Autobiographical memory distributions for negative self-images: memories are organised around negative as well as positive aspects of identity

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Abstract

The relationship between developmental experiences, and an individual's emerging beliefs about themselves and the world, is central to many forms of psychotherapy. People suffering from a variety of mental health problems have been shown to use negative memories when defining the self, however little is known about how these negative memories might be organised and relate to negative self-images. In two online studies with middle-aged (N = 18; Study 1) and young (N = 56; Study 2) adults, we found that participants' negative self-images (e.g., I am a failure) were associated with sets of autobiographical memories that formed clustered distributions around times of self-formation, in much the same pattern as for positive self-images (e.g., I am talented). This novel result shows that highly organised sets of salient memories may be responsible for perpetuating negative beliefs about the self. Implications for therapy are discussed.

Keywords: Autobiographical memory, Self-image, Negative core beliefs, Depression, Identity

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Recent years have seen a continued growth in the evidence base for cognitive behaviour therapy in the treatment of a wide range of disorders, including depression (Hollon, Stewart, & Strunk, 2006), anxiety (Hofmann & Smits, 2008) and schizophrenia (Wykes, Steel, Everitt, & Tarrier, 2008). One approach has been the development of detailed treatment protocols which directly target the maintenance processes within specific mental health problems such as panic disorder (Clark, 1986) and obsessive compulsive disorder (Salkovskis, 1985). However, cognitive behavioural interventions for depression (Beck, Rush, Shaw, & Emery, 1979) and personality disorders (Beck, Freeman, & Davis, 2006) tend to be longer-term and often include clinical formulations which incorporate the role of developmental experiences and 'core beliefs'.

Within this approach, it is argued that sustained negative childhood experiences, such as sexual or physical abuse, have an impact on the beliefs an individual develops about themselves and other people. For example, an individual who was abused as a child may develop a belief about themself as a 'bad person' and others as 'not to be trusted'. These relatively fixed and global beliefs, termed 'core beliefs' within the cognitive behavioural therapy literature (e.g., Beck et al., 1979), are likely to remain stable into adulthood and set up a pattern of behaviour which will make the individual vulnerable to mental health problems. Cognitive behavioural interventions based upon this framework adopt the use of formulations where the links between childhood experience and core belief development are first established and then re-evaluated.

The idea that memories of past experiences are central to concepts of self and identity is a key topic in the cognitive, as well as clinical, literature. For example, Conway and

Pleydell-Pearce's cognitive model of the self-memory system (2000) describes a bi-directional relationship between memory and the self. In this way, autobiographical memories support information about the self (thus a memory of embarrassing oneself in public boosts the self-image or core belief of being socially awkward) whilst knowledge about the self raises the accessibility of self-congruent memories (e.g., thinking of oneself as socially awkward promotes access to memories of past embarrassment). Although the relationship between memory and the self has been the subject of much research (e.g., Berntsen, Rubin, & Siegler, 2011; Conway, 2005; Rathbone, Moulin, & Conway, 2008; Ross & Wilson, 2003), relatively little is known about the relationship between particularly negative core beliefs about the self and autobiographical memory.

The present studies aimed to explore the relationships between negative and positive self-images (in the form of core beliefs about the self) and autobiographical memory. In particular, we set out to examine the role that negative self-images might play in organising autobiographical retrieval across the life-span. Previous research suggests that the retrieval of positive autobiographical memories differs in several key ways compared to the retrieval of negative autobiographical memories. For example, people tend to remember positive events in more detail than negative events (D'Argembeau & Van der Linden, 2008), access positive memories more quickly than negative memories (Lishman, 1974), and forget the details of negative events faster than the details of positive events (e.g., fading affect bias; Walker, Skowronski, & Thompson, 2003). Rubin & Berntsen (2003) found that the recollection of positive and negative memories followed different lifespan distributions. Memories of positive events followed a standard reminiscence bump pattern (e.g., more memories were recalled for the period of late adolescence and early adulthood than for other times in life; Rubin, Wetzler, & Nebes, 1986) whereas memories of negative events did not follow this typical distribution. This may reflect the organisation of autobiographical memories

according to positively-biased cultural life scripts (Berntsen & Rubin, 2004; Collins, Pillemer, Ivcevic, & Gooze, 2007). Thus, positive events are well-organised and rehearsed in line with culturally expected norms (e.g., vivid memories of one's wedding day), whereas negative events are less likely to be associated with normative life events.

Further work on the organisation of autobiographical memories has focused on the temporal distributions of highly self-relevant memories. Research using the IAM Task (I Am Memory Task; Rathbone, Moulin, & Conway, 2008) has shown that people's most central self-images (e.g., the aspects of someone's sense of self that they judge to be most important, such as being a sister, being hard-working, or being a football fan) are associated with sets of salient autobiographical memories. Crucially, when these memories are dated, they are shown to cluster temporally around the period of life in which these central identities are judged to begin (Rathbone et al., 2008). Thus someone who defines themselves as being a football fan from the age of 13 would typically have a set of salient 'self-supporting' memories, dated from their teenage years. This effect has been shown for middle-aged (Rathbone et al., 2008) and young adults (Rathbone, Conway, & Moulin, 2011). By examining the organisation of memories that are associated with self-images we are able to investigate the relationships between aspects of identity and autobiographical memory. Our previous work suggests that temporal clusters are formed for particularly salient and integrated aspects of identity (in the form of people's most important 'I am' statements) – in essence, these organised sets of memories used to are 'support' knowledge about the self. This method therefore offers a means by which to compare the organisation of memories that are relevant to negative, compared to positive, aspects of the self.

