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# Pre-literate people in New Guinea and Indonesia draw specifically distorted faces, as do 'Western' dyslexics, using a paleo visual-representational mode[1]

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*Summary.* Third World populations with a persisting high percentage of preliterates within individual groups draw specifically distorted patterns of the human face characteristic of 'neolithic art' to a degree negatively correlated with the accessibility of reading instruction. A subgroup of 'Western' dyslexic youths also draw these distorted face patterns, which, moreover, facilitate infants 'smiling response'. These findings suggest the persistence of a developmentally early visual representational mode which proceeds in a global way, disregarding differences in characterizing details, whether of face patterns or of lexical symbols.

The problem of pre-literacy is puzzling: Why and in what context has the universal human ability to use written language not yet been developed in certain populations? The goal is to identify an indicator sign that passes through 2 stages parallel to the 2 main phases of mankind's progression from pre-literacy to literacy. Such an indicator turns out to be a specific kind of pictorial representation of the human face with its subtly sculptured area around the bridge of the nose[2-4]. As discussed below, this area is neglected during the pre-literate period of 'neolithic art'[5] the world over up to 4000 years ago, but not thereafter, except for certain pre-literate enclaves[4]. There are practical implications for identifying an indicator of pre-literacy: Some instructors may over-optimistically believe that a population has attained an adequate degree of literacy while a high percentage may still harbor reading difficulties requiring remedial instruction. In such situations a seemingly neutral, not embarrassing test of drawing a human face can be used as a realistic predictive indicator of the level of reading readiness and competency.

I took clues for the research strategy to identify such an indicator sign from previous observations that led to specific experiments: During the period of 'neolithic art'[5] up to 4 millenia ago, a pre-literate period, the facial features are depicted as distorted in a specific manner. This observation led me to study experimental face drawings by dyslexic 'Western' youths[3]. In a subgroup of them (38%), I found low reading ability together with the same characteristic face distortions depicted in neolithic art[5]. Furthermore, I was puzzled by a certain experiment of nature: Along the 700 miles long Sepik River of New Guinea, the people of its readily accessible Lower and Middle regions have been taught to read and to write from the turn of the century (albeit in an unevenly distributed way), while such teaching began only in the 1960's in the Upper Sepik region. Correspondingly it is only in the latter area that the spontaneous sacred art[4] still depicts the human face pattern with the specific distortions that were characteristic of neolithic art[5].

In order further to delineate developmental factors of face representation, I experimented with infants during their unique, brief-lasting period of indiscriminate 'smiling' as an automatic response to seeing the human face[6,7]. In these experiments[2] there emerged a surprising developmental sequence in the infants' preferential 'smiling' to 2 sets of face configurations used as stimuli to elicit the 'smiling response': Up to 18 weeks of age they preferred the face configurations used in mankind's neolithic art. Beginning with 19 weeks of age, however, they preferred those face patterns depicted in post-neolithic art. Having thus identified an early stage of face representation as being preferred in early infancy and in early mankind, let us describe the early and the late stage:

1. During the early phase simple schematized patterns of the human face are preferred as seen in neolithic art[5]. These patterns specifically obliterate the interruption of the forehead-nose continuity by the bridge of the nose area. There are 2 subtypes of distortions in this first phase, both of which are characterized by the specific continuity of the forehead-nose-eyes-sector, obliterating any indication of the bridge of the nose area; in general terms, distorting the measurable ratio[8] between facial features (figure): a) The nose is at least as wide at its bridge between the eyes as it is at its tip (discounting the pictorial representation of flaring nostrils, if present). This subtype was previously labelled the roundish one ('NGr')[2-4]. b) The nose extends upward above the upper border of the eye level, labelled the longish form ('NGl')[2-4].

