

The Phenomenological Origins of Property

by

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A thesis
presented to the University of Waterloo
in fulfillment of the
thesis requirement for the degree of
Master of Arts
in
Philosophy

Waterloo, Ontario, Canada, 2018

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Abstract

This thesis delineates the phenomenological basis of ownership and property. The *phenomenological theory* of property has three main elements: the minimal self, the relationship between the sense of agency and the sense of ownership, and the psychological phenomenon of associative self-anchoring. The well established neurocognitive concept of the minimal self encapsulates a person's immediate self-consciousness, and the non-conceptual senses of agency and ownership are two integral constituents of this immediate sensory experience. Notably, this sense of self is typified by a *motor intentionality* (i.e., the minimal self is primed for goal-directed actions). The motor character of the minimal self primarily manifests itself in the construct of the body schema—a dynamic mental model of the body that functions as an instrument of directed action. A remarkable feature of the body schema is that it expands to incorporate extracorporeal objects that are objectively controlled by the person (e.g., grasping a pen or holding an umbrella). Moreover, this embodiment of extracorporeal objects is accompanied by the phenomenological feeling of ownership towards the embodied objects. In fact, I demonstrate with the aid of empirical evidence from cognitive neuroscience and neuropsychology that the sense of ownership and the sense of agency are inextricably linked, and that the sense of agency modulates (engenders) the sense of ownership. In other words, the mere experience of agency over an object is capable of evoking the sense of ownership—the influence of the sense of agency in eliciting the sense of ownership is moderated by gestalt-like principles of priority, consistency, and exclusivity. In addendum, the non-conceptual sense of ownership is shaped and strengthened by the formation of implicit self-object associations—people psychologically associate themselves with their possessions. Altogether, the motor-intentional nature of the self, the inherent sensory experience of ownership, and the capacity to establish self-object psychological associations make the concept of personal property a natural correlate of mechanisms that lead to the development of self-perception and representation. The phenomenological theory also elucidates the psychological literature on ownership judgments and the vague concept of intellectual property. It is also emphasised that aspects of this property theory are analogous to Hegel's theory of property. As a result, the phenomenological theory may have implications for Hegelian conceptions of property, and can aid them in determining legitimate property relations—these typically denote a close connection between property and personhood.

Acknowledgements

I would like to thank Ori Friedman, for sparking my interest in the topic of ownership, and helping me traverse the immense literature on ownership and property. I also owe deep gratitude to my supervisor, John Turri, who encouraged me to pursue this topic, and who patiently provided judicious intellectual support throughout the long ‘exhausting struggle’¹ of writing a thesis. And finally, I would like to thank my parents, Shehla and Riaz, for financially helping a (yet another) poor graduate student.

¹‘Writing ... is a horrible, exhausting struggle, like a long bout of some painful illness. One would never undertake such a thing if one were not driven on by some demon whom one can neither resist nor understand.’ George Orwell, “Why I Write”, *Gangrel* (Summer 1946).

Dedication

This thesis is dedicated to the many strong women in my life.

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Chapter 1

Introduction

This thesis is an exposition on the nature of ownership and property. The kernel of the account presented is a phenomenological theory of property that posits a deep connection between the sense of self and the neuropsychological concept of ownership. A remarkable consequence of the theory is the fact that appropriation of property is an intrinsic feature of human beings—in fact, property is a necessary component of self development. Additionally, despite the power of the theory to explain a wide range of psychological phenomenon, the underlying cognitive principles are deceptively simple. Notably, the theory is firmly grounded in the empirical sciences—in particular, cognitive neuroscience and neuropsychology.

In what is to follow, I will elucidate the basic cognitive mechanisms at work in ownership perceptions, and establish the principles of the new theory. The next segment, Chapter 2, introduces the concept of the minimal self, and demonstrates that the sense of ownership is a key component of rudimentary self-consciousness. In addition, I showcase that the sense of self is characterized by a motor intentionality (or a ‘motor power’) in the form of the body schema— an adaptive and functional action-oriented model of the ‘body’, capable of embodying extracorporeal objects. In Chapter 3, I establish that perceived agency is a powerful cognitive primer to the sense of ownership. Chapter 4 synthesizes the concept of the preceding two chapters with elements of associative psychology to delineate the mechanism of object ownership. Notably, the described mechanism of property acquisition is a natural correlate of human self development. Chapter 5 employs the derived principles to shed light on the psychological aspects of ownership— i.e., judgments and metarepresentations of ownership. The epilogue, Chapter 6, suggests that the theory may have normative implications for the moral and legal direction of property rights.

The current chapter will be more historical. Specifically, to properly frame the ensuing discourse, I shall conduct a brief survey of prominent property theories. The historical overview will not only allow us to see the shortcomings of existing property theories, but also enable me to appropriate any prescience elements that they may contain.

There have been several major (often conflicting) philosophical accounts on the origin and nature of property— prominent, among these, are the theses of Plato, Aristotle, Hegel, Locke, Hume, Kant, Marx, Bentham, and Mill.¹ In order to traverse the broad theoretical landscape, I will classify property theories into three general groups: rights based theories, conventional and utilitarian theories, and sociobiological/evolutionary theories. Rights based theories can be further divided into two distinct lines of justifications: special property rights (the notion that property rights are attained either by performing specific actions or through certain events happening), and the general right to property.²

1.1 Locke’s Labor Theory of Property

The preeminent conception of a special rights based theory of property is Locke’s ‘labor-desert’ theory. Locke faced the problem of devising a natural account of private property constrained by the ordains of Scripture: If God gave the world in common to all men, ‘it seems to some a very great difficulty how any one should ever come to have a Property in any thing’.³ In order to develop an account of ‘just acquisition’, Locke conceives of the person in the state of nature and emphasizes the moral significance of labor. Specifically, by performing labour on a natural object (e.g., farming a piece of land), the person imbues some or all of their intrinsic bodily rights onto the object — transforming the natural object into private property.

[E]very Man has a Property in his own Person. This no Body has any Right to but himself. The Labour of his Body, and the Work of his Hands, we may say, are properly his. Whatsoever then he removes out of the State that Nature

¹For a brief historical overview of theses on property and ownership, see Waldron, Jeremy, “Property and Ownership”, *The Stanford Encyclopedia of Philosophy* (2016), Edward Zalta (ed.), URL = <<https://plato.stanford.edu/archives/win2016/entries/property/>>. Alternatively, for a comprehensive and excellent analysis of private property justifications, see Jeremy Waldron, *The Right to Private Property* (Oxford: Oxford University Press 1988).

²The distinction is formally introduced by Jeremy Waldron in *The Right to Private Property*, p.3-25.

³John Locke, *The Second Treatise of Government*, in *Two Treatises of Government*, ed. Peter Laslett (Cambridge, 1963) §25.

hath provided, and left it in, he hath mixed his Labour with, and joynd to it something that is his own, and thereby makes it his Property [and] excludes the common right of other Men.⁴

Locke's labor-desert theory of property is a first occupancy theory— i.e., the first person to labor on a natural resource is privileged compared to all other people. Integrating the concept of first occupancy with the value of labor, the 'labor mixing' account provides a morally grounded concept of property that can theoretically arise without requiring any explicit social conventions or political arrangements— the unilateral and just acquisition of property is dictated by reason; it is not contingent on universal consent.

There are several loopholes and incoherencies in Locke's account. The most conspicuous is the ambiguity regarding the amount and type of labour required to establish possession. In an influential thought experiment, Nozick demonstrated the point vividly: 'If I own a can of tomato juice and spill it in the sea ... do I thereby come to own the sea, or have I foolishly dissipated my tomato juice?'⁵ A second complication is the scope of the justification provided by Locke. As Margaret Radin points out, Locke's account of just acquisition is situated in the state of nature, but in 'a heroic inferential leap, he concludes that if property is justified under those conditions, then it is ipso facto justified in the capitalist market society with money and wage-labor.'⁶ The age-old charge that Locke's property account is 'the standard bourgeois theory', does not appear to be without merit.⁷

The inconsistencies in Locke's theory are not merely hypothetical; there are real world counterparts. Prior to the arrival of Britons, the Aborigines of Australia oversaw an expansive and sophisticated communal management of the landmass.⁸ Locke's theory does not consider the collective labor performed by the Aborigines, making the labor aspect of the theory somewhat confused.⁹ A related 'lacuna' was demonstrated by Hume and Kant. They noted that prior to laboring on a piece of land, the person has to exclude others from

⁴*Ibid.*, §28

⁵Robert Nozick, *Anarchy, State, and Utopia* (New York: Basic Books 1974), p.175

⁶Margaret Radin, "Property and Personhood", *Stanford Law Review* (1982): 957-1015, p.979.

⁷Carol M. Rose, "Possession as the Origin of Property," *The University of Chicago Law Review* 52, no.1 (1985): 73-88, p.73.

⁸Bill Gammage, *The Biggest Greatest Estate on Earth. How Aborigines Made Australia*, (Sydney: Allen & Unwin 2011).

⁹In the *Second Treatise*, Locke appears to ignore the possibility that land can be commonly owned and cultivated: 'God gave the World to Man in Common; but since he gave it them for their benefit, and the greatest Conveniences of Life they were capable to draw from it, it cannot be supposed he meant it should always remain *common and uncultivated*. He gave it to use of the Industrious and Rational (and Labour was to be his Title to it); ... [emphasis added].' Quoted in Waldron 1988, *op. cit.*, p.171.

trespassing, in order to ensure that common rights to the land does not interfere with their (i.e., the person's) intended project. If that is the case, then Locke's labor theory 'is either redundant or inadequate'.¹⁰

1.2 The Hegelian Conception of Property

According to the legal and political philosopher Jeremy Waldron, among the most comprehensive general right based property theories is Hegel's conception of property in the *Philosophy of Right*— in particular, the first part, Abstract Right.¹¹ In there, Hegel asserts that object relations are necessary to transition from an abstract autonomy to a 'definite recognizable existence'— 'the person must give its freedom an external sphere in order to exist as Idea.'¹² To that end, the abstract will of the person embodies objects in the external world ('sphere') in order to objectively exist. Therefore, in essence, property is the externalization of a person's will— i.e., an embodiment of their personality. Notably, in Hegel's framework, the designated embodiment of inanimate objects is legitimate 'because the thing has no end in itself; its destiny and soul take on [the person's] will'.¹³

Hegel describes three different modes of embodying objects: 'grasping it physically', 'imposition of form' (i.e., creating or forming an article), and 'marking the object'.¹⁴ In the first mode, the will of the person is directly present in the grasped object—i.e., the object is directly under the person's control and that that constitutes ownership. Alternatively, the second method yields the creator of an object as the genuine owner. Despite superficial similarities to labour based principles (i.e., ownership of an object is granted to the person that labored on the object), the underlying reasoning of Hegel's second mode of ownership is quite different—the essential idea in Hegel is that the object belongs to the creator because the formed object is an expression of the person's will. As to the last mode of appropriation, the rationale is that the mark is a public representation of the fact that the marker has placed their will in the imprinted object. All three modes require the object to be *res nullius* (ownerless) in order to take proper effect.

It should be noted that Hegel's theory of property, in contrast to Locke's theory, does not grant an indefinite right to possess objects. The will of the person must be present in

¹⁰ *Ibid.*, p.173-174

¹¹ Hegel, G.W.F., *Philosophy of Right* [1821], trans. TM Knox. (Oxford: Oxford University Press 1967).

¹² *Ibid.*, §41. Hegel was an idealist, so in his metaphysics, a thing had to exist foremost as an Idea.

¹³ *Ibid.*, §44.

¹⁴ Dudley Knowles, "Hegel on Property and Personality," *The Philosophical Quarterly* (1950-) 33, no.130 (1983): 45-62.

the object to constitute ownership.¹⁵ Another important feature of the Hegelian property framework is the connection between property and ethical development of the person—property is necessary to achieve adequate self-expression, enable mutual recognition (‘Be a person and respect others as persons’), and promote responsible agency. This connection between ethical development of the person and private property has been construed by some legal philosophers to constitute the foundations on which to develop theories of property that argue for a general right to property—i.e., ‘everyone must have property’.¹⁶

The close connection between property and personhood also leads to the idea that there should be a legal and moral dichotomy in property rights. Margaret Radin is a prominent proponent of such a dichotomy and distinguishes two types of property—personal and fungible. Personal property is property that is closely intertwined with personhood—objects that are ‘part of the way we constitute ourselves as continuing personal entities in the world.’ Alternatively, fungible property is property that is void of any deep connections to personhood and is held for ‘purely instrumental reasons.’ Radin suggests that personal property should be accorded greater legal protection than fungible property—personal property ‘gives rise to a stronger moral claim’. In short, the neo-Hegelian personhood perspective provides a general justification of property rights ‘in terms of their relationship to personhood’, and that yields property entitlements on a continuum—‘[t]he more closely connected with personhood, the stronger the entitlement’.¹⁷

Aspects of Hegel’s property theory, extricated from the associated theory of historical development and Hegelian idealism, are discernable in the phenomenological theory of property that I develop in this paper. In particular, the notion of embodied will possesses a neurocognitive analog in my theory—importantly, the phenomenological quality of Hegel’s mode of appropriation is retained. Moreover, the important relationship between property and personhood delineated by the Hegelians, provides the basis to construe moral implications of the theory articulated in this essay.

1.3 Utilitarian & Evolutionary Property Theories

In direct opposition to the aforementioned rights based theories is the idea that property is wholly conventional. Prominent manifestations of this viewpoint are Humean convention-

¹⁵‘Since property is the *embodiment* of personality [*Dasein der Personlichkeit*], my inward idea and will that something is mine is not enough to make it my property; to secure this end occupancy [*die Besitzergreifung*] is requisite.’ Hegel, *op. cit.*, §51.

¹⁶Waldron 1988, *op. cit.*, p.4.

¹⁷Radin, *op. cit.*

alism and utilitarian property theories. In Hume's view, property is an artificial construct that emerges as a consequence of settled social rules to 'bestow stability on the possession of...external goods'. Prior to the establishment of property rules, possession of objects is driven by factors such as physical force, chance, coercion and shrewdness until resources are distributed such that it is favorable for an individual to 'leave another in the possession of his goods, provided he will act in the same manner'; the resulting diminishment of conflict is a prerequisite for the institution of social rules governing property.¹⁸ Comparable sentiments are expressed by the utilitarian Jeremy Bentham, who remarked that 'the idea of property consists in an established expectation.'¹⁹ In particular, Bentham believed that the requisite expectations can only be established by law. 'A feeble and momentary expectation may result from time to time from circumstances purely physical: but a strong and permanent expectation can only arise from law.'²⁰ Accordingly, Bentham viewed any talk of natural property rights (and natural rights in general) as 'nonsense upon stilts.'²¹

There is probably some truth in Hume and Bentham's assertion that laws and social norms stabilize property relations. But as we will see later, the view that property is entirely conventional is undermined by direct empirical evidence from a wide range of investigative domains—in fact, the evidence suggests that acquisition of property is as natural as the acquisition of language.

The notion that accumulation of property is akin to language acquisition is a good segway to the last category of property theories—i.e., sociobiological/evolutionary theories of property. The foremost amongst these is the 'territorial imperative' theory deriving from Freud and Darwin.²² A notable contemporary proponent is Jeffery Stake.

Stake argues that humans have a 'property instinct' analogous to the concept of a 'language instinct' in theories of language.²³ In the context of such a theoretical framework, the general property instinct shared by all humans can give rise to various manifestations that may or may not be encoded in law. Stake attempts to demonstrate that a large number of property laws do indeed possess an evolutionary explanation — including First in Time, First in Right feature of property laws, inheritance laws and the idiosyncratic adverse possession doctrine. The evidence provided in support of the notion that certain

¹⁸David Hume, *A Treatise of Human Nature* [1739] L.A. Selby-Bigge and P. H. Nidditch (eds.), (Oxford: Clarendon Press 1978), p.489-90.

¹⁹Jeremy Bentham, *Theory of Legislation* (R. Hildreth trans. 1840) (1st ed. 1802), p.112.

²⁰Waldron 1988, *op. cit.*, p.196.

²¹Waldron 1988, *op. cit.*, p.16 & 83.

²²Sigmund Freud, *Civilization and Its Discontents*, in Vol 21 of *The Complete Psychological Works of Sigmund Freud* (The Standard Edition) (Strachey ed. 1964), p. 111-14.

²³Jeffery Stake, "The property 'instinct'," *Philosophical Transactions of the Royal Society B: Biological Sciences* 359, no.1451 (2004), 1763-1774.

property laws are ‘grounded’ in evolutionary strategies is of varying quality, but more importantly, Stake’s central argument that these fragmented and diverging strategies constitute a property instinct seems strained. A recurring problem with Stake’s theory is that it is hard to disentangle whether a particular property law is the result of an evolutionary strategy hardwired into our brains, or merely the utilitarian implementation of some general strategy that has a stabilizing effect on human societies. In addition, the studies cited by Stake could plausibly be interpreted in a number of different ways. This makes it hard to adjudge Stake’s conception of a property instinct.

With that said, Stake’s idea that there is a property instinct is not wrong. The problem lies in the fact that the sociobiological/evolutionary account of property grossly underrates the fundamental nature of the property instinct. Instead of a disparate set of evolutionary strategies, the instinct to acquire property is closely tied with the emergence of the sense of self—i.e., property is a reflection of an intrinsic facet of our nature. That is the account of ownership and property I will develop in the remainder of the thesis—an account that stems from the human sense of self and designates property acquisition as an essential component of self development.

Chapter 2

The Minimal Self

The existence of an intrinsic relationship between ownership and the concept of *self* is *prima facie* tenuous. Ownership is an ubiquitous phenomenon, extending to objects that are not explicitly related to the self; whereas the self generally involves what William James referred to as ‘the feeling of the same old body always there’.¹ The apparent discrepancy suggests that constructing a theory of ownership based on the notion of self is a specious endeavour. But contemporary developments in the philosophy of mind and cognitive sciences are eroding that impression, and instead, giving way to the idea that the phenomenal experiences of ownership and self are *in fact* interminably linked. The pivotal theoretic approach of the *minimal self* underpins many of these developments. Indeed, the minimal self provides the groundwork for the establishment of a neurocognitive theory of ownership.

