Hemispheric Specialization and Creativity

Klaus D. Hoppe, M.D., Ph.D.*

In his remarkable book, The Man who Mistook His Wife for a Hat, Oliver Sacks asked for a new sort of neurology, "personalistic," or—as Luria, the founder of neuropsychology, calls it—"romantic science," especially for every description of a right-hemisphere syndrome, since here "the physical foundations of the persona, the self, are revealed." What could be more appropriate for our topic of creativity and the brain, "the enchanted loom" of Sherrington?

Even a critical observer of the dual brain and hemispheric specialization like Schweiger concedes that

... the possibility still remains that certain unconscious processes go on in the right hemisphere while the left hemisphere maintains a conscience domain under control. For example, in the artistic process, which involves a novel arrangement of familiar elements to form an affective message, the right hemisphere may provide the neural substrate for fresh perspectives or insight, simply because of its different mental modus operandi.

This modus operandi atque creandi, examined in split-brain people, normal control subjects, and a patient with deranged creativity, will be utilized for the working hypothesis of creativity as a transcortical symbollexia and as a hemispheric bisociation.

CLINICAL OBSERVATIONS AND EXPERIMENTAL STUDY

Stimulated by the original findings of Sperry and coworkers, chiefly of Bogen, the author interviewed 12 commissurotomy patients and found that their dreams lacked condensation, displacement, and symbolization; their fantasies were unimaginative, utilitarian, and tied to reality; and their symbolizations were concrete, discursive, and rigid. Hoppe and Bogen independently scored these 12 commissurotomy patients for six of the eight key items from Sifneos' Beth Israel Hospital Psychosomatic Questionnaire.

*Clinical Professor of Psychiatry, UCLA; Director of Research and Continuing Medical Education, The Hacker Clinic, Los Angeles, California

and of appropriate words to describe feelings. In order to evaluate these clinical observations, an experimental study was performed by TenHouten and associates. Twenty-six to thirty-one Eight cerebral commissurotomy patients were paired with eight normal control subjects matched for age, sex, ethnic and linguistic background, and handedness. The stimulus in the experiment was a film with the title "Memories: If Truncated in Mourning," which intended to symbolize loss and death. In the first scene a baby plays in its crib, surrounded by dolls and teddy bears and, over its head, by a large rotating white bird with black eyes. Then the crib is empty; the death of the baby is symbolized by a slowing of the piano music ("Somewhere Over the Rainbow") and of the rotation of the white bird over the empty crib. In the second scene, a boy is swinging in a park, kicks his ball away, and chases it into the street. A car approaches, the ball is seen rolling into the street, and then the street and playground are shown empty. The death of the boy is symbolized by the slowing of the piano music ("Raindrops Keep Falling on my Head") and by the slowing, empty swing, while the camera zooms toward the shadow under the swing.

There are no spoken words in the film. The meaning of the film is conveyed by music and by visual images alone; the major events in it are shown not directly but symbolically. If the significant meanings of the symbols are grasped by the subject, it is likely that the film will evoke feelings of loss, sadness, separation, and death.

The film was shown individually to each subject four times. After the first showing of the film, the subjects were asked about their general impression; after the second, to write four sentences about the film; after the third, to answer a series of questions about major symbols in the film; for example, the white bird or the shadow under the swing; and after the fourth showing, to express their feelings about the film.

In addition to the examination of spoken and written responses, EEG recordings were performed on each subject during the whole period of the experimental study by placing gold-cup electrodes over the left (F3) and right (F4) frontal, left (C3) and right (C4) central, left (P3) and right (P4) parietal, and left (T3) and right (T4) temporal scalp locations, using the 10-20 electrode placement system.

With regard to the method of item analysis, factor analysis, discriminant function analysis, Gottschalk-Gleser content analysis, and EEG-spectra analysis, see the original papers and the article entitled "Alexithymia and the Split Brain" in this issue.

RESULTS

Lexical-Level Items

We found that commissurotomy patients, in comparison with normal controls, used significantly fewer affect-laden words. Affect-laden words were defined as those nouns, adjectives, and adverbs in which there is an unambiguous manifest tone or feeling. Commissurotomy patients used a higher percentage of auxiliary verbs, which is indicative of a passive and indirect presentation of their selves. They also produced a significantly higher percentage of incomplete sentences, being especially prone to leave out the subject or an important part, and applied adjectives sparsely, revealing a speech that is dull, uninvolved, flat, and lacking in color and expressiveness.

Sentential-Level Items

Out of the six Beth Israel Hospital Psychosomatic Questionnaire items, used clinically before, two group differences were significant: Commissurotomy patients tended not to fantasize about, imagine, or interpret the symbols, and they also tended to describe the circumstances surrounding events, as opposed to describing their own feelings about these events.

