

# Subject 01: exemplary Indigenous masculinity in Cold War genetics

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**Abstract.** In 1962 a team of scientists conducted their first joint fieldwork in a Xavante village in Central Brazil. Recycling long-standing notions that living Indigenous people represented human prehistory, the scientists saw Indigenous people as useful subjects of study not only due to their closeness to nature, but also due to their sociocultural and political realities. The geneticists' vision crystalized around one subject – the famous chief Apōwē. Through Apōwē, the geneticists fixated on what they perceived as the political prowess, impressive physique, and masculine reproductive aptitude of Xavante men. These constructions of charismatic masculinity came at the expense of recognizing how profoundly colonial expansion into Mato Grosso had destabilized Xavante communities, stripping them of their land and introducing epidemic disease. The geneticists' theorizing prefigured debates to come in sociobiology, and set up an enduring research programme that Apōwē continues to animate even four decades after his death.

On a July morning in 1962, with the sun already beating strongly by ten o'clock, laboratory technician and field assistant Girley Simões marked a number one on the first square of card stock. Tying a knot and looping it through a pre-punched hole, he passed the string around Apōwē's neck. The number hung against the *cacique* or chief's bare chest, a few inches below his white *tsōrebzu*, the cotton cord necktie worn by Xavante men. With this simple action, the famous Xavante leader was designated subject one of a pilot study in human genetics.<sup>1</sup>

The group of six researchers had arrived the day before, flown into central Brazil by the Brazilian Air Force. Coordinated by geneticists James V. Neel and Francisco Salzano,

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1 Although auto-denominated *A'uwē* or *A'uwē uptabi*, in interactions with outsiders members of this Indigenous group usually refer to themselves as Xavante. Following their lead, I use the name Xavante here. There are multiple orthographies for group names (e.g. Chavante, Shavante) and individuals' names (e.g. Apōwē, Apewe, Apoena). For Xavante names, I use the orthography of the local school of Pimentel Barbosa village. I maintain original spellings when citing primary sources. I privilege Xavante names, but maintain the Portuguese when quoting or when commonly used by Xavante.

the team also included physical anthropologist Friedrich Keiter, social anthropologist David Maybury-Lewis and haematologist Pedro Clóvis Junqueira. Together with Simões, the men camped about a kilometre away from Wedezé village at an outpost of the Serviço de Proteção aos Índios (SPI), the government Indian Protective Service. During ten days of fieldwork and the following weeks and years of data analysis, the geneticists created an influential methodology for human genetics research for groups they referred to as ‘primitive’.<sup>2</sup> In this paper I explore how and why the geneticists came to understand Apöwê as embodying a ‘natural’ masculinity characterized by sexual prowess, violence and ruthlessness. Based on the famous leader and the other Xavante men they studied, they developed a theory of human evolution profoundly influenced by their notions of charismatic male leadership. This vision would shape their work in years to come, setting an agenda they scaled up with research in dozens of other South American Indigenous villages, including Kayapó, Terena and Yanomami communities.<sup>3</sup>

The emphasis that Neel and his colleagues placed on aggression and violence was part of a broader interest of mid-twentieth-century human biologists and social scientists. As Erika Milam and Robert Nye have observed, despite a great deal of interest in the history of gender in the sciences, overall historians of science have not given due attention to the role of masculinity and maleness in knowledge production.<sup>4</sup> Milam and Nye highlight how, by focusing on constructions of femininity and the often invisible role of women, historians inadvertently naturalize men and masculinity as the norm against which is measured that which is gendered female. This article contributes to a growing literature that shows how, in mid-century approaches to human evolution, male aggression was a central concern of male scientists.<sup>5</sup>

2 This methodology became influential through the World Health Organization: Soraya de Chadarevian, ‘Human population studies and the World Health Organization’, *Dynamis* (2015) 35(2), pp. 359–388; Joanna Radin, ‘Unfolding epidemiological stories: how the WHO made frozen blood into a flexible resource for the future’, *Studies in History and Philosophy of Biological and Biomedical Sciences* (2014) 47(Part A), pp. 62–73, doi:10.1016/j.shpsc.2014.05.007. The use of the term ‘primitive’ by scholars from the human sciences has been widely critiqued. Foundational approaches to temporal othering include Johannes Fabian, *Time and the Other: How Anthropology Makes Its Object*, New York: Columbia University Press, 2002; Eric R. Wolf, *Europe and the People without History*, Berkeley: University of California Press, 2010 (first published 1982). On the discursive linking of Indigenous peoples to the distant founding of the Brazilian nation see Tracy Devine Guzmán, *Native and National in Brazil: Indigeneity after Independence*, Chapel Hill: University of North Carolina Press, 2013, pp. 63–104. Just at the moment when anthropologists were beginning to problematize the use of ‘primitive’, human biologists began to embrace it. See Joanna Radin, *Life on Ice: A History of New Uses for Cold Blood*, Chicago: The University of Chicago Press, 2017, pp. 108–109. The term signified different qualities to different scientists: see Ricardo Ventura Santos, Susan Lindee and Vanderlei Sebastião de Souza, ‘Varieties of the primitive: human biological diversity studies in Cold War Brazil (1962–1970)’, *American Anthropologist* (2014) 116(4), pp. 723–735, doi:10.1111/aman.12150.

3 On scaling up, standardization and methods see Susan Lindee, ‘Scaling up: human genetics as a Cold War network’, *Studies in History and Philosophy of Biological and Biomedical Sciences* (2014) 47(Part A), pp. 185–190, 189, doi:10.1016/j.shpsc.2014.05.018.

4 Erika Lorraine Milam and Robert A. Nye, ‘An introduction to scientific masculinities’, *Osiris* (2015) 30(1), pp. 1–14, doi:10.1086/682953. See also the other 2015 *Osiris* contributions.

5 Donna J. Haraway pioneered attention to mid-century research on aggression, family and human diversity in physical anthropology in her examination of Sherwood Washburn’s focus on Man the Hunter in his ‘New Physical Anthropology’. See Donna J. Haraway, *Primate Visions: Gender, Race, and Nature in the World of*

In the period leading up to Neel and Salzano's first fieldwork in Mato Grosso, scholarly and popular works promoted a vision of human history in which male aggression was foundational to the progress of the species.<sup>6</sup> By the mid-1960s and early 1970s, this emphasis was also taken up by some social scientists – who had long privileged masculinity in other ways – and won generous funding.<sup>7</sup> Many of these scholars participated in what Erika Milam has referred to as 'colloquial science', writing broadly for a public audience that included specialists from other fields, as well as members of the general public. This colloquial literature contributed to the enduring appeal of male aggression as a driving factor in human evolution, even as emphasis shifted regarding types of genetic selection and the value of comparative ethnology or comparative ethology.<sup>8</sup> The Xavante Pilot Study, and subsequent work modelled on it, would animate lines of thought in sociobiology.

The focus on aggression and violence responded to scientists' broader concerns about social change and the Cold War context. In the 1950s, influential representations of human evolution emphasized that man's natural qualities of aggression and territoriality would protect against threats to democracy.<sup>9</sup> In the late 1960s, anthropologists Robin Fox and Lionel Tiger's arguments responded to what they viewed as the dual threats of 'feminists and Freudians', staking claims that human societies' intellectual progress depended on the close bonds between men, while their biological reproduction depended on the mother–child bond.<sup>10</sup> Scholars theorizing human evolutionary history in this period were both aware of, and invested in, the social and political implications of their analyses.<sup>11</sup> These debates ran through the most prominent US networks of

*Modern Science*, New York: Routledge, 1990, pp. 186–230. On the broad appeal of this work across lay and scientific readerships see Erika Lorraine Milam, *Creatures of Cain: The Hunt for Human Nature in Cold War America*, Princeton, NJ: Princeton University Press, 2019. Aggression also became the focus of women scientists by the 1970s: on primatologist Sarah Blaffer Hrdy see Amanda Rees, 'Practising infanticide, observing narrative: controversial texts in a field science', *Social Studies of Science* (2001) 31(4), pp. 507–531, doi:10.1177/030631201031004002.

6 This includes work by animal behaviourist Konrad Lorenz, archaeologists Louis Leaky and Raymond Dart, ethologist Desmond Morris and playwright Robert Ardrey. See Nadine Weidman, 'Popularizing the ancestry of man: Robert Ardrey and the killer instinct', *Isis* (2011) 102(2), pp. 269–299, 274, doi:10.1086/660130; Erika Lorraine Milam, 'Men in groups: anthropology and aggression, 1965–84', *Osiris* (2015), 30(1), pp. 66–88, doi:10.1086/682966.

