



Swan Research Institute

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The Swan Research Institute (SRI) Office in the Satyananda Yoga Academy at Mangrove Creek NSW was housed in the Research and Education building. With the floods on the 8/9th June 2007, there's now nowhere to sit the computer. It's completely water logged and damaged anyway and all our files and articles etc. are currently stored in a house near the ashram, above the water line – (not so sure about the regular bush fires though) so we wait patiently for an allocated spot when the ashram finally has space.



SRI Office underwater

We are currently gathering bibliographies from this work to add to our existing research database.

SRI has slowly developed and grown over the years, despite the few people available to help out. Some excellent networking meetings have been held, though.

Easter meetings at Mangrove Mt. have seen Swami Niranananda in attendance and people like

Professor Marc Cohen and Stephen Penman from RMIT University coming to share their wisdom and expertise in yoga research

It is now time to expand the network and so we invite interested parties to share their knowledge and commitment to yoga research.

Contact sri@swanresearch.net for more information, to volunteer and to register your interest.

To date most Yoga Research has been carried out in India and overseas with little being done here in Australia. It is important to have both anecdotal evidence as well as structured and well supervised research into yoga, SRI has therefore been instrumental in getting a research component into the Yogic Studies 2b unit which is part of the Satyananda Yoga Teaching Diploma. The research component from this diploma allows students to show greater interest in research within the Satyananda tradition. Assignments by the students are presented at the end of their module for assessment.

SRI JYOTI

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Welcome to the Inaugural SRI Journal

This is the first newsletter and journal from the Swan Research Institute, we hope you find it useful. Inside you will find information and articles about yoga research and information for those wishing to apply for scholarships, grants or the fellowship program.

It is intended both as a way of connecting with researchers and staying in touch with SRI Yoga

Research (newsletter) and a forum for publication and dissemination of research into yoga (journal). Please send us your ideas, articles or other information such as workshops etc for inclusion in our newsletters.

We are hoping the newsletter and journal will be on the website quarterly but need your support to keep the information flowing.

You will be notified of the first few issues by email with a link to the website. Please contact us if your email address has changed and feel free to pass this issue of JYOTI on to any other interested friends or colleagues.

If you have any feedback or wish to help out in any way please email us at sri@swanresearch.net

JYOTI Staff & Contributors

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Assistant Editor: Sn Yoga Prabha

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Sw Samnyasanand
Sn Yoga Prabha
Sw Omteertha
Sn Dharmadev
Sn Mantraganam

About the Directors of SRI

President
Paramahansa Swami
Niranjanananda



Swami Niranjanananda has been guiding the activities of Bihar School of Yoga, Sivananda Math and the Yoga Research Foundation in India since 1983. He founded the Sri Panchdashnam Paramahansa Alakh Bara to further the work of his Guru, Swami Satyananda Saraswati. In 1994 he founded the Bihar Yoga Bharati, an Institute for Advanced Studies in Yogic Sciences, the first yoga university in the world, of which he is the Vice Chancellor. To introduce underprivileged children of the world to yoga, he founded the Bal Yoga Mitra Mandal movement in 1995.

Author of many classic books on Yoga, Tantra and the Upanishads, Swami Niranjanananda at present divides his time between management of institutional activities, national and international tours and residence at the Indian Head Office in Munger.

Vice President
Swami Poornamurti
(Philip Connor)



Sw. Poornamurti is a scientist and engineer based in Sydney, who conducts research and development in a variety of fields including solar energy & yoga physiology. He has an Electrical Engineering degree, Sydney University, 1973, a Masters Degree in Electrical Engineering and Computer Science, University of New South Wales, 1982. He spent seven years at Macquarie University conducting research into speech and music using Fourier analysis and development of a fast digital signal processor. Poornamurti spent 10 years yoga full time & training with Satyananda Ashram.

He was Director Satyananda Ashram 1988-91, President Satyananda Yoga Academy 1996-2000. He worked for fifteen years with the Commonwealth Scientific and Industrial Research Organization (CSIRO) developing electro-optical instruments for the remote sensing and classification of minerals for the mining industry using spectroscopy.

Altogether he has been involved in research and experimentation in solar energy techniques for 25 years, including development of a low-cost solar thermal water pump and a variety of novel photovoltaic and thermal solar electricity - generation techniques. His recent work in solar energy has led to the development of the Liquid Solar Array economical electricity generator covered by Australian patent # 2004243336.

Research Advisor
Swami Samnyasanand
(Philip Stevens)



Sw. Sannyasananda holds Science degrees in Psychology and Physiology, with an Honours degree in Physiology completed at the Centre for Sleep Research at The Queen Elizabeth Hospital in South Australia.

He has explored the effects of certain yoga practices on the heart, brain and autonomic nervous system and runs classes, courses and seminars around Australia and overseas on various aspects of science and yoga. A Certified Yoga Teacher, a Life Member and Fellow of the "World Society For Clinical Yoga" (Lucknow, India) with over 30 years of experience in classes, personal tuition & counselling in Yoga, Meditation, Relaxation and Stress Management (M.B.T.I. Accredited) He is currently completing PhD research exploring the neurophysiological effects of various pranayama and meditation techniques as well as teaching yoga, meditation and relaxation techniques as part of the MBBS course for medical students at Monash Medical School and the Alfred Hospital in Melbourne and developing curriculum based yoga therapy courses for Monash university medical students.

Overseas Ambassador
Dr Rishi Vivekananda
(Brian Thomson)



Dr Rishi Vivekananda has been a physician for 46 years, and a consultant psychiatrist for 41 years. During most of that time, he has taken a keen interest in ways to integrate the ancient eastern techniques of yoga with the modern knowledge of the mind, the functioning of the body, and healing. He has also studied yoga in its role as a system of evolving the quality of the human personality.

Since his initiation by Paramahansa Satyananda in 1976, he spent most of his professional years as a consultant psychiatrist in private practice in Australia. Between 1977 and 1986 he traveled the world, especially India and the Americas teaching and learning about the synergy between yoga and science and has become renowned as a knowledgeable and informative speaker and workshop director, whose humour and ease of communication make his programs entertaining as well as enlightening.

