

THE CASE OF THE JUMPING ELEPHANT

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While reading the *New Scientist* journal recently, I came across a fascinating article discussing a perplexing question concerning elephants. It has been established that elephants can communicate messages to other elephants many miles away, but it isn't clear how they do it. One group of researchers had proposed that elephants stomp their feet on the ground to send messages via seismic vibrations. But some scientists were skeptical as to whether it would be possible for the ground to conduct such messages successfully. So the first group performed an experiment which ultimately confirmed their critics' position, and demonstrated that the vibrations could not travel more than a few hundred meters.

Aside from my general interest in elephants and my specific interest in elephant communication, I was particularly fascinated to read that the experiment was performed in Salinas, California. For I immediately knew exactly which elephants the experiment was done with. I knew, because there are only two elephants in Salinas, and I've met them.

Elephants are not so easy to come by. It's all the more difficult to find an elephant that will stomp on the ground when requested to do so. But in Salinas, California, there is a private animal ranch which trains exotic animals for acting in movies. A few years ago, I visited the ranch and met the two African elephants, Buffy and Lisa. I was even fortunate enough to ride on Buffy's back, a memorable and very rare experience. The single most dangerous occupation in the world is being an elephant trainer. Due to the elephant's sometimes unpredictable nature and massive power, any "incident" can be lethal. But Buffy and Lisa are considered extremely safe to work with, and were the obvious choice for the researcher's experiment.



By the curious workings of providence, a day after reading this article I received two identical questions about elephants. Both were from students in the same yeshivah high school class. They had been studying the Talmud (*Kiddushin* 25b) which discusses the physical act of acquisition which must be done in order to legally purchase animals. According to the opinion of Rabbi Shimon, animals can only be purchased by “*hagbahah*,” raising them up in the air. The Talmud then asks how it would be possible, according to Rabbi Shimon, to purchase an elephant, which is too heavy to pick up.¹ One of the suggestions given in the Talmud is that the elephant can be acquired “via bundles of vines.” However, the Talmud does not elaborate as to what this means.

According to Rashi, it means that one stacks up bundles of vines to form a platform of three handbreadths in height. Then one leads the elephant to stand on them. One has thereby caused the elephant to rise, and has acquired it through *hagbahah*.

Tosafos (to page 26a) on the other hand, does not favor this explanation. He points out that if the Talmud were talking about building a platform, it would surely make more sense to speak of using stones or wood. Others raise the objection that a platform of vines would not be of legally different status than the ground itself. Tosafos therefore cites Rav Meshullam ben Nathan of Melun, France, as giving a different explanation of this method of acquisition. Noting that bundles of vines are food for elephants (as mentioned in the Talmud, *Shabbos* 128a), Rav Meshullam explains the Talmud’s answer to mean that one takes the bundles of vines and hangs them very high up in the air. The elephant will then jump up in the air in order to reach them and eat them. One has therefore caused the elephant to raise itself up and perform *hagbahah* on itself. Ritva and Ramban concur with this explanation.

(Tosafos is definitely referring to the elephant jumping clear from the ground with all four feet, not rearing up on its back legs. His point is not in innovating a form of movement that is acceptable as *hagbahah*, but rather that one can make the elephant into an emissary to do the *hagbahah* on itself. The *hagbahah* itself must be a regular *hagbahah*, which, as always, requires that the item be entirely raised from the ground. Ritva likewise notes that the elephant must have all four feet off the ground at the same time.)

Both students asked me essentially the same question, although each phrased it somewhat differently. One asked if it is indeed true that elephants jump; he had heard that they cannot. The other asked that since elephants cannot jump, how are we to account for Tosafos?

In answer to their questions, I wrote as follows: “Thank you for your fascinating question, which also bothered me when I studied this. I suspect that Tosafos did not know that elephants can’t jump; there probably weren’t very many elephants in twelfth century Europe, so I doubt that Tosafos ever saw one. So I think that Rashi’s explanation has the advantage!”

The confluence of events – on my reading the *New Scientist* article, and receiving these questions – was significant. Tosafos did not have the benefit of a nearby exotic animal ranch

¹ It would always be possible to formally acquire an animal by bringing it into one’s property. However, most people wish to complete the acquisition at the market.

with Buffy and Lisa upon which to perform an experiment. There was no reason not to assume that elephants can jump – after all, almost every other animal in the world can jump. So it was not at all unreasonable for Tosafos to give the answer that he did.

But less than a day later, I was hearing reports of anger from the students' town. "Slifkin claimed that Tosafos didn't know what he was talking about! Who does this thirty year old upstart think he is, dismissing Tosafos like that? Besides, if you look on the Internet, you'll see that it's not even true; although Asian elephants can't jump, African elephants can!"

