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New Weapons for Old Problems

Christopher S. Parker

Conventional Proliferation and Military Effectiveness in Developing States

The relative amity that characterizes relations among industrialized states suggests that the prospects for conflict among them are becoming increasingly remote. While perhaps a valid claim in describing the nature of relationships among Western democracies and other states in the core, it is not an accurate account of interstate relations in the developing world.¹ No longer tethered to their superpower patrons, developing states are now free to seek redress from regional rivals over long-simmering disputes once frozen by the ideological battle between East and West. For this reason, competition—both for security and for regional hegemony—has again become a salient issue, reifying the realist paradigm in regional security systems.² Hastening the resuscitation of realism within regional security systems, and increasing the potential for instability in developing regions, is the ease with which state-of-the-art conventional weapons may now be acquired.³ With market forces having been unleashed on the interna-

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1. For states in the core, economic interdependence, political democracy, and nuclear weapons combine to lessen the security dilemma and promote peace. States in the periphery, on the other hand, do not have a similar mix of incentives and deterrents that militate against the likelihood of conflict. For an exceptional exposition on the post-Cold War security environment between developed and developing states, see James M. Goldgeier and Michael McFaul, "A Tale of Two Worlds: Core and Periphery in the Post-Cold War Era," *International Organization*, Vol. 46, No. 2 (Spring 1992), pp. 467-491. For the purposes of this article, I borrow the following taxonomy from the Stockholm International Peace Research Institute (SIPRI): the industrial world, the developing world, and least developed countries. The roster of states in the developing world includes such key regional players as Israel, Egypt, Iran, Iraq, and Saudi Arabia in the Middle East; and China, the Koreas, and Taiwan in Asia. *SIPRI Yearbook 1997: World's Armaments, Disarmament, and International Security* (New York: Oxford University Press, 1997), p. 294.

2. On the prevalence of regional security systems, see Goldgeier and McFaul, "A Tale of Two Worlds"; and Aaron L. Friedberg, "Ripe for Rivalry: Prospects for Peace in a Multipolar Asia," *International Security*, Vol. 18, No. 3 (Winter 1993/94), pp. 5-33.

3. For an overview of the causes of war and the use of modern weapons in the developing world, see Eliot A. Cohen, "Distant Battles: Modern War in the Third World," *International Security*, Vol.

tional arms industry, more states are now able to balance internally by purchasing the means for *unilateral* defense instead of the more conventional external balancing where state defense is accomplished through alliance formation. Likewise, the quest for regional hegemony is facilitated with the increasing availability of frontline hardware and technology. Together, the proliferation of conventional arms transfers and the increased political autonomy of developing states in the wake of the Cold War could make this one of the most turbulent transitional periods in the history of international politics.⁴

Concerns that policymakers are likely to have with, say, China or Iraq⁵ possessing modern conventional weapons are based on the assumption that these states will eventually optimize their use tactically, possibly affecting U.S. strategic interests. But, as I argue in this article, this assumption is open to serious question. The timely, efficient, and effective use of nonindigenous weapons presupposes a level of familiarity not easily achieved even by indige-

10, No. 4 (Spring 1986), pp. 143–171. Geoffrey Kemp discusses similar issues in greater detail in “Arms Transfers: The ‘Back-End’ Problem in Developing Countries,” in Stephanie Neuman and Robert Harkavy, eds., *Arms Transfers in the Modern World* (New York: Praeger, 1979), pp. 264–275. For a more nuanced treatment of the relationship between weapons deployment, military institutions, and personnel, see Mary Kaldor and Asbjorn Eide, *The World Military Order: The Impact of Technology on the Third World* (London: Macmillan, 1979), pp. 9–10; and Steven J. Rosen, “New Land-Based Technologies,” in Neuman and Harkavy, *Arms Transfers in the Modern World*, pp. 111–124. On weapons and regional instability, see W. Seth Carus, “Weapons Technology and Regional Stability,” in Shelley A. Stahl and Geoffrey Kemp, eds., *Arms Control and Weapons Proliferation in the Middle East and South Asia* (New York: St. Martin’s, 1992), pp. 10–12.

4. By transitional period I refer to the current confusion over the distribution of power that did not exist during the Cold War. Robert Jervis highlights this problem when he states that systemic polarity is “unipolar because the United States is so much stronger than the nearest competitor, bipolar because of the distribution of military resources, and tripolar because of an emerging united Europe.” Jervis, “The Future of World Politics: Will It Resemble the Past?” *International Security*, Vol. 16, No. 3 (Winter 1991/92), pp. 41–42.

5. Since 1991 China has acquired approximately 200 Russian-made Su-27 fighter bombers, 50 MiG-31 high-altitude interceptors, two Sovremennyi-class guided missile destroyers, and an undisclosed number of Russian Kilo-class submarines. Not to be outdone, Iraq in 1985–92 received \$13.6 billion in arms transfers from the Soviet Union, including 1,000 T-72 main battle tanks and 45 MiG-29 Fulcrum fighter-interceptors. For more on Chinese military acquisitions and arms racing in Asia, see Charles P. Wallace, “Arms Race, Round 2,” *Los Angeles Times*, March 23, 1993, p. D1; Desmond Ball, “Arms and Affluence: Military Acquisitions in the Asia-Pacific Region,” *International Security*, Vol. 18, No. 3 (Winter 1993/94), pp. 78–112; Denny Roy, “Hegemon on the Horizon: China’s Threat to East Asian Security,” *International Security*, Vol. 19, No. 1 (Summer 1994), pp. 149–168; and Avery Goldstein, “Great Expectations: Interpreting China’s Arrival,” *International Security*, Vol. 22, No. 3 (Winter 1997/98), pp. 36–73. For an exposition that ties Asian stability to U.S. interests, see Richard K. Betts, “Wealth, Power, and Instability: East Asia and the United States after the Cold War,” *International Security*, Vol. 18, No. 3 (Winter 1993/94), pp. 35–77. For more on arms racing in the Middle East, see Anthony Cordesman, *Iran and Iraq: The Threat from the Northern Gulf* (Boulder, Colo.: Westview, 1993), pp. 14–21. For a synopsis of U.S. interests in the Middle East, see Stephen R. David, “Why the Third World Still Matters,” in Sean M. Lynn-Jones and Steven E. Miller, eds., *America’s Strategy in a Changing World* (Cambridge, Mass.: MIT Press, 1992), pp. 345–356.

nous producers, because it takes time to assimilate new weapons.⁶ Therefore, if assimilation is necessary for the states producing these weapons, it should also be considered a factor for the states purchasing them.⁷ For these reasons, conventional proliferation does not necessarily constitute a shift in the balance of power. Rather, a shift in the balance of power concomitant with the receipt of nonindigenous weapons demands that they be used efficiently, which makes this a question of military effectiveness.

Military effectiveness, according to Allen Millett and Williamson Murray, has both sociological and operational components.⁸ More precisely, the sociological component focuses on the human element of combat, while the operational component emphasizes weapons utilization and assimilation. Both approaches deserve attention. To date, however, only the sociological approach has been examined. In ignoring the operational approach, scholars have overlooked the role of assimilation, which, on its face, seems a necessary condition for military effectiveness. And, as I show below, ignorance of the operational approach will yield flawed assessments in the long run. In this article I argue that the implications of conventional proliferation can be fully understood only by examining the relationship between the operational approach (assimilation)

6. Assimilation refers to the process that takes place between the adoption of a weapon and its use as a fully integrated component of an existing arsenal: that is, the weapon must be absorbed into the tactics, doctrine, and organizational structure of the military establishment. Details on assimilation can be found in Trevor N. Dupuy, *The Evolution of Weapons and Warfare* (New York: Da Capo Press, 1984), pp. 301–303.

7. Sometimes states realize that there will be problems in trying to absorb the new technology, but they persist in buying state-of-the-art systems anyway to increase their “social” status. For more on the sociocultural “whys” of conventional proliferation, see Dana P. Eyre and Mark C. Suchman, “Status, Norms, and the Proliferation of Conventional Weapons: An Institutional Theory Approach,” in Peter J. Katzenstein, ed., *The Culture of National Security: Norms and Identity in World Politics* (New York: Columbia University Press, 1996), pp. 80–113.

