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# A Quantitative Model of the Amplification of Power through Order and Implications for Defense against Hijackings

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**FORUM**

# *A QUANTITATIVE MODEL OF THE AMPLIFICATION OF POWER THROUGH ORDER AND IMPLICATIONS FOR DEFENSE AGAINST HIJACKINGS*

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**ABSTRACT**

I propose a simple quantitative model of how the power of a leader over a group is amplified when he or she starts to order the group. This model implies that a small well-informed minority can easily govern a previously ordered majority such as hijacked passengers. The model suggests the importance of a new concept, "group defense" that may be helpful in preventing fatal hijackings such as the ones that occurred on September 11.

**Introduction**

Why was a minority of 15 barely armed terrorists on September 11 able to hijack 3 planes with several hundred passengers on board and fly them into buildings committing mass murder? The hundred or so passengers and crew were only able to resist in one of the planes, thwarting the intention of the hijackers to kill even more. In the end nobody on that plane survived either. One might have expected that the passengers and crews on all flights would have resisted and been able to overwhelm the terrorists and fly the planes to safety.

In this contribution I propose a simple quantitative model of how the power of a leader over a group is amplified when the group is ordered. This model implies that a small well-informed minority can easily govern an ordered majority and suggests the importance of a new concept, "group defense" that may be helpful in preventing fatal hijackings of the September 11 type.

**How power is amplified through order**

Consider a drill sergeant trying to line up her recruits. This maneuver imposes order on a group and, as we will see, greatly increases the power of the drill sergeant. Assume we measure the power a particular drill sergeant displays over a lone recruit to be P per time interval. Consider two situations which includes all the recruits: none of the recruits lined up and all the recruits lined up – in other words, no order or perfect order among the recruits. In the case of no order, each recruit experiences P/N displayed power from the sergeant because her attention and intimidation has to be equally shared among the N recruits. The sum over all recruits, the displayed or "real" power is then P, same as for a single recruit.

$P_{real}=P$

In the case of perfect order among the recruits, the drill sergeant's total displayed power stays the same, P, but through the ordering process she now has added a new kind of power over the ordered recruits, "virtual" power. Each recruit knows that if he gets out of line, as long as he is the only one doing it, he has to face a P confrontation with the sergeant. This threatened power of the drill sergeant is not actually displayed by her until the recruit gets out of the line. Before it is displayed or "real" we call it "virtual". It is important because it is *considered* to be real and prevents recruits from moving out of the lineup. How large is her virtual power? It is N*P*d (P per recruit, with d likelihood of discovery adding up to N*P*d for all recruits). In the case of perfect order we approximate d=1 and obtain:

$P_{virtual}=N*P$

This is quite extraordinary: a sergeant can enhance her or his virtual power 10-100 times without doing anything but lining up the recruits. No additional weapons or backups are needed. The sergeant's virtual power comes about because and only because the recruits are ordered. The more ordered they are, the larger is her virtual power, in other words, the order amplifies her virtual power. The virtual power varies as the number of recruits get out of the lineup. As she orders the recruits into the lineup, her virtual power rises from 0 to NP.

*A Quantitative Model*

The increase in virtual power due to the ordering of the recruits is but one of the several sources of power through order. Another source of power results from the tendency of most people to copy the behavior of the people around them (Asch, 1956). If we label this power also as virtual, it can be quantified as c*P*n per recruit in the situation of perfectly ordered recruits where c is the conformity power a recruit has over another in units of the power the sergeant has over a recruit, and n is the number of neighbors he has eye contact with. In some instances n is about 8, in some instances this can become much larger depending upon the formation of the recruits. For all the recruits the result is:

$P_{conformity - virtual}=N*c*P*n$

Two other types of power result from the successful threat of collective punishment and the planting of spies among the recruits. Suppose our sergeant imposes collective punishment. If the recruits don't want to be punished, they will look around to make sure any dissenters get in line. A single unaligned recruit faces the real power P from the drill sergeant and the real power (N-1)*P*s from the other recruits, where s the power a recruit has over another in units of the power the sergeant has over a recruit.