7 The Harry Frank Guggenheim Foundation was a particularly strong supporter of this agenda. Milam, op. cit. (5), pp. 79–88. The Wenner-Gren Foundation also funded related physical-anthropology conferences, including the influential 1966 Man the Hunter conference. See Haraway, op. cit. (5), pp. 221–223; Susan Lindee and Joanna Radin, 'Patrons of the human experience: a history of the Wenner-Gren Foundation for Anthropological Research, 1941–2016', *Current Anthropology* (2016) 57(S14), pp. S218–301, S265, doi:10.1086/687926; Richard B. Lee and Irven DeVore, eds., *Man the Hunter*, Chicago: Aldine, 1968.

8 Milam, op. cit. (5).

9 On Sherwood Washburn and other leading figures between evolutionary biology and anthropology see Haraway op. cit. (5); see also Weidman, op. cit. (6); Milam, op. cit. (6).

10 Milam, op. cit. (5), pp. 129–167.

11 This was particularly the case for anthropologists and geneticists promoting what they saw as scientifically grounded anti-racist Darwinian interpretations: see John P. Jackson and David J. Depew, *Darwinism, Democracy, and Race: American Anthropology and Evolutionary Biology in the Twentieth Century*, New York: Routledge, 2017; Sebastián Gil-Riaño, 'Relocating anti-racist science: the 1950 UNESCO Statement on Race and Economic Development in the Global South', *BJHS* (2018) 51(2),

geneticists, ethologists, primatologists and physical anthropologists, involving many of the major players in the modern synthesis and the new physical anthropology. Discussions about human tendencies to violence and aggression brought together interdisciplinary coalitions of mostly male scientists, who capitalized on Cold War funding priorities and anxieties to build their careers and their disciplines.

The geneticists within these networks focused on populations that they interpreted as isolated to inform their understandings of everything from the risks of ionizing radiation to the deep history of human migrations.<sup>12</sup> The explosion of genetic investigation into human variation in the mid-twentieth century depended in large part on scientists' access to study and collect bio-samples from Indigenous peoples around the globe.<sup>13</sup> These research programmes drew on long-standing patterns of colonial engagements and knowledge production.

The Xavante Pilot Study must also be understood in the context of decades, if not centuries, of popular representations of Indigenous masculinities that centered around violent conflict.<sup>14</sup> These mass-produced representations of 'masculindians', in Sam McKegney's terminology, rehearsed 'hypermasculine stereotypes of the noble savage and the bloodthirsty warrior', and circulated transnationally, with Brazilians participating in 'playing Indian' following a US model.<sup>15</sup> Recent works on gender and Indigeneity have also emphasized how settler societies and their institutions 'value only those aspects of Indigenous knowledge, culture, and practice that do not threaten the structures of

pp. 281–303, [doi.org/10.1017/S0007087418000286](https://doi.org/10.1017/S0007087418000286). Likewise, W.D. Hamilton's theory of inclusive fitness was informed by his concerns about social chaos and was prescriptive rather than simply descriptive: Sarah A. Swenson, "Morals can not be drawn from facts but guidance may be": the early life of W.D. Hamilton's theory of inclusive fitness', *BJHS* (2015) 48(4), pp. 543–563, [doi:10.1017/S0007087415000643](https://doi.org/10.1017/S0007087415000643).

12 Veronika Lipphardt, "Geographical distribution patterns of various genes": genetic studies of human variation after 1945', *Studies in History and Philosophy of Biological and Biomedical Sciences* (2014) 47(Part A), 50–61; Joanna Radin, 'Latent life: concepts and practices of human tissue preservation in the International Biological Program', *Social Studies of Science* (2013) 43(4), pp. 484–508, 498; Santos, Lindee and Souza, op. cit. (2).

13 These extractive practices have been strongly contested by Indigenous scholars. See Kim TallBear, *Native American DNA: Tribal Belonging and the False Promise of Genetic Science*, Minneapolis: University of Minnesota Press, 2013; Rebecca Tsosie, 'Indigenous peoples and epistemic injustice: science, ethics, and human rights', *Washington Law Review* (2012) 87(4), pp. 1133–1201. Other critical perspectives include Lisa Gannett and James R. Griesemer, 'The ABO blood groups: mapping the history and geography of genes in *Homo sapiens*', in Hans-Jörg Rheinberger and Jean-Paul Gaudillière (eds.), *Classical Genetic Research and Its Legacy: The Mapping Cultures of Twentieth-Century Genetics*, New York: Routledge, 2004, pp. 117–172; Radin op. cit. (2); Ricardo Ventura Santos, 'Indigenous peoples, postcolonial contexts and genomic research in the late 20th century: a view from Amazonia (1960–2000)', *Critique of Anthropology* (2002) 22(1), pp. 81–104; Edna Suárez-Díaz, 'Indigenous populations in Mexico: medical anthropology in the work of Ruben Lisker in the 1960s', *Studies in History and Philosophy of Biological and Biomedical Sciences* (2014) 47(Part A), pp. 108–117.

14 Philip J. Deloria, *Indians in Unexpected Places*, Lawrence: University Press of Kansas, 2004, pp. 15–51.

15 On masculindians see Sam McKegney, *Masculindians: Conversations about Indigenous Manhood*, Winnipeg: University of Manitoba Press, 2014, p. 1. On Brazilians 'playing Indian' see Guzmán op. cit. (2), pp. 1–9.

heteronormative patriarchy'.<sup>16</sup> The scientists' celebration of polygyny and ferocity together was not coincidental, but rather forms part a much longer history of social and natural scientists placing patriarchal and polygynous family structures higher on the hierarchy of savagery, barbarism and civilization.<sup>17</sup>

Furthermore, as Maile Arvin has argued, close examinations of the ways natural and social scientists' work has gendered and racialized Indigenous subjects highlights that settler colonialism is enacted not only through structures of elimination – following Patrick Wolfe – but also through possession.<sup>18</sup> The scientists' idealized visions of masculine prowess and its relegation to a shared deep human past reflect this tendency to desire and possess Indigenous characteristics and genes to inform Western understandings of human nature.<sup>19</sup> Portrayals of these kinds have long-standing and damaging implications for Indigenous lives, societies and sovereignties as a wide variety of scholars, activists and Native community members continue to explore.<sup>20</sup> A critical examination of the scientists' fieldwork shows one of many moments when pre-existing popular and social-scientific ideas about Native masculinity converged with race and gender ideologies, this time reinstated in the science of genetics.

The blending of different sources of knowledge was a central tenet of the pilot study. Neel and Salzano held that only an interdisciplinary team could create and adequately interpret the data needed to characterize the genetic population structure of the 'relatively unacculturated' people they sought. Imagined as both closer to nature and more deeply marked by cultural traits, Indigenous groups represented a resource and a challenge, in the scientists' view. The geneticists relied especially on the recruitment of a sociocultural anthropologist to help them navigate their fieldwork. Trumpeting interdisciplinarity also allowed them to promote their agenda at a moment when, as Jackson and Depew argue, 'unity within and among the sciences was in some ways the "Holy Grail" of postwar American thinking'.<sup>21</sup> Recent historiography has shown that the links

16 Jennifer Nez Denetdale, 'Return to "The uprising at Beautiful Mountain in 1913": marriage and sexuality in the making of the modern Navajo Nation', in Joanne Barker (ed.), *Critically Sovereign: Indigenous Gender, Sexuality, and Feminist Studies*, Durham, NC: Duke University Press, 2017, pp. 69–98, 73. See also the other contributions to the volume for current ongoing debates around Indigeneity and gender in North America.

17 Joanne Barker, 'The specters of recognition', in Alyosha Goldstein (ed.), *Formations of United States Colonialism*, Durham, NC: Duke University Press, 2014, pp. 33–56.

18 On structures of elimination see Patrick Wolfe, 'Settler colonialism and the elimination of the Native', *Journal of Genocide Research* (2006) 8(4), pp. 387–409. On settler colonial possession as an important corrective that centers gender see Maile Arvin, *Possessing Polynesians: The Science of Settler Colonial Whiteness in Hawai'i and Oceania*, Durham, NC: Duke University Press, 2019, esp. pp. 16–19.

19 Aileen Moreton-Robinson, *The White Possessive: Property, Power, and Indigenous Sovereignty*, Minneapolis: University of Minnesota Press, 2015, p. xii; Jenny Reardon and Kim TallBear, "'Your DNA is our history": genomics, anthropology, and the construction of whiteness as property', *Current Anthropology* (2012) 53(S5), pp. S233–245.

20 Robert Alexander Innes and Kim Anderson, *Indigenous Men and Masculinities: Legacies, Identities, Regeneration*, Winnipeg: University of Manitoba Press, 2015; Barker, op. cit. (16); Scott Lauria Morgensen, 'Theorising gender, sexuality and settler colonialism: an introduction', *Settler Colonial Studies* (2012) 2(2), pp. 2–22; McKegney, op. cit. (15).