I don't normally respond to every condemnation of my work. Yet the case of the jumping elephant is typical of the sort of topic that comes up in the course of what I do. I'm not looking for trouble, but my particular field of interest is the animal kingdom, which is a mixed bag. Sometimes, my studies involve the fascinating task of identifying the animals of the Torah and Talmud, as with the work that I did for Artscroll's Schottenstein Talmud. Often, it means drawing inspirational lessons from animals, as with my study of *Perek Shirah*. And it sometimes includes learning about the Torah's magnificent framework for governing our relationship with the natural world, as explored in my book *Man and Beast*. But it also includes grappling with the conflicts that arise between Torah and zoology. In dealing with the interface between Torah and the natural world, questions such as those asked by these students continually arise. I think it is worthwhile to explain the issues that I face and how I deal with them.

The first point to consider is whether it is at all legitimate to claim that the Tosafist, one of the Rishonim (the great medieval scholars), could have been relying on flawed information. For this, one need not even bring up the recently controversial views of Rambam, Rabbeinu Avraham ben HaRambam, Ramban, Maharam Schick and Rabbi Hirsch, that the Sages of the Talmud possessed knowledge of science that was no better than that of other people in their era. We have the position of the Chassam Sofer (in his novellae on *Maseches Niddah* p. 18a) concerning a discussion by the Rishonim about an aspect of human anatomy. He writes that "after investigations in books and from scholars in the field of anatomy, it is impossible for us to deny that the reality is not in accordance with the explanation of Rashi and Tosafos and the illustration of Maharam Lublin, and we have nothing other than that which the Rambam wrote in his compendium... and therefore I have not bothered at all in explaining the words of Rashi and Tosafos in this topic, because it is impossible to sustain them according to the reality, and you – know this!" We also have the Malbim's discussion of the firmament, in which he dismisses the views of all the Rishonim on the grounds that they were working with the now-obsolete view of there being cosmic spheres encircling the earth.

Ah, but some people will say, Slifkin isn't the Chassam Sofer or the Malbim! He's just thirty years old, and no great Torah scholar!

Now, it is true that some people might confidently assert that elephants don't jump and yet have no real basis for this confidence. For example, while I was talking about this topic on the phone, my two-and-a-half-year old daughter Tikvah overheard me. When I hung up the phone, she said to me in a very serious voice, "Elephants can't jump."

“How do you know?” I asked her.

“Only the monkeys jump on the bed,” she stated confidently, referring to her favorite nursery rhyme.

I must admit that my knowledge on many topics is woefully lacking. Unlike the Chassam Sofer, I have not studied the entire Talmud. Unlike the Malbim, my knowledge of *Tanach* is far from what it should be. I don't even know how to parallel park properly. I am therefore very hesitant to offer opinions about many topics.

But I do know a thing or two about elephants. I have spent most of my life studying animals, and elephants in particular have long fascinated me. I have devoured books about them and have spent much time observing them in dozens of zoos and in several countries across Africa. I have learned about how their trunks contain no bones but eighty thousand muscles, about their ability to memorize vast swathes of territory, and about how they communicate through infrasound. I have watched them being forced to laboriously stand on their back legs and on their front legs. I have also extensively studied all the references to elephants in Talmudic literature, for the purposes of an encyclopedia that I am writing. Most significantly, I have studied the research of authorities who specialize in the mechanics of animal locomotion. And I can confidently state that elephants do not jump.



This is known both empirically and also due to our understanding of animal anatomy. Many people have worked with elephants their whole lives and have observed that they do not jump. And despite intense efforts by circus trainers to make elephants perform an extraordinary range of tricks, and the earth-shattering impact that a jumping elephant act would have, nobody has ever managed to come up with one. It is true that elephants are quite agile in terms of balancing, being able to perform handstands, walk a tightrope, and even ride a tricycle. However, such forced feats, aside from causing distress to the elephant, do not relate to its raw power.

It all boils down to simple physics. An average cantaloupe melon, at about six inches in diameter, is twice as wide as an average orange. But if you cut the melon in half, the area of the cross-section is four times as great as that of the orange. And the melon weighs eight times as much. For any given object, if it increases in length and its proportions remain the same, its cross-sectional area increases at an even greater rate, and its volume at a yet greater rate still. The cross-section is proportional to the length squared, while the volume (mass) is proportional to the length cubed.

