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**Thinking hats and good men: Structured techniques  
in a problem finding task.**

## **Abstract**

Problem finding can often be the first step in problem solving and research has suggested that actively engaging in problem finding can lead to a more beneficial outcome and facilitate creativity. Here, we examine two techniques that may be used to help ‘scaffold’ problem finding ability: the six thinking hats and the six good men. These techniques can require the participant to either adopt multiple perspectives, incorporating a range of specific questions, or utilise a range of simple open ended questions. We had 100 participants take part in an on-line study that involved presenting them with a problem and requiring them to restate the problem in as many different ways as they could within a 3-minute time frame. Participants were randomly allocated to groups comprising the six hats technique, the six men, or a no-intervention control group, and performance was measured in terms of the fluency, quality and originality of the responses. Results showed that both six hats and six men techniques produced greater fluency relative to controls, with a more robust effect for those using the six men. In terms of originality, both techniques proved beneficial relative to controls, with a more robust effect from those using the six hats. Hence, both techniques benefited performance, though in distinct ways. These results are discussed in terms of the potential benefits obtained by explicitly scaffolding thinking.

**Keywords:** six thinking hats, six good men, creativity, problem finding.

## **Introduction**

The problem solving process generally proceeds across a number of phases, though not always in a linear fashion. These are the problem identification phase, followed by the idea generation phase, and finally the implementation and reflection phase (see e.g., Nickerson, 1999). A key element within the first phase of problem identification is problem finding, which includes the anticipation of problems, identifying problems where none exist, and structuring an ill-defined problem so problem solving efforts can proceed. Problem finding has been suggested to be a critical component of creativity (Dillon, 1982; Getzels & Smilansky, 1983) as well as an important asset in business (Fontenot, 1993) and may help individuals deal with uncertainty and adapt to the continuous changes in life (Karpova, Marcketti, & Barker, 2011). Thus, a technique that facilitates problem finding ability is likely to be of significant benefit.

Previous researchers have suggested that when problem finding occurs in an effortful manner, rather than simply automatically, it may result in more original and higher quality solutions (Mumford, Reiter-Palmon, & Redmond, 1994). Furthermore, engagement in problem finding, through instruction or training, may facilitate creativity, and attention to combinations of elements in a problem is likely to influence the outcome (Reiter-Palmon & Robinson, 2009). These suggestions are consistent with the common sense notion that identifying more opportunities increases the probability of finding useful ideas to pursue (Sowden, Pringle, & Gabora, in press). As such, utilising a technique that encourages the individual to think about a problem in an effortful, structured manner that encourages attention to different aspects of the problem is likely to facilitate performance. Two simple techniques that may provide such scaffolding are the Six Thinking Hats (six hats: de Bono, 2009) and The Six Good Men (six men).

The six hats technique helps the individual think in broader, distinct ways and include new and/or different concepts. Each thinking hat is associated with a distinct colour and emphasises a particular style or type of thinking. For example, the white hat encourages the individual to focus on facts and information, helping them ask questions about what information exists regarding the problem and how relevant information may be obtained. By addressing the questions associated with each of the coloured hats the individual is able to thoroughly explore a wider variety of issues, facts, implications, and alternatives that should aid in the problem finding process. Furthermore, by changing hats, the individual can change

viewpoints, which helps to ensure that they don't get stuck in their thinking patterns. Researchers have suggested that the technique helps to provide an explicit framework that will facilitate or scaffold creative thinking (Rizvi, Bilal, Ghaffar, & Asdaque, 2011; Schellens, Van Keer, De Wever, & Valcke, 2009). The technique itself has been praised for being easy to learn (Childs, 2012) yet there is limited empirical evidence supporting this claim, or other alleged benefits. The literature contains subjective reports of its effectiveness (see, Geissler, Edison, & Wayland, 2012) and anecdotal reports from those that have utilised the technique support its use in decision making (Benjes-Small, Berman, & Van Patten, 2014; Hodge & Ozag, 2007; Karadag, Saritas, & Erginer, 2009; Kenny, 2003). Furthermore, Schellens et al. (2009) found that students using the six hats to identify, or tag, their discussion contributions when using an asynchronous, on-line discussion forum showed greater evidence of critical thinking compared to those who did not. In particular those using the six hats showed greater evidence of 'focus' and 'novelty' in their discussion points. In contrast, Birdi (2007) found that self-reports of idea generation following training on the six hats failed to show any benefit. As such, beneficial claims made regarding the use of the six hats to improve creative thinking have yet to be clearly and empirically supported.

