AN INTEGRAL APPROACH TO AGROECOLOGICAL RESEARCH

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1. INTRODUCTION

By the assessment of many of the field's own scholars (Wezel et al. 2009, Buttel 2007, Bland 2004, Francis et al. 2003), the scientific discipline of agroecology is currently in a state of redefining itself. These same scholars tell a coherent history of the discipline, beginning in the late 1920s, as a sort of evolution of worldviews. They identify two broad stages: the first characterized by a narrow productivist approach (1930s-1960s) and the second by a systems-ecology approach with an explicit concern for sustainability (1970s-2000s). At present, although the latter approach still dominates, several novel theoretical frameworks are challenging the systems-sustainability paradigm (Bland & Bell 2009, Buttel 2007, Jordan & Warner 2010), suggesting that transition to a third broad theoretical anchoring of the field may be imminent.

1.1. INTEGRAL THEORY

The Integral framework can be thought of as a map for locating and identifying perspectives. The map is comprised of three crucial elements. The first and most basic element is the four-quadrant plane, which constitutes a sort of ontological skeleton; all entities existing in reality belong to one of four quadrants. The horizontal axis separates individual (top) and collective (bottom), and the vertical axis distinguishes subjective (left) from objective (right). In the upper left (UL) belong entities of an individual subjective nature, like thoughts, emotions, and beliefs. In the upper right (UR) belong entities of an individual objective nature, like cells, brain structures, and observable

behaviors. In the lower right (LR) belong collective objective entities like social groups, ecosystems, and observable interactions among individuals. In the lower left (LL) belong collective subjective entities like cultural values, worldviews, and shared understandings. The ontological units that are then mapped onto the four-quadrant skeleton are *holons*[1]. A holon is defined as any entity that is simultaneously a part and a whole (Koestler 1967). A person is a good example of a holon. Sally Smith is simultaneously a whole collection of constitutive parts (i.e. atoms, molecules, cells, organs, organ systems, ideas, beliefs, emotions, etc.) as well as a constitutive part[2], in and of herself, of larger wholes that in turn depend on her membership (i.e. American culture, the natural environment, her family, the Republican party, the American Society for Cell Biology, the PTA at her children's school, etc.).

Before moving on to the next two critical elements of IT, it is important to explain the concepts of development and holarchy. A foundational principle of IT is that holons do not simply appear out of thin air, but rather *develop* in successive levels of complexity in a natural hierarchy. Wilber uses the term *holarchy,* which is a nested hierarchy of holons in which each successive level builds and depends on the ones before (**.**)

Building on the tenet of holarchical development, the second critical element of the integral ontology is lines. Lines refer to the many different paths along which a holon can develop in any of the four quadrants. In the UL quadrant, for example, a human develops along various developmental lines: cognitive, emotional, rational, moral,

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[1] Technically, IT posits that the world is comprised not of holons, per se, but of the *perspectives* that holons take. This distinction is important in emphasizing that reality is not an objective "given," but rather always depends to some extent on subjective interpretation.

[2] Holons like humans that have interior dimensions are said to be not just parts but *members* of the collective wholes to which they belong, since those wholes necessarily have inter-subjective dimensions deriving from the aggregate interactions among the members' interiors. "Members" signifies that the interiority of such holons has an active and fluid role in shaping this inter-subjective space.

spiritual, aesthetic, kinesthetic[3]. Although cognitive and developmental psychologists have developed many different schemes for characterizing development, the important point for IT is *that* humans develop in these various capacities in quite consistent and predictable ways. There is virtually unanimous consensus on this concept.

The third key element of the integral ontology is levels. Levels can be thought of as the rungs of each developmental ladder, or line. For the sake of simplicity and relevance, let us continue with our example of human development in the UL quadrant. Although IT acknowledges that human development is a continuous, wave-like process, it also holds that discrete levels can be identified, and indeed have been by numerous developmental psychologists, who have created various classification schemes for delineating developmental stages. IT's developmental model is a synthesis of many such schemes, drawing primarily on one based on the research of developmental psychologist Clare Graves and later popularized by Don Beck and Chris Cowan in a theory called Spiral Dynamics (Beck & Cowan 1996). In Spiral Dynamics, individual and collective human development proceed dialectically, along a continuum of increasingly complex "memes," or core value systems, that structure personal and group identities along the developmental spectrum.[4] Since in this model, individual "meme" identities are constructed in relation to collective "meme" identities and vice versa, the developmental level of individuals often reflects that of the groups of which they are part, and vice versa. From here we can identify a certain "center of gravity," or stabilized level of

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[3] Integral Theory maintains that the cognitive line leads all others; in other words, one cannot develop emotionally, spiritually, etc., until sufficient cognitive development has taken place to allow for "cognizing" such development.

[4] Again, although "memes" indicate distinct sets of values and are organized along a continuum of complexity, Spiral Dynamics holds that both groups and individuals possess elements of several memes simultaneously such that development is fluid and not a strictly linear, hierarchical process.

development, not only for individuals but also for groups that may be comprised of individuals at widely varying levels of development. A collective center of gravity can generally be assessed as the developmental level reflected in a group's activities or decision processes, taking into account structural imbalances of power (i.e. elite leadership) that may be built into the group.

With IT map in hand, we now hope to use the principles just outlined to understand the developmental dynamics at work in the group of interest to this analysis: the academic field of Agroecology.

1.2. AGROECOLOGY

1.2.1. An Evolution of Worldviews

Applying Integral Theory (IT), the history of Agroecology can be understood as a sort of micro-cultural evolution, embedded within a macro-cultural context, progressing in sequence through a nested hierarchy of developmental stages. The discipline's early productivist orientation fits neatly into what IT terms "scientific-rational," a stage rooted squarely in the values of modernity. Pluralism and holism, the hallmark values of the next stage in the Integral developmental sequence, characterize the field's subsequent transition into a post-modern systems-sustainability paradigm that largely endures today. IT describes the next stage in this sequence of progressions as "integral," because it honors and integrates the values of all previous stages, in addition to all four quadrants. By thus tracing the historical evolution of Agroecology, we may be able to identify a sort of developmental goal post that can help make sense of the recent theoretical developments that have emerged as the discipline ventures into novel conceptual

territory.

Agroecology as a scientific discipline grew primarily out of the sciences of agronomy and ecology in the late 1920s. Although the concept of "agricultural ecology," indicating a loose application of ecological principles to in agricultural settings, came about shortly after the birth of ecology as a coherent science in the late 19th century, the first use of the word "agroecology" in the scientific literature appears in the work of Basil Bensin, a Russian agronomist who studied and worked primarily in North and Central America. Bensin used the term generically to refer to the application of ecological methods to commercial crop plants (Bensin 1930). His work reflects the productivist focus that characterized this early period in agroecology's history, in which the objective of research was, quite singly, to improve crop yields. A 1928 book by Italian researcher Girolamo Azzi, another early pioneer of ecological methods in agriculture, defined agroecology as the study of the physical characteristics of environment, climate and soil, in relation to the development of agricultural plants, and to the quantitative and qualitative yield of such plants (Azzi 1928). As Wezel et al. (2009) point out, this initial path of the science "primarily can be related to the evolution of two disciplines from which agroecology is derived, agronomy and ecology, but also to other disciplines such as zoology, botany/plant physiology, and their applications in agricultural and environmental issues" (p.504).

The productivist agenda of agriculture coalesced as a result of a variety of co-conspiring institutional forces. Rural sociologist Frederick Buttel at the University of Wisconsin, Madison retrospectively termed this productivist period the "Golden Age of Agricultural Research," in which a "productionist coalition" of land-grant and U.S.

officials and of agribusiness, farm organization, and commodity group leaders in support of a productivist agenda"(Buttel 2007). Three key research practices characterizing this golden age of productivism in agriculture were: 1) an emphasis on applied, locally adapted research aimed mainly at farmers in a particular state or region; (2) the predominance of public-domain technology and the norm of widespread sharing of research results and materials among scientists; (3) publicly dominated technology transfer, mainly through extension (Buttel 2001).

A narrow productivist orientation generally prevailed in Agroecology up through the 1960s. In the 1960s, as the biotechnologies of the Green Revolution matured, the trend toward vast industrialization of agricultural production that had begun postwar intensified. Agroecology's new post-productivist orientation began to incorporate elements of human culture and society into the agroecosystem concept. Instead of focusing narrowly on the interactions between the commercial crop(s) of interest and other plants, animals, and biophysical factors, agroecologists began to formally account for the diverse ways in which humans are deeply embedded within agroecosystems. Post-modernist views about the place of humans in nature helped to usher in this shift; the very concept of agroecosystems as inherently human-dominated landscapes are a sort of case-in-point for the idea that humans are not, in fact, separate from nature. This budding realization gained increasing traction in light of the widespread environmental degradation leveled by intensive Green Revolution agriculture, and called into question the prevailing modernist paradigm that the human capacity for ingenuity could somehow extricate us from the constraints of nature through technological control.

The work of ecologists Eugene and Howard Odum was particularly instrumental

in grounding this realization in empirical rigor, and for planting the seed of the systems paradigm that would take firm root in the burgeoning discipline of Agroecology (Odum, E. 1964). Borrowing novel tools and methods from research in atomic weaponry and energy in the 1950s (Hagen 1992), and drawing on the subfield of ecosystem ecology pioneered by British ecologist Arthur Tansley (Tansley 1935), they employed a systems ontology to compartmentalize discrete inter-related ecological entities connected by flows of matter and energy (Odum, H. 1967). These entities and flows could then be depicted by diagrams bound by the (artificial) scope of the ecosystem. The quasi-artificial nature of agroecosystems meant that fairly discrete bounds could be delineated, which lent well to a systems approach. As Mark Madison explains, "By diagramming… agriculture as a simplified circuit of energy inputs and outputs, the Odums concluded that energy subsidies had created a dangerously unstable system. As a remedy they suggested an end to the Green Revolution and a modification of human society so as to better approach the steady-state of a mature natural ecosystem" (Madison 1997, 209). The Odums' systems approach and precursory rhetoric of sustainability set the theoretical and methodological stage for much of the subsequent scholarship in Agroecology.

Systems thinking quickly became the main theoretical framework guiding scholarship in Agroecology from 1970s on (e.g., Harper 1974, Cox and Atkins 1979, Conway 1985, Altieri 1987, Gliessman 1990). Systems diagrams proved an effective means of highlighting the systemic imbalances that the industrial agricultural model was levying on the various socio-ecological networks of the food system across various scales. As a result, the systems ontology often makes an implicit assumption that sustainability, which is to say a balance of flows among all the entities within the

bounded system, is desirable. One negative consequence of this was that the science of Agroecology became increasingly intertwined with a notion of how agriculture *should* be, and many normative elements embedded themselves in the discipline's very methodology, calling into question the scientific objectivity of the discipline (Dalgaard et al. 2003).

1.2.2. Emergence of Integral Thought

This systems-sustainability paradigm continues to dominate agroecological scholarship to date. However, a variety of recent conceptual developments have begun to challenge the prevailing systems orthodoxy, presenting novel frameworks and theories that reflect a broader cultural and intellectual shift beyond postmodernism to a "post-postmodern" or, alternatively, an "integral" worldview. A defining characteristic of such a worldview is its willingness to acknowledge the merits of all perspectives, including modernism and postmodernism. In this way, the integral impulse strives not to forge yet another novel perspective opening up space for further fragmentation and division of understanding, but rather to be "aperspectival," or able to accept and integrate multiple, sometimes conflicting, lenses.[5]

Let us now turn to examine some of the recent conceptual developments in Agroecology, focusing on how they reflect a trajectory within the field towards an integral perspective.

Since the expansion of Agroecology's farm-scale boundary to include the entire

[5] Wilber maintains that true aperspectivalism is actually associated with higher levels of personal development than integral, and characterized by a unitive, transpersonal, or nondual self-identity that transcends the dualistic, egoic self. The figurative seed of aperspectivalism, however, is planted at the integral stage of consciousness, and demarcates the transition from what psychologist Clare Graves calls first-tier to second-tier development (Wilber 2000b).

food system, a question that continues to receive much attention within the field is its disciplinary status (Wezel & Soldat 2009). While this discussion will be picked back up in more detail in chapter three, it is important to at least note here that several modern scholars have explicitly suggested Agroecology be labeled an inter-discipline because it must integrate a variety of social and natural sciences in order to understand a multi-faceted food system (Buttel 2007; Dalgaard et al. 2003), or a trans-discipline because its systems ontology begets an explicitly holistic philosophy that goes beyond disiplinary and even inter-disciplinary boundaries (Caporali 2008, 2011; Ruiz-Rosado 2006).

Furthermore, the issue of scale is intertwined with the problem of interdisciplinarity, as many dimensions of the food system are not confinable to a certain scale, a condition that disciplinary tools of analysis often require (Francis et al. 2003). While a minority of "hard" agroecologists proposes to delimit scale at the farm or perhaps landscape boundary so as to preempt such concerns, a "soft" agroecology majority reiterates the need to situate strictly agricultural phenomena within the broader economic, social, and even cultural contexts of the food system. Dalgaard et al. (2003) acknowledge that these issues present significant obstacles to the formation of a coherent agroecological discipline: "Interdisciplinarity is a problem because researchers from different disciplines see the world from different viewpoints, use different language, work at different locations and use different criteria to evaluate one another's work" (p.39). Nonetheless, the authors conclude that agroecology can still live up to the Mertonian norms of science (communalism, universality, disinterestedness, originality, and doubt), and can thus qualify as a distinct scientific discipline.

Despite being cohesive enough to qualify as a single discipline, modern

Agroecology is described by Buttel (2007) as being separable into five distinct, coexistent varieties:

1) *Agronomic agroecology*, defined as the agronomic analysis of sustainable agriculture. Productivism is still a central idea here, as the primary metric of agricultural "sustainability" is defined in terms of percent change in yield across time.

2) *Ecosystems agroecology*, rooted in the Odumian ecosystem concept described above. The (inter-)disciplinary focus here is centered in the natural sciences.

3) *Ecological political economy*, whose principal focus is on a political-economic critique of modern agriculture. The (inter-)disciplinary focus here is centered in the social sciences.

4) *Agro-population ecology*, a fairly recent variety similar to ecosystem agroecology but with a primacy on the population dynamics of agroecosystem component species.

5) *Integrated assessment of multifunctional agricultural landscapes*, a term coined by Buttel himself to signify approaches, already fairly common in Europe, that favor the primacy of the landscape rather than the farm or agricultural enterprise as the basic unit of production/analysis. This variety recognizes agriculture and the food system as joint occupants of landscapes and as an institutional complex linked to other social institutions in geographic space. Integrated assessment approaches are the most interdisciplinary of the five, and tend to reject the idea that any one discipline intrinsically leads Agroecology.

Buttel's five varieties of Agroecology reveal a close parallel to the integral historical perspective I have presented thus far on the evolution of Agroecology through the present. The first variety, which defines sustainability in terms of sustained increase of crop yields, represents the extant form of the narrow productivist mentality that I identified as the dominant early paradigm of Agroecology. Together, the second and third varieties form the basis of what I describe as the systems-sustainability paradigm, which has mostly eclipsed—though not displaced—this productivist variety. Finally, the fifth variety embodies many of the elements of what an integral Agroecology might look like,

including an integration of existing (inter-) disciplinary perspectives without favoring any one, and a broadening of the conventional economic schemes of valuation—effectively, the ontology—of agro-food systems.

Buttel's assessment is also interesting because it highlights the persistence of each of these broad strands of thought through the modern day. This can be explained in integral terms in that each variety brings some important partial truth to bear on agro-food sustainability by opening up a perspectival clearing through which one or a few important aspects of the great juggernaut of the modern food system can be understood. However, it cannot be ignored that perspectives like Buttel's fifth variety, which reject uni-disciplinary supremacy and strive to account for maximal complexity through integration of existing perspectives, are uniquely capable of tackling wicked food system problems at the intersection of society and nature at multiple scales, and should thus be accorded preferential weight when attempting to articulate, if not solve, these systemic problems.

The conception of Buttel's fifth variety stems from a broader theoretical strand currently gaining traction in Agroecology known as multi-functional agriculture, or MFA (Wilson 2007, 2008; Jordan and Warner 2010). Primarily a policy framework, the MFA approach offers a basis for assigning value to the various goods and services provided by any given use of a landscape (agriculture tends to provide one of the richest land-use scenarios from the perspective of multifunctionality). The services category can include fundamentally subjective human values that a landscape provides, like aesthetic or spiritual values. In this way the MFA framework offers the advantage of transcending narrow productivist or utilitarian discourse when dealing with agricultural systems.

Another perceived advantage of the MFA framework is that it overcomes the tendency of the sustainability paradigm (the general default in agroecology) to lend to a uni-dimensional, zero-sum framing of complex environmental issues. Whereas the concept of sustainability deals with quantifiable flows and balances to show whether rates of change (e.g. resource extraction) will lead to *either* degradation *or* perpetuation in the long-run, MFA leaves room for qualitative assessment of a variety of entities and does not presume the a binary of outcomes. In fact, it leaves room for the possibility of scenarios in which many goods and services are simultaneously maximized.

From an integral perspective, MFA represents a welcomed and refreshing alternative to the rigid negativity of the sustainability paradigm because it focuses on the positives—all the ways in which agriculture enhances social and environmental systems rather than merely degrading them. This honors the second part of the central paradox of Integral Ecology that the world is simultaneously getting worse *and* getting better. An over-emphasis on how agricultural systems are unsustainable quickly becomes alienating, blaming, and self-defeating, while MFA can provide the much needed alternative of positivity, gratitude, and encouragement to which farmers—and indeed all people—are more likely to respond constructively.