21 Jackson and Depew, op. cit. (11), p. 143. See also Jamie Cohen-Cole, *The Open Mind: Cold War Politics and the Sciences of Human Nature*, Chicago: The University of Chicago Press, 2014.

between human biology and anthropology in the mid-twentieth century were much stronger than previous disciplinary histories suggested.<sup>22</sup> The case of the Xavante Pilot Study helps explain how, beyond the intellectual debates of the North Atlantic, these disciplines were intricately interwoven even at the level of data collection in the field.<sup>23</sup>

As I show here, in Neel and Salzano's fieldwork in the Xavante village of Wedezé, Apöwê's performance of masculinity provided the key point around which the scientists crystalized their model of human evolutionary change, which they would name the fission–fusion model. The scientists came to see Apöwê paradoxically as both remarkable and representative. With his personal history of aggression, his numerous wives and offspring, and his polarizing leadership role in his village, in the geneticists' views the leader came to stand in first for his community, then his people, and finally for the dynamic male leaders of human evolutionary history. The geneticists' fascination with what they saw as the masculine vitality of the villagers they visited, however, obscured their perception of how colonial expansion had disrupted Xavante life. By 1962, Brazilian expansionism was wreaking havoc, fuelling violent confrontation between Xavante communities as well as with encroaching settlers. The same violence that seemed so 'natural' to the scientists was exemplary of the ravages of twentieth-century settler colonialism, not a reflection of deep human history.<sup>24</sup>

### A pilot study

In the years leading up to the arrival of the first researchers, the Xavante had been widely represented in the national news media in Brazil, with consistent emphasis on their

22 Jackson and Depew op. cit. (11); Radin, op. cit. (2); Vassiliki Betty Smocovitis, 'Humanizing evolution: anthropology, the evolutionary synthesis, and the prehistory of biological anthropology, 1927–1962', *Current Anthropology* (2012) 53(S5), pp. S108–125.

23 Of relevance here are Suárez-Díaz's case study and her contention that connected (as opposed to comparative) histories of international projects of population-making can shed light on 'the ways in which people, materials, and tools travel, and on the practices that make national boundaries selectively permeable and transnational histories possible.' See Suárez-Díaz, op. cit. (13), p. 108.

24 I use the theoretical framework of settler colonialism because twentieth-century Brazilian state expansionism primarily sought Indigenous land. Settler colonialism is slowly gaining attention within the extensive literature on colonialism and coloniality in Latin America, and has potential to complement and complicate analytical frames that have centered processes of immigration and *mestizaje*, *mestiçagem*, or race mixing. It also has great potential synergies with approaches such as Silvia Rivera Cusicanqui's work on internal colonialism—see, for example, her *Violencias (re)encubiertas en Bolivia*, La Paz: Mirada Salvaje, 2010. However, it should not be used indiscriminately. On the potentiality of a hemispheric approach see M. Bianet Castellanos, 'Introduction: settler colonialism in Latin America', *American Quarterly* (2017) 69(4), pp. 777–781, doi:10.1353/aq.2017.0063 and accompanying essays; Stephanie E. Smallwood, 'Reflections on settler colonialism, the hemispheric Americas, and chattel slavery', *William and Mary Quarterly* (2019) 76(3), pp. 407–416. For an analysis of the southern Atlantic coast of South America see Michael Goebel, 'Settler colonialism in postcolonial Latin America', in Edward Cavanagh and Lorenzo Veracini (eds.), *Routledge Handbook of the History of Settler Colonialism*, London: Routledge, 2017, pp. 139–151. For a compelling argument as to the urgency of integrating settler colonial theory and Latin American feminist decolonial praxis see Sofía Zaragocín, 'Gendered geographies of elimination: decolonial feminist geographies in Latin American settler contexts', *Antipode* (2019) 51(1), pp. 373–392, doi:10.1111/anti.12454.

aggression towards outsiders. During the Estado Novo (1937–1945), populist dictator Getúlio Vargas promoted westward expansion and developmentalism within Brazil as a mechanism to unify the country.<sup>25</sup> Government publicity for the nationalist ‘March to the West’ romanticized uncontacted Indigenous peoples of Central Brazil as a reserve of strength, resourcefulness and authenticity.<sup>26</sup> Hostile to the outsiders invading their land, the Xavante made headlines with their fierce resistance to ‘pacification’ – the process of government contact whose very name implied the assumption of hostility and violence of Indigenous peoples.

The ‘March to the West’ led to extensive encroachment on Xavante territory. Locally, the Xavante were infamous; they had successfully kept invaders out of large tracts of Mato Grosso. Along the Rio das Mortes in the 1930s and 1940s, Xavante bands – reportedly led by Apöwē – killed both Salesian missionaries and employees of the government’s SPI who sought to establish contact.<sup>27</sup> This failure to succumb to ‘pacification’ became increasingly problematic for the government as Xavante hostility threatened the progress of westward expansion.<sup>28</sup>

In 1946 one group of Xavante finally chose to establish diplomatic relations with Brazilian government officials. Led by Apöwē, the group exchanged gifts with expedition members. This contact at Wedezé unleashed a wave of popular coverage, from travel accounts to documentary film. The media storm told a story of the success of government outreach, and the progress of unifying dispersed regions of the country to render the hinterlands economically productive.<sup>29</sup> Xavante were celebrated as fierce and untameable, but, once they were ‘tamed’, state actors and aligned media simultaneously positioned them as representative of the strong, natural heritage of Brazil and in need of the tutelage of a benevolent state for the sake of their betterment.<sup>30</sup> This high-profile media coverage

25 As de Souza Lima highlighted in his foundational analysis of Indigenist policy, Brazil expanded through a siege of peace, a bureaucratized accounting and territorial constricting of Indigenous groups. See Antonio Carlos de Souza Lima, *Um grande cerco de paz: Poder tutelar, indianidade e formação do estado no Brasil*, Petrópolis: Vozes, 1995. It was this expansionism that made Xavante villages the target of study. Like all those granted expeditionary licenses, the researchers were required to report back to the state on the condition of the communities they visited.

26 For an overview of discourses regarding Indigenous peoples under the Estado Novo see Seth Garfield, *Indigenous Struggle at the Heart of Brazil: State Policy, Frontier Expansion, and the Xavante Indians, 1937–1988*, Durham, NC: Duke University Press, 2001, pp. 23–44. Also see Guzmán, *op. cit.* (2), pp. 124–130.

27 On Salesian attempts to pacify the Xavante in 1933 and on the killing of the SPI’s Pimentel Barbosa and associates see Garfield, *op. cit.* (26), pp. 53, 55.

28 Specifically, Xavante lands stood in the line of the Expedição Roncador-Xingu, the ‘centrepiece of the March to the West’, which began in 1943 and crossed central Brazil, building roads and opening up airstrips: Garfield, *op. cit.* (26), p. 45. The subject of extensive media coverage, the risk of failure in the face of Xavante resistance represented a serious concern for the government. See Garfield, *op. cit.* (26), p. 57.

29 Garfield, *op. cit.* (26), p. 59.

30 Garfield, *op. cit.* (26), pp. 23–44. The masculine appeal of Xavante men and those explorers who dared contact them resonated with broader publics, and even found coverage in US-based publications. ‘Love conquers’, *Time*, 2 September 1946, p. 35.

drew the attention of social scientists, including anthropologist Herbert Baldus, who would later suggest fieldwork in Xavante territory to Maybury-Lewis.<sup>31</sup>

Apöwê featured prominently enough in media coverage that Maybury-Lewis reported having known of the chief's repute even before arriving in the field.<sup>32</sup> The anthropologist described his first meeting with Apöwê in his semi-popular *The Savage and the Innocent*:

I watched his aquiline features and the greying shoulder-length hair and could not help feeling that the man would not have looked out of place as a doge of Venice ... This was Apewen, perhaps the best-known Shavante in Brazil. He was thought to have led the band that massacred Pimentel Barbosa and his companions of the Indian Protection Service.<sup>33</sup>

Likewise, in his first academic monograph, Maybury-Lewis qualified the leader as a man renowned as a 'strong chief'.<sup>34</sup> This emphasis on Apöwê's leadership in the deadly attacks on Salesians and SPI employees of the 1940s and early 1950s would persist throughout scientific publications that cited the leader by name. It also animated the interpretation of the interdisciplinary team that made Apöwê's community the subject of their research.

