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CREATIVITY, INTELLIGENCE, AND PSYCHOTICISM

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Summary—Three studies find Creativity correlates with Psychoticism and Intelligence. With 52 university professors, publication and citation counts correlated 0.26 ($P < 0.05$) with Psychoticism assessed by a weighted composite of trait ratings made by faculty-peers and 0.40 ($P < 0.01$) with faculty-peer rated intelligence. Among 69 university professors, an enjoyment of research composite correlated $r = 0.43$ ($P < 0.01$) with Psychoticism assessed using a weighted composite of trait self ratings, although not with self-rated intelligence ($r = 0.05$). Among 194 university students, the Wallach–Kogan Test of Divergent Thinking correlated $r = 0.17$ ($P < 0.05$) with the P scale from the EPQ and $r = 0.24$ ($P < 0.05$) with an IQ test.

INTRODUCTION

Explaining great originality in terms of individual differences has been de-emphasized in recent years in favour of theories involving social structure. A striking feature of high creativity, however, is its statistical rarity, which poses a problem for purely sociocultural explanations. As Simonton (1988) points out, Zeitgeist or spirit-of-the-times theories, can explain only a small portion of great creativity: that involving scientific and socio-political innovations, but not art and literature. For example, while sociocultural theorists might claim that the theory of evolution by natural selection became inevitable in the middle of the nineteenth century, no claims are expressed that the *Fifth Symphony* would have emerged in the early 1800s whether or not Beethoven existed. Moreover, most lists of 'multiple discoveries' (required by Zeitgeist theories) are, on examination, often quite small and fail to discriminate between genus and individual. Since Darwin's theory was not identical to Wallace's, the course of biological thought would likely have been different had Darwin vanished while on the *Beagle* voyage.

It is unfortunate how few research psychologists there are who are studying higher level productivity, even though, paradoxically, it is supposed to be going on all around them! Instead, we have left the topic, in the main, to the educationalists, the sociologists, the philosophers, and even the historians. Only sporadically over the last decades have psychological aspects of highly creative behaviour been substantially addressed (Campbell, 1960; Getzels & Jackson, 1962; MacKinnon, 1962; Taylor & Barron, 1963; Albert, 1975, 1983). Fortunately, there may be indications that the situation is changing (Findlay & Lumsden, 1988; Jackson & Rushton, 1987; Simonton, 1984, 1988).

INTELLIGENCE

Although Galton (1869) and other early investigators of genius thought that great creativity rested on genetically-based intelligence, in recent years this relationship too has been de-emphasized. In fact, many important reviewers, including those who are not habitual nay-sayers to the importance of intelligence, have concluded that whereas creativity is significantly related to IQ up to about IQ 120, the level of an average North American university undergraduate, after this, creativity becomes independent of IQ (Eysenck, 1983; Findlay & Lumsden, 1988; Simonton, 1984; Vernon, 1987). Because so little evidence is provided for this claim, the statement may be premature.

Individuals with IQs of 120 would have great difficulty competing successfully in some of today's most creative scientific professions (astrophysics, computer engineering, mathematics). Several studies have shown the high average intelligence of professional scientists (Cox, 1926; Gibson & Light, 1967; Harmon, 1961). Moreover, the importance of general cognitive ability has been

shown in literally hundreds of studies to now predict work performance in all occupations, whether measured by supervisor ratings, training success, job knowledge, work samples, or ongoing job learning, with validities as high as $r = 0.80$ (Gottfredson, 1986; Hunter, 1986; Hunter & Hunter, 1984). Many of these studies were carried out on very large samples by the U.S. Employment Service and the U.S. Armed Services examining jobs rated as of low, medium, and high complexity, or categorized as clerical, professional or technical etc. Meta-analyses showed that general cognitive ability, rather than specific cognitive aptitudes or job knowledge, were the best predictors of performance in all cases. It seems likely that such 'validity generalizations' (Schmidt & Hunter, 1977) would also apply within occupations involving creative performance. Indeed, typically, as the complexity of the job increases, the better cognitive ability predicts performance (e.g. managers and professions 0.42 to 0.87, sales clerks and vehicle operators 0.27 to 0.37; see Hunter, 1986, Table 1).

