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Can Synaesthesia Be Cultivated?

Indications from Surveys of Meditators

Abstract*: Synaesthesia is considered a rare perceptual capacity, and one that is not capable of cultivation. However, meditators report the experience quite commonly, and in questionnaire surveys, respondents claimed to experience synaesthesia in 35% of meditation retreatants, in 63% of a group of regular meditators, and in 86% of advanced teachers. These rates were significantly higher than in nonmeditator controls, and displayed significant correlations with measures of amount of meditation experience. A review of ancient texts found reports suggestive of synaesthesia in advanced meditators from India and China. These findings suggest that synaesthesia may be cultivated by meditation, and that laboratory studies of meditators could be rewarding.*

Introduction

Synaesthesia is a condition in which an individual 'experiences sensations in one modality when a second modality is stimulated' (Ramachandran & Hubbard, 2001a, p. 4). For example, music might be experienced as not only sound, but also as colour, or more rarely as touch or taste. The most common form is coloured hearing, in which sounds are associated with a particular colour (Marks, 2001). Eminent synaesthetes probably included the novelist Vladimir Nabakov, composer Olivier Messiaen, painter Wassily Kandinsky, and physicist Richard Feynman (Cole, 1998; Kher, 2001). Until the 1970s it remained a rarely mentioned medical curiosity, but is now the subject of considerable interest across psychological and neuroscientific disciplines (Carpenter, 2001; Grosenbacher & Lovelace, 2001; Ramachandran & Hubbard, 2001a,b; Rich & Mattingley, 2002).

Solid data on incidence is meagre. Synaesthesia is usually thought to be a rare condition, with estimates ranging from one in 20 to 25,000, with recent studies tending to converge around one in 200 to 500 (Baron-Cohen *et al*.,1996;

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Cytowic, 1997; Hubbard and Ramachandran, 2003). However, in one study, 23% of a population of fine arts students claimed to experience it. Synaesthesia is more frequent in women, among relatives of synaesthetes, may show an X-linked inheritance, and is sometimes associated with other unusual psychological capacities such as eidetic imagery and hypermnesia (Dann, 1998; Luria, 1968).

Two factors may induce it temporarily. The first is psychedelics such as LSD and ayahuasca, where synaesthesia accompanies a general amplification of sensory experience (Cytowic, 1998; Grof, 2001; Klüver, 1960; Shanon, 2002; 2003; Walsh and Grob, 2004). The second is severe pathology, specifically episodes of schizophrenia, major depression, and temporal lobe epilepsy episodes (Cytowic, 2002; Harrison, 2001). Permanent synaesthesia may rarely be induced by neural damage (Harrison, 2001). The French World War II resistance leader and hero Jacques Lusseyran (1963) provides an exquisite account of his development of synaesthesia after a childhood accident left him totally blind.

A third suggested instance of induced synaesthesia is associative conditioning. For example, Ellson (1941a,b) produced what he termed 'hallucinations' by repeatedly pairing colours in close temporal association with specific tones, and associative conditioning has often been suggested as a causal mechanism accounting for synaesthesia. However, recent fMRI studies of coloured hearing synaesthetes found that words activated parts of the visual system, specifically areas V4 or V8 of the fusiform gyrus. By contrast, no such activation occurred in nonsynaesthetes after associative conditioning (Gray *et al.*, 2002; Nunn *et al.*, 2002), thereby calling the relationship between synaesthesia and associative conditioning into question.

There are clearly multiple causes and varieties of synaesthetic experiences. As described above, associated causes may range from physical to pharmacological and from psychological to neural. The condition may be transient or permanent, spontaneous or familial, and may be elicited by sensory stimuli or amodal symbolic thought (e.g. letters and numbers).

Likewise, there are multiple varieties of synaesthetic experiences. They may range across photisms (unstructured lights) and organized percepts (Jacobs *et al.*, 1981), unimodal and multimodal (Harrison, 2001), simple and complex (Klüver, 1966), positive and negative (Werner, 1961), personal and transpersonal (Hunt, 1995), basic and higher order (where certain forms of higher order symbolic cognition are interpreted as synaesthesias) (Hunt, 1995).