2.1 Two Concepts of Self

The minimal self is a rudimentary entity restrained to ‘immediate self-consciousness’ and devoid of temporal continuity. Shaun Gallagher, in an influential paper on philosophical conceptions of the self, describes the minimal self ‘as an immediate subject of experience, unextended in time’ and ‘almost certainly’ dependent on ‘an ecologically embedded body’. The minimal self is not concerned with issues of personal identity, and in particular, does not address the *persistence question* (i.e., the ‘continuity of identity’ we typically

¹William James, *The Principles of Psychology* [1890] (Cambridge, MA: Harvard University Press 1983), p.242.

experience).² To resolve those questions, philosophers generally have to grapple with conceptions of self extended in time. For instance, Hume argued that personal identity is a fiction. The person is ‘nothing but a bundle or collection of different perceptions’ and the extended self is an illusion of the mind.³ Daniel Dennett developed a contemporary model of Hume’s notion of personal identity termed the narrative theory of self. Informed by modern neuroscience, the narrative theory of self points to the fact that neural processing is distributed over different brain regions and that isolating a neurologically grounded centre of experience is close to impossible. Instead, people employ the distinctive human capacity of language to weave narratives around themselves and that these ‘stories’ about oneself make existence coherent across time. Dennett proceeds to propose that the self is ‘a centre of narrative gravity’—the abstract point ‘where the various stories told about the person, by himself and others, meet.’⁴

The narrative self is also composed of non-fictional biography and Gallagher notes that that requires a reliable episodic memory. In fact, the importance of memory in the constitution of the person precedes theories of the narrative self. Notably, Locke considered a person to be ‘a thinking intelligent being’ endowed with episodic memory that ‘can consider itself as itself, the same thinking thing, in different times and places.’⁵ Michael Gazzaniga integrated these ideas with results from studies on split-brain patients to propose that the fictional and non-fictional aspects of the extended self are imbricated by the ‘interpreter’ in the left hemisphere to produce intelligible narratives that constitute the extended self.⁶

The ideas of Hume, Locke, Dennett, Gazzaniga, and Gallagher, among others, regarding the nature of the extended self are important but they will not be the focus of attention moving forward. Instead, the emphasis in this section would be on the minimal self, void of long term continuity and accompanying conceptual considerations, but essential to understanding the origins of the concept of ownership (having said that, after I establish

²Shaun Gallagher, “Philosophical conceptions of the self: implications for cognitive science,” *Trends in Cognitive Sciences* 4, no.1 (2000): 14-21.

³David Hume, “Of Personal Identity”, in *A Treatise Of Human Nature* [1739] (Oxford: Clarendon Press 1978), p.252.

⁴Daniel Dennett, *Consciousness Explained*, (Little Brown & Co 1991). Ricoeur also discussed the role of narratives in conceiving the self and proposed a more dynamic conception of the narrative self compared to Dennett’s ‘centre of narrative gravity’ model. Paul Ricoeur, *Oneself As Another*, (University of Chicago Press, transl. from *Soi-même comme un autre*, Editions du Seuil, 1990). See also Gallagher, *op.cit.*, p.18-20.

⁵John Locke, *An Essay Concerning Human Understanding* [2nd ed. 1694], (ed. P. Nidditch, Oxford: Clarendon Press 1975), p.335.

⁶Michael Gazzaniga, *The Mind’s Past*, (Basic Books 1998).

the connection between ownership and the minimal self, the extended self will re-emerge in construing people's judgments of ownership within the framework of the developed theory).

The sense of self-agency and sense of self-ownership are two intimately related aspects of minimal self-awareness (at least in non-pathological cases).⁷ Self-ownership is the persistent perception that 'my body' belongs to 'me'. Self-agency is the impression that 'I' am the generator of an action. Gallagher differentiates these two aspects of the minimal self in the context of motor action—the experiences of ownership and agency are extricated by comparing voluntary (or willed) actions (e.g., when I move my arm) with involuntary actions (e.g., when my arm is moved by another person). The senses of ownership and agency are also distinguished by considering the breakdown of the immunity principle. The principle states that there can not be a self-reference mistake in the use of the first person pronoun 'I' in cases not entailing any 'perceptual or reflective act of consciousness'—i.e., cases of *immediate* and *non-observational* first person experience.⁸ Borrowing from both Campbell and Frith, Gallagher argues that certain schizophrenic experiences (e.g., auditory hallucinations) may indicate the breakdown of the immunity principle and that this malfunctioning of the immediate (minimal) self is caused by the sense of agency being compromised.⁹

Discussion of the immunity principle and its potential collapse, though useful in introducing certain elements of the minimal self, is not the primary mode of approaching the subject. In fact, the formation of the minimal self precedes the development of linguistic and conceptual capacities—the minimal self initially emerges as a 'pre-linguistic'

⁷There has been a deluge of scholarship on the sense of agency and sense of ownership, and their respective contributions to the structure of the minimal self. For instance, Matthis Synofzik et. al proposed a systematic neurocognitive account of ownership and agency with graded functional layers. They '[proceed] from basic non-conceptual sensorimotor processes to more complex conceptual and meta-representational processes of agency and ownership, respectively'. Synofzik, Vosgerau, and Newen, "I move, therefore I am: A new theoretical framework to investigate agency and ownership", *Consciousness and Cognition* 17, no.2 (2008): 411-424.

⁸The immunity principle is an important corollary of expressivism—the view that self attribution of mental states ('self-ascriptions') are bare expressions of mental states rather than reports or descriptions. Expressivism generally traces its origins to Wittgenstein. See Wittgenstein, *Remarks on the Philosophy of Psychology*, Vol. I (Oxford: Basil Blackwell 1980); and also Rodney Jacobsen, "Wittgenstein on Self-Knowledge and Self-Expression", *The Philosophical Quarterly* (1950-) 46, no.182 (1996): 12-30.

⁹Gallagher, *op. cit.* The idea that certain schizophrenic experiences violate the immunity principle is postulated by Campbell in "Schizophrenia, The Space of Reasons, and Thinking as a Motor Process", *The Monist* 82, no.4 (1999): 609-625. Conversely, explaining certain schizophrenic experiences in terms of dysfunctional self-agency generating mechanisms is suggested by Frith in *The Cognitive Neuropsychology of Schizophrenia* (Psychology Press 2014).

and ‘ecological’ self-awareness in neonates.¹⁰ Tracing the development of rudimentary self-awareness in young infants, Verschoor and Hommel, delineate the relationship between the sense of ownership, sense of agency, and the minimal self in a recent paper.¹¹ They discuss evidence that the minimal self emerges by performing actions in the external environment—to borrow from Descartes’ prose, ‘I move, therefore I am.’

2.2 Theory of Ideomotor Learning & Predictive Coding

Elementary goal directed actions can be observed in neonates less than an hour old,¹² whereas 5-month old infants are able to perform the more complex action of grasping interesting physical objects in their vicinity.¹³ Movement and corresponding visual information leads to the earliest signatures of self-recognition. In a study conducted by Courage et al., mirror self-recognition preceded both the use of personal pronouns (‘self-referent language’) and photo identification.¹⁴ Verschoor and Hommel posit¹⁵ that these self-recognition studies indicate that the minimal self ‘is derived from perceived agency’ and ‘that infants apparently learn to predict the sensory effects of their bodily movements before they are actually able to experience *ownership of their mirror image* [emphasis added].’ An even stronger inference that one can draw from early indices of self-recognition is that the experience of self-agency is a prerequisite for the experience of self-ownership.

Tentatively accepting the inferred causal sequence of agency and ownership leaves us requiring the precise mechanism that leads to the development of the inceptive sense of agency. A promising contemporary account is proposed by Verschoor and Hommel in

¹⁰See Synofzik, Vosgerau, and Newen, *op. cit.* See also Gallagher, *ibid*, p.17.

¹¹Stephan A. Verschoor, and Bernhard Hommel, “Self-by-doing: The role of action for self-acquisition”, *Social Cognition* 35, no.2 (2017): 127-145.

¹²For studies on goal directed actions in neonates, see Andrew N. Meltzoff and M. Keith Moore, “Newborn Infants Imitate Adult Facial Gestures”, *Child Development* (1983): 702-709; George Butterworth and Brian Hopkins, “Handmouth coordination in the newborn baby”, *British Journal of Developmental Psychology* 6, no.4 (1988): 303-314; and Bennett I. Bertenthal, “Origins and Early Development of Perception, Action, and Representation” *Annual Review of Psychology* 47, no.1 (1996): 431-459.

¹³Bennett I. Bertenthal and Rachel K. Clifton, “Perception and action”, in *Handbook of child psychology: Vol. 2. Cognition, perception and language*, ed. D. K. W. Damon & R. Siegler (New York: Wiley 1998), 51-102. See also Verschoor and Hommel, *op. cit.*

¹⁴Mary L. Courage, Shannon C. Edison, and Mark L. Howe, “Variability in the early development of visual self-recognition”, *Infant Behavior and Development* 27, no.4 (2004): 509-532.

¹⁵Verschoor and Hommel, *op. cit.*, p.130-1

their aforementioned paper.¹⁶ They argue that unequivocal signs of *intentional* goal directed actions—where ‘expected action outcomes [are taken] into account when deciding which action to perform’—occur no earlier than 9 months of age. The authors argue that bidirectional associations between actions and their anticipated effects is required for the acquisition of genuine action control.¹⁷ In their theoretical framework, the bidirectional associations are established by means of ideomotor learning.

The process of ideomotor learning leading to the acquirement of voluntary action control is an idea that dates back to William James and Hermann Lotze. In the *Principles of Psychology*, James writes that ‘... if, in voluntary action properly so-called, the act must be foreseen, it follows that no creature not endowed with divinatory power can perform an act voluntarily for the first time.’¹⁸ The rule James invokes is that intentional goal directed actions demand knowledge of the expected effects. In turn, that leads to the principle, that to truly ‘anticipate the likely outcome of an action’ requires ‘knowledge about the relationship between the action and its effects’.

The knowledge of goal directed actions and their effects is attained by performing exploratory movements in the environment and forming bidirectional associations between actions and the associated perceptual changes—i.e., ideomotor learning. A bidirectional association entails that sensory effects associated with actions are capable of evoking actions—e.g., ‘thinking’ of the sensory effect activates the ‘effect’s internal representation’ and prompts the generation of the associated action. In short, bidirectional associations render the possibility of voluntary actions (‘action selection’). The database of action-effect associations is constructed during early years of life ‘through active interaction with one’s physical and social environment.’ Young infants may also be learning from actions they do not perform themselves. For instance, 6-month olds are able to predict the action goals of others.¹⁹

Next, to explain the sense of agency, Verschoor and Hommel combine ideomotor learning with predictive coding in their theory. The perception of agency arises by matching the predicted effects of movement (derived by ideomotor learning) with the actual effects. A discrepancy between predicted effect and actual effects diminishes (or eliminates) the sense

¹⁶Verschoor and Hommel, *ibid.*

¹⁷Verschoor and Hommel, *ibid.*, 129-134. See also Verschoor, Spapé, Biro, & Hommel, “From outcome prediction to action selection: developmental change in the role of action-effect bindings”, *Developmental Science* 16, no.6 (2013): 801-814.

¹⁸William James, *op. cit.*, p.487; Rudolf Hermann Lotze, *Medicinische Psychologie oder die Physiologie der Seele*, (Leipzig: Weidmann’sche Buchhandlung 1852).

¹⁹Kazunori Kamewari, Masaharu Kato, Takayuki Kanda, Hiroshi Ishiguro, and Kazuo Hiraki, “Six-and-a-half-month-old children positively attribute goals to human action and to humanoid-robot motion”, *Cognitive Development* 20, no.2 (2005): 303-320.

of agency whereas an adequate match generates the experience of agency. The view that agency is a result of ‘predictive motor control’ is prevalent in contemporary neuroscience.²⁰

To complete the construction of the minimal self, Verschoor and Hommel, hypothesize (on the basis of recent studies) that the sense of self-ownership arises by integrating sources of information that generate agency with interoceptive information (i.e., internal stimuli). Again, the implication is that the sense of ownership trails the development of the sense of agency, and constitutes a more complex experience. The timeline of agency preceding ownership is also conducive to the growth of motor capabilities—people are able to represent the actions of others in analogous manner to their own actions, and the fact that young infants are unable to discriminate between self and other generated actions may be better for motor learning.²¹ Later, the acquisition of the sense of self-ownership consummates the minimal self.

2.3 The Body Schema

The notion that perceived agency leads to the sense of ownership, and therefore ‘selfhood’, is more explicitly supported in theories of the self based on the body schema. Homes and Head introduced the notion of the body schema in a paper on sensory disturbances associated with cerebral lesions.²² The body schema is a ‘coherent and dynamically updated’ representation enabling actions and movements. It is distinct from the *body image*—a ‘conscious representation’ based on ‘perceptual’ body features. Notably, the dynamic nature of the body schema permits action control to extend beyond the body to objects in the external world—i.e., the body schema is intrinsically action oriented.²³

The construal of the body schema as a non-conceptual and embodied minimal self originates in the writings of the French philosopher, Maurice MerleauPonty:

In so far as I have a body through which I act in the world, space and time are not, for me, a collection of adjacent points nor are they a limitless number of

²⁰For a review of conscious motor intention and agency, see Patrick Haggard, “Conscious intention and motor cognition”, *Trends in Cognitive Sciences* 9, no.6 (2005): 290-295.

²¹Verschoor and Hommel, *op. cit.*, p.139.

²²Henry Head and Gordon Holmes. “Sensory disturbances from cerebral lesions”, *Brain* 34, no.2-3 (1911): 102-254.

²³Vittorio Gallese and Corrado Sinigaglia. “The bodily self as power for action.” *Neuropsychologia* 48, no.3 (2010): 746-755. On the conceptual delineation of the body schema and body image, see Shaun Gallagher, “Body Image and Body Schema: A Conceptual Clarification.” *The Journal of Mind and Behavior* (1986): 541-554.

relations synthesized by my consciousness, and into which it draws my body I belong to them, my body combines with them and includes them. Our bodily experience of movement *provides us with a way of access to the world and the object, with a 'praktognosia', which has to be recognized as original and perhaps as primary.* My body has its world, or understands its world, without having to make use of my 'symbolic' or 'objectifying function'[emphasis added].²⁴

In the quoted passage, MerleauPonty is suggesting that there is a basic and essential self represented by the body schema. He notes that the body schema is 'neither the mere copy nor even the global awareness of the existing parts of the body' ; it is the 'active integration of these latter only in proportion to their value to the organism's projects.' In brief, the body schema is characterized by action potentiality—i.e., not 'a spatiality of position, but a spatiality of situation.'²⁵

Another important observation that MerleauPonty makes in the passage is the notion that the 'body combines with' and 'includes' space and time. The synthesis of body and space noted by MerleauPonty is evident in peripersonal space—the dynamic space surrounding body parts coded by certain neurons.²⁶ Neurons dynamically tracking peripersonal space are typically bimodal, possessing both somatosensory and visual receptive fields—i.e., they respond to visual stimuli (occurring in space near the body) and to tactile stimulation of the body. Additionally, these neurons appear to be operating within a motor scheme. The combination of motor and bimodal properties of these neurons coalesces body and peripersonal space into an instrument of directed action—the neural basis of MerleauPonty's 'motor intentionality'.²⁷

Consequently, the body schema (incorporating peripersonal space) yields a conception of the minimal self analogous to MerleauPonty's concept of body— a self 'as the potential source of a certain number of familiar actions'. This self gives rise to 'action having a field or scope' determined by the peripersonal space—where the peripersonal space is

²⁴Maurice Merleau-Ponty, *Phenomenology of Perception* (C Smith, trans. London, NY: Routledge 1962), p.162.

²⁵Merleau-Ponty, *ibid.*, p.114-5. See also Gallese and Sinigaglia, *op. cit.*

²⁶Giacomo Rizzolatti, Luciano Fadiga, Leonardo Fogassi, and Vittorio Gallese, "The Space Around Us", *Science* 277, no.5323 (1997): 190-191.

²⁷'[W]e are brought to the recognition of something between movement as a third person process and thought as a representation of movement—something which is an anticipation of, or arrival at, the objective and is ensured by the body itself as a motor power, a "motor project" (Bewegungsentwurf), a "motor intentionality" in the absence of which the order [to move] remains a dead letter.' Merleau-Ponty, *op. cit.*, p.126-7.

the ‘surroundings as a collection of possible points upon which [the] bodily action may operate.’²⁸

A contemporary theory of the minimal self that is also based on the body schema is proposed by Gallese and Sinigaglia.²⁹ Similar to MerleauPonty, the (embodied) self described is ‘enactive in nature’ and ‘primarily given to us as source or power for action’. They argue that the ‘minimal sense of self’, defined as the set of possible motor potentialities, ‘is at the same time a prerequisite and a core component of both the sense of agency and sense of ownership.’ Specifically, the ‘pre-noetic’ self is reflected in the body schema, a ‘dynamic binding principle [integrating] multiple sensory modalities’ and working ‘at the level of [pre-reflective] motor intentionality.’ In support, evidence from experimental studies is presented that shows intentional actions (perceived agency) mediate bodily self-awareness. Parieto-premotor networks, involved in goal directed actions, are advanced as the neural correlates of this minimal self experience.³⁰

Theories of the self centred around the body schema complement theories of self based on ideomotor learning and predictive coding—both construe the minimal self in terms of motor cognition. Moreover, they both reach equivalent conclusions regarding the genesis of self ownership. Verschoor and Hommel, in their paper on ideomotor learning and predictive coding, assert that perceived agency is the precursor of self recognition and ownership. In the same vein, the theory of Gallese and Sinigaglia postulates that ‘the potentiality for action of our bodily self is a necessary condition to accomplish the sense of body ownership.’ The underlying theme in both assertions is that the pre-reflective corporeal self-awareness, i.e., the experience of ‘the body as one’s own body’, is dependent on the availability of motor intentional features. In fact, it may very well be that ideomotor learning plays an integral role in the development of the body schema.

2.4 Mirror Mechanism & Object Affordances

Gallese and Sinigaglia also propose their own process of motor intentional development—i.e., the process of acquiring *praktognosia*. They point to the evidence showing that neonates and infants engage in social interactions to support the claim that the minimal self is nurtured by interacting with ‘other bodies’. More precisely, their theory states that social reciprocal capacities powered by the mirror neuron mechanism modulates the

²⁸MerleauPonty, *ibid.*, p.120-1.

