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The Possible Significance of Sensorimotor Synchronisation in Modern Postural Yoga Practice

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Abstract

The aim of the paper is to discuss the possible role of sensorimotor synchronisation in Modern Postural Yoga (MPY) *āsana* ritual. The hypothesis is that such synchronisation contributes to the subjective efficacy of MPY practice and facilitates the transmission of doctrinal concepts related to it.

Grounding the discussion in the enactive paradigm, the author describes the phenomenon of sensorimotor synchronisation and the mechanisms responsible for its emergence. The ritual character of MPY *āsana* practice is then accounted for, based on McCauley and Lawson's theory of ritual competence. A discussion of forms of synchronisation occurring during *āsana* ritual follows, with a special focus on Iyengar Yoga. The author then suggests the possible influence of such synchronisation on the perceived effectiveness of the practice and on the acceptance of certain religio-philosophical notions.

Keywords: Cognitive Science of Religion, enactivism, social cognition, sensorimotor synchronisation, sensorimotor entrainment, ritual competence, Modern Postural Yoga
Słowa kluczowe: religioznawstwo kognitywne, enaktywizm, poznanie społeczne, synchronizacja sensomotoryczna, porwanie sensomotoryczne, kompetencja rytualna, nowoczesna joga posturalna

Introduction

The term "Modern Yoga" (MY) has gained relevance within the study of religions in recent years. It denotes an array of systems which began to develop in colonial India under Euro-American influence.[1] Many of these systems have been successfully implemented globally, with English serving as the lingua franca enabling their transmission. As a result, MY strands have become an important part of the contemporary religious landscape.

[1] E. De Michelis, *A History of Modern Yoga: Patañjali and Western Esotericism*, London 2004.

Modern Postural Yoga (MPY), as a conglomerate of systems aimed at maintaining health and agility, occupies an especially important place within MY. Fitting well into the global wellness movement,[2] MPY holds a special appeal for thousands of people, who look for alternative ways to improve their fitness, reduce stress and relieve ailments. Its techniques often serve as exercise routines, whose alleged ancient origin may contribute to their perceived legitimacy. But MPY strands offer more than just exercise routines. They are systems combining a 20th-century take on *haṭha yoga* (influenced by the import of European physical culture) with religio-philosophical underpinnings adopted liberally from *Sāṃkhya-Yoga* and *Vedānta*.[3] For a scholar of religions, MPY strands are systems of eclectic ritual practices combined with equally eclectic doctrinal notions, and as such they demand close attention.

There are many factors to consider during a comprehensive study of MPY. The historical influences on its development have already received substantial attention.[4] As yet, no in-depth examination of its doctrines has been made. The present paper focuses on the ritual aspect of MPY, namely on *āsana* practice. It draws attention to certain effects of this practice and attempts to interpret them by applying the concepts adopted from neurocognitive science. The aim of the paper is to show how MPY practice creates conditions for the emergence of *sensorimotor synchronisation*. The hypothesis is that synchronisation achieved during MPY ritual contributes to the subjective efficacy of this ritual and may facilitate the popularisation of MPY as well as contribute to a better assimilation of doctrinal concepts related to it.

Once the hypothesis has been presented, some reservations must be made. The paper does not aspire to venture into the realm of neuroscience, and when synchronisation is mentioned, only its behavioural, and not neural, correlates are discussed. Moreover, the paper does not summarise any experimental research pertaining to the subject, nor does it propose a particular design for future research. It is an attempt made by a scholar of religion to draw attention to a possibly interesting area of interdisciplinary study. Its objective is to encourage future research projects, which would make it possible to verify the proposed hypothesis. For the time being, the author's aim is to prove that there are grounds for formulating this hypothesis, and that it is a worthwhile pursuit.

Embodiment, enactment and social cognition

This discussion is situated within the Cognitive Science of Religions (CSR), to the extent that it focuses on the modes of cognition which may result in the formation and transmission of religious concepts and behaviour. However, it is quite distant from the interest of CSR in a strict sense, which makes use of the modular model of

[2] See S. Strauss, *Positioning Yoga. Balancing Acts across Cultures*, New York 2005, pp. 57–59.