Data from studies in higher education and on the research productivity and impact of faculty members also demonstrates the role of general cognitive ability. Thus, in North America, students with high Scholastic Aptitude Tests and Graduate Record Examination marks go to more prestigious universities (Rushton & Meltzer, 1981), do better in their undergraduate and graduate careers, and are more successful in their occupations than low scorers (Jensen, 1980). We shall examine whether intelligence relates to research productivity and impact among university professors.

PSYCHOTICISM AND OTHER CHARACTERISTICS

One line of theorizing suggests that people who are highly original and creative differ from others in showing behavioural quirks similar to schizophrenics and other psychotics. Genetic studies have provided some support for this view. Studying offspring of schizophrenic mothers raised by foster-parents, Heston (1966) found that although about half showed psychosocial disability, the remaining half were notably successful adults, demonstrating artistic talent beyond that found in a control group. Among relatives of schizophrenics, Karlsson (1978) found a high incidence of creative achievement. In highly creative adopted children and their biological parents, McNeil (1971) discovered that mental illness rates were related to creativity level. Findings such as these support speculations to the effect that there is a common genetic basis for great potential and for psychopathological deviation.

Using the Psychoticism (P) scale from the *Eysenck Personality Questionnaire* (EPQ: Eysenck & Eysenck, 1975, 1976), a dimension developed as a continuum between normality and psychosis that correlates negatively with measures of 'acceptance of culture', Woody and Claridge (1977) gave 100 Oxford students five tasks from the Wallach–Kogan Creativity Tests (e.g. Name all the things you can think of that move on wheels; *S*s responded with items such as 'ball-point pens', and 'can openers'). They found that the P scale correlated from 0.32 to 0.45 with the 'total' number of responses produced and 0.61 to 0.68 for the number of 'unique' responses. No reliable correlations were found between creativity and E and N, but the L-score which correlates negatively with P and is partly a measure of social conformity, showed consistent negative correlations with creativity scores. Subsequently, Rawlings (1983) provided some replication of Woody and Claridge (1977) finding correlations between P and Creativity of around 0.20, depending on sample size and testing conditions.

Using *in vivo* criteria, 337 professional artists with a record of holding successful exhibits, were administered the EPQ and found to have higher P scores than non-artists (Gotz & Gotz, 1979a, b). With scientists, Terman (1955) reported longitudinal data showing that scientists differed from nonscientists in exhibiting high general intellectual curiosity at an early age and in being low in sociability. Terman concluded that "the bulk of scientific research is carried on by devotees of science for whom research is their life and social relations are comparatively unimportant" (p. 7). Terman noted that such traits were not necessarily defects, for emotional breakdowns were no more common than among nonscientists. Instead, he suggested that this constituted a normal departure from the average that was decidedly favorable for the professional development of a scientist.

Cattell has reported that a reliable profile of the prototypic scientist emerges from both the qualitative study of biographies and from quantitative psychometric studies of leading researchers (Cattell, 1963, 1965). Successful scientists were reported to be: reserved and introverted, intelligent, emotionally stable, dominant, serious-minded, expedient, venturesome, sensitive, radical thinking, self-sufficient, and having a strong and exacting self-concept; in short 'introverted and bold' (Drevdahl & Cattell, 1958).

McClelland (1963) found successful scientists to be calculating risk-takers in the same way as business entrepreneurs; the risk-taking, however, involved dealing with physical rather than social situations, for he too found scientists to be avoidant of interpersonal relationships. McClelland also believed that the source of the need for scientific achievement was a strong aggressive drive "which is normally kept carefully in check and diverted into taking nature apart" (1963, p. 162). Barron (1963) found creative people to be cognitively complex, more differentiated in personality structure, independent and nonconformist, self-assertive and dominant, and to be low in censoring their impulses and thoughts.

Studies of psychologists have found that publication and citation counts can be predicted by those components of achievement motivation concerning the enjoyment of challenging tasks and hard work, although not those components concerned with interpersonal competition or bettering others (Helmreich, Beane, Lucker & Spence, 1978; Helmreich, Spence, Beane, Lucker & Matthews, 1980). Type A 'workaholic' behaviour (aggressive, incessantly struggling, time oriented, hostile when frustrated) has also been associated with the number of citations a psychologist's work earned from others (Matthews, Helmreich, Beane & Lucker, 1980). In two factor analytic studies examining 29 personality traits in psychology professors, research and teaching effectiveness composites (which intercorrelated zero) were targeted as separate orthogonal factors (Rushton, Murray & Paunonen, 1983), and the cluster of traits associated with being an effective researcher were found to be quite different from those characterizing the effective teacher (Fig. 1). The only variables loading positively on both dimensions were intelligence and leadership, while meekness suggested being poor in both.