Another important aspect of MFA is that it attempts to account for non-use values, including spiritual, symbolic, aesthetic, and sociocultural values associated with landscapes—values that, in IT, belong to the oft-neglected lefthand quadrants of personal and cultural interiors. However, although MFA clearly shows promise as a new theoretical framework for informing more holistic agroecological research, a major concern that becomes apparent when MFA is put into practice in economic and policy

spheres is the reduction of interior values (i.e. spiritual, cultural, aesthetic) to incommensurable exterior surrogates (i.e. dollar amounts), and then lumped into the catch-all category of ecosystem services. Many proponents of MFA concede this reduction as a necessary evil for state-level policymaking where classical economics is the official language, but this is not a small sacrifice in IT terms, and such reductionist valuation schemes should be approached with extreme caution given the utter hegemonic disregard for interior cultural and experiential values that have historically characterized the policies of the rational-scientific governments of the West.

Finally, the degree to which MFA will be adopted outside Europe, and particularly in the US, remains to be seen, and this is a significant barrier of concern. One potential reason for this, again in IT terms, is a *type* incompatibility between European and US societies.[6] Whereas societies of the European Union tend to be more collectivist, US society tends to be more individualistic. As a result, adoption of the MFA framework in the US may prove—and to some extend has already proven—to be slow, difficult, or altogether impossible until a major cultural shift is enacted. Culturally entrenched institutions and traditions like strong private property rights, free-market capitalism, and the Jeffersonian vision of decentralized Yeoman agrarianism, are likely to resist any landscape-level coordination efforts—especially agricultural ones, as individualistic ideologies tend to be particularly entrenched in rural areas where centralized planning efforts are often dismissed as "communist" or otherwise threatening to the "American"

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[6] The IT concept of types is related to levels of development, especially when the individual/collective type distinction is invoked (the "orange" level characterized by modernity, scientific rationalism, and liberal economies and embodied most clearly in American capitalist society, is underscored by an individualistic-type ethic, whereas the European societies typically have higher representation of the "green" level characterized by social democracies and underscored by a collectivist-type orientation), but the two are distinct. Type distinctions like masculine/feminine or personality types have much less overlap with levels of development and thus better illustrate the distinctness of the two concepts.

(i.e. libertarian) way of life. Jordan and Warner (2010) seem to anticipate some such obstacles to MFA adoption, including in their own proposed version of the MFA framework a "sub-system" of collaborative partnerships and support mechanisms at the local level to complement the centralized "super-system" of landscape-level-and-beyond policies that are nonetheless the vital backbone of MFA. Jordan and Warner's version of MFA is a laudable step in the right direction, but it is still complicit with a reduction of interior values to dollar amounts, and to what extent MFA-style frameworks are implemented outside of Europe remains to be seen.

Other conceptual works in Agroecology have also pointed out the problematic reduction of interiors to exterior correlates inherent in the MFA and systems frameworks. One that intersects in significant ways with IT is the concept of the farm as a holon, put forth by authors Michael Bell and William Bland in a 2007 paper titled *A Holon Approach to Agroecology*. Characteristic of this agroecological version of the holon is its unique capacity for "intentionality"[7]—in other words, its autonomous ability to make farm management decisions (via the farmer-director), which are influenced by, though ultimately independent of, the broader environmental, sociocultural, political and economic contexts in which it is embedded. Re-framing agricultural systems with the farm holon as the centerpiece, Bell and Bland hope to overcome the limitations of systems theory, which they feel places too much restriction on the unique human attribute of intentionality, thereby failing entirely to account for important phenomenological

[7] Bell and Bland's criterion of intentionality for characterizing holons is similar to Wilber's (and Koestler's) criterion of agency. For Wilber, agency goes all the way down the developmental levels of complexity—even atoms exhibit some level of agency, or "prehension," because they have affinities to certain other atoms and not others (Wilber 2000). For Bell and Bland, however, intentionality may not be a uniquely human attribute, but for the purposes of agroecological research do not consider ascribing intentionality to non-human holons to be either necessary or useful. Thus, for them, only humans and human-coordinated systems (i.e. farms) ought to be thought of as holons.

elements involved in farm decision-making, such as a farmer's spiritual beliefs. Or, in their own words: "Holon agroecology seeks a middle ground between the reductionism[8] that serves purely scientific enterprises so well and the holism that system thinking implies" (p.281). Bell and Bland's framing of agroecological problems in terms of holons embedded within an ecology of contexts makes a momentous and timely first step toward an Integral Agroecology, but this initial conceptualization needs further refinement and formalization. It is my hope that at least part of that refinement and formalization can be found in the following chapters of this thesis.

Although each of the theoretical frameworks so far identified seem to be pointing toward a more integral approach to agroecological research, a formal and coherent approach that unifies and integrates these disparate elements is needed before the field as a whole can move forward in this direction. Drawing primarily on IT, and selectively from various other integrative metatheories, the objective of the remainder of this work is thus to synthesize some of these existing elements into a complete, formal articulation of an Integral Agroecology.

2. CRITICAL REALIST INTEGRAL METHODOLOGICAL PLURALISM

2.1. INTEGRAL METHODOLOGICAL PLURALISM

Integral Theory has already been applied to the field of ecology in a foundational book, Integral Ecology. In the book, authors Michael Zimmerman and Sean Esbjorn-

[8] Bell and Bland's notion of reductionism is narrower than IT's. Here, they contrast it to holism, which they suggest is the philosophical basis for systems thinking. IT is also critical of such pure scientific reductionism, but identifies a further, "subtle reductionism" committed by systems thinking in tending to reduce fundamentally interior phenomena (e.g. spiritual beliefs, cultural values) to exterior representations (e.g. farmer or community behavior) that can be neatly bound in a box and connected by arrows to other external inputs in a systems diagram (Esbjorn-Hargens & Zimmerman 2009, pp. 148-152). The bottom line is that interior phenomena are simply not conducive to systems analysis.

Hargens outline a set of methods, rooted in the core principles of IT, for engaging a maximum of relevant perspectives on a given ecological research problem. This methodological approach is called Integral Methodological Pluralism (IMP). Since the discipline of Agroecology can be taken as, at base, a subdiscipline of the broader science of Ecology, these same principles and methods can be readily adapted to agroecological research.

2.1.1. THE THREE PRINCIPLES

An IMP is guided by three fundamental principles: *nonexclusion*, *enfoldment*, and *enactment*. The principle of nonexclusion is based on the premise that every perspective discloses a true—albeit partial—aspect of reality. Thus, nonexclusion requires the acceptance of all truth claims relevant to the phenomena of study that pass the validity tests in their respective fields and are made using methods appropriate to their respective quadrants. Acceptance of all such truth claims is a minimum requirement of IMP; robustness of an integral ecological analysis will further depend on the extent of the various quadrants, levels and lines that are accounted for by the analysis.

The principle of enfoldment provides criteria for assigning relative weight to truth claims disclosed from various perspectives using various methods. The idea is that some perspectives are capable of holding higher levels of complexity—and some methods capable of accounting for such complexity—such that they "enfold," or include while going beyond, simpler perspectives and methods. In general, more weight should thus be accorded to the practices that are more inclusive, holistic, and/or comprehensive. In turn, the inclusivity of a practice can be measured using the criterion of nonexclusion given

above: the amount of distinct quadrants, levels and lines that are accounted for by the practice. Its wholeness can be can be assessed by the extent to which all four quadrants of the study phenomena are addressed, which, because of prevailing biases toward objective exteriors in western scientific thought, often translates to the extent to which subjective interior phenomena are included in the analysis. And the practice's comprehensiveness can be evaluated by the degree of inter-connections it draws to the broader contexts in which the phenomena is situated, including influences from phenomena in other quadrants, in other lines, and on other levels.

Finally, the principle of enactment warns that there is no such thing as perceiver-free reality; what is disclosed through the use of various methods depends in fundamental and significant ways on the perspective (developmental levels, values, beliefs, worldviews, etc.) of the practitioner. Conversely, research processes and discoveries may cause either gradual or sudden developments in the practitioner's perspective, especially in the context of the kind of participatory, reflexive, and values-explicit approach that is characteristic of integral research. In such research, the observer and the observed are thus inextricably bound in a dynamic, dialectical process of understanding and transformation.

2.1.2. QUADRANTS & QUADRIVIA

Ecological problems are by their very nature systemic problems arising out of imbalances in the inter-objective interactions between system members. They thus tend to be situated most squarely within the LR quadrant of inter-objective systems. However, their fundamental systemic nature also means that both their contexts and influences tend

to extend into all quadrants. For example, an influx of nitrogen into an ecosystem has the potential not only to alter the functionality of the system (LR), but also both the behavioral (UR) and experiential (UL) dimensions of individual member organisms of the system, as well as the semiotic niches those individual members mutually create (LL). For this reason, methods for generating purely systemic (LR) understandings of ecosystems, although central, are by themselves inadequate for sound ecological research. An integral ecological research approach thus draws on insights from all four quadrants.

But an additional layer of complexity exists when research is enacted within one of two fundamental perspectives. To look "in" is to examine the various ways each of the four quadrants influences a given phenomenon. To look "out" is to examine the ways a holon (i.e. the researcher) engages with each of the four quadrants. While a contentious point in IT[9], the subject/object dualism cast by Descartes and reinforced broadly in modern thought, offers a useful notion for drawing this distinction. The subject/object dualism stems from skepticism about the existence of an external world, as well as a traditional ontological conception of being as beings-extant, or lying present-there (Cucen 1998). The subject, or the "I", the "ego" or the "res cogitans" is that which thinks, i.e. the perceiver. In asserting the uniqueness of subject, everything external to the "I" becomes object, i.e. the perceived; looking "in" favors the primacy of the object, while looking "out" favors the primacy of the subject. In integral language, looking "in" at a

[9] Integral Theory's "post-metaphysical" position seeks to dissolve the subject/object dualism by maintaining that the ontology of objects and the epistemology of subjects are inseparable. In practice, however, the subject/object distinction is useful in categorizing the various perspectives a researcher can take. Recasting this distinction in integral post-metaphysics, an inside-out perspective deals with the four-quadrant dimensions of *experience*, and an outside-in perspective with the four-quadrant contexts of *the experienced*.

given external object or phenomenon is to take a *quadrivial* perspective on it, and looking "out" at the world from the interior vantage point of a holon is to take a *quadradic* perspective. Illustrations of the quadrivial and quadradic perspectives in ecological research under the traditional IMP, taken from Integral Ecology, are shown in Figures 1 and 2 below.

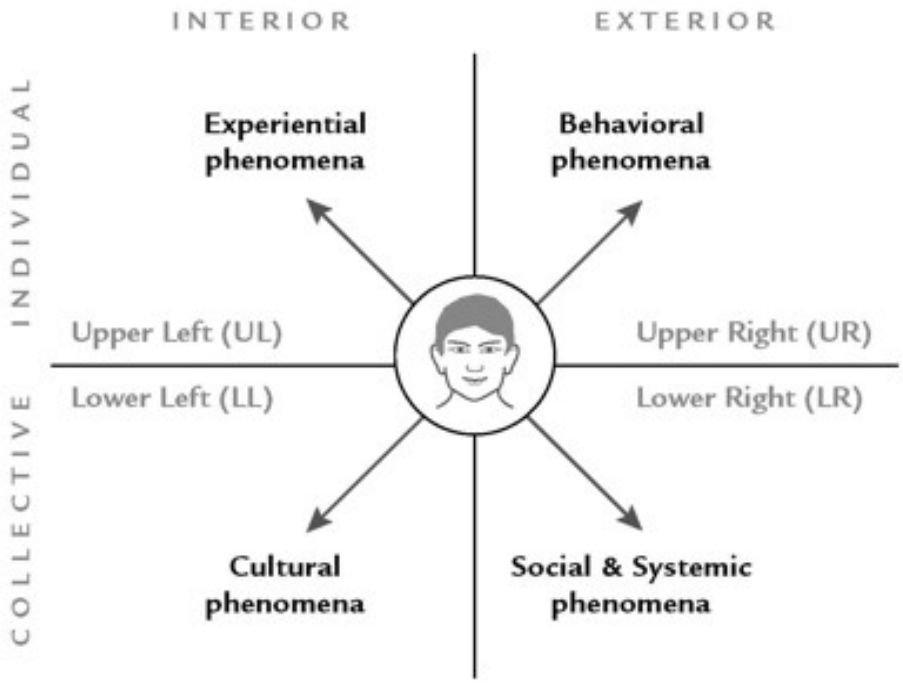

Figure 1: Quadrivial perspective in IMP model (Esbjorn-Hargens & Zimmerman 2008)

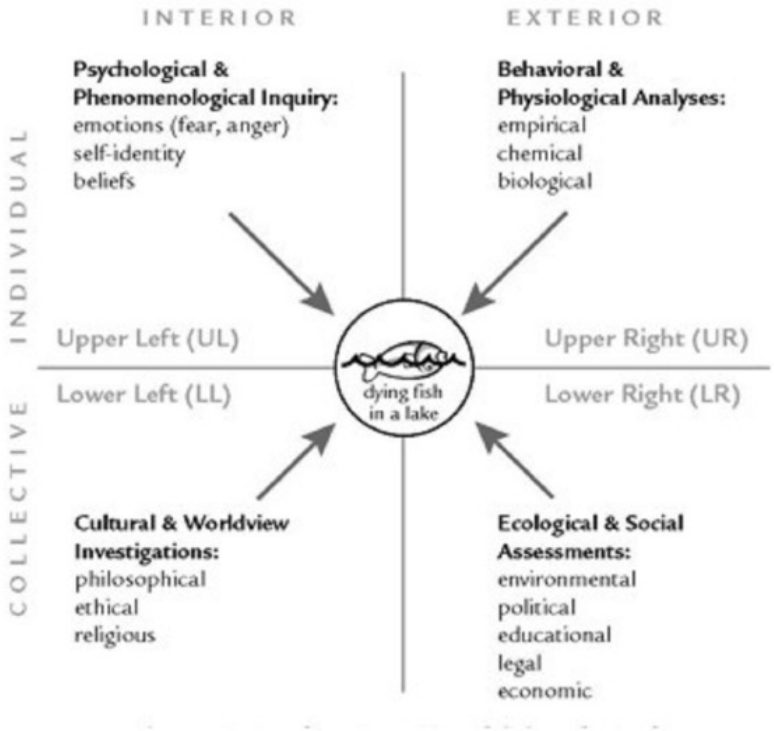

Figure 2: Quadradic perspective in IMP (Esbjorn-Hargens & Zimmerman 2008)

Up to this point, the focus of the current chapter has been to simply summarize the core principles and concepts that underpin Integral Methodological Pluralism. I will now turn to a more critical analysis of IMP in order to set the stage for an eventual synthesis of an adapted framework with greater relevance and accessibility in the context of agroecological research.

2.1.3. THE EIGHT METHODOLOGICAL ZONES

Combining the four quadrants and the two possible perspectives in each, IMP goes on to posit eight distinct and irreducible *zones*, or groupings of methodologies that, when all brought to bear on a given research problem, are said to enact truly holistic, integral research. Figure 3, below, illustrates the eight zones. Zones inside the circle in

each quadrant represent an inside perspective on that quadrant, and zones outside the circle represent an outside perspective. Zones 1 and 2 in the upper left quadrant, for example, are thus said to be distinct in that Zone 1 examines individual interiority through phenomenological or experiential inquiry (e.g., through reflexive practice like journaling), and is carried out by that individual herself, whereas as Zone 2 would use more traditional psychological techniques involving an outside expert (e.g., psychoanalysis).

One problem that arises from this overlaying of the inside and outside perspectives in each quadrant is that the resulting framework fails to retain the distinctness of subject from object, experience from experienced, causing a significant departure from the zones created in the separate quadrivial and quadradic perspectives. Consequently, although the eight resulting zones represent an elegant adherence to IT's anti-dualistic post-metaphysics, their relative importance is imbalanced (e.g. empiricism represents much more substantial and diverse methodological possibilities than, say, autopoiesis). In addition to the lack of methodological robustness of some categories, the way the eight different zones are presented suggests a certain degree of isolation of each one from the rest. This is unfortunate and ironic, as it runs counter to IT's objective of transcending the reductionism and fragmented specialization characteristic of strict academic disciplinarity, and impedes the researcher in making the interconnections necessary to generate a seamless, holistic understanding of the research phenomenon as it occurs in its various human and natural contexts.

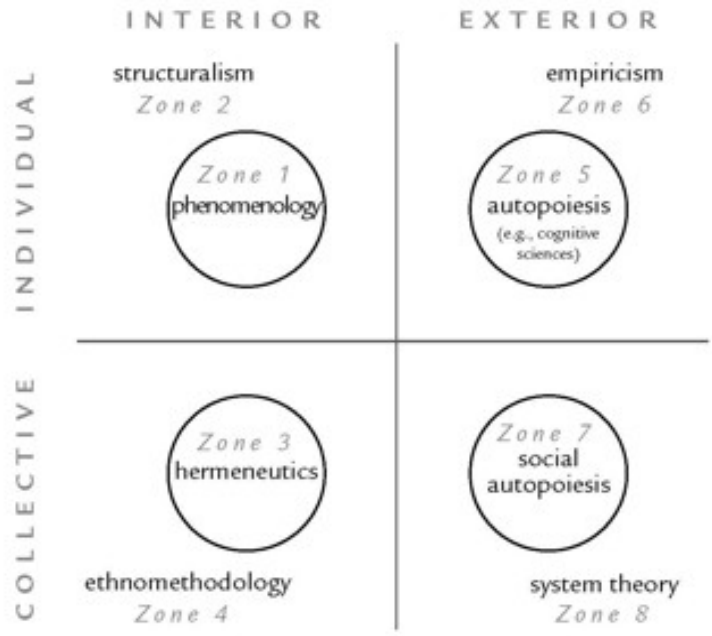

Figure 3: Eight methodological zones of IMP (Esbjorn-Hargens & Zimmerman 2008)

Whether or not it was the authors' intent to preserve the quadrivial/quadradic distinction in IMP's eight zones is unclear, since the connection is not explicitly made in the book. In any case, what is clear is that the IMP framework, as it stands, could benefit from revision and adaptation before being adopted as a useful tool in interdisciplinary agroecological research. To that end, the following section presents a revision of the IMP framework, starting by reinstating the quadradic/quadrivial (subject/object) distinction, retaining but modifying each of the three IMP principles, and recasting it in a more accessible integrative metaphysical system called Critical Realism, authored by philosopher of science Roy Bhaskar. Before doing so I will present a short introduction to Bhaskar's critical realist philosophy.