[3] See M. Singleton, *Yoga Body. The Origins of Modern Postural Practice in India*, Oxford 2010; E. De Michelis, *op.cit.*

[4] See E. De Michelis, *op.cit.*; M. Singleton, *op.cit.*

the mind[5] to explain religious concepts as by-products of the interaction of innate, encapsulated and domain-specific mental modules. The departure point in the present context is the notion of *cognition as enactment*.[6] The *enactive* approach pictures knowledge acquisition not as modular computation, but as ceaseless perception and action resulting in the emergence of recurrent, meaningful sensorimotor patterns. In this approach, the key concern of a perceiving subject is not what concepts they may abstract from a given situation, but rather what *action* they may undertake in it. The subject's sensorimotor endowment forms a part of the *embodied mind*, a dynamic cognising mechanism tied closely to the environment.

Within this environment, other cognising bodies provide a distinct class of stimuli. Other humans also undertake actions, which the perceiver may enact by mapping them onto his or her own body. As such processes may be reciprocated, *social cognition* is possible, understood as simultaneous participation in the *same* cognitive process, or "an emergent product of jointly recruited and time-locked processes."[7] The fact that such co-cogitation occurs and that it contributes to the formation or culture was acknowledged by Émile Durkheim. According to Durkheim, the state of *collective effervescence*, achieved during stimulating social activity, facilitates the formation of collective representations and feelings.[8] As rituals provide perfect conditions for effervescence to occur, their relevance for the emergence of collective representations must be acknowledged. Considering the significance of social cognition within CSR provides a way to re-examine the role of ritual in the formation and transmission of religious concepts. It encourages looking at religions not merely as shared systems of beliefs, but as forms of embodied social interaction, within which ritually entrenched sensorimotor patterns and systems of beliefs intertwine.

Sensorimotor synchronisation and its significance

The concept of social cognition implies synchronicity of behaviour among group members. The actions within a group co-occur in response to one another, so the emergent joint action is something more than just the sum of individual actions. It is easy to observe that group activity often becomes synchronous, e.g. during mass protests and parades or among dancers. As various studies have shown, synchronicity at the level of behaviour (shared motor patterns or emotional states) is accompanied by resonance at the level of neural patterns correlated with this behaviour.[9] Gün Semin and John

[5] See J. Fodor, *The Modularity of Mind: An Essay on Faculty Psychology*, Cambridge 1983.

[6] F. Varela, E.T. Thompson, E. Rosch, *The Embodied Mind. Cognitive Science and Human Experience*, Cambridge 1993, p. 172 ff.

[7] G.R. Semin, J.T. Cacioppo, *Grounding Social Cognition. Synchronization, Coordination, and Co-Regulation* [in:] *Embodied Grounding. Social, Cognitive, Affective, and Neuroscientific Approaches*, G.R. Semin, E.R. Smith (eds.), Cambridge 2008, p. 121.

[8] See É. Durkheim, *The Elementary Forms of Religious Life*, trans. K.E. Fields, New York 1995.

[9] See e.g. T. Komendziński, *Ciała i umysłu poruszone razem. Sensomotoryczne podstawy (neuro) estetyki tańca* [in:] *Neuroestetyka muzyki*, M. Bogucki *et al.* (eds.), Poznań 2013, p. 143 ff.

Cacioppo define synchronisation as "jointly and simultaneously recruited sensory-motor processes... evident in a neurophysiological mirroring of the producer by the perceiver."[10] As a perceiver observes an action, neurophysiological processes occur which facilitate its performance. The actual performance may be inhibited (in such cases one may talk about their *simulation* without execution), but without the synchronous neural representation synchronous behaviour would not be possible. In other words, it is both "our brains and bodies [which] effectively form embodied interactions."[11]

The relationship between perception, neural representation and action is dynamic. As an observed motor act is simulated and executed, it becomes a new perceptual stimulus, which, upon its subsequent simulation and execution, provides yet another stimulus. In this way, perceptuo-motor resonance between interacting subjects occurs, resulting in a *perception-action loop*.[12] Such feedback reinforces synchronisation, as with each loop the participants' actions may become more and more attuned.

Stimuli enabling synchronisation may come from different modalities, not necessarily visual. A special class of stimuli is formed by rhythmical patterns, whose shared perception enables *sensorimotor entrainment*. This form of synchronisation (evident e.g. during dancing or performing music together) is based on the ability to both detect and generate rhythmical signals, and to integrate motor performance with them.[13] The source of rhythmical patterns may come from the external environment, or from other participants in the action (*social entrainment*). The stimulus may also come from the subject themselves – in that case one may speak of *self-entrainment*.

