

the course of the assessment, some of the knowledge states in \mathcal{K} are considered as plausible from the standpoint of the assessor. These 'marked states' are collected in a family which is the value of a random variable M_n , where $n = 1, 2, \dots$ indicates the step number. (Thus, M_n denotes the set of all marked states on step n .) Under certain conditions, (M_n) is a Markov chain. Moreover, during the initial phase of the procedure, this subfamily $M_n \subseteq \mathcal{K}$ decreases in size until a single marked state remains. In the second phase, the single 'marked state' evolves in the structure. This last feature allows the assessor, through a statistical analysis of the observed sequence of problems and answers, to estimate the 'true state.' (A formal definition of 'true state' is given.) Note that, in some cases, a useful estimate can be obtained even if the rule state is not part of the structure.

Both classes of procedures have been applied in practice, especially the continuous ones. Results from simulation and from real life applications indicate that these procedures are efficient in uncovering the knowledge state of an individual. Note however that the validity of these procedures heavily depends upon the accuracy of the knowledge structure on which they operate. As is well known, the construction of a knowledge structure faithfully describing the knowledge states in a population is expensive and time consuming.

See also: Conjoint Analysis Applications; Educational Assessment: Major Developments; Educational Evaluation: Overview; Knowledge Representation; Knowledge Spaces; Markov Decision Processes; Mathematical Psychology; Mathematical Psychology, History of; Neural Networks and Related Statistical Latent Variable Models

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Maroons in Anthropology

Maroons—escaped slaves and their descendants—still form semi-independent communities in several parts of the Americas, e.g., Suriname, French Guiana, Jamaica, Colombia, and Brazil. As the most isolated of Afro-Americans, they have since the 1920s been an important focus of anthropological research, contributing to theoretical debates about slave resistance, the heritage of Africa in the Americas, the process of creolization, and the nature of historical knowledge among nonliterate peoples.

1. Maroons and Their Communities

The English word 'maroon' derives from Spanish *cimarrón*—itself based on an Arawakan (Taino) Indian root. *Cimarrón* originally referred to domestic cattle that had taken to the hills in Hispaniola, and soon after to American Indian slaves who had escaped from the Spaniards. By the end of the 1530s, the word was being used primarily to refer to Afro-American runaways.

Communities formed by maroons dotted the fringes of plantation America, from Brazil to Florida, from Peru to Texas. Usually called *palenques* in the Spanish colonies and *mocambos* or *quilombos* in Brazil, they ranged from tiny bands that survived less than a year to powerful states encompassing thousands of members that lasted for generations or even centuries.

During the last decades of the twentieth century, anthropological fieldwork has underlined the strength of historical consciousness among the descendants of these rebel slaves and the dynamism and originality of their cultural institutions. Meanwhile, historical scholarship on maroons has flourished, as new research has done much to dispel the myth of the docile slave. Marronage represented a major form of slave resistance, whether accomplished by lone individuals, by small groups, or in great collective rebellions. Throughout the Americas, maroon communities stood out as an heroic challenge to white authority, as the living proof of the existence of a slave consciousness that refused to be limited by the whites' conception or manipulation of it. It is no accident that throughout the Caribbean today, the historical maroon—often mythologized into a larger-than-life figure—has become a touchstone of identity for the region's writers, artists, and intellectuals, the ultimate symbol of resistance and the fight for freedom.

More generally, Maroons and their communities can be seen to hold a special significance for the study of Afro-American societies. For a while they were, from one perspective, the antithesis of all that slavery stood for; additionally, they were also a widespread and embarrassingly visible part of these systems. Just as the very nature of plantation slavery implied violence and resistance, the wilderness setting of early

New World plantations made marronage and the existence of organized maroon communities a ubiquitous reality.