2. The later step of 'post-neolithic' face representations has been depicted in art ever since the passing of the neolithic art period four millenia ago, with rare exceptions characteristically persisting in pre-literate enclaves, such as in remote areas of New Guinea[4]. In general, art now represents the human face without the distortions that were characteristic of neolithic art[5]: The face is now depicted with an accurate overall ratio among its features. This specifically includes a disruption of the forehead-nose-eyes sector by indicating the bridge of the nose, such as through a narrowing and/or indentation, which makes the nose begin only at the eye level, if not below it.

The early phase can be conceptualized as being mediated by a developmentally early or 'paleo-visual-representational mode', and the later phase by a 'neo-visual-representational mode'. Such a view interprets the pairing of specific signs here under scrutiny as indicative of the persistence of a developmental lag in a progression from the earlier phase 1 to the later phase 2 for reasons as yet undetermined, probably comprising both inherent and environmental factors in most instances. A reactivation of the early mode can be viewed as occurring in the pathological condition of prosop-agnosia with lesions mostly in the right occipital area[9,10]. As the prosop-agnosic person experiences the face as 'flattened out, without any relief'[9], these distortions obliterate the sculptured individual details around the bridge of the nose area, so that the familiar face can no longer be recognized as an individual one, only as a face as such. This sign of distorted face representation is also paired with the sign of reading disturbances in about half of the cases of prosop-agnosia. It is not essential to add prosop-agnosia in further support of my argument and as a possible 4th member of the newly identified class that shows a pairing of the just cited 2 signs. To add this pathological condition with a known location of brain lesions could, however, be of heuristic value in helping to delineate a neuro-anatomical substratum implicated whenever these two signs are present.

*Hypotheses:* 1. Within 2 sets of contemporary cultural groups (adult and children) in remote enclaves of New Guinea and Indonesia there exists a positive correlation between 2 signs: a) the degree of difficulty of access to reading instruction, implying a comparably related percentage of pre-literacy in these populations as a group; and b)

the percentage of specific distortions in the pictorial representation of the human face pattern that had characterized the 'neolithic' period of art[5] up to 4 millenia ago.

2. It is further hypothesized that in this new context of preliteracy a replication of a previous study[3] will also show the pairing of the just cited 2 signs in the individuals of a significant subgroup of 'Western' dyslexic youths as against their eulexic controls.

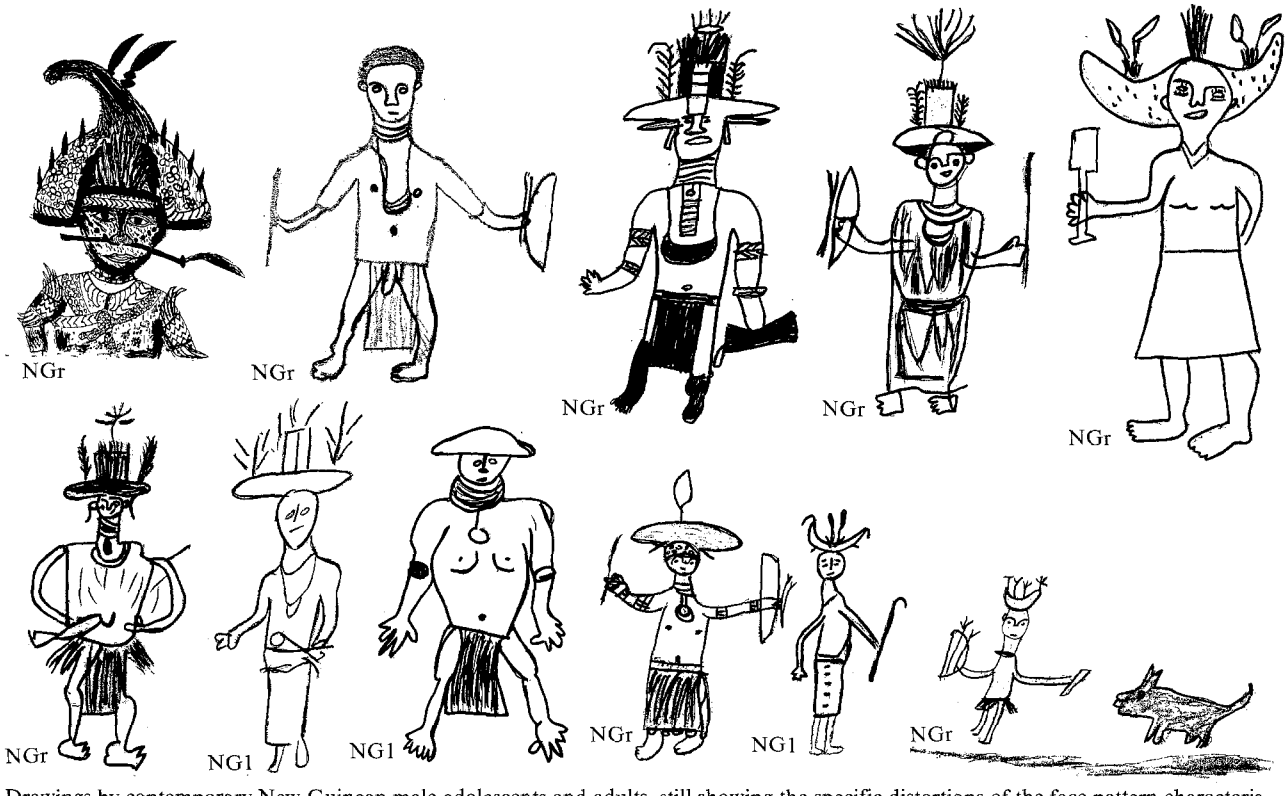
The hypotheses are not addressed to, nor do they imply, a cause-effect relationship between neurological and environmental factors.