²⁹Gallese and Sinigaglia, *op. cit.*

³⁰Gallese and Sinigaglia, *ibid.*, p.749; see also Haggard, *op. cit.*

minimal self. Mirror neurons encode both self actions and the actions of other people—i.e., they discharge both when we perform an action and also when we observe the action of others. In the early years of life, motor resonance produced by mirror neurons, facilitates ‘proto-conversation’ and imitation. These simple social interactions ‘promote the first forms of motor (and emotional) attunement with other bodies enabling infants to carve out their own [primitive] motor potentialities.’³¹

The mirror neuron mechanism is not only important in understanding action, but, more interestingly, permits the possibility of understanding observed actions ‘from the inside’ and yield a ‘first-person grasp of another individual’s motor goals and intentions.’³² In other words, these neurons provide a knowledge of motor actions distinct from both simple action-effect associative mechanisms (i.e., void of motor representation) and inference.³³ The contribution of motor intersubjectivity to the constitution of intentional goal directed actions is, unsurprisingly, foreshadowed in the writing of MerleauPonty:

It is true that often knowledge of other people lights up the way to self-knowledge: the spectacle outside him reveals to the child the meaning of its own impulses, by providing them with an aim. But the instance would pass unnoticed if it did not coincide with the inner possibilities of the child. The sense of the gestures is not given, but understood, that is, recaptured by an act on the spectator’s part. The whole difficulty is to conceive this act clearly without confusing it with a cognitive operation. *The communication or comprehension of gestures comes about through the reciprocity of my intentions and the gestures of others, of my gestures and intentions discernible in the conduct of other people. It is as if the other person’s intention inhabited my body and mine his* [emphasis added].³⁴

The mirror neuron mechanism is what renders the development of this intentional action understanding. To that end, Sinigaglia and Rizzolatti, after conducting an extensive review of the literature on mirror neurons, reiterate the conception of a minimal self grounded in

³¹Gallese and Sinigaglia, *ibid.*, p.752-3.

³²Giacomo Rizzolatti and Corrado Sinigaglia, “The functional role of the parieto-frontal mirror circuit: interpretations and misinterpretations”, *Nature Reviews Neuroscience* 11, no.4 (2010): 264-274.

³³Giacomo Rizzolatti, Leonardo Fogassi, and Vittorio Gallese, “Neurophysiological mechanisms underlying the understanding and imitation of action”, *Nature Reviews Neuroscience* 2, no.9 (2001): 661-670. To read more about the proposed role of inferential processing in understanding self and others, see Peter Carruthers, “How we know our own minds: The relationship between mindreading and metacognition”, *The Behavioral and Brain Sciences* 32 (2009): 121-182.

³⁴MerleauPonty, *op. cit.*, p.215.

motor possibilities—a conception where ‘we primarily experience ourselves and others in terms of our own and of their motor possibilities respectively.’³⁵

They begin by demonstrating that the mirror mechanism enables *instinctive* understanding of another person’s motor intentions. This is achieved by means of a special type of neuron termed ‘action-constrained’ neurons. These neurons (recorded in monkeys) are activated during specific actions but are fully activated when the associated action is performed in the context of a specific goal. For instance, the neurons maximally fire when a monkey grasps something to eat, but they partially fire when the primate grasps the object in order to place it elsewhere. Importantly, a subset of these neurons are also mirror neurons. The ‘action-constrained’ neurons with mirror properties maximally fire when the monkey observes the specific goal directed action (e.g., grasping food to eat) but not when the action is performed external to the associated goal (e.g., grasping to simply displace). This selective activation allows these neurons to be predictive of intentions underlying specific actions—i.e., they aid the observer in not only ascertaining the action, but also provide information regarding why the action is performed.³⁶ A slew of brain imaging studies reveal that mirror networks also modulate action intentions in humans.³⁷ Significantly, these mirror neuron networks present a cogent functional framework for understanding the emergence of intentional goal directed actions in infants.³⁸

In culminating their study, Sinigaglia and Rizzolatti, arrive at the minimal sense of self by considering affordances in the environment. The concept of affordance, introduced by James Gibson, denotes the assortment of motor actions *afforded* by objects in the surroundings.³⁹ Affordance does not simply entail the physical properties of objects, but refers to a property that involves both object and agent—i.e., the action possibilities that

³⁵Corrado Sinigaglia and Giacomo Rizzolatti, “Through the looking glass: Self and others”, *Consciousness and Cognition* 20, no.1 (2011): 64-74.

³⁶Leonardo Fogassi, Pier Francesco Ferrari, Benno Gesierich, Stefano Rozzi, Fabian Chersi, and Giacomo Rizzolatti, “Parietal Lobe: From Action Organization to Intention Understanding”, *Science* 308, no.5722 (2005): 662-667.

³⁷A summary of the brain imaging studies is provided in Sinigaglia and Rizzolatti, *op. cit.*, p.68. Interestingly, an EMG study indicated that children with autistic spectrum disorders (ASD) are unable to mirror the motor intentions of others, their motor intention networks did not activate during action observation. This would imply that these children have to understand the actions of others by means of inferential processing rather than the more instinctive mirror mechanism. Luigi Cattaneo, Maddalena Fabbri-Destro, Sonia Boria, Cinzia Pieraccini, Annalisa Monti, Giuseppe Cossu, and Giacomo Rizzolatti, “Impairment of actions chains in autism and its possible role in intention understanding”, *Proceedings of the National Academy of Sciences* 104, no.45 (2007): 17825-17830.

³⁸Gallese and Sinigaglia, *op. cit.*, p.753.

³⁹James J. Gibson, *The Ecological Approach to Visual Perception* (Classic Edition: Psychology Press, 2014).

a particular object presents to a particular agent. For instance, a walking cane offers several motor possibilities to a person; they can use the cane to assist in walking or wield the stick to defend themselves. Strikingly, evidence from neuroimaging studies and neurophysiology shows that the visual perception of an object generates ‘the suitable set of grasping-related motor representations’ irrespective of whether the person intends to interact with the object.⁴⁰ The implication being that object perception is ‘intertwined’ with action prospects.

Sinigaglia and Rizzolatti argue that the characterization that ‘action constitutively shapes the content of perception’ leads to the impression that ‘we become aware of ourselves as of the selves that can grasp, throw or kick.’ More importantly, they proceed to state that this ‘implies that we do not experience ourselves as a given entity (e.g. a physical body) and then realize that such an entity can grasp or kick’, but on ‘perceiving something as graspable or as kickable’ we become aware of ourselves as a motor potentiality.⁴¹ The mirror mechanism not only cultivates this sense of self but enables us to see others in virtue of their motor possibilities and actions (to the extent that their motor possibilities overlap with ours).

We have seen from three differing approaches (ideomotor learning, the body schema, and mirror neuron mechanism) that the minimal sense of self is formed enactively and that this sense of self is distinguished by a motor intentionality—i.e., the self is expressed as a motor capacity. Furthermore, the self as a ‘motor power’ is represented in the body schema—a versatile and dynamic action-oriented model of the ‘body’. Interestingly, both the body schema approach and the theory of ideomotor learning indicates that perceived agency is a sense of ownership prompt. A plausible interpretation of this correlation may be that the exercise of agency or the tangible perception of agential control, promotes the engenderment of the phenomenological sentiment of ownership. To corroborate this supposition, the next section will examine studies on body ownership in neuropsychology and cognitive neuroscience. These studies will aid in elucidating the often indeterminate relation between aspects of agency and the sense of ownership.

⁴⁰Sinigaglia and Rizzolatti, *op. cit.*, p.70; see also Laila Craighero, Luciano Fadiga, Giacomo Rizzolatti, and Carlo Umiltà, “Action for perception: A motor-visual attentional effect”, *Journal of Experimental Psychology: Human Perception and Performance* 25, no.6 (1999): 1673-1692.

⁴¹Sinigaglia and Rizzolatti, *ibid.*, p.71.

Chapter 3

Does Agency Modulate Ownership?

The precise relation between agency and ownership is a topic of continuing research and debate. In the realm of neuropsychology and cognitive neuroscience, there are two contending positions on the causal constitution of the relationship. The first position states that ownership and agency are ‘qualitatively different experiences, triggered by different inputs, and recruiting distinct brain networks.’¹ A second view asserts that agency modulates ownership—i.e., agency promotes the sense of ownership. This position is consistent with the evidence reviewed delineating the emergence of the minimal self. In fact, the second viewpoint corresponds to the hypothesis derived from the body schema approach and theory of ideomotor learning, proclaiming that perceived agency induces ownership. In this segment of the paper, I expound on an assortment of studies to support the latter point of view and validate the supposition derived in the preceding section.

3.1 Evidence From Atypical Neuropsychological Experiences

In order to gauge the connection between the sense of agency and the sense of ownership, it is instructive to begin by exploring the relationship between self-awareness of actions and sense of limb ownership. Investigating precisely this association, Baier and Karnath examined hemiparetic stroke patients with defective perception of their motor weakness—anosognosia for hemiparesis/hemiplegia (AHP). In particular, they wanted to determine

¹Manos Tsakiris, Matthew R. Longo, and Patrick Haggard, “Having a body versus moving your body: Neural signatures of agency and body-ownership,” *Neuropsychologia* 48, no.9 (2010): 2740-2749.

whether individuals with ‘disturbed awareness for their motor weakness’ would also display atypical ‘perceptions of the affected limb(s)’. They discovered that 92 percent of examined patients with AHP ‘showed additional disturbed sensation of limb ownership (DSO) for the paretic/plegic limb.’ Specifically, patients with AHP did not only have disturbances in the awareness of their motor weakness, but also manifested feelings of disownership and estrangement towards the affected limb(s). The observed association provides strong evidence that the sense of body ownership and self-awareness of actions (*the perception of agency*) are ‘tightly linked.’²

An extensive review on somatoparaphrenia yielded a comparable correlation between disturbed body ownership and deficits in the motor intentional system. Somatoparaphrenia involves delusional beliefs regarding contralesional body parts—people with somatoparaphrenia generally either deny ownership of the affected body part(s) or defer ownership to someone else. In 2009, Vallar and Ronchi surveyed reports of 56 patients (dating back to 1893) with hemispheric lesions and symptoms of somatoparaphrenia.³ Based on their investigation, they concluded that proprioceptive (related to the sense of body position and movement) impairments, and not tactile or visual field defects, causatively contribute to the onset of somatoparaphrenia. The reasoning for this connection, according to Vallar and Ronchi, is that proprioceptive feedback ‘is closely related to, and dependent on, movement, and may be a basic component of the sense of ownership.’

Supplementing the notion that defective motor intentional structures are involved in somatoparaphrenia, the review points to the fact that placing the affected body part in the region of space not suffering neglect (the ipsilesional side) does not alleviate somatoparaphrenia. As noted by Gallese and Sinigaglia, the denial of body part(s) ownership independent of actual spatial position, implicates the body schema. This is because the body schema is not ‘uniquely conceived as a spatial map of different body parts’ but instead functions ‘as the source of our potentiality for actions.’⁴ On this point, it is worth mentioning, that in most cases somatoparaphrenia is coupled with ‘severe sensorimotor’ deficiencies. Taken together, the findings from somatoparaphrenia lend powerful credence to the role of motor intentional features in modulating body ownership. Notably, the complicity of the body schema in somatoparaphrenia implies that the body schema is capable of influencing the phenomenological sense of ownership.

²Bernhard Baier and Hans-Otto Karnath. “Tight Link Between Our Sense of Limb Ownership and Self-Awareness of Actions.” *Stroke* 39, no.2 (2008): 486-488. In the conducted study, lesion location implicated the right posterior insula in producing the sense of limb ownership and self-awareness of actions.

³Giuseppe Vallar and Roberta Ronchi, “Somatoparaphrenia: a body delusion. A review of the neuropsychological literature”, *Experimental Brain Research* 192, no.3 (2009): 533-551.

⁴Gallese and Sinigaglia, *op. cit.*, p.751.

More evidence for the role of motor intentional networks in regulating body ownership comes from researches into asomatognosia—the impression that parts of the body are missing or that they have vanished from corporeal awareness. In an insightful case study, Arzy et al. reported a patient with asomatognosia—segments of the patient’s left arm had disappeared (the patient recounted being able to see through her left arm).⁵ Throughout the experience, the patient was unable to move the affected arm. Subsequent behavioral assessments showed that the patient had deficits in imagining the rotation of body parts. Magnetic resonance imaging (MRI) results attributed these symptoms to damage in the right premotor and motor cortices.⁶ The causal evidence gleaned from Arzy et al.’s case report complements functional magnetic resonance imaging (fMRI) based probes into body ownership; they indicate that neural activity in the premotor cortex reflects limb ownership.⁷ Neuroimaging of people with body integrity identity disorder (BIID) corroborates the involvement of the motor cortices in the sense of ownership. BIID entails the absence of the feeling of ownership for specific limb(s) and the accompanying desire to amputate the affected body parts. In a study published on the topic, the feeling of disownership in BIID correlated with decreased neural activation in the premotor cortex.⁸ Altogether, these neuroimaging studies of irregular neuropsychological phenomenon inculcate motor intentional networks in the basic sense of ownership.

⁵Shahar Arzy, Leila S. Overney, Theodor Landis, and Olaf Blanke, “Neural Mechanisms of Embodiment: Asomatognosia Due to Premotor Cortex Damage”, *Archives of Neurology* 63, no.7 (2006): 1022-1025.

⁶It should be noted that asomatognosia is ordinarily associated with damage to the right posterior parietal cortex; a fact acknowledged by Arzy et alia in their paper. To that end, there is complementary evidence from a positron emission tomography (PET) study that the right posterior insula may have a role in body ownership. Manos Tsakiris, Maike D. Hesse, Christian Boy, Patrick Haggard, and Gereon R. Fink, “Neural Signatures of Body Ownership: A Sensory Network for Bodily Self-Consciousness”, *Cerebral Cortex* 17, no.10 (2006): 2235-2244. Strikingly, there is considerable neuroimaging evidence that links activity in the insular lobe to the experience of agency. Chloe Farrer, Nicolas Franck, Nicolas Georgieff, Chris D. Frith, Jean Decety, and Marc Jeannerod, “Modulating the experience of agency: a positron emission tomography study”, *Neuroimage* 18, no.2 (2003): 324-333; Chloe Farrer and Chris D. Frith, “Experiencing Oneself vs Another Person as Being the Cause of an Action: The Neural Correlates of the Experience of Agency”, *Neuroimage* 15, no.3 (2002): 596-603. More comprehensively, the role of the right posterior insula in generating both the sense of body ownership and self-awareness of actions is discernible in Baier and Karnath, *op. cit.*

⁷H. Henrik Ehrsson, Charles Spence, and Richard E. Passingham, “That’s My Hand! Activity in Premotor Cortex Reflects Feeling of Ownership of a Limb”, *Science* 305, no.5685 (2004): 875-877.

⁸Milenna T. van Dijk, Guido A. van Wingen, Anouk van Lammeren, Rianne M. Blom, Bart P. de Kwaasteniet, H. Steven Scholte, and Damiaan Denys, “Neural Basis of Limb Ownership in Individuals with Body Integrity Identity Disorder”, *PLoS One* 8, no.8 (2013): e72212.

3.2 Evidence From The Rubber Hand Illusion & Self-Recognition

Shifting attention away from abnormal neuropsychological experiences, it is equally worth considering the informative research work on illusory body ownership. The paradigmatic experimental design is the rubber hand illusion (RHI).⁹ In the experiment setup, the participant’s hand is hidden from visual view and tactile stimulation is applied to a visible rubber hand in conjunction to the unseen real hand. If the tactile stimulation applied to the out of view real hand, and the visible rubber hand, is synchronous, the participant experiences a shift in position (*proprioceptive drift*) of the real hand towards the position of the rubber hand. In addition, the participant adjudges that the rubber hand is a part of their body—i.e., they feel ownership towards the rubber hand.

The RHI framework is important in demonstrating the elasticity of the body schema—showing that subjecting an individual to the appropriate visuotactile stimulation leads to the embodiment of the rubber hand.¹⁰ Significantly, synchronous visuo-tactile stimulation is not sufficient to cause the illusion; the illusory embodiment induced by visuo-tactile stimulation is contingent on the congruency of the rubber hand with respect to the real hidden hand.¹¹ For instance, positioning the rubber hand perpendicular to the orientation of the real hidden hand, extinguishes the illusion.

The dependence of the illusion on congruency denotes, as cogently argued by Gallese and Sinigaglia, that the RHI is constrained by the ‘action-compatibility’ of the observed rubber hand with that of the real hand: ‘If the dummy hand occupies a position in space incompatible with the power for action intrinsic to the body schema, the illusion does not occur.’¹² This means that the RHI is not merely a product of Bayesian statistical correlations, but instead, the illusion is regulated by the possibility of actions (generated by the body schema) corresponding to the particular hand. In short, the rubber hand

⁹Matthew Botvinick and Jonathan Cohen, “Rubber hands ‘feel’ touch that eyes see”, *Nature* 391, no.6669 (1998): 756.

¹⁰The RHI manipulates not only the phenomenal experience of body ownership and the concomitant sense of position, but also alters the physiological regulation of the real hand. G. Lorimer Moseley, Nick Olthof, Annemeike Venema, Sanneke Don, Marijke Wijers, Alberto Gallace, and Charles Spence, “Psychologically induced cooling of a specific body part caused by the illusory ownership of an artificial counterpart”, *Proceedings of the National Academy of Sciences* 105, no.35 (2008): 13169-13173.

¹¹Francesco Pavani, Charles Spence, and Jon Driver, “Visual Capture of Touch: Out-of-the-Body Experiences with Rubber Gloves”, *Psychological Science* 11, no.5 (2000): 353-359; Manos Tsakiris and Patrick Haggard, “The Rubber Hand Illusion Revisited: Visuotactile Integration and Self-Attribution”, *Journal of Experimental Psychology: Human Perception and Performance* 31, no.1 (2005): 80-91.

¹²Gallese and Sinigaglia, *op. cit.*, p.751.

illusion vividly showcases the dependence of ownership on action potential characteristics; validating the relationship gleaned from atypical neuropsychological experiences.

Indirect signatures of the sense of ownership, in particular self recognition and identification, are also mediated by agency. A shrewd study by Tsakiris et al. explored the function of efferent information (neural signals conveying motor stimuli) in the recognition of body parts.¹³ In the study, pressing a lever with the left hand resulted in the passive extension of the participant’s right index finger. The lever was pressed (employing the left hand) either by the experimenter (‘externally-generated action’) or the participant (‘self-generated action’). Video feedback of the passive extension was altered so that the participants were either observing their own right hand movement or someone else’s right hand movement. In both cases (‘view own hand’ and ‘view other’s hand’), the hands were covered in identical woolen gloves to make visual discrimination impossible. Remarkably, Tsakiris et al. discovered that the participants were able to distinguish their own hand from someone else’s hand with greater accuracy when they produced the movement themselves—self-recognition improved considerably when the *passive displacement* of the right index finger was self-generated. Specifically, self-recognition performance increased despite there being no difference in proprioceptive and visual information.