Planters generally tolerated *petit marronage*—truancy with temporary goals such as visiting a friend or lover on a neighboring plantation. But in most slave-holding colonies, the most brutal punishments—amputation of a leg, castration, suspension from a meat hook through the ribs, slow roasting to death—were reserved for long-term, recidivist maroons, and in many cases these were quickly written into law. Marronage on the grand scale, with individual fugitives banding together to create communities, struck directly at the foundations of the plantation system, presenting military and economic threats that often taxed the colonists to their very limits. Maroon communities, whether hidden near the fringes of the plantations or deep in the forest, periodically raided plantations for firearms, tools, and women, often allowing families that had formed during slavery to be reunited in freedom.

In many cases, the beleaguered colonists were eventually forced to sue their former slaves for peace. In Brazil, Colombia, Cuba, Ecuador, Hispaniola, Jamaica, Mexico, Panama, Peru, Suriname, and Venezuela, for example, the whites reluctantly offered treaties granting maroon communities their freedom, recognizing their territorial integrity, and making some provision for meeting their economic needs, in return for an end to hostilities toward the plantations and an agreement to return future runaways. Of course, many maroon societies were crushed by massive force of arms, and even when treaties were proposed they were sometimes refused or quickly violated. Nevertheless, new maroon communities seemed to appear almost as quickly as the old ones were exterminated, and they remained, from a colonial perspective, the ‘chronic plague’ and ‘gangrene’ of many plantation societies right up to final Emancipation.

2. African Origins, New World Creativity

The initial maroons in any New World colony hailed from a wide range of societies in West and Central Africa—at the outset, they shared neither language nor other major aspects of culture. Their collective task, once off in the forests or mountains or swamplands, was nothing less than to create new communities and institutions, largely via a process of inter-African cultural syncretism. Those scholars, mainly anthropologists, who have examined contemporary maroon life most closely seem to agree that such societies are often uncannily ‘African’ in feeling but at the same time largely devoid of directly transplanted systems. However ‘African’ in character, no maroon social, political, religious, or aesthetic system can be reliably traced to a specific African ethnic provenience—they

reveal rather their syncretistic composition, forged in the early meeting of peoples of diverse African, European, and Amerindian origins in the dynamic setting of the New World.

The political system of the great seventeenth-century Brazilian maroon kingdom of Palmares, for example, which R. K. Kent has characterized as an ‘African’ state, ‘did not derive from a *particular* Central African model, but from several’ (Price 1996, p. 188). In the development of the kinship system of the Ndyuka Maroons of Suriname, writes André Köbben, ‘undoubtedly their West-African heritage played a part ... [and] the influence of the matrilineal Akan tribes is unmistakable, but so is that of patrilineal tribes ... [and there are] significant differences between the Akan and Ndyuka matrilineal systems’ (Price 1996, p. 324). Historical and anthropological research has revealed that the magnificent wood-carving of the Suriname Maroons, long considered ‘an African art in the Americas’ on the basis of formal resemblances, is in fact a fundamentally new, Afro-American art ‘for which it would be pointless to seek the origin through direct transmission of any particular African style’ (Hurault 1970, p. 84). And detailed investigations—both in museums and in the field—of a range of cultural phenomena among the Saramaka Maroons of Suriname have confirmed the dynamic, creative processes that continue to animate these societies.

Maroon cultures do possess direct and sometimes spectacular continuities from particular African peoples, from military techniques for defense to recipes for warding off sorcery. These are, however, of the same type as those that can be found, if with lesser frequency, in Afro-American communities throughout the hemisphere. In stressing these isolated African ‘retentions,’ there is a danger of neglecting cultural continuities of a more significant kind. Roger Bastide (1972, pp. 128–51) divided Afro-American religions into those he considered ‘preserved’ or ‘canned’—like Brazilian *candomblé*—and those that he considered ‘alive’—like Haitian *voudou*. The former, he argued, manifest a kind of ‘defense mechanism’ or ‘cultural fossilization,’ a fear that any small change may bring on the end, while the latter are more secure of their future and freer to adapt to the changing needs of their adherents. And indeed, tenacious fidelity to ‘African’ forms seems, in many cases, to indicate a culture finally having lost meaningful touch with the vital African past. Certainly, one of the most striking features of West and Central African cultural systems is their internal dynamism, their ability to grow and change. The cultural uniqueness of the more developed maroon societies (e.g., those in Suriname) rests firmly on their fidelity to ‘African’ cultural principles at these deeper levels—whether aesthetic, political, religious, or domestic—rather than on the frequency of their isolated ‘retentions.’ With a rare freedom to extrapolate ideas from a variety of African societies and