The six men technique refers to the six open ended questions: who, what, when, where, how and why. This technique stems from the six 'honest serving men' mentioned in Kipling's 'The Elephant's Child' (1902). The idea is that the individual approaches a problem with these questions in mind to help scaffold and facilitate their understanding of the issues, which in turn may improve their ability to identify more effective solutions. According to Paterson (2006) the use of such open ended questions can encourage the learner to stretch themselves and research shows that such open questions are able to elicit more diverse responses than close-ended questions (e.g., Reja, Manfreda, Hlebec, & Vehovar, 2003). More specifically, Annesley (2010) also found that these six questions can be used to help facilitate understanding. However, whilst such a technique could encourage the individual to adopt multiple perspectives when dealing with a problem, which some have argued would support problem solving (McFadzean, 1998), there is no evidence of such a technique benefiting problem finding ability.

Thus, the aim of this project was to compare the effectiveness of each technique to that of a no-intervention unstructured control group on a problem finding task. Our initial prediction was that participants using either the six hats or the six men technique would exhibit improved problem finding ability compared to the no-intervention control group. However, it

is not clear at this stage whether any difference in problem finding ability would emerge between the two techniques.

## **Method**

### **Participants**

One hundred participants (33 male; 67 female) aged 22y to 70y (mean age 48y) took part in an on-line study that was advertised via the internal home page of the University and via social media sites (e.g., Twitter). All participants were volunteers and completed the study for free.

### **Materials**

The study was conducted on-line using the Qualtrics software program to present information and record responses (Qualtrics). Five self-report questions were created using a 5-point Likert response scale. The first two assessed the participant's views on creativity (Q1: how creative do you think you are? Q2: How important to you think creativity is in life?). The remaining three were used at the end of the study to obtain feedback on the problem restatement task (Q3: How easy/difficult did you find it to restate the problem?) and feedback from those in either of the intervention conditions (Q4: How easy/difficult did you find it to use the technique? Q5: How likely is it that you would use the technique in the future?). An introduction to each of the two interventions (i.e., six hats; six men) was also produced along with an example problem ('There are mice in the basement' from Baer, 1988) to help participants understand how the techniques could be used in problem finding. Those in the control group were given an outline of what problem finding means along with the same example problem and some example restatements. The problem used in the main part of the study was the same for all participants: '*I am in a new city and need dinner*', which was taken from Paletz and Peng (2009).

### **Design**

The study used a between participants design with a single factor of Group with three levels (six hats; six men and control). Three dependent measures were used to assess problem finding. The first was fluency, which referred to the number of problem restatements (see, Fontenot, 1993). The second, quality, captured the degree to which the problem restatements were plausible/reasonable/viable, and was scored on a five point Likert scale from 1 (very

low quality) to 5 (very high quality). The third measure was originality and assessed the degree to which the problem restatements were free from the problem situation or were novel/unique, and was also scored on a five point Likert scale from very low originality to very high originality. These last two measures are standard ones that have been used by others when assessing problem finding skills (see, Reiter-Palmon, Mumford, & Threlfall, 1998).

## **Procedure**

There were six phases in the experiment and each participant completed them in the same order. Phase 1 introduced the study as a 'creative problem finding task' and provided information on the nature of the study, as well as obtaining informed consent. Phase 2 recorded demographic information and phase 3 required participants to complete the two self-report questions on the nature of creativity. In Phase 4, participants were randomly allocated to an intervention or the control. For those allocated to either the six hats or the six men, this involved a short description of the technique and an example problem along with guidance on how the technique could be used to explore the problem. For controls, this involved a short definition of problem finding and the same example problem as the other conditions, along with some example restatements. Phase 5 consisted of presenting the main problem on screen for 3 minutes and requiring participants to type in their responses. Following this, participants completed Phase 6, which comprised the post-problem finding questions regarding how easy/difficult it was to restate the problem and, for those allocated to one of the two interventions, how easy/difficult the techniques were and whether participants would consider using them in the future. Once completed a simple 'thank you' notice was displayed along with contact details of the two experimenters.