8. Military effectiveness is a function of the efficient conversion of resources into fighting power. A high level of military effectiveness, however, is not necessarily congruent with victory on the battlefield; studies conducted on the *Wermacht* during World War II support this assertion. Victory, therefore, cannot be the sole criteria for assessing military effectiveness. Victory is an outcome of battle, but it is not indicative of what a military organization accomplishes during battle. For the myriad factors that comprise military effectiveness, see Allen R. Millett, Williamson Murray, and Kenneth H. Watman, “The Effectiveness of Military Organizations,” in Millett and Murray, eds., *Military Effectiveness*, Volume 1: *The First World War* (Boston: Unwin Hyman, 1988), pp. 2–26; and Trevor N. Dupuy, “Measuring Combat Effectiveness,” in Stephanie G. Neuman and Robert Harkavy, eds., *The Lessons of Recent Wars in the Third World* (Lexington, Ky.: Lexington Press, 1985), pp. 76–77. According to Millett, Murray, and Watman, four types of military effectiveness—political, strategic, operational, and tactical—can be derived from the more general concept of military activity. See also Martin van Creveld, *Fighting Power: German and U.S. Army Performance, 1939–1945* (Westport, Conn.: Greenwood, 1982); and Trevor N. Dupuy, *A Genius for War* (Englewood Cliffs, N.J.: Prentice-Hall, 1977).

and military effectiveness. If my hypothesis is correct, military effectiveness and assimilation should covary.

This article has five sections. First, I examine the context in which recent transfers of technology and arms have taken place, with a focus on the economic incentives that continue to drive the arms market. Second, I briefly review the sociological approach to military effectiveness. Third, I discuss the operational approach to military effectiveness, contending that assimilation acts as a crucial conduit bridging the gap between weapons utilization and military effectiveness. Fourth, I present four cases to test my hypothesis that military effectiveness and assimilation covary. Fifth, I conclude that, for U.S. foreign policy, the benefits of conventional weapons proliferation far outweigh the costs. This is especially true when one considers that the elements most conducive to assimilation are also most prevalent in states friendly to U.S. interests.

Arms Transfers in the Post-Cold War Era

The proliferation of modern conventional weapons since the end of the Cold War has the potential to alter military balances in affected regions, perhaps culminating in instability and war. During the Cold War, arms transfer policies devised by the superpowers induced nonaligned states to commit to alliances and helped guarantee the physical integrity of extant alliance networks. In the post-Cold War era, however, economic necessity has replaced ideological dogma as the reason for the continued transfer of conventional weapons and technology. With many states slashing defense spending in the wake of the Cold War—and its corollary, shrinking domestic demand—sustaining indigenous production has become increasingly difficult, leading to what Richard Bitzinger calls “the globalization of the arms industry.” Bitzinger argues that the politico-economic reality of the post-Cold War world “entails a significant shift away from traditional, single-country patterns of weapons production toward internationalization of the development, production, and marketing of arms.”⁹ According to Ethan Kapstein, the ensuing erosion of autonomy in the design, development, and manufacture of arms could jeopardize the national security of those states most heavily involved.¹⁰ Consequently, the economics

9. For more on globalization and its implications, see Richard A. Bitzinger, “The Globalization of the Arms Industry: The Next Proliferation Challenge,” *International Security*, Vol. 19, No. 2 (Fall 1994), pp. 170–198, at p. 170.

10. Ethan B. Kapstein, “Explaining Arms Collaboration,” in Kapstein, ed., *Global Arms Production: Policy Dilemmas for the 1990’s* (New York: Lanham Press, 1992), pp. 1–28.

of arms production and military procurement have forced Western powers such as France and the United Kingdom to subsidize these activities by exporting as much as 40 percent of their defense production.¹¹ As competition for clients in the arms market stiffens, arms producers are forced to share more technology, resulting in an unfettered buyer's market. Below I consider arrangements through which technology is diffused and the implications that follow.

COLLABORATIVE ARRANGEMENTS

National security dictates that states should, whenever possible, steer an autonomous course in the production and procurement of arms. But fiscal and technical realities often militate against the pursuit of complete autonomy, forcing states to seek a middle ground. Given the importance of fiscal considerations both in sharing the costs of research and development (R&D) and in subsidizing the armed forces, the seller wants to share as little technology as possible while achieving both financial and security-related goals. The buyer, on the other hand, wants to acquire as much technology as possible, with similar (although not identical) financial and security-related objectives. Collaborative arrangements are the only means through which both parties may realistically achieve such goals. Generally, these arrangements result from compensatory agreements called "direct offsets." Typically, a direct offset refers to an agreement stipulating that, as a condition of purchase, technology is diffused from the seller, who also provides the necessary technical assistance. In a practical sense, direct offsets normally result in collaborative arrangements such as codevelopmental partnerships and coproduction agreements.¹²

For states in the technological core, codevelopment is the most popular collaborative instrument, because it presumes a level of technological competence that allows both states to benefit through reciprocal technology flows. In codevelopment projects, the parties work together in designing, developing, and manufacturing a weapon system throughout its life cycle. For states

11. The economics of arms production and military procurement includes, *inter alia*, maintaining the costs of R&D, defraying the costs of weapons for one's own armed forces, and maintaining an indigenous military industrial complex for the sake of domestic employment. For more on the need to subsidize defense industries, see William W. Keller, "Global Defense Business: A Policy Context for the 1990's," in *ibid.*, pp. 61–104.

12. According to Grant T. Hammond, a direct offset is "a compensatory device to 'offset' costs accruing with the purchase of a weapons system. In other words, the cost of a system is offset by an agreement where the states involved negotiate the percentage that the purchase is offset by." For more on offsets, see Hammond, "The Role of Offsets in Arms Collaboration," in *ibid.*, pp. 205–220, at p. 206.

outside the technological core, coproduction is the next best collaborative option and the most common type of direct offset. Coproduction permits the buyer to manufacture jointly a weapon system that has *already* been developed by the supplier. Both codevelopment and coproduction result in technological diffusion, because each provides a means of access for the indigenous scientific and military communities. They differ only in the direction of the flow: codevelopment is horizontal, whereas coproduction is vertical.

NONCOLLABORATIVE TRANSFERS

For national security purposes, licensed production is by far the best noncollaborative way to offset the purchase of expensive weapons through technology transfers. A standard licensing agreement consists of the transfer, or transnational sale, of the rights to manufacture a weapon system originally developed in the supplier's country. Licensing has a distinct advantage over collaborative agreements because a semblance of autonomy is maintained: continued production is not contingent upon a production arrangement with another state, which could potentially derail the procurement of key weapons. The least attractive option for technological diffusion is "straight-off-the-rack" importing. In this case, no concessions are won and no rights secured. Simply stated, it is a cash-and-carry transaction. Here the purchaser is vulnerable because arms are transferred but technology is not. Furthermore, the purchaser is wholly dependent upon the supplier state for spare parts.

In sum, globalization and the free market have combined to allow technology and arms to flow across borders practically unimpeded. States that are vying for regional hegemony and have the means to pay can often acquire the desired technology at nearly the same time as the producing state's armed forces.¹³ If this trend continues, it could alter the status quo in ways not conducive to the peaceful resolution of interstate conflict. As William Keller maintains, "The acquisition of weapons and military technology . . . change[s] the balance of power among nations. By exporting large quantities of potent weapons, the advanced industrialized states continue to build up the ability of renegade . . . nations to make trouble."¹⁴ Thus, at least theoretically, arms transfers and the diffusion of technology have the potential to militate against

13. For more on conventional weapons proliferation and its implications for supplier-recipient relations and the speed with which transfers now take place, see Christian Catrina, *Arms Transfers and Dependence* (New York: Taylor and Francis, 1988), p. 28.

14. Keller, "Global Defense Business," p. 76.

stability in developing regions. This conclusion, however, assumes that the states acquiring these weapons have some measure of technological competence with using (and repairing) them—an assumption that I challenge below.

A Sociological Approach to Military Effectiveness

Adherents of the sociological approach to military effectiveness argue that human factors derived from social structures and culture¹⁵ contribute to a state's ability to generate military power. They further contend that if social structural and cultural factors were not considered, it would be difficult, if not impossible, to understand the role of unit cohesion, politico-cultural effects, and education on military effectiveness. Before laying out the sociological approach, I discuss how culture insinuates its way into this study. For the purposes of this article, I leave aside difficulties with defining, much less operationalizing, culture.¹⁶ I focus instead on the effect that civil-military relations, as derived from culture, has on military power in developing states. Toward this end, I link them by identifying political culture as the mediator that logically separates civil-military relations and military power. That said, the validity of the sociological approach on military power should provide sufficient theoretical leverage to retain it as an explanatory variable.

SOCIAL STRUCTURE

In considering the effects that social structure can have on military capabilities, Stephen Rosen aims to explain a nonmaterial basis for how military power is generated.¹⁷ He suggests that neorealism cannot explain the production of different levels of military power from functionally similar units in an international system with comparable resources.¹⁸ Specifically, Rosen argues that the level of military power that a society is capable of generating is contingent upon its domestic social structure and the degree of insularity its military enjoys. To make his point, Rosen juxtaposes the cohesiveness of German

15. Although social and cultural systems are inextricably linked, they are still analytically distinct. See Carole Pateman, "Political Culture, Political Structure, and Political Change," *British Journal of Political Science*, Vol. 1, Pt. 3 (July 1971), pp. 291–301.