adapt them to changing circumstance, maroon groups included (and continue to include today) what are in many respects *at once* the most meaningfully African and the most truly 'alive' and culturally dynamic of all Afro-American cultures.

3. Four Cases

The most famous maroon societies are Palmares in Brazil, Palenque de San Basilio in Colombia, the Maroons of Jamaica, and the Saramaka and Ndyuka Maroons of Suriname.

Because Palmares was finally crushed by a massive colonial army in 1695, after a century of success and growth, actual knowledge of its internal affairs remains limited, based as it is on soldiers' reports, the testimony of a captive under torture, official documents, modern archaeological work, and the like. But as a modern symbol of black (and anti-colonial) heroism, Palmares continues to evoke strong emotions in Brazil. (For recent scholarship, including archaeology and anthropology, see Reis and dos Santos Gomes 1996.)

Palenque de San Basilio boasts a history stretching back to the seventeenth century. In recent years, historians, anthropologists, and linguists working in collaboration with Palenqueros have uncovered a great deal about continuities and changes in the life of these early Colombian freedom fighters. For an illustrated introduction, see de Friedemann and Cross (1979).

The Jamaica Maroons, who continue to live in two main groups centered in Accompong (in the hills above Montego Bay) and in Moore Town (deep in the Blue Mountains), maintain strong traditions about their days as freedom fighters. Two centuries of scholarship, some written by Maroons themselves, offer diverse windows on the ways these men and women managed to survive and build a vibrant culture within the confines of a relatively small island. (A useful entree is provided in Agorsah (1994).)

The Suriname Maroons now constitute the most fully documented case of how former slaves built new societies and cultures, under conditions of extreme deprivation, in the Americas—and how they developed and maintained semi-independent societies that persist into the beginning of the twenty-first century. From their late seventeenth-century origins and the details of their wars and treaty-making to their current struggles with multinational mining and timber companies, much is now known about these peoples' achievements, in large part because of the extensive recent collaboration by Saramakas and Ndyukas with anthropologists. The relevant bibliography now numbers in the thousands; useful points of entry are Price and Price (1999) and Thoden van Velzen and van Wetering (1988).

4. Anthropological Issues

Since the Herskovitses' fieldwork in Suriname in the 1920s (Herskovits and Herskovits 1934), Maroons have moved to the center of anthropological debates, from the origins of creole languages and the 'accuracy' of oral history to the nature of the African heritage in the Americas and the very definition of Afro-American anthropology. Indeed, David Scott (1991, p. 269) argues that the Saramaka Maroons have by now become 'a sort of anthropological metonym ... providing the exemplary arena in which to argue out certain anthropological claims about a discursive domain called Afro-America.' Much of the most recent anthropological research has focused on Maroon historiography—how Maroons themselves conceptualize and transmit knowledge about the past—and has privileged the voices of individual Maroon historians. Eric Hobsbawm (1990, p. 46), commenting on this work in the more general context of the social sciences, notes that 'Maroon societies raise fundamental questions. How do casual collections of fugitives of widely different origins, possessing nothing in common but the experience of transportation in slave ships and of plantation slavery, come to form structured communities? How, one might say more generally, are societies founded from scratch? What exactly did or could such refugee communities ... derive from the old continent?' Questions such as these are sure to keep students of Maroon societies engaged in active research for many years to come.