An identical conclusion was reached by Tsakiris, Schutz-Bosbach, and Gallagher in their discussion of the same experiment: ‘Self-recognition was significantly more accurate when subjects themselves were the authors of the action, even though visual and proprioceptive information always specified the same posture, and despite the fact that subjects judged the effects and not the action per se.’¹⁴ The findings of the study and corresponding assessments are consistent with prior self-recognition research. A determinative study conducted in 2002 exhibited that motor intentional knowledge regulated self-recognition in conditions of scarce morphological information. In particular, congruence between proprioceptive and visual signals, and movement recognition (based on matching visual and efferent signals) led to self-recognition. Indicative of the later results unearthed by Tsakiris et al., the experimenters (Esther van den Bos and Marc Jeannerod) found that the presence of movement overrode other sources of information (including spatial orientation of the hand; i.e., proprioceptive information) and achieved near perfect recognition.¹⁵ The evidence from self-recognition perception coincides with an astute neuroimaging inquiry

¹³Manos Tsakiris, Patrick Haggard, Nicolas Franck, Nelly Mainy, and Angela Sirigu, “A specific role for efferent information in self-recognition”, *Cognition* 96, no.3 (2005): 215-231.

¹⁴Quoted in Manos Tsakiris, Simone Schütz-Bosbach, and Shaun Gallagher, “On agency and body-ownership: Phenomenological and neurocognitive reflections”, *Consciousness and Cognition* 16, no.3 (2007): 645-660, p.654-655; see also Gallese and Sinigaglia, *op. cit.*, p.750.

¹⁵Esther Van Den Bos and Marc Jeannerod, “Sense of body and sense of action both contribute to self-recognition”, *Cognition* 85, no.2 (2002): 177-187.

into the bodily self, revealing that the capacity to differentiate self from others is partly based on a sensorimotor representation.¹⁶

The role intentional action plays in the production of a coherent sense of ownership is more explicitly discernible in a subsequent study by Tsakiris, Prabhu, and Haggard.¹⁷ The RHI was induced through synchronous tactile stimulation to an individual finger in three separate conditions: active finger movement (self-generated intentional action), passive finger movement, and (bare) tactile stimulation. With both passive finger movement and simple tactile stimulation, the RHI was localized to the stimulated finger—i.e., there was ‘fragmented body awareness.’ However, in the active finger movement condition, the proprioceptive drift associated with the RHI extended to ‘the whole hand’. On the basis of their results, Tsakiris, Prabhu, and Haggard contend that ‘[w]hereas a purely proprioceptive sense of body-ownership is local and fragmented’, a coherent and cohesive sense of body ownership is produced with the incorporation of agency. Another study examining the impact of movement on the RHI found that active synchronous movements produced stronger illusory ownership effects than passive synchronous movements.¹⁸

Probing the effects of the RHI on action oriented representation(s) of the body, Newport et al. showed that embodiment of a fake hand (induced by active touch) led to alterations in the body schema (indicated by pointing errors).¹⁹ In the same vein, Riemer et alia discovered that proprioceptive drifts measured with a pointing (motor) task, were larger in rubber hand illusions induced via voluntary synchronous movement as compared with those elicited by synchronous visuo-tactile stimulation.²⁰ A study exploring virtual body ownership illusion registered the same pattern. The illusory ownership was stronger when generated by visuomotor synchronous stimulation as opposed to visuotactile synchronous stimulation.²¹ In aggregate, these five studies firmly denote that illusory embodiment is more robust when motor intentionality is involved.

¹⁶Francesca Ferri, Francesca Frassinetti, Martina Arduini, Marcello Costantini, and Vittorio Gallese, “A Sensorimotor Network for the Bodily Self”, *Journal of Cognitive Neuroscience* 24, no.7 (2012): 1584-1595.

¹⁷Manos Tsakiris, Gita Prabhu, and Patrick Haggard, “Having a body versus moving your body: How agency structures body-ownership”, *Consciousness and Cognition* 15, no.2 (2006): 423-432.

¹⁸Timothy Dummer, Alexandra Picot-Annand, Tristan Neal, and Chris Moore, “Movement and the rubber hand illusion”, *Perception* 38, no.2 (2009): 271-280.

¹⁹Roger Newport, Rachel Pearce, and Catherine Preston, “Fake hands in action: embodiment and control of supernumerary limbs”, *Experimental Brain Research* 204, no.3 (2010): 385-395.

²⁰Martin Riemer, Dieter Kleinböhl, Rupert Hölzl, and Jörg Trojan, “Action and perception in the rubber hand illusion”, *Experimental Brain Research* 229, no.3 (2013): 383-393.

²¹Elena Kokkinara and Mel Slater, “Measuring the Effects through Time of the Influence of Visuomotor and Visuotactile Synchronous Stimulation on a Virtual Body Ownership Illusion”, *Perception* 43, no.1 (2014): 43-58.

Supplementing the findings on the observed interplay between movement and ownership, Burin et al. administered the RHI on people with complete upper left limb hemiplegia (paralysis of left upper limb) and compared the effects with those measured in healthy subjects during the same illusion. The results revealed that proprioceptive drift for the affected hand was significantly greater than the proprioceptive drift perceived in healthy individuals. This implies that lack of movement weakens the sense of body ownership, occasioning a more flexible body representation, which in turn leads to the paretic hand being more prone to the embodiment illusion.²² Remarkably, the unaffected (right) hand of the hemiplegics, did not display substantial susceptibility to the rubber hand illusion. A possible interpretation of the last result (proposed by Burin et al.) is that the ‘regular and repeated overuse of the healthy arm’ generates increased ‘number of movement-related signals’—leading to elevated body ownership. Consequently, the part of the body schema pertaining to the unaffected arm becomes more rigid and the healthy hand becomes resistant to illusory embodiment. Despite the ambiguity in interpreting the absence of illusory effects when the unaffected arm of a hemiplegic is synchronously stimulated, on the whole, the study clearly demonstrates that voluntary movement indeed ‘impacts’ ownership.

3.3 Denouement

The combined evidence from atypical neuropsychological experiences, the rubber hand illusion, and self-recognition experiments substantiate the hypothesis gleaned from the body schema approach and theory of ideomotor learning: i.e., agency modulates ownership and perceived agency engenders ownership. This relationship between agency and ownership is essential to understanding the phenomenological basis of non-corporeal object ownership. That said, the asserted relation is agnostic on questions regarding the dissociability of agency and ownership, and the possible effects of ownership on agency instead. As a matter of fact, these issues are tangential to the theory of ownership I am developing—the theory solely incorporates the fact that perceived agency and tangible motor intentional ‘power’ are capable of evoking the sense of ownership. Still, there is interesting empirical work addressing such peripheral issues.

On the subject of ownership’s effects on agency, recent experimental evidence indicates that the interaction of ownership and agency is indeed bidirectional. In particular, a study demonstrated that illusory ownership of a rubber hand led to the sense of agency over

²²Dalila Burin, Alessandro Livelli, Francesca Garbarini, Carlotta Fossataro, Alessia Folegatti, Patrizia Gindri, and Lorenzo Pia, “Are Movements Necessary for the Sense of Body Ownership? Evidence from the Rubber Hand Illusion in Pure Hemiplegic Patients”, *PLoS One* 10, no.3 (2015): e0117155.

the actions performed by the fake hand. The self-attribution of the movement manifested both explicitly (questionnaire responses) and implicitly (presence of sensory attenuation).²³ Based on their results, the experimenters intimated that body ownership ‘entails’ motor representations of movements. On dissociability of ownership and agency, there is much confusion.²⁴ Even schizophrenia, a neuropsychological disorder that is classically associated with a selective deficit in the sense of agency, does not manifest a clear dissociation between agency and ownership. On the contrary, recent evidence identifies accompanying disturbances in the sense of body ownership.²⁵ The evidence is primarily derived from experiments comparing the RHI in people with schizophrenia and control subjects. These investigations found that the RHI is ‘quantitatively and qualitatively stronger’ in individuals with schizophrenia—symbolizing a weakened sense of body ownership.²⁶

As stated before, these parallel topics, though interesting, are not directly relevant to the theory of ownership being presented. To develop the theory, all that is required is the premise that perceived agency generates the non-conceptual sense of ownership—a premise that is evident from the neuropsychology and cognitive neuroscience literature surveyed above.

²³Dalila Burin, Maria Pyasik, Adriana Salatino, and Lorenzo Pia, “That’s my hand! Therefore, that’s my willed action: How body ownership acts upon conscious awareness of willed actions”, *Cognition* 166 (2017): 164-173.

²⁴On the potential dissociation of body ownership and agency, see Appendix A for a compact overview.

²⁵For a review, see Maayke Klaver, and H. Chris Dijkerman, “Bodily Experience in Schizophrenia: Factors Underlying a Disturbed Sense of Body Ownership”, *Frontiers in Human Neuroscience* 10 (2016): 305.

²⁶Katharine N. Thakkar, Heathman S. Nichols, Lindsey G. McIntosh, and Sohee Park, “Disturbances in Body Ownership in Schizophrenia: Evidence from the Rubber Hand Illusion and Case Study of a Spontaneous Out-of-Body Experience”, *PloS One* 6, no.10 (2011): e27089; see also Avi Peled, Michael Ritsner, Shmuel Hirschmann, Amir B. Geva, and Ilan Modai, “Touch feel illusion in schizophrenic patients”, *Biological Psychiatry* 48, no.11 (2000): 1105-1108.

Chapter 4

Extracorporeal Object Ownership

A case study reported in 1996, described a woman with delusional disownership of her left hand (somatoparaphrenia) due to right brain damage.¹ In addition to the hand itself, the patient displayed selective disownership of objects typically associated with the left hand—i.e., the denial of ownership extended to extracorporeal objects that were ‘related’ to the affected hand (e.g., rings). Notably, this delusional disownership of objects only manifested when the articles were viewed on the affected hand itself (e.g., when she wore the objects on her left hand)—in contrast, the objects were correctly recognized by the patient as belonging to her, when viewed on her right hand, or in the hands of the examiner. Personal objects that were not ordinarily associated with the disowned hand were correctly recognized by the patient irrespective of where they were viewed.

This remarkable case study lucidly intimates that the body schema is capable of altering ownership perceptions. It also suggests that systematic associations between the embodied self and object, shape and strengthen these perceptions. And finally, the study depicts the strong interconnectedness between the sense of ownership and memory—the patient couldn’t recall the autobiographical information related to the object when seeing it on the left affected hand; whereas by simply moving the object to the right hand, the patient recognized the object and retrieved the related memories. In addendum to the palpable relationship between perceived agency and ownership (i.e., perceived agency promotes the sense of ownership), these conceptions are integral to understanding non-corporeal object ownership. Moreover, as we will see, they are essential constituents of a comprehensive theory of ownership.

¹Salvatore Aglioti, Nicola Smania, Michela Manfredi, and Giovanni Berlucchi, “Disownership of left hand and objects related to it in a patient with right brain damage”, *Neuroreport* 8, no.1 (1996): 293-296.

4.1 Object Embodiment

In probing the origins of non-corporeal object ownership, it should be emphasized that the body schema is a functional representation that extends beyond the body to objects in the external world—a mechanism of directed action (or *an instrument to transform will into action*). To that end, there is overwhelming evidence that the body schema incorporates external (physical) objects—i.e., the body schema can expand to embody objects that are not naturally part of the body. This integration of body and objects is commonplace in humans; it is also observable in monkeys. In a condensed review, Maravita and Irki examined empirical evidence denoting transformations in the body schema during (and immediately after) tool use. They inspected behavioral markers and neuronal recordings in primates during tool activity. In humans (including brain damaged patients), they explored behavioral manifestations of body schema alterations. The combined evidence presented in the review signifies that the body schema is updated during the usage of an instrument—the tool becomes incorporated into the putative ‘body in the brain’.² In the ensuing paragraphs, I examine the evidence presented in the review of Maravita and Irki, and more recent studies, that delineate the incorporation of paraphernalia into the body schema. The evaluated studies vividly establish the synthesis of body and object within the schema.

As briefly mentioned in Section I (during the discussion on the body schema), neurophysiological studies in primates have identified bimodal neuron networks in the ventral premotor cortex (possessing both somatosensory and visual receptive fields) that dynamically track peripersonal space—these visual receptive fields (vRFs) move in synchrony with the associated body part (e.g., they are anchored to the arm) and not the eye.³ In an important study, Iriki et alia displayed, that after training macaque monkeys to use an instrument for weeks, bimodal neurons in the trained macaque’s caudal postcentral gyrus could also track the space surrounding the instrument during active use.⁴ These findings show that the neurons comprising the body schema subsume tools during active use—i.e., the space around the non-corporeal instrument is coded in the same manner as the space near the body.

Additional studies have reported equivalent findings (i.e., the expansion of these bi-

²Angelo Maravita, and Atsushi Iriki, “Tools for the body (schema)”, *Trends in Cognitive Sciences* 8, no.2 (2004): 79-86.

³Michael S. Graziano, Gregory S. Yap, and Charles G. Gross, “Coding of visual space by premotor neurons”, *Science* 266, no.5187 (1994): 1054-1057; see also Rizzolatti, Fadiga, Fogassi & Gallese, *op. cit.*

⁴Atsushi Iriki, Michio Tanaka, and Yoshiaki Iwamura, “Coding of modified body schema during tool use by macaque postcentral neurones”, *Neuroreport* 7, no.14 (1996): 2325-2330.

modal receptive fields to include visual space accessible with the instrument) immediately after instrument use.⁵ To emphasize, these studies symbolize that the body schema (Merleau-Ponty's 'motor intentionality') can extend to include external objects. Interestingly, a later investigation using light and electron microscopy revealed the emergence of novel functional neural connections in prefrontal areas (including the intraparietal area) of monkeys that underwent training in tool use.⁶

A remarkable study by Iriki, Tanaka, Obayashi, and Iwamura replicated the extension of the body schema to encompass virtual objects.⁷ In their experimental setup, the monkey performed tool use by observing visual feedback from a video monitor (direct observation was prevented by an opaque plate). After the requisite training, the visual receptive fields corresponding to the bimodal neurons in the monkey's intraparietal cortex, 'projected' to incorporate the virtual hand (corresponding to the real hand) on the video monitor. Furthermore, immediately ensuing tool use, the visual receptive fields coding the image of the hand on the monitor, extended to incorporate the virtual tool—i.e., the vRFs expanded to encompass the length of the virtual instrument. More surprisingly, the compression and displacement of the virtual hand (i.e., the image of the hand) prompted corresponding changes to the visual receptive fields of these bimodal neurons. The modification to the vRFs materialized despite no changes to the actual posture, position, and size of the real hand. Markedly, the same visual receptive fields coalesced around the instrument tip ('akin to a computer cursor') when every other image was filtered out (including the remainder of the instrument).

According to Maravita and Irki, the results signify that the virtual (*functional*) counterparts of the hand and instrument become an extension of the monkey's body. This body extension is not merely functional in nature; there is perhaps an element of ownership over the virtual hand as depicted by the fact that the monkey retracts the real hand when a threat is presented near the image. Maravita and Irki suggest that these neurons might represent the neural correlates of the 'distal presence' felt during teleoperators (e.g., a controllable robot) and contingent virtual displays (e.g., controllable video game character).⁸

⁵Maravita and Iriki, *op. cit.*, p.79-80.

⁶Sayaka Hihara, Tomonori Notoya, Michio Tanaka, Shizuko Ichinose, Hisayuki Ojima, Shigeru Obayashi, Naotaka Fujii, and Atsushi Iriki, "Extension of corticocortical afferents into the anterior bank of the intraparietal sulcus by tool-use training in adult monkeys", *Neuropsychologia* 44, no.13 (2006): 2636-2646.

⁷Atsushi Iriki, Michio Tanaka, Shigeru Obayashi, and Yoshiaki Iwamura, "Self-images in the video monitor coded by monkey intraparietal neurons", *Neuroscience Research* 40, no.2 (2001): 163-173.

⁸Maravita and Iriki, *op. cit.*, p.81; see also Jack M. Loomis, "Distal Attribution and Presence", *Presence: Teleoperators & Virtual Environments* 1, no.1 (1992): 113-119.

Inquiries into tool usage in humans reveal the existence of analogous body schema based extension mechanisms. A study by Berti and Frassinetti, involving a patient that had suffered a right-hemisphere stroke, demonstrated that visual neglect restricted to the space surrounding body parts (peripersonal space) could be extended to distant spaces by artificially extending the patient’s body by means of wielding a rod (i.e., the visual neglect would extend to areas surrounding the rod upon use of the long implement)—indicating that external objects become incorporated in the ‘body’ representation.⁹

Equivalent effects can be discerned in patients (typically with brain damage) suffering from cross modal extinction. These patients ignore sensory stimuli of a specific modality (e.g., tactile stimulus) on the contralesional side (opposite side of the lesion) when a stimuli of a different modality (e.g., visual stimulus) is presented simultaneously on the ipsilesional side (same side of the lesion). Interestingly, the extinction of the contralesional tactile stimuli is moderated by the distance of the ipsilesional visual stimuli—i.e., the closer the visual probe is to the ipsilesional hand, the greater the tactile extinction on the contralesional hand.¹⁰ Singularly, Maravita and colleagues discovered that the distance effect is attenuated by holding a stick with the ipsilesional hand to touch the distant visual stimuli—i.e., the decrease in extinction is eroded by wielding a stick to touch the ipsilesional visual probe. The attenuation of the distance effect when wielding a reaching stick signals the extension of the peripersonal space to also include space around the tool. In effect, the tool is integrated into the body map. Moreover, the effect could not be replicated by merely placing the stick near the ipsilesional hand (tangible control over the stick via wielding was necessary).¹¹

Since the prominent review by Maravita and Irki, there have been more direct studies on tool induced changes to the body schema in humans. An important study conducted by Cardinali et alia explicitly demonstrated that the kinematics of movement are modified after using a mechanical grabber—i.e., the kinematics of a person’s empty hand (*without* the mechanical grabber) became distorted, as if their arm had lengthened, after performing actions with a mechanical grabber that increased reach. The altered arm kinematics observed in the study represent changes to the action oriented body schema. In particular, localized touches conveyed by the subjects to the elbow, and middle fingertip of their

⁹Anna Berti and Francesca Frassinetti, “When Far Becomes Near: Remapping of Space by Tool Use” *Journal of Cognitive Neuroscience* 12, no.3 (2000): 415-420.