In this paper the relation of creativity to intelligence and psychoticism is explored from a re-examination of existing data and from novel data collected for the purpose. The studies differ in samples used (university professors, undergraduate students), assessment of individual differences (peer and self-ratings, paper-and-pencil IQ and personality tests), and estimates of creativity (publication and citation counts, paper-and-pencil creativity tests).

STUDY 1: FACULTY AT THE UNIVERSITY OF WESTERN ONTARIO

Method

Subjects

Participants were 46 male and 6 female full-time psychology professors of varying ranks at The University of Western Ontario. Due to the small number of females, all analyses are collapsed across sex.

Personality assessment

Each faculty member's personality was measured on 29 traits using four assessment techniques: faculty-peer ratings, student ratings, self-ratings, and self-report questionnaires (Rushton *et al.*, 1983). The rating measures were based on 9-point adjective rating scales, with the trait names and brief descriptions shown in Table 1, along with split-half reliabilities for the faculty-peer and student judgments. The instructions for the ratings emphasized that judgments were to be made relative to other university professors rather than to other people in general. Between 9 and 17 peer ratings were obtained for each of 52 participating professors with a mean return of 12 ratings per faculty member.

Convergent validities were found for the different personality assessments. For example, the self-ratings and questionnaire scale scores had a mean correspondence across the 29 traits of 0.52, while the correspondence between personality ratings made by faculty peers and by students showed a mean of 0.43. However, because the response rates for the faculty-peer ratings ($n = 52$)

