Military Modernization and Technological Maturation, an Indian Perspective: Stabilizing the Instability-Stability Paradox

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India and Pakistan are only now reaching the point in their strategic modernization programs where both can reasonably calculate, and therefore accept, that the other side has a secure second strike capability—both because of the increasing quantity of forces and increasingly survivable basing modes—which renders any thoughts of neutralizing the other’s arsenal, no matter how remote they may have been before, simply infeasible. Thus, military modernization and the technological maturation of India and Pakistan’s nuclear forces are only now beginning to generate stability at the strategic level. This is the good news, for now. The biggest threat to stability at the strategic level would be the development of a workable ballistic missile defense system (BMD). For a variety of reasons, such as the quantity of forces needed to saturate or evade BMD systems and the increasing penetrability with MIRVs, I argue that a condition of strategic stability is likely to exist for quite a while as both India and Pakistan’s forces and command and control architectures mature. Although conflicts can nevertheless escalate uncontrollably, there will be declining rational incentives to initiate a strategic nuclear exchange, irrespective of how intense a conflict has already erupted.

On the other hand, a growing array of capabilities at the lower-end of the use spectrum, by both countries, including tactical missile systems, cruise missiles, miniaturized warheads, systems at higher states of readiness, also amplify the tactical instability of the relationship. This suggests not only that conventional conflict may be increasingly possible under the umbrella of strategic stability, but that limited or tactical nuclear use may also be possible since such use would theoretically be war terminating since, under a condition of strategic stability, the receiving side of limited nuclear use still has no rational incentive to retaliate with full strategic nuclear force. Thus, technological maturation of both sides’ nuclear forces are simultaneously stabilizing the strategic level of the relationship and destabilizing the tactical and operational levels of the nuclear relationship. These developments and the growing stability of the strategic nuclear balance, paradoxically, actually amplify the probability of major conventional conflict and even tactical nuclear use as the relationship moves forward.

When the strategic balance was unstable or just emerging, limited or tactical nuclear use was inhibited or deterred because the instability of the strategic nuclear balance generated nontrivial probabilities of further escalation to the strategic level. As technological maturation stabilizes the strategic nuclear balance, this condition will reverse itself. That is, over time with the maturation of nuclear forces structures on both sides, the probability of strategic nuclear exchange has and will decline, but the probability of limited or tactical nuclear use may increase. Figure 1 provides a very crude conceptual depiction of how this relationship operates, with some hypothetical probabilities in the event of a major India-Pakistan conflict. The important point here is to recognize the inverse relationship between strategic and tactical nuclear stability):
Figure 1. Relative relationship between Strategic and Tactical Nuclear Stability in the event of nuclear conflict. *The actual magnitudes of Pr(x) are not meant to be realistic.*

The key point is that the driving variable for this relationship is the modernization of both sides’ nuclear force structures, particularly incontrovertibly secure second-strike capabilities, and the development of lower order use options by both sides, particularly Pakistan which has explicitly assigned nuclear roles to its battlefield capabilities, e.g. the Nasr. Of course, India could do the same eventually with the Prahaar and cruise missiles. The central argument of this paper is that nuclear force modernization in South Asia will have a key tradeoff: the probability of strategic nuclear exchange will fall, which is certainly a positive development, but the probability of limited nuclear use will correspondingly rise in the event of a major ground engagement. This dynamic assumes that there is a meaningful distinction between tactical and strategic nuclear use in South Asia.

**Clarifying the Stability-Instability Paradox**

There is a significant amount of conceptual sloppiness when referring to the so-called stability-instability paradox, a term first coined by Glenn Snyder in 1965, and further unpacked by scholars such as Robert Jervis and, in the South Asian context, Paul Kapur. The general referent in the stability-instability paradox is the mutual nuclearization of a conflicting dyad. That is, once two rivals acquire nuclear weapons, the terrifying prospect of their use caps conventional escalation beyond a certain point, thereby freeing both sides to engage in lower levels of conflict at higher frequencies than prior to nuclearization. However, a key qualification of the stability-instability paradox often forgotten is that it takes more than simply the mutual possession of nuclear weapons to
generate stability at the nuclear level. There must be a condition of mutual secure second-strike capabilities in order for a state of strategic stability—when neither side has an incentive to initiate a strategic nuclear exchange—to obtain. Without this qualification, the strategic balance is unstable since one or both sides may calculate that a strategic nuclear war is ‘winnable’, either through a preemptive counterforce strike, or some combination of preemption and damage limitation measures. Only when the strategic balance is such that both sides are mutually vulnerable despite iterative attempts at disarming strikes, can a dyad be termed stable.