He was initiated into Rishi Sannyasa by Paramahansa Niranjanananda in 1993. Since March 2002, has been on a world lecture tour, spending three months of the year in Australia, and the rest of the time teaching in India, Europe and the Americas. This is planned to continue.

Treasurer
Dr Sw Shankardevananda



Dr Swami Shankardev Saraswati is an eminent yoga Acharya (authority), medical doctor, yoga therapist and internationally acclaimed author of several books on medical aspects of yoga and yoga therapy.

As a direct disciple of Swami Satyananda Saraswati, he lived in the Bihar School of Yoga India for 10 years (1974-1985), where he was trained to teach the highest practices of yoga and tantra. During this time he wrote and edited many of the books on Yoga and Yoga Therapy now published by the Bihar School of Yoga.

The major dissemination of his latest work; his many articles and training CDs is through www.bigshakti.com which presents authentic knowledge of yoga, meditation, tantra and the healing arts.

Secretary
Sannyasi Dharmadeva
(John Thomas)



Sn. Dharmadeva is a Clinical Psychologist with degrees from Sydney University and the University of Western Australia. He worked in the state welfare departments in NSW and WA before moving into private practice in Albany, WA.

He was initiated into Karma Sannyasa by Swami Satyananda in 1983 and completed Yogic Studies in 2000. He moved to Satyananda Yoga Academy at Mangrove in 2002, where he lectures in Yoga Psychology and oversees the Academy's compliance with RTO registration requirements.

He conducted the first SRI research project in 2004. This was a study of the relationship of wellbeing to yogic lifestyle. Its findings were presented to the Australian Centre for Quality of Life Conference at Deakin University in 2005. He is currently completing a PhD (part-time) through RMIT University investigating the EEG signatures of the phenomenal states induced by various meditation practices.

(What about you?)

Want to be involved in research? We need to expand the research network and take it to another level and so we invite all interested parties to share their knowledge and commitment to yoga research. We also need people to help run the organisation. Contact sri@swanresearch.net



SRI Grants, Scholarships and Fellowships

In 2006 SRI received a substantial donation to set up a scholarship fund for research and another in 2007 allowing us to set up several research grants, scholarships and fellowships.

For more information see www.swanresearch.net

SRI Research Grant

The annual SRI research grant has been operating for 2 years now. The first recipient was Sn Jagannatha (Roger Bodman) and this year Omteertha (Ruth Burgess) was presented with a cheque for \$1008 to assist in a literature review for her study into pranayama. The grant is awarded each year to encourage research into the field of Yoga, to develop understanding of its practices and its implications for physical and mental health, healthy lifestyle, mental and spiritual development.

SRI Research Scholarship in Yoga Education

SRI is also offering a Research Scholarship in Yoga Education through the Satyananda Yoga Academy (SYA) at Mangrove Mountain, NSW. It can be either a part or full time scholarship. The scholarship is intended for those persons who may be unable to attend the academy due to remoteness of their local

community; financial difficulty; adversity or some physical or other disability. The scholarship is awarded each year to spread the teaching of yoga to all areas and all diverse backgrounds.

The Diploma already has a research component thanks to the input of SRI and the successful applicant will be required to further develop or assist in researching some aspect of yoga for physical and mental health or healthy lifestyle.

SRI Research Fellowship

We wish to announce a new annual SRI Research Fellowship program where suitably qualified people can conduct research or assist SRI to conduct research into Yoga, to help SRI develop better understanding of yoga practices and implications for physical and mental health, healthy lifestyle, mental and spiritual development.

The Fellowship will be applied directly towards research in an area that satisfies SRI's aims of exploring and better understanding the various practices and techniques in the science of yoga such as: asana, pranayama, meditation, kriyas, shat karmas, yogic lifestyle, yogic chanting, yogic and ayurvedic diet, mantras, yogic physiology, yogic psychology etc.

The Fellowship tenure is temporary and issued on an annual basis. On completion of their tenure, SRI Research Fellows will receive a certificate of Fellowship and will be encouraged to share their knowledge and skills with subsequent Fellows in later research programs by supporting and supervising various SRI research projects according to their interest and availability (if on a volunteer basis) or according to contractual arrangements if offered further Fellowship tenure.

As the SRI Fellowship program is not full-time, applicants may hold SRI Fellowships concurrently with any other award or scholarship as long as participation and completion are assured and time and activities are appropriately managed.

SRI is a registered "Non Profit" organization with "Charitable Gift Recipient" status from the Australian Tax Office. We accept tax deductible donations to the SRI "Research & Education" fund. Please contact us for more details if you are interested in supporting our aims by providing any gift, financial or other donation or bequest.

Donations over \$2 are fully tax deductible.

About Swan Research Institute (SRI) Membership

The aims & objects of the Association are:

1. To scientifically investigate systems, techniques, methods and processes which may have therapeutic benefits for, or may improve the quality of life for individuals, families and the community. These systems may include physiological, psychological and/or philosophical inquiries.
2. To acknowledge, liaise, cooperate with and support, where appropriate, other organizations with similar aims and objectives.
3. To acknowledge and cooperate, where appropriate, with suitably qualified practitioners of other healing techniques including allopathic and natural sciences, complementary therapies and counselling modalities.
4. To publish in reputable, peer-reviewed journals. To also make information available for members and the general public and hold conferences, seminars etc. for the purpose of education of the community at large.
5. To establish and maintain a research and resource centre and broad based library for the collecting and dissemination of relevant information and research data.

Currently SRI has two types of Membership "Full Members" and "Associate Members".

Full Membership is for those who subscribe to the aims and objectives of the association, have approved qualifications and/or experience in research skills. Committee Members manage SRI's day to day commitments and long term planning.

Associate Membership is available to people and organizations that support the aims and objectives of SRI and who wish to voluntarily assist the work of SRI in some way. Associates are often also involved in research, but they are non-voting members. They have access to the member's area of the SRI website. Membership fee is \$1 per year plus \$1 application fee.