To date there has been no direct investigation of the emotional valence of self-images generated in the IAM Task, and it is unknown whether self-image valence has an impact on the distributions of associated autobiographical memories. In our 2008 study, we were unable

to directly compare negative and positive self-images as too few negative statements were freely generated (Rathbone et al., 2008). Indeed, there is an established tendency for people to generate positive, rather than negative, information about themselves when prompted to describe their identity (e.g., Baumeister, 1998; Sedikides & Gregg, 2003). To help address this bias, the present study differed from previous versions of the IAM Task in that we did not ask participants freely to generate self-images. Instead, participants were asked to rate their level of agreement with a standardised set of six positive and six negative self-images using the Brief Core Schema Scale (BCSS; Fowler et al., 2006). This increased the likelihood that participants would consider the negative as well positive aspects of their identity, and enabled us to explore more fully the memories associated with negative self-images.

There are clear clinical implications for improving our understanding of the link between negative self-images and autobiographical memory. The changes in autobiographical memory function associated with different psychopathological disorders have been the focus of much research (Bergouignan et al., 2008; Jobson, 2011; Raes et al., 2006; Werner-Seidler & Moulds, 2011, 2012; Williams et al., 2007), and recent studies have also begun to investigate the ways in which such changes in autobiographical memory function might impact on identity. Investigations of self-defining memories in clinical groups have shown, for example, that schizophrenic patients' self-defining memories were rated as more traumatic than controls' (Berna et al., 2011), and that there was a weaker thematic association between self-images and associated memories in schizophrenic patients compared to controls (Bennouna-Greene et al., 2012). A recent study by Jorgensen et al. (2012) found that the memories 'most central to the life story' of patients with borderline personality disorder tended to be more negative and less coherent than those of controls. The authors suggested that these patients may have compromised identities as a result of negative memories playing a dominant role in shaping current concepts of self. Sutherland and Bryant (2005) compared

the self-defining memories of participants with post-traumatic stress disorder (PTSD), participants exposed to trauma but without PTSD, and non-trauma-exposed controls. Results showed that the PTSD group's self-defining memories were more frequently trauma-related and of negative valence, compared to the two comparison groups.

Much research on PTSD has highlighted the impact that autobiographical memories of overtly negative events can have on the self. For example, Berntsen, Willert, and Rubin (2003) found that people with PTSD reported that the traumatic events they had experienced were integrated into their current identity. It has since been suggested that the degree to which a stressful negative event becomes 'central' to an individual's identity may play an important role in PTSD (Berntsen & Rubin, 2007; although centrality of negative events seems less predictive of depression outcome, Newby & Moulds, 2011). Further work highlighting the role of the self in the etiology and maintenance of PTSD is reviewed by Jobson (2009), who proposed a novel model of PTSD, the 'Threat to the Conceptual Self' model, which emphasises the role that cultural differences in the conceptual self may have on PTSD outcome.

Finally, work in the field of depression has highlighted the critical role of negative memories in shaping beliefs about the self. Depression is frequently characterised by both distressing, intrusive memories of negative life experiences (Kuyken & Brewin, 1994; Lemogne et al., 2006) and stable negative self-beliefs (e.g., being a failure; overlapping with the concept of negative core beliefs, Beck, Rush, Shaw, & Emery, 1979), leading researchers to propose that models of depression should include cognitive constructs of self and memory (e.g., Barry, Naus, & Rehm, 2006). As described above, the self-memory system proposes that beliefs about the self are both supported by, and influence, autobiographical retrieval (Conway & Pleydell-Pearce, 2000). Thus, one could view the bi-directional link between

negative self-images and memories of negative life events as a vicious circle, reinforcing negative beliefs about the self.

As demonstrated by the research reviewed above, there is evidence that the memories most central to supporting self and identity may be altered in several clinical disorders. Furthermore, it is argued that readily accessible negative memories relating to the self may play a central role in perpetuating negative self-beliefs (e.g., Conway & Pleydell-Pearce, 2000). It therefore seems pertinent to develop an understanding of the relationship between negative self-images and associated memories.

The present study sought to examine the relative prominence of negative and positive self-images in a non-clinical population, and to examine the role that autobiographical memories might play in supporting these two types of self-image. The central question was whether autobiographical memories would be organised in temporal clusters for negative, as well as positive, self-images. This was an empirical question; organisational memory processes (e.g., memory distributions) may only exist to support positive information about the self (e.g., Rubin & Berntsen, 2003, Walker et al., 2003), in which case we would expect to see clustering of memories around positive, but not negative, self-images. However, it was also considered that, for a negative self-image to exist there may be a set of salient and organised autobiographical memories existing to support that concept. In this case, we would expect there to be clustered distributions for negative, as well as positive, self-images.

Study 1

Method

Participants. The online questionnaire was accessed by 191 people, of whom 40 completed the study. Of these 40, only 18 participants' data were usable due to an error in the

initial set-up of the online questionnaire. A set of responses was deemed complete if the participant had (1) filled in the DASS21 (Lovibond & Lovibond, 1995), (2) ranked the self-images for how closely they reflected their identity, and (3) generated and dated at least two memories for at least one self-image. Of these 18 participants, 5 were male and 13 were female (Mean age = 57.78 years, *SD* = 13.13; Range = 42 – 79).

Participants under the age of 40 were not recruited and any participant who entered an age under 40 in the demographic details section was taken to an exit page that reiterated the inclusion criteria. The age of 40 was chosen as a cut-off based on similar studies (Elnick, Margrett, Fitzgerald, & Labouvie-Vief, 1999; Rathbone et al., 2008) as participants over this age allow a fuller analysis of differences in distributions of memories over the lifespan.

Procedure. The questionnaire was programmed using SurveyGizmo and posted on two online questionnaire hosting sites: http://psych.hanover.edu/research/exponnet.html and http://www.socialpsychology.org/expts.htm. In addition, members of the Ageing Research Panel at a UK university were emailed an invitation to participate. No incentive to participate was provided. Data was collected over a period of 8 months.

