

- Sedlmeier P 2000 How to improve statistical thinking: Choose the task representation wisely and learn by doing. *Instructional Science* 28: 227–62
- Sedlmeier P, Robles de Acuña-Ponseti J 1992 'Intelligente' Hilfe beim Lösen von alltagsnahen Wahrscheinlichkeitsproblemen: Modellierung dynamischer Wissensinhalte für ein flexibles Tutorsystem ['Intelligent' help in solution of probability problems with everyday applications: Modeling of dynamic knowledge for a flexible tutor system]. *Kognitionswissenschaft* 3: 24–37
- Self J 1985 A perspective on intelligent computer-assisted learning. *Journal of Computer Assisted Learning* 1: 159–66
- Wenger E 1987 *Artificial Intelligence and Tutoring Systems*. Morgan Kaufmann, Los Altos, CA

P. Sedlmeier

Intensification and Specialization, Archaeology of

Many of the major transitions studied by archaeologists—the development of agriculture, urbanism, institutionalized inequality, and markets; processes of imperial incorporation, colonialism, and political collapse—either consist of, or are accompanied by, significant changes in the organization of production. As such, these changes, their causes, and consequences have been pivotal research issues. Studies of intensification and specialization build on archaeological approaches to production, and must be understood in the light of this broad construct, which differs significantly from its use in economics.

1. The Archaeology of Production

Archaeological concepts of production are typically situated in the anthropological perspective that productive activities are embedded in larger cultural and social systems. Production—the creating, constructing, and tending of artifacts, structures, human-modified plants and animals, even entire landscapes—is a fundamental focus of the study of the archaeological record. Production, as one dimension of human economy is both responsive to and constitutive of other domains such as processing, distribution, and consumption. This perspective is a legacy of the formalist–substantivist debate in anthropology, which centered around whether nonindustrial economies could be understood in the same terms as industrial capitalism (the formalist position), or whether the economies of nonindustrial societies typically studied by anthropologists were, in Polanyi's (1957) words, more fundamentally 'embedded and enmeshed' in social institutions. However, this picture is complicated by important strands in archaeological thinking

which draw on economic approaches or on those approaches as modified by ecology and evolution.

Research has not focused evenly on all arenas of production. Although agriculture and animal husbandry constitute important areas of research, there is a longer history of emphasis on durable goods or artifacts, objects made or modified by humans. Artifact manufacture is often termed craft production. While changes in the organization of craft production are generally conceived in terms of specialization, food production is more often viewed in terms of intensification. Part of this divergence may relate to the different kinds of information available about each arena of production. Students of craft production typically work with artifacts themselves and with evidence from production locales such as kilns, workshops, even dumps. Food production research does involve products such as seeds and animal bones, but these are often conceived as objects of consumption, with production studies focused primarily on locales of production such as fields.

2. Intensification

Archaeological studies of intensification have focused primarily on agriculture. In some sense, the historical trajectory of agricultural change can be viewed as a long, although variable, history of productive intensification, concomitant with the rise in global population, its clustered distribution on the planet, and the entrenchment of economic and social inequality.

2.1 The Concept of Intensification

The difference between intensification and simple increase is analogous to the difference between concentration and amount. Intensification of production refers to attempts to increase the concentration of production, or productive output per unit of land, labor, or some other fixed quantity. The focus on production effort in this definition highlights the salience of input, allowing failed efforts to increase productivity to be included in studies of intensification. In archaeology, the variable held constant almost always refers to land in reference to agriculture (getting more from a given area), and labor in reference to craft production (increasing efficiency of production). Situations in which both land and labor are held constant while capital inputs are increased, as in industrialized agriculture, are more rarely discussed.