There are other ways you can be involved:

SRI Fellow

This category is for those who are actively involved in research for and on behalf of SRI. We hope to develop a talented pool of Research Fellows that can assist in getting several research projects up and running.

Friends of SRI

This basically covers everyone else who is interested in hearing about research, receiving email newsletters about yoga research, conferences etc. Friends can be supportive by

volunteering their services at various times or just sit back and enjoy knowing that they have access to a special area of the SRI website

Patrons

A Patron is a person or an organisation that supports SRI with financial or other real support in the form of donations, bequests or gifts. We need Patrons to help us do the work that we plan to do. If you are interested in becoming a patron, please contact us by email and ask for information

Sponsors

A sponsor is a corporate organisation that wishes to support the work of SRI by sponsoring us with commercial backing to help us run a conference or other official public program whereby the sponsor would receive advertising rights and visual exposure at the conference and in various SRI literature and printed promotional material.

Research Peer

A Research Peer is a person of sufficient standing in the yoga and/or research community with significant knowledge and experience who is willing and able to conduct peer reviews for SRI's publications in order to make sure that we set and maintain a very high standard of work in research.

Please contact us for more information sri@swanresearch.net

Facilitation of Motor Skill Learning Using Yoga Nidra

By Sannyasi
Mantraganam
(Maarten A. Immink
PhD) Psychomotor
Lab at the School
of Exercise
Science, Australian
Catholic University



As a cycle of twenty-four hours can be divided into day and night, so is a person's level of awareness of the surrounding world similarly divided between wakefulness and sleep. While the experience of the wakeful state of consciousness is regarded as quite standard and predictable, sleep remains very much mysterious and extraordinary. This is to the extent that sleep is universally accepted as an altered state of consciousness (Druckman & Bjork, 1994). This differentiation based on the quality of the state of consciousness implies that dissimilar and autonomous cognitive processes take place during wakefulness and sleep. This is especially so with respect to the processes of learning and memory.

Where western scientific research once treated sleep as an insignificant event, with no more value than providing the brain and body with rest, there is now a great deal of scientific evidence to suggest that sleep is an important component in the formation of long-term memory (see Rauchs et al., 2005 for a review). Sleep dependent learning appears to be a phenomenon that applies to all memory systems as sleep offers improvements in performance for tasks that involve both declarative memory (e.g., word list recall) and procedural memory, which is involved in the production of motor skills (Walker, et al., 2003; Fischer et al., 2002).

The changes to brain activity that sleep provides appears to be critical for learning. Part of this change involves inhibiting brain processes that are typically active during waking states. For example, during sleep there is inhibition of neurons that link the thalamus to the cerebral cortex (Hobson & Pace-Schott, 2002). It is this inhibition that allows the cerebral cortex to shift from exteroceptive stimulus input, which happens via the thalamus, to the "off-line", interoceptive state that is characteristic of deep sleep. When we are asleep, we lose awareness to external stimuli and this seems to be quite an important requisite for learning. Interestingly, reduction in external stimulus awareness and the inward focus of awareness are also essential features of many meditation practices. Recent research on brain activity during meditation practices does confirm that parallels in brain activity exist between sleep and meditation. For example, brain wave activity has been shown to slow down during meditative practice (Aftanas & Golosheikin, 2003). One meditation practice in particular called Yoga

Nidra has remarkable similarities to sleep. During this meditation practice, the participant becomes disconnected from external stimuli, increases their parasympathetic drive (i.e., relaxation) and reaches states of dream-like visual experiences. Yoga Nidra is described as a meditation practice that allows the practitioner to approach states of consciousness that approach sleep yet allow for certain levels of awareness to remain (Saraswati, S.S., 1998). Consistent with this, Mandlik, Jain & Jain (2006) showed that with practice, Yoga Nidra allowed participants to go from fast beta (alert or anxious) and alpha (relaxed and awake) brain wave electroencephalogram (EEG) frequencies to slow theta (creativity, learning) EEG activity indicating an increasing ability to reach deep states of consciousness.

In one stage of the practice, Yoga Nidra involves progressive relaxation of the physical body through visualisation and awareness of body parts. Toma et al. (1999) demonstrated that muscular relaxation, which was measured with electromyography (EMG), can take place after activation of associated somatosensory and motor cortical areas. Activation of cortical areas associated with body sensations and movements with inhibition of cortical areas associated with movement production is a pattern that is quite consistent with cortical activity during sleep. In addition and also similar to sleep-dependent memory evidence, it has been demonstrated that active muscular relaxation practices benefit performance on memory retrieval tasks (Gosschalk & Gregg, 1996; Esmeralda et al., 2004). The rotation of consciousness through the body that takes place during Yoga Nidra may in itself be an effective means of establishing motor skill learning that is further enhanced in the later and deeper stages of the practice.

The most convincing pieces of evidence to suggest that Yoga Nidra can facilitate motor skill acquisition involves two studies that used brain imaging while participants were undergoing this meditation practice. First, Lou et al. (1999) conducted positron emission tomography (PET) scans on experienced yoga teachers during rest and during Yoga Nidra. They showed increased cerebral blood flow, a measure of cortical activity, in the parietal cortex (sensory processing), hippocampus (long-term memory formation) and frontal lobe areas associated with attention focus. Remarkably, these are areas of the brain that are also quite active during actual practice on motor tasks. A second piece of evidence involves the neurotransmitter dopamine, produced in the basal ganglia, a neural structure that is also activated during sleep (Hobson & Pace-Schott, 2002). An increase in dopamine release has been shown to be directly implicated with motor memory formation, a process necessary for motor skill acquisition (Flöel et al., 2005). Kjaer et al. (2002) demonstrated that Yoga Nidra participants elicited both theta EEG activity and increases in dopamine release. If Yoga Nidra does share similar memory

consolidation processes to sleep, then it may be able to be utilised after sessions of motor task practice in order to facilitate long-term memory consolidation. The development of a Yoga Nidra intervention to enhance motor skill learning would have implications for areas such as education, industry (e.g., training machinery operation), health sciences (e.g., rehabilitation) and sport science.