More generally, the Xavante 'Pilot Study', as the scientists would call it, was infused at every level with the Cold War context. From methodology, to funding, to intellectual orientation, to the local realities that the scientists would witness, Neel and Salzano's first collaborative field seasons encapsulated many dynamics of the scientific and technical realities of the mid-twentieth century. University of Michigan geneticist and physician Neel was the architect of the project. A leading figure in human genetics, Neel secured funding for the fieldwork from the Atomic Energy Commission, the World Health Organization and the US Public Health Service.<sup>35</sup> Neel's success was due not only to his prominence, but also to the project's championing of interdisciplinary study.<sup>36</sup> As Jamie Cohen-Cole has argued, at the height of the Cold War, work in multiple disciplines was increasingly understood as a virtuous, democratic practice.<sup>37</sup> Neel's proposal also appealed to funders optimistic about international research collaborations as a form of US soft diplomacy, and those who saw technical cooperation as a road to modernization.

31 Herbert Baldus, 'É belicoso o Xavante?', *Revista do arquivo municipal* (1951) 142, pp. 125–129; David Maybury-Lewis, *Akwê-Shavante Society*, Oxford: Oxford University Press, 1974 (first published 1967), p. xxii.

32 Maybury-Lewis travelled with his wife and baby in part to attenuate risks of violence. See David Maybury-Lewis, *The Savage and the Innocent*, Boston: Beacon Press, 1988 (first published 1965), pp. 153–154.

33 Maybury-Lewis, *op. cit.* (32), p. 168.

34 Maybury-Lewis, *op. cit.* (31), p. 37.

35 James V. Neel, Francisco M Salzano, Friedrich Keiter, David Maybury-Lewis and Pedro Clóvis Junqueira, 'Studies on the Xavante Indians of the Brazilian Mato Grosso', *American Journal of Human Genetics* (1964) 16(1), pp. 52–140, 52. The National Research Councils of Brazil and Germany also offered support.

36 Jamie Cohen-Cole, 'Instituting the science of mind: intellectual economies and disciplinary exchange at Harvard's Center for Cognitive Studies', *BJHS* (2007) 40(4), pp. 567–597, doi:10.1017/S0007087407000283.

37 Cohen-Cole, *op. cit.* (21).



In the planning, execution and analysis of the fieldwork, Neel worked most closely with Salzano, a young professor of genetics at the Universidade Federal do Rio Grande do Sul in southern Brazil, who had completed a postdoctoral fellowship in Neel's Ann Arbor lab from 1956 to 1957 funded by the Rockefeller Foundation.<sup>38</sup> As Neel had emphasized in proposals to funders, their methodology would go far further than prior genetic investigations. Rather than simply reporting blood groups, they would combine blood typing with comprehensive genealogical, medical and anthropometric research conducted by experts in each area.

Salzano was essential in building their team, quickly confirming the collaboration of Austrian physical anthropologist Keiter and the politically well-connected Brazilian haematologist Junqueira. Keiter would conduct anthropometric measurements, while Junqueira's networks in the elite circles of Rio de Janeiro would help secure official permission for the expedition in a matter of days, and assure the group's transport to Xavante territory by the Brazilian Air Force.<sup>39</sup> However, despite Neel's perspective that the sociocultural anthropologist they looked to find was 'the key person in the project', they despaired of finding an appropriate final team member.<sup>40</sup> There were few local scholars with field experience in the kind of Indigenous communities – those with least contact with surrounding settler society – that the geneticists privileged.<sup>41</sup> When Salzano finally heard of David Maybury-Lewis's work and Neel confirmed the newly appointed Harvard professor's willingness to collaborate, Maybury-Lewis's addition cemented their choice to conduct their first study in a Xavante village.<sup>42</sup>

### Scientific motivations: the search for mechanisms of human evolution

Salzano and Neel developed their studies of Indigenous groups to address a pressing scientific question: what were the underlying selection mechanisms driving human evolution? As others have elegantly discussed, specialists from diverse disciplines claimed that a focus on Indigenous groups could help explain deep human history.<sup>43</sup> As Neel

38 Salzano to Rockefeller Foundation, 'Report of Francisco M. Salzano', Folder 305E, Record Group 10.1, Rockefeller Foundation records, Rockefeller Archive Center. On the Rockefeller Foundation and genetics in Brazil, specifically, see Thomas F. Glick, 'The Rockefeller Foundation and the emergence of genetics in Brazil, 1943–1960', in Marcos Cueto (ed.), *Missionaries of Science: The Rockefeller Foundation and Latin America*, Bloomington: Indiana University Press, 1994, pp. 149–164; Vanderlei Sebastião de Souza, Rodrigo Ciconet Dornelles, Carlos E.A. Coimbra Jr and Ricardo Ventura Santos, 'História da genética no Brasil: um olhar a partir do Museu da Genética da Universidade Federal do Rio Grande do Sul', *História, Ciências, Saúde–Manguinhos* (2013) 20(2), pp. 675–694, 682, doi:10.1590/S0104-59702013000200018.

39 Papers of the Conselho de Fiscalização de Expedições Artísticas e Científicas, Livro 8, Ata 1537, Museu de Astronomia e Ciências Afins, Rio de Janeiro; James V. Neel, *Physician to the Gene Pool: Genetic Lessons and Other Stories*, New York: J. Wiley, 1994, pp. 122–129.

40 James V. Neel to Francisco M. Salzano, 20 March 1962, Salzano Correspondence (1 of 10), Box 66, Papers of James V. Neel–Manuscript Collection 96, American Philosophical, Philadelphia (hereafter Neel Papers, APS).

41 Salzano to Neel, 8 March 1962, Salzano Correspondence (1 of 10), Box 66, Neel Papers, APS.

42 Francisco M. Salzano to James V. Neel, 8 March 1962; Neel to Salzano, 20 March 1962; Salzano to Neel, 11 April 1962, Salzano Correspondence (1 of 10), Box 66, Neel Papers, APS.

43 Radin, op. cit. (2); Santos, op. cit. (13); Santos, Lindee and Souza, op. cit. (2), pp. 723–735.

would write in the introduction to the first publication based on their research at Wedezé, ‘The time factor in evolution being what it is, there can be little doubt that many – most – of the genetic attributes of civilized man have been determined by the selective pressures and breeding structures of these primitive communities’.<sup>44</sup> However, Neel’s purpose of understanding hunting–gathering groups was not necessarily to make sense of them for their own sake. He continued, ‘If we would understand modern man, we must study such of these primitive groups as still remain in a way in which they have rarely if ever been investigated to date’.<sup>45</sup> The study of the Xavante and particularly the figure of Apöwē would become a means to study the past and create a vision of a masculine natural state that should inform the management of the human gene pool in the future.

Sandwiched between the Second World War and Paul Ehrlich’s *The Population Bomb*, Neel articulated strong concerns about the direction of human evolution, and whether as a species humanity was deviating from the path of natural betterment.<sup>46</sup> His writings did not uniformly replicate earlier eugenics discourses, but they shared some important motivations, and grew out of a deep pessimism about what he saw as the misguided present.<sup>47</sup> Part of his answer to addressing the present was through accumulating and applying knowledge about human population structure.

According to Neel’s estimation, human geneticists had made great progress in thinking about ‘the origin and persistence of genetic differences between and within populations’ during the 1920s and 1930s with the development of statistical approaches to population modelling. But once geneticists turned to real populations, they lost momentum.<sup>48</sup> Neel explored the potential comparative study of populations in a 1958 article published shortly after Salzano completed his postdoctoral studies in Ann Arbor. He described the problem facing the field, writing, ‘The principle of natural selection as a guiding factor in human evolution is today universally accepted. However ... our knowledge of the actual workings of natural selection in human populations is almost nil’.<sup>49</sup> He went on to

44 Neel *et al.*, *op. cit.* (35), p. 52.

45 Neel *et al.*, *op. cit.* (35), p. 52.

46 The 1968 bestseller predicted mass starvation and advocated aggressive population control. See Paul R. Ehrlich, *The Population Bomb*, London: Macmillan, 1968.

47 On eugenics and genetics, many of the techniques and tools for analysing human difference carried over from pre-war sciences of human classification. A rich literature explores continuities and disjunctions from eugenics to human genetics. A classic study is Daniel Kevles, *In the Name of Eugenics: Genetics and the Uses of Human Heredity*, Cambridge, MA: Harvard University Press, 1998 (first published 1985). Alexandra M. Stern’s *Eugenic Nation: Faults and Frontiers of Better Breeding in Modern America*, Berkeley: University of California Press, 2005, pp. 150–210, focuses on the post-war period in the United States. Recently Nathaniel Comfort has argued that the shift from focusing on human improvement to emphasizing relief of suffering defined the rise of medical genetics, but the field continues to be an essentially eugenic project. Nathaniel Comfort, *The Science of Human Perfection: How Genes Became the Heart of American Medicine*, New Haven, CT: Yale University Press, 2012. On Neel’s pessimism: his knowledge of the suffering caused by the atomic bomb through his work with the Atomic Bomb Casualty Commission only accentuated his worries. See M. Susan Lindee, *Suffering Made Real: American Science and the Survivors at Hiroshima*, Chicago: The University of Chicago Press, 1997.

