

Aims of the International Graphonomics Society (IGS)

During the second international graphonomics conference in 1985, the decision was made to establish the International Graphonomics Society (IGS). The general aims of the IGS are the advancement of research in the field of graphonomics. These aims include an exchange of views and expertise, joint-project research, and the dissemination and application of knowledge wherever appropriate. Some means to achieve these goals are: the organization of conferences and workshops and the publication of their proceedings, the stimulation of communication and research contacts by any other means, the transmission of information through a regular bulletin (BIGS), an electronic list (Scrib-L) and the maintenance of a graphonomics research directory. The IGS has the status of a legal non-profit organization. It was established as a foundation ('stichting') under the law of the Netherlands on January 30th 1987.

BIGS: Bulletin of the IGS (ISSN 1560-3253) is published bi-annually, in April and in November, by the International Graphonomics Society, Department of Experimental Psychology, University of Nijmegen, P.O. Box 9104, 6500 HE Nijmegen, The Netherlands (+31.24.361.2632 /26 33). It contains information relevant to the Society including book reviews, research papers, and conference calls. Responsibility for the contents rests upon the authors and not upon the Society, or its members. Copyright and Reprint Permissions. Abstracting is permitted with credit to the source. For all other copying, reprint, or republication permission, write to the IGS Office (Secretarial Assistant: Mrs Marianne Stienen, email: m.stienen@nici.kun.nl). BIGS is distributed among IGS Members. Printed in Singapore.

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From the Editors



In BIGS 14,2, the 28th Bulletin of the International Graphonomics Society, we feature several abstracts that were originally presented in June 2000 at the International Workshop on Computational Handwriting Models held at the University of Nijmegen. This



workshop marked the retirement of Professor Arnold Thomassen, founder and Past President of the IGS. A six-page summary of Professor Thomassen's valedictory lecture, presented as the finale to the workshop, is also included in this issue. We wish Arnold all the best in his retirement, although we have no doubt he will remain active in his contributions to graphonomics and we shall continue to hear more from him at future conferences and in this bulletin.

Details of the next biennial IGS conference (to be held 6th-8th August 2001) are also included. As the deadline for submission of papers is rapidly approaching (15th March 2001) we hope you can set aside enough time after the holidays to prepare a paper.

We welcome four new members to the IGS and also invite existing members to update their membership details (see page 43) using the enclosed yellow flyer. We would also encourage existing members whose membership is due for renewal to complete the enclosed blue flyer.

At the end of this bulletin we list of a few recent publications and conferences and details of several future conferences which are of relevance to the IGS community.

To expand the content and interest of this bulletin in the future we would welcome contributions of any type that are relevant to IGS members. Being a wide-ranging inter-disciplinary group it is often very difficult to identify and address all the issues relevant to graphonomics. If you would like to see something included, or have anything to say, please let us know. There will be two issues of BIGS published in 2001, volume 15,1 in April 2001 and volume 15,2 in October 2001. The deadlines for submission of contributions to these two issues are 15th March 2001 and 15th October 2001 respectively. If you have anything to contribute to BIGS, please email or write to either of the editors at the addresses below. As a reminder, and something to browse through, past issues of BIGS are available electronically at http://www.socsci.kun.nl/psy/igs/BIGS_Volumes.html.

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Message from the IGS Secretary



Nijmegen, December 13, 2000

Dear IGS members,

At the time this BIGS issue was being completed the President of our Society, Rejean Plamondon, attended a conference in Brasil and was therefore unable to write his regular opening statement. Since the current editors of BIGS, Graham Leedham and Jose Contreras Vidal, did not want to delay the distribution of this Fall issue too much, I proposed to them to write an opening statement on behalf of Rejean Plamondon,

The reason that the current issue has arrived somewhat later than usual is that the printing and distribution of BIGS has recently been transferred from the IGS office in Nijmegen in The Netherlands to Singapore. The transfer ran into some unexpected, temporary logistic problems which, however, were quickly solved.

I would like to draw your attention to the recent and upcoming IGS-related activities that are described in this BIGS issue. The update on the preparations of our next meeting at the University of Nijmegen, 6-8 August 2001, deserves your special attention. Both the conference organising committee and the IGS Board are looking forward to meeting you in August next year. Since the membership of our society has increased up to about 130 members the conference promises to become a very active exchange.

Another news item that I am pleased to be able to bring to your attention, is the following. Professor Arnold Thomassen, the former President of the IGS, has kindly made available to our society his personal archive of graphonomic publications. The collection consists of more than 60 volumes and includes special issues of scientific journals, edited conference proceedings, PhD theses, and many other books and reports that cover all the major fields of interest represented in the IGS. A list of bibliographical details of the archive's contents will be drawn up in the near future. It will be made available to you via the IGS Website on the Internet. We are grateful to Arnold Thomassen for this generous gift to the IGS from which many IGS members will profit.

Finally, towards the end of this year you will probably all be very busy with many professional obligations and things that you would like to see completed before your Christmas Holidays starts. Nevertheless, I hope you will be able to find enough time to carefully read the updates on IGS-related matters printed in this BIGS issue.

Also on behalf of Rejean Plamondon, I send you Seasonal Greetings and, I wish you all a very Happy and Healthy New Year!