Unfortunately, there exists no empirical evidence to support or refute the potential of Yoga Nidra as a facilitator of motor learning. Closely related research studies on the effects of transcendental meditation (TM) on the acquisition of fine motor skills have failed to support a more general proposal that a meditation practices benefit motor learning (Wood, 1986; Williams, Lodge, & Reddish, 1977; Williams & Vickerman, 1976; Williams & Herbert, 1976). In addition, research with hypnosis has failed to demonstrate any benefits for the learning of tennis skills (Greer & Engs, 1986). Since hypnosis and TM are quite distinguishable from the practice of Yoga Nidra it stills remains inconclusive if the latter may play a role in motor memory consolidation. As no study exists that addresses the efficacy of Yoga Nidra as a means for memory consolidation, this review of literature reaches the conclusion that there is a need to conduct a series of experiments aimed at testing the hypothesis that Yoga Nidra involves processes that are similar to sleep and thus, may have an important role for the formation of long-term memory.

Footnote

S. Mantraganam has recently released an eBook which considers the relationship of the Brain and Yoga. A complimentary copy of *Three Principles of the Brain for Yogis* can be downloaded from www.integratmindbody.com

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Bhastrika & Blood Pressure Study

Over the last few years I have been completing a bachelor's degree in Health Science with the Victoria University of Technology. Two of the units I have studied have centered on research skills and methodology – and one of these required I conduct a systematic review on a topic of interest. I chose to review the current state of scientific knowledge in regards to the cardiac response to bhastrika pranayama; with an aim to conducting primary research in this area in 2008.

Bhastrika is traditionally contraindicated in cases of hypertension as well as in cardiovascular and cerebrovascular disease, hernia, gastrointestinal ulcer, epilepsy and vertigo (Saraswati, 1996). Hypertension is now a very prevalent disorder; records from 2004-05 report that 11% of Australians have hypertension (Australian Bureau of Statistics, 2006). It is therefore likely that within any one yoga class there will be someone suffering from this condition and, if the class is not specifically tailored to meet the needs of hypertensive practitioners, then it could contain unsuitable techniques.

Since yoga is currently enjoying widespread popularity in Western cultures, and has "gained acceptance amongst the wider group of 'mind-body' interventions in Western medicine" (Arias, Steinberg, Banga, & Trestman, 2006, p. 817); yogic techniques are increasingly being sought out by those with medical and psychological problems, a significant proportion of whom (statistically) will be hypertensive. In a typical yoga class there are certainly a range of beneficial practices and it is not essential that bhastrika is practised, however, a question which has been raised by both teachers and practitioners alike - especially in the light of the benefits bhastrika offers in regards to the conditions often associated with hypertension (obesity and diabetes) is: "does bhastrika raise one's blood pressure, and if so, by how much? Do the different rates of bhastrika practice affect blood pressure differently? And, are there alterations in this phenomenon over time?"

The systematic review revealed that, to date, most pranayama studies have been small in size and of poor methodological quality; and certainly further research is warranted. And this is what I am looking forward to doing through SRI at Mangrove Mountain next year!

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By Swami Omteertha, who graduated one of the first teacher training courses with Satyananda Yoga in Australia and has been teaching with inspiration and clarity ever since. She is a qualified Naturopath with academic awards for excellence in herbal and nutritional medicine. Swami Omteertha's scientific background makes her an excellent lecturer in the Yogic Sciences and her skills in practical yoga teaching are well known as is her rare skill in the melodic chanting of Sanskrit mantra through kirtan and bhajan.

Meditation Research at RMIT University

Sannyasi Dharmadeva (John Thomas) is completing his PhD through RMIT University under the supervision of Prof Marc Cohen (RMIT University) and Dr Graham Jamieson (UNE). He is exploring the state of meditation both from the perspective of the meditator's phenomenological experience and its physiological correlates. Dharmadeva is now beginning data collection and would like to contact advanced meditators (more than 20 years) from the following traditions: Satyananda Yoga, Transcendental Meditation, Tibetan Buddhist and Theravadin Buddhist (Vipassana). Participation in the study would take approximately 4 hours over two sessions. The first consists of a semi-structured interview about the participant's meditation history and practice as well as completing a few questionnaires. In the second session, EEG and respiration measures will be taken during a series of meditation practices. The measures are non-invasive & safe.

The research can be conducted at a convenient location or at Mangrove or Rocklyn ashrams.

If you are interested, please contact Dharmadeva on Dharmadeva@satyananda.net or phone him on (02) 43771871 for more information.

Mental Imagery Improves Physical Abilities

By Philip Stevens (Swami Samnyasanand)
BSc (Psych, Physiol) BSc (hons) (Physiol)
University of Adelaide Human Movement Studies

Abstract:

Visualisation techniques from practices such as Meditation and Yoga Nidra used as strategies and interventions such as in Motor Imagery (MI) or mental rehearsal provide contrasting reports on the level of effectiveness of MI in learning new motor skills. There is consensus that MI can lead to improvements in performance used in combination with physical practice because it shares similar neural mechanisms with cortical preparatory processes used in motor control.

Athletes often report novel cognitive and meditative techniques to enhance performance including rich, detailed, and multisensory internal imagery. To test this whether MI has any real effects, in a controlled, repeated measures experiment, 20 male and 20 female subjects volunteered to test effectiveness of Motor Imagery in targeting ability.

Evidence is presented to support the notion that MI facilitates motor performance to the extent that, in this experiment, Males were better at throwing overall, though Females tended to improve their scores more than Males with physical practice over a single distance and with mental practice at more than one distance.

Introduction:

The study of mental and physical ability as a science is an increasingly popular area of psychophysiological research. Performance enhancement strategies and interventions such as goal setting, meditation, relaxation techniques such as Yoga Nidra, motor imagery or mental rehearsal, stress management, self-instruction and modelling interventions dominate the field of literature. Blair, et al., (1993) investigated the effect of an imagery training programme on performance. Using both visual and kinaesthetic imagery and both internal and external imagery, they found significant improvement for both the skilled and novice in the imagery group compared to controls.