The questionnaire was divided into six parts. In part 1, participants gave their age and gender. In part 2, participants completed half of the BCSS (Fowler et al., 2006). The BCSS contains 24 statements, 12 of which refer to the self (e.g., I am successful) and 12 of which refer to others (e.g., others are hostile). As the present study was focused on participants' self-beliefs, we only used the 12 self-related items, six of which were positive (I am respected, valuable, talented, successful, good, interesting) and six negative (I am unloved, worthless, weak, vulnerable, bad, a failure). The advantage of using a fixed set of self-beliefs for all participants (as opposed to an open-ended self-belief measure, e.g., The IAM Task; Rathbone et al., 2008) is that there is a greater degree of control over the valence of the self-

beliefs used to cue memories – a core feature of the present study. All participants were asked to rate how much they identified with each of the 12 self-beliefs on a five-point scale (Not at all, Believe it slightly, Believe it moderately, Believe it very much, Believe it totally). All self-beliefs that the participant rated as believing to some extent (e.g., only excluding those marked 'Not at all') were then ranked by the participant in order of personal significance. The top three highest rankings for both negative and positive self-images were then used as memory cues in part 3.

In part 3, participants were re-presented with the negative self-beliefs that they had identified as personally significant (and ranked one to three) and asked to use each self-belief to cue up to six specific autobiographical memories. Participants were given the following instructions: "*We are interested in memories you have about being [weak]. In a moment you will be asked to think of six memories of events associated with this belief about yourself. They can be from any time in your life, apart from the last year. It is very important that the memory is of a specific event that you can bring to mind, lasting minutes or hours, but no longer than a day. The memory should be at least 1 year old. e.g., NOT from or after 2010. For each of the six different memories about being [weak] that you think of, please give a brief title.*" This process was then followed for any positive self-beliefs that the participant had identified as personally significant (and ranked one to three).

In part 4, participants were re-presented with the memory titles that they generated in part 3. They dated all of the memories cued by negative self-beliefs (as age of participant when the recalled event took place) and then dated all of the memories cued by positive self-beliefs. In part 5, participants were re-presented with the self-beliefs (e.g., I am bad) that had been used as memory cues, and were asked to give the age at which they felt each statement became a defining part of their identity (age of self-emergence). This process was completed for negative self-beliefs, followed by positive self-beliefs.

Finally, in part 6, participants completed the DASS21 (Lovibond & Lovibond, 1995), providing a measure of mood over the last seven days. The DASS21 subscales of depression, anxiety and stress were calculated for use in analysis.

Results

All 18 participants agreed with and generated memories associated with at least one positive self-image (Mean number of positive self-images used as memory cues = 2.94, *SD* = 0.24; Range = 2 to 3; total sum of positive-self cued memories = 253). Of these 18, 11 participants also rated agreement with at least one negative self-image and generated a set of associated memories (Mean number of negative self-images used as memory cues = 1.06, *SD* = 1.11; Range = 0 to 3; total sum of negative self-cued memories = 88). Overall there was much higher agreement with positive self-images (Mean agreement rating of 3.45, *SD* = 0.77; on a scale of 1 to 5 where 1 = 'not at all' and 5 = 'believe it totally') compared to negative self-images (Mean agreement rating = 1.44, *SD* = 0.59); $t(17) = -7.16$, $p < .001$. Participants generated a mean of 4.00 memories for negative statements that were agreed with (*SD* = 2.50; range = 0 to 6) and a mean of 4.77 memories (*SD* = 1.88; range = 0 to 6) for positive statements that were agreed with.

Our primary aim was to investigate the distributions of memories associated with negative and positive self-images. Previous work has established that positive and neutral self-images are associated with sets of salient memories that are clustered around the period in life when the respective self-image is dated as emerging (Rathbone et al., 2008), but to date no research has investigated whether a similar pattern holds for memories associated with negative self-images. To allow investigation of the distributions of memories relative to the self-images that cued them, all memory dates (e.g., age of participant at time of event) were reformulated as a distance in years from the age when the associated self-image (e.g., I

am a failure) was dated as emerging. Thus all memories were given either a positive score (occurring after age of self-emergence) or a negative score (occurring before age of self-emergence), or 0 if they occurred in the same year as self-emergence. Thus, for a participant who dated 'I am talented' as emerging at age 40, their associated memory of acting in a community show aged 42 would be reformulated as 2 (e.g., Rathbone et al., 2008, 2011). These reformulated data are shown in Figure 1. As there was a wide distribution of memories around ages of self-formation, these data were divided into 12 ten-year epochs (as shown on the x axis of Figure 1). The central epoch of -4 years before self-formation to 5 years after self-formation is of most interest, as this is the period in which participants dated their selves as emerging (e.g., year zero). To account for the fact that more participants agreed with (and thus generated memories for) positive self-images compared to negative self-images, all memories were analysed as proportional data.

(Insert Figure 1 about here)

Figure 1 demonstrates a temporal clustering pattern for memories associated with both positive and negative self-images. Regardless of whether the self-image cue is positive or negative in valence, the memories associated with each self-image tend to cluster around the period in life when that self-image was formed. To investigate potential statistical differences in these patterns of data, the proportional epoch data shown in Figure 1 was analysed using a repeated measures 2 (valence of self: positive, negative) x 12 (epoch: -64 to -55, -54 to -45, -44 to -35, -34 to -25, -24 to -15, -14 to -5, -4 to 5, 6 to 15, 16 to 25, 26 to 35, 36 to 45, 46 to 54) ANOVA. This analysis was based on 11 participants (as only 11 generated memories for both positive and negative self-images). Results revealed a main effect of epoch (F [11, 110] = 11.30, $p <$ .001, partial η^2 = .53) and no interaction between epoch and valence ($F < 1$). The main effect of valence could not be calculated as the datasets for