16. Michael Desch provides a useful discussion of the difficulties encountered when defining and operationalizing cultural variables. See Desch, "Culture Clash: Assessing the Importance of Ideas in Security Studies," *International Security*, Vol. 23, No. 1 (Summer 1998), pp. 141–170.

17. Stephen Peter Rosen, "Military Effectiveness: Why Society Matters," *International Security*, Vol. 19, No. 4 (Spring 1995), pp. 5–31. For a more complete exegesis, see Rosen, *Societies and Military Power: India and Its Armies* (Ithaca, N.Y.: Cornell University Press, 1996).

18. Rosen, *Societies and Military Power*, p. vii.

society with the class-bound, atomistic nature of Italian society, and argues that dissimilarities between the two social structures explain in part Germany's successes and Italy's failures during war. In short, he argues that class cleavages rooted in a state's social structure can be reproduced in the military, ultimately affecting unit cohesion.¹⁹

Equally relevant is the manner in which social structure affects the manpower pool available to the military.²⁰ If, for example, a society is structured in a way that allows its most capable citizens (in terms of education) to avoid military service, military effectiveness will suffer. To the extent that skills consistent with operating and maintaining modern weapons are contingent on literacy, a state that excuses members of the middle class from military service, for example, may encounter greater difficulty during wartime. Two factors can contribute to the dearth of personnel with the skills required to operate complex weapons. First, the vast majority of educated young men come from the middle class; in the case of developing states, this is typically a relatively small number. Second, but equally important, the middle class in developing states is generally well connected politically. Consequently, when war approaches and conscription becomes necessary, members of the middle class often manage to avoid the draft. The military is thus forced to rely upon uneducated conscripts to operate and maintain sophisticated equipment, thereby undermining military effectiveness.

CULTURE

In the context of this article, culture functions as the cognitive prism through which political beliefs are conceived and acted on, resulting in the formation of political culture. For conceptual clarity, the relationship between culture, political culture, and civil-military relations may be described as "serially embedded," with political culture embedded in culture and civil-military relations embedded in political culture. For better or worse, then, political culture informs civil-military relations by providing the political context in which the relationship between civil and military institutions develops. Indeed, the confluence of politics and culture may be viewed as "the historical develop-

19. For details on Italy's military ineffectiveness during World War I, see John R. Gooch, "The Italian Armed Forces in WWI," in Millett and Murray, *Military Effectiveness*, pp. 182–185.

20. To be sure, a leap of faith is not required in establishing the relationship between social structure—which includes social class—and manpower pools and their compositions. But because the relationship between social structure and manpower pools is critical, it needs to be explicit. For an account of social structure, see Rosen, *Societies and Military Power*, pp. 22–26.

ment of a given society produc[ing] different systems of 'non-political beliefs—such as feelings of basic trust in human relations, orientations toward time, and the possibility of progress . . . [which] can be of overriding importance' in shaping political institutions."²¹ Thus defined, political culture should have great influence on the kind of civil-military model that develops in a given state.

The political context of civil-military relations (i.e., political culture) is a critical factor in contributing to military effectiveness. Serving as a filter through which culture ultimately influences military effectiveness, political culture and the attending civil-military relationship have the potential either to undermine military effectiveness or to aid it. To elucidate this point, I draw on Morris Janowitz, who cites three basic models of civil-military relations: aristocratic, democratic, and authoritarian.²² In the democratic model "civilian-political elites control the military through a formal set of rules . . . exclud[ing] the military from involvement in domestic politics."²³ The authoritarian model, on the other hand, features a military that is controlled by a centralized, authoritarian, one-party system. In this model the military supports the political elite because the party boosts the resources at the military's disposal.²⁴ Both models of civil-military relations, *ceteris paribus*, predict opposite effects on combat readiness and effectiveness.

Political culture and civil-military relations can influence military effectiveness in two ways. First, military effectiveness is compromised when an autocrat, fearing a coup, withholds live ammunition from military exercises.²⁵ Absent live-fire exercises and realistic training, an army is potentially robbed of the ability to train under realistic conditions, undermining military effectiveness in the long run.

Second, and even more debilitating for overall effectiveness, is the politicization that typically occurs in authoritarian civil-military models. Janowitz describes the process of politicization as one in which "political control . . . is

21. See Lucien W. Pye, "Introduction: Political Culture and Political Development," in Pye and Sidney Verba, eds., *Political Culture and Political Development* (Princeton, N.J.: Princeton University Press, 1965), pp. 8–11.

22. Morris Janowitz acknowledges that the aristocratic model is somewhat anachronistic. See Janowitz, *Military Institutions and Coercion in the Developing Nations* (Chicago: University of Chicago Press, 1977), p. 79.

23. *Ibid.*

24. *Ibid.*, p. 80.

25. See Anthony Pascal, Michael Kennedy, and Steven J. Rosen, *Men and Arms in the Middle East: The Human Factor in Military Modernization*, R-2460-NA (Santa Monica, Calif.: RAND, 1979).

enforced by [the] infiltration of party members into the military hierarchy . . . and by control over the system of officer selection.”²⁶ This too undermines combat readiness, but in a different way. Political culture and civil-military relations affect readiness through the regime’s micromanagement of military affairs.²⁷ To facilitate this micromanagement, the party members and officers to whom Janowitz refers are appointed to key military posts—from division commanders to chiefs of staff. Although politically expedient, the politicization of the upper ranks of the armed forces damages military effectiveness, because these appointees are often selected more for their allegiance to the regime than for their skills in combat. Another negative consequence of politicizing the military is that the ideas of the best and the brightest can be stifled or muted by political appointees who are either senior to them or who enjoy the confidence of the head of the regime. Political nepotism and the sycophants who benefit can eventually cripple the regime, particularly in wartime, when these appointees often reveal their incompetence. A politico-military environment that supports the appointment of political loyalists to key military posts without consideration of their level of ability is one in which military effectiveness will not flourish.

It is almost beyond dispute that the sociological approach provides theoretical support in explaining military power in developing states. What happens, however, when two relatively evenly matched opponents meet on the battlefield? And what is the decisive factor if both states have a policy of universal military service and a command structure based on merit (two critical elements of the sociological approach)?

The Operational Approach

In discussing the operational approach to military effectiveness, I concentrate specifically on the methods of arms procurement and technological diffusion. At least two conditions must be satisfied for assimilation to occur in an arms-producing state, let alone in a state in which the technology does not originate. These conditions include (1) effective coordination of the state’s economic, technological-scientific, and military resources; and (2) the presence of industrial and developmental research institutions and military staffs with administrative arrangements linking these to high-level government decision-

26. Janowitz, *Military Institutions and Coercion in the Developing Nations*, p. 80.

27. Pascal, Kennedy, and Rosen, *Men and Arms in the Middle East*, p. 42.

makers.²⁸ Therefore, given the material and technological limitations of most non-Western states, the likelihood that assimilation will be successful cannot be taken for granted.

In the operational approach, technological diffusion is the conduit through which arms transfers result in successful assimilation. Specifically, the operational approach links arms transfer policies (and the concomitant diffusion) to military effectiveness, with assimilation mediating the process. To establish the relationship between technological diffusion and military effectiveness, I draw on cognitive psychological concepts to account for differences in successful and unsuccessful assimilation. I contend that the relative ability to modify and maintain modern conventional systems can be decisive on the battlefield when otherwise equally matched belligerents (in sociocultural terms) go to war. Careful consideration of the operational approach to military effectiveness, specifically assimilation, should increase the accuracy of net assessments for developing states, because if the likelihood of assimilation can be determined, a better estimate of prospective military effectiveness is possible. Illuminating the relationship between assimilation and military effectiveness first requires an understanding of the technical and operational components of assimilation.

TECHNICAL ASSIMILATION

To have a meaningful impact on the operational approach, technical assimilation must be linked to technological diffusion; declarative and procedural knowledge act to bridge this gap. Declarative knowledge consists of information that may be described as “book knowledge”; procedural knowledge is the ability to learn through hands-on experience. When applied to assimilation, this theory of cognition explains the indispensability of technology transfers to expeditious and efficient assimilation. According to one study, when declarative and procedural methods are brought to bear, problem solving in mechanical aptitude tests can increase significantly.²⁹

States that procure weapons through arms transfers (as opposed to technology transfers) are similar to a control group that is forced to rely strictly upon instruction, hence exercising only declarative knowledge. States that rely on

28. Dupuy, *The Evolution of Weapons and Warfare*, pp. 305–306.

29. Cognitive psychologists have proven that the most effective learning occurs when both methods of knowledge acquisition are employed. For instance, in problem-solving exercises, studies have shown that subjects who were given only abstract instructions or an example using hands-on learning scored significantly lower than subjects who were provided with both instructions and examples. In one study, only 13 percent of the subjects were able to solve problems when supplied

reverse engineering (i.e., a weapons acquisition policy with an emphasis on replication through duplication without a formal agreement) as their method for technological diffusion and procurement realize few if any benefits from this practice.³⁰ In a practical sense, the process begins when one party makes an off-the-rack purchase from another party, after which the purchaser disassembles the item to evaluate how it works, then reassembles it. States that depend on reverse engineering as their principal means of technology transfer find themselves in a situation similar to that of the second control group in which only procedural knowledge is exercised to the exclusion of declarative knowledge, with sub-par results.