2.2. CRITICAL REALISM

Critical Realism (CR) is a philosophy of science that combines a philosophy of natural science called Transcendental Realism (TR) with a philosophy of social science called Critical Naturalism (CN) (Bhaskar 1997, 1998). TR is a critique of empiricism based on a transcendental argument that asks the question of what reality must be like in order for experimental (empirical) science to even be possible, and replies that it must be *structured*, *differentiated*, and *changing* (ibid.). Through the transcendental argument, Bhaskar demonstrates that empiricists commit what he calls an "epistemic fallacy" by reducing the ontological domain of reality—consisting of real generative mechanisms and structures that *transcend* our observations of them—to mere constant conjunctions of events (epistemology) (Bhaskar 1989: 13, 15-17). Though we can in principle come to accurately understand such real structures, Bhaskar argues, their reality is ultimately independent of such understanding.

On the other hand, CN is a philosophy of social science that asks the question of whether the TR model of natural science can, in principle, be applied to the social sciences, and answers in the affirmative. However, Bhaskar qualifies this with additional considerations owing to the emergent property of human agency in the social domain, and its co-creative relationship with structure (Bhaskar 1989: 92). CN resolves the agency/structure binary by asserting structure as a determinative pre-condition for agency, but agency as capable of transforming structure. Agency and structure are thus "existentially interdependent but essentially distinct" (ibid.). An additional qualification to the naturalistic possibility of social science lies in the "holistic, hermeneutical and historical character of social objects." This character necessitates an understanding of

them as “partially conceptually articulated totalities in continual transformation,” which defy the possibility of closed-system experimentation and instead require “purely explanatory (non-predictive) criteria of confirmation and falsification” (Bhaskar 1989: 93). Nonetheless, given these caveats, social objects are scientifically knowable.

2.3. CONSTRUCTING THE CRIMP FRAMEWORK

It is important to note that, just as Wilber is careful to distinguish the “map” of IT from the reality it describes, the Critical-Realist Integral Methodological Pluralism (CRIMP) framework I develop herein is only the beginning of a continually evolving conceptual process. It represents an initial and imperfect attempt at revising something which itself is incomplete. No single theory will ever be able to seamlessly account for the messy complexity of the social and natural worlds—much less the intersection of the two. Integrative metatheoretical work is more of a process than a product, and its value lies neither in the literal nor in the absolute, but rather in the imagined, as a sort of psychoactive software that both transforms and gets transformed by experience. The psychoactive and transformational capacity of IT has certainly rung true in my own experience as an integral scholar and practitioner, and CRIMP represents something of a snapshot of the current state of my evolving understanding. All of this to say: it needs further refinement—the primary task of a future doctoral dissertation.

Beginning with IT’s quadrivial/quadradic distinction, we can begin to reconstruct IMP based on CR principles. The following two figures present critical realist adaptations to the objective quadrivial (Figure 4) and subjective quadradic (Figure 5) domains.

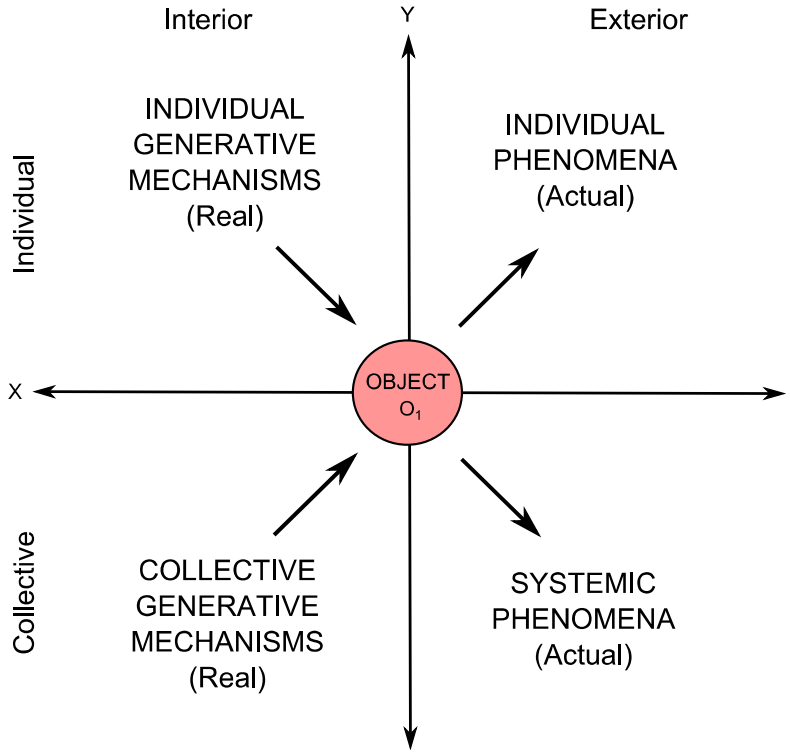

Figure 4: Critical realist-adapted quadrivial (objective) perspective

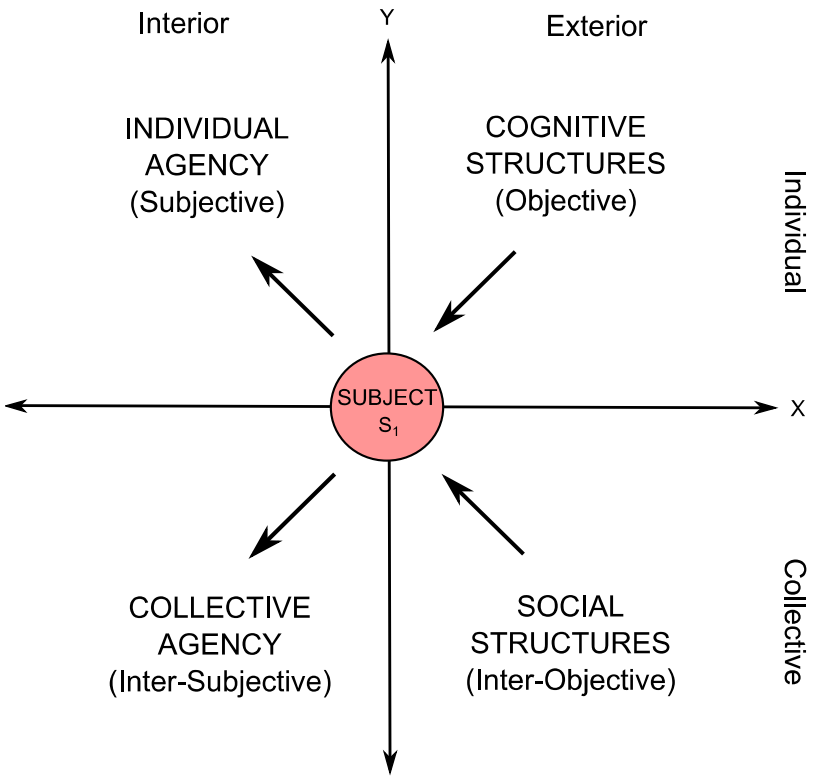

Figure 5: Critical realist-adapted quadradic (subjective) perspective

With regards to the quadrivial perspective (Figure 4), division of quadrants in the objective perspective is based on the separation of the domain of the real—that is, the underlying structures and generative mechanisms that pre-exist and give rise to all manifest phenomena—from that of the actual—that is, the manifest phenomena themselves. This distinction is foundational to CR philosophy. In fact, its entire metaphysics turns on the transcendental argument explained above, which attacks the position of *actualism* that Bhaskar ascribes to classical empiricism, epitomized by Hume. The actualism implied by classical empiricists reduces the domain of the real (e.g. natural laws) to the domain of the actual (e.g. empirical regularities). The division, along the x axis, between individual and collective mechanisms and phenomena, is mostly a vestige of IT and not addressed explicitly by Bhaskar. However, this division becomes particularly insightful in exploring agroecological research, which is an inherently systemic scientific discipline in which some scholars wholly reject the atomism of the upper quadrants.

Turning to the quadradic perspective (Figure 5), the two axes of IT's quadradic framework and the four irreducible quadrants they yield dovetail with the CR synthesis and resolution of two defining dichotomies of the social sciences: that of agency/structure, and individualism/collectivism. Bhaskar resolves these dichotomies by synthesizing the opposing poles in a *transformational* and *relational* conception of the social world in which the relations that individuals enter into are themselves structures that pre-exist those individuals, but are only reproduced (or transformed) by the actions and interactions (agency) of those individuals for whom they are necessary conditions (Bhaskar 1989: 4). The fact that these structures (society) both pre-exist and rely on

individuals—and can be transformed through their agency—establishes a dialectic between individuals and society and structures and agency that preserves their independence and irreducibility. This dynamic is reflected in the four irreducible quadrants of the subject and the arrows interconnecting them.

Although the UR quadrant, cognitive structures, is not an explicit component of CR, it is very important in IT and indeed implicitly embedded in much of the CR discourse on structure, often obscured by Bhaskar's apparent bias toward the social over the individual (Marshall 2012). Since many social theorists—and Bhaskar is no exception—tend to see humans as inextricably social organisms, they tend to neglect the purely individual structures of consciousness, namely the neurosensory "hardware" of the human brain, nervous system, etc., as well as its cognitive "software," the operating system encoded through patterns of experience, culture, language, etc. Although social theorists would be right to argue that much of these latter elements are products of social structures in the conventional sense, it is undeniable that such cognitive programming is in large part co-determined by material structures of the brain, and directly manifested in consciousness, i.e. the phenomenological experience at the level of the individual. As such, individual cognitive structures should not be reduced to social structures.

It is of particular importance for natural scientists to note that, in accordance with CR, the four quadrants of the subject in critical naturalism actually comprise only a small (though very important) subset of the objective domain of transcendental realism. This is because, according to Bhaskar, the realm of the real (reality) contains everything, including humans, their cultures, societies, thoughts, beliefs, etc; and, scientific knowledge of the human world is possible in the same fundamental way (qualified by

certain aforementioned caveats) that such knowledge of the natural world is possible (Bhaskar 1989). Conversely, precisely *in virtue of* the additional emergent properties of the social world that distinguish it from the natural, special consideration of these social elements must be made. A central tenet of CR-informed research thus follows:

(i) *Whenever the object(s) of research overlap in explanatorily relevant ways with subjective agents (i.e. humans or their culture), a quadradic (subjective) analysis of those subjective agents is required.*

This means that, for example, when humans exert substantial influence on an ecosystem (as is invariably the case in agroecosystems, as well as, arguably, all ecosystems on earth), the four-quadrant subjective dimensions of those human agents ought to be analyzed in addition—and in relation—to the various biophysical dimensions. Additionally, to the extent that CR-informed research is participatory and reflexive, this leads to a second, related tenet:

(ii) *At minimum, a statement of researcher interiority, including values, assumptions, and potential biases, is required. Since research is carried out by human agents who are themselves embedded in four-quadrant social contexts, a quadradic (subjective) analysis of the researchers themselves may also be appropriate.*

Situated oppositionally across a reflective dual plane, the quadrivial and quadradic perspectives yield an adapted version of IMP, which I call here Critical Realist Integral Methodological Pluralism (CRIMP), presented in Figure 6 below. In addition to

the eight fundamental zones yielded by the four quadrants in each of the two perspectives, a ninth zone arises out of the subject/object duality: the empirical. Distinct from both the real and the actual in the quadrivial perspective, the empirical domain is a subset of the actual in that it consists of only those manifest phenomena that are empirically observed (or, in IT terms, “enacted”) by a cognizant (human) subject. In keeping with the IT principle of co-enactment, the empirical thus represents the realm of reality which is mutually-constituted, or co-created, by subject and object, perceiver and perceived, ontology and epistemology. As such, what arises in the empirical realm is a product of the particular metaphysical paradigm under which the empirical phenomena come into being. In CR terms, the empirical realm is where the *transitive* dimension of knowledge—that is, as a real social object, as opposed to *intransitive* objects of knowledge, which exist independently of mental activity—are produced (Bhaskar 1987).

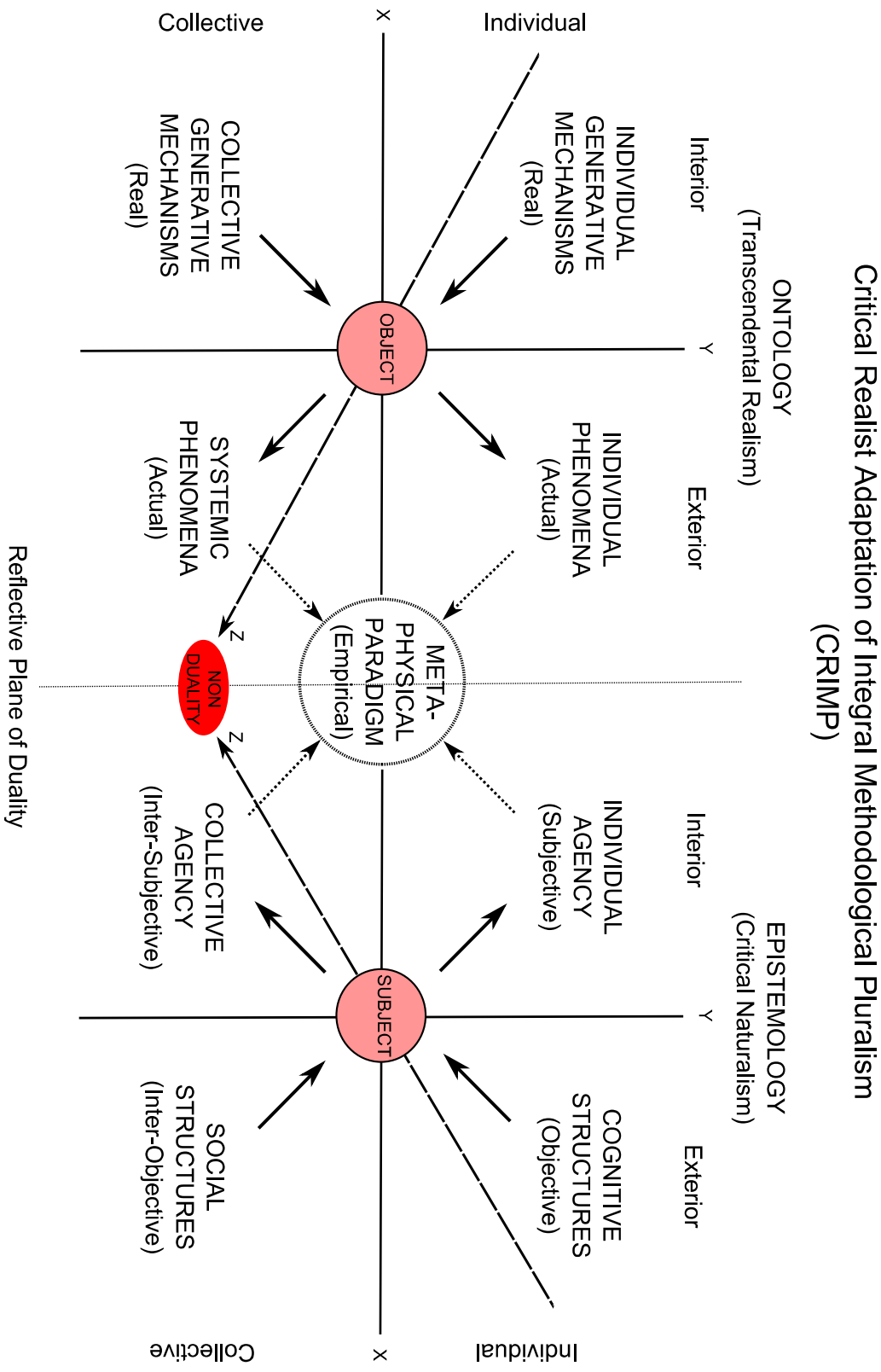

Figure 6: Critical realist-adapted integral methodological pluralism (CRIMP)

2.4 MODIFICATIONS OF IMP

CRIMP represents a significant metaphysical departure from the original IMP framework, while still maintaining many of its IT underpinnings. To start, CRIMP upholds the three IMP principles of nonexclusion, enfoldment, and enactment—with a few qualifications. First, the IMP principle of *nonexclusion*—that all forms of knowledge are at least partially true as long as they pass the validity tests of their respective (disciplinary) paradigms—corresponds roughly to a combination of the CR notion of science, broadly, as an *adequating practice*—metaphorically, a working of cognitive matter into a matching representation of a non-cognitive object—with the principle of *epistemic relativity*—that (at least transitive) objects of knowledge are essentially infallible insofar as "all knowledge is transient, and neither truth values nor criteria of rationality exist outside historical time" (Bhaskar 1989, 23-24). Here critical realism extends the principle of *judgmental rationality* as a means of qualifying epistemic relativity and a tool for adjudicating between various truth claims by asserting that science is not arbitrary and that there are rational criteria for judging some theories as better and more explanatory than others (Bhaskar 1987).