Mental rehearsal combined with observational and physical techniques improves performance both qualitatively and quantitatively (Lejeune, et al., 1994). Correlations suggest mental training effects cannot be explained in terms of visual imagery alone. White & Hardy, (1995) examined the relative efficacy of different imagery perspectives and found internal visual imagery more effective for the planning of action in response to changes in a visual field. However, external visual imagery was found to be more effective than internal visual imagery for both learning and subsequent retention.

Despite contrasting reports on the level of effectiveness of Motor Imagery (MI) in learning new motor skills, there is general consensus that

MI can lead to improvements in performance, (Yaguez, et al., 1998) especially in combination with physical practice. Decety, (1996) defines MI as "a dynamic state during which representations of a given motor act are internally rehearsed in working memory without any overt motor output." MI is well accepted as a major component of learning new and practicing existing motor skills, and has long been used in elite sports training. Research into the role of MI in motor learning examines the relationship between imagery and the acquisition of motor skills. Although cerebellar circuits are known to be modified by experience, (Kandel 1991) it has also been shown that repetitive and specific practice of a particular routine may attenuate adaptation of the learned task to any new conditions (Kitazawa et al 1997).

MI shares similar neural mechanisms with cortical preparatory processes used in motor control. Part of the distributed neural activity that takes place during movement also involves internal simulations and is said to reinforce the planning and cognitive stages of motor execution, thus helping in motor learning (Goodbody and Wolpert 1998). The prefrontal cortex is responsible for explicit representations that guide thought and action and Decety, (1996) emphasises the importance of the prefrontal cortex and its connections to the basal ganglia in maintaining dynamic motor representations in working memory.

Functional brain imaging studies indicate several cortical and subcortical areas active during actual motor performance are also active during imagination or mental rehearsal of movements (Schnitzler, et al., 1997). The primary motor cortex may also be involved in motor imagery. Experience and results of neuropsychological studies have shown that motor imagery can improve motor performance and enhance motor learning. MI shares some characteristics with motor preparation as well as with motor execution in a form similar but distinct from both motor preparation and execution. Several electro-physiological and functional imaging studies have investigated the physiological basis for this observation (Stephan & Frackowiak, 1996), eg Madigan, et al., (1992) examined cognitive techniques for enhancing motor skills and competitive strategies. Athletes often report cognitive strategies that enhance their performance as rich, detailed, and multi-sensory.

Three sensory modalities are involved: Vision, Kinesthesia and Audio/ verbal experiences are all reported. MI may be internal (first person perspective) or external (third person) (Murphy, 1994). Individual differences in the imagery used may be related to individual differences in cognitive styles with patterns of cerebral activation during the mental rehearsal similar to those produced by its actual execution. Strong affective states, especially confidence and satisfaction, can also often accompany the imagery.

Performance measures on imagery tasks may vary as a function of the independent, internal processes used in mental imaging, depending on previous experience, personal preferences and the nature and demands of the task at hand. It may even vary according to gender and sex based parameters that include different cognitive strategies, imaging abilities and physical propensities to excel at the task at hand.

Aims:

- To test whether physical performance improves with practice.
- To test whether mental imagery improves performance with practice.
- To determine if these effects interact.
- To test whether any improvement generalises after previous specific motor training, by seeing if practicing at more than one distance improves performance at a new, novel distance, with or without motor imagery.

Hypothesis:

That generalised mental rehearsal, involving motor imagery, provides more adaptable targeting ability than when previous practice is specific.

Purpose:

In order to contribute towards the understanding of the neurophysiology of motor imagery, the present study was designed to examine the effect of motor imagery practice (using a simple visual-meditation technique) in conjunction with physical practice on generalised targeting performance.

Method:

Subjects:

- 20 male and 20 female subjects with a mean age of 21 years gave written consent to participate in the study.
- No subject had a history of neurological disorders or severe visual impairment at time of participation.
- Subjects were randomly assigned to one of four groups, with two main groups. One group practiced throwing at a single distance (SD) before the intervention of MI or control, and the other group practiced at dual distances (DD) before the intervention of MI or control. Each group had equal numbers of subjects as a sub group of MI or control.
- Subjects in both of the MI groups were asked to mentally imagine successfully completing the task for 5 minutes as a treatment, while subjects in the control groups did not mentally imagine the task, but counted numbers instead.

Protocol

- Subjects aimed a small rubber ball in a series of 20 underarm throws at a target using their straight, non-throwing arm, then underwent a 5-minute intervention of MI or control before again throwing a further 20 times.
- SD subjects threw their first 20 times at the target from a distance of 3 metres.

- DD subjects threw their first 10 times from a distance of 3 metres and the remaining 10 of their first 20 throws from a distance of 7 metres.
- After the 5 minute treatment interval, all subjects threw a final 20 times from a common distance of 5 metres from the centre of the target.

Intervention

Upon completion of the first 20 trials, which comprised common physical practice for all subjects, the MI subjects from both SD and DD groups quietly mentally rehearsed using internal, visual imagery of the throwing action for a period of 5 minutes. They were given the instructions "Imagine the target in your mind's eye. Imagine seeing the ball land in the target." They were to do this as often as they could whilst kept alone in a small, dark and quiet room so that their "mini meditation" would not be disturbed.

Control subjects from both SD and DD groups were asked to count backwards from 10,000 in multiples of 9 for the same period. Accuracy was checked by an observer, who was present to ensure compliance.