48 James V. Neel, ‘Between two worlds’, *American Journal of Human Genetics* (1966) 18(1), pp. 3–20, 9.

49 James V. Neel, ‘The study of natural selection in primitive and civilized human populations’, *Human Biology* (1958) 30(1), pp. 43–72, 43.

outline research that could potentially address selection. Neel was opening up a research trajectory in which, as Milam puts it, 'How evolution *worked* became more important than what had *happened*'; this agenda would come to animate sociobiologists, as well as some of their opponents.<sup>50</sup> The key area of interest for Neel would be the question of differential individual reproduction.

Neel's thinking about selection, fitness and reproduction aligned well with other population geneticists; those working in this field considered reproductive success to be the primary measurement of fitness, and thus the most important factor in determining selection.<sup>51</sup> Evolution as driven by selection could only occur when populations were growing or shrinking significantly, or when some individuals had many more children than others. The cause for this 'differential reproductive success' and the resulting selection, Neel continued, 'may be either on biological or cultural grounds. It will often be difficult to distinguish between the two types'.<sup>52</sup>

In his 1958 article, Neel focused on individuals and differential fertility *within* a group, departing from, or perhaps sidestepping, much of the scholarship on group selection that animated contemporary ethologists' and evolutionary biologists' approach to aggression.<sup>53</sup> Neel understood fertility differentials to be a factor where culture might influence biology. Citing literature on the cultural determinants of fertility *between* groups, he instead stressed the importance of examining individuals, because 'within any group, there are still great ranges in fertility'.<sup>54</sup> Individual fertility differences could be determined by a variety of factors, from child survival, polygamy and infanticide to extramarital births and fertility control. As such, these were some of the key parameters to be built into the methodology of the Xavante Pilot Study. Comprehensive sampling – including as many members of each village as possible – would allow the researchers to determine within-group variation and the unequal contributions of individuals to subsequent generations.

As Haraway has argued, a focus on differential reproductive success could lead 'to an emphasis on competition, individualism, antagonistic difference, and game theory views of life as a problem in strategic decision-making', laying out the conditions for sociobiology's coming 'logic of competitive individualism'.<sup>55</sup> Neel found both biological and social promise in the bodies and lives of his Indigenous research subjects. Apöwë, specifically, provided compelling material for study.

50 Milam, *op. cit.* (5), p. 6, original emphasis.

51 As Erika Lorraine Milam has shown, this exclusive focus on genetic contribution to the next generation at the expense of questions of health and vitality separated geneticists from organismal biologists. See her *Looking for a Few Good Males: Female Choice in Evolutionary Biology*, Baltimore: Johns Hopkins University Press, 2010, pp. 126–128.

52 Neel, *op. cit.* (49), p. 783.

53 Ullica Segerstråle, *Defenders of the Truth: The Sociobiology Debate*, Oxford: Oxford University Press, 2000, p. 54.

54 Neel, *op. cit.* (49), p. 789.

55 Haraway, *op. cit.* (5), p. 213.

**Apöwê in the field and on the page**

Before the scientific team ventured into the field, Neel had already outlined the interests that meant that Apöwê's life and genes would contribute to the study's major findings. With their focus on individual fertility differentials and cultural determinants of reproductive success, they set about collecting the data they needed for analysis.

On the first day of their stay, the six researchers went to the village just before sundown to meet Apöwê and the rest of the community, explain their research and offer gifts.<sup>56</sup> Aided by government employee Ismael Leitão, the scientists explained their research in general terms to the men's council meeting, the evening *warã*. The *warã* decided that they would accept the project, but that the men would be examined first: Neel wrote that they initiated their examinations 'at their insistence, with the males (since the Shavante were not yet sure of our intentions toward their women)'.<sup>57</sup>

They began their study with Apöwê. Despite his fame, it is unlikely that the scientists thought twice as they hung the numbered card around the old man's neck. Prior to their fieldwork in Wedezé, Salzano and field technician Simões had conducted genetic studies in Kaingang villages in the south of Brazil. There they had begun inviting the *cacique* to be the first participant. This practice, they held, helped build trust while demonstrating respectful precedence for leadership. Once a prominent leader had shown amenability, they hoped other community members would follow suit.<sup>58</sup>

On the first day of the study, with a number of stations set up at the SPI post, a kilometre's walk from the village, the research began with the simple act of giving each individual a number. Over the next hour or so, Apöwê was ushered through a battery of questions, tests and measurements. In an hour-long interview he recounted the demographics of his family, including his five wives, his brothers and sisters, his twenty-three surviving children, and their sex and age.<sup>59</sup> Next Keiter took a series of eleven measurements, including nine of Apöwê's facial features and head. After five standardized photographs and a vision test, Apöwê underwent a medical examination by Neel.<sup>60</sup> Almost two weeks later, on the last two days of the research, the scientists took a saliva sample, dermatoglyphic impressions of each hand and each foot, and blood samples.

Although Apöwê was already quite old and no longer cut as imposing a figure as he had twenty years earlier, as the scientists sifted through their data, Apöwê's profile became increasingly compelling. Much as the scientists' expedition replicated existing imaginaries of masculine daring and challenge for the sake of scientific exploration, the Xavante men they encountered lived up to the group's reputation: 'The general impression of the men was of exuberant health and vitality. They were erect in carriage,

56 Francisco M. Salzano, Caderno de Campo #1, Personal Papers of Francisco M. Salzano, UFRGS, Porto Alegre.

57 Neel, *op. cit.* (39), p. 126.

58 Salzano described this as an intuitive decision. Francisco M. Salzano, interview with Rosanna Dent, 17 August 2015, Porto Alegre.

59 Francisco M. Salzano, interview with Rosanna Dent, 11 July 2012, Porto Alegre; Neel *et al.*, *op. cit.* (35), p. 90.

60 Girley Simões, interview with Rosanna Dent, 10 December 2013, Porto Alegre.

deep-chested, and very well muscled, with a notable absence of adiposity'.<sup>61</sup> The scientists' perceptions of the women were quite different:

By contrast, the women, although in apparent good health and nutrition when young, gave an impression of early aging, an impression more than sustained by the results of the physical examinations. Indeed, one of the most striking impressions of this study was of the different medical worlds of men and women.

The scientists recorded in their field notes that the men danced on their first evening and every night thereafter, marvelling at the energy it took to keep up the rhythmic stomp and chant throughout the night.<sup>62</sup>

Other cultural practices made similarly strong impressions:

In the examinations of the Shavante males, we were initially puzzled by a universally present callus on the right shoulder. Sudden insight came the day we witnessed our first *buruti* race ... After the race we found one of the 'batons' to weigh 75 kilograms and the other 85! All the adult males participate!<sup>63</sup>

The spectacle of teams of men sprinting with the great palm logs and passing them off to one another only served to confirm the scientists' sense that they had found a population of great masculine vitality. The geneticists failed to note that in addition to doing the majority of day-to-day heavy lifting, Xavante women also log race, often carrying batons as heavy as fifty kilogrammes.

For a group that showed such strength and 'bellicosity', the male leader could only be expected to be a force to be reckoned with. Building on Maybury-Lewis's assessment and Apöwē's existing reputation, the researchers wrote that as 'the senior man of the dominant faction in the village', Apöwē was a particularly 'strong' chief.<sup>64</sup> Over the course of their eighty-eight-page treatise, the researchers described Apöwē's history of violent conflict three times. Based on Apöwē and on Maybury-Lewis's experiences in other villages, they made multiple generalized references to violence and the chieftaincy. First they noted Apöwē's involvement in the 1941 slaughter of government functionaries, and then went on to twice describe the results of a 'purge' of an opposing faction within the village. Their prose evoked a brutal and daring political ploy to consolidate leadership in 1953: 'On that occasion eight men were killed in their sleep. Their kinsmen and factionaries fled, resulting in a loss to the village of about 30 to 40 people ... The action seriously weakened Apewe's village, but as a calculated risk, it appears that Apewe gambled and won'.<sup>65</sup>

Subsequently, in his 1967 *Akwē-Shavante Society*, Maybury-Lewis would report that Apöwē 'certainly secured the chieftaincy by being the shrewdest leader of the most ruthless faction' and that he had established himself through 'the killing or expulsion of those who stood in his way'.<sup>66</sup> As the geneticists inquired into Apöwē's polarizing role in the

61 Neel *et al.*, op. cit. (35), p. 110.

62 Neel, op. cit. (39), p. 150.

63 Neel, op. cit. (39), p. 150.

64 Neel *et al.*, op. cit. (35), p. 60.

65 Neel *et al.*, op. cit. (35), p. 60.

66 Maybury-Lewis, op. cit. (31), p. 193.

political life of his community, the interaction between Xavante kinship structures and political conflict emerged as the key place to make sense of differential individual reproduction.