## **Results**

Two independent raters blind to the aims/objectives of the study were used to code and rate all responses. Consistent agreement was obtained for responses to self-report questions and the measure of fluency. For measures of quality and originality, where coded responses differed by more than one rating point in either direction (<16%), a third blind rater was brought in to arbitrate the decision. Inter-rater reliability was measured by intra-class correlations (Shrout & Fleiss, 1979) and these were 0.67 for quality and 0.75 for originality. Descriptive statistics regarding responses to the initial questions on participant's views of creativity are shown in Table 1. This shows that participants in each group rated their own

creativity levels similarly at just over the half-way point. However, they all rated the ‘importance of creativity in life’ as significantly more important (grand means of 3.37 and 4.36 respectively;  $t(99)=12.219$ ,  $p<0.001$ ,  $d'=1.2$ ) showing a clear understanding of the important role of creativity.

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Table 1 about here

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To test the predictions that the structured interventions would lead to improved creativity performance (i.e., one-tailed) relative to controls a one-way analysis of variance (ANOVA) was carried out on each of the three creativity measures (i.e., fluency, quality, originality) with orthogonal planned contrasts comparing performance of each intervention to controls. For Fluency this led to a main effect of Group  $F(2,97)=3.875$ ,  $p=0.024$  with contrasts showing that those using the six men technique produced significantly more restatements than controls (mean fluency 10.34 vs. 8.11 respectively;  $t(97)=2.78$ ,  $p=0.003$ ,  $d'=0.7$ ), whilst those using the six hats showed only a weak marginal improvement relative to controls (mean fluency 9.24 vs. 8.11 respectively;  $t(97)=1.42$ ,  $p=0.079$ ,  $d'=0.33$ ). Post-hoc analysis (two-tailed) showed no difference in fluency between the six men and six hats techniques (mean fluency 10.34 vs. 9.24 respectively;  $t(64)=1.42$ ,  $p=0.159$ ). Analysis of Quality showed no main effect of Group  $F(2,97)=0.91$ ,  $p=0.407$  with contrasts showing no difference between those using the six men technique and controls (mean quality 3.92 vs. 3.69 respectively;  $t(97)=1.14$ ,  $p=0.128$ ), and no difference between those using the six hats and controls (mean fluency 3.92 vs. 3.69 respectively;  $t(97)=1.18$ ,  $p=0.120$ ). Analysis of Originality revealed a main effect of Group  $F(2,97)=5.338$ ,  $p=0.006$  with contrasts showing that those using the six men technique produced significantly more original restatements than controls (mean originality 3.32 vs. 2.86 respectively;  $t(97)=2.14$ ,  $p=0.017$ ,  $d'=0.49$ ), with a similar pattern evident from those using the six hats who showed greater levels of originality compared to controls (mean originality 3.54 vs. 2.86 respectively;  $t(97)=3.20$ ,  $p=0.001$ ,  $d'=0.76$ ). Post-hoc analysis (two-tailed) showed no difference in originality between the six men and the six hats



techniques (mean originality 3.32 vs. 3.54 respectively;  $t(64)1.21$ ,  $p=0.230$ ). Thus, structured approaches improved fluency and originality scores but not quality.

Descriptives statistics of responses to the post-restatements questions regarding the difficulty of the task, the use of the technique and possible future use are shown in Table 2.