Data Analysis

- Data analysed using a two-way ANOVA.
- Practice scores were ignored for comparison.
- Trial scores calculated from post treatment test score with alpha set at 0.05

Results:

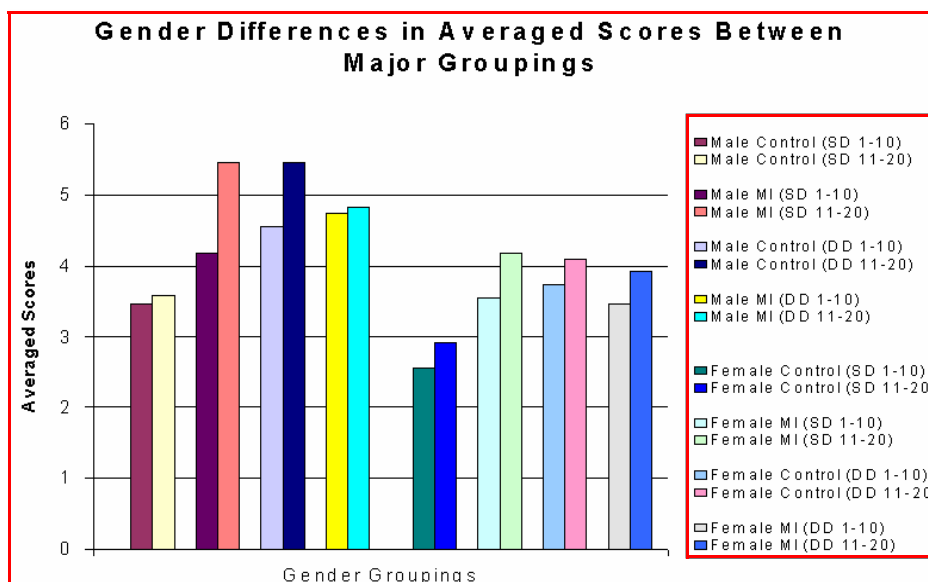
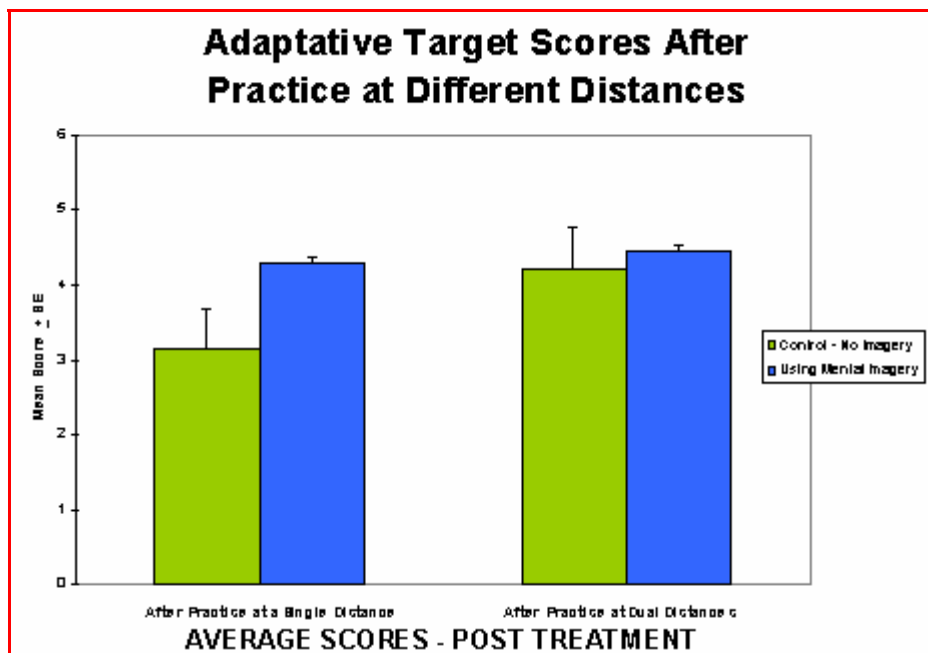
Two-way ANOVA results across all subjects.

- In the SD group, MI subjects performed with significantly greater ($p < .05$) accuracy and less variability compared with control subjects. In the DD group, the effect was similar though less pronounced and not significant ($p > .05$).
- There was a significantly ($p < .05$) greater physical practice improvement effect found in the control groups when comparing average scores between control subjects in the SD and DD groups.
- There was less variability in MI subjects scores across both the SD and DD groups, than in either control group.
- Males consistently outperformed females, across all groups and treatments.
- Males had better overall improvement scores than females in SD-MI and in DD-Control.
- Females had greater improvement scores in SD-Control and DD-MI

Discussion:

Motor images are endowed with similar properties as corresponding motor representations, and therefore have a similar functional relationship to the imagined or represented movement as well as a similar causal role in the generation of movements.

Simple motor tasks can often be improved over time by repeated practice. As seen in the SD group, MI subjects performed significantly better ($p < .05$) with greater accuracy and less variability compared to controls.



This improvement does not always generalise, however, to any differently matched sequence of identical component movements, as evidenced by the DD group, where the effect was similar though less pronounced and not significant ($p > .05$). The learning of specific skills is mediated by discrete, experience-driven changes within specific neural pathways that subserve the motor performance of the trained task. Although these performance gains do not often generalise to other similar activities, limited training experiences can sometimes be sufficient to trigger performance gains that require time to become evident (Conditt, *et al.*, 1997). Complex motor skills are acquired through a process of segmented motor learning. Simple movements become segments, or sub components, of larger schemata that are created by modulating neural activity in those circuits that link the motor cortex with the periphery. The circuits are many, varied and include the cerebellum for fine motor control. MI reinforces the neural modulation in the motor cortex, increasing synaptic efficacy via sensitisation of existing neural circuits involved in the motor learning.

Real learning is adaptive to changes in the movement dynamics by internal mental and/or motor components that reproduce the required movements, despite external perturbations. Development and retention of complex motor skills is thought to involve the formation of new synapses between segments and sub components into larger schemata that encode for more complex movements.

Physical practice also involves improvements over time and there were significant physical practice improvements in the control groups comparing subjects in the SD and DD groups. As no similar significant physical practice improvement effect was found when comparing MI subjects across the SD and DD groups, it can be assumed that the effects of MI and physical practice did not interact in this instance.

There was less variability in MI subject scores, however, across both the SD and DD groups, than in either control group. This indicates that grouping and accuracy were both more improved with MI than without.