Critical realism's judgmental rationality is also related to the second IMP principle of *enfoldment*, that some perspectives are more inclusive and/or account for more complexity (i.e. are more developed) than others. Although enfoldment is one of IMP's three stated principles, developmental dynamics are wholly absent from its 8-zone framework. To remedy this, CRIMP incorporates a third (Z) axis, in addition to the traditional X and Y axes delineating the IT quadrants, to show that as scientific research progresses and our knowledge (and perspectives) becomes more integrated, nuanced, and

complex, these perspectives begin to approach a true understanding of the generative mechanisms behind all phenomena. CRIMP thus accounts for the correspondence between subject (S_0, S_1, S_2...S_{ND}) and object (O_0, O_1, O_2...O_{ND}), and their simultaneous evolution or development, passing through, e.g., pre-rational, rational, post-rational, integrative and trans-rational stages. The current CRIMP model is centered on a rational (S_1-O_1) to integrative level of development, reflective of academia's disciplinary realities and inter-disciplinary possibilities.

Finally, CRIMP upholds the IMP principle of *enactment* by highlighting the importance that the subject's epistemological values and biases bring to bear at the exterior limit of objective phenomena (righthand quadrants of quadrivial perspective). This principle is illustrated in two places in the CRIMP framework. On the developmental Z axis, the correspondence between level of developmental of subject and object reinforces the principle of enactment, but without reducing ontology to epistemology. Within the quadrivial (object) domain, it is important to note that the domain of the empirical (that which is *observed* by human subjects and thus subject to the transitive modes of science, i.e. epistemic values) is a subset of the actual (that which is actually manifest in form or occurrence, though not necessarily observed), which in turn is a subset of the real (the underlying generative structures and mechanisms that precede and give rise to those manifest phenomena).

Beyond the three revised IMP principles, CRIMP is additionally based in the following seven critiques of, and modifications to, IMP:

1. The non-dualism implied by IMP's post-metaphysics can be awkward for

rational scientific researchers whose metaphysical paradigm relies upon a subject-object duality.

CR upholds distinction between subject and object as the first moment of scientific understanding. CRIMP thus reinstates subject/object duality, while making room for the potential dissolution of this duality at postrational stages of researcher development (i.e. strong trans-disicplinarity, discussion to follow).

2. Some of IMP's eight methodological zones (e.g. autopoeisis) may be too abstract or narrow in most mainstream academic research contexts.

CRIMP distinguishes the four quadrants of social (quadradic) and natural (quadrivial) sciences and allows for broader methodological associations within each quadrant—distinctions that give most scientists a better sense of their own location on the map.

3. IMP zones fail to explicitly account for the influence of epistemic values on research outcomes.

CRIMP represents this important space as the domain of the empirical.

4. IMP's autopoiesis zones confuse the internal logic of exterior entities like the

cognitive circuitry of the brain with the true interiority of external things, i.e. their underlying generative mechanisms.

CRIMP puts the generative mechanisms of objective reality in the lefthand (interior) quadrants, separate from the exterior manifestations of these mechanisms in the righthand quadrants of objects.

5. IMP conflates the agentive (inter-)actions of subjects with external structures, neglecting the potential for agency-in-action to transform structures

CRIMP recognizes the simultaneous inner and outer dimensions of actions and behaviors. Insofar as human actions—both individual and collective—usually entail both structurally determined and agentive dimensions, the former belong in the righthand quadrants and the latter in the lefthand quadrants of subjects.

6. IMP fails to explicitly account for transformational dialectic between research objects and subjects.

CRIMP incorporates a developmental (Z) axis into the two-dimensional X-Y integral quadrant map, accounting for the potential of knowledge and action to transform structures for individual and societal emancipation. Increased understanding of generative mechanisms behind

all phenomena facilitates embodiment of nondual awareness.

7. IMP fails to graphically situate the methodological zones along the full post-disciplinary gamut of IT.

   CRIMP is presented across a continuum of uni-, multi-/pluri-, inter-, and trans-disciplinary perspectives, reflecting increasing methodological integration of complexity.

The result of these IMP adaptations is a model yielding nine zones that are more fluid, familiar and interconnected than the zones of the original. As we will explore further in the next chapter, the quadradic/quadrivial (subject/object) distinction that CRIMP maintains also corresponds to a general distinction between the social and natural sciences, which especially helps researchers in the nebulous (multi-/inter-/trans-) discipline of Agroecology to more easily orient their own work on the map and relate it to that of their peers within the discipline, as well as potential collaborators across disciplines and even outside the university.

3. CRIMP IN AGROECOLOGY

Why should agroecologists, specifically, use IT and the CRIMP framework in their research? What advantages does it confer over other inter-disciplinary or holistic-type conceptual constructs like systems analysis? And, how does it connect and possibly reconcile some of the recent theoretical currents that are challenging the systems

paradigm? These are all questions that will be addressed in the following section. In doing so, it will be proposed that there are indeed very concrete practical advantages of using CRIMP for both designing and conducting research, especially in an inherently interdisciplinary field like Agroecology.

3.1. POST-DISCIPLINARITY

By means of assessing the ontological comprehensiveness and methodological rigor of integral research, the original IMP asserted that the more of the eight zones included in a given piece of research, the more "integral" it is. But when viewed through IT's own self-proclaimed *post-disciplinary* lens, such a criterion is an over-simplification. That is because post-disciplinarity refers to the accommodative capacity of a discipline to provide contextual and inter-relational space for all possible ways to produce, interpret and utilize scientific knowledge within, among, across, beyond, and/or without disciplinary frameworks. What is missing from IMP, thus, is sensitivity to the various degrees of disciplinarity along the post-disciplinary range of research, and the contextual appropriateness of each. *Integral Ecology* states:

> …Integral Theory is *postdisciplinary* in that it can be used successfully in the context of disciplinary (e.g., helping to integrate the various schools of psychology into Integral Psychology), *multidisciplinary* (e.g., helping to investigate ecological phenomena from multiple disciplines), *interdisciplinary* (e.g., helping to apply methods from political science to psychological investigation), and *transdisciplinary* (e.g., helping numerous disciplines and their methodologies interface through a content-free framework) approaches. (Esbjorn-Hargens & Zimmerman 2009: 47)

In the spirit of IT's post-disciplinarity, we will now turn to an exploration of some of the most common ways disciplinary frameworks are used, combined, and integrated to achieve research objectives. The appropriateness of each approach will depend on several

factors, notably the *scale* of research, as well as the *level(s) of complexity* of both researcher(s) and the objects of study. With regards to the latter, a general correspondence between the degree of integration across disciplines and the axiological development of the researcher (as discussed in the Introduction) will be explored, though it should be noted that this correspondence is highly generalized, and unique to some historical contingencies of the field of Agroecology.

3.1.1. Disciplinarity

Despite issues related to scaling and interdisciplinarity, and the embeddedness of normative assumptions in systems methodologies (Wezel & Soldati 2009), Agroecology passes the Mertonian norms of science to qualify as a coherent scientific discipline (Dalgaard et al. 2003). Strictly speaking, Agroecology as a single scientific discipline can be located on the CRIMP map in zone 4, the lower-right objective quadrant, as an applied systems-science. Viewed singularly, IT can enhance Agroecology's disciplinary cohesiveness by providing a model for integrating research generated within the discipline itself. This thesis is case-in-point; by tracing a developmental trajectory of the field—informed by IT's developmental framework—and synthesizing some of the theoretical elements on the cutting edge of the discipline into a theory of integral emergence, I have (hopefully) demonstrated not only how the discipline has evolved up to the present (and in so doing, established some sense of relationality among the various iterations of Agroecology's dynamic research program), but also how the discipline can maintain integrity and coherence as it moves forward into an increasingly complex and expansive future.

The “dignity” of this sort of meta-disciplinary analysis, guided by IT, is that it lends to an enhanced sense of identity for agroecological researchers who rightfully wish to resist being lumped into larger, more traditional disciplinary categories like agronomy or ecology. After all, disciplinary specialty, despite and even *by virtue of* its reductionism, is very important for uni-dimensionally *deepening* knowledge about a single aspect of reality. In other words, science can become shallow if it relies too heavily on approaches of *breadth*. On the other hand, the “disaster” of adherence to narrow disciplinary identities—tendencies of modern and even pre-modern (IT’s “rule-role”) levels of consciousness—are apparent in the myopic over-specialization, disciplinary absolutism, and tribal-esque politics of competition that characterize many university departments.

Figure 7 presents a schematic of the eight zones of disciplinarity in CRIMP. The solid black boxes around each zone represent the absence of communication or “outside-the-box” thinking that characterizes narrow disciplinary research programs.

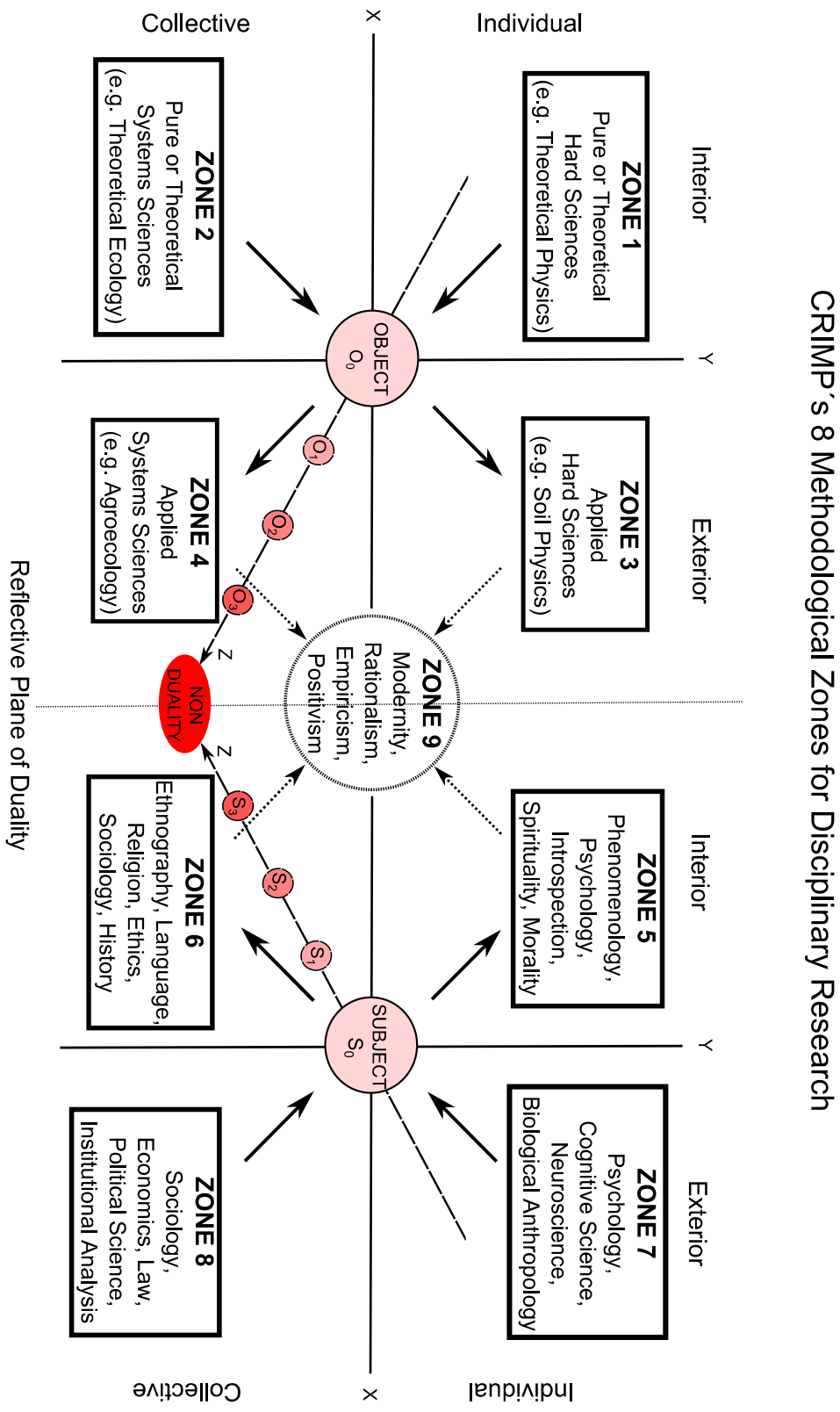

Figure 7: Nine methodological zones of narrow disciplinary research in CRIMP

3.1.2. Pluri- & Multi- Disciplinarity

Multidisciplinarity can be defined as simply the additive efforts of multiple disciplines looking at the same phenomenon without any special effort towards coordination or integration, while pluridisciplinarity usually involves some degree of coordination (Max-Neef 2005). Under these definitions, any combination of the first eight methodological zones of CRIMP represents multi-disciplinarity. Pluridisciplinarity would typically involve a coordinated combination of disciplines, most likely all from within either the objective or subjective quadrants (e.g. combining physics, chemistry, and ecology to understand the multi-faceted nature of soil, or combining sociology, economics and political science to understand how farmers make soil management decisions).

The dignity of multi- and pluri-disciplinary approaches is that they recognize the legitimacy of a plurality of perspectives on a single phenomenon, honoring complexity and affirming the fact that while some phenomena can be thoroughly and sufficiently analyzed through one disciplinary lens (e.g. the atom), others (e.g. soil) simply cannot. Post-modernist worldviews are most closely associated with multi- and pluri-disciplinary research agendas that hold space for all relevant perspectives on a given matter. Accordingly, the disaster of such approaches is their resistance to the invoking of higher integrative principles capable of arbitrating among what are otherwise purely relative strands of knowledge, for fear of privileging or absolutizing any one strand.

Figure 8 presents a schematic of the nine zones of a multi- or pluri-disciplinary research approach in CRIMP. The appearance of a ninth zone indicates the post-modern rejection of the possibility of perfect scientific objectivity, and emphasis on the subjective

(constructivist) elements of science. Notice, however, that despite the dissolution of disciplinary “boxes” in Figure 7, the various methodological zones merely co-exist, without any degree of integration across disciplines.

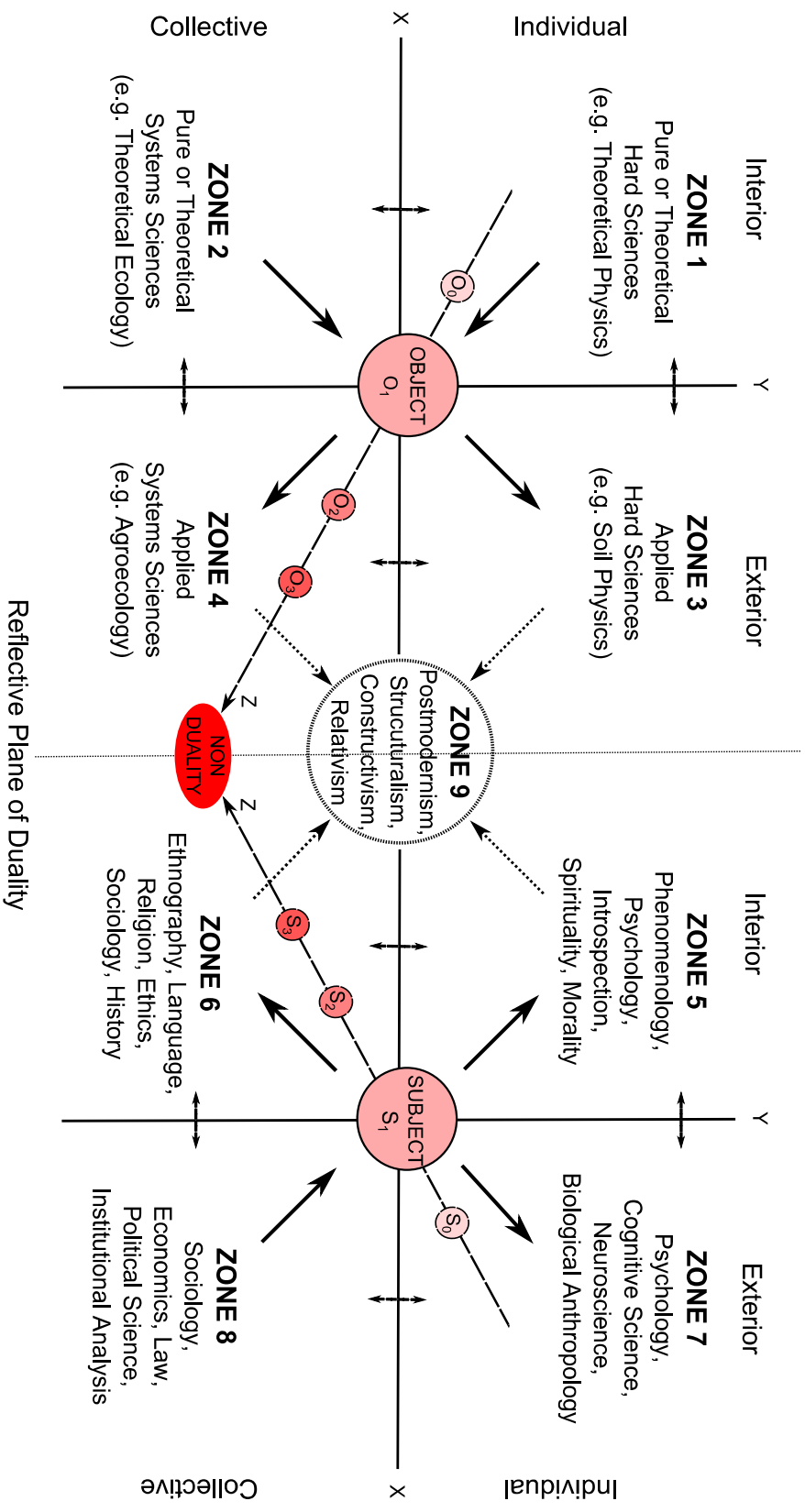

Figure 8: Nine Methodological Zones of Multidisciplinary Research in CRIMP

3.1.3. Inter- & Weak Trans- Disciplinarity

Max-Neef (2005) distinguishes between weak and strong transdisciplinarity. What he describes as the weak version is often used interchangeably with interdisciplinarity. For example, the US National Academy of Science defines both inter- and trans-disciplinarity (the latter being a subset of the former) in the following broad sense:

> Interdisciplinary research (IDR) is a mode of research by teams or individuals that integrates information, data, techniques, tools, perspectives, concepts, and/or theories from two or more disciplines or bodies of specialized knowledge to advance fundamental understanding or to solve problems whose solutions are beyond the scope of a single discipline or area of research practice. (National 2005)

This kind of generalized notion of inter- and trans-disciplinarity leaves room for much interpretation, and many scholars have indeed posited varying forms of the concept (Pohl & Hadorn 2007, Boix Mansilla 2006, Jantsch 1970). From the many versions, however, three universal features can be distilled:

1. It is a means to an end, that is, it serves a purpose
2. It is based on validated expertise from various disciplines and/or other bodies of specialised knowledge;
3. It is integrative, that is, it integrates diverse expertise for a specific purpose. (Plurality 2013)

Overcoming the relativism of multi- and pluri-disciplinary approaches, the distinguishing characteristic of inter- and trans-disciplinarity, apparent in the above definition, is that it *integrates* information across disciplines in novel ways, rather than merely combining that information.