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Table 2 about here

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A one-way ANOVA conducted on participants ratings of how easy/difficult it was to restate the problems showed no main effect of Group  $F(2,93)=0.22$ ,  $p=0.803$ . Independent samples  $t$  tests comparing responses from the two intervention groups on difficulty of technique and possible future use showed no differences ( $p=0.14$  and  $p=0.202$  respectively). We also examined the relationship between creative performance and ease of use of a technique and how likely participants were to use it in the future. This revealed that participants using the six men technique exhibited a positive correlation between fluency and ease of use of the technique,  $r(31)=0.374$ ,  $p=0.038$ . Whilst participants using the six hats showed positive correlations between fluency and ease of use of the technique  $r(33)=0.50$ ,  $p=0.003$ , as well the likelihood of using the technique in the future  $r(33)=0.35$ ,  $p=0.050$ . They also exhibited a marginal positive correlation between originality and ease of use,  $r(33)=0.302$ ,  $p=0.087$ .

## **Discussion**

Use of the six men technique produced a greater number of restatements, with a positive association between ease of use of the technique and the number of restatements. Use of this technique also resulted in more original restatements relative to controls. Similarly, use of the six hats technique produced a robust benefit in terms of originality of restatements, with a positive trend evident between ease of use of the technique and originality. With regards to fluency there was only a weak trend for the six hats suggesting a limited benefit relative to controls, though again those who found the technique easier to use produced more responses

and also indicated that they would be more likely to use the technique in the future. Whilst no clear difference emerged between the two techniques the effect sizes are nevertheless suggestive. Given the suggestion by Cohen (1988) that an effect size of 0.5 may be considered medium, and 0.8 large, it could be argued that use of the six men produced a greater benefit in terms of fluency yet use of the six hats elicited a more robust effect on originality.

That both techniques led to improved performance is consistent with research showing that creativity can improve with explicit training (see e.g., Feldhusen & Clinkenbeard, 1986) and that active engagement with the problem can increase creativity (Mumford et al., 1994; Reiter-Palmon, Mumford, Boes, & Runco, 1997). In this instance, however, the techniques were self-taught rather than forming part of a more formally structured course. It should also be noted that we did not ask participants how, if at all, familiar they were with the techniques and future research would do well to capture such information. Nevertheless, the simplicity and ease of use of the techniques allowed participants to utilise them with very little training, which may be seen as a strength. However, it may be the case that providing a more formal and/or structured introduction with greater exposure to the techniques, allowing time for additional practice, would lead to more robust effects and possibly help tease apart any potential differences between the two techniques. Such a possibility would fit with research showing that increasing the duration of creative problem solving training can elicit effects that are not evident when short duration training sessions are used (Daniels, Heath, & Enns, 1985; Wang & Horng, 2002).

It is also worth noting that all participants in this study were volunteers and completed the study in their own time for no explicit reward. There is some consensus in the literature suggesting that while external rewards may hinder creativity (Fasko, 2001; Hennessey & Amabile, 1987), intrinsic motivation may facilitate creative performance (Amabile, 1983, 1996). However, Ryan and Deci (2000) suggest that under certain conditions, or at certain times, optimal performance may be obtained when both intrinsic and external motivation work constructively together in the same individual. Nevertheless, the use of an on-line research paradigm may represent a good opportunity to tap into those individuals with sufficient intrinsic motivation to complete the required task. Of course, this in itself may influence and/or limit the nature of the research questions that can be posed and, as with most things, a 'one size fits all' approach is unlikely to yield comprehensive insights into the nature of creativity. Nevertheless, use of on-line data collection, as clearly shown here, can be

used to provide useful insights that may then be further developed in a more comprehensive manner using face-to-face and/or lab based sessions.

Both techniques proved to be more effective than the no-intervention condition, yet there is some suggestion that their benefits may have been subtly distinct. For instance, the six men approach elicited a borderline large effect for fluency (0.76) whereas the six hats produced only a small effect (0.33). This pattern was somewhat reversed for originality when the six hats technique produced a large effect (0.76) and the six men (0.49) a medium sized effect. Given that no significant difference was found between the two techniques such differences should be interpreted with caution. Nevertheless, such subtleties may also help provide useful insights into the nature of the techniques.