Neuropsychological findings demonstrate that mental imagery relies on left-hemisphere posterior areas, the right hemisphere seems to play an analogous role in imagery and perception (Trojano & Grossi, 1994). Using functional brain imaging studies, Schnitzler, *et al.* (1997) found several cortical and subcortical areas active during motor performance as well as during mental rehearsal or imagination. Gandevia, *et al.* (1997) found no evidence of activation of muscle spindle afferents during imagined motor tasks and no evidence for selective fusimotor activation during imagined movement. Mental rehearsal therefore seems to involve some unintentional performance of the planned motor task as evidenced by the increased background EMG. There also seems to be a primary visuo-spatial component in which actions are consciously represented along with a motor component, activated in generating the imagined actions (Annett, 1995). There are two distinctly different imagery encoding techniques, one is conscious and verbalisable and another is a normally unconscious, yet demonstrable, encoding or representative, which can be shown to occur in behaviour. MI forms an essential mediating link between the two encoding systems. Annett, (1994) describes many subjects adding to or varying the given mental routines to fit their own internal schemas. Murphy, (1994) also found variance between subject's internal processes regarding MI. The physical basis of mental representations of actions though is best understood in terms of the mechanisms of motor control, the first stage is the repeated generation of a similar, prototypical action and the second stage relies on the ability to have instant retrieval of sensory inputs from working memory, plus either verbal or visual feedback to aid in the maintenance of appropriate MI (Annett, J. 1996).

The timing of simulated movements also follows the same constraints as that of actually executed movements. Many neural mechanisms are activated during MI, eg sharp increases in tendinous reflexes and vegetative changes correlated with the level of mental effort. At the cortical level, any specific pattern of activation resembling an actual action, is also observed in areas devoted to motor control. This activation may very well be the substrate for the effects of mental training. It has been experimentally proven many times that mental rehearsal of an activity not only improves motor performance but also has vegetative effects correlated with imagined effort (Thill, *et al.*, (1997). The beneficial effects can be explained in terms of central programming structures capable of anticipating the metabolic demands of the task. Electromyographic potential and heart rate show significantly faster heart rate with a task involving a goal, compared with no goal, during both actual and imagined contractions. Autonomic nervous system (ANS) parameters (skin potential, resistance, temperature and blood flow, and instantaneous heart rate) reveal ANS responses that correlate with MI (Deschaumes-Molinari, *et al.*, 1992). Imagery contents influence autonomic responses, making it comparable to real activity. An almost identical ANS response is evidenced during activity and in

mental concentration before activity, distinguished from neutral imagery but comparable to the activity itself as far as ANS responses are concerned (Deschaumes-Molinari, *et al.*, 1991).

If subjects were merely visualising the imagery rather than involving other senses as well, any MI effect may be masked by inter subject variability in imaging skills. In subjects, classified as good or poor imagers, alpha, beta 1 and beta 2 brain waves at different cortical regions show no differences between MI and control conditions, (Williams, *et al.*, 1995) confirmed the involvement of motor as well as spatial processes in dynamic motor imagery. Brain mapping techniques reveal an attenuation of alpha power in vivid images during visual imagery only, particularly in the left posterior quadrant of the cortex, but alpha is enhanced during MI (Marks & Isaac, 1995) which could explain some of these results.

In general females report more vivid imagery than males but by about age 50, female movement imagery is somewhat reduced in vividness, however Males consistently outperformed Females, across all groups and treatments in this study. Children with poor movement control are usually extremely poor imagers as well, with nearly half reporting no imagery at all, and physical education students report more vivid imagery than students specialising in more intellectual pursuits, with significant differences between elite athletes' imagery and that of matched controls (Isaac & Marks, 1994).

While Males had better overall improvement scores than Females in SD-MI and in DD-Control, Females had the opposite result with greater improvement scores in SD-Control and DD-MI. Females improved their scores in SD-Control conditions more than in DD, which was an effect opposite to that of males and lower in magnitude. It would seem then that Males are better at throwing overall, with physical practice at more than one distance, as well as mental practice but only at a single distance, though Females tend to improve their scores more than Males with physical practice over a single distance and with mental practice at more than one distance.

Conclusions:

Mental imagery significantly improves the learning of a motor task, if you are a female and you are practicing at more than one distance. Physical practice at more than one distance improves performance at a new distance for Males but not Females. The effects of Physical Practice and Motor Imagery do not seem to interact.

Suggested improvements for further research:

Establishment of prior imagery skills, as it was not known if the subjects had previously performed any mental imagery. Increased number of practice trials to reduce variability in the overall averaged scores. Space sessions out over a greater time to allow for practice effects between trials. Use of a more novel task than merely throwing with the non dominant hand. Feedback to the subjects between sessions may have led to greater improvement.

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Yoga Magazine is published by Sivananda Math and contains information about the Bihar School of Yoga, the Yoga Research Foundation, Bihar Yoga Bharati (the world's first Yoga University) and other affiliated organisations.

Searchable Archives

A valuable resource is the online searchable Yoga Magazine archive section which contains a wealth of information on a wide range of yogic topics (yoga and back pain, chakras, tantra, teaching yoga to children, yoga psychology, yoga for HIV+, etc.) drawn from past issues.

Yoga Magazine has been published for over forty years. During that time there has been a wide and varied range of topics covered both within the articles by Swami Satyananda and Swami Niranjanananda and within those of other people. There has also been a wide range of yoga research articles, specialist yoga teaching information, reports, etc. published.

See www.yogamag.net/archives.shtml

Other Scholarships, Grants & Awards

Tasmanian Community Fund (from www.australia.infoed.org smarts@infoed.org)

Grants to community organisations that make a difference by enhancing well-being and improving social, environmental and economic outcomes for the Tasmanian Community.