*Method.* The populations consist of all persons (adult and children) of various cultural groups of A) New Guinea and B) Indonesia who were willing to draw a person during my 5 visits between 1971 and 1977; and C) of all youths (age 8–16) attending special classes for dyslexics (and being of at least average intelligence) in Heidelberg, Germany, who were available during one of my visits in 1977. 4 complete classes of eulexics of comparable age were also tested as controls. (This was a replication of a previous study[3] there with different subjects. None of these subjects had any school instruction in face drawing, only taught after the 6th grade).

The 'Draw-A-Person Test' was used (largely circumventing the language barrier), with the sole specification that the human face be drawn in frontal view (called DAPF here). By far the greatest part of the Indonesian population is of Islamic faith and has not been taught how to draw the human face. Among the New Guinea peoples, it cannot be known for sure whether those who had instruction in reading also had it in face drawing. However, as the table shows, the positive correlation between neolithic-like drawings and the paucity of reading instruction is even stronger for the New Guineans than for the Indonesians. Therefore instruction in face drawing, even if possibly present, is obviously not an essential factor in the statistically significant correlation found in both populations.

The Third World (TW) people were asked to do the DAPF test in their modern native languages (Baha Indonesia and Pidgin English, Tokboi version, in New Guinea). In some very remote areas of New Guinea, where this language was not understood, sign language was used by indicating with a crayon only a roundish shape in the air, without any details, and by pointing towards a face. If crayons were unknown to the people, one straight line was drawn with a crayon on a piece of paper to demonstrate its effect. Among both adult and child Ss the male sex was much more frequently represented than the female one. The visits took place mostly during these populations' school vacations, so that those children attending school (at times outside their village) were most likely to be home and thus included in the TW sample. In the remote Indonesian areas visited, reportedly 30–60% of the youths (mostly boys) are attending a 3- or 6-year primary school, depending largely on the geographical accessibility of the area and in part on the individual child's circumstances. By far most of the adults of the TW sample had never had any reading instructions, and the older they were, the less they had had such opportunity.