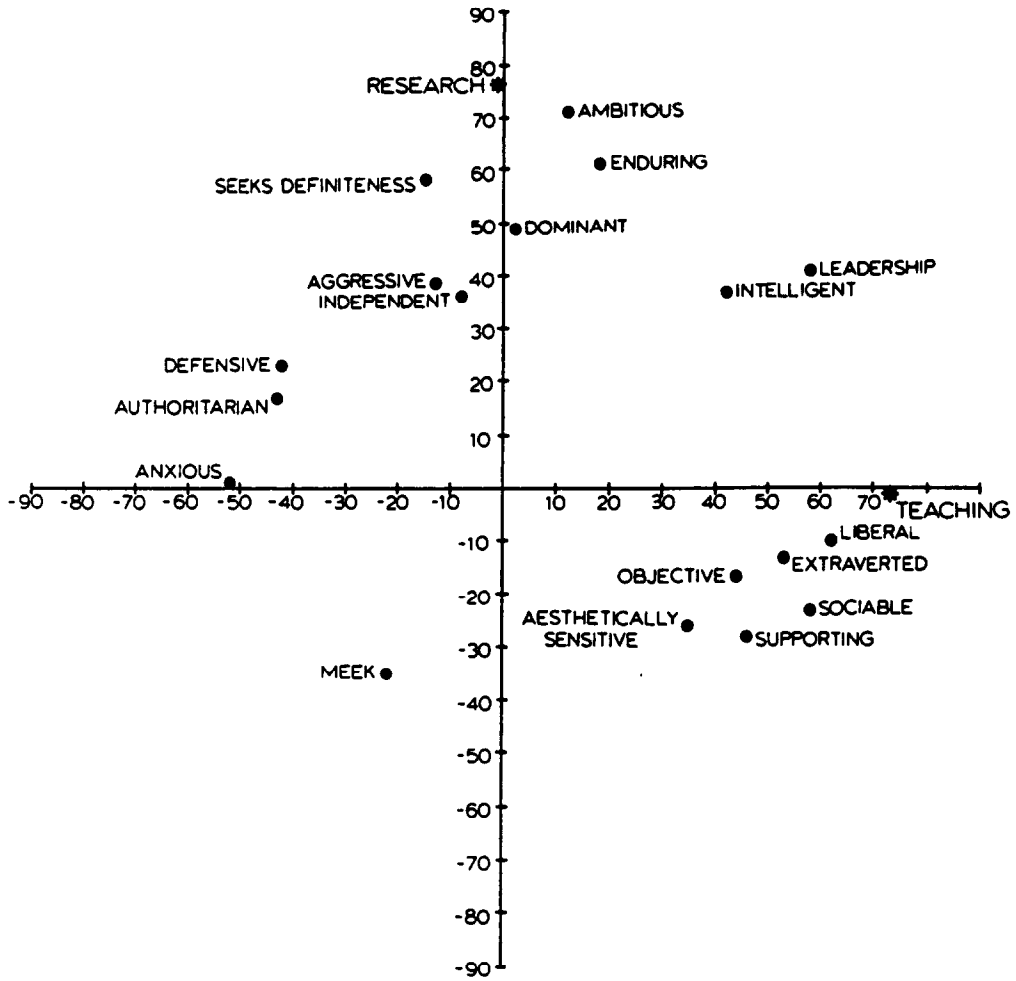

Fig. 1. Plot of mean factor pattern coefficients of personality traits on dimensions of research productivity and teaching effectiveness, averaged across two studies. Only those traits with absolute values of <0.30 on either factor in both studies are shown. (After Rushton, Murray & Paunonen, 1983.)

were considerably higher than for the student ratings ($n = 43$), the faculty self-report questionnaires ($n = 32$), and the self-ratings ($n = 32$), the analyses in this report are limited to the faculty-peer ratings.

In the present study, several trait ratings were combined to produce a Psychoticism score. The list of trait terms and definitions shown in Table 1 were sent to Professor H. J. Eysenck who obligingly assigned each of them a weighting of from -3 through 0 to $+3$ depending on how much he judged that they conformed to the defined conception of psychoticism (Eysenck & Eysenck, 1975, 1976). These weightings are shown in Table 1. For each faculty member a P score was created, first by combining the peer-ratings for each trait using standard scores, than adding these traits using the weights shown.

Creativity assessment

Two aggregate measures of research effectiveness were themselves aggregated to form a composite assessment of 'creativity'. The first measure consisted of all publications the faculty member had produced for the years 1976, 1977, 1978, and 1979 combined, as listed in the *Source Index* of either the *Social Science Citation Index* (SSCI) or the *Science Citation Index* (SCI). Credit was assigned equally for senior and junior authorship. The second consisted of the total number of times the faculty member's work was cited over the 3 yr 1977, 1978, and 1979, as indexed in the SSCI or SCI for those years. First authored self-citations were excluded. The year-to-year stabilities for the research measures were 0.60 for publications and 0.98 for citations. These two

Table 1. Split-half reliabilities of peer and student ratings of personality computed across Professor targets for each of 29 personality traits (decimals omitted). Also shown is the weighting assigned to the trait for its loading on Psychoticism

Personality trait and trait definition	Raters: Faculty ($n = 52$)	Raters: Students ($n = 43$)	P Weighting
(1) Meek (mild mannered; subservient)	73	57	−3
(2) Ambitious (aspiring to accomplish difficult tasks; striving, competitive)	88	74	+1
(3) Sociable (friendly, outgoing, enjoys being with people)	74	63	−2
(4) Aggressive (argumentative, threatening; enjoys combat and argument)	84	62	+3
(5) Independent (avoids restraints; enjoys being unattached)	80	48	+2
(6) Changeable (flexible, restless; likes new and different experiences)	77	33	0
(7) Seeks definiteness (dislikes ambiguity or uncertainty in information; wants all questions answered completely	84	22 NS	+1
(8) Defensive (suspicious, guarded, touchy)	72	56	+3
(9) Dominant (attempts to control environment; forceful, decisive)	87	60	+2
(10) Enduring (willing to work long hours; perservering, steadfast, unrelenting)	90	52	0
(11) Attention seeking (enjoys being conspicuous, dramatic, colorful)	88	67	+1
(12) Harmavoiding (careful, cautious, pain-avoidant)	84	90	−2
(13) Impulsive (spontaneous, hasty, impetuous and uninhibited)	89	31	+3
(14) Supporting (gives sympathy and comfort; helpful, indulgent)	84	36	−3
(15) Orderly (neat and organized; dislikes clutter, confusion, lack of organization	77	56	−1
(16) Fun loving (playful, easygoing, light-hearted; does many things 'just for fun')	88	75	0
(17) Aesthetically sensitive (sensitive to sounds, sights, tastes, smells)	80	74	0
(18) Approval seeking (desires to be held in high esteem; obliging, agreeable)	76	42	−2
(19) Seeks help and advice (desires and needs support, protection, love, advice)	80	86	−2
(20) Intellectually curious (seeks understanding; reflective, intellectual)	78	65	0
(21) Anxious (tense, nervous, uneasy)	60	63	0
(22) Intelligent (bright, quick, clever)	89	50	0
(23) Liberal (progressive, seeks change, modern, adaptable)	81	29 NS	0
(24) Shows leadership (takes initiative and responsibility for getting things done)	86	54	0
(25) Objective (just, fair, free of bias)	78	48	0
(26) Compulsive (meticulous, perfectionistic, concerned with details)	69	50	0
(27) Authoritarian (rigid, inflexible, dogmatic, opinionated)	70	52	0
(28) Extraverted (has many friends; craves excitement; fond of practical jokes; is carefree, easygoing, optimistic)	90	71	0
(29) Neurotic (a worrier; overly emotional; anxious, moody, and often depressed)	61	71	0
Mean	79	56	