Global-Level Items

Whereas the variables of quantity and quality of fantasy and quantity of symbolizations were in the direction predicted, that is, impoverishment in commissurotomy patients, the three items of quality, structure, and capacity of symbolization were in addition statistically significant: Commissurotomy patients symbolized in a discursive, logically articulate structure, using mainly a secondary process, as opposed to a presentation structure as an expression of a predominantly primary process. They also showed a concreteness of symbolization, emphasized low rather than creative capacity, lacked a summary of the whole gestalt, showed a relatively impoverished fantasy life, and tended not to be able to convey symbolic meanings.

In other words, the quality of their symbolization emphasized stereotyped denotation as opposed to being flexible and rich in symbols, images, ideas, and connotations.

Gottschalk-Gleser-Level Items

Seven anxiety scales were reduced by factor analysis to three factors, of which death-separation anxiety was statistically significant: Commissurotomy patients expressed less death-separation anxiety than did normal subjects. Together with two hostility factors, we found that commissurotomy patients showed a significantly higher level of a complex of shame- and total-anxiety in combination with hostility directed both inward and outward. In contrast, mutilation-separation anxiety and death-separation anxiety were most characteristic of the normal subjects when confronted with our film (which symbolically depicted the death of a baby and a boy).

EEG Analysis

Comparing alexithymia, manifested in seven commissurotomy patients and one control subject, with expressiveness in seven control subjects and one commissurotomy patient, we found the following results:

1. In alexithymic subjects, the right temporal area (T4) was less activated, suggesting an inadequate grasp of the significance of visual images and music of the film.
2. In alexithymic subjects, the two language areas of the left hemisphere (F3—Broca, and T3—Wernicke) were less activated, suggesting a possible lack of inner speech. In addition, the higher left parietal (P3) acti-
vation might be interpreted as an inhibition of conducting inner speech between the two language areas.

3. Alexithymic subjects showed a higher coherence between the right frontal (F4) and left parietal (P3) areas, suggesting a possible interhemispheric aspect of inhibition of expression. In contrast, expressive subjects had a higher coherence level between the right frontal (F4) and left temporal (T3) areas, which suggests a possible mechanism facilitating the transformation of the affective understanding in the right hemisphere into the verbal expression of the left hemisphere.

**DISCUSSION**

Joseph Bogen, closest coworker of the Nobel Laureate Roger Sperry, neurosurgeon of the "split-brain" patients, and coauthor of our experimental study, together with his wife, Glenda, emphasized a role for the corpus callosum in creativity. The functioning of the corpus callosum is "associated with the highest and most elaborate activities of the brain." If transcallosal interhemispheric exchange is blocked, the result is the lack of creativity. Bogen attributes a lack of creativity to various factors, including a transcallosal inhibition of the right hemisphere by the dominant left hemisphere. This may explain how failure to develop fresh insights in the outside world is closely related to lack of further insight into one's other self. The artist needs an openness towards "the other side of the brain."

Bogen and Bogen amplified their original ideas by postulating a two-phase process of creativity with regard to the cerebral hemispheres. In the first phase, there is a relative paucity of interhemispheric communication; both hemispheres can thus independently develop their own processes without too much interference. The second phase consists of a temporary establishment of a more free access and communication between the two hemispheres. At that particular time, imagery or configuration, generated in the right hemisphere, can be realized through the left hemisphere (see also their article in this issue about the same topic).

The results of our experimental study, described above, illuminate the difference in creativity. The surgical disconnection of transcallosal interhemispheric exchange and of any access or communication between the two hemispheres results in a lack of creativity in commissurotomy patients.

Their dull, uninvolved, and flat speech is lacking in color and expressiveness, indicated by their significantly lower use of affect-laden words and adjectives. It also showed a higher percentage of auxiliary verbs, which conveys a passive and indirect presentation of the self as well as a higher percentage of incomplete sentences in which often the subject was left out. Already this lexical alexithymia makes clear that alexithymia is the opposite of creativity.

The sentential-level items underscore this phenomenon: If you cannot fantasize about, imagine, or interpret symbols, so richly presented in the film, if you are only describing the circumstances surrounding events but not your own feelings about these events, then you lack creativity, as commissurotomy patients do.
have not been operated on but function in a similar way ("functional commissurotomy").