2.2 History of Approaches to Intensification

The model of intensification set forth by economist Ester Boserup (1965) has been the most influential

formulation of the problem, and was widely adopted in archaeology (e.g., Cohen 1977). Boserup's model was parsimonious, general, and comprehensive; however, like other unilineal models of cultural evolution, it greatly generalizes and simplifies this complex process. Boserup's view of population pressure as an independent variable driving intensification inverted the earlier Malthusian formulation. While Malthus saw arable land as limiting increases in production, Boserup optimistically asserted that constantly increasing population (an assumption shared with Malthus) acted as a motor, driving technological changes in land use along an extensive-intensive continuum.

The most contested aspect of Boserup's model was the causal efficacy of population pressure, a view resting on several related assumptions. First, producers are assumed to exert the minimum effort required to meet their needs (the law of least effort). Thus, the most labor-extensive regime possible will always be employed. Second, Boserup argued that there are diminishing marginal returns to labor (declining efficiency) with increasingly intensive forms of production. The disadvantages of intensive agriculture—increased labor inputs and declining efficiency of that labor—ensure, for Boserup, that more intensive forms of production will be adopted only when strictly necessary. These assumptions have been criticized on empirical grounds, as has the prime-mover status of population pressure. There is now a vast literature considering such causal factors as population density and distribution; sedentism; market-driven, prestige-driven, or politically-driven demands for produce; risk, climate change; and many others (reviewed by Morrison 1994). Contemporary approaches to intensification tend to stress multiple and cascading causes which may be locally contextual and historically contingent (e.g., Kirch 1994).

2.3 Consequences of Intensification

In a proximate sense, the most common consequence of intensification is increased productivity. More significant, however, are less-proximate consequences, such as the restructuring of human labor, possibilities for differentiation of nonfood production, and the support of nonproducers. It is in this sense that intensification has been seen as underwriting social and political complexity, by which archaeologists generally mean the existence of institutionalized inequality and/or the presence of complex polities such as states or chiefdoms. Historically, intensified food production has also had dramatic ecological consequences, leading to landscape modification on a large scale, the worldwide movement of plant and animal taxa, and the existence of artifactual landscapes such as cities.

2.4 Methodological Issues in Intensification Studies

The study of intensification poses serious methodological challenges. The investigation of past agriculture, in particular, is difficult because of its large spatial scale and ephemeral material remains. For this reason, archaeologists consider numerous indicators of land use, including agricultural implements, historical documents, settlement distributions, agricultural facilities, and botanical remains. Identifying intensification in the archaeological record depends on the definition adopted; views which stress output require some measure of productive success, a difficult requirement for archaeology, where agricultural productivity can rarely be quantified. Output-based models are more popular in craft production studies, where such measures may be more reasonably inferred. Production effort is usually postulated on the basis of inferences about the overall form of production, using clues such as technological forms, products, or cultigens with special productive requirements, as well as knowledge of specific environmental conditions.

2.5 The Future of Intensification Studies

Three promising trends in the archaeology of intensification may be identified. The first is increased attention to the process of intensification itself, a process incorporating a great degree of variability. Kaiser and Voytek (1983) for example divide intensification into three components: specialization, diversification, and intensification proper. These involve changes in the amount and organization of labor and its application through technology, and require measurement of multiple variables. The second trend is increased attention to actual historical trajectories of change and the variable paths intensification may follow. Finally, in accord with moves toward a more inclusive view of production, many studies now weigh cultural meanings of food products alongside concerns of labor efficiency or energetics.

3. Specialization

The origins and development of specialized production have always been major concerns in archaeology. If intensified food production is often seen as undergirding social complexity, then specialization has been regarded as its index. Students of specialization draw on Marxian traditions which integrate concern for the means and social relations of production with anthropological attention to culture. This research tradition, however, draws equally from Adam Smith in its attention to the division of labor and focus on exchange, as well as its often embedded assumptions about the nature of economic behavior. In their concern for social and political implications of

specialization, archaeologists have also drawn on Durkheimian notions of solidarity and integration.