indices themselves intercorrelated $r = 0.28$ ($P < 0.05$), and were combined (using averaged standard scores) to form an even more reliable and general measure of research productivity.

RESULTS

As described, the trait ratings from Table 1 were aggregated into a Psychoticism score based on the assigned weightings and correlated with the Research Creativity measure as was the composite rating of Intelligence. For the 52 university professors in this study the Pearson product-moment between Psychoticism and Creativity was $r = 0.26$ ($P < 0.05$) and between Intelligence and Creativity, it was $r = 0.40$ ($P < 0.01$).

STUDY 2: A SURVEY OF NINE CANADIAN PSYCHOLOGY DEPARTMENTS

Method

Subjects

Participants were 69 (68 male, 1 female) respondents from a mail survey sent to 400 tenured faculty members listed in the catalogues of nine leading English-speaking psychology departments in Canadian universities. These universities were chosen because they maintain active graduate departments and their faculty had opportunity for both teaching and research.

Personality assessment

A 66-item anonymous survey was mailed along with a prepaid, preaddressed return envelope (Rushton *et al.*, 1983). Included were the 29 personality trait names and the trait definitions shown in Table 1, along with a column headed 'Percentile'. Respondents were instructed to rate themselves: 'relative to other Canadian university psychology professors'.

Each of the distributions of the 29 self-ratings was roughly normal, with a mean percentile rating across all the 29 traits of 55 and a standard deviation of 21. As might be expected, the more socially desirable traits were rated higher than the less socially desirable traits. Thus, the average respondent felt that he or she was at the eightieth percentile on intelligence and at the twenty-sixth percentile on authoritarianism!

Creativity assessment

Four items were selected from the questionnaire that seemed appropriate as measures of research effectiveness: (a) total number of publications, (b) mean number of publications in last 5 yr, (c) number of hours spent on research, and (d) rated enjoyment of research (Rushton *et al.*, 1983). Each of these four was significantly related to the others, with a mean correlation of $r = 0.36$ ($P < 0.01$). The four measures of research effectiveness were aggregated into a composite by averaging standard scores.

RESULTS

The self-ratings on the traits listed in Table 1 were aggregated into a Psychoticism score based on the assigned weightings and correlated with the Creativity measure, as was the self-rating of Intelligence. For the 69 university professors in this study, the Pearson product-moment between Psychoticism and Creativity was $r = 0.43$ ($P < 0.01$) and between Intelligence and Creativity, it was $r = 0.05$.

STUDY 3: UNDERGRADUATE STUDENTS

Method

Subjects

Two hundred and eleven undergraduates (112 female, 99 male) enrolled in an introductory psychology course at The University of Western Ontario with an average age of 20.3 yr participated for course credit. *S*s were anonymously tested in groups of 30–80 in two sessions, the first lasting 2 hr with *S*s completing tests of intelligence and of creativity, and the second lasting 3 hr with the *S*s completing the EPQ along with a life history questionnaire.