*Results.* These are summarized in the table and support the 2 hypotheses. A and B show a statistically significant ($p < 0.01$) positive rank order correlation after Spearman[12] ($r_s = 0.66$ for Papua/New Guinea; $r_s = 0.87$ for Indonesia) between the 2 variables: 1. the degree of difficulty in having access to reading instruction, the institution of




Drawings by contemporary New Guinean male adolescents and adults, still showing the specific distortions of the face pattern characteristic of 'neolithic art'[5] up to 4 millenia ago (and also still depicted by a subgroup of 'Western' dyslexics[3]). Note the simplifying continuity between forehead and nose, whereby the bridge of the nose area with its indentation and/or narrowing is obliterated in 2 subtypes: 'NGr', in which the nose is at least as wide at its bridge as it is at its tip (discounting flaring nostrils, if depicted); and 'NGl', in which the nose begins above the upper border of the eye level.

which is historically known, particularly to my Indonesian informant[1], and mainly determined by geographical factors, such as distance from teaching centers, and by informants' knowledge about the isolation of the groups from such centers (the validity of the various measurements gets support from nature's experiment with the settlements along the Sepik River mentioned above); 2. specific distortions of the human face pattern as used in neolithic art[5], described above, depicted in the figure, and detailed previously[3].

C: For the 'Western' dyslexic youths the previous findings[3] were replicated in essence. As regards those individual subjects who were compared with one another, again there appeared a statistically significant ($\chi^2 = 37.09$, $p < 0.001$) pairing between the 2 variables under scrutiny, as against their eulexic controls. 43% of the 69 dyslexic boys (including 5 left-handed ones), with a mean age of 10.7 years, drew face patterns characteristic of the neolithic art[5] period, and 26% of the 19 dyslexic girls (including 1 left-handed one), with a mean age of 9.4 years, did so. By contrast, only 7.7% of the 64 eulexic boys, with a mean age of 9.2 years drew face patterns used in neolithic art[5], and only 4.8% of the 63 eulexic girls, with a mean age of 9.0 years, did so.

*Discussion.* As previously shown[2-4], the present findings reveal again the significant ($p < 0.01$) pairing of variables in a new class that had remained unnoticed prior to my

| Settlement | Number of drawings (including normal faces) | 'neolithic' face drawings Types 'NGr' + 'NGl' | % of all 'neolithic' face drawings | Rank order of paucity of accessible reading instruction | Percentage of 'neolithic' face drawings |
|---|---|---|---|---|---|
| A) Papua/New Guinea | | | | | |
| Biaga (Upper Sepik) | 20 | 5+14 | 95% | 1 | 1 |
| Ambunti (Middle Sepik) | 5 | 2+1 | 60% | 8 | 9 |
| Korogo (Middle Sepik) | 22 | 4+11 | 68% | 9 | 4 |
| Kanganamam (Middle Sepik) | 29 | 10+10 | 69% | 11 | 3 |
| Angoram (Lower Sepik) | 6 | 1+2 | 49% | 13 | 11 |
| Yuru (West. Highlands) | 33 | 9+6 | 45% | 2 | 13 |
| Hawinda (Western Highlands) | 21 | 5+9 | 66% | 3 | 5 |
| Porgera (Western Highlands) | 55 | 22+17 | 71% | 4 | 2 |
| Yogos (Western Highlands) | 38 | 15+10 | 65% | 5 | 6 |
| Sapundis (Western Highlands) | 112 | 48+24 | 64% | 6 | 7 |
| Kompiam (Western Highlands) | 82 | 27+24 | 62% | 7 | 8 |
| Kopiago (Western Highlands) | 8 | 3+1 | 50% | 10 | 12 |
| Asaro (Eastern Highlands) | 12 | 4+3 | 58% | 12 | 10 |
| Minj (Eastern Highlands) | 25 | 4+7 | 44% | 14 | 14 |
| Masul and Pave (Eastern Highlands) | 35 | 2+9 | 31% | 15 | 15 |
| Watabang School (Eastern Highlands) | 28 | 1+6 | 25% | 16 | 16 |
| | $\sum N = 531$ | 162+154 | Weighted mean = 59.5% | Spearman's $\rho = 0.66$, | $p < 0.01$ |
| B) Indonesia | | | | | |
| Moluccas | 42 | 24+14 | 90% | 1 | 1 |
| Geser and Tomia Barat | 30 | 19+2 | 70% | 3 | 5 |
| Komodo | 45 | 14+15 | 64% | 4 | 7 |
| Banda and Flores | 38 | 14+5 | 50% | 9 | 9 |
| Toradja (Sulawesi) | 7 | 4+2 | 86% | 2 | 3 |
| Kotu (Sulawesi) | 25 | 12+5 | 68% | 8 | 6 |
| Bira (Sulawesi) | 41 | 11+6 | 41% | 11 | 12 |
| Bau-Bau (Sulawesi) | 58 | 8+10 | 31% | 12 | 13 |
| Ujung Pandang (Sulawesi) | 18 | 5+3 | 44% | 13 | 11 |
| Akima (Baliem Valley) | 15 | 10+3 | 87% | 6 | 2 |
| Jivika (Baliem Valley) | 34 | 25+1 | 76% | 7 | 4 |
| Biwar-Laut (Asmat) | 40 | 8+15 | 56% | 5 | 8 |
| Agats (Asmat) | 33 | 5+11 | 48% | 10 | 9 |
| Lake Sentani (W. Irian) | 13 | 0+0 | 0% | 14 | 14 |
| | $\sum N = 439$ | 159+92 | Weighted mean = 57.1% | Spearman's $\rho = 0.87$, | $p < 0.01$ |
| C) Heidelberg youths | | | | | |
| Dyslexics | 88 | 13+22 | 40% | $\chi^2 = 37.09$, | $p < 0.001$ |
| Eulexics | 127 | 3+5 | 6% | | |