Not all these varieties will be detailed here. However, one obvious conclusion of these multiple causes and experiences is that the term 'synaesthesia' currently refers to a diverse family of phenomena. In short, 'synaesthesia is dizzyingly diverse' (Marks, 2002, p. 758). It is therefore important to remember that lifelong, coloured hearing synaesthesia, which is currently the focus of considerable laboratory research, and for some researchers is paradigmatic of 'real' synaesthesia, may be only one form of a more complex and varied phenomenon. Consequently, it is crucial to remain open to and investigate other forms as well.

The present study therefore begins investigation of a possible novel form of induced synaesthesia.

With the exception of temporary inductions by psychedelics, conditioning and psychopathology as described above, it is usually assumed that synaesthesia is innate in rare individuals, and cannot be cultivated to significant degrees or for long time periods in other individuals. However, ancient texts from both China and India describe apparent synaesthesia in advanced contemplatives (e.g., Wong, 1997). In addition, before having read about the phenomenon, the author noted the development of synaesthesia in himself while doing intensive introspection in meditation and psychotherapy, and subsequently reported it (Walsh, 1976; 1977; 1978). He later heard similar reports from other meditators, and therefore decided to conduct formal surveys of populations of meditators to determine the nature and extent of this phenomenon.

Subjects and Methods

Subjects

Three groups of Buddhist meditators and a comparison group of 39 medical students were surveyed. The first meditation group consisted of 60 participants at a Tibetan Buddhist retreat. The second comprised eight members of a Vipassana (insight) meditation group for medical students and recently graduated physicians. The third group consisted of seven meditation teachers from three schools (Theravadin, Tibetan and Zen) of Buddhist meditation. These teachers were long-term (24–31 years), advanced meditators, who had averaged some four years in full time retreats. Each had been certified by their teacher(s) as advanced practitioners, had been empowered to teach, and had significant followings. Most had national or international reputations, some had published widely, and four were also mental health professionals. In short, this was an extremely rare group of psychologically sophisticated, long-term, very advanced meditation practitioners and eminent teachers.

The comparison group comprised 39 first and second year medical students. Of these 39 subjects, seven (18%) happened to be meditators. This high figure probably reflects increased efforts at this and other universities to apprise medical students of the potential benefits of meditation for dealing with the significant stress of medical training. A fortunate benefit was that the 32 nonmeditators not only served as controls for the three experimental groups of meditators, but in addition could be compared with the seven meditators. A further benefit of this comparison group was that the subjects were presumably closely matched on multiple variables to the subjects in the second (vipassana) meditation group comprised of medical students and recent physician graduates.

Methods

Subjects were recruited from the groups described above. They were then given simple information about synaesthesia, invited to ask questions, and then requested to fill out a survey form.

Subjects were told that synaesthesia is a topic of interest to researchers, and that some people experience it while others do not. Synaesthesia was defined as 'cross modality perception', in which one kind of stimulus, such as sound, is also experienced as another kind of sensory stimulus, such as light or body sensations. An example was given of a synaesthete listening to music and also 'seeing' the sound. Subjects were then invited to ask questions.

The survey questionnaire requested information about the respondent's personal biography, type and amount of meditation practice, and experience of synaesthesia. Subjects were asked 'Have you ever or do you currently, experience synaesthesia (cross modality perception)? For example, do you sometimes "hear" a sensation, "feel" a sound, or "see" a taste?' Positive responders were then requested to give detailed descriptions and examples of their relevant experiences, were asked when these began, when they occurred, whether they were experienced as pleasant or unpleasant, helpful or unhelpful, and if there were any other notable qualities to their experiences.

In order to maximize comprehensibility and minimize bias, the description of synaesthesia presented to subjects was deliberately simple and undetailed, offered minimal specifics, and was limited to sensory stimuli. No mention was made of amodal stimuli, such as words or numbers, or of symbolic synaesthetic experiences, such as Gendlin's 'felt sense' (a somatic sensation associated with a psychological issue) (Hunt, 1995). Consequently, these classes of experience may have been underreported, although several respondents from the advanced teachers group did give striking examples.

The question concerning when synaesthetic experiences occur asked 'When do they occur, e.g. only when meditating, only when in retreat, at other times, any time?' This may have introduced a bias to associate or report synaesthesia in conjunction with meditation, but the question was considered essential for the study. Otherwise, in order to minimize bias, no mention was made of the idea that meditation might increase the incidence or intensity of synaesthesia, and subjects were urged to complete the survey form whether or not they felt they had relevant experiences.