Figure 9 presents a schematic of the nine interdisciplinary zones in CRIMP. Notice the addition of two-way arrows across methodological zones to represent greater communication and overlap between zones, as well as the expanded ninth zone of synthesis, integration and reflexivity at the empirical junction of objective and subjective

realities. The growing prominence of zone 9 reflects the fact that at this integrative junction is where the action happens for interdisciplinary research, rather than in the home disiciplines themselves.

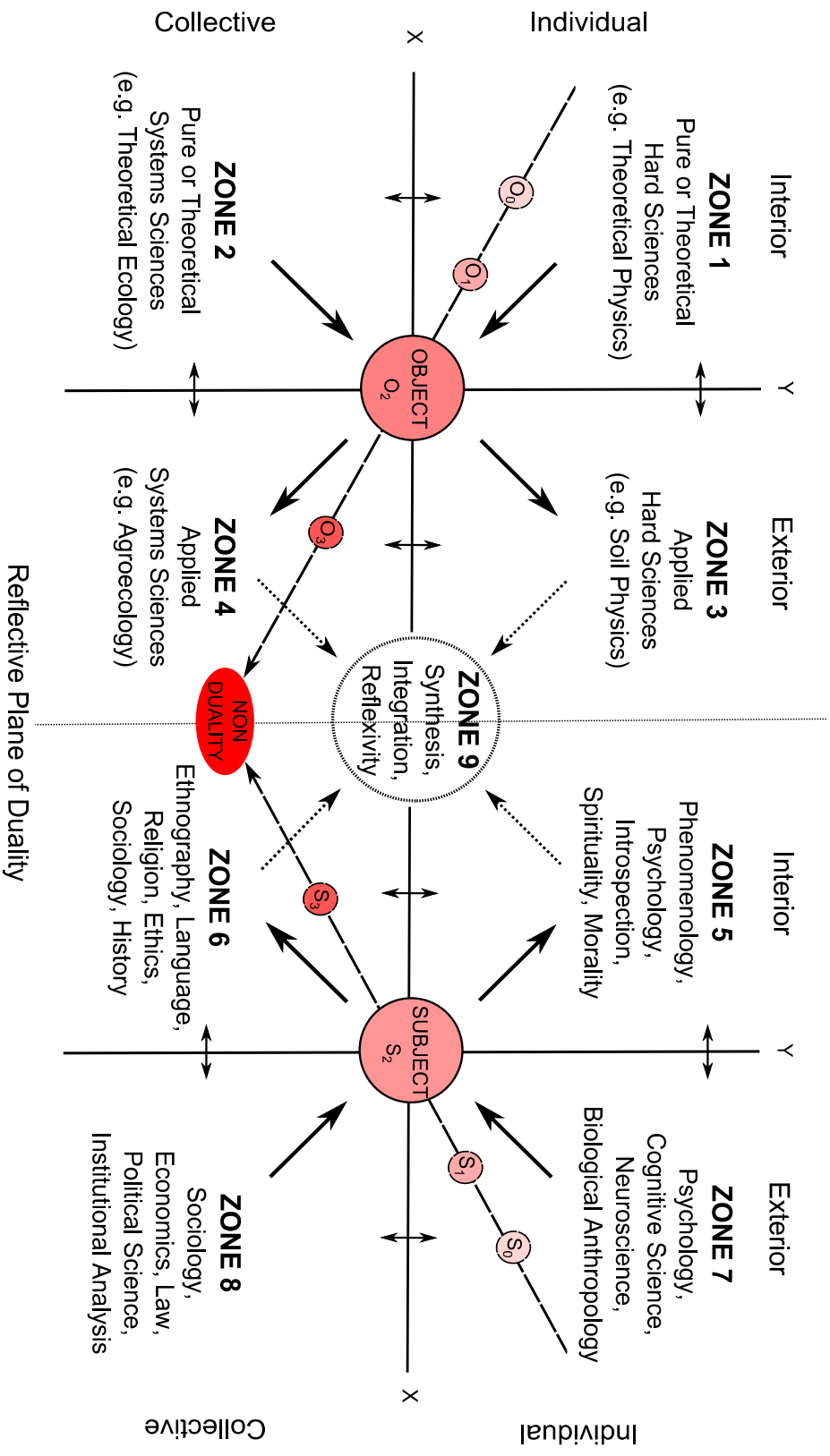

Figure 9: Nine Methodological Zones of Interdisciplinary Research in CRIMP

Although interdisciplinarity and weak transdisciplinarity are often used interchangeably, some scholars do distinguish between the two. Some ways in which transdisciplinarity is thought to "go beyond" interdisciplinarity is in its values-explicitness and in drawing on non-academic (i.e. societal) forms of knowledge (Jantsch 1970, Max-Neef 2005, Ruiz-Rosado 2006, Caporali 2012). This area of academic inquiry is much less explored than interdisciplinarity, however, so its forms in the nine zones are not fully coalesced.

Following Italian agroecologist Fabio Caporali, one notion of transdisciplinary research is research which abandons objectivist pretenses by making its values explicit, resulting in disciplinary and methodological principles and practices that are based on, and inextricable from, a core philosophical foundation (Caporali 2011). In Agroecology, this refers to "a systems approach as its basic methodology of enquiry and the concept of ecosystem, in the form of agroecosystem, as its basic epistemological tool for representing and explaining the agricultural reality" (ibid.). Built into the systems approach and agroecosystem concept, Caporali argues, is an explicit ethic of social and environmental sustainability.

Figure 11 maps Agroecology as a trans-discipline onto the 9 zones by listing a set of prescriptive practices, principles, and/or conceptual tools that a transdisciplinary agroecologist would draw upon to realize the sort of sustainable transformation Caporali is arguing for. The capacity for effective transdisciplinary research practice corresponds to a post-rational, or post-modern, stage of development. This developmental shift is represented by the O_2-S_2 level in the subject and object quadrants, beyond the O_1-S_1 level of modernist disciplinary or even inter-disciplinary rationality.

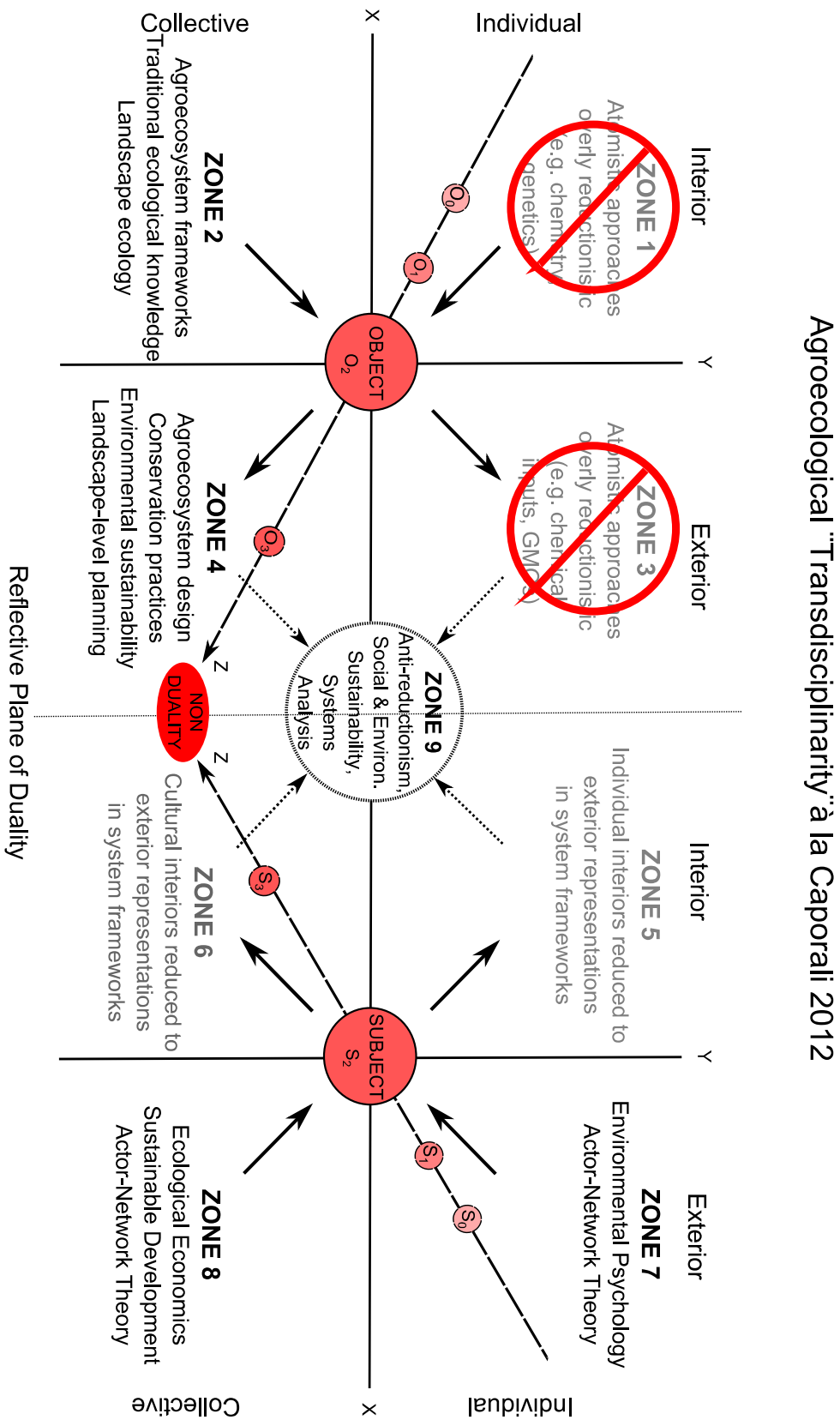

Figure 11: Caporali's agroecological transdisciplinarity in CRIMP

Caporali's conception of transdisciplinarity is ultimately shortsighted in comparison to other transdisciplinary theorists. A stated philosophical commitment to the systems-sustainability paradigm only more deeply entrenches the postmodern ideological underpinnings of Agroecology as they arose in response to environmental and social atrocities of the Green Revolution. In doing so, it commits subtle reductionism of interior (subjective) realities to their exterior correlates, and, as evidenced by its implicit denial of the legitimacy of modern-reductionist perspectives, reinforces the first-tier tendency to identify with, and privilege, a single, value-laden perspective.

Although Caporali is one of the only agroecologists who explicitly employs the term "transdisciplinary," a stronger version of transdisciplinarity can be teased out of some of the other more integrative, reflexive and societally-informed approaches to agroecological research discussed in Chapter 1, including Bell and Bland's holon agroecology and multifunctionality. Figure 12 offers a glimpse at what a stronger agroecological trans-discipline might look like.

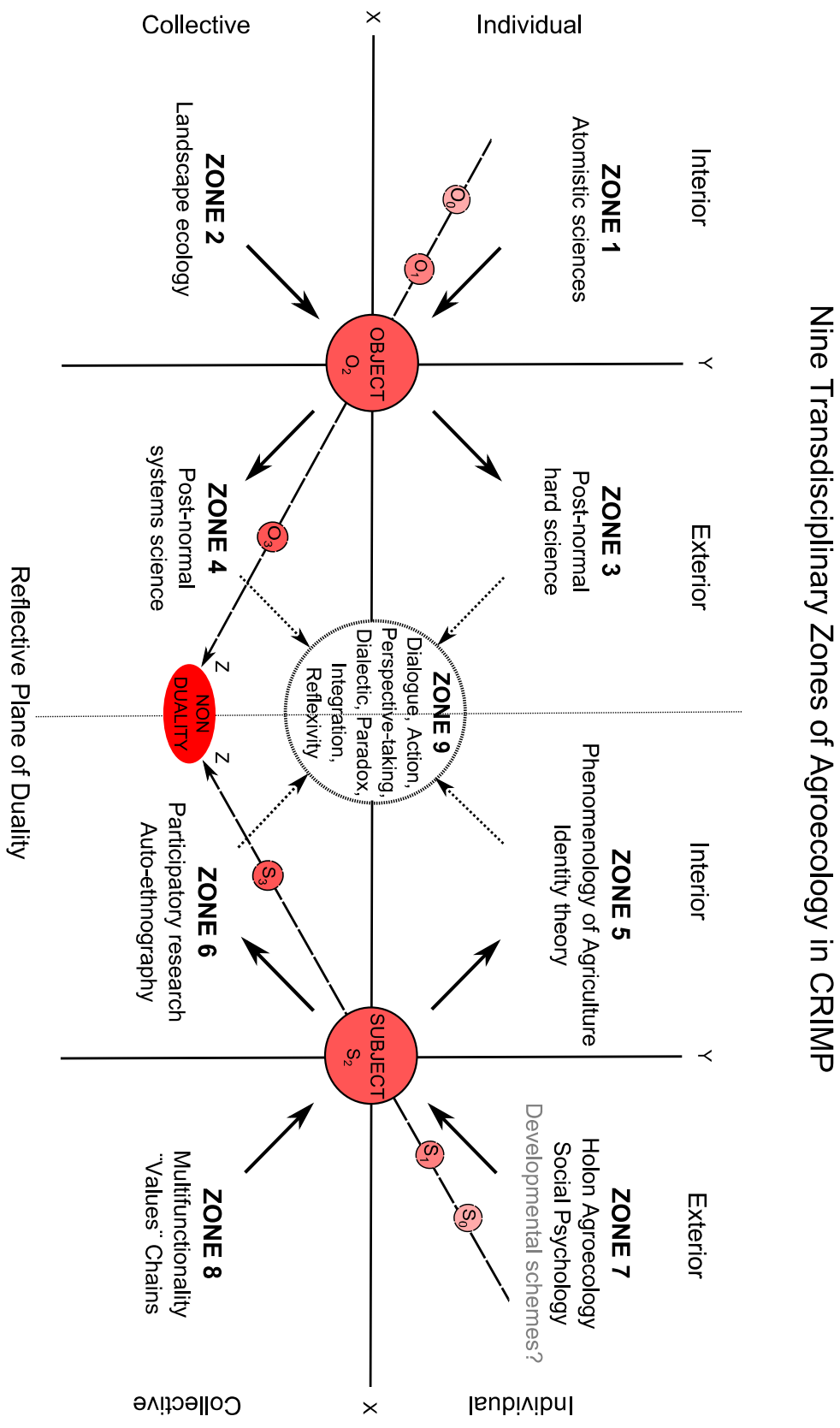

Figure 12: Agroecological transdisciplinarity in CRIMP

3.1.4. Strong Trans-Disciplinarity

For the current discussion, we will therefore look to the International Center of Transdisciplinary Research, and in particular the work of Basarab Nicolescu, for a definition of interdisciplinarity that is perhaps the most well-developed and widely accepted throughout the academic world. The short definition of transdisciplinarity is inquiry which "concerns that which *is* at once *between* the disciplines, *across* the different disciplines, and *beyond* all discipline. Its goal is *the understanding of the present world*, of which one of the imperatives is the unity of knowledge" (Nicolescu 1998). Nicolescu outlines three major aspects of Nature in accordance with the transdisciplinary model of Reality :

> 1) *Objective Nature*, which is connected with the natural properties of the transdisciplinary Object ; objective Nature is subject to *subjective objectivity.* This objectivity is subjective to the extent that the levels of Reality are connected to levels of perception. Nevertheless emphasis here is on objectivity, to the extent to which the methodology employed is that of science.
>
> 2) *Subjective Nature*, which is connected with the natural properties of the transdisciplinary Subject ; subjective Nature is subject to *objective subjectivity*. This subjectivity is objective to the extent that the levels of perception are connected to levels of Reality. Nevertheless, emphasis here is on subjectivity, to the extent to which the methodology is employed is that of the ancient science of being, which crosses all the traditions and religions of the world.
>
> 3) *Trans-Nature*, which is connected with a similarity in Nature which exists between the transdisciplinary Object and the transdisciplinary Subject. Trans-Nature concerns the domain of the sacred. It cannot be approached without considering the other two aspects of Nature at the same time. (Nicolescu 2000)

Although Nicolescu upholds the various dualisms of modern though as useful heuristic constructs, his version of transdisciplinarity ultimately overcomes them. There are thus nondual implications to this kind of understanding. Nicolescu explains:

> The two zones of non-resistance of transdisciplinary Object and Subject

> must be *identical* in order that the transdisciplinary Subject can communicate with the transdisciplinary Object. *A flow of consciousness crossing the different levels of perception in a coherent manner must correspond to the flow of information crossing the different levels of Reality in a coherent manner*. The two flows are in a relation of *isomorphism* thanks to the existence of one and the same zone of non-resistance. Knowledge is neither exterior nor interior: it is *at the same time* exterior and interior. The study of the universe and the study of the human being sustain one another. The zone of non-resistance permits the unification of the transdisciplinary Subject and the transdisciplinary Object while preserving their difference. (ibid)

This "zone of non-resistance" corresponds to a realm of understanding that circumvents the need for representation, leading to trans-rational insights into, in CR parlance, the underlying general mechanisms of the objects of study. Insofar as the use of representation (based on already established facts, theories, models, methods, and paradigms) is always limited to understandings of the *transitive* (socially produced) objects of science in open systems (i.e. outside of closed, controlled experimental settings), and the generative mechanisms in the domain of the real are the *intransitive* (beyond representation) objects of science, Nicolescu's strong-transdisciplinary zone of non-resistance thus represents an imortant mode of access to the generative mechanisms at work in open systems. And since agroecological research is virtually always done in open systems (rarely through closed and carefully controlled experimentation), transdisciplinarity offers a potentially extraordinary tool for agroecologists at stable trans-rational levels of awareness.