OPERATIONAL ASSIMILATION

The key to successful operational assimilation is the ability to modify a weapon after it has been procured and adopted—and after procedural and declarative knowledge have become effective. In many cases, modification is necessary to compensate for topographical and climatic differences in the physical strategic environment that often exist between the supplier and the recipient state's proposed theater of operations. When compensatory modifications are not made, the imported system can either function below expectations or fail entirely.³¹ Moreover, the ability to modify facilitates the alteration of nonindigenous weapons to specifications consistent with the requirements of the recipient's tactical goals. In this instance, the imported system (tank, aircraft, or ship) is little more than a platform that is converted for use with augmenting

simply with instructions (declarative knowledge), while subjects given an example where hands-on learning was emphasized were able to solve 28 percent of their problems (procedural knowledge). In contrast, when the methods are combined, the study shows that the problem-solving success rate increases to 40 percent. See John R. Anderson, *Cognitive Psychology and Its Implications*, 4th ed. (New York: W.H. Freeman, 1995), pp. 242–244. See also S.K. Reed and C.A. Bolstad, "Use of Examples and Procedures in Problem Solving," *Journal of Experimental Psychology: Learning, Memory, and Cognition*, Vol. 17, No. 4 (Spring 1991), pp. 753–766.

30. China has had a troubled history with reverse engineering since it began relying on it as the principal means of arms transfer after the Sino-Soviet split in the early 1960s. With rapprochement nowhere in sight, Moscow removed the technical manuals and schematics from Chinese arms procurement, leaving Beijing with only physical access. China's difficulty with reverse engineering includes problems with the MiG-21, MiG-23, T-62 tank, and British Tornado. This difficulty is indicative of the inherent limitations of relying too heavily on a method of arms procurement that emphasizes reverse engineering. For more on China's reverse engineering policy, see Michael G. Gallagher, "China's Illusory Threat to the South China Sea," *International Security*, Vol. 19, No. 1 (Summer 1994), pp. 180–181. According to Onkar Marwah, North Korea also pursues reverse engineering as the principal vehicle for technological transfers. See Marwah, "India's Military Power and Policy," in Marwah and Jonathan D. Pollack, eds., *Military Power and Policy in Asian States: China, India, Japan* (Boulder, Colo.: Westview, 1980), p. 134.

31. Gerald M. Steinberg, "Indigenous Arms Industries and Dependence," *Defense Analysis*, Vol. 2, No. 4 (December 1986), p. 299.

systems designed for the tactical environment.³² Because the weapons are now “tailor made,” the sum of these changes should result in greater military effectiveness.

Although close coordination between the military and the scientific sector is not an independent variable, it is nevertheless part of the assimilation process. Thus, for the purposes of this study, I designate it to be an intervening variable, because it is through such close coordination that the scientific sector can make the necessary modifications to the weapon systems based on the military’s requirements and recommendations.³³ Military officers assigned to R&D posts should gain a better appreciation of the fit between weapons and technology, and the strategic objectives and tactical missions for which they are designed.

Case Studies

Along with the principal objective of this article, theory building, the case studies were selected to satisfy both practical (policy relevance) and methodological considerations. To this end I focus on two regional powers, Egypt and India, both of which have been involved in medium-intensity conventional wars.³⁴ Methodologically, I aim to show that controlling for the effects of other possible explanatory variables, the key causal variable (method of arms procurement) covaries with the dependent variable (military effectiveness).³⁵

No real consensus exists on what military effectiveness is, much less how to measure it. I therefore rely on anecdotal evidence and quasi-empirical indicators to make inferences about the relationship between assimilation and military effectiveness. I use three indicators to measure assimilation: (1) Trevor

32. For example, the Israeli air force maximized the tactical capabilities of jets purchased from France by adding to the aircrafts’ existing electronic suite. See Stuart Reiser, *The Israeli Arms Industry* (New York: Holmes and Meier, 1988), p. 53.

33. Specifically, Dupuy refers to great power assimilation of weapons produced indigenously in the mid-twentieth century; the process of assimilation should also apply to assimilation in developing states. Dupuy, *The Evolution of Weapons and Warfare*, p. 306.

34. Michael Klare divides conflict into three spectrums: low, medium, and high. In this scheme low-level conflicts are guerrilla wars and other limited conflicts fought by irregular units. Medium-intensity conflicts are regional wars fought with modern weapons; by Klare’s account, the Iran-Iraq War is an example of such a conflict. High-intensity conflicts are global conventional wars; World Wars I and II are examples. Given these distinctions, insurgency and counterinsurgency campaigns are not considered. Thus conflicts such as Vietnam and Bosnia are omitted. For more on conflict classification and low-intensity war, see Klare, *Low-Intensity Warfare: Counterinsurgency, Proinsurgency, and Antiterrorism in the Eighties* (New York: Pantheon, 1988).

35. Because the present inquiry is an exercise in theory building, comparative case study is my method of choice—particularly the method of difference in conjunction with the plausibility probe. See John Stuart Mill, *A System of Logic*, Books 1–3, ed. J.M. Robson (Toronto: University of Toronto Press, 1973), chap. 8, pp. 388–406. The plausibility probe, according to Harry Eckstein, is a low-cost,

Dupuy's indicators for successful assimilation; (2) mission capability; and (3) the arms proliferation ladder. I estimate operational assimilation as the degree to which the weapons procured conform to Dupuy's four criteria for successful assimilation: confident employment with existing systems, offensive flexibility, the ability to deal with countermeasures, and decreasing casualties for the employing side with increasing casualties for the opposition. To measure technical assimilation, I use mission capable (MC) rates. The chief factors determining the MC rate are the ability to maintain aircraft and battlefield attrition rates.³⁶ The arms proliferation ladder, according to James Nichol, estimates the arms production capability of a state on any given weapon system. The ladder is coded from the lowest value of 1, at which the state has on-site maintenance and overhaul facilities, to the highest value of 7, or full indigenous design and production. Thus the arms proliferation ladder serves as the indicator that measures the extent to which technology is diffused by the "rung" upon which the state is situated, with the first rung, for example, indicating the lowest level of diffusion.³⁷

Based on these criteria, the following four cases should serve as valid tests of the operational approach to military effectiveness: Egypt's wars with Israel in 1967 and 1973, and India's wars with Pakistan in 1965 and 1971. At first

efficient way to determine whether a set of hypotheses warrants further research. See Eckstein, "Case Study and Theory in Political Science," in Fred I. Greenstein and Nelson Polsby, eds., *Handbook of Political Science*, Volume 7 (Reading, Mass.: Addison-Wesley, 1975), pp. 108–113.

36. The mission capable rate is the percentage of aircraft that are capable of carrying out their specified missions at any given time. In addition to MC rates, Pascal employed a more subjective method of measuring assimilative capacity: informed judgment. For example, Pascal asked Americans responsible for training indigenous personnel their opinion regarding the capabilities of states to assimilate these systems. By his own admission, Pascal recognizes that this approach is problematic because of its inherently subjective nature. Pascal, Kennedy, and Rosen, *Men and Arms in the Middle East*, p. 19.

37. The coding values of the ladder are (1) the presence of on-site maintenance and overhaul facilities in the purchasing state; (2) the negotiation of licenses for the domestic assembly of a particular system, and the assembly of kits; (3) the fabrication of simple components domestically under license, but sophisticated components (such as engines and electronics) continue to be imported; (4) a decrease in the number of components for a given system that must be imported, until a point is reached where the developing state can be said to produce the entire system under license; (5) the local design of the components for weapons systems and incorporation into existing systems; (6) the production of domestically designed systems that begins initially with the use of imported components that embody more sophisticated technologies beyond the capabilities of developing manufacturers; and (7) the manufacture of indigenously designed systems incorporating no imported components. See James P. Nichol, "The Soviet Union," in James Everett Katz, ed., *The Implications of Third World Military Industrialization: Sowing the Serpents' Teeth* (Lexington, Ky.: Lexington Press, 1986), p. 72. Nichol pioneered the term "conventional proliferation ladder," and Michael Moodie later refined it. See Moodie, "Defense Industries in the Third World: Problems and Promises," in Neuman and Harkavy, *Arms Transfers in the Modern World*, p. 299.

glance, the age of the cases may give pause to any attempt to apply inferences drawn from them to contemporary cases. Close examination, however, reveals that these cases should acquit themselves well considering my principal objective (theory building) and the ability of the cases to withstand methodological scrutiny. First, both countries were and are regional powers that fought the same adversary six years apart. Second, both were client states of the Soviet Union during the assigned period; this allows for the control of technological differences. Third, both fought adversaries equipped with U.S. weapons. And most important, both deployed a common weapon system—the MiG-21—which allows for the assessment of comparative assimilative capability by measuring the efficiency and effectiveness of the system. The ability to control for these factors allows the methodological advantages to mitigate objections raised on grounds of contemporary relevance. The Egyptian cases demonstrate the ultimate futility of policy adjustments aimed at everything but the method of arms procurement; alternatively, the Indian cases illuminate the efficacy of policy objectives aimed directly at the method of arms procurement. The differences between the two sets of cases provide empirical support for my hypothesis.