To some extent, this pattern of effects could be related to the nature of the technique as well as the timing of the task. For instance, the six men technique requires the participant to ask a number of open ended questions about the issue at hand. Such a line of enquiry is almost certain to increase the number of generated responses, which is consistent with other reports (Reja et al., 2003). However, whilst there may be an association between fluency and originality (see e.g., Silvia et al., 2008), greater fluency does not guarantee greater originality (Forster, Friedman, & Liberman, 2004). Furthermore, given the limited time duration for responding (i.e., 3 minutes), it should come as no surprise that asking a number of open ended questions benefited fluency. It may be that with more time, originality may have also increased. Thus, the effect of time may impact more on the evaluative aspect of creativity rather than the generative component. Such an idea is consistent with suggestions that allowing more time may enable the individual to work through the more usual/less original ideas and then move on to the more unusual/original ideas (Haman, 1996; Isaksen, Dorval, & Treffinger, 2011).

In contrast, the six hats elicited a large effect size on originality despite the limited time. This may be accounted for in terms of the complexity of the technique as well as the variety of its components. For instance, Scott, Leritz, and Mumford (2004) have suggested that techniques that provide more structure, which in turn helps to scaffold thinking, may have a greater effect on performance. With this in mind it is possible to see that the six hats not only provides a way of viewing the problem from different perspectives, similar to the six men, but also encourages a more elaborate range of processes associated with each hat that goes beyond asking a single question. For instance, while 'wearing' the white hat the individual is

encouraged to think about information and ask questions such as ‘what information do I have?’ and ‘what information do I need?’ as well as ‘how can I obtain the information I need?’. As such, each hat may encourage a greater depth of processing. Such a proposal is consistent with the view that incorporating a level of abstraction when approaching a problem, helping the individual to think about the problem in more general terms, can help to create a richer understanding of the problem (Smith, 1988). Furthermore, shifting between the perspectives of the six hats would encourage a diverse range of perspectives and processing approaches. This shifting of attention to focus on different elements of the problem may also facilitate creativity. Such a view is consistent with research suggesting that shifting perspectives fosters the development of ideas and may aid creativity (Basadur, Graen, & Graen, 1982; Kozbelt, Beghetto, & Runco, 2010).

It is worth noting that whilst others have found positive changes in the ‘quality’ of problem restatements (see, Reiter-Palmon et al., 1998), this study failed to elicit any clear changes in this measure. This should not be taken to indicate that such techniques cannot influence the quality of potential problem restatements, simply that, in this instance, no clear effect emerged. Feedback from our coding assistants indicated that all of them struggled with this concept. In part, this may be because we adopted the definition used by Reiter-Palmon et al (1998) where quality largely denoted plausibility. It is beyond the scope of this article to examine the nature of the measures used to assess creativity (see, Silvia et al., 2008) but, to provide a more comprehensive view of the impact of these techniques, future attempts to assess their potential beneficial impact on problem finding could utilise alternative and possibly more concise measures such as flexibility (i.e., the number of distinct categories of ideas; Sowden & Dawson, 2011) and/or frequency (i.e., how often a response occurs; Runco, Okuda & Thurston, 1987).

In conclusion, we show that helping to scaffold thinking can improve creative fluency and originality when attempting to find or identify a problem.

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**Table 1.** Showing mean responses to initial self-report questions on a scale from 1 (not at all) to 5 (very) from participants within each group.

| <b>Condition</b> | <b>How creative do you think you are?</b> | <b>How important do you think creativity is in life?</b> |
|------------------|---|--|
| <b>6 Hats</b>    | 3.44                                      | 4.26   |
| <b>6 Men</b>     | 3.31                                      | 4.28   |
| <b>Controls</b>  | 3.35                                      | 4.52   |



**Table 2.** Showing mean responses to post-restatement task self-report questions on task difficulty (1=extremely difficult; 5=extremely easy), technique difficulty (1=extremely difficult; 5=extremely easy) and likelihood of using the technique in the future (1=not at all likely; 5=extremely likely).

| <b>Condition</b> | <b>How easy/difficult to restate the problem?</b> | <b>How easy/difficult to use the technique?</b> | <b>How likely to use the technique in the future?</b> |
|------------------|---|---|---|
| <b>6 Hats</b>    | 2.96  | 2.66  | 2.91  |
| <b>6 Men</b>     | 2.81  | 3.13  | 3.26  |
| <b>Controls</b>  | 2.84  | -   | -   |