the growth of PP. Two hundred and thirty-three key PP terms were derived from the literature (substantially more terms than in previous studies). It investigated a total of 1.7 million documents from 700 journals in detail. It is also the first quantitative study to analyze growth along four dimensions: size, disciplinary reach, impact, and topic breadth. It incorporated PP research across a wide range of academic fields. Finally, the two-dimensional maps allowed the breadth and interrelationships between topics in PP to be explored in a novel and informative way.

Several methodological issues limited this analysis. One source of error comes from the selection of PsycINFO® journals included within the analysis, which may have under-represented PP documents due to sports science, business, management, education, and public health fields being under-represented in PsycINFO®. Furthermore, journals present in the PsycINFO® database could only be used if their document records were available from the Web of Science®. The document records for many PsycINFO® journals in the fields of education, management, counseling, coaching, and other special topics were not available. The lack of data from the field of counseling is particularly notable in light of the finding of Lopez et al. (2006) that PP has significantly influenced counseling psychology. A similar observation can be made about the field of management and business in light of the work by Donaldson and Ko (2010). The recent assessment by Schmidt et al. (2011) also suggests that, had medical and health journals outside the PsycINFO® database been included, the influence of PP research would have also been evident in these fields. This limitation suggests that even with the current extensive data-set used in this study, the results may actually still under-represent the disciplinary reach of PP research.

A second potential limitation may be the method used to classify documents as belonging to the field of PP. In the co-term analysis, most verbs were ignored. Consequently, several words relevant to the field of PP were ignored. For example, the well-known broaden and build theory of positive emotions put forward by Fredrickson (2001) was ignored because the words ‘broaden’ and ‘build’ are verbs. However, the article putting forward this theory was still classified as belonging to PP because it mentioned four PP key terms identified by the co-term analysis: ‘positive emotions’, ‘positive psychology’, ‘human strength’, and ‘flourishing’. PP key terms are more likely to be mentioned together in documents within the field of PP, which would have reduced the effect of omitting verbs on the calculated size, disciplinary reach and impact of PP. However, some verbs (e.g. ‘esteem’, a part of the phrase ‘self-esteem’), would have been expected to feature as PP topics in Figure 1 had they been included. The results of the topical reach of PP should therefore be seen as a lower limit on the number of topics covered by PP research.

The co-term analysis provided a very good starting point for the identification of PP-related terms, but the final selection of the 233 key PP search terms was subjective. Since a conservative approach to selecting terms was taken, some appropriate terms may have been omitted. Again to be conservative, a two-term search method was used, which gave matches far more precise than those generated by a simple one-term search. Despite these conservative measures, approximately 13% of the PP-related documents were false-positives (documents not related to PP subjects identified in Figure 7),
sugestis an appreciable margin of error in these results. It can be expected that the number of false-negatives was likely to be much greater, however, since 48% of all PP key terms occurred in documents that were not specifically identified as PP by the authors but possibly focused on PP topics. Consequently, the actual size and reach of PP may be larger than the values calculated in this analysis.

Conclusions
Within the 15 years since the establishment of PP, the field has grown substantially in size, reach, impact, and breadth, and hence, it has become notable in its own right. Documents related to PP are being published in a wide variety of disciplines, suggesting that PP concepts have broad application and are attracting a diverse set of scholars from many different disciplines. The findings indicate that the scope and boundaries of the field of PP are broader than earlier research has suggested. The concepts and paradigms of PP appear to have provided a valuable focal point that has allowed previously separate lines of research to join in the shared inquiry into positive functioning.

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Notes
1. However, using conditional probability weighting reduces the effect of overly-broad terms that are of little use, such as ‘self’, ‘life’, ‘health’, ‘social,’ and ‘behaviour’. It is comparable to the ‘term frequency – inverse document frequency’ weighting scheme commonly used in textual analysis.
2. The cosine similarity between two terms, $s_{kj}$, can be written here as:

$$s_{kj} = \frac{\sum_{i} p(i|k) \times p(i|j)}{\sqrt{\sum_{i} p(i|k)^2} \times \sqrt{\sum_{i} p(i|j)^2}}$$

where $a$ is the total number number of terms (180,227) and $i \neq j$.
3. This modification to the inclusion index was used to reduce unrealistically high similarities calculated when one of the documents had only a few citations.
4. The validity of the subjective list was endorsed by nine experts in PP.

References