negative and positive self-images were both proportional, however our main interest was in whether there would be an interaction between valence and epoch. The lack of significant interaction suggests that memories cued by negative and positive self-images follow a similar distribution across epochs. To investigate potential differences across epochs, the data were split and memory distributions were analysed separately for positive and negative self-cued memories. A repeated measures ANOVA on the distribution of positive self-cued memories (for all 18 participants) across the 12 epochs revealed a main effect of epoch (F [3.23, 54.85] = 10.27, $p < .001$, partial $\eta^2 = .38$, Greenhouse-Geisser corrected). Bonferroni corrected pairwise comparisons on the 12 epochs showed that in the central epoch (-4 to 5 years either side self-emergence), participants generated a significantly higher proportion of memories (Mean proportion = .33) than in the following epochs: -64 to -55 ($p = .03$, corrected), -54 to -45 ($p = .01$, corrected), -44 to -35 ($p = .01$, corrected), -34 to -25 ($p = .02$, corrected), -24 to -15 ($p = .02$, corrected), and 46 to 54 ($p = .01$, corrected). There were also significant differences between other epoch pairs, predominantly featuring the epoch following the central epoch (e.g., 6 to 15) which was associated with significantly more memories than epochs -64 to -55 ($p = .03$, corrected), -54 to -45 ($p = .01$, corrected), -44 to -35 ($p = .003$, corrected), -34 to -25 ($p = .02$, corrected), -24 to -15 ($p = .02$, corrected), and 46 to 54 ($p = .001$, corrected).

Analysis of the distribution of negative self-cued memories (based on the 11 participants who generated memories for negative self-images) across the 12 epochs also revealed a main effect of epoch (F [11, 110] = 6.84, $p < .001$, partial $\eta^2 = .41$), however Bonferroni corrected pairwise comparisons revealed no significant differences between epochs ($p > .09$, corrected).

Finally we were interested in whether depression subscale scores on the DASS21 would differ for participants who agreed with at least one negative self-image (n = 11) compared to those who only agreed with positive self-images (n = 7). Those who agreed with at least one negative self-image had a higher mean score on the depression sub-scale of the DASS21 (Mean = 9.64, SD = 9.24) than those who only agreed with positive self-images (Mean = 4.29, SD = 5.94) however this difference was not significant (t [16] = 1.36, p = .19).

Discussion

In summary, study 1 showed a significant clustering effect (e.g., main effect of epoch) for memories cued by both positive and negative self-images. Multiple comparisons showed that the 10 year bin around identity formation (between four years prior to five years after emergence of each self-image) was associated with the highest proportion of memories for both positive and negative self-images, although this difference was not significant for negative self-cued memories. Mean differences in DASS21 depression scores suggested that people who identified with negative self-images had higher depression scores, but this difference did not reach significance.

There were two main limitations of study 1: sample size and dropout rate. The results reported are based on a sample of 18, which allows some initial investigation of the organisation of memories associated with positive and negative self-images but does not permit analysis of additional potentially interesting features. For example, with a larger data set we would be able to investigate the age at which negative and positive self-images emerge across the lifespan, and more closely examine the relationship between agreement with negative self-images and the DASS21 subscale scores. The method of recruitment for study 1 (e.g., posting links to the questionannire on host websites and not providing any incentive) has been very successful in the past for shorter online studies (e.g., Rathbone & Moulin,

2010), however the dropout rate of around 80% suggests that the present study was too lengthy and effortful for this method of data collection.

To address these concerns, and to enable us to explore additional research questions, we collected data from a younger adult sample who took part for course credits. Our main aims in study 2 were to replicate the clustering effect for negative self-cued memories, and to explore the distributions of self-images across the life span. Previous work has suggested that only positive information about the self is organised in a typical reminiscence bump distribution (e.g., Rubin & Berntsen, 2003), thus it was predicted that positive self-images would follow the pattern of the reminiscence bump (being most frequently formed in young adulthood), and that negative self-images would show a flatter distribution. Finally, we aimed to carry out more detailed analysis on the relationship between depression (as measured by DASS21 subscale scores) and presence of negative self-images. We predicted that participants who had higher depression subscale scores would be more likely to agree with – and generate memories for - negative self-images than those with lower depression subscale scores.

Study 2

Method

Participants. The online questionnaire was accessed by 61 people, of whom 56 completed the study. The response completion criteria were identical to those in Study 1. Of these 56 participants, four were male and 52 were female (Mean age = 22.20 years, *SD* = 8.08; Range = 18 to 54). All participants were undergraduate students at a UK university and completed the study for credits.

Procedure. The questionnaire used was identical to that in Study 1, except participants were not excluded if they were aged under 40 and the time taken to complete the survey was recorded (mean time taken to complete = 35 minutes, *SD* = 17 minutes).

Results

All 56 participants agreed with and generated memories associated with at least one positive self-image (Mean number of positive self-images used as memory cues = 2.89, *SD* = 0.41; Range = 1 to 3; total sum of positive self-cued memories = 822). Within this group, 43 participants also rated agreement with at least one negative self-image and generated a set of associated memories (Mean number of negative self-images used as memory cues = 1.97, *SD* = 1.30; Range = 0 to 3; total sum of negative self-cued memories = 555). As in study 1, there was much higher agreement with positive self-images (Mean agreement rating of 3.03, *SD* = 0.88) compared to negative self-images (Mean agreement rating = 1.73, *SD* = 0.63); $t(55) = -6.91$, $p < .001$. Participants generated a mean of 4.78 memories for negative statements that were agreed with (*SD* = 2.03; range = 0 to 6) and a mean of 5.07 memories (*SD* = 1.62; range = 0 to 6) for positive statements that were agreed with.

As in study 1, our primary aim was to investigate the distributions of memories associated with negative and positive self-images. Following the standard procedure, all memories were reformulated relative to the age of emergence of the self-image that cued them, then split into proportional bins. The younger age of the participants in study 2 enabled a more fine-grained analysis of these data. Thus, seven epochs were used for analysis, of which the central five consisted of five-year bins whilst the outer two epochs comprised wider bins of 28 years: -40 to -13, -12 to -8, -7 to -3, -2 to 2, 3 to 7, 8 to 12, 13 to 40. The data (shown in Figure 2) were entered into a 2 (valence) by 7 (epoch) repeated measures ANOVA, which revealed a main effect of epoch of epoch (F [3.02, 126.93] = 52.72, $p < .001$,

partial η^2 = .56, Greenhouse-Geisser corrected) and no interaction between epoch and valence (F < 1).