The geneticists were particularly interested in exogamous moieties, which both determined who could marry whom and, according to Maybury-Lewis, tended to predict political factions. These political allegiances and fissures were of great interest since their genealogical nature implied both a social and a biological relationship. Trying to appreciate the way social structure might determine genetic population structure, the moiety system promised to help meet their first objective, 'to identify those cultural elements with particularly biological implications'.<sup>67</sup>

Political cunning, ruthlessness and carefully calculated risks – particularly Apöwē's – led to village splits along biologically important moiety lines. This would become one of their most important findings but was not readily apparent at first. The drop in the number of inhabitants from about 220 in 1958 when Maybury-Lewis conducted the bulk of his fieldwork to only 120 in 1962 risked compromising their study's sample size. And yet as they explored their data, the schism that Apöwē had caused also provided them with the most compelling mechanism to generate genetic change over time.

By the time the 1964 paper went to press, the researchers had cast what had initially seemed a setback as a window into evolutionary history. By assuming that the unexamined people in the pedigree were living in the splinter village, they deduced that groups of brothers, predominantly of Apöwē's opposing moiety, left the village together. Thus individuals who were closely biologically related tended to form new villages in a highly 'non-random' pattern.

Furthermore, the scientists suggested that these kinship splits could be considered a general pattern: 'We regard it as fortunate that we were able to provide preliminary documentation of the biological lines along which a village split occurs, since this is a process which must have occurred frequently in the history of man'.<sup>68</sup> And so factionalism came to represent 'non-random sampling' as human groups formed new communities. The geneticists paid little regard to the role of settler interference, land incursions, or epidemic disease that might have fuelled the 'sampling events' they documented.

While the first of Apöwē's compelling characteristics was his unabashed use of force, the second was his prolific fertility. At first glance, he may not have seemed an ebullient masculine subject. Greying and already in his fifties or sixties, he was old by Xavante standards in 1962. And yet, as if to complete the imaginary of a virile leader, Apöwē had more wives and children than any other member of the village. Neel had outlined polygamy as a possible source for individual fertility differentials in his 1958 thought piece.<sup>69</sup> Apöwē was exceptional: 'the reproductive history of the chief, Apewe, is striking. As befits the chief, he had had more wives (five) than any other member of the

67 Neel *et al.*, *op. cit.* (35), p. 53. Anthropologist James Welch later challenged Maybury-Lewis's assertion that moiety belonging mostly determined allegiance. See James R. Welch, 'Age and social identity among the Xavante of Central Brazil', PhD diss., Tulane University, 2011, pp. 324–326.

68 Neel *et al.*, *op. cit.* (35), p. 127.

69 Neel, *op. cit.* (49), p. 787.

tribe'.<sup>70</sup> Apöwê's twenty-three surviving children impressed the researchers. Polygyny provided the second parameter of exceptionality – it allowed Apöwê to sire far more offspring than any other man of his village, and, the scientists would soon learn, of any other Xavante village.

Apöwê brought together strength, violence, leadership and, perhaps most importantly, what the geneticists called a 'very disproportionate' contribution to subsequent generations.<sup>71</sup> His masculine prowess first as a fierce leader and second as a fertile progenitor allowed the scientists to think about new models for micro-evolution.

### From Apöwê and Wedezé to the generalizable Xavante

The preparation of the 1964 Xavante manuscript was a laborious process that began in the autumn of 1962 and dragged on until the eve of the researchers' second collective foray into Central Brazil. Over the course of the preparation of the unusually lengthy first paper, the researchers had to negotiate which claims to make based on their preliminary pilot study.

As they considered Apöwê and his potential to inform questions of human micro-evolution, they had to determine whether he was the exception or the rule. 'Of particular interest', they wrote, '*should it be found to be a general phenomenon* is the disproportionate contribution of the village chief (and possibly certain other outstanding members of the village, such as the heads of clans) to the next generation'.<sup>72</sup> Some of the very aspects that made their first subject a compelling focus also raised the possibility that he was an anomaly: 'However, we must recognize the possibility that the relatively prolonged and dominant nature of Apewê's chieftaincy has discouraged immigration to the village but encouraged emigration, as suggested from the snatches of history available'.<sup>73</sup> They did not recognize, however, that settler colonial incursions and the introduction of extensive trade goods may have also dramatically altered Apöwê's role in his village.

Numerous clauses qualifying the generalizable nature of the pilot study did not prevent Neel from elaborating on the potential he saw in Apöwê's chieftaincy to represent both possible sources for genetic change and the natural course of evolution. 'The evidence suggests that fertility differentials have far more genetic significance in the Xavantes than is true for civilized man today', Neel and his colleagues wrote. They went on,

The position of chief or head of clan is not inherited but won ... The greater fertility of these leaders (assuming this to be a rather general pattern) must have genetic implications. Indeed it may be that the single most dysgenic event in the history of mankind was departure from a pattern of polygamy based on leadership, ability, and initiative.<sup>74</sup>

70 Neel *et al.*, *op. cit.* (35), p. 94.

71 Neel *et al.*, *op. cit.* (35), p. 131.

72 Neel *et al.*, *op. cit.* (35), p. 100, emphasis added.

73 Neel *et al.*, *op. cit.* (35), p. 93.

74 Neel *et al.*, *op. cit.* (35), p. 127.

Part of what made Apöwē so compelling was the possibility that he could pass on his exceptional qualities to his many offspring, and in so doing improve his community's gene pool.

Over the course of the 1964 fieldwork, the team of scientists maintained their interest in polygynous leadership. In their 1967 publications, drawing on subsequent research in the Xavante villages of São Marcos and Simões Lopes, they again emphasized that a man's reproductive privilege as chief was linked to highly valued masculine traits, and was an earned social status:

In general, leaders will be accomplished orators, good hunters and warriors, well versed in the tribal lore. In these small communities, one's performance under widely varying conditions is well known; it seems reasonable to postulate that the leaders will tend to have intellects and physiques which in that culture are superior.<sup>75</sup>

Masculine traits were a driving force for genetic change.

The second season of fieldwork also helped clarify the way the scientific team would articulate the interface between politics and genetic change. While Apöwē's community focused the researchers on the importance of political fissures and the founding of new villages following violent confrontation, subsequent villages drew their attention to the tendency for smaller groups to aggregate. The researchers explained this shift, writing, 'The picture which now emerges is of constant, continuing realignment among groups [such that] ... over a period of several generations there should be so much exchange between "villages" that the breeding unit approximates the entire tribe'.<sup>76</sup> After their second joint field trip, Salzano suggested that what they were witnessing was a fission–fusion model. Neel loved the new term, and Salzano's suggested name stuck.<sup>77</sup>

In the 1960s, there was consensus among population geneticists that mutation led to new variants of genes, referred to as polymorphisms, but no certainty as to how these variants could persist long enough to become widespread. Regardless of whether a polymorphism was beneficial, if too rare in a group it would be statistically unlikely to be preserved in a large gene pool with random mating. The fission–fusion hypothesis, however, suggested a mechanism for polymorphisms to become stabilized. The scientists reasoned that since Xavante communities typically split along biological kinship lines, it was likely for a new village to include many closely related individuals. This increased the probability of a polymorphism becoming prevalent in the new community. In combination with the disproportionate genetic contribution of certain powerful male figures, the geneticists argued, it was quite possible to attain the necessary frequency for new alleles to be maintained.

<sup>75</sup> James V. Neel and Francisco M. Salzano, 'Further studies on the Xavante Indians. X. Some hypotheses and generalizations resulting from these studies', *American Journal of Human Genetics* (1967) 19(4), pp. 554–574, 563.

<sup>76</sup> Francisco M. Salzano, James V. Neel and David Maybury-Lewis, 'Further studies on the Xavante Indians. I. Demographic data on two additional villages: genetic structure of the tribe', *American Journal of Human Genetics* (1967) 19(4), pp. 463–489, 469. See also Neel, *op. cit.* (48), p. 12.

<sup>77</sup> Salzano, *op. cit.* (58).