The following assertions should hold if my hypothesis is correct that the method of arms procurement is the key to the assimilation and eventual conversion of nonindigenous weapons and technology. First, states with access to technology through coproduction or licensing agreements normally receive technical assistance from the licensor to expedite the construction of production facilities and to ease the transition from consumer to on-site producer. This process should give developing states that import technology a better grasp both technically (procedural and declarative knowledge) and operationally (the ability to modify) than it does states that fail to emphasize such a policy. Second, states that benefit from the diffusion of technology, and whose militaries are actively involved in R&D, will be more successful in assimilating nonindigenous weapons than states that have neither a policy conducive to diffusion nor active military participation, or that possess only one of the above.

EGYPT, 1967

The Free Officers' Movement seized power in Egypt in 1951. The officer corps, led by Gamal Abdel Nasser, then joined forces with leading economic, administrative, and political groups in a bid to share power. Officers loyal to Nasser who chose to leave active duty began occupying high-level government posts

almost immediately. Between 1952 and 1964 approximately 1,500 officers fit into this category.³⁸ Accelerating the transition toward a politicized military was a second category of officers who benefited from further training at the Institute of Higher Studies of National Defense, which came into existence, not coincidentally, in 1952. Officers who attended this prestigious institution enjoyed great respect from the new regime and, subsequent to staff appointments, were granted disproportionate authority in military *and* political decisionmaking. Backed by Nasser, these new general staff officers, together with the technocratic elite, successfully challenged their civilian counterparts, resulting in the growing politicization of the military. As the evidence indicates, this increasing politicization was the principal cause of Egypt's defeat in the 1967 Six-Day War.

CULTURE. Consonant with the hypothesized effects of military politicization (in which wartime failure may be traced to appointments based on loyalty instead of talent) was the incompetence and cowardice demonstrated by the Egyptian high command. Field Marshal General Abd el Hakim Amer (who was also chief of staff) and his field commanders personified these undesirable traits.³⁹ Charged with command responsibilities and coordination of the combined Arab forces, General Amer set the tone for the performance of senior Egyptian officers. Stunned by the ferocity of the Israeli air campaign, Amer was initially unable to issue instructions to his ground forces even though the Egyptian battle plan had anticipated the intensity of the Israeli counteroffensive.⁴⁰ Instead of heeding the counsel of subordinates who implored him to stay the course, Amer inexplicably issued orders to retreat,⁴¹ a tactical blunder that contributed to Egypt's strategic defeat. Initially operating from a tactical disadvantage, the Egyptian forces were further hindered by two political appointees serving as commanders of the Second and Third Infantry Divisions deployed to the Sinai. The Second Infantry Division, considered one of Egypt's finest before the 1967 war, was led by Major General Sadi Naguib, a man of limited competence. According to Dupuy, Naguib's "only apparent qualifica-

38. Notably, officers who did not retire after Nasser took power were stripped of all rank and privileges prior to assuming these government posts, which consisted of positions such as senior diplomatic and cabinet ministerial posts. See Anouar Abdel-Malik, *Egypt: Military and Society* (New York: Random House, 1968), pp. xxvii–xxviii.

39. Trevor N. Dupuy, *Elusive Victory: The Arab-Israeli Wars, 1947–1974* (New York: Harper and Row, 1978); and Kenneth B. Pollack, "The Influence of Arab Society on Arab Military Effectiveness," Ph.D. dissertation, Massachusetts Institute of Technology, 1996.

40. The plan encompassed a defensive-offensive strategy in which Egyptian forces allowed the Israelis to puncture their defense, luring them into a designated "kill zone." *Ibid.*, pp. 266–267.

41. *Ibid.*

tion for command was his experience as drinking companion of Field Marshal Amer."⁴² Naguib's Third Infantry Division counterpart and another Amer confidant was Major General Osman Nasser (no relation to the president). Nasser was also a political appointee who was later court-martialed for incompetence and cowardice after the 1967 campaign. Unfortunately for Egypt, these highly undesirable traits were more the rule than the exception during the June campaign.

SOCIAL STRUCTURE. Placing the preponderance of blame for Egypt's defeat on the politicization of the military is fairly easy. But social structure affected the conduct of war as well insofar as middle-class conscripts served less time (if any) in the armed forces than their lower-class brethren. This is significant because the illiteracy rate for Egyptian males hovered around 60 percent,⁴³ which at the time was exceptionally high for a developing state. Among Egyptian conscripts, however, the rate was at least 15 percent higher. Although a "new" conscription policy calling for universal military service was putatively installed after the Free Officers seized power, the old system, which under King Farouk allowed the middle class to avoid compulsory service, remained intact. This continued deference to the middle class may be viewed as Nasser's recognition of the politico-economic reality at the time. Specifically, Nasser's goal of industrial expansion required the cooperation of the middle class. Thus his pursuit of infrastructural objectives seemed to supersede his dislike of the bourgeoisie and forced him to accede to their demands to exempt their offspring from military service. In sum, the military was dealt a devastating blow because it was forced to draw on a manpower pool that lacked Egypt's most capable citizens.

ASSIMILATION. In 1955 Nasser had leveraged Egypt's strategic importance during the Cold War by aligning with the Soviet Union in a partnership that included a bilateral arms deal. To alleviate Egypt's dependency on the Soviet Union, however, Nasser sought to establish an indigenous major arms-production capability. This lofty political objective, however, would eventually backfire.

Although the Soviets were extremely generous with the terms of the arms transfer agreement, they steadfastly refused to share their technology with the Egyptians, a position that was consistent with their vigilance against industrial espionage. Soviet reluctance was not confined to the transfer of technology,

42. Dupuy, *Elusive Victory*, p. 239.

43. These findings are based on census data from 1960. The illiteracy rate is based on a composite of both rural and urban males starting at age ten. *Statistical Yearbook, 1976* (Geneva: United Nations Educational, Scientific, and Cultural Organization, 1976), p. 42.

however. To foster Egyptian dependence on Soviet arms, the Soviets refused to aid Egypt in developing an indigenous arms industry. According to Michael Barnett, "This produced the intended effect: Egypt became more dependent on the Soviet Union for its military needs."⁴⁴ Nasser's turn toward the Soviet Union obviously made it extremely difficult to achieve his goal of total independence, because the Soviets were the sole suppliers of weapons and technology for the Egyptian military. Recognizing how debilitating this dependence could be, Nasser turned to the West for the technology Egypt needed to begin the indigenous production of modern weapons.⁴⁵ But Nasser's willingness to add Egypt to the Soviet Union's constellation of states, letting it serve as Moscow's key outpost in the Middle East, had alienated the West, and the technology never materialized. Thus, without the ability to modify, much less replicate, the Soviet weapons, Egypt became increasingly dependent on the Soviet Union for the continued supply of weapons and technology.

EGYPT, 1973

After Egypt's defeat in 1967, Nasser set out to rectify the shortcomings he believed had been responsible for this outcome. Both he and his successor, Anwar Sadat, went to great lengths to depoliticize the Egyptian military. In particular, they expanded the conscription pool to include the middle class, thus increasing the skill level of the Egyptian forces. The Soviets did their part by boosting their contribution to Egyptian readiness, pouring in "advisory" personnel and swelling the Soviet military presence in Egypt from 500 to 15,000 in 1968. Live-fire exercises and the rehearsal of Oplan Badr (the surprise attack of Israel in 1973) also contributed to combat readiness by preparing Egypt's troops for the 1973 assault under authentic conditions. When one adds to this Soviet acquiescence to Egyptian demands for weapons comparable to, if not exactly the technological equivalent of, Israeli weapons,⁴⁶ it appears that Egypt was better off in 1973 than 1967. Sole reliance on the sociological approach, then, would indicate that Egyptian military effectiveness should have im-

44. See Michael N. Barnett, *Confronting the Costs of War: Military Power, State, and Society in Egypt and Israel* (Princeton, N.J.: Princeton University Press, 1992), p. 101.

45. In his drive to make Egypt self-sufficient, Nasser successfully contracted with West German, Swedish, and French firms to produce a small arms factory in 1954. And in 1960 he established the Helwan Engine Company to produce engines intended for jet training aircraft. For a more detailed discussion of Egypt's bid for self-sufficiency, see R. Vayrynen and T. Ohlson, "Egypt: Arms Production in the Transnational Context," in Michael Brzoska and Thomas Ohlson, eds., *Arms Production in the Third World* (London: Taylor and Francis, 1985), p. 107.