Ruud Meulenbroek
IGS Secretary – Treasurer

IWCHM 2000

International Workshop on Computational Handwriting Models

University of Nijmegen, The Netherlands, 28-30 June 2000

Introduction

The organizing committee of the International Workshop on Computational Handwriting Models 2000 is very pleased to welcome you to this workshop at the University of Nijmegen, 28-30 June 2000. In the preliminary communications the background and aims of the workshop were described as follows:

"In the 1960s a number of scientists, including Denier van der Gon, Thuring, Vredenburg and Koster, developed the first cybernetic models of handwriting. Since then, several neurocognitive and biophysical models of handwriting have been developed that have built upon and in turn extended the insights of these pioneers. The International Workshop on Computational Models of Handwriting will be aimed at discussing these advances. It will do so by bringing together researchers from a variety of disciplines who have recently taken up the challenge to apply their theories to the complex skill of handwriting."

It is the committee's view that recent advances in the area of computational handwriting models reflect important developments in the field of human motor control. The workshop's programme confirms this view and holds promises for interesting discussions. Your cooperation and the generous support by the Nijmegen Institute for Cognition and Information (NICI), the Faculty of Social Sciences and the Board of the University of Nijmegen (KUN), the Netherlands Organization for Scientific Research (NWO), and the International Graphonomics Society (IGS) have made it possible to organize IWCHM 2000.

IWCHM 2000 is also organized to honour **Professor Arnold Thomassen** who will officially retire as head of the Department of Experimental Psychology of the University of Nijmegen in 2000. Between 1985 and 1995 Professor Thomassen was President of the International Graphonomics Society (IGS) which is one of the ways in which he made significant contributions to our field. The workshop will be concluded by the official valedictory speech of Professor Thomassen.

On behalf of the IWCHM 2000 organizing committee,

Ruud Meulenbroek¹ - Workshop Organizer

Organizing committee:

Prof. dr. Gerard P. van Galen¹, Prof. dr. Stan C.A.M. Gielen¹, Prof. David A. Rosenbaum², Dr. Wouter Hulstijn¹, Dr. ir. Frans J. Maarse¹

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Programme

International Workshop on Computational Handwriting Models

- **Abstracts for the three indicated presentations are included in this copy of BIGS**

Wednesday 28 June - "Inverse Kinematics and Dynamics"

Official opening - G. Van Galen (The Netherlands)

*** Computational handwriting models: Issues and Trends - R. Meulenbroek (The Netherlands)**

Adaptive behavior and motor learning - P. Morasso (Italy)

Posture-based motion planning: Motor equivalence in handwriting - D. Rosenbaum (USA)

On the formation, segmentation and internal representation of arm and eye trajectories, T. Flash (Israel)

Flexibility and degrees of freedom in motor control - S. Gielen (The Netherlands)

Motor anticipation and perceptual anticipation - S. Kandel (France)

A computational handwriting model based on the minimization principle - Y. Wada (Japan)

Extension of the minimum torque-change model to account for approach constraints in planar aiming movements. - M. Klein-Breteler (The Netherlands)

Thursday 29 June - "Timing, Coordination and Muscle Activation"

Time as emergent feature of neurocognitive control of handwriting movements

G. Van Galen (The Netherlands)

An adaptive network model of cortico-cerebellar contributions to practice effects in serial movement timing - B. Rhodes (Australia)

The modeling of rapid human movement: Handwriting and beyond - R. Plamondon (Canada)

Dynamics and cognition in bimanual rhythmic coordination - P. Beek (The Netherlands)

Coding of bimanual movement within an egocentric reference frame: The constraining role of direction, amplitude, and force - S. Swinnen (Belgium)

Proximo-distal coordination in rapid finger movements - H. Heuer (Germany)

Developing fluent strokes in writing produced with the non-dominant hand - C. Wright (USA)

Some observations on handwriting signals based on a simple model - E. Dooijes (The Netherlands)

*** *The optimization of duration, fluency, and accuracy of drawing movements in different directions - H. Teulings (USA)***

Friday 30 June - "Motor Disorders and Neural Organization"

Writing from a neuropsychological perspective: The outline of a simple figure-copying test for planning deficits - W. Hulstijn (The Netherlands)

Rethinking neuropsychological writing impairment: Implication from a computational theory of cursive handwriting - K. Fukuzawa (Japan)

Cortical invariant representation in premotor and primary motor cortex during drawing - A. Schwartz (USA)

Practice-related changes in brain activity during maze tracing revealed by neuroimaging techniques - H. Van Mier (The Netherlands)

Forum discussion - Van Galen, Gielen, Rosenbaum, Hulstijn

*** *Valedictory speech by A. Thomassen (The Netherlands)***

Computational Handwriting Models: Issues and Trends *

Ruud Meulenbroek

Nijmegen Institute for Cognition and Information, University of Nijmegen, The Netherlands

An overview of computational handwriting models that have been developed since the 1960s demonstrates several interesting developments in the field of motor control. In the 60s and 70s central and peripheral information-processing models of handwriting were developed in relative isolation. Whereas the central-neurocognitive models emphasized hierarchical top-down information processes, the peripheral-biophysical models addressed heterarchical, bottom-up processes. Examples of these pioneering analyses of the control of handwriting movements are a neural model of variations in cerebral organization as a function of handedness and writing posture [1], the neurocognitive models of memory and motor processes involved in spoken and written language [2,3,4] and the cybernetic models of handwriting movements which, among other aspects, identified the minimum number of independent peripheral mechanisms that are responsible for the quasi-continuous pen-tip displacements that people generate during cursive handwriting production [5,6]. In the 80s and 90s the neurocognitive and biophysical models converged in various ways. Whereas neurocognitive accounts of handwriting yielded computational (neural network) models capable of automatically parsing and recognizing the peripheral stream of digitized pen-tip displacements (e.g., [7,9]), biophysical models gradually increased in complexity by describing control mechanisms at more central levels of the neuromotor system [9-17]. Researchers from many disciplines contributed to these developments. As a result a variety of important motor control issues are addressed by computational handwriting models. Examples of these issues are: motor equivalence, inverse kinematics, inverse dynamics, optimization principles, output variability control and perception-action relationships. In the presentation, the overview of computational handwriting models and the issues and trends in the study of human motor control that can be distinguished in this area, will be illustrated by discussing empirical evaluations of some claims that were made in various stages of model development.