In 1965, Glenn Snyder famously wrote the following about the condition known as the stability-instability paradox, which is worth reproducing here verbatim: “[T]he greater the stability of the ‘strategic’ balance of terror, the lower the stability of the overall balance at its lower levels of violence. The reasoning is that if neither side has a ‘full first-strike capability,’ and both know it, they will be less inhibited about initiating conventional war and the limited use of nuclear weapons, than if the strategic balance were unstable. Thus firm stability in the strategic nuclear balance tends to destabilize the conventional balance and also to activate the lesser nuclear ‘links’ between the latter and the former.”

The stability-instability paradox is often characterized incorrectly as: mutual nuclearization creates stability at higher levels of violence, thereby generating instability at lower levels of violence. This is largely an incorrect reading of the concept. What Snyder, and Jervis after him, indicated was that nuclear stability at the strategic level can generate instability at both lower conventional and nuclear rungs of the escalation ladder. That is, the stability-instability paradox does not simply obtain when two adversaries merely acquire nuclear weapons, it obtains when they both achieve secure-second strike forces and both sides are aware of this condition, thereby neutralizing any incentive to disarm the adversary with a first strike, which is what Snyder and Jervis classify as nuclear instability at the strategic level. This distinction is incredibly important in the context of regional nuclear powers where achieving secure second-strike forces and a correspondingly survivable command and control infrastructure is not necessarily a trivial matter.

There is a wide space for rival nuclear states to have highly unstable strategic nuclear balances, for example, when one or both have arsenals vulnerable to being completely disarmed. Snyder very explicitly notes that only once a state of mutual stable strategic nuclear balance is achieved might two rational states experience higher incidences of conventional conflict, or even limited nuclear use, since neither party would have an incentive to escalate the conflict to the full strategic level. The balance of conventional forces actually has little to do with the theoretical logic of the stability-instability paradox, except to suggest that the conventionally inferior side—NATO during the Cold War and Pakistan in the India-Pakistan dyad—has incentives to manipulate nuclear risk; but whether it does so at the tactical or strategic nuclear level depends on the degree to which there is strategic nuclear stability.

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This reading, correct in my view, of the stability-instability paradox generates several observable implications for the India-Pakistan dyad. First, the true stability-instability paradox has not yet been applicable to India and Pakistan. As Brigadier Gen (Ret.) Feroz Hassan Khan has argued, because of this strategic instability, Pakistan in the 2000s could not afford a strategy of graduated escalation since it risked being disarmed by an Indian retaliatory strike, which put Pakistan’s strategic forces in a “use them or lose them” situation, and therefore demanded a full release against Indian targets, including population centers and C2 nodes, if it anticipated Indian nuclear use.2

If one or both sides believes the other does not have a secure-second strike capability, and there is instability at the strategic nuclear level, Paul Kapur’s insightful ‘instability-instability’ paradox ought to result (though he does not specify why it is unstable, just that there is a risk of nuclear escalation).3 I would actually refine this characterization slightly as the ‘instability-stability-instability’ to refer to the three levels of conflict: nuclear-conventional-subconventional. Here, the instability at the nuclear level enables one party with revisionist intentions to engage in low-level subconventional attacks at the other, knowing that a full-scale conventional conflict ought to be inhibited for fear of escalation to the tactical and subsequently strategic nuclear level, since instability at the strategic level increases the probability of such an exchange. This is the condition that India and Pakistan found itself in for the first ten years after nuclearization, as Kapur argued. Instability at the nuclear level created stability at the conventional level, which both in turn created instability at the subconventional level. But it was a tenuous stability at the conventional level and the Subcontinent was one aggressive decision away from strategic nuclear exchange. In short, instability at the strategic nuclear level made every crisis in South Asia a potential nuclear tinderbox.