It ought to be emphasized here that while most certainly have the *potential* for trans-rational thought, not all scientists, based on current levels of development, are presently capable of incorporating transdisciplinary modes of understanding into their research. In fact, very few probably are. Such a capacity requires stable development

through—transcending and including—both pre-rational and rational stages. Rational critiques of "new age" concepts like non-duality and Nicolescan trans-disciplinarity do not (indeed *can* not) distinguish between pre-rational and post- or trans-rational ways of knowing. Wilber calls this the pre/trans fallacy (Wilber 1998). The problem arises because, by definition, there simply is no rational way of verifying trans-rational thought, and as a result trans-rational insights are typically labeled derogatively as new-age or pseudo-science. Further compounding the problem is the fact that stable development of these stages of development is extremely rare. For example, in a 2008 special issue of *World Futures* entitled "The Connection Between Postformal Thought and Major Scientific Innovations," Commons and Ross estimate the relative proportions of adults in the US population who have stabilized postformal levels of development (these correspond to integral-level awareness and beyond) to be roughly 20 percent. Capacity for Nicolescan transdisciplinarity seems to become possible at what they call the Paradigmatic stage, at which they estimate fewer than .05 percent of US adults can function without support (Commons and Ross 2008). This assessment helps explain why truly transdisciplinary modes of scientific understanding are so difficult to recognize and validate against a backdrop of abundant pre-rational, new age, and pseudo-scientific jargon.

Because the center of gravity of modern scientific societies is overwhelming rational, trans-rational insights or visions must be translated into rational language in order to become valid. Such was the great challenge and tragedy of Einstein, who in his lifetime was not able to elaborate the mathematical proof of his intuition about the existence of a unified field theory to integrate the macro-level fields explained by his

theory of general relativity with the micro-level fields unified in the Standard Model of quantum physics.

It seems stable transdisciplinarity in science is something as of yet relegated to the realm of theoretical or particle physics, or at least to a study of the most fundamental structures underlying the cosmos. Perhaps this is explained solely by the sheer genius of quantum physicists thinkers like Einstein, Bohr, and Nicolescu, all of whom have been brought through their work to the cliff edge where reason ends and further understanding proceeds only through trans-rational modes of knowing. Perhaps there is something exceptional about the language of mathematics in which such scientists speak that acts as a unique bridge between rationality and intuition. But it also seems that something about the fundamental nature of their work is explanatory: perhaps only through such fine-grain and sophisticated inquiries into the complex micro-tuning of the universe, at least so far in history, can physical scientists begin to catch glimpses of the unified nature of all beings and of knowledge of those beings. As the sophistication of these fundamental understandings builds up and out with time, it may be that scientists looking at larger-scale phenomena (e.g. agroecosystems) will begin to draw increasingly on trans-rational ways of knowing. Analagous to Nicolescu's zone of non-resistance are Goethean science (Max-Neef 2005) and Bhaskar's practical mysticism (Bhaskar 2002). Figure 13 below includes these concepts in a mapping of strong transdisciplinarity in CRIMP:

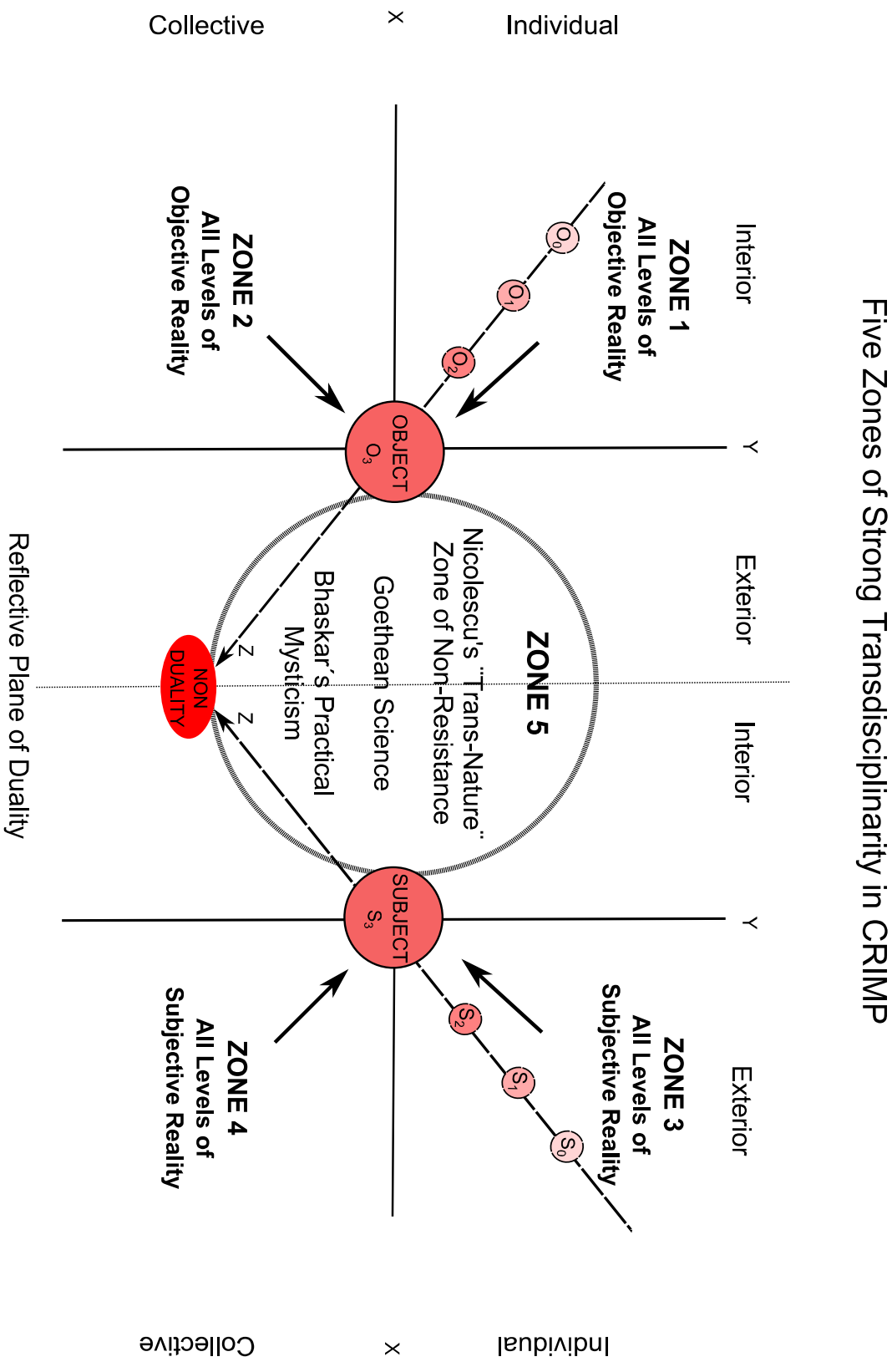

Figure 13: Five zones of strong transdisciplinarity in CRIMP

As hinted at in Figure 13, transdisciplinary understanding culminates in the state-stage of non-dual consciousness where various dualisms that give structure to CRIMP, of epistemology vs. ontology, individual vs. collective, and interior vs. exterior, collapse in upon themselves. Non-duality implies total unity of subject and object, self and other. It is a universal state that pre-exists all form—human thought, cellular life, matter itself—whether "experienced" or not. Yet it remains undetected, uninhabited, by dualistic human thinking that divides, atomizes, compartmentalizes, and objectivizes, even if all such fragmented thinking ultimately arises from that very universal ground of being that is non-duality. In the same way that epistemology is contained by ontology, dualistic thinking is contained by non-duality. This is why, the more complex self-awareness we can cultivate, the more firmly we begin to stand and reclaim not only our own wholeness but, what is the same, the wholeness of the entire universe that both gives rise to us in materiality, and that we give rise to in consciousness. This is also why it is misleading to speak of a culminating state-stage of non-duality; indeed, it is rather the purest, most fundamental, and most permanent element of awareness that we have access to in every moment. It is there, the only question is how muddled is our awareness of it by the fleeting, illusory artifacts generated by dualistic thinking.

3.2. WICKED PROBLEM-SOLVING

Contemporary environmental problems are almost always systemically embedded in both natural and social spheres and span various levels of complexity. Such "wicked" problems often transgress the disciplinary boundaries of the academy (Rittel and Webber 1973). Due to the complex interdependencies at their root, narrow disciplinary attempts

to solve merely one dimension of the problem tend to exacerbate or even create other problems. Because of this, wicked problems call for problem-solving approaches that go beyond traditional academic disciplines. Examples of wicked problems abound in a field like Agroecology, whose increasingly expansive food-system scope encompasses systemic dysfunctions at scales ranging from biophysical interactions on the farm field to societal dynamics on a global stage (Wezel et al 2009, Francis 2003, Cox & Atkins 1979).

Given the wickedness of contemporary food system issues, perhaps the greatest strength of applying IT in Agroecology is its capacity to inform the multiple post-disciplinary approaches previously discussed. Single-, multi-, inter- and trans-disciplinary insights must all be brought into play in order to identify the various points of leverage from which to tackle wicked problems. As a post-disciplinary system, the comprehensive, meta-level purview of IT may thus provide the most powerful framework to date for unraveling the wicked problems of the modern food system. An example of IT's might in a wicked food system context will be presented in the last chapter, which will apply CRIMP to the food vs. fuel controversy.

3.3. NARRATIVE CHOICE & CONTEXT

Sensitivity to contexts, both in the subjective and objective domains, must be accounted for in holistic agroecological research. One advantage of using CRIMP to guide research is that it provides a relational, categorical structure for making sense of the entire range of contexts that either shape or are shaped by any given phenomenon. In particular, cultural and phenomenological blindspots can cause us to ignore certain

contextual dimensions of a research problem and thereby neglect connections to less obvious phenomena with potentially high explanatory relevance. As I will show in the "Practice in CRIMP" section of Chapter 4, these blindspots can have disastrous effects. But what exactly is meant by context? In IT terms, context is the reminder that holons "tetra-arise" in all four quadrants. In other words, when research concerns itself squarely with phenomena arising in a single (or even in just two or three) quadrant(s), it is necessarily leaving out potentially important contextual dimensions in the other quadrants.

As an example in the subject quadrants, an agroecologist may want to explore the connection between race and agriculture in a given population subset. To do this, she may look to demographic statistics in that subset – rates of farm ownership by racial category, for example, compared with participation in farm labor employment by racial category. She might find a disproportionate number of a particular racial group involved in farm labor without ownership. To explain this phenomenon, she may draw on Marxist theory, point to institutional racism, and/or analyze intersections with other social structures and constructs like class and gender. This would seem to be a rather rigorous and complete social scientific analysis of the relationship between race and agriculture in this population. However, once put on to the CRIMP map, it becomes clear that this research—from the problem to the methods to the conclusions—is an exclusively lower-right quadrant inquiry. It completely neglects LL cultural dynamics (e.g. racial histories and cultural perceptions of farming, values about ownership, risk, success), UL agentive dynamics (e.g. What are the intentions, dreams, and ambitions of individuals of this racial group, i.e., would they even *like* to own a farm?), and UR cognitive structures (e.g. What

personal narratives and broader structures are influencing these individuals' agency and either promoting or stifling their self-realization?). All of these wider contextual dimensions may have potentially strong explanatory relevance that must at least be acknowledged for integral research to take place. The CRIMP map provides a guide for this contextual inventory.

The abundance of examples of contextually vacuous research in the object quadrant is indicative of the zeitgeist of reductionist science whose atomistic ontology is infamously adept at generating wicked problems occurring at high levels of systemic complexity. Contextual sensitivity, particularly to emergent systemic properties, is what is sorely missing from the fragmented, over-specialized approaches of modern science and industry.

All research can be conceived of as narrative because in order to do research, artificial bounds must be placed around the objects of study, which in turn necessarily involves a choice about what objects will *not* be studied. A researcher wanting to understand a given phenomenon would ideally do so by first identifying all explanatory variables that may influence it. This is not to say that all integral research must be perfectly holistic; the researcher who faces temporal and material constraints is a master of improvisation, leaving out those dimensions that may not be particularly relevant to the research at hand. But the point is that CRIMP provides the researcher a simple framework for taking full ontological and epistemological inventory of her research scenario. In making narrative choice, such an inventory guides and informs the researcher about what should be included, as well as how to formally acknowledge the potential significance of dimensions that will not be fully explored. This process of ontological

inventory aids the researcher in making more conscious and appropriate narrative choices.

3.4. REFLEXIVITY, SELF-AWARENESS & TRANSFORMATION

IT holds that epistemology and ontology are inextricably linked phenomena. In other words, what is understood depends on who/what is having the understanding, and who/what is having the understanding depends on what he/she/it understands. We can draw upon the Kuhnian concept of paradigms as a parallel to IT's concept of developmental levels in order to synthesize these ideas: the scientist's discoveries will inevitably be influenced by prior conceptions of the way the world works, and those discoveries can either transform, or merely perpetuate those pre-held conceptions (Kuhn 1970). Attempting to identify such values and paradigmatic biases and make them explicit can thus increase the likelihood of conducting epistemologically meaningful research, i.e. research with the transformational potential to shift the epistemological structures that confine the researcher. Greater awareness of these epistemological structures also yields greater ontological clarity through deeper penetration of the mind's constructed representations of real objects (in CR terms, the transitive objects of science), offering glimpses of the pure generative structures underlying such representations.

In this way, IT not only advocates for participatory research, but asserts that the very endeavor of research is already inevitably a participatory activity, regardless of whether its participatory nature is even acknowledged, let alone explored in depth by the researcher through a reflexive process. And because research is participatory it is also thus necessarily transformative, or at least potentially transformative, for both the

researcher as well as the object of study. This is perhaps most clearly the case in a field like Agroecology where the objects of study tend to be human-dominated systems. Because agroecosystems are shaped by human management, by engaging in the study of an agroecosystem the participatory agroecologist becomes part of that ecosystem, if only temporarily, by virtue of his collaborative and dialogic involvement (e.g. articulating a problem/hypothesis, conducting interviews, sharing data and results, etc.) with the farmers that manage it. In this way, the research transforms both the researcher and the farmers through enhanced understanding of the agroecosystem of which they are members. By extension, the agroecosystem itself is thus also transformed by virtue of the increased awareness of its constitutive members.

Given this deep embeddedness of research in both subjective and objective contexts, CRIMP facilitates transformation of the individual researcher (who), the agroecosystem she studies (what), and of the (inter- and/ or trans-) disciplinary methods she uses (how). The direction of such transformation is a continuing to push toward ever-greater self-awareness and sophistication of reflexivity within the research process, expanding the notion of self to include both subject and object. Although CRIMP is created from an integral perspective that realizes the necessity of fully holistic research, every single one of the various dimensions that comprise holistic research—from the structure of atoms to spiritual beliefs to social structures—precedes and enables the very integrative perspective that makes them explicit. An integral perspective contains them but is also wholly contained *in them*. It is nevertheless only through this integrative lens and the process of unfolding self-discovery that all these dimensions and their importance come into focus.

4. TWO AGROECOLOGICAL CASE STUDIES

The following two sections present case studies of an Integral Agroecology in action, using CRIMP as a sort of preliminary mapping device. The first is an example of "CRIMP in practice" in recent agroecological scholarship, illustrating the IT principle that integral modes of thinking are not some sort of novel contrivance of IT, but are rather already apparent in existing scholarship. The second is an exercise of "Practice in CRIMP" in which I myself apply IT principles to map the complex food vs. fuel problem onto the CRIMP framework.