(Insert Figure 2 about here)

As in study 1, we found a temporal clustering around the central epoch (here -2 to 2 years around self-image formation) for both positive and negative self-images. To analyse the distributions across epochs within each valence, additional one way ANOVAs on epoch were carried out for positive and negative self-cued memories. For memories cued by positive self-images, there was a significant main effect of epoch (F [2.65, 145.84] = 39.42, p < .001, partial η^2 = .42, Greenhouse-Geisser corrected). Bonferroni corrected pairwise comparisons on the 7 epochs showed that in the central epoch (-2 to 2 years either side self-emergence), participants generated a significantly higher proportion of memories (Mean proportion = .48) than in all other epochs (p < .003, corrected). Pairwise comparisons also showed significant differences between epoch 3 to 7 and all of the other epochs (p < .01, corrected) apart from epoch -7 to -3 (p = .25, corrected). In addition, epoch -7 to -3 also differed significantly from epoch -40 to-13 (p = .003, corrected) and epoch -12 to -8 (p = .001, corrected).

Analysis of the distribution of negative self-cued memories across the 7 epochs also revealed a main effect of epoch (F [3.09, 129.69] = 35.21, p < .001, partial η^2 = .46, Greenhouse-Geisser corrected). Unlike in study 1, Bonferroni corrected pairwise comparisons revealed multiple significant differences between epochs, with epoch -2 to 2 associated with a significantly higher proportion of memories than all other epochs (p < .01, corrected). There were also significant differences between epoch 3 to 7 and all of the other epochs (p < .01, corrected) apart from epoch -7 to -3 (p = .71, corrected). Epoch -7 to -3 differed significantly to epochs -40 to -13 (p = .005, corrected) and -12 to -8 (p = .026, corrected).

We were also motivated to examine when in the lifespan participants felt that negative and positive aspects of their identity were first formed. Using the age of emergence data (e.g., when participants dated each self-image as having emerged) we plotted the dates for negative compared to positive self-images as divided into five-year epochs (see Figure 3). Again, as there were fewer negative compared to positive self-images, the data shown are calculated as the proportion of selves within each valence (positive or negative) that fell into each epoch.

(Insert Figure 3 about here)

Figure 3 suggests that the distribution of self-images across the lifespan is relatively similar for both positive and negative aspects of identity. The proportional data were analysed using a 2 (valence) by 8 (epoch) repeated measures ANOVA which showed a significant effect of epoch (F [3.21, 134.88] = 33.13, $p < .001$, partial $\eta^2 = .44$, Greenhouse-Geisser corrected) and no significant epoch by valence interaction ($p = .10$). These results suggest that the ages at which young adults believe positive and negative aspects of their identities emerge follow a similar pattern. Identity emergence hits its peak in late adolescence (the period closest to the present for most of the participants in study 2), with the highest proportion of both negative and positive self-images being formed between ages 15 and 19.

Our final aim was to examine the relationship between mood scores and the presence of negative self-images. Using participants' DASS21 depression subscale scores, we compared the mood ratings of participants who generated memories for one or more negative self-image ($n = 43$) with those who generated memories for only positive self-images ($n = 13$). The mean depression subscale score of participants who generated memories for one or more negative self-image was 13.72 ($SD = 9.22$, Median = 14, Range = 0 to 34). Those who only generated memories for positive self-images scored 4.92 ($SD = 3.23$, Median = 4**,** Range = 0 to 10). These results indicate that the mean depression subscale score for those who

generated memories about one or more negative self-image was within the mild to moderate range for moderate depression (set at 10 – 13 for mild and 14 – 20 for moderate; Lovibond & Lovibond, 1995). In contrast, participants who only generated memories for positive self-images had a mean score in the 'normal' range (0 - 9). An independent samples *t* test showed that participants with sets of memories associated with negative self-images had significantly higher scores (e.g., were more depressed) than those who only generated memories associated with positive self-images (t [52.68] = 5.28, $p < .001$, corrected). Using the reverse of this analysis, we found that participants who scored high (e.g., above group average) on the depression subscale produced a significantly higher number of negative core beliefs (n = 25, Mean number of negative self-images = 2.68, SD = 0.63) than those who scored low on the depression subscale (n = 31, Mean negative self-images = 1.32, SD = 1.30), t (45.10) = 5.12, $p < .001$, corrected.

Analysis using the additional DASS21 subscales also revealed that participants with at least one negative self-image scored significantly higher for anxiety (Mean = 13.58, SD = 8.61) and stress (Mean = 17.02, SD = 8.39) than those without negative self-images (Mean anxiety = 5.54, SD = 7.36; Mean stress = 8.77, SD = 5.33), for anxiety: t (54) = 3.04, p = .004; for stress: t (31.66) = 4.22, $p < .001$, corrected.

Finally, in order to directly compare the relationships between the presence of positive compared to negative self-images and mood, correlational analyses were run on the number of positive and negative self-images agreed with, in relation to DASS21 depression scores. There was a significant positive correlation between number of negative self-images agreed with and DASS21 depression score (R = .487, N = 56, $p < .001$) and a non-significant trend towards a negative correlation between number of positive self-images agreed with and DASS21 depression score (R = -.254, N = 56, p = .059). These results suggest that having a greater number of negative self-images, and fewer positive self-images, are both related to

higher depression scores. However, to examine whether mood is more closely correlated with the number of positive or negative self-images, the above two correlation coefficients were compared using Hotelling William method t tests. The results suggest that there is no significant difference between the correlations for number of negative self-images and depression score, compared to number of positive self-images and depression score (t = 1.523, df = 53, p = .134; two-tailed). Thus, the number of negative self-images people agreed with was no more (or less) related to depression score than the number of positive self-images agreed with.