Bigger animals are therefore built differently than smaller animals, since the weight increases according to the volume, whereas the strength of a leg-bone depends primarily upon its cross-sectional area. Imagine a deer that is magically doubled in size to the height of elephant. The cross-sectional area of its leg bones would quadruple in size, but its weight would increase eightfold. Its legs would therefore not be able to support it. A mouse can support its weight on very slender legs; a deer has thicker legs; and an elephant's legs must be very thick indeed. As a consequence, it has a heavily built skeleton which is necessarily very rigid, and its movements are relatively stiff.



An Asian elephant at the Jerusalem Biblical Zoo. Note how its pillar-like legs are locked in an upright position. This is known as a graviportal stance.

The strength of muscle, like that of bone, also depends on its cross-sectional area. It only increases by a factor of four when height is doubled, whereas weight increases by a factor of eight. The bigger an animal, the stronger it is in an absolute sense, but the weaker in a relative sense. Elephants simply lack the muscular strength to propel themselves from the ground.

The posture of an elephant is also necessarily very different from that of smaller animals. A mouse can keep all its legs in a crouching position, ideally suited for moving fast in a dangerous world. A dog or deer stands with its hind legs in a bent position, ready for acceleration. But an elephant does not have enough muscular power to stand in such a way. Elephants therefore stand with their legs positioned like columns beneath them, and run by swinging these pillars back and forth rather than with the flexibility and grace that smaller animals possess. In fact, it is generally considered inappropriate to use the term “running” for elephants, since at no point do all their feet leave the ground.

The legs of an elephant are engineered for supporting massive weight, not for athletic ability. If we consider the lifestyle of an elephant, it becomes clear that it simply has no need to run like other animals or jump. The animals that possess athletic skills and leaping ability are those that need such skills to catch their prey or to escape predators. But elephants prey on trees, which they can push over in order to eat, and they don't have many predators.

It is not just leaving the ground that is problematic – coming back down would involve further troubles. If an elephant were to fall on its feet, it would suffer severe damage. The circus acrobatics that elephants are forced to perform (usually by means of prodding them painfully with a spiked stick) cause immense strain. Even something as seemingly simple as going down on its knees puts a tremendous strain on an elephant's joints and intervertebral discs. Elephants are very ponderous beasts and are only too aware of how much support their vast bulk needs. They tread carefully and are reluctant to even take two legs off the ground at the same time. Zoos are able to keep elephants restrained in their enclosures with only a shallow ditch; the elephants usually realize that they are simply incapable of crossing it.



This elephant at London Zoo died when it fell into a shallow moat.

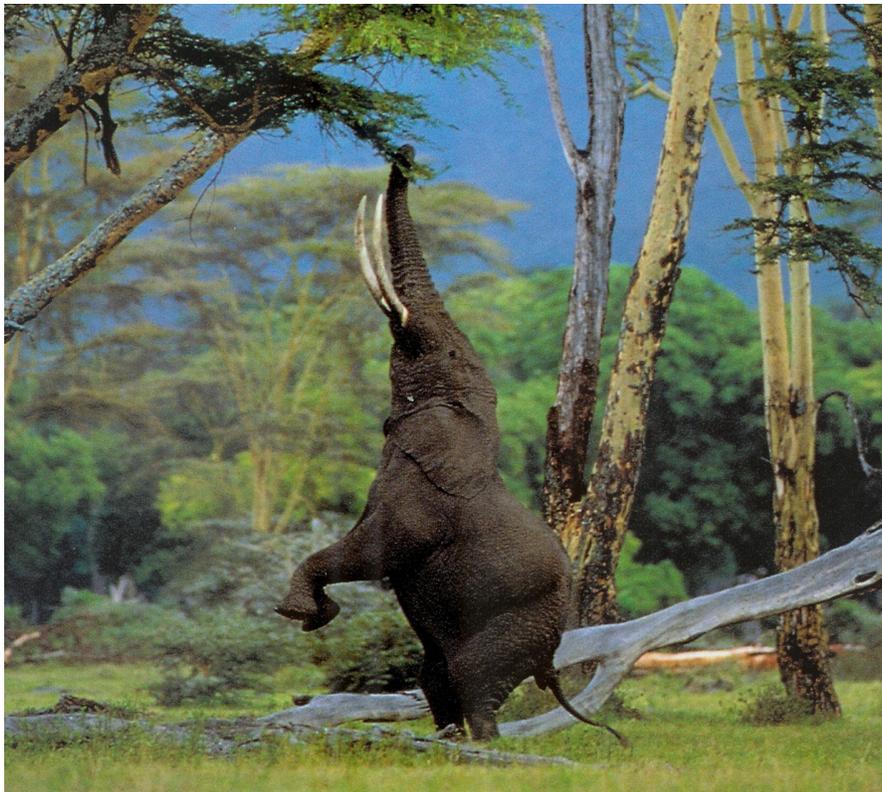
A mouse is far stronger than an elephant – relative to its size. But scale up a mouse to the size of an elephant, and its legs would collapse. The structural modifications of an elephant barely suffice to keep it upright; jumping is out of the question. And there may be further factors that contribute towards its inability to jump, relating to the inflexibility of its leg and foot bones.