Synchronisation may occur in relation not only to motor activity, but also to somatosensory experience. Experimental data suggests that observing the emotional states of others triggers the same neural response as the actual experiencing of these states.[14] The same applies to the observation of tactile stimulation, or to witnessing pain being inflicted.[15] When appropriate neural mechanisms are activated, and simulation of a given somatosensory state occurs, actual experience of that state is facilitated. In this way, members of a group may potentially share feelings, experiencing what is referred to as empathy.

Synchronisation is a complex process, partially automatic and partially voluntary, engaging various neural structures and cognitive functions. The most basic mechanism involved is *mirroring*, i.e. automatic response of a particular group of visuomotor neurones to the observation of an action. These are the so-called *mirror neurones*, first discovered by Giacomo Rizzolatti in macaque monkeys.[16] They

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[10] G.R. Semin, J.T. Cacioppo, *op.cit.*, p. 123.

[11] S. Schüler, *Synchronized Ritual Behavior: Religion, Cognition and the Dynamics of Embodiment* [in:] *Religion and the Body: Modern Science and the Construction of Religious Meaning*, D. Cave, R. Sachs Norris (eds.), Leiden 2011, p. 84.

[12] T. Komendziński, *op.cit*., p. 154.

[13] *Ibidem*, pp. 151–152.

[14] See e.g. A. Goldman, *Simulating Minds. The Philosophy, Psychology and Neuroscience of Mindreading*, Oxford 2006, pp. 117–118.

[15] *Ibidem*, pp. 135–136.

[16] G. Rizzolatti, L. Fadiga, V. Gallese, L Fogasi, *Premotor Cortex and the Recognition of Motor Actions*, "Cognitive Brain Research"1996, no. 3, pp. 131–141.

become activated both when an action is performed and when it is merely observed. A similar, though more complex, mirroring system has been identified in the human brain.[17] Although it is crucial for synchronisation, as it provides its most rudimentary neural substrate, it is not sufficient, especially for the performance of higher-order, goal-mediated actions. A more complex mechanism, postulated by Alvin Goldman, is *enactment imagination* (or *e-imagination*).[18] This involves deliberate construction of mental representations, mainly of a quasi-visual character. It can be applied for a variety of purposes in many different contexts, one of which is representing an action to be performed.

An important factor possibly significant for synchronisation is the use of language. As speaking and doing are evolutionarily entwined, mental construal of actions supports the comprehension of language, and vice versa. Vittorio Gallese and George Lakoff[19] propose a theory of *neural exploitation*, claiming that as the human brain evolved, additional functions were taken up by neural structures already in place, originally intended for different purposes. As a result, language comprehension employs neural systems otherwise used for perception, action, and emotional processing. According to Arthur Glenberg,[20] the meaning of an expression is grasped in relation to the set of actions a subject can undertake in the situation implied by this expression. As a sentence is comprehended, these actions are simulated, and thus their performance is facilitated. Indeed, various studies have shown that being exposed to particular linguistic content influences subjects' motor capabilities.[21]

Since attending to language involves simulating action, one may expect that being simultaneously exposed to the same linguistic content would result in synchronous simulation of similar sensorimotor patterns. Similar simulations, in turn, mean facilitation of similar motor acts, and thus smoother synchronisation. This fact is less trivial than it might initially seem, as the process involved is largely automatic – hearing a verbal command may result in an automatic facilitation of the muscles responsible for a given action, even before the agent has time to think about – and e-imagine – what they are hearing and doing.

This brief discussion of the phenomenon of synchronisation may give an idea of its significance in a religious, or, more precisely, ritual context. During rituals, groups of people engage in collective activity, involving chanting, dancing or offering sacrifice. They may be guided by the voice of the priest, or by the sound of music. The possibility of achieving neural resonance in the process, and sharing not only actions, but also emotions, is immense. The following section is a discussion of some possible forms of synchronisation during a very particular ritual, namely that of *āsana* within Modern Postural Yoga.

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[17] See Goldman, *op.cit.*, p. 135.

[18] *Ibidem*, p. 149 ff.

[19] V. Gallese, G. Lakoff, *The Brain's Concepts: The Role of the Sensory-Motor System in Conceptual Knowledge*, "Cognitive Neuropsychology" 2005, no. 22 (3–4), p. 456.