Discussion

The temporal distibutions of memories cued by positive and negative self-images showed similar patterns. Replicating the results of study 1, in study 2 we found that memories associated with both negative and positive self-images were clustered temporally around the period in life when these self-images were judged to emerge. With the larger sample in study 2, pairwise comparisons revealed signicant differences between the central epoch and all other epochs for both positive and negative self-cued memories.

The second aim of study 2 was to examine the distribution of self-images across the lifespan. Our results suggested that negative self-images followed a similar distribution to positive self-images, with both increasing in number up to the present age of the majority of our participants (e.g., early twenties). We expected to see this pattern (similar to a reminiscence bump) for the positive self-images, particularly as previous work by Rubin and Berntsen (2003) has shown reminiscence bumps for positive, but not negative, memories. It was therefore quite surprising to see that negative self-images were generally dated as emerging at similar periods to positive self-images. Of course, the young age of the majority of participants in study 2 means that the reminiscence bump cannot be examined fully (for this

approach we would need to test participants over the age of 40, as in study 1). A clear topic for further study is therefore to examine patterns of emergence for negative and positive self-image in older adults. As suggested by Janssen, Rubin, and St. Jacques (2011), analysis of this type should use small bins (such as the five year epochs in study 2) to ensure that temporal distributions are not misrepresented.

Finally, we saw that the presence of negative self-images was significantly related to higher scores on all subscales of the DASS21, highlighting the importance of exploring the link between negative conceptions of self and mood.

General Discussion

The primary aim of this research was to investigate whether negative self-images would cue sets of autobiographical memories that clustered temporally around the periods in life when negative aspects of the self were judged to have begun. Results from two studies showed that this clustering pattern was found for both positive self-images (replicating previous work using an open-ended identity generation task; Rathbone et al., 2008) and, in a novel finding, for negative self-images. This pattern of results suggests that negative self-images may be supported and reinforced by retreival of organised sets of salient autobiographical memories. In both studies we focused our attention on the high proportion of memories in the central epoch (the period of identity emergence). This is because these clusters of memories might be considered to play a particularly important role in organising knoweldge about the self (e.g., Rathbone et al., 2008). However, it is clear that memories from more distant periods are also associated with self-images, and future research should examine whether there are qualitative or phenomenological differences between memories within the central epoch and those that are less temporally associated with times of identity formation.

Overall, participants identified with a far higher proportion of positive, compared to negative, self-images, in line with established self-enhancement biases (e.g., Baumeister, 1998; Sedikides & Gregg, 2003). Interestingly, even when participants agreed with negative self-images, they tended to cue fewer associated autobiographical memories compared to positive self-images. The design of the present study meant that full analysis of this effect was not possible (the fact that negative self-images were rated lower for agreement than positive self-images would confound a simple comparison of number of memories generated for each valence). However, this preliminary finding fits with the goal-based self-memory system (Conway, 2005). Conway's model proposes that autobiographical retrieval is motivated to support the goals of the self, with memories that conflict with these goals being inhibited. As discussed above, we are generally motivated to view the self favourably (e.g., Baumeister, 1998), thus we would expect retrieval of positive memories to be more successful than retrieval of negative memories (e.g., D'Argembeau & Van der Linden, 2008; Lishman, 1974). As we discuss in more detail below, future work using alternative paradigms could explore the relative accessibility of memories associated with positive and negative self-images.

The results of the present study contrast with previous studies that have shown different effects for positive and negative autobiographical memories. Indeed, past results suggest that organisational processes in memory function only to support positive conceptions of the self and one's past, such as the reminiscence bump for positive, but not negative, events (Berntsen & Rubin, 2003) and the fading-affect bias (Walker et al., 2003). However, it is notable that the participants in study 2 who identified with negative self-images scored significantly higher for depression, anxiety and stress than the participants who only identified with positive self-images. Thus, it is possible that people who possess negative self-beliefs have spent time retrieving and rehearsing sets of memories associated

with those self-beliefs, assimilating negative memories into their current concept of self (e.g., Luke & Stopa, 2009), which may have a detrimental impact on mood. The degree to which negative life events are viewed as central to identity has been shown to correlate with measures of emotional distress and PTSD (Berntsen, Rubin, & Siegler, 2011). Furthermore, unlike positive events, negative life events tend not to be organised or recalled in line with typical life script patterns (e.g., a peak of memories during the reminiscence bump, Rubin & Berntsen, 2003) but rather they are rehearsed and integrated into concepts of self and identity through processes associated with emotional distress (Berntsen, Rubin, & Siegler, 2011). Therefore we might consider the sets of autobiographical memories that are clustered around negative core beliefs to play an important role in reinforcing negative views of the self. This conclusion is in line with the assumptions embedded within a cognitive behaviour therapy for depression (Beck et al., 1979).

The fact that negative self-images appear to develop during identifiable phases of early adulthood has implications for clinical intervention. One approach adopted within formulation based cognitive behaviour therapy is to discuss the origin of negative core beliefs, and to explore whether these beliefs are still valid and accurate now they can be reviewed from an adult perspective. For example, although it was understandable for a patient to conclude that people should not be trusted when they were abused as a child, does this global belief seem to be accurate within their current life? Also, given that the negative meaning associated with these memories seems to drive a current negative self-image, clinical interventions which are aimed at weakening the meaning derived from the early negative experiences may be particularly powerful. One such intervention involves revisiting childhood events using imagery techniques in order to modify distressing memories (Holmes, Arntz, & Smucker, 2007). It is argued that the patient must be reliving the emotional experience of the past event, for example through the use of imagery, in order to alter the

meaning. For instance, a frequent distressing memory of being physically abused by a parent, and experiencing oneself as weak and pathetic, can be revisited and evaluated as surviving a stressful situation. Another relevant clinical intervention involves training patients to enhance access to positive memories which contain a positive self-image, and in doing so weaken the pathway to the previously dominant negative memory and associated negative self-image (Brewin, 2006). A crucial next step will be to explore whether people with emotional disorders such as depression and PTSD also possess organised clusters of autobiographical memories related to core negative self-images – the results of the present study suggest that this is likely to be the case.