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* Abstract prepared for opening lecture at IWCHM 2000, International Workshop on Computational Handwriting Models, University of Nijmegen, 28-30 June 2000.

The Optimization of Duration, Fluency, and Accuracy of Drawing Strokes in Different Directions

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According to the Optimized Submovement Model (Meyer et al., 1988), the motor system minimizes the total time of aiming movements by selecting an optimal division between a fast but inaccurate ballistic (primary) submovement and a slow but accurate corrective (secondary) submovement. The motor system may select different combinations of primary and secondary submovements. To explore submovement analysis we tested 16 adult participants, who produced single-stroke movements from a home position to one of 8 target positions using a non-inking pen on a digitizer. The home and the target positions on paper were clearly visible from underneath the opaque plastic sheet covering the digitizer. The home position in the middle of the digitizer was a solid circle with a diameter of 0.2 cm. The 8 target positions were open circles with a diameter of 0.2 cm at a distance of 2 cm and directions of 0 (rightward), 45, 90 (upward), 135, 180, 225, 270, and 315 degrees. After the participants received the direction stimulus they quietly placed the pen tip on the home position and produced a stroke towards the target circle as fast and accurate as possible. The participants received moderate practice until most of their primary submovements were accurate within 22.5 degrees and 0.4 cm. They performed sixteen trials of each movement direction in random order. Most interestingly, the shortest stroke durations of about 400 ms are achieved with a particular combination of primary submovement durations of about 200 ms, followed by a secondary submovement duration of about 200 ms. Both faster and slower primary submovements result in longer stroke durations. The movement system selects most frequently longer than optimal primary submovement durations of about 300 ms. The reason for the longer than optimal primary submovements may be control economy as for all primary submovement durations beyond 300 ms the secondary submovement remains constantly 150 ms and has a constant likelihood of about 70%. On the other hand, if the motor system selects primary movements that are faster than 300 ms, the duration of the secondary submovement increases dramatically, the likelihood of a secondary submovement increases from 70% to 100%, and the relative size of the secondary submovement increases from 20% to more than 50% of the target distance. As expected, different optimizations exist for movements in different directions. Movements of 45 and 225 degrees (wrist flexions and extensions) have reduced secondary submovement durations of 100 ms versus 200 ms for the other directions. Although not all assumptions of the submovement model could be confirmed, submovement analysis yields valuable information on optimal versus suboptimal motor control.

Meyer, D.E., Abrams, R.A., Kornblum, S., Wright, C.E., & Smith, J.E.K. (1988). Optimality in human motor performance: Ideal control of rapid aimed movements. *Psychological Review*, 95, 340-370.

Growth of Graphonomy: FestSchrift for Arnold Thomassen (*)

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A quarter century ago much of our knowledge in handwriting stemmed from Denier van der Gon & Thuring (1965), Denier van der Gon, Thuring & Strackee (1962), McDonald (1965), Kao, Smith & Knutson (1969), Vredenburg & Koster (1971), Wing (1978), Dooijes (1979), Soevik (1979), Viviani & Terzuolo (1980), Hollerbach (1981). These researchers started a new type of research where handwriting and drawing movements were recorded and analyzed in terms of x and y time signals. In 1976, Arnold Thomassen, and Willem Levelt, formulated (in cooperation with neurologist Dr F.J. Gabreels) an ambitious, interfaculty research project entitled "Motor preconditions for handwriting". The aim was to investigate developmental trends in handwriting and drawing movements in young children and to find parallels in older children suffering from neurological disorders. It was my privilege to conduct the first research in that project. However, it soon became evident that a concerted research effort would be needed to uncover the complex nature of handwriting and drawing movements. Arnold Thomassen played a significant role to make this domain of scientific research known as "Graphonomics" by at least three contributions:

- The organization of The International Workshop on the Motor Aspects of Handwriting, 12-18 July, 1982, in Nijmegen, The Netherlands, which soon would become a tradition of tri-annual, later bi-annual International Workshops.
- The appearance of Acta Psychologica, 54, "Handwriting", in 1983, containing a selection of papers presented at this "First" Workshop (Thomassen et al., 1983).
- The Foundation of the International Graphonomics Society (IGS) in 1985 during the Second International Workshop in Hong Kong.

The first handwriting experiments in Arnold Thomassen's laboratory were attempted using an in-house produced device described by the unfamiliar term X-Y Coordinate Input Tablet, currently known as digitizer, realized by Frans Maarse and Jos Wittebrood. Soon, a Vector General display and digitizer connected to a Digital PDP11/45 computer became available which allowed fast and accurate stimulus presentation and pen-movement recording. Even data collection in the field was possible using a Philips digital data magnetic tape recorder. However, other researchers may have had little options to replicate or reject those results because the technologies to record and analyze handwriting and drawing movements were not comparable with those in other laboratories. Several of those original technologies could still be state of the art today, in spite of the enormous advances of equipment and software during the last quarter century. The cost of computer equipment has become 100 times lower, memories 1000 times larger, and data

storage media 10,000 times larger. Remarkably sophisticated handwriting and drawing experiments were carried out and significant results were achieved and published. Equipment to conduct research in Graphonomics has now become widely available. Many laboratory results could lead to valuable applications in various professional settings. A continued growth of the field of graphonomics may be possible. The number of not yet researched questions may grow not only by increasing the refinements of analysis but also by making results better replicatable. To achieve this, some of the following thoughts could be helpful:

(1) In traditional movement research data collection and analysis are often not 'double-blind' because of the manual decisions by the experimenters during the process of collection and analysis. The manual interactions may influence the results or/and its replicability. A solution is to define automated data collection and analysis procedures that allow equal processing settings for all conditions and participants within an experiment.