46. Dupuy, *Elusive Victory*, p. 598.

proved. But, as I show, Egypt's inability to both modify and maintain its equipment explains, at least partially, Egypt's failure to achieve the level of improvement it sought regardless of its radical policy adjustments. For despite having been caught completely off guard, the Israeli forces recovered quickly and, according to Dupuy, were fighting on equal terms after three days. This recovery constituted one of the most remarkable comebacks in military history⁴⁷ and vitiated the sociological approach in the process.

CULTURE. Nasser's immense popularity at home helped him escape direct criticism for Egypt's dismal showing in 1967. The Egyptian military, however, did not fare as well; its poor performance resulted in the court-martial of more than 140 officers. The Egyptian air force suffered the brunt of Nasser's criticism, while the army emerged relatively unscathed.⁴⁸ Embarrassed by the performance of their proxy, the Soviets pointed to the politicization of Egypt's armed forces as the reason for its failure in 1967. They noted that there appeared to be "a type of officer-businessman who was more concerned with business than with the combat training of soldiers and NCOs."⁴⁹ As a result, Nasser purged the military of approximately 500 officers, including his close friend, Field Marshal Amer. The purge, however, was not completed until Nasser replaced the former military officers in government with civilians. At the time of Nasser's death in 1970, Egypt's military reform campaign had not been completed. But Anwar Sadat, who was equally chagrined at the 1967 rout, put to rest any doubts that reform would continue.

In an effort to depoliticize the Egyptian forces, Sadat installed the highly competent and apolitical General Ahmed Ismail as commander in chief in 1972.⁵⁰ Ismail, recognizing Egypt's strength in defensive operations, opted for a limited-aims strategy (Oplan Badr).⁵¹ Oplan Badr consisted of the following: first, Ismail would attack the western Sinai, after which Egyptian forces would advance across the Suez Canal; second, the Egyptians would seize five or more bridgeheads 10–15 kilometers deep on the eastern bank of the canal; finally,

47. In fact, Dupuy states that the Israeli forces improved their combat efficiency value compared with the value they achieved in 1967. *Ibid.*, p. 599.

48. Nasser singled out the air force because he felt that it had never really supported his social revolution. The air force, Nasser believed, had tried to undermine his efforts to democratize the National Assembly. See Alvin Z. Rubenstein, *Red Star on the Nile* (Princeton, N.J.: Princeton University Press, 1977), p. 23.

49. *Ibid.*

50. Dupuy, *Elusive Victory*, p. 482.

51. For a comprehensive look at conventional warfare strategies, see John J. Mearsheimer, *Conventional Deterrence* (Ithaca, N.Y.: Cornell University Press, 1983); on pp. 29–30, Mearsheimer illustrates the anatomy of a limited-aims strategy.

they would repel Israeli counterattacks and inflict maximum punishment upon the Israeli forces.⁵² What resulted from Oplan Badr, in contrast to the war planning that occurred in 1967, was the professional planning, implementation, and successful execution of one of Egypt's most important military operations in the twentieth century. Under Ismail's leadership, Egypt achieved a standoff in 1973⁵³ that, in the final analysis, was far removed from the humiliation suffered in 1967.

SOCIAL STRUCTURE. Nasser's disappointment with the Egyptian military's dismal performance in 1967 contrasted with his awe of the Israelis' performance. The most tangible difference between them lay in the quality of their soldiers. This finding is not surprising given the lack of participation of the Egyptian middle class. Israel's relatively small population base forced it to call on 98 percent of its people to help ensure its survival, which guaranteed a large presence of educated conscripts. The net effect was that significant numbers of educated conscripts manned its forces. Nasser also observed that class cleavages affected the performance of his forces, and that such cleavages were minimized in the Israeli military.⁵⁴ These, Nasser thought, were the critical differences that had perhaps cost Egypt the 1967 war.⁵⁵

Adopting a policy of universal conscription similar to Israel's proved to be the most expedient way for Nasser to address the deficiencies he attributed to social structural variables. In doing so, Nasser reasoned that widening the conscription net would ensure that the Egyptian forces benefited from the infusion of technical talent from the educated classes. This action resulted in the addition of 35,000 college graduates to the conscription pool in 1969, spurring the growth of the officer corps and, as Nasser had anticipated, an increase in the technological expertise that accompanied the expansion.⁵⁶ Finally, the devastation and embarrassment experienced in 1967 helped to galvanize Egyptian nationalism, healing social cleavages in the process and improving unit cohesion.

ASSIMILATION. In the aftermath of the 1967 war, fully 80 percent of Egyptian equipment had to be replaced. By war's end, Egypt was left with only 160 of

52. Dupuy, *Elusive Victory*, pp. 389–390.

53. *Ibid.*, p. 544.

54. Barnett, *Confronting the Costs of War*, pp. 123–124.

55. *Ibid.*

56. For an excellent account of the prelude and aftermath of the 1967 war in both Israel and Egypt, see *ibid.*, p. 125.

the more than 500 combat aircraft and only 400 of the 1,200 main battle tanks it had at the start of the conflict.⁵⁷ By the end of June, however, the Soviets had provided more than 200 MiG-21s, and by October they provided an additional 100 MiGs.⁵⁸

For the reasons cited above, when compared to their Israeli counterparts, Egypt's MC and sortie rates were relatively low, as the Soviets continued to refuse to share technology with Egypt going into the 1973 campaign.⁵⁹ A comparison of Egyptian and Israeli sortie rates drives home the point: Israel reported 10,500 sorties (the theoretical maximum was 11,000), whereas the Egyptians mustered only 6,815. In addition, a comparison of the relative MC rates illustrates Egypt's relative failure to assimilate the MiG-21: whereas the Israeli MC rate for combat aircraft was 80 percent, the Egyptian MC rate hovered around 65 percent.⁶⁰ Thus, even after the relative depoliticization of the Egyptian military and Nasser's adoption of universal conscription, assimilation increased only marginally.

The performance of the Egyptian forces is better understood if one examines how assimilation influences military effectiveness. To be sure, there was improvement after 1967, but if we take Dupuy's criteria into consideration, the attainment of operational assimilation is highly questionable. The only criterion the Egyptians, arguably, met was the coordination of the newly acquired system with existing assets. At first glance, the MiG-21s performed admirably when supported by the Soviet surface-to-air (SAM) umbrella, making their performance appear consistent with criteria indicative of nascent assimilation. Close inspection, however, reveals Soviet participation in such air defense operations, making the claim of assimilation highly dubious. Further, without the cover of the SAM umbrella, the Egyptian pilots were ordered to stay clear of the Israeli air force.⁶¹ The mere fact that Egyptian pilots were instructed not to engage Israeli pilots is sufficient to reject compliance with the remainder of Dupuy's criteria for operational assimilation, indicating the moderate level of assimilation achieved.

57. Anthony McDermott, *Egypt: From Nasser to Mubarak* (New York: Croom Helm, 1988), p. 158.

58. *Ibid.*

59. Anthony Cordesman and Abraham Wagner, for instance, note that "Arab forces did . . . suffer from external problems. . . . The USSR seriously restricted the availability of many key systems." See Cordesman and Wagner, *The Lessons of Modern War: The Arab Israeli Wars, 1973-1989*, Volume 1 (Boulder, Colo.: Westview, 1990), p. 355.

60. Dupuy, *Elusive Victory*, p. 550.

61. *Ibid.*, p. 548.

INDIA, 1965

In India's 1965 war with Pakistan, both the sociological and operational approaches accurately predict the performance of the Indian military. The sociological approach demonstrates that the lack of material resources can be overcome by talented leaders and skill. Although technologically deficient, the Indian air force still managed to fight better-equipped Pakistani forces to a draw. The air force's exceptional performance demonstrates that individual skills and steady, talented leaders matter. The assimilation variant of the operational approach is also useful in analyzing this case, because it shows that leadership and exceptional individual skills, although important, are not enough to ensure sufficient military effectiveness. But the impressive performance of the Gnat fighter-interceptor, coproduced with Folland of Great Britain, however, would foreshadow later events,⁶² such as the wisdom of adopting an arms procurement policy that emphasized technological transfer versus a simple transferral of arms.

CULTURE. As a democracy, postindependence India continued in the British tradition of maintaining separate spheres of influence for politicians and soldiers. The British model of civil-military relations was strengthened by three organizational changes that were implemented in 1947. First, the position of commander in chief was abolished, which led to incessant infighting among the chiefs of staff of all three services: because each possessed equal rank, none wished to defer to the other.⁶³ Second, the Defense Ministry was expanded, which undermined military authority in the decisionmaking process by including more civilians and affecting the control of information. Third, the state increased the (government service) rank of civilians in the Defense Ministry vis-à-vis their military counterparts,⁶⁴ thus reinforcing civilian control of the military. The intended result was achieved because the British model of civil-military relations kept political and military spheres separate, which contrib-

62. The Indian government had already entered into coproduction agreements with Folland in 1957 to produce the Gnat fighter-interceptor (later renamed Ajeet), and with the British manufacturer Vickers-Armstrong in 1963 to coproduce the Chieftain tank (now known as the Vijayanta). See Raju G.C. Thomas, *Indian Security Policy* (Princeton, N.J.: Princeton University Press, 1986), p. 252.