Two raters were used who were both psychologists and had several years of meditation experience. Meditation experience was deemed important since the practice can induce a variety of unusual and powerful experiences (Kornfield, 1979; Walsh, 2000), and it seemed valuable for raters to be familiar with these. The raters evaluated responses for clarity and adequacy of descriptions of purported synaesthesia, whether the sense stimulus and modality (or modalities) of resultant experience were clearly noted, whether the experience was clearly cross modal, whether the experience was repetitive (only repetitive experiences were scored positive), and whether experiences were related to drugs or pathological states (such as fever). Responses were not automatically ruled out if subjects reported a *history* of psychedelic use, but to be counted as positive, responses had to provide recurrent examples that were definitely *not* associated with concurrent psychedelic use.

Examples of reports that were scored negative, in spite of respondents claiming that they experienced synaesthesia, included the following. 'I had a blue orgasm', 'when I look at the stars in the sky … I hear them like music', 'when meditating I've "seen" colours and shapes appear', 'listening to jazz trumpet and feeling that I was a seagull blasting up and down with the notes', 'I sense sounds … Also can sense energy in a room or physical space/location'.

Responses scored as positive included the following. 'The strongest and most persistent cross-modality experience I have is of seeing sound … Each instrument produces a visual vibrational pattern which may be for example tall and short or fat and wide. When many instruments are playing simultaneously, they stack up and form strata of interweaving patterns. The experience of seeing taste is more like seeing an object which is usually hollow and takes on the various shapes each flavor is.'

The two raters assessed responses independently. Inter-rater agreement was initially 86%. After discussion of forms on which their assessments differed, agreement rose to 92%.

Results

Incidence of synaesthesia

Of 60 participants at the Tibetan Buddhist retreat, 34 responded (a 57% response rate). Of these 34 respondents, 16 (47%) stated they had no experience of synaesthesia, whereas 18 (53%) claimed that they had. The reports of these claimants yielded the following breakdown.

Two of the 18 claimants reported synaesthesia only during psychedelic experiences. A further four claimants described experiences which the raters agreed did not meet criteria for true synaesthesia. This left 12 respondents (35%) who claimed to have synaesthesia not associated with psychedelics, and whose reports were judged positive. The incidence of positive reports was higher in women (42%) than men (31%), but the difference was not significant.

The medical students and physicians of the second group had an average of 12 years meditation experience and two weeks in retreat. The response rate was 100%. Six of the eight claimed synaesthesia and the judges agreed that five (63%) did experience synaesthesia. Three subjects reported that they particularly noticed synaesthesia during meditation.

	Medical Student Control Group		**Meditation Groups**		
	Non Meditators	Meditators	GP1 Tibetan Buddhist Retreatants	GP2 Physicians and Medical Students	GP3 Teachers
Synaesthestes	3	3	12	5	6
Non Synaesthetes	29	4	22	3	1

Table 1

Incidence of synaesthesia in all groups

The third group comprised seven teachers and the response rate was 100%. Six of the seven subjects claimed synaesthesia, and the raters both evaluated them as positive. The sole nonsynaesthete — a myopic (short sighted) Zen teacher — remarked with wonderful Zen humour that he could 'barely see sights and hear sounds, let alone see sounds and hear sights'. Four of the subjects reported multimodality synaesthesia. For these teachers, stimuli in any one of several sense modalities could be experienced in at least one other modality, and sometimes in multiple modalities.

Among the comparison group of 39 first and second year medical students, seven happened to practice meditation. Of these seven meditators, three (43%) reported synaesthesia. By contrast, of the 32 nonmeditators, only three (9%) reported synaesthesia.

Relationship of synaesthesia to amount of meditation

The incidence of reported synaesthesia among all meditators surveyed was significantly higher than among nonmeditators (chi-square = 8.48, DF = 1, P <0.005). Likewise, the incidence of synaesthesia in the medical student comparison group was also higher among meditators than nonmeditators (chi-square = 4.19, DF = 1, P<0.05).