Assessments

Intelligence was measured using the *Multidimensional Aptitude Battery* (Jackson, 1984) an omnibus group-test with 10 subscales, taking an hour and a half to administer. Personality was measured using the EPQ. Creativity was appraised by some of the tests of divergent thinking provided in Wallach and Kogan (1965) as adapted by Woody and Claridge (1977) and modified here. Two sheets of paper headed 'Creativity Test' were provided to the *S*s upon his completion of the IQ test (i.e. after about 1 1/2 hr). Instructions were printed on the first sheet and also read aloud by the Experimenter: "We want you to tell us all the different uses you can think of for various concepts. Please make sure you are writing down *everything* you can think of in each of the four categories. You have 12 min to complete the test. Please write on the back of the sheet if you need to". The second, the 'Answer Sheet', was subdivided into four parts: "1, Name All The Round Things You Can Think Of"; "2, Name All The Things You Can Think Of That Will Make A Noise"; "3, Name All The Square Things You Can Think Of"; "4, Name All The Things You Can Think Of That Move On Wheels". For each question, *S*s were given 3 min to write down any ideas. Three minutes per item is longer than the 1 min given by Wallach and Kogan (1965) but shorter than the unlimited time given by Woody and Claridge (1977).

On each of the four creativity measures the *S* was assigned several scores: A 'uniqueness' score of 1, 5, or 10 depending on how many other *S*s had generated the same item, and a 'total' for each question. Scores were added across the subtests to produce composite numbers of unique 1, 5, 10 sec and totals.

RESULTS

The mean IQ was 120 with a standard deviation of 11, which is what has been found previously with university students (Jackson, 1984). Normative findings were also found for P ($M = 3.2$, $SD = 2.4$). Low but consistently positive correlations were found between Creativity and Intelligence and Creativity and Psychoticism. The highest correlates were with the 'total' number of ideas generated rather than with the 'unique' numbers. Total Creativity correlated $r = 0.17$ ($P < 0.05$) with the P scale and $r = 0.24$ ($P < 0.05$) with the IQ test.

DISCUSSION

Psychoticism, intelligence, and any other traits exerting effects on creative output presumably do so first through the cognitive system, and secondly through the social system. Simonton (1988) has advanced a 'chance-configuration' theory, grounded in Darwinian evolutionary principles, to explain the acceptance of novel ideas at both levels by building on Campbell's (1960) model of 'blind-variation and selective-retention'. At the cognitive level: (1) mental elements undergo chance permutations until a stable configuration emerges; (2) this is evaluated by an intrinsically motivated self-organizing system and integrated with higher-order configurations; and (3) this is translated into communicable form and conveyed to potential consumers. At the societal level, these products: (1) become variations to be selected and retained through interpersonal influence, including through 'schools' and 'traditions'; (2) these become sociocultural variations vying with rivals for dominance within societies; and (3) these compete on a global scale incorporating innovations.

With respect to initial generating mechanisms, most cognitive theories of creativity involve the organization of semantic networks through the forging of links among previously dissociated elements (Findlay & Lumsden, 1988). For example, Simonton (1988) characterizes mental organization along two dimensions: (1) the number of associations linking mental elements, and (2) the probability distribution of association strength. The 'analytical genius' has mental elements arranged in a rich associative network, but one structured in a hierarchial manner, with associative bonds *either* maximally potent *or* nonexistent such that the corresponding concepts are supremely clear and distinct. In contrast, the 'intuitive genius' has elements connected with weak, equi-probable associations among diverse concepts, thus permitting creative leaps by juxtapositions of chance permutations in an unpredictable 'stream of consciousness'. In Simonton's account, the arts and the sciences might diverge into the types of mental elements that are subject to the permutation mechanism with emotional associations and subjective experiences being more prominent in the aesthetic enterprise.

It is interesting to speculate on how personality traits may affect the cognitive and social systems. With intelligence, there may simply be a larger network of associations with more efficient connections between them; at the societal end, more effective communication. With P there may be a tendency to put 'odd' or 'unusual' associations together more frequently or to be less self-censorious in considering their worth; at the societal level, independent dominance might aid in transmitting unusual ideas to others. With introversion, there may be fewer externally aroused motives competing with the cognitive search process through various permutations; socially, rewards may have less capacity to deflect an internally organized purpose. With industriousness, more effort will go into pondering problems and then promulgating the solutions.

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