63. After the position of commander in chief was abolished, the committee of the chiefs of staff was established. Although the committee had been able to work together, this arrangement proved an impediment to interservice coordination during the 1965 war, as each branch essentially fought its own war. *Ibid.*, pp. 128–129.

64. *Ibid.*, pp. 172–173.

uted to maximizing military organizational effectiveness by diluting the influence of the military in political decisionmaking.⁶⁵

SOCIAL STRUCTURE. The Indian armed forces, unlike many of the world's largest militaries, had no conscription policy. Instead it relied on a professional, all-volunteer force. Prior to the war with Pakistan in 1965, army officers were drawn primarily from the upper classes. But after the Sino-Indian War of 1962, in which the Chinese army decisively defeated the Indian army, the allure of a military career declined somewhat for upper-class Indians. For the middle class, however, the attractiveness of a career in the military increased. Thus, when members of the upper class began choosing not to join the military, the middle class, led by unemployed engineers, stepped into the breach. The large influx of engineers into the Indian armed forces had a dual effect: the military provided a viable career alternative for jobless engineers at the same time that it benefited from the presence of a cadre of skilled soldiers, sailors, and airmen. As India's armed forces became flush with highly skilled personnel during the mid-1960s, the military experienced a technological explosion that, as indicated below, led to successful assimilation.

ASSIMILATION. China's defeat of India in 1962 and India's continued technical difficulties with its indigenous production of the HF-24 Marut fighter-interceptor forced New Delhi to deviate from its declared policy of nonalignment. In 1962 India signed an arms pact with the Soviet Union that was designed both to ease India's dependence on Britain (its sole arms supplier) and to serve as a springboard to technological development for its nascent aircraft industry. As the centerpiece of the agreement, the MiG-21 would, India hoped, replace the Marut. Of equal importance, India stipulated that Soviet technology for the MiG-21 would have to be transferred or the deal would be terminated; the Soviets capitulated.⁶⁶ Thus in 1962 India embarked on a large-scale policy of licensing, the efficacy of which Raju G.C. Thomas explains as follows: "The policy of licensed coproduction in India in collaboration with an overseas manufacturer has been most favored by the government of India in recent years. This policy constitutes a compromise between overseas purchase and indigenous design, development, and production. The production of foreign weapons made under license in India implies access to modern technology available abroad while also promoting technical know-

65. Stephen Cohen, *The Indian Army: Its Contribution to the Development of a Nation* (Berkeley: University of California Press, 1971), pp. 172–173.

66. Marwah and Pollack, *Military Policy and Power in Asian States*, p. 122.

how in India.”⁶⁷ The coproduction agreement with the Soviet Union is significant because until 1962 no country outside the communist bloc had benefited from the transfer of Soviet technological know-how.⁶⁸ While pursuing a policy objective dubbed “matching capabilities,” Prime Minister Jawaharlal Nehru justified these purchases by citing the need to balance U.S. arms transfers to Pakistan.⁶⁹

When hostilities broke out between India and Pakistan in 1965, India’s defense program yielded very few returns on the coproduction agreement reached with the Soviets in 1962. The Gnat, on the other hand, performed reasonably well against Pakistan’s F-86s and F-104s,⁷⁰ and presaged the impact of technology transfers and military effectiveness. In general, however, Pakistan’s technology outclassed India’s. However, even though Pakistan possessed superior firepower, its pilots had trouble handling the supersonic F-104. Pakistani tankers also had difficulty mastering the automatic fire control computer installed in their U.S.-manufactured Patton tanks. During the conflict, however, the aircraft operated by the Indian air force were routinely outperformed by the more advanced U.S. hardware manned by the Pakistani forces.

INDIA, 1971

With Indian sociological variables remaining constant between the 1965 and 1971 wars, the superior performance of India’s armed forces in its 1971 war with Pakistan is easily explained when the process of assimilation is considered. In both wars culture had a positive impact on civil-military relations insofar as the structure of Indian society continued to permit the best and the brightest to participate in the armed forces. The only discernible differences during the interwar years included increased access to Soviet technology

67. Raju G.C. Thomas, “India: The Politics of Procurement,” in Katz, *The Implications of Third World Military Industrialization*, p. 156. By 1965 India had successfully produced more than 100 HAL/Folland Gnats. See Nisha Sahai Achutan, *Soviet Arms Transfers in South Asia* (New Delhi: Lancer International, 1988), p. 25.

68. Soviet strategic objectives explain why India was the first state outside the communist bloc permitted to transfer Soviet technology. As the Sino-Soviet split deepened and its intractability became apparent, the Soviets needed a regional ally to force China to consider the possibility of a two-front war. Thus India’s nonalignment policy provided it with considerable political leverage as the Soviets sought to balance China. Egypt, on the other hand, did not possess such leverage. See Raju G.C. Thomas, *The Defense of India: A Budgetary Perspective* (Delhi: Macmillan, 1978), pp. 54–55.

69. Thomas, *Indian Security Policy*, p. 22.

70. As Michael Carver notes, the Pakistani pilots were unable to exploit the technological superiority of their F-104 fighters vis-à-vis the Gnat because the Gnat operated at low altitude, a level at which the Pakistani pilots experienced difficulty maneuvering their Starfighters. See Carver, *War since 1945* (London: Weidenfeld and Nicholson, 1980), p. 225.

(which reached the fourth level on the proliferation ladder), the participation of the military in R&D, and the establishment of the Defense Research and Development Organization (DRDO). Much of the success of India's air operations can be attributed to the confluence of the transfer of technology through coproduction, military input in the R&D process, cognitive learning theory, and the ability to modify weapon systems. The sum of these events, which led to India's success, demonstrates the validity of an approach that includes the assimilation process.

ASSIMILATION. The expansion of India's arms industry coincided with the termination of the Indo-Pakistani War of 1965. As a result of a Western arms embargo that was imposed during the hostilities, the Indian government began to realize that dependence on another state could jeopardize national security by affecting its ability to prosecute a war. The Indians therefore pressed the Soviets to complete the factories they had agreed to build as well as initiate the technical assistance promised in 1964 as quickly as possible.⁷¹ This agreement called on the Soviets to deliver 90 MiG-21s between 1965 and 1967 and to provide technical assistance in conjunction with factories to be built, with the goal of delivering more than 200 MiGs after the initial production run.⁷² The pact resulted in the production of 196 Hindustan Aeronautics Limited (HAL) MiG-21s between 1967 and 1974 with 60 percent indigenous content.⁷³

In addition to these successful production runs, the Indian air force modified the MiG-21s to its specifications. Led by the DRDO, these modifications both expanded the MiG-21's capability from intercept to attack-intercept and, with the installation of electronic countermeasure packages, reduced its vulnerability.⁷⁴ Moreover, in 1968 the military participated in R&D with the deputation of air force officers to HAL in order to increase their technological competence.⁷⁵ By 1971 indigenization of the HF-24 reached 70 percent, the MiG-21 60 percent, and the Gnat 80 percent.⁷⁶ The MC rate of the MiGs reached 70 percent at the height of the war.⁷⁷

The MiG-21 modifications not only allowed India's air force to attain air superiority vis-à-vis the older but still technologically superior F-104s, but they

71. See Chris Smith, *India's Ad Hoc Arsenal* (New York: Oxford University Press, 1994), p. 82.

72. Achutan, *Soviet Arms Transfers in South Asia*, p. 40.

73. *Ibid.*

74. One of the DRDO's functions is to work hand in hand with the military to ensure that modification requests conform to the standards of the Indian armed forces. See Thomas, *Indian Security Policy*, pp. 241–242. These modifications were designated MiG-21M and MiG-21FL, respectively. See Smith, *India's Ad Hoc Arsenal*, p. 157.

75. *Ministry of Defense Annual Report: 1969–70* (New Delhi: Government of India Press, 1969), p. 29.

76. *Ministry of Defense Annual Report: 1971–72* (New Delhi: Government of India Press, 1972), p. 86.

77. *Ibid.*, p. 66.

also permitted the air force to play an important role in supporting the Indian army via the retrofit that facilitated the MiG-21's transition to an attack role. These modifications contributed to India's stunning victory in 1971. The increased MC rate for the MiG-21 is indicative of the Indian forces' ability to maintain the weapon. Therefore, even by Dupuy's standards, operational assimilation was achieved.