Deadline(s): 30/08/2007 Established Date: 21/07/2004 Follow-Up Date: 03/02/2008

Contact: Mark Green, Senior Executive Officer
Address: GPO Box 1350, Hobart TAS, 7001
E-mail: admin@tascomfund.org
Web Site: www.tascomfund.org/applications-GR15.html
Program: www.tascomfund.org/Attachments/GR15/GR15-Guidelines-Apps.pdf
Tel: 03 6233-2800
Fax: 03 6233 5690

The sponsor is committed to supporting projects that provide benefits to the Tasmanian community across the following areas: community welfare; sporting or recreational activities; youth issues; cultural and arts purposes; health; religious purposes; education; regional development; environment; and economic development and employment. The Board will consider an application for funding from an incorporated not-for-profit organisation: based in or proposing to undertake a project in Tasmania. Unincorporated not-for-profit organisations may also apply for a grant if an incorporated organisation is prepared to auspice the project. Individuals are not eligible to apply for a grant. A detailed business case plan must be attached to an application requesting a grant near, or in excess of, \$100,000.

Asthma Foundation of Victoria (from www.australia.infoed.org smarts@infoed.org)

The sponsor funds research to support its mission of helping people manage their asthma all year round. In 2008 the Foundation will award the following grants: Helen Macpherson Smith Trust grant for general asthma research in the amount of \$25,000 and The Asthma Foundation of Victoria Research Grant for children's/adolescent asthma research in the amount of \$25,000 for research conducted in Victoria.

Deadline(s): 31/07/2007 Established Date: 17/05/2006 Follow-Up Date: 03/07/2008

Contact: Garry Irving, Services Manager
Address: 491-495 King Street, West Melbourne VIC 3003,
E-mail: girving@asthma.org.au
Web Site: www.asthma.org.au/Default.aspx?tabid=51
Program: www.asthma.org.au/Portals/0/Application%20Form%202008.doc
Tel: 03 9326 7088
Fax: 03 9326 7055

The University of Melbourne

Australia's largest postgraduate scholarship program with 436 places valued at a total of more than \$20 million. Melbourne Uni has the largest and most generous scholarship program covering the living expenses of postgraduate research scholars across a wide range of disciplines. University of Melbourne Deputy Vice-Chancellor (Research) Professor John McKenzie says the University is now calling on the best and brightest minds across Australia to apply to do their postgraduate research study at Melbourne. See http://uninews.unimelb.edu.au/articleid_3798.html

The SATYA Foundation Grant (University of Adelaide)

The SATYA Foundation is dedicated to promoting research on yoga and associated studies such as anatomy, physiology, psychology, philosophy, Ayurveda Jyotish etc. SATYA provides grants, scholarships and prizes for university studies into the benefits of yoga to encourage proper scientific yoga research programs by independent research. This trust will also liaise with and/or support other persons and organisations with a similar purpose in order to mutually assist in the promotion and expression of the formal study of yoga in the wider community. See www.yogalinks.net/SATYA/Research.htm for more information

The ASI 'SMART Company' Scholarship Fund

Financial assistance in the form of scholarships and education subsidies up to \$20,000 per year (\$2,000 per individual). The study that the applicant intends undertaking must be directly relevant to professional education in the not-for-profit sector. See www2.communitybuilders.nsw.gov.au/funding/2943.html for information on these scholarships.

Australian Academy of Science Awards: See www.science.gov.au/awards

Melbourne Research & Grants Bulletin : See www.researches.unimelb.edu.au/researchbulletin

Journal of Yoga - Ontogenetic and Therapeutic Investigation

- Journal** [noun] a periodical dedicated to a particular subject
- Yoga** [noun] from Sanskrit "yug" meaning to join or bring together. A discipline involving body, mind & consciousness for a balanced state of spiritual insight, physical & mental health, well being and tranquillity; a healing system of theory and practice through a combination of breathing techniques, physical practices, meditation skills and lifestyle adjustments.
- Ontogenetic** [adjective] pertaining to ongoing development of the individual.
- Therapeutic** [adjective] to cure or restore to health; a restorative technique; having or exhibiting healing power: a therapeutic agent or process.
- Investigation** [noun] the work of inquiring into something thoroughly and systematically.



Satyananda Yoga Teachers' Association

Supporting yoga teachers of the
Satyananda tradition throughout Australia

SYTA wishes to extend an invitation to members of the Satyananda yoga community to present papers and workshops at the 2008 Yoga Teachers' Conference addressing the topic: **Koshas - unfolding the self.**

The conference will be held over three days and speakers are invited to choose a particular kosha as a discussion or workshop topic.

The conference organisers intend that, over the course of the conference, all of the koshas be discussed as discrete entities.

There is also opportunity for teachers to present early morning classes, as well as meditation and yoga Nidra sessions. In developing these practical sessions teachers will have an opportunity to relate them to the theme of the conference and speakers' presentations.

Interested parties are required to submit an expression of interest to the SYTA Conference Committee by Friday 7th September 2007 identifying which kosha/s they would like to focus on and outlining their presentation topic or practical session.

Please feel free to contact us if you would like further information.

SYTA Conference Co-ordinators:
Shakti Mudra or Mantrasarita
02 6566 5313 or 02 9799 4852
shakti.mudra@gmail.com mantrasa@yahoo.com

Satyananda Yoga Teachers' Association
Supporting yoga teachers of the
Satyananda tradition throughout Australia
SYTA P.O. Box 252, Enmore NSW 2042
See www.syta.org.au for more information.



This is a photo of Rocklyn Ashram in Victoria covered in recent falls of heavy snow, where SRI, with the support of the Yoga Association of Victoria and the Satyananda Yoga Academy, held various presentations on the effects of yoga on wellbeing, the effects of asana and pranayama, comparisons between traditions, and examples and applications of how yoga is being assessed and applied in a range of therapeutic situations.

Further SRI research conferences will be held in Rocklyn over the next few years.

See www.yogavic.com for more information

SRI Calendar of Events

Events	Date
SRI Research Scholarship in Yoga Education	Electronic Application 31 st August Hard Copy 7 th September 2007 Awarded in November each year
SRI Research Grant	Electronic Application 28 th Feb Hard Copy 7 th March 2008 Awarded in April each year
SRI Fellowship Program	Electronic Copy 31 st August Hard Copy 7 th September 2007 Awarded in April each year
2008 Networking Meeting & Student Presentations	April 2008 with Swami Niranjanananda
Research Weekend	Networking +++ September 2008
Colloquium	Melbourne 2008
Newsletter and SRI Research Journal	March, June, Sept, December