(2) Differences between participant groups may sometimes be so large that group by condition interactions may be multi-interpretable. The replicability of the results can be improved when baseline conditions are included where the group differences should be non-significant.

(3) Results achieved in a laboratory may be difficult to replicate in other laboratories or in applications because of the highly specific experimenting methods used. Using standardized, documented, generally available data collection and analysis methods will improve replicatability.

(4) Averages and standard deviations may often obscure the nature of the underlying data and artifacts and unanticipated results may not be uncovered without inspecting the individual data points pooled in the averages. Quick, explorative evaluation can be achieved, for example, by scatter plots together with the averages or histograms, and exploiting colors, sizes, shapes of data points for various levels of conditions and groups.

(5) In most analyses, complete up and downstrokes are treated as movement units in handwriting patterns, while in some settings even multi-stroke letters may form units (Teulings et al., 1983). We have recently found exciting results when analyzing drawing movements at the sub-stroke level (e.g., Meyer, Abrams, Kornblum, Wright, & Smith, 1988).

In summary, with the increased affordability of hardware to record handwriting and drawing movements, the wide use of standardized analysis technologies and methods may be increasingly in demand and will allow researchers and professional users all over the world to easier replicate and exploit results achieved by others. The Graphonomy research field as originally described by Arnold Thomassen may thus provide many useful applications for several professional settings and far beyond the original imaginations of the elite group of researchers who helped Graphonomy to become an established science.

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(*) Originally presented on the 29th June 2000 during the Workshop on Computational Models of Handwriting and Drawing

Summary of the valedictory lecture by Arnold J.W.M. Thomassen.

**Main Auditorium (Aula Maior),
University of Nijmegen,
Friday June 30, 2000, at 15.45h.**



On the theme of writing: Movement in graphic space

The lecture takes a recent lefthanded piano performance on the campus by Chris Seed as a starting point. How is it possible that some people, using their unpractised 'other' hand, can perform complex tasks in mirror fashion without extended exercise? As an example of complex movements, the paper explores the representation and performance of handwriting patterns by looking at left-handed writing in the normal rightward direction as well as mirror writing to the left. Bilateral hemispheric activation and inhibition are tentatively proposed as a basis for the capacity, especially in lefthanders, to generate mirror patterns. These issues constitute the first part of the lecture. The second part looks for the determinants of our global writing orientation to the right. By including cultural-historical, cognitive-motor, and psycholinguistic aspects, it is rather distinct from the first part. Together, however, the two parts present a wide, multi disciplinary view of the factors involved in movement in graphic space.

Among these, neuro-cognitive and cognitive-motor determinants appear to be predominant (Note).

Part 1. Lefthanded writing and leftward mirror writing

Right and lefthanded writing have been compared by Wright (1990). He showed that spatial and kinematic features are systematically different between the hands, and he questioned whether, in the case of right and left limbs, the assumption of a single, generalised motor programme (cf. Bernstein, 1947) can be upheld. In their performance, subjects may be guided by a visuo-spatial target pattern as well as by a stored motor programme. To the extent that handwriting movements are based on such programmes, these central representations appear to be of a high-level, abstract nature.

The limbs of the righthanded subjects in the quoted experiments behave differently indeed, first because they have had little practice (Newell & Van Emmerik, 1989), and second because for the left and right hand the anatomical-geometrical relations are entirely different when the same spatial pattern is produced in graphic space.

By looking at mirror writing we may be concerned more with pure motor control because the visual product is reversed, and therefore probably less influential as a

target during the task, while the anatomical correspondence between the limbs is -- in principle -- maximal.

We look at mirror writing also because it may shed light on the representation and activity in the brain when performing complex movements, especially handwriting. It appears that very little is known here when it comes to such complex patterns.

Spontaneous lefthanded mirror writing is seen in many lefthanded writers who can wilfully produce it. In some clinical cases, due to left-hemisphere damage, writing with the left hand results in a tendency to produce mirror script. It also occurs in children using their preferred (right) hand, occasionally as a consequence of spatial constraints.

'Engram theory' attempts to explain mirror writing. The theory (Orton, 1928) holds that when a visuo-motor pattern is learned, a permanent engram is established in the corresponding hemisphere, enabling the later recognition and performance of the pattern. In motor tasks, the engram's locus will be in the dominant hemisphere. It is claimed that, simultaneously, a mirror engram is formed in the opposite hemisphere. When the dominant hemisphere is damaged and fails in its control, the other hemisphere takes over, and the mirror engram is run off, resulting in mirror writing by the non-dominant hand.

Although engram theory explains many observations in daily life, and clinical as well as experimental findings, several phenomena do not fit in the framework. A more fundamental objection is that the representation of workspace should be continuous across the sagittal midline, just like objects and movements across the midline have themselves a continuous orientation. The half-fields are served by different hemispheres, but if these were to represent objects and movements with opposed orientations, adaptive behaviour would be impossible.

Two alternative explanations of mirror performance are concerned with a single representation in the brain and with cross-lateral and ipsilateral activity patterns, respectively. The first one hinges on cross-talk between the hemispheres. Supposedly, the spill-over, especially from the dominant left to the non-dominant right hemisphere, leads to homologous activation, which -- given absent or insufficient inhibition -- may result in overt symmetrical movements (cf. Swinnen et al., 1996). It is noted, however, that homology is not the result of activation at the low level of muscles and joints (cf. Heuer, 1994).