There was also a relationship between reported synaesthesia and amount of meditation practice. Among the Tibetan Buddhist retreatants (group 1), the synaesthetes had almost twice as much meditation experience as non-synaesthetes. This difference was significant for years of practice (17 ± 14.1 and 8 ± 10.2 years, t = 1.88, P < 0.05 one tailed), but not for time in retreat (3.3 ± 4.2 and 1.7 ± 1.9 months, t = 1.26, P > 0.1), and was not due to age differences (average age for both groups was 45).

Among all meditators, synaesthetes tended to have done more meditation than nonsynaesthetes, as measured by both duration of practice and time in retreat. The point biserial correlation of synaesthesia with duration of practice was 0.387 (n = 48, p < 0.01), with time in retreat was .307 (n = 48, p < 0.05), and for the interaction variable obtained by multiplying duration and retreat times was .318 (n = 48, p < 0.05). Multivariate analysis using logistic regression to examine effects of duration of practice, retreat time, and group membership on synaesthesia was significant for duration of practice (p = 0.01). Clearly, amount of meditation practice is related to the probability of reporting synaesthesia.

For meditators, at least, synaesthesia is apparently a positive experience. Thirty eight percent of all meditator-synaesthetes reported their synaesthesia to be pleasant, 4% rated it as neutral, and only 2% rated it as unpleasant. Likewise, 22% rated it as helpful and there were no reports of it being unhelpful.

Discussion

Compared to previous surveys of synaesthesia suggesting an incidence of one in several hundred or several thousand, the incidence reported by the meditators in this study is striking (35%, 63%, and 86% for Buddhist practitioners, and 43%

for the medical student practitioners). This incidence is four to ten times higher than among the nonmeditator controls. The only study which reported a comparable incidence was a questionnaire survey of 358 fine art students, of whom 84 (23%) claimed synaesthesia (Domino, 1989), a claim consistent with the idea that synaesthesia is more common among artists, poets and novelists.

Interpretations of the high incidence of synaesthesia among meditators

Four interpretations of the high incidence seem possible.

(1) Survey method: The questionnaire survey method used here is probably significantly more sensitive than previous methods, such as newspaper advertisements (Baron-Cohen *et al.*, 1996). Of course, the small sample sizes and specific populations limit generalizability.

(2) Response bias: Response bias could have occurred if meditators desired or felt pressured to report synaesthesia. Against this are the methodological efforts, described above, made to minimize bias, and the wide variety of convincing descriptions that subjects gave of their experiences.

(3) Self-selection: Self-selection would suggest that people with synaesthesia, or at least the potential for it, are especially drawn to meditation. However, there is no a priori reason to suspect this, the magnitude of the incidence among meditators is probably far more than would be expected from this explanation alone, and the positive correlation between amount of meditation and synaesthesia argues against it. Therefore, while each of the above factors may play a role, several lines of evidence suggest that meditation-induced perceptual changes may be central.

(4) Perceptual transformation: The perceptual transformation hypothesis suggests that meditation induces either the process of synaesthesia, or a heightened awareness of it, or both. Supporting evidence includes:

- Meditation affects perception in multiple ways, including enhancing perceptual sensitivity.
- Several respondents spontaneously reported first noticing synaesthesia only after beginning meditation.
- Some reported that synaesthesia was most apparent during meditation sessions, and/or while on retreat.
- The presence of synaesthesia correlated with amount of prior meditation experience.

Possible mechanisms involved in meditation-associated synaesthesia

If the high incidence of synaesthesia is due to a meditation-induced perceptual change, then what is the nature of this change? Is it increased cross-modality activation? For example, Paulesu *et al*. (1995) used PET to detect activation of visual associative areas in coloured hearing synaesthetes, while Nunn *et al*.

(2002), using the more sensitive method of fMRI, found word activation of the colour-selective region of the visual system V4/V8.

On the other hand, could the apparent increase in synaesthesia among meditators simply reflect heightened sensitivity to, and recognition (perhaps through unmasking) of, preexisting cross-modality activation? Both are possible and only neurophysiological studies will provide definitive answers. However, several lines of evidence suggest that heightened perceptual sensitivity may be involved.