The MiG-21's coordination with the Gnat and the Indian army satisfies the criterion for the first indicator of operational assimilation: confident employment with an existing system. The flexible manner in which the MiG-21 was deployed, both as a fighter and as an attack aircraft, is consistent with the second criterion: offensive flexibility. India's ability to adopt the MiG-21 to satisfy these criteria would have been impossible without a method of arms procurement conducive to modification. Given the incompetence of the Pakistani military, it is difficult to measure the attainment of the final two indicators—that is, dealing with countermeasures and the inverse relationship that should result from the successful assimilation of the weapon. It is clear, however, that neither operational assimilation nor technical assimilation would have occurred to the extent it did without moving from 4 to 6 on the arms proliferation ladder.

SUMMARY

Egypt's 1967 war with Israel and India's 1965 war with Pakistan may be described as learning phases. Both Egypt and India learned that their opponents had superior weapons. This of course reflected the arms transfer policy of the patron state, which in both cases was the Soviet Union. Unlike India, for whom inferior weapons served as the principal impediment to military effectiveness, Egypt's shortcomings were much more severe. Whereas India's forces enjoyed participation from all classes, Egypt's forces did not benefit from the participation of the upper classes. Culture and how it affected civil-military relations differed in both states as well. India, for example, followed the British civil-military model, which militates against the politicization of the military. Egypt, in contrast, had no comparable tradition; this, too, had an effect on the relative military readiness of the two states. If the net assessment is restricted to sociological factors, the sum of these differences between Egypt and India would lead one to conclude that there was a large disparity in military effectiveness between them. Yet this was not the case. In fact, somewhat similar outcomes obtained: military ineffectiveness occurred in both cases. The sociological approach, therefore, cannot by itself explain relatively similar outcomes

even though Egypt's and India's sociological factors exhibited marked differences.

The failure of the sociological approach to explain military effectiveness in Egypt's 1973 war with Israel and India's 1971 war with Pakistan is reminiscent of the first learning phase. This time, however, the difference that the operational approach makes is even more pronounced. Primarily the result of policy adjustments implemented first by Nasser and then by Sadat, the sociological factors that were thought to have led to the rout in 1967 were corrected. At this point, Egypt's forces, at least in appearance, were comparable to India's forces. Both had sufficient levels of expertise, cohesion was not a problem, and the military was a meritocratic institution in each state. The only difference was that India, unlike Egypt, was able to adopt a method of arms procurement that was conducive to technological diffusion and maximized the assimilation of nonindigenous weapons. The establishment of the DRDO and the training of its military officers in the technical aspects of weapons maintenance, modification, and capabilities allowed India to meet the conditions necessary for successful assimilation.⁷⁸

Egypt, on the other hand, was not as fortunate. A possible rapprochement between the East and the West foiled attempts by both Nasser, and later Sadat, to persuade the Soviets to diffuse technology. This in turn affected their station on the proliferation ladder, making indigenous modification all but impossible. The sum of these deficiencies led to Egypt's poor operational assimilation and the inability of its forces to maintain their equipment, hence the low MC rates and failure to satisfy any of the criteria for operational assimilation. In conclusion, some of the modifications that the Indian forces made to the MiG-21 decreased its vulnerability, while others increased its lethality, which led to increased military effectiveness. Thus only by combining the sociological and operational approaches can we explain India's increase in military power in 1971 as well as Egypt's failure to win in 1973, despite some tactical success.

Conclusion

Forecasting the military effectiveness of developing states amid the vicissitudes of international politics and the global arms market is a challenging enterprise. Collaborative agreements and licensing arrangements have blossomed during the post-Cold War era, potentially tilting the regional balance of power toward

78. Dupuy, *The Evolution of Weapons and Warfare*, pp. 305–306.

states that, at the very least, can afford them. Shifts in the distribution of power, however, rest on the faulty assumption that developing states possess the technological competence to deploy the weapons commensurate with the missions for which they were designed. But as I have demonstrated, technological familiarity and, more important, the putative military power that attends it should not be taken for granted. Before ascribing military capabilities to developing states in receipt of nonindigenous weapons and technology, myriad factors must be considered—most notably the likelihood of assimilation. Otherwise, flawed net assessments are likely to follow.

If my findings are correct, the United States has relatively few worries about conventional proliferation and the diffusion of technology. First, the United States is by far the largest arms producer in the world, accounting for 57 percent of all arms sales worldwide, which rivals the combined volume of its European counterparts.⁷⁹ Second, both collaborative arrangements and licensing agreements are dominated by Western industrialized nations and other states friendly to the United States. Firms in the United States and in other Western countries, for instance, accounted for 90 percent of all arms deals in 1996.⁸⁰ Third, major collaborative arrangements involving the United States include codevelopment of the NATO F-16 and, with Great Britain, the AV-8B Harrier. Other collaborative offsets involving the United States include codevelopment and coproduction with Taiwan on its Indigenous Fighter Plane, and with South Korea on its Korean Fighter Plane. Key regional states such as Egypt and Israel in the Middle East and South Korea and Japan in East Asia benefit from licensing agreements with the United States.⁸¹ In short, the states most likely to assimilate are states sympathetic to U.S. foreign policy interests.

For so-called pariah states such as North Korea, Iran, and Iraq, access to arrangements conducive to diffusion are not forthcoming. Assimilation and military effectiveness, in other words, will be difficult for them to achieve. Licensing is the only other way that technological diffusion could threaten U.S. interests. A smaller producer, say, Israel, may allow a state of questionable character to purchase weapons, but few regional powers would be interested because they could buy comparable, if not necessarily superior, technology for less from cash-starved Russia.⁸² Fortunately, none of the states in the West that

79. *SIPRI Yearbook 1997*, p. 293.

80. *Ibid.*, p. 240.

81. The following states (as of 1997) had licensing agreements with the United States: Egypt (M1A1 Abrams); Japan (F-15J, P-3C Orion, SH-60 Seahawk, and UH-60 Blackhawk); and South Korea (F-16C, and K-1 MBT). *Ibid.*

82. The rapid decline of Russia's economy has forced Moscow to grant unprecedented access to its arsenal, a trend that is supported by a growing number of Russian economists and defense

are capable of producing big-ticket items licenses to any of these “pariah” states.

To command so much of the international arms trade is to essentially dominate it—which, apparently, is what the United States does. It dictates who gets what and how much. Thus it is fairly easy to prevent bad states from diffusing technology. But in the event that a state unsympathetic to U.S. interests manages to wrangle an offset deal from, say, Russia, there is no guarantee that any amount of technical assistance will compensate for the technological sophistication required to absorb nonindigenous technology. China, for example, has entered into a licensing agreement with Russia to offset the purchase of 24 Su-27s. But since China is both unaccustomed to formal transfer agreements and handicapped by a military industrial complex that by Western standards is still in its infancy, it will be some time before China benefits from technological diffusion.⁸³

Considering the effect that the operational approach has on assimilation and military effectiveness, analysts and grand strategists alike should be heartened by the collection of states that are sympathetic to U.S. interests on the collaborative end of the collaborative-noncollaborative axis. Even on the noncollaborative end, where pariah states must rely instead on off-the-rack purchases, states friendly to the United States are more likely to benefit from licensing agreements than states that are not. Whether they subscribe to selective engagement, offshore balancing, or wholesale withdrawal, grand strategists concerned with U.S. retrenchment in the wake of the Cold War⁸⁴ should embrace the operational approach because it is compatible with all three strategies.

industry managers who believe that arms exports can benefit the Russian economy. See Yuri Pinchkov, “Arms Trade and the Proliferation of New Military Technologies,” in Stahl and Kemp, *Arms Control and Weapons Proliferation in the Middle East and Asia*, p. 19.

83. Avery Goldstein, for example, argues that “it is . . . unclear whether China’s military and defense industry has the ability to maintain the advanced equipment it is importing and coproducing.” See Goldstein, “Great Expectations,” p. 46.

84. The contemporary retrenchment debate arguably started with Robert J. Art in “A Defensible Defense,” in Sean M. Lynn-Jones and Steven E. Miller, eds., *America’s Strategy in a Changing World* (Cambridge, Mass.: MIT Press, 1992), pp. 68–118. More recently, Barry Posen has argued for the realist-based selective engagement in which U.S. intervention should be undertaken only when great power war is possible. See Posen and Andrew L. Ross, “Competing Visions for U.S. Grand Strategy,” *International Security*, Vol. 21, No. 3 (Winter 1996/97), pp. 5–53. Christopher Layne makes his case for offshore balancing in “From Preponderance to Offshore Balancing: America’s Future Grand Strategy,” *International Security*, Vol. 22, No. 1 (Summer 1997), pp. 86–124. The most recent viewpoint on retrenchment is in Eugene Gholz, Daryl G. Press, and Harvey M. Sapolsky, “Come Home, America: The Strategy of Restraint in the Face of Temptation,” *International Security*, Vol. 21, No. 4 (Spring 1997), pp. 5–48.