The second alternative interpretation refers to ipsilateral control (cf. Summers et al., 1995). Here the commands from one (especially the left) hemisphere are transferred not only to cross-lateral body parts, but also to limbs at the same (left) side of the body. Thus, in particular in the left hemisphere, there may be a conflict between commands to the right arm and those to the left arm.

Commands issued by one hemisphere that normally go to the opposite arm, but that now arrive in the ipsilateral effector, will result in homologous activation and possibly

(if insufficiently inhibited) in overt mirrored movement. Left-hemisphere ipsilateral control may thus facilitate left-handed mirror writing.

The motor-control system is involved in selecting the 'best' movement to be made from a number of alternatives (e.g., Rosenbaum et al., 1995). In this case the required limb needs to be selected, so that the contralateral hemisphere is activated while the ipsilateral activity is inhibited. Possible circuits involving higher centres that include the supplementary motor areas for selection are indicated tentatively in the paper.

Due to a greater equivalence of the two hemispheres in lefthanders as compared to righthanders, it may be that in lefthanded persons inhibition is not always absolute, or that it can be switched off with relative ease, so that for them mirror performance with the other hand remains available as an option. Chris Seed's lefthanded piano virtuosity, acquired in a very short time after a career on normal keyboards, may be a demonstration of this.

It is proposed to test the cerebral 'circuitry' of bilateral activation and inhibition of complex movements -- of which very little is known to date -- in behavioural and brain-imaging studies. The lecture continues with Part 2, looking at the global, progressive movement direction in writing space from an even more wide-angled perspective.

Part 2. Righthanded writing and rightward script.

The Phoenicians, trading and colonising in the Mediterranean 3000 years ago, used a left-oriented orthography consisting of alphabetic letters. As a Semitic language, Phoenician attributed great significance to clusters of consonants. In writing, it ignored vowels completely: These had to be inferred from the semantic and linguistic contexts.

When they colonised Greece, the Phoenicians also imported their writing system. The Greeks adopted the Phoenician alphabet, but they changed the value of five letters whose consonant sounds they did not need for Greek.

They replaced these by five vowels which were essential in Greek as an Indo-European language. Thus, Greek orthography soon encompassed a complete alphabet with vowels as well as consonants.

Consequently, Greek texts could be read aloud letter-by-letter as it were, without the inference required for Phoenician. The implied sound-based strategy was also expressed by their 'scriptura continua' style of writing which lacked any marking of word boundaries. The intended stream of speech sounds in reading could unambiguously be derived from the continuous string of letters.

The Greeks also made another change. In due course, and after a period of mixed orientations, they reversed the direction of writing from leftward to rightward. The

transition is of interest because it may give us a clue as to why rightward writing was the end result.

In the 6th century BC the Greek 'scriptura continua' style involved alternating leftward and rightward lines of writing, which is known as 'boustrophedon'. The letter shapes varied accordingly, always facing in the direction of the word, i.e., leftward or rightward. It was found (Brekle, 1994) that in both letter shapes, the strokes and the build-up of the letters were, however, generally performed from left to right, i.e., independent of the direction of the current line of writing.

In the righthanded majority, this rightward stroke preference reflects a biomechanical and motor advantage for extension and abduction movements, which have been reported to be faster and more accurate (Brown et al., 1948; Meulenbroek et al., 1995; Van Sommers, 1984). A disadvantage of this variation in writing the same letter is, however, that it requires the availability of two motor programmes which, although both executed from left to right, are entirely different for the two orientations. The paper illustrates this for the letter E (see Figure 1). Having two motor programmes for a letter has been shown to constitute a cognitive load that delays the writing process (Van der Plaats, 1993).

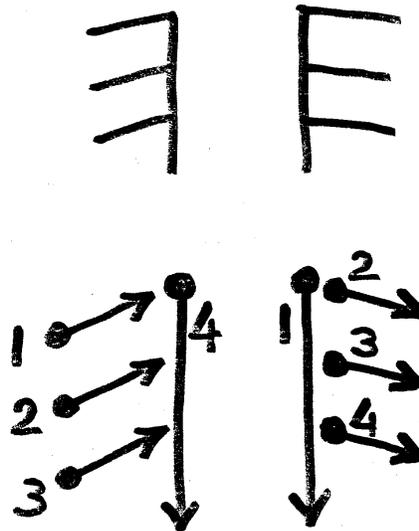


Figure 1. Different motor programmes of the Greek uppercase epsilon, for leftward and rightward global writing directions, respectively. Given the within- and between-stroke direction from left to right in both programmes, consistency between letter and word formation exists only during right-oriented writing.

When the socio-economical pressure to write fast increased in Athens during the fifth century BC, this may have led to the survival of a single motor program. The one that came to be selected was in line with a third factor of motor origin, namely the need for fluent writing with short trajectories, i.e., avoiding to-and-fro movements. This is

possible only when the global orientation of the writing line corresponds with the direction of stroke and letter production, i.e., rightward.

All this may have been the cause of consistent right-oriented writing in Greece from the 5th century BC onwards. Greek orthography was in turn adopted by the Romans, from whom we directly inherited our writing system. Thus the three motor factors (stroke-direction preference, motor-program parsimony, and direction consistency) could explain why we have come to write in a rightward direction.

An intriguing observation by De Kerckhove (1988) is that the visual and phonological features of the world's orthographies determine their global orientations in space in a highly systematic fashion. Since these are not directly related to the discussed motoric features, could there be other factors than motor control? A determinant may be the reading process. Do we read in the direction of our most economical writing, or do we write in the direction in which we read most easily?