What ought to happen as India and Pakistan establish stability at the strategic nuclear level, augment their nuclear force structures and establish increasingly survivable deployment modes and procedures? In this case, stability at the highest level should, logically, generate instability at each lower order level of the conflict spectrum. That is, stability at the strategic nuclear level allows escalation all the way up to limited nuclear use, but no further. Therefore, South Asia might find itself in a condition of stability (strategic nuclear)-instability (tactical nuclear)-instability (conventional)-instability (subconventional); or what Snyder and Jervis would recognize as simply a stability-instability paradox.

The upside is that the probability of strategic nuclear exchange should fall as both accept mutual vulnerability at that level, thereby providing high-order stability to the Subcontinent. The downside is that it becomes rational for conventional conflicts to be initiated by one or both sides, which can escalate all the way to limited nuclear use as a war-termination strategy. The most likely scenario for this would be Pakistani limited nuclear use against an Indian armored offensive operating on Pakistani soil in retaliation to some real or perceived provocation, which would terminate the conflict at that level, with either a tit-for-tat limited nuclear response or simply war termination since a full

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Indian strategic retaliatory response ought to be deterred by Pakistan’s survivable second-strike capabilities. Therefore, as argued earlier, the achievement of strategic stability at the nuclear level ought to immunize South Asia’s cities from nuclear use, but at the price of an increased risk of serious conventional conflict and limited nuclear use on military targets.

The critical point is not that the overall risk of nuclear escalation has changed, but that the type of escalation that is risked has changed as India and Pakistan establish true strategic nuclear stability with mutually accepted second-strike forces. In the first decade, the risk of nuclear escalation was all the way up to full strategic nuclear exchange. This led to a cap on conflict at the sub-conventional level, since conventional conflict could very quickly lead to strategic nuclear use. Going forward, when the two states establish a level of strategic stability that deters strategic nuclear use, the cap on escalation actually rises to the tactical nuclear level. That is, conventional conflict can proceed, as well as tactical nuclear use, without triggering a full strategic nuclear exchange. Thus, in the coming decades, there is still a risk of nuclear use, and it may even be probabilistically higher. This is the key tradeoff as the nuclear force postures of the two states mature in the years to come.

**Getting to Stability**

Nuclear states in the early phases of post-nuclearization have historically struggled to establish secure second-strike forces, even when the primary adversary had few counterforce options. The establishment of secure second-strike forces is not automatic. Indeed, the United States did not accept the surety of a Soviet second strike until the late 1960s when the number of Soviet ICBM/IRBM/MRBMs finally reached a level that made a successful American counterforce strike infeasible. Similarly and objectively, India and Pakistan did not have strategic nuclear stability when they tested nuclear weapons in 1998. Both sides had limited fissile stockpiles, few warheads, few delivery vectors and survivability in the event of a serious conflict would have had to be a serious concern for nuclear planners on both sides. Obviously, both erected procedures to enhance survivability of whatever assets they possessed—dispersion, concealment, movement, deception—but the sheer numerical limits and the absence of an obviously survivable deployment mode e.g. an SSBN, meant that both sides could have been vulnerable to a disarming conventional or nuclear strike.

Several developments over the past fourteen years are increasing the stability at the strategic nuclear level between India and Pakistan. The critical point is that in addition to learning processes which may inherently stabilize the India-Pakistan relationship, there is an increasing condition of strategic stability, such that neither state would have a rational incentive to initiate a strategic nuclear strike. The following is by no means an exhaustive treatment of these capabilities, but captures some of the critical stabilizing developments.

**Numbers**

The first major development is just the quantitative increase in warheads and delivery vehicles each side possesses. With nuclear weapons, at certain thresholds around, say, three-digits, quantity really
does have a quality all of its own. Just the sheer expansion of each country’s fissile material stockpile and warhead numbers, which has doubled or tripled the number of assets each would have to destroy in order to neutralize the other’s nuclear warheads, is critical. The numbers are hard to establish in the open source—and this ambiguity, if shared at the classified level, reinforces stability—but if both had around 30 nuclear weapons, they now both stand close to 100+. Furthermore, Pakistan’s likely shift to plutonium warheads with increasing Khushab Pu production/reprocessing will also enable a steady expansion of the arsenal, and toward miniaturized warheads with higher yield. Both sides enhance the survivability of these nuclear forces through deployment procedures that emphasize dispersion, movement, concealment, and deception that increases the number of components to be neutralized in order to fully disarm the adversary and makes it impractical for the adversary to have real-time intelligence about locations regarding nuclear assets.