Creativity depends on the transformational intercallosal process of symbollexia (Fig. 1). The question remains: What facilitates that creative moment? What combines primary and secondary process to the "magic synthesis" of a "tertiary process"? By using Koestler's ingenious concept of bisociation, we could call creativity a hemispheric bisociation. Whereas the left hemisphere follows the fixed set of rules, this code governs the matrix of an overwhelming possibility of choices expressed by the right hemisphere. The "magic synthesis" of the two cerebral planes is a creative process of hemispheric bisociation. As Koestler put it, "By living on both planes at once, the creative artist or scientist is able to catch an occasional glimpse of eternity looking through the window of time."

Interestingly enough, our EEG analysis supports this hypothetical concept of hemispheric bisociation. Since the alexithymic person cannot fully grasp the significance of visual images and music of his right hemisphere, he is impeded in hemispheric bisociation and can only follow the fixed set of rules of his left hemisphere. The possible lack of inner speech between the two language centers of the left hemisphere increases its fixed rules further. In addition, the suggested interhemispheric inhibition of inner speech deprives him of the affective and symbolic understanding of his right hemispheric and thus from "looking through the window of time."

Hemispheric bisociation combines the view through the window of outside time (erlebte Zeit or clock time), registered in the left hemisphere, with the view through the window of inner time experience (gelebte Zeit or spatial time), experienced mainly in the right hemisphere. Hemispheric bisociation also makes use of homospatial and janusian thinking, which transcends space and time.

With regard to feelings, so much involved in creativity, it should be stressed that emotions, which are generated in the two closely linked limbic systems, are not simply lateralized to the right hemisphere. The cognitive representation of emotions (feelings and symbols) is also represented in both hemispheres. However, there exists experimental evidence suggesting that the right hemisphere plays a special role in perceptual judgment of a variety of affect-laden stimuli (see literature in ref. 26). Ley and Bryden have found that emotional stimuli are perceived more accurately when presented to the right hemisphere, which suggests that the right hemisphere has a special and prominent influence on the reception and expression of emotions.

Here, the affects of anxiety and hostility, scored for the Gottschalk-Gleser content analysis scales, have to be considered with regard to creativity.

The significantly higher level of the complex of shame- and total-anxiety in combination with hostility directed both inwardly and outwardly corresponds with superego functions on a childhood level in commissurotomy patients. Their strict, punitive conscience directs hostility toward themselves, sometimes also in angry outbursts toward authority figures outside, whereas a fearful avoidance of sex and a submissive clinging to an external idealized figure indicate shame- and total-anxiety. Thus, the person who is restricted to the fixed set of rules of his left hemisphere and of his early superego components cannot develop creativity, since he is deprived of symbollexia and the access to symbolization and imagery of his right hemisphere. He can daydream about hostile revenge and sexual involvement but is incapable of romantic or more elaborate and metaphorical fantasies.

In contrast, the expressive persons of our study verbalized mutilation-separation anxiety and death-separation anxiety due to their empathic identification and scopic understanding of the film. They were able to imagine the symbolically depicted death of the baby and the boy, to experience empathically pain, grief, and sorrow caused by it, and to express creatively by being open to hemispheric bisociation. If we follow Bogen's speculation that "Each hemisphere represents the other and the world in complementary mapping: the left mapping the self as a subset of the world, and the right mapping the world as a subset of the self," we appreciate the importance of our brain hemispheres for creativity. Open to the presentational matrix of self-asserting and self-transcending choices of the right hemisphere, combining it with the discursive power of the left hemisphere via symbollexia, we may experience our being in the world as an infinite act of creation.

CLINICAL EXAMPLE OF A DERANGED CREATIVITY

In our clinical practice, we might be confronted with expressive patients who are overwhelmed by hostility as well as mutilation-separation anxiety and death-separation anxiety. They show deranged hemispheric bisociation of their creativity as the following case vignette may illuminate:

Jennifer, a slender, delicate-looking woman with a pretty face and fragile body, dressed in black from top to bottom, started psychotherapy with me at the age of 45.

Whether her condition should be diagnosed as a hysterical psychosis, borderline or severe narcissistic personality disorder, or schizophrenia in remission appears not as important as to understand her style of functioning or malfunctioning and her inner life history. During her childhood, Jennifer created a private fantasy world with fragile creatures developed out of trees. These creatures had no words, but spoke in color and movements. Jennifer named herself after one of them that was playing the flute. In reality, she was intensively involved in ballet classes and art school.

Until 8 years ago, she painted only with her right hand. Since then, she is using her left hand or sometimes both hands. Jennifer stated, "I have complete freedom with my left hand, direct emotions are coming out, whereas my right hand is censoring me."

Her painting has been hampered by arthritic pains in both hands and a frequent headache, always at the frontal temporal side, which Jennifer described as "emotional pain." This headache occurred especially when Jennifer worked with her right hand.