Refinement of awareness is one of the seven central goals and practices of the world's meditative traditions, and is now supported by considerable experimental evidence (Murphy & Donovan, 1997; Walsh, 1999). Subjectively, meditators report 'introspective sensitization', heightened sensitivity to both inner and outer stimuli (Goldstein, 1983; Walsh, 1977; West, 1987). Objectively, meditation effects on perception include unique Rorschach test responses, enhanced field independence and empathy, and increased perceptual sensitivity and processing speed as measured tachistoscopically (Brown & Engler, 1986; Brown *et al.*, 1984; Forte *et al.*, 1985; 1987; Shapiro & Walsh, 1984; Shapiro *et al.*, 1999). (For reviews see Alexander *et al.*, 1992; Andresen, 2000; Murphy & Donovan, 1997; Shapiro *et al.*, 2002; Shapiro & Walsh, 1984, 2003; Walsh, 2000; Walsh & Vaughan, 1993; West, 1987).

These data suggest that meditators can develop exceptional perceptual sensitivity, which may underlie their enhanced synaesthesia. This may lend partial support to the claim that synaesthetic processes are common to all of us. This idea has been suggested by, for example, the phenomenologist Merleau-Ponty (1962) and neurologist Cytowic (1998). There is also some indirect experimental support from studies demonstrating cross modal sensory interactions, for example, in the finding that a substance's colour affects its perceived odour intensity (Zellner and Kautz, 1990). For example, Cytowic (1998, p. 166) claims that '*Synaesthesia is actually a normal brain function in every one of us, but that it's workings reach conscious awareness in only a handful'* (italics in original). A more cautious conclusion might be that ' some forms of synaesthesia may reflect normal brain function in some of us, but its workings reach conscious awareness in only a handful'. Of course it is important to remember that there are multiple forms of synaesthesia, and it is by no means universally accepted that some, let alone all, of these reflect a simple enhancement of normal cross modal perception. Measurement of other perceptual capacities that might be modified by meditation and related to synaesthesia, such as absorption and openness to experience (Hunt, 1995), constitutes a large area of potential research.

Several intriguing implications follow. First, it appears, contrary to previous assumptions, that it may be possible to cultivate enduring synaesthesia. There have been possible hints of this capacity with associative conditioning, but the cross modal percepts induced were limited, weak and perhaps transient (Ellson, 1941a,b). Moreover, their relationship to accepted varieties of synaesthesia is questionable (Gray *et al.*, 2002). A second implication is that the present study offers indirect evidence against the idea that synaesthesia is necessarily

associated with psychopathology, since meditation can enhance psychological health and maturity (Alexander *et al*., 1991; Murphy & Donovan, 1997; Walsh, 2000).

A third concerns the basis of psychedelic synaesthesia. From his observations of a very high incidence of synaesthesia among ayahuasca users, Benny Shanon (2003) concludes that this calls into question the genetic explanation of synaesthesia advocated by, for example, Ramachandran and Hubbard (2001). Not necessarily!

Some forms of synaesthesia could be genetically based, while being widespread but usually subthreshold for most people. However, they could reach threshold levels in large numbers of people, through either increased perceptual sensitivity (with meditation) or increased activation (with psychedelics).

One reviewer of this study suggested that, rather than surveys, laboratory studies of tone-colour specificity and stability would have been preferable in order to establish whether the meditators *really* experienced synaesthesia. But this suggestion is based on several erroneous assumptions that seem to be increasingly common among synaesthesia researchers. It assumes that coloured hearing should now be paradigmatic for all forms of synaesthesia, that stimulus-response specificity and stability are common to all forms, and that stimulus-response specificity and stability should now be the criterion for determining the existence and validity of all forms of synaesthesia. Of course, it is possible that stimulus-response specificities may turn out to be invariant features of a wide variety of synaesthesias, but this is a possibility to be tested, not assumed.

There is a stage-specific appropriateness to specific research methods. Beginning with laboratory studies of meditators would have been premature in this population, because the first task is to establish whether meditators *themselves* claim to experience synaesthesia at higher than normal rates, whether raters agree, and if there is any correlation with amount of meditation. With preliminary survey evidence for these in hand, laboratory investigations, and comparisons with familial synaesthesia, are now appropriate and valuable next steps.

Ancient observations of possible synaesthesia in meditators

Although this paper may provide the first contemporary evidence, it seems that the idea that synaesthesia can be cultivated by meditation is far from new. Ancient texts claim that meditation can refine perceptual sensitivity, and a few texts specifically note synaesthesia and suggest that it can be developed to extraordinary degrees.