$P_{collective\ punishment}=(N-1)*P*s$

The corresponding virtual power is (N-1)*P*s per recruit or, for all recruits:

$P_{collective\ punishment - virtual}=N*(N-1)*P*s$

The role of spies is to keep the power of the sergeant intact when her or she is not present. The more spies, the higher the probability that the sergeant will find out about individual deviations, for simplicity we assume that there are enough spies to make the probability 1. The power from spies is then

$P_{spies - virtual}= P_{virtual}$

In total, the power of the sergeant in the case of all ordered recruits is all virtual and is:

$P_{totalordered}= P_{virtual}+ P_{conformity - virtual} +P_{collective\ punishment - virtual}+ P_{spies - virtual}=$

$N*P+ N*c*P*n + N*(N-1)*P*s$

The power amplification resulting from ordering the recruits is then:

Amplification= N+N*c*n+N*(N-1)*s
If we pick s=0.1, n=8, and c=0.1 the amplification for 100 recruits is then

Amplification (N=100, s=0.1, n=8, c=0.1)=1170

thus the sergeants power has increased more than 1000 times.

## IMPLICATIONS FOR HIJACKING VICTIMS

If a lightly armed hijacker is an experienced fighter and can evenly battle say four passengers, four hijackers should not be able to control more than sixteen passengers. The model of power amplification through order, however, suggests otherwise. Once the hijackers orders the passengers, their virtual power $P_{virtual}$ is amplified 100 times if there are 100 passengers. The passenger group would then act as if the hijackers could evenly battle 1600 of them.

## STRATEGIES FOR GROUP DEFENSE AGAINST HIJACKINGS

The informed minority we have alluded to is one which has experienced the amplification of power through order. Such informed minorities would presumably include the hijackers of September 11, but also school teachers, flight cabin crew and other people who are in charge of groups and who have seen the consequences of the ordering of groups.

The majority of passengers and crew members may not be aware of this phenomenon, however. The model of power amplification through order suggests that to prevent hijackers from taking control of a passenger/crew group, the passengers and crew have to become more informed about "group defense".

A group can defend against ordering in two ways, by not ordering or by counteracting ordering with a more powerful opposing ordering.

To not be ordered, the passenger population should be instructed as a whole not to respond to hijackers' ordering requests. The judgement of which orders can be followed and which cannot should probably not be left open to individuals; that would allow the hijacker to begin to order

some passengers, immediately making it more difficult for the remaining group to prevent further ordering. Leaving the judgement to group consensus is probably even worse: it is very difficult for any group to quickly organize a common response to an ordering request, let alone if one of the ordering requests is not to communicate within the group.

If the group did not succeed to preventing the ordering of itself, the group will be in a difficult position because of the amplified power of the hijackers. The group then has to try to counteract the ordering by either removing the ordering or imposing an opposing ordering.

Further research on this topic includes to understand what parameters have been used by hijackers to order the passenger/crew group (for example, having the passengers move to the back of the plane or sit with their heads between their legs) and how the particular geometry and furnishing of an airplane influences the choices and effectiveness of those parameters. What practical measures can be taken to defend a passenger/crew group against the hijackers' attempt? Crew training in group defense is one possibility, another is to feed prerecorded messages about hijackings to the passengers instructing them, for example, not to order, a third is to have the cabin audio visual equipment be taken over by the ground controls.❑

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**Eugen Tarnow**, earned his doctorate in physics from the Massachusetts Institute of Technology. He is the principal of Avalon Business Systems, Inc., a Lotus Notes software developer. Prior to becoming the head of Avalon Business Systems, he served as a visiting scientist at the Xerox Palo Alto Research Center and as a Director's fellow at Los Alamos National Laboratories. His professional interests include obtaining measurable improvements in organizational contexts whether using computers to streamline business processes or using concepts of physics and social science to prevent airplane accidents.