The first picture was painted by Jennifer with her right hand as a young teenager after 1 year of art school (Fig. 2). The patient could very well remember her painful identification and sympathy with the old lady.
Figure 2. Picture painted by Jennifer with her right hand after 1 year of art school.

who sat as a model in the class of the academy. Several times she had to leave the room in order to cry. She was afraid that her picture would be rejected by her admired teacher; but the opposite happened, he took her face in his hands and said: "Jennifer, we haven't had one like you for a long time."

The second picture was painted recently with the left hand (Fig. 3). Questioned about it, Jennifer stated: "I cannot describe what I was thinking; feelings came out without control in a free flow. I'm sad that I had to see things like that, but they have to come out and bounce back to me. With my left hand, I am never painting happy things, but they are clear, to the point, of what people are. With my right hand, I can camouflage it."

In addition, Jennifer remembered the visit of her mother the day before she painted the picture. When she tried to bring her mother to an understanding of how their lives together had been painful and harmful to each other, the mother refused. Jennifer got in a fury and destroyed bookshelves and plates in the kitchen. After that, the mother left her daughter's home and Jennifer felt deeply depressed.

The third picture illuminates the conflict and struggle between the two hands represented by the two hemispheres (Fig. 4). Jennifer started an abstract painting with her right hand when her daughter was close to giving birth to her own child. Jennifer stated: "Suddenly my daughter grew out of it. I got in trouble; there was a struggle. I could not allow my right hand to get rid of my daughter. There was inside a wall, made me ill to my stomach, and I felt pain in both sides of my head when I used both hands. I had to paint the baby in my daughter's stomach with my left hand." After she finished the painting, she was called to the hospital where her daughter gave birth by cesarean section.

Jennifer's struggle between her two hands and two different worlds of artistic experience correlates with the different cognitive styles of the two hemispheres. Her left hemisphere seems to be overflooded by right hemi-
Based upon Koestler's above-mentioned concept of bisociation, we could call Jennifer’s creativity a deranged hemispheric bisociation. Whereas her right hand and left hemisphere follow the fixed set of rules, this code governs the matrix of an overwhelming possibility of choices expressed by the left hand and her right hemisphere. The creative collision of the two incompatible planes is Jennifer’s painful bisociation. She had to suffer for “living on both planes at once,” and “to catch an occasional glimpse of eternity looking through the window of time.” This glimpse terrified Jennifer. Her window of time did not combine the outside or clock time, verbalized in the left hemisphere, with the inner or spatial time experiences, mainly registered in the right hemisphere.

Thus, Jennifer’s left hemisphere had been overflooded by right hemispheric images and configurations, accentuated by powerful affects of free-floating hostility and mutilation-separation and death-anxiety. This overflow of affect-laden symbols and images, expressed in her recent pictures, also thwarts a transcallosal symbollexia, the ability to verbalize presentational symbols.

Therapeutically, in addition to psychotherapy and psychopharmacologic treatment, the deranged hemispheric bisociation and impeded symbollexia should be focused upon, stressing the verbalization of symbols and feelings in the left hemisphere on the basis of the creative ability of such a patient. In contrast, alexithymia patients need stimulation of their right hemispheric capacities, which thus increases transcallosal symbollexia and hemispheric bisociation.

SUMMARY

The results of an experimental study on commissurotomy (split-brain) patients and normal control subjects illuminate the difference in creativity. The surgical disconnection of transcallosal interhemispheric exchange and of any access or communication between the two hemispheres creates in commissurotomy patients an outstanding lack of creativity which could be demonstrated on a lexical, sentential, global, affective, and EEG-analysis level.

In contrast to split-brain or alexithymic people, expressive-creative persons verbalized their presentational symbolization and imagery of the right hemisphere which was transformed via corpus callosum to the left hemisphere, called symbollexia. Thus, creativity can be understood as the opposite of alexithymia.

The hypothetical concept of creativity as hemispheric bisociation was supported by EEG-findings, suggesting an inhibition and lack of inner speech between the two language centers in alexithymic people versus a higher interhemispheric coherence level in expressive-creative persons.

Further on, the difference of expressed feelings of anxiety and hostility suggests a restrictive set of rules and of early superego components in commissurotomy patients in contrast to expressive-creative people who empathically experience and verbalize their anxiety about death and are open to the experience of their being in the world as an act of creation.
Finally, the vignette of a creative patient whose left hemisphere was overflooded by affects and imagery, expressed in her pictures, illuminates the importance of a balanced transcallosal symbollexia and hemispheric bi-

REFERENCES


HEMISPHERIC SPECIALIZATION AND CREATIVITY


The Hacker Clinic
No. 414
6399 Wilshire Boulevard
Los Angeles, California 90048