The results of these studies suggest several avenues for future research, but are also subject to several limitations. Firstly, a clear limitation of the present design is that we deliberately avoided counterbalancing the order of the positive and negative memory tasks. This was for ethical reasons; we did not want anybody to finish the study by focusing on the negative aspects of their identities. Had the study been conducted in a laboratory, then counterbalanced conditions could have been followed by a positive mood induction, to ensure all participants ended the study by focusing on something positive. As the study was online and already quite lengthy, we did not feel a positive mood induction would be successful so opted to use a fixed task order. Future work should thus counterbalance the order of memory tasks to ensure that order does not affect the pattern of results.

A further point relates to the use of temporal clustering as a measure of the self-memory relationship. In these studies we have assumed that the temporal organisation of autobiographical memories tells us something important about the self-image they are associated with – in essence, we propose that temporal clusters play an important role in supporting and reinforcing knowledge about the self. It thus follows that if a person has a deeply held belief that they are a bad person, then a temporal cluster of memories from a time

in life when that person feels they 'became' bad could prove to be an important target for therapy. Although the temporal links between memories and self-images represent one means of examining the self-memory relationship, we acknowledge that there many other approaches one could take. In a recent study we found that self-images that were rated as most personally significant were associated with more plentiful sets of autobiographical memories (as measured using a fluency task paradigm) than self-images that were less personally significant (Rathbone & Moulin, submitted). Thus, rather than exploring temporal distributions, we examined the self-memory relationship via a measure of fluency. A similar approach could be taken to investigate the relative accessibility of memories associated with negative and positive self-images. A notable limitation of the present study was the lack of information about the phenomenological and qualitative features of memories cued by positive and negative self-images. Future work should examine these aspects of memory more fully, enabling a broader understanding of the features of memories that reinforce negative core beliefs about the self.

To conclude, the present study is the first to systematically demonstrate that negative self-images are associated with clusters of temporally organised autobiographical memories. These memory clusters may play a key role in reinforcing negative views of the self and it is suggested that future work explore these self-cued memory clusters in clinical populations.

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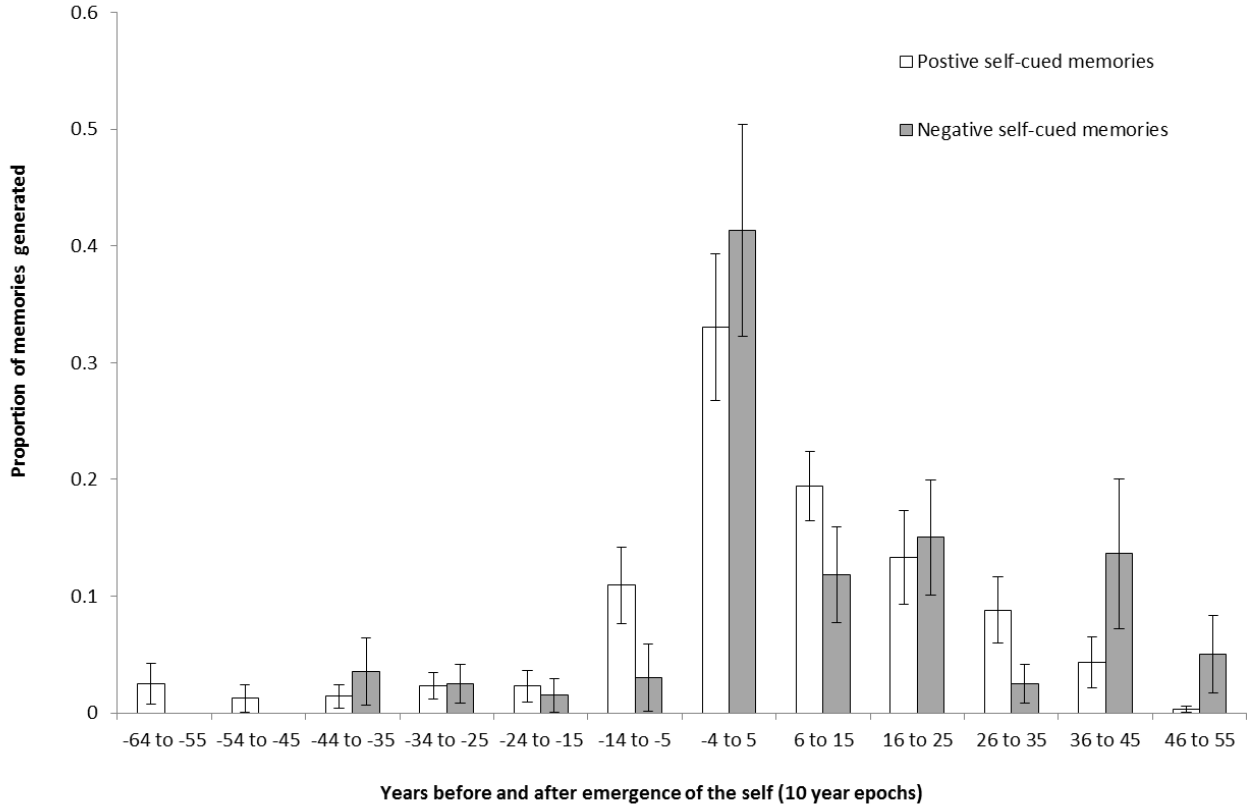

Figure 1: Proportion of memories recalled in epochs around age of self-image formation (Study 1)

(N.B. Error bars show standard error)