4.1. CRIMP IN PRACTICE: *FARMING FOR US ALL*

Michael Bell is a sociology professor at the University of Wisconsin, Madison, who draws on a variety of qualitative research methods to understand the social dimensions of agro-food systems. In his book *Farming for Us All*, he places primacy on the farmer's perspective in an attempt to understand why some Iowa farmers choose to "go organic" while others do not. In answering this question, the book presents a well-rounded CRIMP analysis of the complex political, economic, social, cultural, and psychological dimensions that together influence whether an individual Iowa farmer chooses to stick with conventional farming methods or opts for more sustainable practices.

In true integral fashion, Bell is careful to first identify the dimensions of his own subjectivity that inevitably color his research. In an opening chapter, he candidly lays out his and his collaborators' values for the reader: "We did [the study] because we believe that sustainable agriculture is a social cultivation of great significance—to rural life, to

urban life, to the environment, and…to fundamental issues of knowledge and democracy." He further remarks, “The most value-*free* social science may well turn out to be the most value-*less*” (p.11). This resonates strongly with the Integral assertion that epistemology and ontology are inextricably linked phenomena. In other words, what is understood depends on who/what is having the understanding, and who/what is having the understanding depends on what he/she/it understands. This spirit of reflexivity opens the researcher to the possibility of discovering information that may potentially transform her values, and perhaps even shift her entire worldview. Put simply, research done without some sort of conscious self-reflection is less likely to yield truly meaningful outcomes.

The book also utilizes a variety of interluding chapters, called *intermezzos*, in which metacritical reflections are elaborated to nurture an ongoing sense of theoretical reflexivity, weaving paradigmatic and axiological transparency on the part of the researcher throughout the more focused discussion around choice of agricultural practices in Iowa. The first intermezzo is particularly demonstrative of integral awareness in Bell’s research. In it, he fleshes out the differences between modern and postmodern worldviews, identifying both the dignities (i.e. modernism as practical and action-oriented, postmodernism as inclusive and dialogic) and disasters (i.e. modernism as oppositional and universalizing, postmodernism as overly critical and solipsistic) associated with each (pp.22-26). Furthermore, he attempts to integrate the best of both, proposing “practical postmodernism” as an integral synthesis of the two and a paradigmatic lens with which to consider the agricultural realities of Iowa’s farming communities (p.25).

It is thus with a voice of practical postmodernism that Bell skillfully navigates the sociocultural climate of Iowa agriculture. The book's central themes are laid out onto the CRIMP map in Figure 14 below.

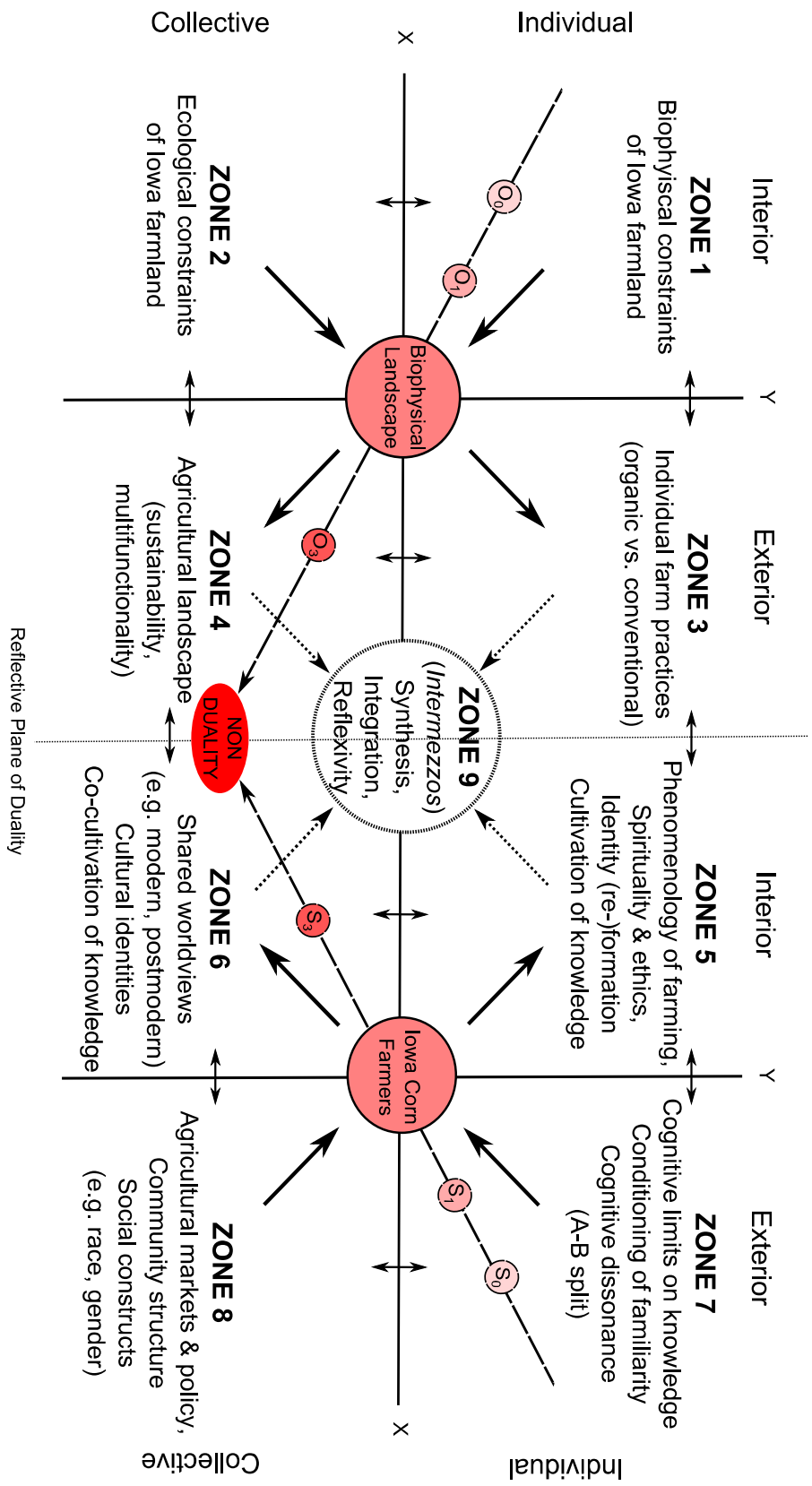

Figure 14: Themes of *Farming for Us All* mapped onto the CRIMP framework

What is especially remarkable about *Farming for Us All* is the painstaking care that seems to be taken by Bell in order to avoid what IT terms *subtle reductionism*, or the tendency to reduce fundamentally left-hand (interior) phenomena like phenomenology and culture to right-hand (exterior) representations of mere behavior or social structure, which is a common shortfall of systems thinking. For example, although Bell rightfully acknowledges the dialectic influences of external social structures on the interior dimensions of both cultural meaning (Intermezzo pp. 145-147) and individual cultivations of knowledge and identity (2nd full pgph., p. 143), he does so only after evaluating and unpacking these interior dimensions on their own terms. He even goes so far as to call equal attention to the importance of the reverse dynamic through which exterior structures actually play into interior phenomena in a two-way dialectic:

> We usually understand economics as the realm of money and necessity…But economics is far more than money, and far more than necessity…It is…not just in the gaining of our living but in the *living* of our living. It is part of our phenomenology of being and doing…a structure that gives shape to our daily practices, just as our daily practices in turn give shape to that structure. (p.154)

The significance of this passage should not be understated; it represents a complete reversal of the empirical-reductionist tendency to translate left-hand concepts like phenomenology into a right-hand language of deterministic structures. Instead Bell shows here how the opposite is true as well. This idea reinforces the Integral principle of co-enactment—that phenomena in each quadrant never arise in isolation, but always co-enact corresponding changes in each of the other quadrants. In the concluding chapter, Bell's commitment to understanding interiors on their own terms extends into a rather unconventional but highly integral suggestion for agricultural policy: to craft effective bottom-up initiatives that have the goal of catalyzing (or at least facilitating)

phenomenological ruptures, despite the difficulty inherent in the immensely diverse and individualistic nature of such experiences.

4.2. PRACTICE IN CRIMP: FOOD VS. FUEL

Imagined environmental benefits and increased energy independence and security have fueled a surging interest in U.S. biofuel production in recent years. Production levels peaked in 2011, reaching 13.9 billion gallons, a diversion of approximately 40% of the total US corn harvest (RFA). Since 2001 when production was 1.77 billion gallons, this represents an average annual increase of approximately 80%, a near doubling each year (ibid.). This increase has been propelled by federal policy incentives like Energy Independence and Security Act of 2007, which set the goal of increasing biofuel production to 36 billion gallons by 2022, with a stipulation that no more than 15 billion gallons could come from corn grain. With second-generation cellulosic ethanol still on the distant economic horizon, the 2007 Act poised the 8.5 billion gallons of corn ethanol that constituted the gap between the 2007 production level of 6.5 billion gallons and the 15 billion-gallon limit as the low-hanging fruit.

The massive diversion of both cropland and corn grain entailed by these statistics has not been without important consequences. One important concern over first-generation grain-derived biofuels like corn ethanol is their competition with the end uses of food and feed, which are generally higher priority uses of grain commodities. A 2007-2008 spike in world grain prices inflamed such concerns, as many blamed increases in biofuel production in developed countries (US corn ethanol in particular) as a primary cause. These food price spikes impose disproportionate negative effects on the world’s

poor, where a much higher proportion of already-marginal incomes is spent on food. Seven key studies investigating the relative weight of various factors in influencing the 2008 spike in world grain prices identify eight main structural and market-based culprits (IMF, IFPRI, CME, World, US, Collins, Biofuels):

1. Biofuels, both supply-side (resulting from diversion of finite land resources from food or feed production to fuel production) and demand-side (structural changes in the demand for biofuel grains due to subsidies like those of the 2007 Energy Independence and Security Act) factors
2. Increase in crude oil price, including its effects on oil-dependent production costs
3. Increased demand for grain and grain-embodied animal products in developing countries
4. Under-investment in agricultural research and technologies and rural infrastructure, leading to lower grain supplies
5. Depreciation of the US dollar
6. Poor weather and disease in major grain- and oilseed-producing regions
7. Increased export bans on commodities as protective strategies against grain price spikes
8. Speculative investment in commodity markets

All eight of these causes of the food vs. fuel controversy are explanatorily relevant and thus important to consider when attempting to deconstruct this global phenomenon. However, they are all purely exterior, structural causes. Even within the first category of causes dealing with biofuels alone—which, after a balanced review of the literature, are likely accountable for 30-50% of the commodity price increase in 2008—the existing literature is narrowly focused on external factors. Aside from a fair amount of retrospective attention given to ethical considerations of biofuel production in light of the commodity price crisis of 2008 (e.g. Gomiero et al. 2009, Nuffield 2011,

Gamborg et al. 2011), virtually nowhere in the literature on the food vs. fuel problem is there mention of the interior dimensions at the belly of the problem—the cultural values embedded in the US biofuel landscape, for example. Even among these articles considering the ethical ramifications of biofuel production in light of global food shortages, ethics are stripped from their local contexts in the evolving minds and hearts of individuals and cultures, and dealt with objectively, as if stemming from some fixed, universal moral code. Furthermore, ethical values are but one subcategory of individual and cultural interiors, and as such only one small piece of the greater explanatory puzzle of the food vs. fuel crisis.

Harkening back to one of the chief tenets of CR-informed research I laid out in chapter 2, *whenever the object(s) of research overlap in explanatorily relevant ways with subjective agents (i.e. humans or their culture), a quadradic (subjective) analysis of those subjective agents is required.* To that end, CRIMP provides the necessary framework for taking ontological inventory of the research literature and identifying the gaps. In Figure 15 below, I have attempted to outline the major categorical issues at play in the food vs. fuel dilemma, with a specific focus on filling in the major blind spots in the literature, occurring primarily in Zones 5 and 6.

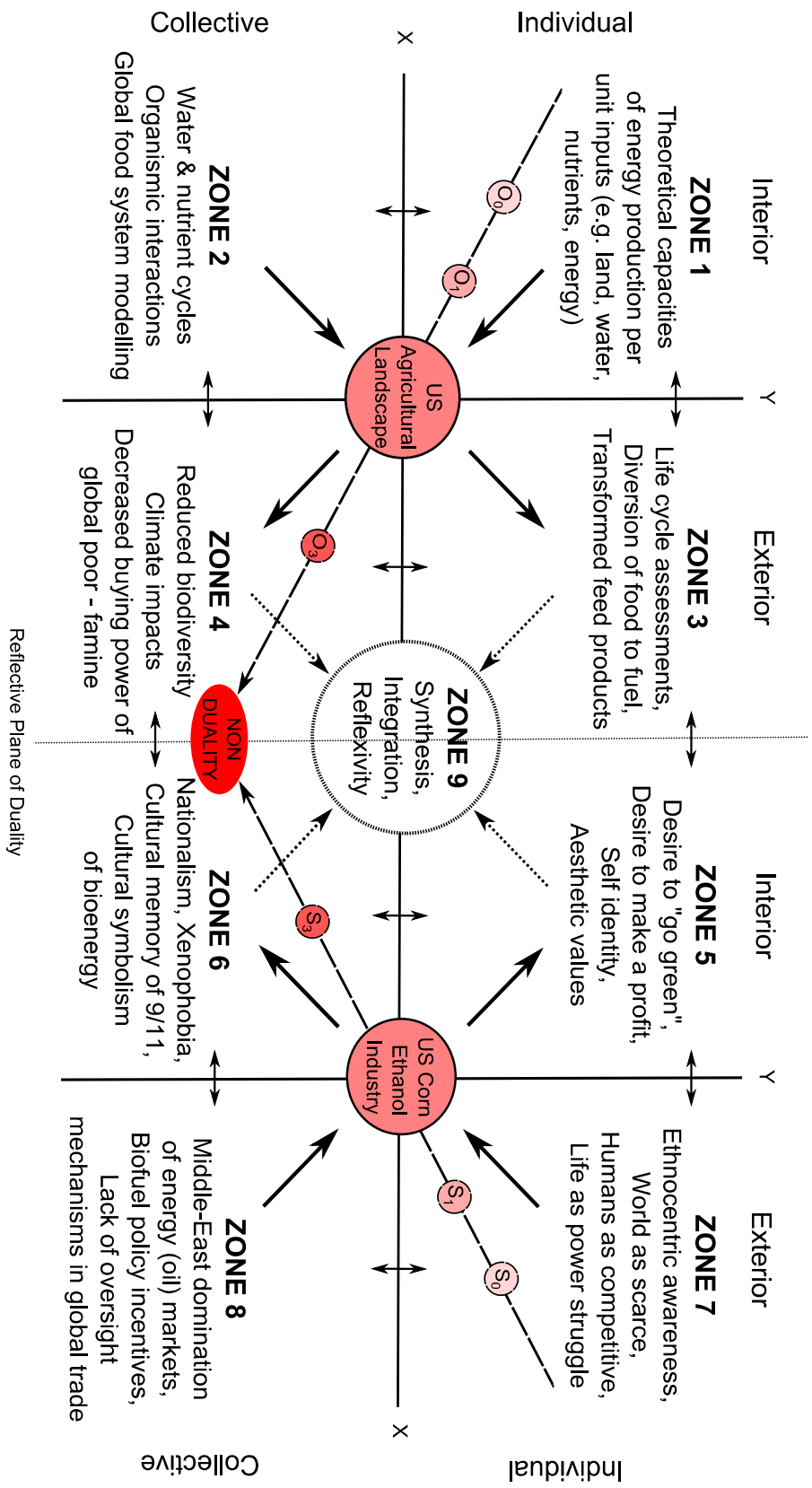

Figure 15: Practice in CRIMP with example case study in the food vs. fuel dilemma

Due to space limitations, the lists in each zone are admittedly limited, and particularly the individual and cultural values in Zones 5 and 6. Some others that could add to (but still not exhaust) the list in these zones include values around:

- Culturally acceptable uses of land
- Aesthetics of rural landscapes
- Farmer identity as “feeder of the world” - or “fueler of the world”
- Intrinsic valuation of the environment (e.g. biodiversity, ecosystems)
- Political ideologies regarding the role of the state in land management
- Private property rights and what it means to “own” land
- Religious narratives (e.g. land as the God-given dominion of man)
- Racism, stereotypes, and a culture of hostility toward the Middle East

Had we as Americans (or at least our political leaders) been able to fill in the gaps in our interior values surrounding biofuels, we may have been able to prevent or at least curb the crisis in the first place. This should serve an important lesson to us as a nation and a culture, as we look toward second-generation biofuel sources that promise to overcome the food vs. fuel challenges by making use of non-edible portions of plants (or algae) for energy extraction. However, like the blind spots that resulted from a lack of awareness around the interior dimensions underlying the unfettered explosion of US corn ethanol production and attendant spikes in global food prices in 2007-2008, preventing the potential disasters of second generation fuel crops will require identifying the unique blind spots of these technologies early on.

These blind spots may very well occur at different locations on the CRIMP map than those of first-generation biofuels, reiterating the importance of taking ontological inventory of each problem separately, using the CRIMP framework. Indeed, it has become clear that using crop residues (e.g. corn stover) for cellulosic biofuels involves problematic environmental tradeoffs because these residues, when managed properly under no-till or conservation tillage regimes, provide valuable resources for protecting

water quality and soil fertility. Removing these residues exposes the soil to higher rates of erosion and nutrient transport, and also removes valuable organic matter and microbial communities that otherwise contribute to better plant nutrient availability and overall soil tilth. Second-generation cellulosic ethanol sourced from dedicated biofuel crops is not without its flaws, either. Although such practices do not directly compete with food, they do require the conversion of more marginal agricultural lands as well as land that may have previously been held in conservation (i.e. in the federal Conservation Reserve Program). To meet our energy goals, it is likely that additional, previously uncultivated land would need to be converted to make way for dedicated energy crops, further exacerbating environmental degradation and exhausting land resources that may otherwise be critical buffers, for example, in emergency or disaster scenarios.