¹⁰Giuseppe di Pellegrino, Elisabetta Làdavas, and Alessandro Farné, “Seeing where your hands are”, *Nature* 388, no.6644 (1997): 730.

¹¹Angelo Maravita, Masud Husain, Karen Clarke, and Jon Driver, “Reaching with a tool extends visual-tactile interactions into far space: Evidence from cross-modal extinction”, *Neuropsychologia* 39, no.6 (2001): 580-585.

arm, corresponded to an increase in the arm length representation—the arm morphology represented in the schema had been expanded to incorporate the external reaching instrument.¹²

Significantly, the modified motor behavior ensuing the use of the mechanical grabber, lasted (at the minimum) for the duration of the ‘post-tool’ monitoring period (approximately 10 to 15 minutes), and occurred without any training in wielding the mechanical grabber. This rapid change in motor based representation stands in contrast to lower primates that require a period of training. A possible explanation may be that ‘evolutionary pressure’ triggered full expression of primitive ‘body’ integrating features in humans—features that would have been present in some common ancestor. This precursor would exist today in closely related primates, explaining the capability of macaque monkeys to embody external objects into their body representation only after some familiarity with the object. On the other hand, in humans, the fully developed body schema is capable of embodying objects almost instantaneously. There is evidence that this difference in elasticity of body representation corresponds to expanded prefrontal and intraparietal areas in humans as compared with monkeys.¹³

4.2 Glimpsing Ownership in Afterimages

In addition to studies focusing on kinematics of action, the afterimage experimental paradigm is also useful in probing the incorporation of objects into the body schema. More importantly, the paradigm provides the basis to connect, integration of objects into the body schema, with the subjective feeling of ownership over embodied objects. In an afterimage experiment, participants in a dark room are exposed to a brief light flash, the momentary flash creates an enduring afterimage of the whole field of view, moreover, when the afterimage contains a body part, the body part ‘fades’ or ‘crumbles’ when it is displaced (actively or passively) from its manifest position in the afterimage, however the rest of the afterimage remains intact.¹⁴

¹²Lucilla Cardinali, Francesca Frassinetti, Claudio Brozzoli, Christian Urquizar, Alice C. Roy, and Alessandro Farnè, “Tool-use induces morphological updating of the body schema”, *Current Biology* 19, no.12 (2009): R478-R479.

¹³Maravita and Iriki, *op. cit.*, p.80; see also Guy A. Orban, David Van Essen, and Wim Vanduffel, “Comparative mapping of higher visual areas in monkeys and humans”, *Trends in Cognitive Sciences* 8, no.7 (2004): 315-324.

¹⁴P Davies, “Effects of Movements upon the Appearance and Duration of a Prolonged Visual Afterimage: 1. Changes Arising from the Movement of a Portion of the Body Incorporated in the Afterimaged Scene”, *Perception* 2, no.2 (1973): 147-153.

In a remarkable study, Hogendoorn et alia discovered that the disruption of the afterimage can be completely inhibited by ‘disowning’ the limb present in the field of view—the subjective feeling of ownership over the limb is decreased (or eliminated) by relocating the limb during the brief period of time between the end of the flash of light and formation of the afterimage.¹⁵ The findings by Hogendoorn et alia suggest that the afterimage disruption is not simply a result of the conflict between vision and proprioception, but that it is also influenced by the higher-order subjective feeling of ownership.

In the same vein, a novel study by Ritchie and Carlson replicated the disruption effect in afterimages of mirror reflections—the afterimage comprised of reflections of the subject’s arm using both (alternatively) a frontally placed mirror and mirror box. Ritchie and Carlson posit that the ‘crumbling’ effect observed in their experiment is partially explained by the subject’s ‘sense of ownership’ towards its reflection and bodily self-awareness.¹⁶ These two singular afterimage studies suggest that the crumbling effect is modulated by the subjective feeling of ownership—movement is a necessary, but not a sufficient, condition; to actually take place, *the crumbling effect requires a feeling of ownership towards the active object represented in the image.*

The derived determinant for the crumbling effect (i.e., the subjective feeling of ownership) is going to be important when considering rapid first-order extensions (integration of objects that are held directly) of the body schema in the afterimage experimental paradigm. In that regard, there have been several significant experiments conducted. The principal among these is a clever study by Carlson, Alvarez, Wu, and Verstraten.¹⁷ They carried out an afterimage based experimental study to demonstrate the rapid incorporation of first-order objects into the body schema. In the study, both object and hand would fade from the afterimage after displacement from its envisaged position. Additionally, an object held by the subject faded from the afterimage upon being dropped. Inversely, objects also faded when the observer grasped the object and displaced it from the area incorporated in the afterimage. These results demonstrate that external objects were rapidly (‘within a few seconds’) integrated into the body schema.¹⁸

¹⁵Hinze Hogendoorn, Marjolein PM Kammers, Thomas A. Carlson, and Frans AJ Verstraten, “Being in the dark about your hand: Resolution of visuo-proprioceptive conflict by disowning visible limbs”, *Neuropsychologia* 47, no.13 (2009): 2698-2703.

¹⁶Ritchie, J. Brendan and Thomas Carlson, “Mirror, mirror, on the wall, is that even my hand at all? Changes in the afterimage of one’s reflection in a mirror in response to bodily movement”, *Neuropsychologia* 48, no.5 (2010): 1495-1500.

¹⁷Thomas A. Carlson, George Alvarez, Daw-an Wu, and Frans AJ Verstraten, “Rapid Assimilation of External Objects Into the Body Schema”, *Psychological Science* 21, no.7 (2010): 1000-1005.

¹⁸Notably, the study failed to detect fading for second-order objects (i.e., a ball held using a mechanical arm). Conversely, a recent study by Rademaker et alia replicated the fading effect for second-order objects

Though not examined in the paper, according to the evidence from the previous afterimage studies (Hogendoorn et alia, and Ritchie and Carlson), the subjective sense of ownership mediates the crumbling effect. Applying that constraint to the current study, the observed crumbling effect not only denotes that the external object was incorporated into the body schema, but that the process of embodiment extends the phenomenological experience of body ownership to the encompassed object. To reiterate, the afterimage experiment paradigm provides indirect evidence that incorporating objects into the schema, may also involve a (transient) non-conceptual sense of ownership towards the incorporated object—the same non-conceptual sense of body ownership that comprises the minimal self.

4.3 The Phenomenology of Object Ownership

There is considerable direct evidence for the above hypothesis (connecting the body schema and perceived agency, to the subjective feeling of ownership). In a formative study, Fay Short and Robert Ward examined the distinctive coding of body (personal) space—the external region of space ‘occupied by our body’ and corresponding to the body schema.¹⁹ They conducted a series of experiments involving virtual limbs (hands or cones) to determine the properties required to provoke the distinctive coding of space that enables efficient motor movements. The results revealed that visual space controlled by a person (‘visual space subject to predictable consequences from movement’) garnered a distinctive spatial code. Therefore, stimuli located within the controlled visual space resulted in faster motor responses than stimuli presented just outside this space. In addition, Short and Ward found that the appearance of the virtual limb, and the spatial correspondence between visual and proprioceptive feedback, did not modulate the distinctive coding of the virtual object.

To emphasize, *predictable control* was the governing factor in extending the body schema—perceptual features of the virtual limb, and spatial correspondence between the

(cotton balls held using chopsticks) — denoting ‘second-order extensions’ of the body schema. The fading effect for second-order objects increased as a function of familiarity with the first-order tool—a parallel situation to that of first-order extensions in macaques. A plausible conjecture that can be drawn is that humans have evolved a rapid capacity for first-order body extensions but use analogous neural learning processes to that employed by macaque monkeys for higher order body extensions. Rosanne L. Rademaker, Daw-An Wu, Ilona M. Bloem, and Alexander T. Sack, “Intensive tool-practice and skillfulness facilitate the extension of body representations in humans”, *Neuropsychologia* 56 (2014): 196-203.

¹⁹Fay Short and Robert Ward, “Virtual Limbs and Body Space: Critical Features for the Distinction Between Body Space and Near-Body Space”, *Journal of Experimental Psychology: Human Perception and Performance* 35, no.4 (2009): 1092-1103.

seen virtual object and the felt real hand, possessed no bearing on the incorporation of the virtual object into the distinctive spatial code. Intriguingly, analysis of the results showed that participants not only experienced subjective agency, but also *ownership* of the virtual limb, in those experiments where they had objective control over the simulated object. In light of their results, Short and Ward hypothesized that the body schema is capable of incorporating any controllable ‘space or objects’ and that that ‘may make an individual feel as though the object has become a part of his/her own body.’

The results of Short and Ward are an explicit demonstration that objective agency does not simply lead to object incorporation (into the body schema) in order to facilitate actions, but in addition, the perceived agency engenders the subjective feeling of ownership towards the integrated object. This hypothesis is corroborated by subsequent studies. In particular, an innovative study by Ma and Hommel showed that the phenomenological experience of ‘body ownership’ is conceived for ‘actively operated non-corporeal objects.’²⁰ Specifically, participants controlled virtual balloons, and virtual squares by moving their real hand—i.e., the hand and the virtual object moved in synchrony. In addition, participants could change the size of the virtual balloon (by opening and closing their hand), and either the size or color of the virtual square. This agential control over the virtual (non-corporeal) object garnered a sense of body ownership, in addition to a subjective sense of agency, towards the operated object. Though, not a necessary condition, the ownership illusion was stronger when the virtual object and the real hand appeared spatially close and connected. This signals that the phenomenological sense of ownership is moderated by gestalt laws of proximity and continuity.²¹

To reiterate, the study revealed that body ownership extends to objects whose ‘behavior’ or ‘relevant features’ are controlled. This confirms the hypothesis that the phenomenological sense of ownership is ‘perceived’ for any arbitrary object that expresses the person’s intentions (particularly if there is a semblance of physical connection between object and person).

A follow up study by Ma and Hommel set out to corroborate the role of objective agency in ownership perceptions. They compared virtual illusions induced through synchronous visuo-tactile stimulation, with those induced via synchronous visuo-motor stimulation (i.e., through maintaining objective control of the effector). They found that agency strengthened the sense of ownership—i.e., synchrony based ownership perceptions are modulated

²⁰Ke Ma and Bernhard Hommel, “Body-ownership for actively operated non-corporeal objects”, *Consciousness and Cognition* 36 (2015): 75-86.

²¹Ma and Hommel, *op. cit.*, p.84. For an introduction to gestalt psychology, see Kurt Koffka, *Principles of Gestalt psychology* (Routledge 2013).

by objective agency.²² Interestingly, they also discovered that agency played a greater role when the virtual object didn't resemble a body part (e.g., a green rectangle). In the case of the passive virtual hand, the visual resemblance with the participant's real hand compensated for the lack of objective control.

In order to consolidate the findings on non-corporeal object ownership into a more systematic theoretical framework, and because of the interplay between perceived ownership and agency, Ma et alia conducted a study to determine if Wegner's three criteria for the experience of conscious will extended to the perception of ownership.²³ Wegner's three principles mediating causality perception are priority, consistency, and exclusivity—these principles enable us to 'draw the inference that our thought has caused our action'. Aspects of the three criteria could be traced to Hume's work on causation.²⁴

The first two principles, priority and consistency, are already discernible in illusory ownership studies. Adequate temporal synchrony, required to engender virtual object embodiment, is a manifestation of the priority principle—intimating a connection between motor intentions and action effects. The moderation of illusory ownership perception due to factors such as natural connectivity between object and person, can be classified as a facet of the consistency principle—i.e., the effects are consistent with the action. In their study, Ma et alia demonstrated that Wegner's final principle, exclusivity, also had a pronounced effect on virtual object ownership—i.e., ownership perception increases when there is certainty that the movement of the controlled virtual object does not have a plausible alternative cause.

The results of this last study provides us with an integrated framework to analyze ownership and agency experiences. In particular, Wegner's principles allows us to apprehend, that with the proper multisensory integration and presence of *action-compatibility*, even a discrete volume of space can be embodied.²⁵ It appears that the class of non-corporeal objects that can be embodied, and over which ownership can be experienced, is not critically constrained by physical features—more precisely, physical characteristics of the object do not constitute a fundamental variable (i.e., a variable that cannot be reduced into more primitive variables).

²²Ke Ma and Bernhard Hommel, "The role of agency for perceived ownership in the virtual hand illusion", *Consciousness and Cognition* 36 (2015): 277-288.

²³Ke Ma, Bernhard Hommel, and Hong Chen, "The roles of consistency and exclusivity in perceiving body ownership and agency", *Psychological Research* (2018): 1-10; Daniel M. Wegner, "The mind's best trick: how we experience conscious will", *Trends in Cognitive Sciences* 7, no.2 (2003): 65-69.

²⁴Wegner, *ibid.*, p.67-8.

²⁵Arvid Guterstam, Giovanni Gentile, and H. Henrik Ehrsson, "The invisible hand illusion: multisensory integration leads to the embodiment of a discrete volume of empty space", *Journal of Cognitive Neuroscience* 25, no.7 (2013): 1078-1099.

In fact, there is evidence from the RHI that the exact opposite is the case. Longo et alia discovered that objective similarity (skin luminance, hand morphology, and third person hand similarity ratings) between the rubber hand and the subject's real hand did not influence the illusion, but embodiment of the rubber hand lead to perceived similarity.²⁶ Importantly, the increase in perceived similarity was selectively linked to the subjective experiences of ownership and agency; not to the proprioceptive drift associated with the illusion. This salient finding implies that the subjective feeling of ownership is deeply interwoven with self perception. Indeed, it suggests that the experience of ownership is powerful enough to alter perception in a way that attributes certain self features to the possessed object.

The sentiment that possessions mirror particular qualities of their owner (to themselves, and to others) is not an uncommon notion in the annals of philosophy and psychology. In *Being and Nothingness*, Sartre remarks that 'the totality of my possessions reflects the totality of my being ... I am what I have ... What is mine is myself'.²⁷ In the same vein, William James notes that the the 'line' between the conceptions of 'me' and 'mine' is often 'difficult to draw':

In its widest possible sense, however, a man's Self is the sum total of all that he CAN call his, not only his body and his psychic powers, but his clothes and his house ... his reputation and works, his lands and horses, and yacht and bank-account. All these things give him the same emotions. If they wax and prosper, he feels triumphant; if they dwindle and die away, he feels cast down, - not necessarily in the same degree for each thing, but in much the same way for all.²⁸

The palpable impression that owned objects are assimilated into the self image is corroborated by the implicit association test (IAT) paradigm.. In an original study, Nicole LeBarr and Judith Shedden employed a new version of the IAT to assess implicit cognitive associations between self concepts and owned objects.²⁹ In trials where self related words required the same response key as the color corresponding to self-owned objects,

²⁶Matthew R. Longo, Friederike Schüür, Marjolein PM Kammers, Manos Tsakiris, and Patrick Haggard, "Self awareness and the body image", *Acta Psychologica* 132, no.2 (2009): 166-172.

²⁷Jean-Paul Sartre, *Being and Nothingness: An Essay on Phenomenological Ontology* [1943], (New York: Philosophical Library 1956), p.591-2

²⁸William James, *op. cit.*, p.183.

²⁹Nicole LeBarr, and Judith M. Shedden, "Psychological ownership: The implicit association between self and already-owned versus newly-owned objects", *Consciousness and Cognition* 48 (2017): 190-197.

the response times were significantly faster. Interestingly, there was no marked difference in response times between trials with ‘already-owned’ and ‘newly-owned’ objects. This denotes that cognitive associations are formed rapidly (within minutes) between the self and newly-owned objects. According to LeBarr and Shedden (and in accordance with the precepts of the theory developed in this paper), a possible mechanism that enables the rapid formation of these self-object associations is the act of physically grasping or using the object.

In addition to manufacturing self-object psychological associations, ownership has an appreciable effect on the visuomotor system. A study by Constable, Kritikos, and Bayliss demonstrated that ownership status influenced grasping actions and perception of object affordances. In their study, participants performed a stimulus-response compatibility task with mugs—i.e., subjects reacted to stimuli presented on mug handles. As predicted, participants responded quicker to the stimulus when the response location was in the same direction as the mug handle. Importantly, the compatibility effect was abolished when the mug belonged to the experimenter—the affordances provided by the mug handle were suppressed when the subject knew that the mug was another person’s personal property. Furthermore, the study revealed that subjects performed lifting actions differently depending on who owned the mug. In the case of their own mug, they lifted the mug more forcefully (relatively greater acceleration) and moved it closer to themselves. Alternatively, when handling the experimenter’s mug, subjects were more cautious (lower accelerations) during the lifting movement and the trajectory was slightly biased towards the location of the experimenter.³⁰

I have now completed the review of empirical evidence delineating the foundations of the theory. To summarize, the phenomenological sense of ownership is a powerful neurocognitive phenomenon. It is capable of altering phenomenal perceptions, object affordances, and motor intentionality (reflected in changes to the visuomotor system)—most notably, these effects take place within minutes of ownership induction. Equally important, the cognitive processes leading to the inception of ownership are based on three interrelated precepts. The most foundational concept is that perceived agency over an object induces the sense of ownership. This principle is evident in studies where subjects feel ownership towards objects that they objectively control. In addition, the *perceived agency* rule is modulated by three gestalt-like principles: priority, consistency, and exclusivity.

The second rule relates to the body schema. Incorporation of an object into the body schema (e.g., by grasping the object) leads to a non-conceptual sense of ownership towards

³⁰Merryn D. Constable, Ada Kritikos, and Andrew P. Bayliss, “Grasping the concept of personal property”, *Cognition* 119, no.3 (2011): 430-437.

the integrated object. This is evidenced by the synthesis of tool incorporation literature and the afterimage paradigm, and aspects of the epochal case study reported by Aglioti, Smania, Manfredi, and Berlucchi. In addition, the inextricable relation between action control and the body schema (i.e., the body schema enables volitional actions) means that the integration of an object into the schema is a neurocognitive primer to object control. The inherent relation between objective control and the body schema is identifiable in the results obtained by Short and Ward.