[20] A.M. Glenberg, *Toward the Integration of Bodily States, Language, and Action* [in:] *Embodied Grounding. Social, Cognitive, Affective, and Neuroscientific Approaches*, G.R. Semin, E.R. Smith (eds.), Cambridge 2008, pp. 43–70.

[21] See e.g. *ibidem*, pp. 47–48, 51–52.

Modern Postural Yoga and the *āsana* ritual

The term Modern Postural Yoga (MPY)[22] denotes yoga practice systems, whose origin dates back to the late colonial period in India, and whose main focus is the performance of *āsana* (yogic postures) and *prāṇāyāma* (breath-control techniques). Nowadays, MPY strands are spread globally, but English remains their primary language. According to Mark Singleton, their development was strongly influenced by the emergence of the European physical culture movement,[23] imported to India by the British. Popular exercise routines found their way into Indian gymnasia, where, combined with elements derived from *haṭha yoga*, they were turned into comprehensive systems. In these systems, the concept of *āsana* played a central role.

Perhaps paradoxically, the Western influence drew the emerging movement closer to its Indian roots. To set the "indigenous" systems apart from their European counterparts, their founders strove to provide them with ancient legitimisation. Medieval *haṭha yoga* provided an ideal of a noble, heroic Indian ascetic.[24] At the same time, attempts were made to prove the correspondence between the modern *āsana* practice and the *aṣṭāṅga yoga* of *Patañjali*. As a result, contemporary MPY strands are a combination of modern systems of exercise with a slightly vague religio-philosophical background, built around the categories borrowed from *Sāṃkhya-Yoga* and the modernised, Westernised *Vedānta*.[25]

Nowadays, the most widespread strands of MPY are Iyengar Yoga (IY; founded by B.K.S. Iyengar, 1918–2014), and Ashtanga Vinyasa (AV; founded by K. Patthabi Jois, 1915–2009). In both systems, the focus is placed on the practice of *āsana* sequences. In a typical setting, a group performs a sequence together, under the guidance of a teacher. In both IY and AV a different model is possible, in which each practitioner performs their own sequence, according to their own needs.[26] However, for the purposes of the present discussion, simultaneous group practice is of the most interest.

Solid foundations exist for understanding MPY *āsana* practice in terms of religious ritual. This does not imply that MPY, or strands thereof, should be unambiguously classified as *religions*. Considering the plurality of the definitions of religion, and the recent debate within CSR concerning the question of whether religion can be anything more than just a "convenient non-technical pointer"[27] to the vast field of interest of the study of religions, it is clear that no unanimous verdict can be given in

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[22] See E. De Michelis, *op.cit.*, p. 187 ff.

[23] M. Singleton, *op.cit.*, p. 81 ff.

[24] *Ibidem*, p. 169.

[25] This "modernised, Westernised" version was popularised to the greatest extent by Swami Vivekananda. See E. De Michelis, *op.cit.*, p. 127 ff.

[26] This is the case during individual practice and therapeutic classes in IY, and during so-called *Mysore style* practice in AV.

[27] P. Boyer, E*xplaining Religious Concepts: Lévi-Strauss, The Brilliant and Problematic Ancestor* [in:] *Mental Culture. Classical Social Theory and the Cognitive Science of Religion*, D. Xygalatas, W.W. McCorkle (eds.), Durham 2013, p. 171.

that matter. This, however, does not change the fact that ritual practices exist within MPY which are related to certain doctrinal assumptions of a possibly "religious" character.

A typical group *āsana* ritual has a tripartite structure, with a short meditation and a chant as the opening phase, the practice of a sequence of *āsanāni* as the main phase and passive relaxation as the closing phase. Elizabeth De Michelis interprets this structure in terms of van Gennep's model of the rite of passage[28] (with its phases of separation, transition, and incorporation), referring to MPY practice as "healing ritual of secular religion."[29]

For the purposes of this paper, Robert McCauley and Thomas Lawson's understanding of ritual is suitable.[30] According to them, comprehension of ritual structure engages cognitive mechanisms employed to represent action in general.[31] The key difference between any kind of action and ritual action is that in the latter so-called *culturally postulated superhuman agents* (or *CPS-agents*) play a pivotal role. During ritual activity, a constrained group of actors, applying assigned instruments, acts upon assigned patients to effectuate a transaction with CPS-agents and cause change in a postulated religious world.