Of course, these claims need to be approached cautiously. The best known examples said to reflect synaesthesia are from the *haiku* poetry of the seventeenth century Japanese Zen poet, Basho. Odin (1986) cites as ‘an intensely synaesthetic experience’ the poem:

> As the bell tone fades,
> Blossom scents take up the ringing,
> Evening shade.

However, the problem is how to differentiate phenomenology from metaphor. In this case metaphor wins out because of the paucity of data, and because of the apparent temporal delay between stimulus and 'synaesthetic' percept (Harrison, 2001). Of course this does not make the poem irrelevant to synaesthetic studies because there is now considerable interest in the possibility that synaesthesia may underlie many metaphors (Ramachandran & Hubbard, 2003). This raises the interesting question of whether meditation training may affect capacity for, and use of, metaphors.

However, some less well-known examples may be more convincing. Apparently ancient meditators themselves, as well as Asian psychologists and philosophers, believed that meditative synaesthesia is more than metaphor. This is suggested by the fact that the phenomenon is specifically discussed and incorporated into Buddhist psychology and philosophy. For example, the Buddhist *Mahayana-sutra-alamkara*, whose verses are attributed to the fourth century sage Asanga, claims (ch. 9, verse 41) that for a Buddha (the ultimate master of meditation), 'In the transformation of the five senses highest mastery is acquired, in the operation of all (five senses) upon all (five) objects …' (Nyugen, 1990).

A commentary by the seventh century philosopher Sthiramati explicitly explains that 'all upon all' means that:

> for a Buddha, each of the five senses perceives all five kinds of sense object, i.e., the eye sense not only sees forms, but hears sounds, etc. And so for each of the other senses (Nyugen, 1990).

This seems to describe an example of what Ramachandran and Hubbard (2003) call 'five-fold synaesthesia' in which all five senses are linked. A famous contemporary example of five-fold synaesthesia was presented by Luria (1968) in the case of a remarkable synaesthetic with virtually unlimited memory capacities.

In China, an ancient Taoist contemplative claimed that upon his enlightenment:

> I heard with my eyes and saw with my ears. I used my nose as my mouth and my mouth as my nose (Wong, 1997, p. 48).

To what extent these ancient claims may represent accurate descriptions of very advanced meditation experiences, and to what extent they represent idealized extrapolations or metaphors is unknown. Deciding the issue experimentally will not be easy since Buddhas are in short supply. However, claims such as these make clear that multisensory synaesthesia has been recognized in, and regarded as cultivatable by, meditators in multiple cultures for thousands of years. Taken together with the reports described in this paper, they suggest that synaesthesia may indeed be cultivated in some people.

Conclusion

Several general conclusions follow from this study. First, contrary to previous assumptions, it seems that the experience of synaesthesia can be cultivated. This

raises the question of whether there are other groups who also develop the capacity. Possible populations include artists, psychedelic users, and the blind.

Meditators may offer a valuable subject pool for investigating psychological and neural correlates of synaesthesia and its development. They might also prove valuable for studies of related capacities such as use of metaphor.

The development of synaesthesia in meditators may stem, at least in part, from their heightened perceptual sensitivity to a previously subliminal process. If so, this supports the idea that synaesthetic processes are widespread in the population.

More generally, this study provides further evidence for the idea that meditators may constitute excellent 'super sensitive subjects' for phenomenological investigations of a wide variety of phenomena. They have already proved their value for investigating the subjective effects of antidepressant drugs (Bitner *et al*., 2003) and there are obviously many other possible applications.

This study provides experimental support for the ancient claim that meditation can induce synaesthesia. As such, it provides one more example of a general trend in meditation research. Specifically, it provides experimental evidence for a meditation-induced capacity that contemporary Western researchers had previously dismissed as impossible. Examples of other such 'impossible' meditation-induced capacities include voluntary control of the autonomic nervous system, dramatically heightened perceptual sensitivity, and the existence of lucidity during both dreaming and nondreaming sleep (Brown *et al*., 1984; Murphy & Donovan, 1997; Walsh & Vaughan, 1993). This suggests that it may be worthwhile to investigate classic claims that meditation can enhance a variety of other sensory, motor and psychological *siddhis* or capacities (Murphy, 1992).

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