But it is not clear when, or even if, the transition from first to second generation biofuels will occur. The current economic climate for US biofuel production has shifted significantly due to regulatory support of the natural gas industry starting with significant deregulation in1985, and expanding through various tax incentives laid out in the Energy Policy Act of 2005 (U.S. EIA). Combined with improvements in hydraulic fracturing (fracking) technologies, which crush deep shale bedrock layers to release natural gas stores bound up by them, the favorable shale gas regulatory climate has opened the door to widespread use of fracking, increased domestic production of natural gas, and significant drops in natural gas prices. Since natural gas and biofuels are highly substitutable transportation fuels, the fall in natural gas prices has precipitated stagnation in biofuel markets.

Accompanying this market shift is a transfer of environmental burdens levied by

the two different fuel sources, public complicity to which may reveal clues as to the relative weight of the sociocultural values behind fuel choice. While initially viewed as a bridge fuel for smoothing the transition away from traditional fossil fuels with high GHG impact (Pacala & Socolow 2004), more recent life-cycle assessments of shale gas actually show worse GHG emissions (mostly due to methane released during fracking) than conventional gas or oil, and even coal (Howarth et al. 2011). Since biofuels are, at least in theory, assumed to be carbon-neutral, the substitution of biofuels for natural gas entails a large net increase in GHG emissions contributing to global climate change. In addition to increased GHG emissions, another notable environmental impact of shale gas is contamination of groundwater by the methane released from the fracked shale layer (Jackson 2011). When weighed against the various environmental, land-use, and food-system impacts of biofuels already discussed, the tradeoffs between the two energy sources become clear.

Just as we have used individual and cultural values as a lens through which to explore their outward reflections in markets and policies, we can use external structural phenomena like this shift in energy markets and the attendant environmental tradeoffs to reflect back on, and deepen our understanding of, individual and cultural values. One admittedly large assumption that must be made for such an analysis is perfect information. But if we take the policies created by publicly-elected officials to be accurate proxies for collective public values, these officials' access to up-to-date information about the various aforementioned environmental tradeoffs (as well as the economic and social ones) can be assumed to be quite good, and certainly better than that of the average consumer.

In this case it is difficult to tease out the environmental tradeoffs involved with increased natural gas production from the economic ones, as the shift has so closely tracked the presumably greater influence of market forces while any discourse about social and environmental issues have remained mostly peripheral. Perhaps the most salient insight we can tease from this shift, then, is that U.S. society as a whole continues to be more driven by short-term economic gain than by, for example, any values around the symbolic meaning of the land, aesthetic values, or ethics of sustainability. Nationalist identities and domestic security-related values associated with energy independence, however, should not be minimized, as these are common denominators in both domestic biofuel and natural gas production and are likely important interior drivers of them. Though this may be unsurprising to some, and discouraging to yet others, it may be helpful in simply coming to grips with the current reality, allowing a continued focus of pragmatic efforts for environmental change—at least for those problems needing urgent, short-term solutions—on market-based strategies. In the meantime, this also highlights the need for new and/or better long-term strategies for improving environmental values, as decades of environmental education have mostly failed to make significant progress on this front (Price 2007).

This has so far been a very broad-stroke and over-simplified analysis of the food vs. fuel problem for the sake of CRIMP practice. It admittedly smooths over the immense variation and complexity of both the US biofuel landscape, and the diverse communities and individuals that shape and are shaped by that landscape, many of which surely have values and perceptions that conflict in myriad ways with the CRIMP schematic presented in Figure 15. To even begin to do justice to the intricate diversity of the US biofuel

landscape across various social and geographic scales, a number of separate CRIMP analyses would need to be done at a scale no bigger than, for example, the community of Iowa farmers that Bell studied in *Farming for Us All*—and even then, much care must be taken to properly characterize and represent the heterogeneity of individual and cultural interiors, as Bell succeeded in doing.

Hopefully, this practice in CRIMP did succeed in driving home one overarching methodological principle for IT-informed agroecological research: interior values are real, and can serve as a useful lens through which to interpret external phenomena. This highlights the importance for agroecological researchers, especially those stuck in atomistic or systems paradigms (which, according to IT, are equally guilty of the sin of subtle reductionism of interiors to exteriors) to let go of the idea that agricultural landscapes are merely things "out there," and to re-envision them instead as manifestations of the diverse desires, beliefs, fears, dreams, aesthetics, and imaginations of the people and cultures that live and depend on them. This is not to reduce exteriors to interiors, either; as Bell pointed out in *Farming for Us All*, structural forces like markets, regulations, and subsidies have enormous power to sculpt agricultural landscapes in their own right. But again, these structures themselves should also be analyzed through an interior lens—i.e. the values of the public majority (as well as the public minority that remains complicit with the status quo) that elected the officials who in turn create the structures, plus additional considerations for the unique personal (e.g. desire for power) and emergent cultural (e.g. tribal-esque entrenchment of partisan identities) interiors of the formal institutions of power.

As CRIMP illustrates, and as Bell repeatedly puts into practice throughout his

book (e.g. the shaping of daily practices by economics and the shaping of economics by daily practices), the reflective plane of duality is a two way mirror with bi-directional causality. Exploring the various dialectics that link subjective and objective perspectives as well the various quadrants of each can unlock novel frames of understanding that lead to far more holistic understandings of the kind of open-system phenomena that are so often the objects of agroecological study.

5. CONCLUSION

5.1. ENVISIONING AN INTEGRAL AGROECOLOGY

After exploring the historical evolution of Agroecology through its conceptual leading edge, the core elements of IT, CR, and CRIMP, and two case studies of CRIMP in practice, is it possible to arrive at a single coherent vision for what an Integral Agroecology will actually look like? Perhaps not. It may be too soon to proclaim a paradigmatic revolution in the field, and certainly too soon to give a detailed outline of what the new paradigm will look like. But it would be a shame not to at least try, for in order to change the world for the better, one must first have a vision for a better world. In imagining this future, let us draw inspiration from the cogent vision of Basarab Nicolescu, in his 2012 book *Transdisiciplinarity and Sustainability*:

> In the transdisciplinary approach, there is a fundamental openness of Reality, which involves the openness of the future. We are part of the ordered movement of Reality. Our freedom consists in entering into the movement or perturbing it. We can respond to the movement or impose our will of power and domination. Our responsibility is to build sustainable futures in agreement with the overall movement of Reality...Reality is *plastic*. We are part of this Reality that changes due to our thoughts, feelings and actions. This means that we are fully responsible for what Reality is. Reality is not something outside or inside us: it is simultaneously outside and inside. (pp. VII-VIII)

The intention of this concluding chapter is thus not to “impose [my] will of power and domination” on the future course of Agroecology. Such an imposition of will could take the form of alarmist rhetoric designed to provoke an unmediated response to what I perceive to be the urgent wicked problems of our socially and environmentally destructive food systems (or else!). But telling such a narrative is ultimately an act of violence, whether conscious or unconscious, as its main effects are to induce fear in those who accept it, and alienate and demonize those who do not. Instead, I will take Nicolescu's cue to embrace the fundamental openness of Reality and of the future, and attempt to enter into its natural movement. Inside, the plasticity of Reality allows for our co-creation of it, not by imposing willful force but rather by finding alignment between its natural direction and our own, which, through the careful practice of transcending our personal and cultural egos, become one and the same. So here is my attempt to align my vision with agroecological Reality in order to arrive at some sort of foundation for an Integral Agroeclogy that is itself aligned with this Reality.

Let us start with Nicolescu's transdisciplinary imperative to explicate a *poethical* foundation for scientific inquiry in which “ethics [is] intertwined with analytical mind and with the imaginary of the 21st century” (Nicolescu 2012, VIII). Caporali proposed the poethical foundation of Agroecology to be a sustainability ethic intertwined with the systems paradigm. But a CRIMP analysis (Figure 11) reveals the blind spots that Caporali's poethical foundation entails in the dimensions of human interiors and atomistic science. Whereas Caporali's sustainability ethic effectively excludes atomistic and productivist orientations, I propose a widening of Agroecology's ethical embrace to reflect a richer, more honest imaginary of the 21st century.

Perhaps we can find such an imaginary in the *Integral Ecology* slogan, “[T]hings are getting worse, things are getting better, things are Always Already perfect” (Esbjorn-Hargens & Zimmerman 2008, p. 307). This vision of Reality honors the multiplicity of interior perspectives and exterior circumstances that co-enact it, that make it real. The importance of this vision is that it not only acknowledges paradox, but embraces it as a natural and productive feature of the universe. Paradox is productive because power is always relational; were it not for the ideological force levied by modernism's faith in free markets and techno-scientific progress as a means to social and environmental salvation, the countervailing postmodernist force of green environmentalism would virtually lose its *raison d'être,* and thus its power. The same is true in the opposite direction. But it is precisely this paradox and the tension it creates that gives way to the impulse for synthesis, integration, and greater appreciation of complexity. In fact, the greater the tension, the greater potential energy of this impulse (though also of misunderstandings and acts of violence).

In what ways is the world “Always Already perfect,” then? Capacity to hold paradox can give rise to a sense of perfection because, at this moment in time, the dialectical process that drives the evolution of humanity depends on it; it simply could not happen any other way. Nonetheless, total identification with the separate self (that which grounds its identity in either of the two poles of the dialectic) entails a disconnection from the natural flow of Reality—a sort of existential dissonance. The striving for realignment of one's identity with Reality often begets violence, albeit subtle or unconscious, as the self longs to extinguish this dissonance. To be fully inside this flow is to choose the Middle Way of Buddhism, where goodness and badness, love and

hate, self and other, collapse in upon themselves. To be fully inside is to recognize that things are Always Already perfect just the way they are.

The paradoxical imperative for practitioners of an Integral Agroecology is thus two-fold:

1) *To merge with the flow of Nature by dissolving the separate self and realizing the Always Already perfect nature of agroecosystems and the myriad perspectives through which they are enacted, and;*

2) *To embrace the separate self as a necessary force of dialectical opposition to the powerful antagonistic forces that pose immediate threats to agroecosystem health and sustainability, and to act consciously and nonviolently from it (i.e. through CRIMP-guided post-disciplinary agroecological research).*

In one sense, these two imperatives appear to be mutually exclusive in the same way that dualistic thinking seems to somehow erase the nondual ground of being that precedes all things (including duality itself). But the truth is that cultivating a connection to the flow of Nature (e.g. through a meditation practice that helps dissolve the separateness of self) leads to a healthier, keener awareness of the separate self—a still very necessary tool for action in the 21st century. As a result, the more effectively agroecologists can master the first imperative, the more skillful, patient, and peaceful they will be at executing the second. In the end, then, perhaps the single definable characteristic of an Integral Agroecology is that it asks the researcher to understand and transform their interior selves before attempting to understand and transform their exterior world—and ultimately to realize that the two processes are actually one and the same.

5.2. SOME NOTES OF REFLECTION

After reading my thesis, the reader may be asking herself, “If he thinks reflexivity on the part of the researcher is so important, why didn't he include a statement of his own interiority?” Well, here it is; I have deliberately placed it at the end. The reason for this is that putting it at the beginning, to me, would seem to suggest that I had a fairly firm grasp on my own interiority going into this thesis, and that it would remain essentially the same throughout the process of researching and writing it.

The truth is, however, that it is only upon completion that I feel ready to make such a disclosure, and even then with the disclaimer that this is by no means the final word. It is my personal philosophy that the moment one stops challenging himself to grow (intellectually, emotionally, spiritually, etc.) is the moment he stops truly living. At least that is what I say now; perhaps in a PhD dissertation I will have no reservations about making this statement at the beginning.

If “Integral” can be thought of as not just a developmental perspective, but also a personality type (and I think it can), I might be the poster child. As far back as I can remember, I have had an interest in virtually every subject in school, and the gift of being proficient in most all of them. My 8th grade math teacher fought with my English teacher over which team I would compete for in the academic field day. My standardized test scores in high school were always within five or so points of each other. The breadth of the 271 credits I took in college would seal my fate as Jack of all trades, master of none—ranging from biology, physics, chemistry and environmental science to economics, psychology and philosophy, to international studies, French and Spanish—in all of which I completed a year or more of coursework.

I was the perfect candidate for the Agroecology master's program at UW Madison. Perhaps even more than any other time in my life, my master's has been a process of intensive self-exploration and growth. I have had the luxury of a supportive advisor and committee as well as a flexible inter-disciplinary structure in Agroecology, both of which allowed me to continue to explore various academic curiosities through diverse coursework and professor interactions. Over the last three years, some of the fields of study I have explored as potential career paths, in addition to agroecology, include urban planning, agricultural engineering, environmental philosophy, science journalism, interdisciplinary environmental studies, and medicine.

But by far the most formative of my various explorations while in the Agroecology program has been my involvement in my advisor Doug Reinemman's seminar in Integral Ecology in which we plumb the depths of the *Integral Ecology* tome I have cited throughout this thesis. The seminar introduced me to the vast world of IT, and I felt like a grad-student kid in an intellectual candy store. What was unique about Integral Ecology, though, was that it pushed me to develop not only intellectually, but along all “lines” of development, and most notably for me, the line of the “self.” This helped me focus attention inward in a world where the gaze always seems to be outward. I developed a meditation practice, did exercises in shadow work and other self-development practices, and communed with my fellow practitioners of IT in the seminar and beyond. As I cultivated greater self-awareness and mindfulness through my practices, I began to understand the full meaning of something a dear mentor in college once told me: “You can't really help others until you've helped yourself.” The realization that working on my own self development is actually just the opposite of selfish was

profoundly liberating.

Wilber sometimes refers to IT as an "Integral Operating Software," and sure enough, by the end of my second year in the seminar, I felt like it had been successfully installed into the platform of my phenomenology. If Integral is also a stage of development—and I do believe there is truth to that—then I think I had stably achieved it in myself (oh boy, an Integral personality type at an Integral level of development! This must be what God feels like!). I joke about it because I think any meta-theory that tries to explain everything in the universe should be tempered with a little humorous humility. Humor keeps us grounded and from taking ourselves too seriously. Providing a space for unabashed laughter—and Doug, leading by example, does the best job of this of anyone I know—is also one of the wonderful functions of the Integral Ecology seminar that has kept me coming back (for four years in a row now).

Another feature of the IT community that keeps me coming back is its own reflexivity—its willingness to take a meta-perspective on its own meta-perspectives. As I mentioned in the second chapter of this thesis, integrative metatheoretical work should be thought of more as a process than a product, as its value lies neither in the literal nor in the absolute, but rather in the imagined, as a sort of psychoactive software that both transforms and gets transformed by experience. The next-generation community of integral scholars—aptly named MetaIntegral—recognizes this. They are actively pushing the boundaries of IT to transcend and include the legacy of Ken Wilber. A major theme at the last Integral Theory Conference was that "even theories can do shadow work." In fact, this is how I discovered the enlightening work of Roy Bhaskar. First recommended to me by *Integral Ecology* co-author and environmental philosophy professor Michael

Zimmerman, I recently had the joy of meeting and conversing with Bhaskar in person at the 2013 Integral Theory Conference. Along with Edgar Morin's philosophy of Complex Thought, Bhaskar's Critical Realism is being incorporated by this new wave of MetaIntegral folks into “traditional” Wilberian IT in the spirit of synthesis, integration, and greater appreciation of complexity. They were both invited speakers at the 2013 conference.

The parallels between the evolution of IT and that of my own self are remarkable. Just when I had gotten to a point where I felt I had more or less mastered the principles Wilberian IT, and had actually begun to feel a bit stymied by some of the heavily stylistic and certain quasi-dogmatic aspects of the IT framework, so, too, had some of the leading scholars of the integral community. The CRIMP framework I developed in the second chapter, for example, was inspired both by my growing dissatisfaction with IMP and my simultaneously burgeoning interest in Bhaskar's philosophy of Critical Realism. The lengthy elaboration of the various iterations of disciplinarity (multi-, inter-, trans-, etc.) in the third chapter stemmed from an urge to really understand what the *Integral Ecology* authors meant when they said their approach was “post-disciplinary.” And finally, the emphasis on Nicolescu and strong transdisciplinarity that I wove throughout much of the later sections grew out of my desire to find academically-rooted scholarship on the possibility of the more advanced, “transrational” levels of awareness that Wilber discusses, and their potential place in science. This last one is a strand of scholarship that really grabbed my interest toward the end of writing this thesis; I hope to develop it further and incorporate it in a future doctoral dissertation.

Another reason why this statement is only showing up at the end of my thesis is

that the trajectory of thought revealed by it very much reflects these ongoing intellectual developments. And although the process is far from complete, only after having read it will the reader be able to understand this statement of reflection. I realize and acknowledge the imperfection and incompleteness of this thesis, and especially the CRIMP framework, and am not ashamed or disappointed in this recognition. Despite its incompleteness, I still believe I have made an important contribution to the field of Agroecology, as well as to the broader academic community of integrative, interdisciplinary thinkers, by planting the seed of an impulse for greater reflexivity and integration. If nothing else, I have certainly succeeded in cultivating this impulse in myself, a continuing scholar in these fields. In the end, this thesis represents to me, as hopefully it does to you as a reader, a work in progress—the patient ripening of intellectual fruits that may one day help nourish a whole community of Integral Agroecologists.

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