Among reading strategies, we distinguish direct from indirect routes to the mental lexicon. The former depend on visual whole-word recognition, the latter on the sequential phonological build-up of the (virtual) sound of the word on the basis of grapheme-phoneme correspondence between the letters and the speech elements they represent.

Greek orthography, with its neat sequential mapping of letters onto speech sounds, and its lack of visual cues for word segmentation, is a good candidate for the indirect phonological route. In contrast, Phoenician writing with its clear word boundaries and its consonant letter clusters to be detected visually, while lacking a straightforward graphic representation of the word's phonology, seems to be best suited for the direct route.

The left hemisphere is specialised in sequential processing, particularly of language, while the right hemisphere is more capable of dealing with complex visuo-spatial configurations. It could therefore be that phonology-based orthographies (like classical Greek and Dutch) should preferably be processed by the left hemisphere, while Gestalt-like pattern-based orthographies (like Phoenician and Hebrew) should profit more from a preliminary analysis in the right hemisphere.

We know that, when reading text with a rightward orientation (English), the eyes acquire information further to the right during a fixation; when reading left-oriented text (Hebrew) there is a leftward bias (Pollatsek et al., 1981). This asymmetry about the point of fixation as a function of the global orientation of the writing system could reflect an optimisation in the above sense: The left hemisphere deals with phonology-based script (present in the right visual half-field since reading is rightward) immediately. In contrast, the right hemisphere first performs an analysis of the more complex visual letter-cluster configurations of less transparent script forms (present in the left visual half-field when reading leftward).

These optimal reading conditions might be seen as another determinant of our Greek ancestors writing their transparent orthography to the right. But we must

realise that reading in classic (and later) times was rather different from our current practice: It was reading aloud and slowly from noisy, handwritten texts, often containing standard formulations.

Consequently, the influence of the very first processing stages in one of the hemispheres may have been negligible. Therefore, the motor arguments, connected to the hardware and to recognised information-processing factors, seem to prevail.

The lecture is rounded up by referring back to its multidisciplinary format in which perceptual, motor, psycholinguistic, and neurocognitive elements have been considered. It is pointed out that neuronal units like hemispheres, functions like visual pattern detection, categories like lefthanders, and mechanisms like activation and inhibition must and can be refined considerably, hopefully in cleverly designed behavioural experiments in combination with brain-imaging techniques.

Finally, some words of acknowledgement are directed at colleagues and administrators in the university, and at relations and family members in the audience. The closing phrase "In dei nomine feliciter" is the adage of the University of Nijmegen.

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Note. The full Dutch text of the lecture is available from the author on a limited scale as a 47-page booklet containing six figures, 19 notes, and 63 references. It bears the title "Op het vlak van schrijven: Beweging in de grafische ruimte".



Update on IGS 2001
10th Biennial Conference of
The International Graphonomics Society
6-8 August 2001
University of Nijmegen, The Netherlands

First invitation

Last Spring - see BIGS Vol. 14, Issue 1 - we invited you to participate in IGS 2001, the 10th biennial conference of the International Graphonomics Society. The meeting will be held from *Monday 6 to Wednesday 8 August 2001* at the University of Nijmegen in The Netherlands. Here we repeat our invitation and we remind you of the important dates to be taken note of. We also give you an update on the current state of affairs regarding the preparations of the conference.

Reactions to first invitation

Many IGS members informed the Conference Secretariat (address see below) they will attend and contribute to IGS 2001. The survey we held among the IGS members has resulted in the distribution of 154 Publicity Flyers additional to the 130 Flyers that were sent out in the first mailing. We thank you all for helping the Organizing Committee of IGS 2001 in promoting the meeting.

Special Theme

The special theme of IGS 2001 will be *Motor Disorders*. It will cover a variety of issues ranging from diagnostics and treatment, central and peripheral disorders, to the neurological and neuropsychological basis of disorders. Also disorders like Parkinson's disease, Repetitive Strain Injury, and Development Coordination Disorder will be focused on. These important themes are of interest to many disciplines represented in the IGS and therefore deserve to be focused on at the next IGS meeting. Please note that besides the conference special theme all aspects of the science and technology of handwriting and graphic skills will be considered for presentation at IGS 2001.

Activities of organizing committee

The Organizing Committee of IGS 2001 - myself and Gerard Van Galen, Wouter Hulstijn, Bert Steenbergen, Bouwien Smits-Engelsman, Marina Schoemaker,

Hanneke Van Mier, Chris Bouwhuisen, Frans Maarse and Angelo Marcelli - are trying to obtain funding to create the facilities to invite two or three inspiring keynote speakers who are leading scientists in the area of 'Motor Disorders'. We hope to be able to inform you about the keynote speakers at IGS 2001 in BIGS 15,1. Further, the Organizing Committee is exploring possible outlets of a selection of high-quality conference presentations in the form of one or more special issues of international scientific journals representing areas that will be represented at IGS 2001. Updates on the status of these negotiations will be given shortly before or during the conference.

Important Dates

The important dates of the conference are:

Paper submission	15 March, 2001
Notification of acceptance *	31 May, 2001
Camera-ready papers and registration	1 July, 2001
Conference	6-8 August, 2001

Scope of Submission

Papers of maximum 6 pages are invited on all aspects of the science and technology of handwriting and graphic skills including, but not necessarily limited to, the following topics: Motor Disorders, Motor Control, Computer Science, Forensic Science, Education, and Palaeography (for further details, see the Conference Website).