At first glance, it might not be obvious that MPY *āsana* practice fulfils McCauley and Lawson's criteria. Specifically, the presence of CPS-agents in the given context might seem dubious. However, a closer look at the religio-philosophical assumptions underlying MPY may clear up the matter. In the following paragraphs, Iyengar's exposition of these categories will serve as an example.

According to *Sāṃkhya-Yoga* cosmology, two exclusive principles constitute reality: *prakṛti*, the substrate of the phenomenal world, and *puruṣa*, the absolute, transcendent consciousness, independent from *prakṛti* substantially, but attached to it for the purpose of its own liberation. Apart from the subtle and gross elements, *prakṛti* also makes up the human mental apparatus. The *Yoga Sūtra* of *Patañjali* refer to this apparatus as *citta* – a tripartite structure consisting of *manas* (the "mind"), *ahaṅkāra* (the "I" principle) and *buddhi* (the discriminative consciousness). *Buddhi*, by virtue of its disposition of *jñāna* (knowledge, insight), serves a salvific role, liberating *puruṣa* from its entanglement with *prakṛti*. In this context, *puruṣa*, on account of its omniscience related to its unlimited vision (it is called *draṣṭṛ* – "the seer"), and its ability to exist after the dissolution of the world, may be interpreted as a CPS-agent.[32]

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[28] See A. van Gennep, *The Rites of Passage*, London 1960.

[29] E. De Michelis, *op.cit.*, p. 252 ff.

[30] R.N. McCauley, E.T. Lawson, *Bringing Ritual to Mind. Psychological Foundations of Cultural Forms,* Cambridge 2004. The classically cognitivist (i.e. representationalist) grounding of McCauley and Lawson's theory is at odds with the more radical forms of enactivism (see E. Myin, D.D. Hutto, *Radicalizing Enactivism. Basic Minds without Content*, Cambridge, MA, 2013). However, for the purpose of the present paper, applying very general notions of both *enaction* and *representation*, referring to this theory is justified.

[31] *Ibidem*, p. 8 ff.

[32] Even though *puruṣa* is considered completely passive (*akartṛ*), it could still be construed as an agent, provided that agency is understood in terms of intentionality, rather than ability to exert physical force. Being conscious (*cetana*), *puruṣa* is a subject (*viṣayin*), an experiencer (*bhoktṛ*) and a knower (*jñātṛ*). Despite its passivity, it effectuates its own liberation by influencing *prakṛti* to act for its benefit

Iyengar identifies *ahaṅkāra* with "ego" or the "small self", and *buddhi* with "intelligence" – these are the two principles guiding a yogi's life and practice. *Puruṣa*, on the other hand, is identified with *ātman* (the conscious principle of the *Upaniṣad* and *Vedānta*), the Universal Soul, or "inner divinity"[33] (understood in a vague, syncretistic manner adapted to the more or less theistic, atheistic or agnostic views of IY practitioners).

The goal of the *āsana* ritual may be understood as holistic healing, effectuated in a mechanistic way. However, the notion of agency – or, in fact, CPS-agency – is very much present in it. The human body is represented as a sacred realm ("the temple of the soul"),[34] in which conscious forces of divine origin operate. Yoga practice is aimed at "the tracing of the source of consciousness – the seer [*puruṣa*] – and then diffusing its essence... throughout every particle of the... body."[35] In other words, its aim is to encounter the inner divinity and, as if through dissolving it in fluid, spread it evenly inside the body. The said fluid is consciousness (*citta* or *buddhi*) and, at the same time, *prāṇa*. Its infusing with the divine essence and homogenous distribution is achieved through cultivating proper body alignment in *āsana*. To interpret this notion in terms of ritual agency, during *āsana* practice the agent of *buddhi*, using the instrument of the body and the medium of *prāṇa*, acts to come into contact with inner divinity. This sacred encounter (explained in terms of the "divine marriage of Nature and the Universal Soul"[36]) leads to a qualitative transformation of the body.

The understanding of the effects of the *āsana* ritual in theistic terms does not exclude its simultaneous secular interpretation. A variety of psychosomatic effects (stimulating, calming, anti-depressive, anti-anxiety etc.) are attributed to different postures and sequences thereof. Especially in IY, precisely crafted *āsana* sequences are used for therapeutic purposes, to relieve a large variety of ailments (from the common cold to life-threatening diseases). To explain the efficacy of such sequences, the categories of Western medicine are employed. In effect, a practitioner may seek proper alignment in *āsana* to both restore the proper functioning of the thyroid and encounter the divine within.