3.1 The Concept of Specialization

Specialization may be defined as the channelling of resources and/or labor into restricted ends, a definition focusing on the products and process of specialization. Other definitions stress the role of specialization in setting apart people, technologies, and production locales, both physically and socio-economically. Most literature on specialization in archaeology focuses on craft production; such studies have been dominated by a concern for technological process, interest in the organization of production, and, more recently, an expanded interest in the social relations of production, including issues such as identity and meaning. Specialization implies exchange on some level and as such, is not intelligible outside larger political/economic contexts.

3.2 History of Approaches to Specialization

Most early studies of artifacts emphasized typology, using morphology and manufacturing technology to classify objects, creating the chronological and spatial systematics that still underlie disciplinary practice. Despite pioneering studies such those of V. Gordon Childe that stressed the social and political roles of craft specialists in early stratified societies, most observations on artifact variability were oriented toward defining the cultural/temporal units which were themselves the goals of research. With moves toward functionalism in the 1950s and 1960s however, technologies of production commanded greater attention as areas of study in their own right; this focus on technology continues into recent materials science approaches.

With the 1960s and 1970s came concerted efforts to delineate the organization of production and especially the integration of specialized producers into larger political economies. Growing from this interest, much effort has been spent investigating the scale (household production, workshops, factories) and tempo (full- vs. part-time specialists) of specialized production and the material correlates of organizational forms. Also of concern were forms of control over production, strategies of labor and resource mobilization, and the disposition of manufactured goods. Several classifications have attempted to capture some of these contextual dimensions of production, distribution, and consumption (Costin 1991). Studies of exchange have been particularly important, congruent with a focus on regional economies and with the development of new analytical methods for determining source areas of raw materials.

Specialization studies have been marked by a concern for the initial causes of specialization, although here explanations often stress socially-based demands, perhaps because many artifacts are clearly not biologically necessary for survival. More recently, archaeologists have begun to stress processes of production, especially agent-based approaches which focus on structured chains of culturally-inflected decisions made by producers (Lemmonier 1986) and on interrelations between technology and meaning. A new focus on producers, too, has followed from concern for more finely-divided aspects of producer identity, including gender and ethnicity and from recognition that multiple organizational forms of production often co-exist, even where the producers are the same.

3.3 Consequences of Specialization

From the time of Childe, archaeologists have explicitly linked specialized production with complex political forms and social inequality (Brumfiel and Earle 1987). The very existence of elites is typically inferred, in part, from sumptuary objects identified by their elaboration, restriction, and sometimes exotic provenance. Curiously, specialization in craft production (sometimes cast as intensification) is generally viewed as promoting efficiency, while intensified agriculture is depicted as producing declining marginal returns. Recent work on the meaning of production, especially its ritual context, draws more fully from an anthropological tradition de-emphasizing efficiency.

3.4 Methodological Issues in Specialization Studies

Recognizing specialized production begins with the objects and by-products of manufacturing and their distribution. The definition of specialization allows for certain ambiguities, as issues of scale and context impinge. For example, the production of artifacts in one region and exchange to another may be considered regional specialization, although artifacts were manufactured by every household. Locations such as quarries are specialized places without necessary associations with producer specialization. Although the goal of archaeological research is usually to identify producer specialization, because archaeological data are fundamentally spatial, determining the organization of production is inevitably inferential. Much of the methodological development of specialization studies grew around this dilemma. Complex technological requirements or high levels of producer skill are sometimes assumed to index specialist manufacture; another criterion advanced for identifying specialization and its scale is standardization, mass-production being thought to promote standardization (for reasons of efficiency).

3.5 The Future of Specialization Studies

The trends identified in intensification studies also hold for studies of specialization. Concerns for process are implicated in perspectives that draw specialized production into the larger field of the anthropology of technology; this concern is sometimes expressed in the language of 'crafting' and the ways in which crafting both draws from and creates social relationships (Costin and Wright 1998). Recent developments in the archaeology of both intensification and specialization tend to stress process over cause and explore the consequences of productive organization for differently situated social actors rather than classify productive forms along an evolutionary continuum.