The final cognitive process underpinning the theory is the rapid formation of self-object associations immediately ensuing the inception of ownership. The associations are likely strengthened over time as suggested by the case study discussed at the beginning of the chapter. These psychological associations form the basis for a range of ownership related phenomenon—including the endowment effect (overvaluing objects that are owned) and the mere ownership effect (evaluating owned items more positively).³¹

4.4 Hegelian Elements or (The Repudiation of Conventionalism)

Integrating the three cognitive precepts of ownership attained in the last section with emergent aspects of the minimal self, it becomes evident that property acquisition is a natural correlate of processes leading to the development of self perception and representation. To see this, recollect that the theory of ideomotor learning stipulates that voluntary action is attained through continual motor interactions with the physical environment. Add to that the fact that visual perception of an object generates the range of possible actions afforded by the object—i.e., our perception of objects are intrinsically action oriented. Together, this means that during the requisite exploratory movements leading to voluntary action acquisition, children and infants will inevitably incorporate objects into their body schema. They will form action and effect associations corresponding to these objects—in part, aided by the mirror mechanism. Eventually, the infants will learn to intentionally operate objects frequently present in their environment.

According to the perceived agency principle, these important developmental interactions yield the nascent instances of non-corporeal object ownership. Namely, embodying objects (by way of the body schema) and exercising objective control over things

³¹Bertram Gawronski, Galen V. Bodenhausen, and Andrew P. Becker, “I like it, because I like myself: Associative self-anchoring and post-decisional change of implicit evaluations”, *Journal of Experimental Social Psychology* 43, no.2 (2007): 221-232.

leads to the subjective experience of ownership. In addition, after the inception of ownership towards these objects, the mind forms rapid self-object associations (associative self-anchoring). These associations strengthen and intensify over time if the object remains in the child's possession. As noted by Susan Sutherland Isaacs, the full-fledged self-object associations may lead to the conspicuous perception on the part of the child that 'what is mine becomes (in my feelings) a part of ME.'³²

These self construction processes reveal that the appearance of personal property is a corollary of the minimal self. That is to say, children acquiring possessions is a normal part of self development—somewhat akin to the acquisition of language.³³ It follows that the purely conventional account of property, asserting that there is no natural 'mine' or 'thine', is erroneous. In fact, the sense of ownership is a pervasive neurocognitive experience that constitutes the basic sense of self. And as we have seen, this sense of ownership often extends to extracorporeal objects—either by embodying the object and/or objectively controlling the thing. In turn, this often leads to enduring self-object associations.

In this regard, developmental studies show that the concept of ownership rights emerges in children at ages 2- to 3-years—i.e., 2- to 3-year olds begin to assert ownership rights over their personal possessions.³⁴ The process of acquiring these ownership concepts originates much earlier, at around 9 months of age, when infants start to form triadic relationships that 'that links self, people, and objects in the environment.'³⁵ Interestingly, children uphold ownership rights and side with owners over non-owners in disputes much more strongly and consistently than adults—during ownership disputes, adults also take into account alternative entitlement principles such as continued use and duty to share.³⁶ The stringent adherence to ownership rights displayed by children (in contrast to adults) does not conform with purely conventional and learning accounts of property. Indeed, studies suggest that the ownership rights inferred by children are an extension of the bodily rights that they intuitively possess (a fact that conforms to the phenomenological theory of ownership)—specifically, they do not distinguish between body parts and personal property when making moral judgments about ownership.³⁷

³²Susan Isaacs, *Social Development in Young Children* (London: Routledge & Kegan Paul Limited 1933), p.225

³³Noam Chomsky. *Aspects of the Theory of Syntax* (MIT Press 2014).

³⁴Shaylene E. Nancekivell, Julia W. Van de Vondervoort, and Ori Friedman, "Young Children's Understanding of Ownership", *Child Development Perspectives* 7, no.4 (2013): 243-247.

³⁵Philippe Rochat, "Possession and Morality in Early Development," *New Directions for Child and Adolescent Development* 132 (2011): 3031.

³⁶Karen R. Neary and Ori Friedman, "Young Children Give Priority to Ownership When Judging Who Should Use an Object", *Child Development* 85, no.1 (2014): 326-337.

³⁷Julia W. Van de Vondervoort and Ori Friedman, "Parallels in Preschoolers' and Adults' Judgments

Additionally, there is evidence from certain linguistic and anthropological theories that the concept of ownership is a universal feature of human languages and societies. The strongest example of the former is the theory of Natural Semantic Metalanguage (NSM).³⁸ The theory stipulates the existence of ‘semantic primitives’ (or ‘primes’) that constitute the semantic building blocks of all lexicon. The primes are universal (i.e., same meaning in every human language) and primitive (i.e., they cannot be defined in terms of other words). Terms denoting possession are amongst the list of proposed semantic primes. In the latter domain, property is among the list of human universals (i.e., present universally among humans) compiled by the anthropologist David Brown.³⁹ Experimental studies in nonhuman primates also favor theoretical accounts that involve a biological basis for property—queer psychological features such as the endowment effect (overvaluing objects that are owned by the subject) and pragmatic ownership behavior (e.g, bartering) have been observed in other primates.⁴⁰

Add to all this the fact that humans have the capacity to identify with others and engage in prosocial behaviors, we see that systems of property rights do not require the sovereign authority of the state to emerge (a position held by Hobbes and Bentham, among others). People can devise property rules based on their shared perspective (‘shared evaluative attitudes’), and the inherent human instinct to acquire possessions in order to adequately express themselves.⁴¹

I will end the chapter by discussing the relevance of the Hegelian conception of property. As noted in the introduction, elements of the property theory I’ve developed are analogous to Hegel’s theory of property (absent the idealism and theory of historical development). In particular, the Hegelian concept that property is the externalization of will or the embodiment of personality, accords with the fact that the body schema enables action control to extend beyond the body to objects in the external world. A person often expresses their motor intentionality through operating embodied objects—e.g., incorporating tools into the body schema to perform needed actions. This exercise of objective control over embodied objects, mediated by the body schema, not only leads to the phenomenological experience of ownership, but allows us to accomplish a variety of projects. In the Hegelian framework, this would correspond to a person placing their will into an object, in order to

About Ownership Rights and Bodily Rights”, *Cognitive Science* 39, no.1 (2015): 184-198.

³⁸Cliff Goddard, “The Natural Semantic Metalanguage approach”, in Bernd Heine and Heiko Narrog (eds.) *The Oxford Handbook of Linguistic Analysis* (Oxford: Oxford University Press 2010): 459-484.

³⁹Donald E. Brown, *Human Universals* (New York: McGraw-Hill 1991).

⁴⁰Sarah F. Brosnan, “Property in Nonhuman Primates,” *New Directions for Child and Adolescent Development* 132 (2011): 922.

⁴¹Michael Tomasello, and Amrisha Vaish, “Origins of Human Cooperation and Morality”, *Annual Review of Psychology* 64 (2013): 231-255.

realize their needs.

By being taken into possession, the thing acquires the predicate ‘mine’ and my will is related to it positively ... The use of the thing is my need being externally realized through the change, destruction, and consumption of the thing.⁴²

In the passage, Hegel is saying that the use of an object ‘manifests the will of [the] possessor’ by revealing how the object fits into the person’s projects and intentions.⁴³ To that end, Hegel considers that physically grasping an object is ‘the most complete of these modes [of possession], because then I am directly present in this possession, and therefore my will is recognizable in it.’⁴⁴ And as discussed extensively in Chapter 2, it is the body schema that enables Hegel’s foremost mode of possession. The schema ‘provides us with a way of access to the world’, and is the ‘potential source of a certain number of familiar actions’—i.e., the body schema is ‘primarily given to us as source or power for action’. We are able to grasp, use, and manipulate objects due to its dynamic and action oriented nature.

What about other modes of possession? Hegel mentions the imposition of form and marking as two other methods of acquiring property. These alternative means are important since objectively controlling an object is a very limited mode of obtaining and maintaining possession. In the next chapter, I will show how memory and past person-object interactions shape our judgements of ownership. These intuitive metarepresentations will give rise to more sophisticated modes of possession. Importantly, these additional precepts of possession will still be related to the phenomenological principles of ownership discussed in this chapter—in fact, the phenomenological principles will play a pivotal role in influencing and shaping these newer precepts. And finally, I will use these principles to shed light on the obscure concept of intellectual property.

⁴²Hegel, *op. cit.*, §59.

⁴³Knowles, *op. cit.*, p.52

⁴⁴Hegel, *op. cit.*, §55.

Chapter 5

Metarepresentations of Ownership

Extending the work on the role of agency in ownership, a constitutive paper by Liepelt, Dolk, and Hommel investigated the role of *past agency* on the composition of non-corporeal object ownership. In their study, they conducted a version of the RHI using several different objects—computer mouse, rubber hand, smart phone, and a wooden block. Implicit measures of ownership (proprioceptive drift) were significantly greater for objects that people had agency experiences with in the past. Particularly, illusion with the smart phone and the rubber hand produced greater proprioceptive drifts than the computer mouse and wooden block. According to the authors, these results show that ‘ownership can be obtained for virtual non-corporeal objects that either currently move with our body or that have been moving with our body in the past’—i.e., suggesting ‘that what we perceive as our body is affected by knowledge about our past interactions with objects.’¹

The fact that knowledge of past agency influences the sense of ownership brings to the fore the concept of the narrative self. This means that episodic memory and past experiences are now at play in construing the sense of ownership (towards extracorporeal objects). In particular, the study showed that past experiences modulate the phenomenological sense of ownership. Therefore, it seems plausible to suggest, that episodic memory is powerful enough to evoke a sense of ownership for objects that the person had agential control over in the past. In this regard, Liepelt, Dolk, and Hommel suggest as much: ‘the mere recall of past agency experience may’ elicit the sense of ownership.²

¹Roman Liepelt, Thomas Dolk, and Bernhard Hommel, “Self-perception beyond the body: the role of past agency”, *Psychological Research* 81, no.3 (2017): 549-559.

²*Ibid.*, p.554.

5.1 Ownership Judgments

This idea that experiences and memories modulate the sense of ownership, in addition to immediate perceptions (constituting the minimal self), is important in forming a coherent framework that will enable us to properly analyze ownership judgements. These judgements operate at a conceptual level and are interpretive in nature. In particular, ownership judgments are based on two interacting cognitive components: the phenomenological perception of ownership (restricted to cases where these feelings are present) and inferential reasoning (generally playing an exclusive role in ownership judgments regarding other people)—i.e., to make an ownership attribution, both the non-conceptual feelings of ownership (or the lack thereof), and pre-existing conceptual belief stances are processed through an ownership attribution schemata. Based on the subjective weighting of these two components, an ownership judgement is achieved by the subject.³

Formalizing and extending the results of Liepelt, Dolk, and Hommel, I propose that past agency experiences not only influence the phenomenological sense of ownership, but that they modulate *ownership judgments*—i.e., people take into account past agency when making ownership judgments involving self and others.

There is good evidence from developmental psychology that that is the case. A study by Shaylene Nancekivell and Ori Friedman showed that preschoolers infer plausible person-object history when understanding and explaining ownership. That is to say, children seem to think that ‘past investment’ (i.e., agential involvement) in an object implies ownership of that object.⁴ In addition to the evidence from developmental psychology, a slew of psychological studies in adults corroborate the role of agential involvement, and causal considerations in ownership judgments. In an article exploring people’s reasoning about the acquisition of ownership, Ori Friedman compared ‘first possession’ considerations against ‘necessary for possession’ logic. The results of the study clearly favored the necessary for possession rationale—i.e., people employed necessary for possession based reasoning to judge ownership in third party disputes. In light of the results, Friedman suggests that ownership judgements may be based on ‘processes akin to those used to make judgments about causality.’⁵ In fact, the necessary for possession justification conforms with the

³The conception of ownership judgments that I delineated is based on a modified and amalgamated version of the ‘Judgment of ownership’ and ‘Meta-representation of ownership’ concepts in Synofzik, Göttsfried, and Newen, *op. cit.*, p. 420.

⁴Shaylene E. Nancekivell and Ori Friedman, “Preschoolers Selectively Infer History When Explaining Outcomes: Evidence From Explanations of Ownership, Liking, and Use”, *Child Development* 85, no.3 (2014): 1236-1247.

⁵Ori Friedman, “Necessary for Possession: How People Reason About the Acquisition of Ownership”,

perceived agency precept, and obeys the three gestalt-like principles of priority, consistency, and exclusivity that underpin agency perception.

The notion that ownership judgments are based on ‘an agent’s intent and control in bringing about an outcome’ was reaffirmed in a subsequent study by Palamar, Le, and Friedman.⁶ They conducted three separate experiments that showed that people judge ownership by considering the intentional will to bring about possession—i.e., they judge ownership based on the ‘attribution of responsibility’ principle. The authors go on to suggest that their findings indicate that ownership reasoning is not entirely conventional and instead based on psychological processes underlying perception of causality.

The principle of *agential involvement* offers a cogent and integrated framework for the conceptual analysis of ownership intuitions, including the effects of labour on ownership. In this regard, a paper by Kanngiesser, Gjersoe, and Hood showed that children and adults transferred ownership of an object (e.g., modeling-clay) from the original owner to the person that invested creative labor into the object (e.g., a person that shaped a dog using the modeling-clay). In other words, preschool children and adults transfer ownership of an object from the original owner to a person who creatively labours on it to make a new object. Intriguingly, the effect was significantly more pronounced in children than in adults.⁷ The results of this study are in line with the precept that human ownership intuition takes into accounts forms of agential involvement. In particular, *intentional creative labor*, an archetypal example of agential involvement, appears to play a prominent role in the ownership attribution schemata.

In fact, as pointed out earlier, Hegel considered the imposition of form (i.e., intentional creative labor) to be a prominent mode of possession. The reasoning underlying as to why that is the case is made clear by looking at aspects of Hegel’s Master-Slave dialectic. Consider the following passage from the *Phenomenology of Spirit*:

Work is desire held in check, fleetingness staved off... (it) forms and shapes the thing... the formative activity is at the same time the individuality or pure being-for-self of consciousness which now, in the work outside of it, acquires an element of permanence. It is in this way, therefore, that consciousness,

Personality and Social Psychology Bulletin 36, no.9 (2010): 1161-1169.

⁶Max Palamar, Doan T. Le, and Ori Friedman, “Acquiring ownership and the attribution of responsibility”, *Cognition* 124, no.2 (2012): 201-208.

⁷Patricia Kanngiesser, Nathalia Gjersoe, and Bruce M. Hood, “The Effect of Creative Labor on Property-Ownership Transfer by Preschool Children and Adults”, *Psychological Science* 21, no.9 (2010): 1236-1241.

qua worker, comes to see in the independent being (of the object) its own independence.⁸

Hegel considered property to be the externalization of will or the embodiment of personality. According to Dudley Knowles, in the above passage Hegel is asserting that creative labor is ‘an ordered will on the external world, and our creations displays it.’⁹ This constitutes the reason why we sometimes perceive personal qualities of the maker in their creations. More generally, the process of creation requires the imposition of will on the constituent objects, in order to perform the proper transformative operations.

The empirical evidence from developmental studies seems to suggest that Hegel’s second form of possession is an important ownership rationale. Moreover, in contrast to grasping, creation is a more enduring method of externalizing the will and expressing personality. It may not be surprising to find that creation engenders self-object associations, and involves a phenomenological sense of ownership towards the creation. In addition, creation is likely to be a powerful and pervasive factor in ownership judgements.

To determine whether creation is a prevalent precept in ownership attribution, it is constructive to discern manifestations of the principle in young children across cultures. In this regard, an important cross cultural study of ownership in children carried out by Rochat and colleagues showed that creation is a universal and basic principle of attributing ownership (i.e., the principle that attributes ownership of an object to the creator). The study involved children from seven distinct social, economic and cultural situations and revealed that only the creation principle got used consistently, and that principles such as first contact, familiarity and disparity of wealth did not get used uniformly. This was despite the fact that the principle of first contact is an easier precept to cognitively comprehend.¹⁰

A research study in adults extended and refined the ownership precept. Levene, Star-mans, and Friedman explored the effects of creation and intention on ownership, and found that adults predominantly applied the creation criteria to judge ownership. In addition, they found that intention to create mattered in judging ownership—i.e., accidental creation diminished the creator’s claim to ownership. Interestingly, the creation precept operated even in the absence of physical possession—i.e., creation established ownership even without physical possession. Perhaps, most importantly, the study showed that creation lead to

⁸Quoted in Knowles, *op. cit.*, p.58

⁹*Ibid.*, p.59

¹⁰Philippe Rochat, Erin Robbins, Claudia Passos-Ferreira, Angela Donato Oliva, Maria DG Dias, and Liping Guo, “Ownership reasoning in children across cultures”, *Cognition* 132, no. 3 (2014): 471-484.

ownership even if the created object had a lower value than the original material. Finally, creation enhanced the effects of creative labor in ownership judgements—i.e., creation mattered ‘over-and-above the labor involved in creation.’¹¹

These results provide a compelling case that creation is a powerful factor in ownership judgements. Moreover, the ownership precept emerges from the more basic perceived agency principle—i.e., the person intentionally manipulates raw materials to produce a new object. And the creation embodies aspects of the maker’s personality.

This leaves only Hegel’s last mode of possession, marking the object, outside the purview of empirical validation. It is unclear whether marking the object establishes ownership. More likely, people mark already owned objects in order to publicly signal their possession of the object. It is reasonable to interpret Hegel in that manner. In particular, Hegel states that ‘[t]he meaning of the mark is supposed to be that I have put my will into the thing.’¹² Note, that in the statement, Hegel simply refers to the meaning of the mark, not that the mark is an actual mode of externalizing the will. Nevertheless, it would be interesting to see in an experimental setup whether there are cases in which mere marking constitutes ownership of an object.

5.2 Intellectual Property

This section will try to elucidate the amorphous notion of intellectual property within the framework of the phenomenological theory of property. The essential idea that I would like to postulate is that thought generation is somewhat akin to action. In particular, intentional thinking bears resemblance to intentional physical actions. They both demand conscious will and appear to be subject to its jurisdiction in ordinary cases. In fact, the notion that thinking is a ‘kind of action’ has been suggested previously in order to account for certain schizophrenic experiences.¹³

If we accept that thinking is indeed an assemblage of some kind of non-physical actions, and that these actions can be combined in original and creative ways, then intellectual property is subject to the perceived agency precept and the creation principle can be invoked to justify the concept. The former is applicable because intentional thoughts are analogous to intentional physical actions, and intentional actions entail the feeling of agency. This

¹¹Merrick Levene, Christina Starmans, and Ori Friedman, “Creation in judgments about the establishment of ownership”, *Journal of Experimental Social Psychology* 60 (2015): 103-109.

¹²Hegel, *op. cit.*, §58.