(see O. Łucyszyna, "Czy puruṣa jest podmiotem? Na podstawie analizy opozycji podmiotu (viṣayin) i przedmiotu (viṣaya) w klasycznej sāṃkhyi", [in:] *Purusza, atman, tao, sin... Wokół problematyki podmiotu w tradycjach filozoficznych Wschodu*, O. Łucyszyna, M.St. Zięba (eds.), Łódź 2011, pp. 77–89). In other words, according to the criteria proposed by CSR, *puruṣa* could be attributed *mentality* (in terms of so-called folk psychology, *not* sāṃkhyan ontology – according to the latter *puruṣa* is substantially distinct from *manas* – "the mind"). Since the concept of mentality can be construed without an underlying concept of physicality (see J.L. Barrett, *Coding and Quantifying Counterintuitiveness in Religious Concepts: Theoretical and Methodological Reflections*, "Method and Theory in the Study of Religion" 2008, no. 20, p. 327), it is sufficient for *puruṣa* to be a passive, disembodied spectator, for it to bring about notions of (super)human agency.

[33] See e.g. B.K.S. Iyengar, *Light on Life. The Yoga Journey to Wholeness, Inner Peace and Ultimate Freedom*, Vancouver 2005, pp. 3, 148, 9 ff.

[34] See e.g. B.K.S. Iyenagar, *Yoga Vṛkṣa. The Tree of Yoga*, Oxford 1988, p. 17; B.K.S. Iyenagar, *Light on the Yoga Sūtras of Patañjali. Pātañjala Yoga Pradipika*, New Delhi 2005, p. 145.

[35] *Ibidem*, p. 4.

[36] B.K.S. Iyengar, *Light on Life...*, p. 201.

The purpose of the next section of the paper is to show that both the subjective efficacy of the practice (perceived as relaxation, stimulation, alleviating of disease symptoms) and the comprehension of religio-philosophical notions, such as those pertaining to *puruṣa*, may be associated with the experience of sensorimotor synchronisation during the *āsana* ritual.

Modes of synchronisation in MPY *āsana* ritual

Despite the similarity of the general structure of the *āsana* ritual (brief meditation, sequence of postures, relaxation), the differences in the performance of IY and AV *āsana* sequences are significant. In AV, the postures are executed in an aerobic manner, accompanied only by the basic commands of the teacher. The fairly dynamic alteration of poses is synchronised with the breath, which is controlled and, very importantly, audible. In IY, each posture in a sequence is broken down into numerous configurations of precisely delimited body parts. As the *āsanāni* are performed, the teacher describes these configurations in detail. The teacher's commands guide the practitioners systematically along the entire pose, motion after motion, usually starting with the lowermost body parts (i.e. the feet), and ending with the uppermost ones. Depending on the advancement of the group, the described body parts and their movements may be quite large (e.g. "push the thigh back", "roll the shoulder back and down") or quite minute (e.g. "move the indent between the femur head and the buttock into the body" or "suck the skin on the sides of the neck towards the cervical vertebrae"). In both AV and IY, practitioners are arranged in the room in an ordered manner, facing in the same direction. A teacher or an assistant commonly faces the group, presenting the postures to the participants.

The most fundamental aspect of synchronisation during the *āsana* ritual is mirroring. Especially in IY, practitioners lean on the teacher's modelling of the postures. As the model faces the group, they perform the *āsanāni* in the opposite direction, literally becoming the mirror image of the students. This facilitates automatic imitation of the motor patterns they present. Apart from the mirroring of the teacher/assistant, possible mirroring synchronisation between co-practitioners may occur. Although the members of a group are discouraged from focusing on the performance of others, in most postures part of the group always remains within their scope of vision. Therefore visual stimuli, also of a subliminal character, are always present, enabling automatic, if not deliberate, synchronisation.

Apart from visual stimuli, rhythmical patterns are available during the *āsana* performance, providing conditions for sensorimotor entrainment. In AV this element is especially salient, due to the audibility of the practitioners' synchronised breaths. In IY, a fair degree of rhythmicity is provided by the sound of verbal commands. The teachers usually speak in a melodious manner, accentuating the verbs pertaining to the ascribed movements. The more concise the commands, the more rhythmical they become. Since each command is accompanied by immediate execution of the movement, the motion of the group may be reminiscent of dancing.