**Survivable Modes**

Second, the expansion and deployment of a greater number of strategic delivery vectors that are road or rail mobile and solid-fuel, increases their readiness as well as their survivability by reducing the logistics required for old liquid fuel missiles e.g. the *Prithvi*. Pakistan has a growing array of strategic ballistic missiles that provide coverage against major Indian targets—a capability which it did not have in any meaningful numbers in the early 2000s. Prior to the development of the *Shaheen* family of missiles, Pakistan was dependent on a highly vulnerable air vector (F-16 A/Bs and possibly Mirages and F-16C/Ds) to deliver nuclear weapons against Indian strategic targets in the south. The *Shaheen* family of solid-fuel missiles, however, will provide coverage at 500-km and 2000+-km (*Shaheen II*) which, as the production of these capabilities ramps up and they become fully operational, will provide a true land-based deterrent against Indian strategic nuclear use by putting most major Indian cities at risk.

India dedicated a better part of the past decade in production and operationalization of the mobile solid-fuel *Agni I/II* (eventually the III and V), as well as the mobile cannesterized *Shaurya* missile. The 800-km *Agni I* was deployed with the 334 missile brigade in 2004, which put most Pakistani strategic targets in range from Western India. The further development and operationalization of the *Agni II/III* provides more survivable deployment modes as they are mobile and can be launched from Southern and Eastern India against Pakistani strategic targets, making them less vulnerable to conventional counterforce attempts.

For India, the true achievement of survivable second-strike capabilities and an assured retaliation nuclear posture is the SSBN. The *Arihant* prototype is still in development, and the *Sagarika* SLBM is still in the early phases of testing. Realistically, India is at least half to a full decade away from being able to field an SSBN capability. Even when it does, the noise levels and command and control considerations for a wholly ‘cannesterized’ system leave its deployment modes open: will India have a continuous deterrent patrol model like the United States or a more ad hoc model like the Soviets, which kept armed SSBNs closer to port and dispersed them as a crisis unfolded? The former model maximizes survivability if it can be obtained; the latter maximizes centralized control of the arsenal. Which end of the spectrum India chooses to emphasize remains an open question, but fielding any
SSBN capability might be a significant leap in the survivability of India’s nuclear forces. As of this writing, it is unclear what Pakistan’s plans for an SSBN capability are, though it would make logical sense for it to develop one, since of the two nations, it is Pakistan that has a thin geography which would—like with Israel—complicate land-based survivability.

There is an additional command and control piece to improving survivability and the assurance of retaliation. That is, both India and Pakistan are likely developing responsive and survivable command and control infrastructures that would enable each to calculate that the other could initiate a retaliatory strike after a first-use with certainty. Much of this is unknown in the public domain but would likely include characteristics such as decapitation contingencies, hardened infrastructure to survive a nuclear attack, redundancy, etc.

All of these capabilities and corresponding deployment modes are moving India and Pakistan toward what I characterize as enhanced strategic nuclear stability. That is, both are approaching conditions of ‘assured retaliation’, which has two critical components: (1) the ability to survive iterative attempts to disarm one’s nuclear forces and (2) the ability to retaliate with certainty against the adversary’s strategic targets following such attempts. They are approaching numerical thresholds at which survivability of forces is less of a concern, and they are developing capabilities that can increasingly cover and penetrate to each other’s major population centers and strategic targets. Once the condition of mutually assured retaliation is achieved and accepted by both parties, the risk of strategic nuclear exchange on the Subcontinent should fall precipitously. This is the good news.

**Toward Lower Level Instability**

The bad news is that both India and Pakistan are modernizing their forces at lower ends of the conventional and nuclear use spectrum, perhaps unintentionally, in anticipation of the stability umbrella provided by strategic invulnerability. These forces, and the strategic condition of nuclear stability at the highest levels, create very real risks of limited nuclear use because now such capabilities can be employed with higher confidence that there will not be escalation to full strategic nuclear exchange. The categories of capabilities emerging and their potential impact on the risk of lower-order nuclear use are listed below. Furthermore, the C2 infrastructure being erected to enhance the assurance of retaliation could also be employed to make tactical nuclear use more credible as well—though some of these features, notably delegative nodes, might be distinguishable from the infrastructure designed to support retaliatory missions. Again, the following list is not exhaustive but highlights the growing trends at the lower end of the use spectrum.