¹³Gallagher, *op. cit.*, p.17; see also Christopher Donald Frith, *op. cit.*

would mean that intentional thoughts are accompanied by the phenomenological feeling of agency (a feeling that disappears in certain schizophrenic experiences). According to the perceived agency precept, there should also be a feeling of ownership towards these thoughts in typical (i.e., non-pathological) circumstances. Furthermore, in cases where the thoughts are strung together in novel and creative patterns, then these thoughts constitute a new entity. If that is the case, then the author(s) of the novel thought pattern can invoke the creation principle in order to claim tangible ownership over their ideas.

There is some evidence in support of this account from studies in developmental psychology. A study by Shaw, Li, and Olson demonstrated that 6 to 8 year old children apply ownership principles to ideas (but not to common words)—including the necessary for possession principle, non-transfer by theft, and control of permission rules.¹⁴ A subsequent study investigated whether children value ideas more than labor in artistic creation. They found that 6-year-olds valued ideas over labor (they chose pictures containing their ideas over pictures that merely contained their labor), but that 4-year-olds did not particularly appreciate ideas (they appeared to simply prefer pictures with their ‘idiosyncratic preferences’).¹⁵ This suggests that it takes children longer to apply the ownership concepts that they use for physical objects to ideas. A plausible conjecture is that 6-year-olds but not 4-year-olds value ideas as unique, precious and something that may acquire them recognition or reward; therefore children need to learn the value placed on ideas (at least some ideas) before they begin to extend ownership rights over them.

A cross cultural study with children from the United States, Mexico, and China demonstrated that 5- and 6-year-olds from all three cultures responded negatively to plagiarism. It follows that these children value ideas as things over which ownership rights are applicable.¹⁶ A succeeding study suggested that children’s negative reaction to plagiarism is based on the fact that it takes away credit from the rightful owner.¹⁷ This seems to indicate that children evaluate plagiarism negatively because it violates the attribution of responsibility principle.

In aggregate, the results from developmental psychology support the premise that the phenomenological feeling of ownership extends to the domain of ideas and that they are

¹⁴Alex Shaw, Vivian Li, and Kristina R. Olson, “Children Apply Principles of Physical Ownership to Ideas”, *Cognitive Science* 36, no.8 (2012): 1383-1403.

¹⁵Vivian Li, Alex Shaw, and Kristina R. Olson, “Ideas versus labor: What do children value in artistic creation?”, *Cognition* 127, no.1 (2013): 38-45.

¹⁶Fan Yang, Alex Shaw, Eric Garduno, and Kristina R. Olson, “No one likes a copycat: A cross-cultural investigation of children’s response to plagiarism”, *Journal of Experimental Child Psychology* 121 (2014): 111-119.

¹⁷Alex Shaw and Kristina Olson, “Whose idea is it anyway? The importance of reputation in acknowledgement”, *Developmental Science* 18, no. 3 (2015): 502-509.

broadly subject to the principles (e.g., perceived agency, creation, and attribution of responsibility) of the phenomenological theory of property. Ownership of ideas may be a natural development that reflects the ability of human children to appreciate more abstract concepts. Indeed, creative ideas enable children to express their personality and talents in original ways that go above and beyond the ordinary use of language. In fact, Hegel extends the embodiment of personality account in the *Philosophy of Right* to the realm of intellectual property:

Attainments, eruditions, talents, and so forth, are, of course, owned by free mind and are something internal and not external to it, but even so, by expressing them it may embody them in something external and alienate them.¹⁸

In essence, Hegel is stating that intellectual property is a proficient means of expressing personality and externalizing the will. Perhaps, in some ways, intellectual property is better suited to the task than physical property. In particular, the medium of the written word is a powerful and lasting method of conveying the intentions, desire, personality, and will of the author. The works of Shakespeare, Dostoevsky, Woolf, and Baldwin attest to that power. Moreover, Hegel's conception of intellectual property also provides a reason for why the author's intellectual works shouldn't be plagiarized by consumers. Simply stated, a particular piece of intellectual property is an embodiment of expression that belongs exclusively to the author.¹⁹ And the imperative of right is: 'Be a person and respect others as persons.'²⁰

¹⁸Hegel, *op. cit.*, §43.

¹⁹The Hegelian justification of intellectual property is extensively discussed by Justin Hughes in "The Philosophy of Intellectual Property", *Georgetown Law Journal* 77 (1988): 287-365.

²⁰Hegel, *op. cit.*, §36.

Chapter 6

Epilogue

The phenomenological theory of property developed in this thesis tells us that ownership is a ubiquitous human experience. It is an experience that is closely related to self perception and representation. Moreover, the acquisition of personal property is a part of the natural social development of children that enables new forms of self expression, intentions, and fulfilment of desires. In essence, property is necessary for concrete *freedom*. Perhaps not exactly as Hegel meant the word, but in a more modest way. A conception of freedom in the simple sense that property is needed to live a decent and dignified life. It is needed to be free of material destitution. Indeed, a minimum amount of property is required to adequately express one's personality and further self-perception. This intimates that property, despite being grounded in the neurocognitive sense of self, functions as a rich mode of social interaction. In this regard, it is similar to the Chomskyan conception of language. As Dudley Knowles elegantly puts it:

Freedom would be impossible were men not able to accumulate and dispose assets required to support the conception of the good life which they adopt. As soon as this conception goes beyond a conception of the self as atomistic consumer, men will appropriate durable items which can be employed regularly in the satisfaction of socially ordered, recurrent desires. Property is a social relation akin to language in interesting ways; a medium of transparency, it permits both self-expression and public intelligibility, both self-identification and mutual recognition. Like language, a consciousness which determines itself cannot be a private object of inspection.¹

¹Knowles, *op. cit.*, p.57.

The central question that remains to be answered now is how do we use the phenomenological conception of property to determine the legitimacy of the different property relations that are found in the world. The answer to this question is important seeing the central role that property plays in the structures of society. I will not provide a comprehensive account of the pertinent views, but just the broad direction that property laws should move towards in order to better conform with the dispositions that lead to property in the first place. There are two main concerns, both related to the close connection between personhood and property.

The first is the idea that because of the tight link between self (personal) development and property, there should be a general right to property. The reasoning that leads to this conclusion, in the words of Jeremy Waldron, is that ‘[w]e cannot argue, on the one hand, that property-owning is necessary for ethical development, and then, on the other hand, affect unconcern about the moral and material plight of those who have nothing.’² Importantly, a person deprived of an adequate degree of property is entitled to claim that their autonomy and development of agency has been ‘undermined’ and ‘violated’.³

The second notion is related to the concept that there should be a legal and moral dichotomy in property rights—an idea first suggested by Margaret Radin. According to Radin, personal property (closely bound up with the person) yields ‘a stronger moral claim’ than fungible property (possessions held purely for instrumental reasons). In addition, Radin contends that personal property should be considered distinct from ‘other necessities of personhood’—e.g., a welfare rights theory, providing ‘a set of core entitlements’ necessary for personhood, should maintain the distinction between property and non-property rights.⁴

By synthesizing the general right to property with a dualist theory of property, we obtain a radical conception of property rights. There is no constitution currently in the world (as far as I’m aware) that provides a universal right to property and ensures that every citizen is a proprietor of at least an adequate amount of personal property. If such a conception of property were to be legally adopted, that would mean that instead of a right to mere shelter, people would have the right to a particular house or apartment.

The final aspect of property relations pertains to labor and the methods of production. On this theme, the spectre of Marx looms large. Interestingly, there is empirical evidence that *alienation* is a real psychological occurrence. The ‘recognition’ of the laborer and ‘purpose’ of labor influences labor supply—the presence of these two factors adds meaning to labor and positively affects the labor supply. The absence of recognition or the lack

²Waldron 1988, *op. cit.*, p.4.

³*Ibid.*, p.24.

⁴Radin, *op. cit.*, p.988-91.

of purpose negatively influences the laborer.⁵ It would appear that the laborer yearns a certain degree of participation in the process of production, and desires recognition for their creative work. Modifying contemporary labor laws to make them more amenable to the worker is a complicated endeavour, but that is nonetheless the course of action suggested by the phenomenological theory of property. As John Stuart Mill emphasized, ‘The laws of property have never yet conformed to the principles on which the justification of private property rests.’⁶ That needs to be corrected.

⁵Dan Ariely, Emir Kamenica, and Dražen Prelec, “Man’s search for meaning: The case of Legos,” *Journal of Economic Behavior & Organization* 67, no.3-4 (2008): 671-677.

⁶John Stuart Mill, *Principles of Political Economy* [1848], (ed. Jonathan Riley) (Oxford: Oxford University Press 1994), p.14-15.

References

- [1] Aglioti, Salvatore, Nicola Smania, Michela Manfredi, and Giovanni Berlucchi. “Disownership of left hand and objects related to it in a patient with right brain damage”. *Neuroreport* 8, no.1 (1996):293–296.
- [2] Ariely, Dan, Emir Kamenica and Dražen Prelec. “Man’s search for meaning: The case of Legos”. *Journal of Economic Behavior & Organization* 67, no. 3-4 (2008):671–677.
- [3] Arzy, Shahar, Leila S. Overney, Theodor Landis, and Olaf Blanke. “Neural Mechanisms of Embodiment: Asomatognosia Due to Premotor Cortex Damage”. *Archives of Neurology* 63, no.7 (2006):1022–1025.
- [4] Baier, Bernhard, and Hans-Otto Karnath. “Tight Link Between Our Sense of Limb Ownership and Self-Awareness of Actions”. *Stroke* 39, no.2 (2008):486–488.
- [5] Bentham, Jeremy. *Theory of Legislation* [1st ed. 1802]. Translated by R. Hildreth, 1840.
- [6] Bertenthal, Bennett I. “Origins and Early Development of Perception, Action, and Representation”. *Annual Review of Psychology* 47, no.1 (1996):431–459.
- [7] Bertenthal, Bennett I., and Rachel K. Clifton. “Perception and action”. In *Handbook of child psychology: Vol. 2. Cognition, perception and language*. Edited by D. K. W. Damon R. Siegler. New York: Wiley, 1998: 51-102.
- [8] Berti, Anna, and Francesca Frassinetti. “When Far Becomes Near: Remapping of Space by Tool Use”. *Journal of Cognitive Neuroscience* 12, no.3 (2000):415–420.
- [9] Bertram, Christopher. “Property In The Moral Life of Human Beings”. *Social Philosophy and Policy* 30, no. 1-2 (2013):404–424.

- [10] Botvinick, Matthew, and Jonathan Cohen. “Rubber hands ‘feel’ touch that eyes see”. *Nature* 391, no.6669 (1998):756.
- [11] Brosnan, Sarah F. “Property in Nonhuman Primates”. *New Directions for Child and Adolescent Development* 132, (2011):922.
- [12] Brown, Donald E. *Human Universals*. New York: McGraw-Hill, 1991.
- [13] Burin, Dalila, Alessandro Livelli, Francesca Garbarini, Carlotta Fossataro, Alessia Folegatti, Patrizia Gindri, and Lorenzo Pia. “Are Movements Necessary for the Sense of Body Ownership? Evidence from the Rubber Hand Illusion in Pure Hemiplegic Patients”. *PLoS One* 10, no.3 (2015):e0117155.
- [14] Burin, Dalila, Maria Pyasik, Adriana Salatino, and Lorenzo Pia. “That’s my hand! Therefore, that’s my willed action: How body ownership acts upon conscious awareness of willed actions”. *Cognition* 166, (2017):164–173.
- [15] Butterworth, George, and Brian Hopkins. “Handmouth coordination in the newborn baby”. *British Journal of Developmental Psychology* 6, no.4 (1988):303–314.
- [16] Campbell, John. “Schizophrenia, The Space of Reasons, and Thinking as a Motor Process”. *The Monist* 82, no.4 (1999):609–625.
- [17] Cardinali, Lucilla, Francesca Frassinetti, Claudio Brozzoli, Christian Urquizar, Alice C. Roy, and Alessandro Farnè. “Tool-use induces morphological updating of the body schema”. *Current Biology* 19, no.12 (2009):R478–R479.
- [18] Carlson, Thomas A., George Alvarez, Daw-an Wu, and Frans AJ Verstraten. “Rapid Assimilation of External Objects Into the Body Schema”. *Psychological Science* 21, no.7 (2010):1000–1005.
- [19] Carruthers, Peter. “How we know our own minds: The relationship between mindreading and metacognition”. *The Behavioral and Brain Sciences* 32, (2009):121–182.
- [20] Cattaneo, Luigi, Maddalena Fabbri-Destro, Sonia Boria, Cinzia Pieraccini, Annalisa Monti, Giuseppe Cossu, and Giacomo Rizzolatti. “Impairment of actions chains in autism and its possible role in intention understanding”. *Proceedings of the National Academy of Sciences* 104, no.45 (2007):17825–17830.
- [21] Chomsky, Noam. *Aspects of the Theory of Syntax*. MIT Press, 2014.

- [22] Constable, Merryn D., Ada Kritikos, and Andrew P. Bayliss. “Grasping the concept of personal property”. *Cognition* 119, no.3 (2011):430–437.
- [23] Courage, Mary L., Shannon C. Edison, and Mark L. Howe. “Variability in the early development of visual self-recognition”. *Infant Behavior and Development* 27, no.4 (2004):509–532.
- [24] Craighero, Laila, Luciano Fadiga, Giacomo Rizzolatti, and Carlo Umiltà. “Action for perception: A motor-visual attentional effect”. *Journal of Experimental Psychology: Human Perception and Performance* 25, no.6 (1999):1673–1692.
- [25] Davies, P. “Effects of Movements upon the Appearance and Duration of a Prolonged Visual Afterimage: 1. Changes Arising from the Movement of a Portion of the Body Incorporated in the Afterimaged Scene”. *Perception* 2, no.2 (1973):147–153.
- [26] Dennett, Daniel. *Consciousness Explained*. Little Brown & Co, 1991.
- [27] di Pellegrino, Giuseppe, Elisabetta Ldavas, and Alessandro Farné. “Seeing where your hands are”. *Nature* 388, no.6644 (1997):730.
- [28] Dummer, Timothy, Alexandra Picot-Annand, Tristan Neal, and Chris Moore. “Movement and the rubber hand illusion”. *Perception* 38, no.2 (2009):271–280.
- [29] Ehrsson, H. Henrik, Charles Spence, and Richard E. Passingham. “That’s My Hand! Activity in Premotor Cortex Reflects Feeling of Ownership of a Limb”. *Science* 305, no.5685 (2004):875–877.
- [30] Farrer, Chloe and Chris D. Frith. “Experiencing Oneself vs Another Person as Being the Cause of an Action: The Neural Correlates of the Experience of Agency”. *Neuroimage* 15, no.3 (2002):596–603.
- [31] Farrer, Chloe, Nicolas Franck, Nicolas Georgieff, Chris D. Frith, Jean Decety, and Marc Jeannerod. “Modulating the experience of agency: a positron emission tomography study”. *Neuroimage* 18, no.2 (2003):324–333.
- [32] Ferri, Francesca, Francesca Frassinetti, Martina Ardizzi, Marcello Costantini, and Vittorio Gallese. “A Sensorimotor Network for the Bodily Self”. *Journal of Cognitive Neuroscience* 24, no.7 (2012):1584–1595.
- [33] Fogassi, Leonardo, Pier Francesco Ferrari, Benno Gesierich, Stefano Rozzi, Fabian Chersi, and Giacomo Rizzolatti. “Parietal Lobe: From Action Organization to Intention Understanding”. *Science* 308, no.5722 (2005):662–667.

- [34] Freud, Sigmund. *Civiltzation and Its Discontents*. In Vol 21 of *The Complete Psychological Works of Sigmund Freud*, edited by Strachey. The Standard Edition, 1964.
- [35] Friedman, Ori. “Necessary for Possession: How People Reason About the Acquisition of Ownership”. *Personality and Social Psychology Bulletin* 36, no.9 (2010):1161–1169.
- [36] Frith, Christopher Donald. *The Cognitive Neuropsychology of Schizophrenia*. Psychology Press, 2014.
- [37] Gallagher, Shaun. “Body Image and Body Schema: A Conceptual Clarification”. *The Journal of Mind and Behavior*, (1986):541–554.
- [38] Gallagher, Shaun. “Philosophical conceptions of the self: implications for cognitive science”. *Trends in Cognitive Sciences* 4, no.1 (2000):14–21.
- [39] Gallese, Vittorio, and Corrado Sinigaglia. “The bodily self as power for action”. *Neuropsychologia* 48, no.3 (2010):746–755.
- [40] Gammage, Bill. *The Biggest Greatest Estate on Earth. How Aborigines Made Australia*. Sydney: Allen & Unwin, 2011.
- [41] Gawronski, Bertram, Galen V. Bodenhausen, and Andrew P. Becker. “I like it, because I like myself: Associative self-anchoring and post-decisional change of implicit evaluations”. *Journal of Experimental Social Psychology* 43, no.2 (2007):221–232.
- [42] Gazzaniga, Michael. *The Mind’s Past*. New York: Basic Books, 1998.
- [43] Gibson, James J. *The Ecological Approach to Visual Perception*. Classic Edition: Psychology Press, 2014.
- [44] Goddard, Cliff. “The Natural Semantic Metalanguage approach”. In *The Oxford Handbook of Linguistic Analysis*. Edited by Bernd Heine and Heiko Narrog. Oxford: Oxford University Press, 2010: 459-484.
- [45] Graziano, Michael S., Gregory S. Yap, and Charles G. Gross. “Coding of visual space by premotor neurons”. *Science* 266, no.5187 (1994):1054–1057.
- [46] Guterstam, Arvid, Giovanni Gentile, and H. Henrik Ehrsson. “The invisible hand illusion: multisensory integration leads to the embodiment of a discrete volume of empty space”. *Journal of Cognitive Neuroscience* 25, no.7 (2013):1078–1099.