Salzano and Neel described these findings in provocative atomic metaphors, writing, ‘the pattern of fission–fusion would seem to provide the basis for what might be termed a genetic chain reaction, as in successive villages the critical frequency is exceeded by the addition of groups of people from villages in which the polymorphism is already established’.<sup>78</sup> The fissions provided the possibility for the stabilization of new gene frequencies. Meanwhile, the wider practices of mobility between different communities – the fusions – ensured that over longer timescales selection would lead to the expansion of beneficial genetic changes. The model fit with key contemporary thinking about the conditions necessary for rapid and effective evolution.<sup>79</sup> Using the Xavante to stand in for prehistoric humans, the geneticists offered an explanation of how human variability could have developed over time. But for the case of the Xavante, the Cold War and the local political and economic moment offered more than just metaphors.

### Unacknowledged colonial ravages and high antibody counts

The geneticists set out on their second joint field excursion only days after the Military–Civilian Coup of 1964. As the military assumed control of the country’s institutions, the political instability in urban centres threatened to make the geneticists’ work impossible. But a slower and even more pernicious economic–political trend was under way in Central Brazil. The state-led process of opening up the interior placed acute pressure on Indigenous communities. Even as Neel, Salzano and their colleagues described masculine vitality and health, Xavante communities were under extreme strain.

The geneticists were careful to specify that they did not consider the group ‘untouched’.<sup>80</sup> They also recognized that the local context and historical moment might have influenced the fission–fusion pattern that they observed.<sup>81</sup> However, despite careful disclaimers, they wrote with optimism that their observations of a living group could stand for primordial humanity. The geneticists’ estimations of the health of the communities they studied seem to have been so strongly influenced by the impression of Xavante men’s strength and vitality as to blind them to other realities. While they identified very high prevalence of antibodies to a wide variety of pathogens, they interpreted this trend as suggesting ‘that a high level of challenge of immunological competence ... has been a feature of human existence for a long time’.<sup>82</sup> Rather than interpreting the high antibody count as a relatively recent phenomenon linked to

78 Neel and Salzano, *op. cit.* (75), p. 557. Since the 1930s molecular biologists had drawn on techniques and language from physics as they sought prestige among the sciences. See Pnina Abir-Am, ‘The discourse of physical power and biological knowledge in the 1930s: a reappraisal of the Rockefeller Foundation’s “policy” in molecular biology’, *Social Studies of Science* (1982) 12(3), pp. 341–382.

79 Specifically, this theory supported Sewall Wright’s work.

80 Salzano, Neel and Maybury-Lewis, *op. cit.* (76), p. 464.

81 Salzano, Neel and Maybury-Lewis, *op. cit.* (76), p. 469.

82 Neel and Salzano, *op. cit.* (75), p. 568.

waves of epidemic disease, the findings puzzled them. The antibody data ‘only intensifies the mystery of the relative absence of aged in this population’, they wrote.<sup>83</sup>

But even other members of their team had divergent perceptions. Maybury-Lewis emphasized the changes he witnessed from 1958 to 1962. ‘Many things had changed since 1958’, he wrote. ‘The Shavante were no longer haughty in their dealings with outsiders. Their lands had been infiltrated. The population of the community was half its former size owing to epidemics and internecine warfare’.<sup>84</sup> Later studies would suggest that the destructive process of increased contact with Brazilian society caused both the high antibody counts and high population attrition rates. The pressures of developmentalism accelerated the observed disintegration and re-formation of Xavante villages. Competition over material goods led to violent conflict within and between Xavante communities, and epidemics of disease accounted for the high infant mortality rate and relative absence of the elderly that the 1962 studies documented.<sup>85</sup> While Neel and Salzano were interested in documenting the effects of culture on the evolution of humankind, their conception of Xavante bodies as natural representatives of the past blinded them to the immunological and political present.

### Scaling up: the expansion of the masculinist imaginary

Even before the interdisciplinary group had finished their first season of fieldwork, Neel was promoting the promise of their methodology on an international stage and preparing to scale up his own work. Since 1959, he had been working closely with the World Health Organization (WHO) to develop the agency’s programme in human genetics.<sup>86</sup> In the lead-up to the Xavante Pilot Study, the scientists knew that their fieldwork could serve as a model for an upcoming WHO meeting on Population Genetics of Primitive Groups.<sup>87</sup> Following that first international meeting, the geneticists’ approach would also be promoted by the Pan American Health Organization and institutionalized as a major framework for the International Biological Program’s Human Adaptability Arm, though not without its critics.<sup>88</sup>

83 Neel and Salzano, op. cit. (75), p. 569.

84 Maybury-Lewis, op. cit. (31), p. xiii. Salzano also remembered tourists visiting Wedezé during their 1962 fieldwork. Salzano, op. cit. (59).

85 Carlos E.A. Coimbra Jr, Nancy M. Flowers, Francisco M. Salzano and Ricardo V. Santos, *The Xavante in Transition: Health, Ecology, and Bioanthropology in Central Brazil*, Ann Arbor: University of Michigan Press, 2004, pp. 82, 130; Maybury-Lewis, op. cit. (32), p. 177; Garfield, op. cit. (26), pp. 45–65.

86 James V. Neel, R.A. Fraser Roberts, William Schull and Alan Stevenson, draft report, ‘Possible roles of the World Health Organization in research in human genetics’, pp. 11–13, folder WHO Genetics Primitive, Series I: Correspondence, Grants 12, Neel Papers, APS. Meeting held at University of Michigan from 28 April 1959 to 30 April 1959.

87 Neel to Salzano, 20 March 1962, Salzano Correspondence (1 of 10), Box 66, Neel Papers, APS.

88 World Health Organization, ‘Research in population genetics of primitive groups: report of a WHO Scientific Group’, World Health Organization Technical Report Series No. 279 (1964); WHO Scientific Group on Human Genetics Research, ‘Research on human population genetics’, World Health Organization Technical Report Series (1968) no. 387; James V. Neel, ‘Multidisciplinary studies on primitive populations in Latin America’, Advisory Committee on Medical Research, Washington, DC: Pan American Health Organization, 9 March 1964; Neel, ‘The American Indian in the International Biological Program’,

Interdisciplinary methodology attending to fission–fusion came to animate the following decades of both Neel’s and Salzano’s fieldwork. From Xavante data, Salzano turned his attention to Kayapó communities, where he and collaborators would conduct fieldwork, but were unable to travel to the field with a sociocultural anthropologist. Rather, they corresponded with Maybury-Lewis’s first graduate student, Terence S. Turner, who provided lists of Kayapó names and relationships and visited Salzano in Porto Alegre. Salzano reported to Neel that Turner encouragingly suggested that three Kayapó communities’ population structure ‘fits very nicely on our fission–fusion model’.<sup>89</sup> He pursued similar questions with social anthropologist Roberto Cardoso de Oliveira in a 1970 genetic study of Terena communities.<sup>90</sup> Salzano would continue to consider fission–fusion essential to understand prehistoric human micro-differentiation and one of his key contributions to the field, but in his future publications he would not emphasize masculine leadership in the same terms.<sup>91</sup>

It was Neel, as he turned his attention to Yanomami communities along the Brazil–Venezuela border, who would most forcefully promote the importance of male aggression for human evolutionary history. He found his most charismatic collaborator in anthropology graduate student Napoleon Chagnon, who, with Neel’s encouragement and funding, departed for his first fieldwork in Yanomami communities in 1964 just as the Xavante Pilot Study paper was published.<sup>92</sup>

Chagnon’s approach and interests fit precisely with Neel’s vision of the masculine prowess of Indigenous leaders, and together Chagnon and Neel became late producers of ‘colloquial science’ with their joint work. In what would become highly controversial research, Chagnon travelled from community to community, playing into existing conflicts. He paid informants to break a Yanomami taboo and speak the names of their opponents’ deceased relatives in order to document the genealogies that formed the basis for subsequent genetic and anthropological study. In 1968 Neel and Chagnon documented their work in an educational film, called *Yanomamö: A Multidisciplinary Study*, which reiterated the exact conceptualization of the Xavante Pilot Study for a broader audience, explaining the importance of collaborations between geneticists and anthropologists. Describing the Yanomami as ‘extremely warlike’ in the opening frames of the forty-five-minute documentary, Neel narrated the prominence of polygyny

Advisory Committee on Medical Research, Washington, DC: Pan American Health Organization, 13 May 1968. Radin, *op. cit.* (12), pp. 492–493, discusses the WHO meeting at length, including critiques that came from those unconvinced by the methodology.

89 Salzano to Neel, 14 April 1966, Salzano Correspondence (4 of 10), Box 66, Neel Papers, APS.

90 Francisco M. Salzano and Roberto Cardoso de Oliveira, ‘Genetic aspects of the demography of Brazilian Terena Indians’, *Social Biology* (1970) 17(3), pp. 217–223.