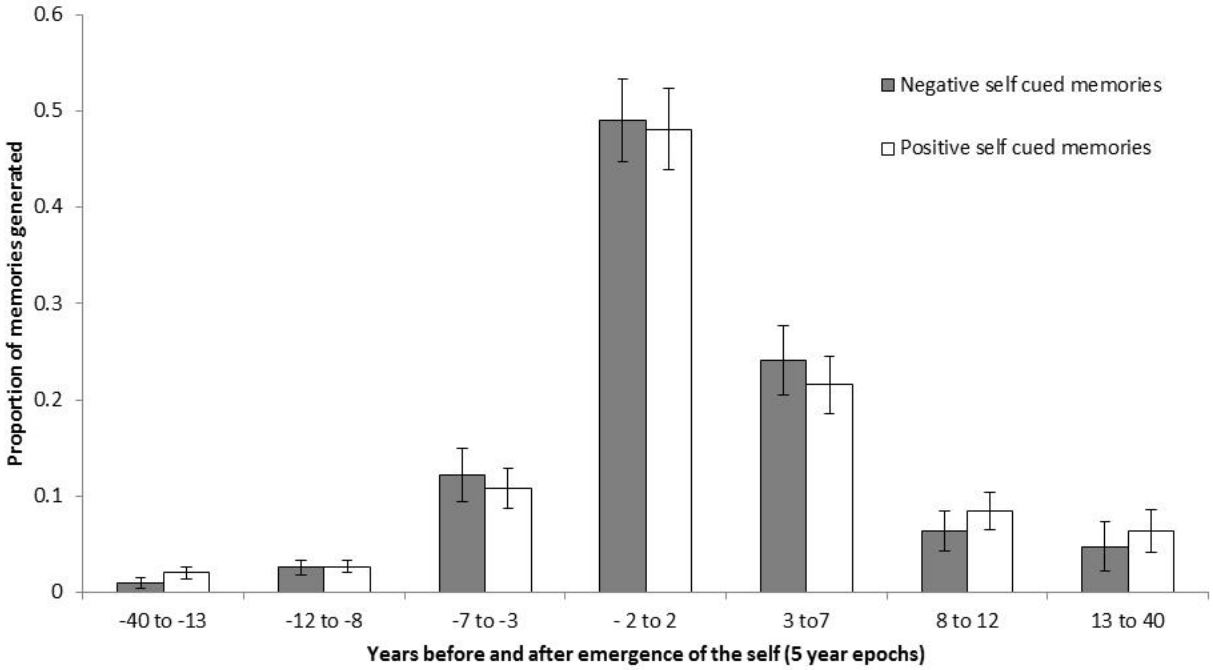

Figure 2: Proportion of memories recalled in epochs around age of self-image formation (Study 2)

(N.B. Error bars show standard error)

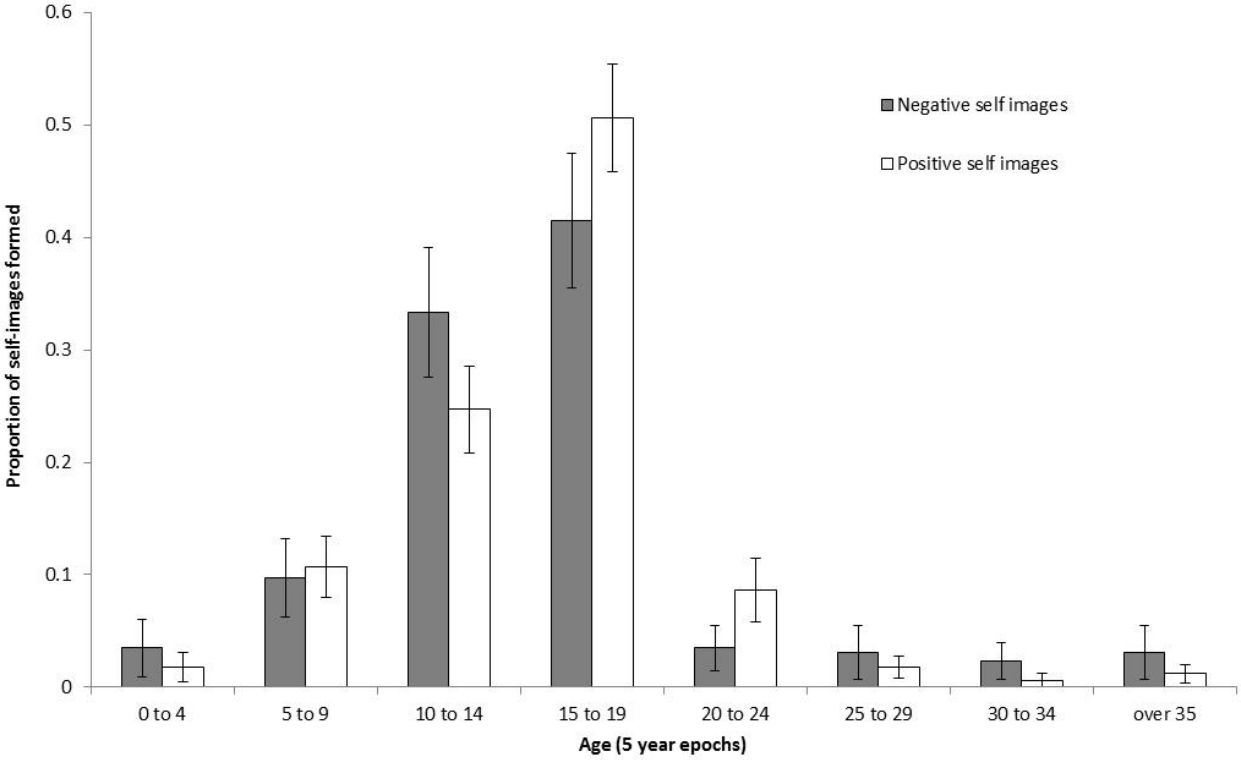

Figure 3: Distribution of self-images across the lifespan (Study 2)

(N.B. Error bars show standard error