**Tactical Missiles**

Pakistan’s development of the *Nasr (Hatf-9)* 60-km SRBM, based on a mobile MLRS, is explicitly designed to provide nuclear use options at lower ranges for battlefield or theater contingencies. Then Director General of Pakistan’s Strategic Plans Division, Lt. Gen (Ret.) Kidwai, noted after the April 2011 test of the Nasr that it “carries nuclear warheads of appropriate yield with high accuracy and
shoot-and-scoot attributes. This quick response system addresses the need to deter evolving threats.”

Unnamed strategic planners similarly averred that it “is a low-yield battlefield deterrent, capable of deterring and inflicting punishment on mechanized forces like armed brigades and divisions.”

Presumably, a miniaturized plutonium warhead with a yield on the order of tens of kilotons or lower could be mated with the Nasr. The development of plutonium warheads thus contributes both to strategic stability and lower level instability by providing warhead options for shorter range and lower throw-weight systems. As the Nasr undergoes further testing and operationalization, Pakistan will truly have a system explicitly designed for limited nuclear use in the theater of envisioned conflict. With stability at the strategic nuclear level, Indian decision-makers may be tempted to test Pakistani resolve on lower order nuclear use options and authorize conventional operations that risk crossing these lower order thresholds. And the Pakistan Army may be tempted to employ limited nuclear use options in the event of a conventional breakdown, knowing the strategic nuclear deterrent ought to inhibit full scale Indian nuclear retaliation.

India is similarly developing battlefield support capabilities, most notably the Prahaar 150-km ballistic missile. DRDO claims that “the missile with a pay load of 200 kg has a fast reaction time, which is essential for the battle field tactical missile. The missile is launched from a Road Mobile System, which can carry six missiles at a time and can be fired in salvo mode in all directions covering the entire azimuth plane.” Such a capability has not been assigned a nuclear role, and India’s Strategic Force Command presently denies that it has any intention of developing tactical nuclear capabilities. The Prahaar, however, can be used to support conventional offensives, which carry its own risks, but could easily be tipped with a miniaturized 200kg nuclear warhead. This development would eventually provide India’s Strategic Forces Command and political leadership with more flexible nuclear options, including a lower-order tit-for-tat capability should a nuclear-Nasr ever be used on Indian forces. The critical point here is that role assignment to conventional or nuclear is extremely flexible in the future, as the missile itself is only restricted by payload weights; whether that payload is conventional or nuclear is largely irrelevant to the development process, provided a nuclear warhead of that payload exists.

**Cruise Missiles**

Higher accuracy air breathing capabilities that are not vulnerable to potential theater missile defenses—such as cruise missiles—may provide additional lower order nuclear use options to India and Pakistan. Pakistan has explicitly declared the Babur (Hatf-7) cruise missile as nuclear capable and it has an operational envelope of 700km. Pakistan’s Inter Service Public Relations (ISPR) stated that “the three-tube MLV [Multiple Launch Vehicle] enhances the targeting and deployment options in the conventional and nuclear modes. With its shoot-and-scoot capability, the MLV provides a major force multiplier effect for target employment and survivability.” Similarly, the beyond visual

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5 Ibid.
range Ra‘ad (Hatt-8) air-to-surface cruise missile, which has been successfully fired from Mirages, is also dual-capable. According to ISPR, “the state-of-the-art Ra‘ad Cruise Missile with stealth capabilities is a low altitude, terrain-hugging missile with high maneuverability, and can deliver nuclear and conventional warheads with great accuracy…Ra‘ad gives Pakistan ‘greater strategic standoff capability’ on land and at sea, which implies that it can be used against targets both at sea and on land while keeping the launching platform undetected by enemy air defense systems. Ra‘ad is designed to launch aerial strikes against fixed enemy installations including enemy command centers, radars, surface-to-air missile launchers, ballistic missile launchers, and stationary warships.” These capabilities are designed to provide additional flexibility at lower order nuclear use options, with the explicit aim of evading detection and any potential defenses, such as theater BMD should India successfully field it.