Two sets of statistical tests are used: 1. The $\chi^2$ test is used with respect to the number of C individual dyslexic Western youths and their eulexic controls. 2. The Spearman rank order correlation test is employed with the Third World populations of A New Guinea and of B Indonesia, who are all ranked as groups, comprising adults and children. Both these populations of A and B show about the same percentage of face drawings used in neolithic art[5] (weighted mean 59.5 and 57.1, respectively), thus supporting one another's findings, and for both the positive rank order correlation - $r_s = 0.66$ and $r_s = 0.87$, respectively - (between the paucity of accessible reading instruction and the percentage of neolithic face drawings) is significant at $p < 0.01$. Thus, these populations, from an ethnographically varied background, support one another's findings.

Inasmuch as reading instruction has become available to large segments of Third World populations only latterly, many of the older youngsters and adults have not had the benefit of such teaching. Indeed, I gained the overall impression that the older the persons, and the later in life a person had received reading instruction, the more 'neolithic' faces were drawn. As regards the distribution of the age variable among the subjects, it is a reasonable estimate that it is about the same for all the settlements visited (with the exeption of Watabang, as marked). There was a general pattern of age distribution: Boys (about 9–13 years of age) participated most actively, followed by adolescent and adult males, while girls and women were much less often represented, comprising less than 10% of the subjects.

research: a) specifically distorted configurations of the forehead-nose-eyes-sector of the human face, as seen in neolithic art[5]; and b) a low or absent ability to read and write. The nontriviality of this pairing can be seen in its existence in a variety of members of this new class, comprising substantial subgroups of the following situations: 1. artists of the neolithic art period[5]; 2. infants during an early phase of the automatic 'smiling response'[2] (who obviously cannot yet actively depict faces, but who react preferentially with automatic 'smiling' to the same distorted facial patterns depicted in neolithic art[4,5]; 3. dyslexic 'Western' youths[3]; and 4. possibly also circa 50% of persons suffering from prosop-agnosia[13–19], a pathological disturbance.

All these data are surprising and need a hypothesis that could explain them a fortiori and that thereby could then be considered to be true along the lines of reasoning used in pattern detection by Hanson[20]. Such retroductive speculation does not necessarily have to lead to a cause, but rather to the identification of a formal principle which patterns the observed data[20]. Thus, it is speculated that a common denominator for the just listed 4 situations consists of a specific archaic visual representational mode that still prevails over a developmentally later mode (within a cultural context). The archaic mode glosses over the actually existing proportions of the face pattern in a global manner[21]; the persistence of that mode also hampers the ability to read and to write.