See also: Agricultural Change Theory; Boserup, Ester (1910–99); Ceramics in Archaeology; Differentiation: Social; Indigenous Knowledge and Technology; Labor, Division of; States and Civilizations, Archaeology of; Trade and Exchange, Archaeology of

Bibliography

- Boserup E 1965 *The Conditions of Agricultural Growth*. Aldine, Chicago
- Brumfiel E, Earle T K (eds.) 1987 *Specialization, Exchange, and Complex Societies*. Cambridge University Press, Cambridge, UK
- Cohen M N 1977 *The Food Crisis in Prehistory*. Yale, New Haven, CT
- Costin C L 1991 Craft Specialization: issues in defining, documenting, and explaining the organization of production. In: Schiffer M (ed.) *Archaeological Method and Theory*, Vol. 3. University of Arizona Press, Tucson, AZ
- Costin C L, Wright R P (eds.) 1998 *Craft and Social Identity. Archaeological Papers of the American Anthropological Association*, Vol. 8. American Anthropological Association, Arlington, VA
- Kaiser T, Voytek B 1983 Sedentism and economic change in the Balkan Neolithic. *Journal of Anthropological Research* 2: 323–53
- Kirch P V 1994 *The Wet and the Dry: Irrigation and Agricultural Intensification in Polynesia*. University of Chicago Press, Chicago
- Lemmonier P 1986 The study of material culture today: toward an anthropology of technological systems. *Journal of Anthropological Archaeology* 5: 147–86
- Malthus T R *Essay on the Principle of Population, as it Effects the Future Improvement of Society*. Johnson, London
- Morrison K D 1994 The intensification of production: archaeological approaches. *Journal of Archaeological Method and Theory* 1: 111–59
- Polanyi K 1957 The economy as an instituted process. In: Polanyi K, Arensberg C M, Pearson H W (eds.) *Trade and Market in the Early Empires: Economies in History and Theory*. Free Press, Glencoe, NY

K. D. Morrison

Intentionality and Rationality: A Continental-European Perspective

1. The Text

There is an objective interrelationship between 'intentionality' and 'rationality.' As a rule, intentionality is considered to be a necessary, although not a sufficient, condition for rationality. This means that one is usually convinced that something or someone can be called rational only when the predicate 'intentional' can be applied to it or to him or her first. In addition, both concepts can be applied both in the sense of an expression of disposition and to describe specific manifest qualities. Thus, intentionality is attributed to living beings when they have the ability to produce something that can be described as intentional: actions, psychic occurrences, or linguistic utterances. Conversely, the intentional has always been understood as the actualization of the disposition 'intentionality.' Similarly, in the case of 'rationality,' that which can be seen as rational, can be traced back to the activation of rational competence which itself presupposes intentionality. Both can be applied only to people. If one considers institutions, systems, or even machines and their achievements to be rational, one uses this expression in a figurative or derived sense.

2. Intentionality

2.1 Intentionality From the Standpoint of the Theory of Action

This artificial philosophical term does not have an equivalent in colloquial language except to characterize something that someone has done as intentional, i.e., deliberate. Thus, it made sense that the theory of action use this predicate in a defining sense as well, and speak of actions only when there is sufficient reason to assume that the action or behavior took place intentionally. For the social sciences in so far as they conceive of themselves as sciences of action, but also in a court of law or in morally relevant situations, it is important to know what it is that makes occurrences in the world actions. Reflex movements or forms of instinctual behavior certainly do not belong in this category; they are objects neither of social scientific research nor of normative judgment. The specific difference of actions is usually seen in the fact that they took place deliberately, and only under this condition is responsibility taken for them. The question, then, is how this relation to intentions fits together with the causal interpretation of all world events: are intentions causes? If so, then they themselves would have to have been caused, and this is considered incompatible with our self-understanding as subjects acting freely and spontaneously.

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