The semantic content of spoken commands also needs to be considered as a factor aiding synchronisation. As the practitioners attend to the commands, they simulate the motor acts described by them fairly simultaneously. Thus, in the entire group similar movements are facilitated even before anyone executes them. During advanced classes, many commands concern varieties of motion invisible to an outside observer. For instance, the aforementioned motion of "the skin on the sides on the neck into the cervical vertebrae", though visible upon close inspection in the form of subtle elongation of the neck, is felt rather than seen. Attending to the same, precise expressions enables the sharing of the subtle proprioceptive experience by the entire group. It seems that during advanced practice, when the described motor acts gradually become infinitesimal, the verbal commands are often used to guide proprioception rather than motion. Without the ability to simulate this experience through language comprehension, its sharing would not be possible.

The last aspect of synchronisation is related not so much to group practice as to the individual experience of each practitioner. Various aspects of *āsana* performance suggest the possibility of what may be termed *auto-synchronisation*. Especially in IY, executing a posture involves feeling the actual position of the body, then simulating the target position, the movements necessary to achieve it, executing them, feeling the new body configuration, once again juxtaposing it to the desired one, simulating and executing corrective movements etc. A likely result is what may be termed *proprioception-action loop*, and a kind of *interoceptive overload* in which the feed of stimuli coming from the body significantly exceeds the number of stimuli of which a person is aware in a normal situation. Attending to one's breath, providing yet another salient stimulus and conditions for self-entrainment, may reinforce this effect. The psychological and neurophysiological implications of such over-stimulation seem an interesting subject for empirical research.

The significance of sensorimotor synchronisation in MPY *āsana* ritual

Discussing the phenomenon of *collective effervescence*, Durkheim depicts astounding effects of joint action that occur in times of social unrest.

> The result of that heightened activity is a general stimulation of individual energies. People live differently and more intensely than in normal times... man himself becomes something other than what he was. He is stirred by passions so intense that they can be satisfied only... by acts of superhuman heroism or bloody barbarism.[37]

Similar arousal, though on a much smaller temporal scale, occurs during Australian aboriginal *corroborees*.

> Once the individuals are gathered together, a sort of electricity is generated from their closeness and quickly launches them to an extraordinary height of exaltation... The initial impulse is...

[37] É. Durkheim, *op.cit.*, p. 213.

> amplified each time it is echoed, like an avalanche that grows as it goes along... gestures and cries tend to fall into rhythm and regularity, and from there into songs and dances... The effervescence often becomes so intense that it leads to outlandish behavior; the passions unleashed are so torrential that nothing can hold them.[38]

Group MPY practice brings about similar effects, though milder in degree. "Individual energies" are indeed stimulated as the strength, stamina and agility of individual practitioners increase. Especially during large workshops and conventions, when hundreds of people gather together, the participants often claim to be able to "do more". Individual limitations are transcended and progress is facilitated. It is likely that mutual synchronisation between practitioners is the key factor contributing to this effect.

The other issue is the subjective effectiveness of the practice. In a group, the psychosomatic effects resulting from *āsana* performance seem more salient. The quietening, stimulation or exhilaration are much more visible, when participants are more numerous. Such sharing may be mediated by two mechanisms. On one hand, motor expressions of calmness or joy of one practitioner may be mirrored by others. On the other hand, sharing verbally guided somatosensory experience through its synchronous simulation may produce a similar result. Effects such as pain or stress relief are probably aided by the same mechanism.

The last issue concerns the influence of *āsana* practice on the transmission of religio-philosophical notions. It has been postulated on numerous occasions that participation in rituals may aid the acceptance of doctrine. In a truly cognitivist vein, Durkheim appreciates the power of ritual to exert "invisible influence over consciousnesses" and its "manner of affecting our states of mind". The "moral support" offered by the community in a ritual setting creates a "predisposition toward believing", regardless of any inconsistencies in doctrinal statements.[39] Almost a century later, Harvey Whitehouse highlights the ability of highly arousing rituals to facilitate memorising experiences and concepts through activating *flashbulb memory* – memory of an episodic kind, using particularly vivid and detailed visual representations.[40] Scott Atran points out that in a ritual setting aversive stimuli (i.e. related with initiatory practices) are usually paired with the feeling of social acceptance.[41] This mixture may contribute to a better memorisation of doctrinal concepts. Moreover, "ritual ceremonies... rivet attention on specific and conspicuous sources of sensory stimulation, including stimulation emanating from one's own body."[42] If, then, doctrinal knowledge somehow corresponds to those embodied stimuli, and is encoded not only in discourse, but also in modes of behaviour, its transfer may be greatly facilitated.[43]

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[38] *Ibidem*, p. 218.