- [47] Haggard, Patrick. “Conscious intention and motor cognition”. *Trends in Cognitive Sciences* 9, no.6 (2005):290–295.
- [48] Head, Henry, and Gordon Holmes. “Sensory disturbances from cerebral lesions”. *Brain* 34, no.2-3 (1911):102–254.
- [49] Hegel, G.W.F. *Philosophy of Right* [1821]. Translated by TM Knox. Oxford: Oxford University Press, 1840.
- [50] Hihara, Sayaka, Tomonori Notoya, Michio Tanaka, Shizuko Ichinose, Hisayuki Ojima, Shigeru Obayashi, Naotaka Fujii, and Atsushi Iriki. “Extension of corticocortical afferents into the anterior bank of the intraparietal sulcus by tool-use training in adult monkeys”. *Neuropsychologia* 44, no.13 (2006):2636–2646.
- [51] Hogendoorn, Hinze, Marjolein PM Kammers, Thomas A. Carlson, and Frans AJ Verstraten. “Being in the dark about your hand: Resolution of visuo-proprioceptive conflict by disowning visible limbs”. *Neuropsychologia* 47, no.13 (2009):2698–2703.
- [52] Hughes, Justin. “The Philosophy of Intellectual Property”. *Georgetown Law Journal* 77, (1988):287–365.
- [53] Hume, David. “Of Personal Identity”. In *A Treatise Of Human Nature* [1739]. Oxford: Clarendon Press, 1978.
- [54] Hume, David. *A Treatise of Human Nature* [1739]. Edited by L.A. Selby-Bigge and P. H. Nidditch. Oxford: Clarendon Press, 1978.
- [55] Iriki, Atsushi, Michio Tanaka, and Yoshiaki Iwamura. “Coding of modified body schema during tool use by macaque postcentral neurones”. *Neuroreport* 7, no.14 (1996):2325–2330.
- [56] Iriki, Atsushi, Michio Tanaka, Shigeru Obayashi, and Yoshiaki Iwamura. “Self-images in the video monitor coded by monkey intraparietal neurons”. *Neuroscience Research* 40, no.2 (2001):163–173.
- [57] Isaacs, Susan. *Social Development in Young Children*. London: Routledge & Kegan Paul Limited, 1933.
- [58] Jacobsen, Rodney. “Wittgenstein on Self- Knowledge and Self-Expression”. *The Philosophical Quarterly* (1950-) 46, no.182 (1996):12–30.

- [59] James, William. *The Principles of Psychology* [1890]. Cambridge, MA: Harvard University Press, 1983.
- [60] Kamewari, Kazunori, Masaharu Kato, Takayuki Kanda, Hiroshi Ishiguro, and Kazuo Hiraki. “Six-and-a-half-month-old children positively attribute goals to human action and to humanoid-robot motion”. *Cognitive Development* 20, no.2 (2005):303–320.
- [61] Kanngiesser, Patricia, Nathalia Gjersoe, and Bruce M. Hood. “The Effect of Creative Labor on Property-Ownership Transfer by Preschool Children and Adults”. *Psychological Science* 21, no.9 (2010):1236–1241.
- [62] Klaver, Maayke, and H. Chris Dijkerman. “Bodily Experience in Schizophrenia: Factors Underlying a Disturbed Sense of Body Ownership”. *Frontiers in Human Neuroscience* 10, (2016):305.
- [63] Knowles, Dudley. “Hegel on Property and Personality”. *The Philosophical Quarterly* (1950-) 33, no.130 (1983):45–62.
- [64] Koffka, Kurt. *Principles of Gestalt psychology*. Routledge, 2013.
- [65] Kokkinara, Elena, and Mel Slater. “Measuring the Effects through Time of the Influence of Visuomotor and Visuotactile Synchronous Stimulation on a Virtual Body Ownership Illusion”. *Perception* 43, no.1 (2014):43–58.
- [66] LeBarr, A. Nicole, and Judith M. Shedden. “Psychological ownership: The implicit association between self and already-owned versus newly-owned objects”. *Consciousness and Cognition* 48, (2017):190–197.
- [67] Levene, Merrick, Christina Starmans, and Ori Friedman. “Creation in judgments about the establishment of ownership”. *Journal of Experimental Social Psychology* 60, (2015):103–109.
- [68] Li, Vivian, Alex Shaw, and Kristina R. Olson. “Ideas versus labor: What do children value in artistic creation?”. *Cognition* 127, no.1 (2013):38–45.
- [69] Liepelt, Roman, Thomas Dolk, and Bernhard Hommel. “Self-perception beyond the body: the role of past agency”. *Psychological Research* 81, no.3 (2017):549–559.
- [70] Locke, John. *The Second Treatise of Government*. In *Two Treatises of Government*, edited by Peter Laslett. Cambridge, 1963.

- [71] Locke, John. *An Essay Concerning Human Understanding* [2nd ed. 1694]. Edited by P. H. Nidditch. Oxford: Clarendon Press, 1975.
- [72] Longo, Matthew R., Friederike Schüür, Marjolein PM Kammers, Manos Tsakiris, and Patrick Haggard. “Self awareness and the body image”. *Acta Psychologica* 132, no.2 (2009):166–172.
- [73] Loomis, Jack M. “Distal Attribution and Presence”. *Presence: Teleoperators & Virtual Environments* 1, no.1 (1992):113–119.
- [74] Lotze, R. H. *Medicinische Psychologie oder die Physiologie der Seele*. Leipzig: Weidmann’sche Buchhandlung, 1852.
- [75] Ma, Ke, and Bernhard Hommel. “Body-ownership for actively operated non-corporeal objects”. *Consciousness and Cognition* 36, (2015):75–86.
- [76] Ma, Ke, and Bernhard Hommel. “The role of agency for perceived ownership in the virtual hand illusion”. *Consciousness and Cognition* 36, (2015):277–288.
- [77] Ma, Ke, Bernhard Hommel, and Hong Chen. “The roles of consistency and exclusivity in perceiving body ownership and agency”. *Psychological Research*, (2018):1–10.
- [78] Maravita, Angelo, and Atsushi Iriki. “Tools for the body (schema)”. *Trends in Cognitive Sciences* 8, no.2 (2004):79–86.
- [79] Maravita, Angelo, Masud Husain, Karen Clarke, and Jon Driver. “Reaching with a tool extends visuotactile interactions into far space: Evidence from cross-modal extinction”. *Neuropsychologia* 39, no.6 (2001):580–585.
- [80] Meltzoff, Andrew N., and M. Keith Moore. “Newborn Infants Imitate Adult Facial Gestures”. *Child Development*, (1983):702–709.
- [81] Merleau-Ponty, Maurice. *Phenomenology of Perception*. Translated by Colin Smith. London, NY: Routledge, 1962.
- [82] Mill, John Stuart. *Principles of Political Economy* [1848]. Edited by Jonathan Riley. Oxford: Oxford University Press, 1994.
- [83] Moseley, G. Lorimer, Nick Olthof, Annemeike Venema, Sanneke Don, Marijke Wijers, Alberto Gallace, and Charles Spence. “Psychologically induced cooling of a specific body part caused by the illusory ownership of an artificial counterpart”. *Proceedings of the National Academy of Sciences* 105, no.35 (2008):13169–13173.

- [84] Nancekivell, Shaylene E., and Ori Friedman. “Preschoolers Selectively Infer History When Explaining Outcomes: Evidence From Explanations of Ownership, Liking, and Use”. *Child Development* 85, no.3 (2014):1236–1247.
- [85] Nancekivell, Shaylene E., Julia W. Van de Vondervoort, and Ori Friedman. “Young Children’s Understanding of Ownership”. *Child Development Perspectives* 7, no.4 (2013):243–247.
- [86] Neary, Karen R., and Ori Friedman. “Young Children Give Priority to Ownership When Judging Who Should Use an Object”. *Child Development* 85, no.1 (2014):326–337.
- [87] Newport, Roger, Rachel Pearce, and Catherine Preston. “Fake hands in action: embodiment and control of supernumerary limbs”. *Experimental Brain Research* 204, no.3 (2010):385–395.
- [88] Nozick, Robert. *Anarchy, State, and Utopia*. New York: Basic Books, 1974.
- [89] Orban, Guy A., David Van Essen, and Wim Vanduffel. “Comparative mapping of higher visual areas in monkeys and humans”. *Trends in Cognitive Sciences* 8, no.7 (2004):315–324.
- [90] Palamar, Max, Doan T. Le, and Ori Friedman. “Acquiring ownership and the attribution of responsibility”. *Cognition* 124, no.2 (2012):201–208.
- [91] Pavani, Francesco, Charles Spence, and Jon Driver. “Visual Capture of Touch: Out-of-the-Body Experiences with Rubber Gloves”. *Psychological Science* 11, no.5 (2000):353–359.
- [92] Peled, Avi, Michael Ritsner, Shmuel Hirschmann, Amir B. Geva, and Ilan Modai. “Touch feel illusion in schizophrenic patients”. *Biological Psychiatry* 48, no.11 (2000):1105–1108.
- [93] Rademaker, Rosanne L., Daw-An Wu, Ilona M. Bloem, and Alexander T. Sack. “Intensive tool-practice and skillfulness facilitate the extension of body representations in humans”. *Neuropsychologia* 56, (2014):196–203.
- [94] Radin, Margaret. “Property and Personhood”. *Stanford Law Review*, (1982):957–1015.
- [95] Ricoeur, Paul. *Oneself As Another*. Translated from *Soi-même comme un autre*, Editions du Seuil. University of Chicago Press, 1990.

- [96] Riemer, Martin, Dieter Kleinböhl, Rupert Hölzl, and Jörg Trojan. “Action and perception in the rubber hand illusion”. *Experimental Brain Research* 229, no.3 (2013):383–393.
- [97] Ritchie, J. Brendan, and Thomas Carlson. “Mirror, mirror, on the wall, is that even my hand at all? Changes in the afterimage of one’s reflection in a mirror in response to bodily movement”. *Neuropsychologia* 48, no.5 (2010):1495–1500.
- [98] Rizzolatti, Giacomo, and Corrado Sinigaglia. “The functional role of the parieto-frontal mirror circuit: interpretations and misinterpretations”. *Nature Reviews Neuroscience* 11, no.4 (2010):264–274.
- [99] Rizzolatti, Giacomo, Leonardo Fogassi, and Vittorio Gallese. “Neurophysiological mechanisms underlying the understanding and imitation of action”. *Nature Reviews Neuroscience* 2, no.9 (2001):661–670.
- [100] Rizzolatti, Giacomo, Luciano Fadiga, Leonardo Fogassi, and Vittorio Gallese. “The Space Around Us”. *Science* 277, no.5323 (1997):190–191.
- [101] Rochat, Philippe. “Possession and Morality in Early Development”. *New Directions for Child and Adolescent Development* 132, (2011):3031.
- [102] Rochat, Philippe, Erin Robbins, Claudia Passos-Ferreira, Angela Donato Oliva, Maria DG Dias, and Liping Guo. “Ownership reasoning in children across cultures”. *Cognition* 132, no.3 (2014):471–484.
- [103] Rose, Carol M. “Possession as the Origin of Property”. *The University of Chicago Law Review* 52, no.1 (1985):73–88.
- [104] Sala, Clelia Marchetti Sergio Della. “Disentangling the Alien and Anarchic Hand”. *Cognitive Neuropsychiatry* 3, no.3 (1998):191–207.
- [105] Sartre, Jean-Paul. *Being and Nothingness: An Essay on Phenomenological Ontology* [1943]. New York: Philosophical Library, 1956.
- [106] Shaw, Alex, and Kristina Olson. “Whose idea is it anyway? The importance of reputation in acknowledgement”. *Developmental Science* 18, no.3 (2015):502–509.
- [107] Shaw, Alex, Vivian Li, and Kristina R. Olson. “Children Apply Principles of Physical Ownership to Ideas”. *Cognitive Science* 36, no.8 (2012):1383–1403.

- [108] Short, Fay, and Robert Ward. “Virtual Limbs and Body Space: Critical Features for the Distinction Between Body Space and Near-Body Space”. *Journal of Experimental Psychology: Human Perception and Performance* 35, no.4 (2009):1092–1103.
- [109] Sinigaglia, Corrado, and Giacomo Rizzolatti. “Through the looking glass: Self and others”. *Consciousness and Cognition* 20, no.1 (2011):64–74.
- [110] Stake, J. E. “The property instinct”. *Philosophical Transactions of the Royal Society B: Biological Sciences* 359, no.1451 (2004):1763–1774.
- [111] Synofzik, Matthis, Gottfried Vosgerau, and Albert Newen. “I move, therefore I am: A new theoretical framework to investigate agency and ownership”. *Consciousness and Cognition* 17, no.2 (2008):411–424.
- [112] Thakkar, Katharine N., Heathman S. Nichols, Lindsey G. McIntosh, and Sohee Park. “Disturbances in Body Ownership in Schizophrenia: Evidence from the Rubber Hand Illusion and Case Study of a Spontaneous Out-of-Body Experience”. *PloS One* 6, no.10 (2011):e27089.
- [113] Tomasello, Michael, and Amrisha Vaish. “Origins of Human Cooperation and Morality”. *Annual Review of Psychology* 64, (2013):231–255.
- [114] Tsakiris, Manos, and Patrick Haggard. “The Rubber Hand Illusion Revisited: Visuotactile Integration and Self-Attribution”. *Journal of Experimental Psychology: Human Perception and Performance* 31, no.1 (2005):80–91.
- [115] Tsakiris, Manos, Gita Prabhu, and Patrick Haggard. “Having a body versus moving your body: How agency structures body-ownership”. *Consciousness and Cognition* 15, no.2 (2006):423–432.
- [116] Tsakiris, Manos, Maike D. Hesse, Christian Boy, Patrick Haggard, and Gereon R. Fink. “Neural Signatures of Body Ownership: A Sensory Network for Bodily Self-Consciousness”. *Cerebral Cortex* 17, no.10 (2006):2235–2244.
- [117] Tsakiris, Manos, Matthew R. Longo, and Patrick Haggard. “Having a body versus moving your body: Neural signatures of agency and body-ownership”. *Neuropsychologia* 48, no.9 (2010):2740–2749.
- [118] Tsakiris, Manos, Patrick Haggard, Nicolas Franck, Nelly Mainy, and Angela Sirigu. “A specific role for efferent information in self-recognition”. *Cognition* 96, no.3 (2005):215–231.

- [119] Tsakiris, Manos, Simone Schütz-Bosbach, and Shaun Gallagher. “On agency and body-ownership: Phenomenological and neurocognitive reflections”. *Consciousness and Cognition* 16, no.3 (2007):645–660.
- [120] Vallar, Giuseppe, and Roberta Ronchi. “Somatoparaphrenia: a body delusion. A review of the neuropsychological literature”. *Experimental Brain Research* 192, no.3 (2009):533–551.
- [121] Van de Vondervoort, Julia W., and Ori Friedman. “Parallels in Preschoolers’ and Adults’ Judgments About Ownership Rights and Bodily Rights”. *Cognitive Science* 39, no.1 (2015):184–198.
- [122] Van Den Bos, Esther, and Marc Jeannerod. “Sense of body and sense of action both contribute to self-recognition”. *Cognition* 85, no.2 (2002):177–187.
- [123] van Dijk, Milenna T., Guido A. van Wingen, Anouk van Lammeren, Rianne M. Blom, Bart P. de Kwaasteniet, H. Steven Scholte, and Damiaan Denys. “Neural Basis of Limb Ownership in Individuals with Body Integrity Identity Disorder”. *PLoS One* 8, no.8 (2013):e72212.
- [124] Verschoor, Stephan A., and Bernhard Hommel. “Self-by-doing: The role of action for self-acquisition”. *Social Cognition* 35, no.2 (2017):127–145.
- [125] Verschoor, Stephan A., Michiel Spapé, Szilvia Biro, and Bernhard Hommel. “From outcome prediction to action selection: developmental change in the role of action-effect bindings”. *Developmental Science* 16, no.6 (2013):801–814.
- [126] Waldron, Jeremy. *The Right to Private Property*. Oxford: Oxford University Press, 1988.
- [127] Waldron, Jeremy. “Property and Ownership”. *The Stanford Encyclopedia of Philosophy*. Winter 2016 Edition, edited by Edward N. Zalta. URL=<<https://plato.stanford.edu/archives/win2016/entries/property/>>.
- [128] Wegner, Daniel M. “The mind’s best trick: how we experience conscious will”. *Trends in Cognitive Sciences* 7, no.2 (2003):65–69.
- [129] Wittgenstein, Ludwig. *Remarks on the Philosophy of Psychology*. Vol. I. Oxford: Basil Blackwell, 1980.

- [130] Yang, Fan, Alex Shaw, Eric Garduno, and Kristina R. Olson. “No one likes a copycat: A cross-cultural investigation of children’s response to plagiarism”. *Journal of Experimental Child Psychology* 121, (2014):111–119.

APPENDICES

Appendix A

Dissociation of Body Ownership and Agency

The dissociability of ownership and agency is a topic of ongoing research. Tsakiris, Longo, and Haggard designed an fMRI based experiment to explore the precise relation of agency and ownership. To regulate ownership, they manipulated the synchrony of visual feedback and movement. On the other hand, they controlled agency with conditions of passive and active movement. Neuroimaging of the subjects covering possible experiment conditions (the variables of interest being agency and ownership) revealed that there was no common neural activation shared between agency and ownership. In other words, the two experiences are represented by distinct neural representations. Alternatively, introspective reports from the same experiment signified that the two aspects of the minimal self were correlated. Specifically, the reports showed that agency increases the sense of ownership. A possible explanation for the contradictory results, posited by Tsakiris, Longo, and Haggard, is that there is no injective (one to one) mapping between the experiences comprising the minimal self and neural activity.¹ It should also be noted that the imaging results of Tsakiris, Longo, and Haggard do not conform with the assortment of neuroimaging studies presented in Section II—they pointed to both ownership and agency being grounded in motor intentional (neural) networks.

Contrariwise, dissociability of body agency and ownership may be perceptible in the anarchic hand syndrome. People suffering from the anarchic hand syndrome perform involuntary goal directed actions with the affected hand—the person’s agency is selectively

¹Tsakiris, Longo, and Haggard, *op. cit.*

disturbed in that they are aware of the discrepancy between their will and actions.² It appears that affordances provided by objects in the environment lead to the initiation of goal directed actions; there is no inhibition of these possible actions in keeping with the actual motor intentions of the agent. Despite this absence of intention, the agent perceives these actions as their own. Gallese and Sinigaglia describe this segregated dysfunction in terms of a malfunctioning ‘control mechanism regulating the potentialities for action’ that does not overtly affect body ownership because the performed actions are nonetheless experienced as potentialities of the ‘bodily self’. More briefly, the ‘correct instrumental goal-relatedness of these actions’ ensures that they are experienced as motor potentialities of the self. Therefore, the person with the anarchic hand syndrome does not deny that the unintended action belongs to them.³

²Clelia Marchetti Sergio Della Sala, “Disentangling the Alien and Anarchic Hand”, *Cognitive Neuropsychiatry* 3, no.3 (1998):191-207.

³Gallese and Sinigaglia, *op. cit.*, p.749-50.