See also: Caribbean: Sociocultural Aspects; Ethnogenesis in Anthropology; Latin American Studies: Economics; Race Identity; Racism, History of; Slavery: Comparative Aspects; Slaves/Slavery, History of; South America: Sociocultural Aspects

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R. Price

Marr, David (1945–80)

David Courtnay Marr was born on January 19, 1945 in Essex, England. He attended Rugby, the English public school, on a scholarship, and went on to Trinity College, Cambridge. By 1966, he obtained his B.S. and M.S. in mathematics, and proceeded to work on his doctorate in theoretical neuroscience, under the supervision of Giles Brindley. Having studied the literature for a year, Marr commenced writing his dissertation. The results, published in the form of three journal papers between 1969 and 1971, amounted to a theory of mammalian brain function, parts of which remain relevant to the present day, despite vast advances in neurobiology in the past three decades. Marr's theory was formulated in rigorous terms, yet was sufficiently concrete to be examined in view of the then available anatomical and physiological data. Between 1971 and 1972, Marr's attention shifted from general theory of the brain to the study of vision. In 1973, he joined the Artificial Intelligence Laboratory at the Massachusetts Institute of Technology as a visiting scientist, taking on a faculty appointment in the Department of Psychology in 1977, where he was made a tenured full professor in 1980. In the winter of 1978 he was diagnosed with acute leukemia. David Marr died on November 17, 1980, in Cambridge, Massachusetts. His highly influential book, *Vision: A Computational Investigation into the Human Representation and Processing of Visual Information*, which has redefined and revitalized the study of human and machine vision, was published posthumously, in 1982.

1. A Theory of the Brain

Marr's initial work in neuroscience combined high-level theoretical speculation with meticulous synthesis of the anatomical data available at the time. The question he chose to address is the *nec plus ultra* of neuroscience: what is it that the brain does? Marr proposed a definite answer to this question for each

of three major brain structures: archicortex (the phylogenetically older part of the cerebral cortex), cerebellum, and neocortex. The three answers complement each other, rallying around the idea that the brain's central function is statistical pattern recognition and association, carried out in a very high-dimensional space of 'elemental' features. The basic building block of all three theories is a *codon*, or a subset of features, with which there may be associated a cell, wired so as to fire in the presence of that particular codon.

In the first paper, Marr proposed that the cerebellum's task is to learn the motor skills involved in performing actions and maintaining posture (Marr 1969). The Purkinje cells in the cerebellar cortex, presumably implementing the codon representation, associate (through synaptic modification) a particular action with the context in which it is performed. Subsequently, the context alone causes the Purkinje cell to fire, which in turn precipitates the next elemental movement. Thirty years later, a significant proportion of researchers working on the cerebellum seem to consider this model as 'generally correct'—a striking exception in a field where the *nihil nisi bono* maxim is not known to be observed.

The next paper (Marr 1970) extended the codon theory to encompass a more general kind of statistical concept learning, which he assessed as 'capable of serving many of the aspects of the brain's function' (the vagueness of this aspect of the theory would lead him soon to abandon this approach, which, as he realized all along, was 'once removed from the description of any task the cerebrum might perform'). How can a mere handful of techniques for organizing information (such as the codon representation) support a general theory of the brain function? Marr's views in this matter are profoundly realist, and are based on a postulate of 'the prevalence in the world of a particular kind of statistical redundancy, which is characterized by a 'Fundamental Hypothesis,' stating that 'Where instances of a particular collection of intrinsic properties (i.e., properties already, diagnosed from sensory information) tend to be grouped such that if some are present, most are, then other useful properties are likely to exist which generalize over such instances. Further, properties often are grouped in this way' (Marr 1970 pp. 150–51). These ideas presaged much of the later work by others on neural network models of brain function, which invoke the intuition of learning as optimization ('mountain climbing') in an underlying probabilistic representation space.

A model at whose core is the tallying of probabilities of events needs an extensive memory of a special kind, allowing retrieval based on the content, rather than the location, of the items. Marr's third theoretical paper considers the hippocampus as a candidate for fulfilling this function (Marr, 1971). In analyzing the memory capacity and the recall characteristics of the hippocampus, Marr integrated abstract mathematical