91 R.H. Ward, F.M. Salzano, S.L. Bonatto, M.H. Hutz, C.E.A. Coimbra and R.V. Santos. ‘Mitochondrial DNA polymorphism in three Brazilian Indian tribes’, *American Journal of Human Biology* (1996) 8(3), pp. 317–323; T. Hünemeier, J. Gomez-Valdes, M. Ballesteros-Romero, S. de Azevedo, N. Martinez-Abadias, M. Esparza, T. Sjøvold, *et al.*, ‘Cultural diversification promotes rapid phenotypic evolution in Xavante Indians’, *Proceedings of the National Academy of Sciences* (2011) 109(1), pp. 73–77, [doi:10.1073/pnas.1118967109](https://doi.org/10.1073/pnas.1118967109); Francisco M. Salzano, ‘The fission–fusion concept’, *Current Anthropology* (2009) 50(6), p. 959.

92 Napoleon A. Chagnon, *The Yanomamö*, 5th edn, Fort Worth: Wadsworth/Thomas Learning, 1997, p. 1. Neel, *op. cit.* (39), p. 134, comments on his support and funding of Chagnon.

in his vision of human evolution: 'Finally, since in this polygynous society it is the village headman who usually has the most wives, we must understand how a man gets to be headman, and by virtue of having twice as many children as the average Indian, transmits his genes disproportionately to the next generation'.<sup>93</sup> Chagnon also popularized the focus on certain charismatic leaders in his 1968 introductory anthropology text, *Yanomami: The Fierce People*, focusing on a 'particularly accomplished man' who 'had 11 wives, by whom he had 43 children', as an example of the importance of polygyny for Yanomami village cohesion or fissioning.<sup>94</sup>

Chagnon's book would quickly become a widely assigned introductory anthropology text, likely passing through the hands of two to three million readers over the course of forty years and five editions.<sup>95</sup> He and his evolutionary approach to anthropology also became associated with the rising tide of sociobiology in the 1970s. E.O. Wilson introduced the fourth edition of Chagnon's book, calling the demographic data and 'detailed history of village fissioning and warfare' crucial, and emphasizing that 'most serious fighting starts over women', and that fundamentally men 'are contesting the key limiting resource to their personal reproduction ... control of access to women'.<sup>96</sup>

Chagnon took the emphasis on violent masculinity even further than Neel. In 1988 he published a study in *Science* that framed male violence as primarily about competition for the 'scarce' resource of women: 'Most fights begin over sexual issues: infidelity and suspicion of infidelity, attempts to seduce another man's wife, sexual jealousy, forcible appropriation of women from visiting groups, failure to give a promised girl in marriage, and (rarely) rape'.<sup>97</sup> Using statistical methods that would later be challenged by a number of scholars, he notoriously argued, 'Demographic data indicate that men who have killed have more wives and offspring than men who have not killed'.<sup>98</sup>

The arguments which developed out of the research on Apöwë and Yanomami warfare promoted an individualistic evolutionary benefit to male aggression, setting up conditions for sociobiologists to frame violence as innate.<sup>99</sup> This contrasted to earlier approaches to Man the Hunter, which equally valorized masculinity, but framed humankind as fundamentally cooperative. Chagnon's and Neel's research was damaging to Yanomami. Beyond perpetuating 'masculindian' stereotypes, Chagnon's work was cited by local Brazilian *fazendeiros* and politicians in an attempt to block the demarcation of a large unified Yanomami territory. The settlers argued that Yanomami internecine warfare made it – conveniently – safer to separate groups onto

93 *Yanomamö: A Multidisciplinary Study*, film directed by Timothy Asch and Napoleon Chagnon, Watertown, MA: Documentary Educational Resources, 1980.

94 Chagnon, op. cit. (92), p. 150.

95 Rob Borofsky, *Yanomami: The Fierce Controversy and What We Can Learn from It*, Berkeley: University of California Press, 2005, p. 39.

96 E.O. Wilson, 'Preface', in Napoleon Chagnon, *The Yanomamö: The Last Days of Eden*, 4th edn, Fort Worth: Wadsworth/Thomas Learning, 1992, pp. ix–xii, x.

97 Napoleon Chagnon, 'Life histories, blood revenge, and warfare in a tribal population', *Science* (1988) 239(4843), pp. 985–992, 986.

98 Chagnon, op. cit. (97) p. 985.

99 Milam, op. cit. (5), p. 230–232.

small, isolated parcels of land. Brazilian anthropologists contested and fought Chagnon's work, successfully supporting Yanomami in protecting their land but with little support or attention from the North American academy until the scandal of *Darkness in El Dorado* broke in 2001.<sup>100</sup> Neel's work, though more debated by historians, also caused harm. This harm was both indirect, through his promotion of Indigenous people as representatives of the past and his recruitment and encouragement of Chagnon, and direct, through his long-term storage of blood samples without Yanomami permission.<sup>101</sup>

### **Conclusion: the enduring legacy of Apöwē and fission–fusion**

The Xavante studies and the resulting fission–fusion hypothesis had a lasting influence both on the careers of the geneticists who planned and led this work, and on the broader field of human population genetics. In the short term, the fieldwork experience established a model for future research. The data collected provided a foundation for diachronic health and demography research as well as quantitative comparisons with other human populations. In the long term and at the theoretical level, this initial work defined the primary area of scholarship to which Salzano and his future students would contribute. Many of the same motivations that shaped the Xavante research agenda would inspire the collaborations that Salzano and Neel carried out over the course of the next decade, which took them to visit dozens of Indigenous communities throughout Amazonia. Whether working with the Kayapó, the Terena or the Yanomami, Salzano–Neel expeditions continued to inquire into polygyny and socio-political organization as factors underlying genetic micro-evolution and the maintenance of human variation.

Both the fission–fusion hypothesis and Apöwē's prominence as an exemplary subject weathered the transition from genetic analysis of proteins as expressed in the blood to the direct study of DNA. One recent study documented the importance of cultural differences leading to rapid evolution at both the genetic and the morphological level. The 2012 paper published by Salzano and collaborators argued that sexual selection 'could be the culture-generated force that would explain the results and cause of such divergence. For example ... [w]hen familiar data were collected on the São Domingo village, 25% of the inhabitants were sons of the Xavante chief Apoena, who had five wives and a vast array of alliances'.<sup>102</sup> Based on both the anthropometric measurements and the frozen blood samples of the 1962 field research, new DNA-based research corroborated Salzano and Neel's early findings of morphological differentiation. Apöwē persisted into the twenty-first century as a compelling example of how culture could translate to human genetic evolution.

100 Borofsky, *op. cit.* (95). On Manuela Carneiro da Cunha and the objections of the Associação Brasileira da Antropologia see p. 35.

101 On the damage of stored blood samples as articulated by Yanomami see Borofsky, *op. cit.* (95), pp. 63–67. On both the historical–anthropological debates and the broader ethical issues at hand see Radin, *op. cit.* (2), pp. 168–170, 184–185.

102 Hünemeier *et al.*, *op. cit.* (91), p. 76.

While Apöwē's participation in the research was not the only factor leading to the geneticists' development of the fission–fusion concept, his reputation, reproduction, life story and political position served to focus their attention on an exceptional case. Masculinity, its cultivation, and its promise for the future of humanity not only stimulated the interest of the scientists who travelled to Xavante lands, but also profoundly informed theorizations of deep human history.

Neel and Salzano were important architects of future agendas for human-biology research. The logics of these programmes endured the second half of the twentieth century and into the twenty-first. As Kim TallBear and other have shown, geneticists and genome scientists continue to treat Indigenous peoples as representatives of the deep past, coveting their genes and biosamples in broad, highly funded research programmes such as the Human Diversity Genome Project and the Genographic Project.<sup>103</sup> The Xavante Pilot Study demonstrates how scientists' imaginaries of 'masculindians' contributed to the larger trend of valuing Indigenous data and biosamples as a window into the past while overlooking the colonial dynamics that so profoundly shaped the political and biomedical present. Even though their model departed from a promotion of an explicitly nuclear family, their emphasis on the adaptive potential of polygynous male leaders naturalized a patriarchal order.

The Cold War context was permeated both by violence and by the threat of violence. However, the scientists' focus on evolutionarily adaptive aggression overlooked the violence that most impacted the population structure of Apöwē's community. Economic and political instability in Brazil cultured the conditions for military rule. On the frontier of western expansionism, *fazendeiros* hungry for land and outbreaks of disease perpetrated both physical and structural violence on Xavante communities. It was in this context that geneticists set their sights on the violence of Xavante society and the fierceness of the Xavante warrior to make sense of human evolution. Their interests found their match in the reputation and political action of Apöwē, 'perhaps the best-known Shavante in Brazil', but charismatic masculinity blinded the scientists to other realities.<sup>104</sup>

103 TallBear, op. cit. (13), pp. 149–176.

104 Maybury-Lewis, op. cit. (32), p. 168.