India has similarly developed a range of cruise missiles, including the BrahMos and Nirbhay, both of which could potentially be nuclear-capable. BrahMos has already been operationalized into several regiments and there are land, air, and naval variants. Many news outlets rightly refer to the weapon as nuclear-capable since it can carry a 300kg payload—even though it has not been assigned a nuclear role insofar as public sources indicate. As these capabilities mature and become further operationalized, it is within the realm of possibility, depending on the nature of the India-Pakistan and India-China balance, that they will start to be assigned nuclear roles for the same reasons as mentioned above with respect to tactical missiles.

**Ballistic Missile Defenses**

The impact of reasonably effective BMD on the balance between India and Pakistan has largely received rudimentary treatment. It is unlikely that either side would be able to erect midcourse ballistic missile architectures that would neutralize each other’s strategic deterrents. The investment, technological sophistication, number of capabilities required detecting, tracking, and intercepting a midcourse phase warhead is probably prohibitive at this point for India. It is likely, however, that in the next decade, India will be able to field high-altitude (Prithvi-based) and terminal phase (Ashwin-based) BMD systems. These will likely be thin though. DRDO claims it can protect two cities, e.g. Delhi and Mumbai. Thus, they could be saturated by a full strategic Pakistani launch or evaded by nuclear capable cruise missiles. Should India be capable of fielding a BMD architecture that threatens Pakistan’s second-strike capability, the Subcontinent would revert back to strategic nuclear instability but one where India could use conventional power at its perceived will, since it would have a monopoly on strategic nuclear use. Even at limited levels, a theater BMD system might support Indian ground offensives by threatening to credibly neutralize Pakistan’s lower order nuclear ballistic missile capabilities. Again, however, the Nasr, Babur, and Ra‘ad might be capable of defeating such a system. The balance of BMD is a critical area to watch as both countries’ architectures modernize and mature. These systems can have a very sharp impact in supporting offensive action at lower rungs of the escalation ladder or, worse, destabilize the strategic nuclear balance back toward making nuclear exchange ‘winnable.’

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MIRVs

After India’s test of the *Agni* V in April 2012, DRDO Director General Dr. V.K. Saraswat noted in post-test media appearances that India is several years away from being able to deploy MIRVs on the *Agni* V and possibly the *Agni* III. Although he conceded that it is not Government of India policy to deploy MIRVs on any of its nuclear assets, the capability is nevertheless being developed. If deployed, MIRVs could be a serious threat to strategic nuclear stability as India could theoretically multiply its ability to target Pakistani nuclear systems, thereby achieving enhanced penetrability and, more critically, a potential damage limitation capability that may make a strategic nuclear exchange ‘winnable’ for India. Although this might be developed with China in mind, it would nonetheless have serious implications for the strategic nuclear balance between India and Pakistan. This is a development to closely watch over the coming years. South Asian observers will need to watch for any Indian appetite to MIRV any of its land or sea-based missiles, even for defensive purposes (e.g. to retain sufficient throw weight in the event that a pre-emptive Chinese or Pakistani conventional or nuclear strike disabled a significant number of *Agnis*).

Conclusion

This paper argued that technological modernization and maturation in the Indian and Pakistani nuclear force postures and command and control infrastructure will carry with it a key tradeoff between strategic and tactical nuclear stability. The extent of that tradeoff will vary depending on the types of systems fielded. Some developments, such as the numerical growth of forces and increasingly survivable basing modes, will enhance strategic stability. Others such as BMD and MIRVs could undermine strategic stability. Meanwhile, the increasing sophistication of tactical and cruise or beyond visual range missiles enable both India and Pakistan to, as Glenn Snyder put it, activate “lesser” nuclear links under conditions of strategic nuclear stability. Thus, going forward, the dyad may shift from a condition of a tenuous stability at the conventional level to one at the highest strategic nuclear level. This development would open the possibility for significant conventional conflict and even lower order nuclear-use as a war termination strategy but ought to eliminate the risk of a full strategic nuclear exchange by either party.