Conference Website

Regularly updates of information about IGS 2001 can be found at the conference Website: www.socsci.kun.nl/psy/igs/igs_2001. Between February 28 and October 3, 2000 the Website was visited 265 times by people from all over the world. The site contains all information relevant to IGS 2001 such as the Call For Papers, Authors' Guide (including a preformatted paper), Registration Form, and Hotel Reservation Form. If you prefer to receive hard copies of these forms, please contact Marianne Stienen at the Conference Secretariat (address below).

Venue

IGS 2001 will be held at the Auditorium of the University of Nijmegen, Comeniuslaan 2, Nijmegen, The Netherlands. The Auditorium has proven to be a very pleasant and well-staffed facility (see information in this BIGS issue about the 'International Workshop on Computational Handwriting Models' which was held in the Auditorium on 28-30 June 2000). The address of the Auditorium is given below.

Secretariat and Agency

PAPER SUBMISSIONS	REGISTRATION & HOTEL RESERVATION
IGS 2001 Secretariat	Conference Agency (and Auditorium)
Marianne Stienen	Mary Bluysen and Marie-Jose Verbeek
NICI - University of Nijmegen P.O. Box 9104 6500 HE Nijmegen The Netherlands Tel: +31.24.361.2633 Fax: +31.24.361.6066 E-mail: IGS2001@nici.kun.nl	Conference Agency - University of Nijmegen P.O. Box 9111 6500 HN Nijmegen The Netherlands Tel: +31.24.361.2184 Fax: +31.24.356.7956 E-mail: M.Bluysen@bureau.kun.nl

Related conference

The organizing committee of IGS 2001 is pleased to inform you about, and recommend 'The 5th International Congress of the GFS' ('Gesellschaft für Forensische Schriftuntersuchung') from June 13-16, 2001, at Bingen on Rhine in Germany. The scientific program includes lectures, discussions and workshops on various topics of forensic document examination. For more information, please contact Dr. Peter Baier (E-mail: PEBaier@aol.com).

Your contribution to IGS 2001

We are looking forward to receiving your submission to IGS 2001, whether it will be an (4 to 6-page) abstract of a planned oral presentation, a summary of a poster you would like to present at the conference, a description of a special symposium on a specific topic of interest you would like to organize, or an interesting demonstration you wish to set up in the conference building during the meeting.

Ruud Meulenbroek, Chair IGS 2001
NICI, University Nijmegen

E-mail: IGS2001@nici.kun.nl

IGS MEMBERSHIP

New IGS Members

Dr. Hanneke **van Mier**, Dep. of Psychology, Neurocognition, University Maastricht, Postbus 616, 6200 MD Maastricht, The Netherlands, Tel. 043-3884010; fax. 043-3884125, E-mail: h.vanmier@psychology.unimaas.nl (Fields: ed ep np).

Ms. Emily J. **Will**, M.A., Education, Counseling, Syracuse University, P.O. Box 58552, Raleigh, NC 27658, USA, Tel. 919-556-7414; fax. 99-556-7414, E-mail: ewill@qdewill.com (Fields: ec fs).

Mrs. H. **Fournier**, 7095, Place Giraud, Anjou, Quebec, Canada H1J 2H2, Tel. (514) 354-2077; fax. (514) 354-1348, E-mail: docexam@videitron.ca (Fields: fs).

Mrs. Kay **Micklitz**, 4120 Running Springs, San Antonio, Texas 78261, USA, Tel. 830-980-4083; fax. 830-980-4076, E-mail: kay@micklitz.com (Fields: fs).

New IGS Membership Directory

Every other year the IGS office sends you an update of the Membership Directory of the Society. The Directory contains the names, work addresses, e-mail addresses, telephone numbers, fax numbers, and the fields of interest of all registered members. The new IGS Membership Directory is currently in preparation and will be sent to you together with BIGS 15, 1 in April 2001. In order to provide you with accurate information we would appreciate if you would inform the IGS office about any changes in your personal data. We kindly ask you to verify your entry in the 'Membership Directory and Constitution of the Society' of April 1999. If any change needs to be made to your entry, please fill out the Personal Data form enclosed in this BIGS mailing and send it to:

Mrs. Marianne Stienen - IGS Office NICI, University of Nijmegen P.O. Box 9104 Nijmegen The Netherlands

The IGS Personal Data Form can also be downloaded from the IGS Membership entry of the IGS homepage on the Internet at: <http://www.socsci.kun.nl/psy/igs/>

IGS Membership Dues

The IGS office kindly reminds IGS members who have not already done so, to effectuate their membership dues for the current year 2000 by following the instructions specified on the colourful payment slip enclosed in this BIGS mailing. All members are also reminded to effectuate the payment of their membership dues for next year, 2001. For this purpose, the colourful payment slip enclosed in this BIGS mailing can also be used. Please note that any reductions which the IGS may obtain with respect to, for example, publications following IGS conferences, will only apply to paying members.

Credit Card Payments

Recently, the IGS office has reduced the number of payment facilities it offers to IGS members to effectuate their membership dues. The facilities now consist of transferring your dues directly to one of the bank accounts of the IGS (see instructions on the enclosed colourful payment slip) or by filling out, and sending the IGS office, a credit card payment leaflet. Credit card payment leaflets will be effectuated twice a year, namely in the first week of January of each year and in the first week of June of each year. Consequently, when you pay your IGS membership dues by means of a credit card payment, please note that your credit card payment will be effectuated either in January or in June of the year in which you have paid your dues.

RECENT PUBLICATIONS

ABSTRACT of a paper from Naomi Weintraub, IGS member

Weintraub, N., & Graham, S. (2000). The contribution of gender, orthographic, finger function, and visual-motor processes to the prediction of handwriting status. *The Occupational Therapy Journal of Research*, 20 (2), 121-140.