*Practical implications.* a) The identification of a new class with members from various situations is a necessary prerequisite for an ultimate correlation between the behavioral signs specified here and the yet-to-be-determined neuroanatomical and -physiological substrata mediating them. b) In general, a refined conceptual basis for designing specific remedial intervention is provided wherever a new class has been delineated whose members share specific difficulties with abilities that evolve in steps parallel to one another. In the particular case at hand, such remedial intervention could focus on the inability to draw faces correctly, an ability that is emotionally more neutral to the student with reading difficulties than dealing directly with lexical symbols. Thus, teaching to read could initially focus on the pictorial (abstract) representation of subtle facial features, specifically of the bridge of the nose area. Later on, such training could branch out to include various subtle graphic signs[25] before finally dealing with lexical ones.

1 Thanks are gladly given to a former Sultan of Ternate, presently member of the Indonesian Parliament, for his invaluable advice and information; and as previously cited[3], to Director Schmitt of the Heidelberger Schulamt and to Prof. H. Gänshirt, Chairman, Department of Neurology, University of Heidelberg, Germany.

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21 Of special note here is a case cited by Luria[22] with unilateral optic agnosia due to a tumor in the right parieto-occipital area (a location which may provide some clue as to the system necessary for mediating a non-distorting representational mode here under discussion). The so far unexplained and even unnoticed signs of this patient's specifically distorted 'copying', show the pictorial representation of the human face pattern (depicting it as the longish subtype 'NGl' described above, as used in neolithic art[5]). This finding encourages an interpretation along the lines of a regressive reactivation of an 'inner' representation of the face pattern that facilitated the automatic 'smiling response' in early infancy[2,7,8] and that is possibly mediated by a 'special receptor field'[22] in the occipital lobes, so far known to exist in animals[23], where information is processed in a global way consistent with a paleo-visual representational mode. Within this context I speculate that there exists a dysfunction of the (right) occipital lobe, triggering a standstill at or a reactivation of an early level of functioning. Such a factor is necessary but not in all cases sufficient for the existence of certain subgroups of pre-literacy and of dyslexia in this discussion: I further speculate that an additional factor is associated with frontal lobe dysfunction. This is characterized by 'pathological inertia'[22] in visual perception. This inertia refers not only to a disturbance of the eyes' scanning movements, but also to a sensory aspect that is relevant: Previously perceived stereotypes that have become automatized are seemingly 'seen' again and again, distorting perception of actual objects. In the present context it can thus be speculated that the persistence of 'seeing' the once established stereotype of the simplified face pattern that elicits preferentially the infant's automatized 'smiling response' is facilitated not only in pathological cases (probably rare), but in youths where the degree of frontal lobe myelination is still normally low until after puberty. This young age group comprises all of the present 'Western' sample as well as most of the Third World sample. Because of its late myelination, the frontal lobe component is also influenced by experiential factors which probably also influence the occipital lobe component, such as the exposure to graphic signs[25]. A puzzling side observation that objects other than the human face are in general pictorially represented adequately by the population under study can also be explained by assuming an additional frontal lobe factor at work that compounds the effect of a dysfunction of the (right) occipital lobe in form of a persistent paleo-visual-representational mode. This only exists in reference to the only perceptual stereotype known in man: the human face, a stereotype which is necessary for the prompt release of the infant's automatized 'smiling response' in the service of survival.

As to the present findings of the dyslexic and the pre-literate subjects' specifically distorted drawings of the face, it is of note that one can rule out as a weighty factor a lack of graphic skills in general, and in particular, dysgraphia (with or without spatial alexia[24]). This is so inasmuch as body parts other than the human face (with the possible exception of the hand, yet to be explored), are usually represented in a non-distorted way, at least without revealing a consistent pattern of distortion, as does the face configuration.
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