[39] É. Durkheim, *op.cit.*, pp. 364–365.

[40] H. Whitehouse, *Modes of Religiosity. A Cognitive Theory of Religious Transmission*, Oxford 2004, p. 106 ff.

[41] S. Atran, *In Gods We Trust. The Evolutionary Landscape of Religion*, Oxford 2002, p. 174.

[42] *Ibidem*, p. 181.

[43] See S. Schüler, *Religion, Kognition, Evolution. Eine Religionswissenschaftliche Auseinanderung mit der Cognitive Science of Religion*, Stuttgart 2012, p. 191.

During MPY ritual, naturally, there can be no talk of strongly aversive stimuli typical of traditional initiatory rites. However, the factor of increased social cohesion is definitely present. Positive evaluation of social interaction during practice may contribute to a more accepting attitude towards the religio-philosophical notions presented along the way. This is especially the case if these notions are incorporated into the ritual, e.g. through providing a particular *āsana* sequence with a motto in the form of a given *sūtra* from the collection of *Patañjali*. With IY, what is especially relevant is that all categories of *Pātañjala Yoga* are translated into the *āsana* experience. One of Iyengar's famed claims is that within *āsana*, all limbs of *aṣṭāṅga yoga* may be practiced.[44] Careful investigation of other concepts stemming from *Sāṃkhya-Yoga*, such as the aforementioned notion of *puruṣa*, proves that their interpretation is grounded in Iyengar's long-lasting experience related to *āsana* and *prāṇāyāma* performance. In other words, doctrinal concepts, thanks to their embodied interpretation, may be *felt*. If this feeling is shared and amplified through synchronisation, the said concepts may be comprehended more easily.

To illustrate this claim, one may once again refer to Iyenagar's understanding of *buddhi* and *puruṣa*. As noted above, *buddhi* is construed as fluid that should be distributed evenly inside the body. In this fluid, *puruṣa* should be diffused – dissolved or dispersed like particles in a suspension. This conceptualisation has its source in the specific somatosensory experience associated with IY *āsana* performance. As the teacher describes the movements of particular body parts, the practitioners' attention moves along and inside the body, bringing about the notion of fluidity. As the practice progresses, and postures are refined, multiple body parts and their configurations are felt simultaneously. This results in the notion of the fluid filling the entire body evenly. Naturally, to recreate this kind of interoceptive experience one does not need group practice. Becoming familiar with the IY style of *āsana* performance and applying it individually may be sufficient. However, sharing the somatosensory patterns through synchronisation may contribute to their greater salience. During group *āsana* ritual the practitioners are likely to feel more and with greater intensity. Like many other issues raised by this paper, this one also requires further study.

Conclusion

The foregoing discussion hopefully directed attention to the ways in which MPY group *āsana* practice promotes sensorimotor synchronisation. Since synchronisation goes beyond co-regulation of motor patterns and provides grounds for sharing somatosensory experience, it may be expected that participation in group *āsana* rituals contributes to shared proprioception and interoception, including shared feelings of emotion. This may contribute to the observed subjective efficacy of the practice (in the form of positive psychosomatic effects). It may also be a factor facilitating the transfer of doctrinal notions. To verify this hypothesis, empirical studies should be

[44] B.K.S. Iyenagar, *Yoga Vṛkṣa*..., pp. 51–76.

designed that investigate both the behavioural and the neuronal correlates of synchronisation. Special attention should be given not only to cases of mirroring, but also to the role of language in triggering shared motor activity and somatosensory experience. Apart from group practice, individual practice should be studied as well, to investigate the existence and the effects of the postulated *proprioception-action loop*, and of forms of self-entrainment. During experimental research, modes and effects of sensorimotor synchronisation in different strands of MPY (such as IY and AV) should be compared. The differences between beginner and advanced practitioners should be considered, too, as well as the effects of long-term practice on the ability to simulate and synchronise both motor and somatosensory states. Finally, the influence of synchronisation on the comprehension and acceptance of doctrinal notions should be investigated. Careful analysis of the results of such research may not only provide additional insight into the phenomenon of synchronisation itself, but it may also contribute to a better understanding of the increasing global popularity of modern forms of yoga practice.

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