The present study examined if orthographic, finger function, and visual-motor processes as well as gender made a unique and significant contribution to the prediction of handwriting status of fifth grade students classified as good or poor handwriters. Visual-motor integration and finger functioning made a unique and significant contribution to the prediction of handwriting status, whereas gender and orthographic processes did not. Furthermore, knowledge of children's gender, finger functioning, and visual-motor status resulted in the correct classification of 77% of the participating students as good or poor handwriters.

NEW BOOK

Sassoon, R (1999) *Handwriting of the Twentieth Century*, Routledge: New York
ISBN 0-415-17882-7 (pbk)

Rosemary Sassoon does a nice job of providing a historical record of the evolution, techniques and tools, and teaching of handwriting from Henry Gordon at the turn of the century, to the Montessori influence of the 1930's, to the Nelson handwriting scheme in the 1960's, leading to the author's account of handwriting and the computer at the end of the twentieth century. The book is comprised of twelve chapters and it is full of graphic samples of handwriting styles, and instruction methods. Overall, this book is well written and of great interest to those concerned with the history and teaching of handwriting.

FORTHCOMING PUBLICATIONS

Following the IGS99 conference in Singapore several papers were selected for authors to expand for review and possible publication in special issues of international journals. We can report that following this exercise, six papers have been accepted for publication in the *Journal of Forensic Document Examination* and eight papers have been accepted for publication in *Pattern Recognition Journal*. It is hoped that these will appear in print in the respective journals before IGS2001. We will bring you more detailed news of these publications in the next issue of BIGS in April 2001.

RECENT CONFERENCES

Symposium on 'Neural control of movement synergy',
held on 5th & 6th October 2000 in Ohlstadt near Munich, Germany.

The main focus was on the neural mechanisms that organize and Control multiple effector movements simultaneously, and suitable underlying Spatial representations. For more information on the symposium see the symposium web-site at:

http://www.mpipf-muenchen.mpg.de/~neggers/mov_syn.html

IWFHR VII

Seventh International Workshop on Frontiers in Handwriting Recognition,
held 11th- 13th September, 2000, Amsterdam, The Netherlands.

The workshop consisted of 80 papers: 45 presented orally and 25 presented as posters. The topics of the papers were grouped into On-line recognition, Preprocessing and feature computation, Multiple classifiers, agents and combination schemes, Off-line recognition, Hidden-Markov modelling, Usage of heterogeneous information sources, post-processing and lexicon-driven methods and miscellaneous data processing.

For more information contact: Dr Lambert Schomaker, schomaker@computer.org

DOCUMENT EXAMINERS IN A DIGITAL WORLD

Association of Forensic Document Examiners - Continuing Education Symposium
Was held from 26th – 29th October, 2000 Milwaukee, Wisconsin

For information see: <http://www.afde.org/conferences.html>

FORTHCOMING CONFERENCES

The 5th International Congress of the GFS ('Gesellschaft für Forensische Schriftuntersuchung')

This conference will be held from 13th – 16th June, 2001, at Bingen on Rhine in Germany. The scientific program includes lectures, discussions and workshops on various topics of forensic document examination. For more information, please contact Dr. Peter Baier (E-mail: PEBaier@aol.com).

IGS 2001

The 10th Biennial Conference of The International Graphonomics Society will be held on the 6th-8th August 2001 at the University of Nijmegen, The Netherlands (see *details in this copy of BIGS*)

Website: http://www.socsci.kun.nl/psy/igs/igs_2001

Submission of papers: 15th March 2001

ICDAR 2001

The 6th International Conference on Document Analysis and Recognition will be held 10th – 13th September, 2001 in Seattle, Washington, USA

Website: <http://isl.wtc.washington.edu/ICDAR01/index.html>

Submission of papers: 15th February, 2001

CIMA'2001

Computational Intelligence, Methods and Applications

Website: <http://www.icsc.ab.ca/cima2001.htm>

The second International ICSC Congress on COMPUTATIONAL INTELLIGENCE: METHODS & APPLICATIONS (CIMA 2001) will be held on 19th – 22nd June, 2001 in Bangor, Wales, UK. CIMA 2001 will include four symposia and the Granular Computing workshop:

- Fuzzy Logic and Applications FLA 2001 <http://www.icsc.ab.ca/171-info.htm>
- Advances in Intelligent Data Analysis (AIDA 2001) <http://www.icsc.ab.ca/172-info.htm>
- Advanced Computing in Bio Medicine (ACBM 2001) <http://www.icsc.ab.ca/173-info.htm>
- Advanced Computing in the Financial Market (ACFM 2001) <http://www.icsc.ab.ca/175-info.htm>
- Granular Computing Workshop (GcC 2001) <http://www.icsc.ab.ca/175-info.htm>

Submission of papers: 30th November, 2000

Delivery of Full Paper and Registration Deadline: February 15, 2001

IWFHR 8

The eighth International Workshop on Frontiers in Handwriting Recognition will be held from 6th – 8th August 2002 in Niagara-on-the-Lake, Ontario, Canada

Website: <http://www.cedar.buffalo.edu/IWFHR-8/>

Submission of papers: 15th October 2000

ICPR2002

The 16th International Conference on Pattern Recognition will be held from 11th – 15th August, 2002 in Quebec City , Quebec, Canada

The theme of the conference will be "Pattern Recognition for Mankind and the Environment" and the conference will be held in four tracks:

Track 1 Computer Vision and Robotics

Track 2 Pattern Recognition, Neural Networks, and Document Analysis

Track 3 Image and Signal Processing

Track 4 Biomedical and Multimedia Applications

Website: <http://icpr2002.gel.ulaval.ca/>

Submission of papers: December 2001.