Ah, my critics claimed, but there is a website stating that although Asian elephants can't jump, African elephants can and do! This reflects one of the problems of the Internet: a great deal of information is presented, and the average reader often lacks the ability to judge its value. In this case, yes, there is indeed a letter on a website discussing the annual "Elephant Jumping Festival" in Nairobi. It describes how the elephants are categorized according to the type of jump (high jump versus long jump) as well as by the sex and weight of the participant.

Unfortunately, the letter is a prank. This ought to be obvious from the subsequent discussion about dope-testing suspected anabolic steroid-enhanced bull elephants by taking urine samples, and how winning competitors are suspected to be linked to crazed pygmies with freshly honed spears poking the elephants in sensitive regions. However, it seems that some people nevertheless believe it to be describing a real event. (Take a look at <http://www.straightdope.com/mailbag/melepha2.html>, and judge for yourself!)

Now, in a book appropriately entitled *Do Elephants Jump?* the author does cite some claims that baby elephants will jump when provoked, and a report of an adult elephant leaping over a ravine. The experts that I spoke to were skeptical of these reports, and when I contacted the book's author, he himself wrote to me that he was almost certain that such accounts are not true. However, it is in any case irrelevant to our discussion. First, baby elephants are not too heavy to be picked up either, which means that the Talmud's question would not apply to them (since it is only discussing how one can acquire an animal that is too heavy to be acquired via the preferred method of picking it up). Second, and more fundamentally, we are not discussing whether it is *ever* possible for *any* elephant to jump, but rather whether it is a normal behavior which it would do to obtain food. The Talmud is discussing how, according to Rabbi Shimon's view, it is possible to acquire an elephant, which is too heavy to be picked up. It is not discussing how it is ever possible for an elephant to jump, but rather, generally speaking, how elephants can be acquired. And, generally speaking, making it jump up in the air is not an option.

Another point to consider is that we are not only discussing an elephant jumping, but rather we are discussing making it jump by hanging food out of its reach. The remarkable photograph below illustrates what an elephant does in such a situation. First it tries to reach it with its trunk. If that doesn't work, it tries to increase its reach by standing on its back legs (although only males can do this, and only briefly). If it still couldn't reach, jumping would now require using the force exerted by its hind legs alone – which would be even less conceivable than jumping with all four legs.



Thus, people who have studied elephants can indeed confidently state that elephants do not jump. But isn't it at least theoretically possible that I am wrong? What if scientists were to discover that the elephants of Talmudic times were of a now-extinct species that did indeed jump to get food? The answer to that is to consider what would happen if we discovered that human anatomy has changed and that the explanation by the Rishonim of human anatomy in *Maseches Niddah* was indeed correct. This would not mean that the Chassam Sofer was wrong to reject their explanation. He was fully entitled to rely on the medical advances of his era. Likewise, I have every reason to rely on the extremely advanced elephant expertise of today.

Is it disrespectful to state that the Tosafist did not know that elephants don't jump? Not at all. Why on earth would Rav Meshullam have known it? He was a towering Torah scholar who attained widespread recognition for his great erudition, even in an era of great personalities. But he did not know how to install Windows XP, because it hadn't been invented yet. And he didn't know that elephants don't jump, because he had never seen one.

There were no zoos in medieval Europe, and very few elephants. The emperor Charlemagne, king of the Franks, received an elephant as a gift in 797. Frederick II used an elephant in his capture of Cremona in 1214. King Henry III of England received an elephant from Israel in 1254. Alfonso V of Portugal gave an elephant to René d'Anjou in 1477. The Vatican was given an elephant in 1514. The average person in those times never saw an elephant, and unlike today, did not benefit from *National Geographic*. Illustrations from that era show that artists, basing themselves on stories, were very unsure about how to depict elephants. They were often portrayed as possessing a body like those of horses or deer, sometimes even with split hooves. Of particular relevance to us is that they are sometimes drawn with the hindlimb structure of lions or dogs, poised with elastic energy. Rav Meshullam ben Nathan, who was born in Provence in 1120 and passed away in Melun in 1180, never saw either a live elephant or an accurate drawing of one. It is no wonder that he assumed that elephants jump.



The Great Khan Hunting, from the *Livre des Merveilles du Monde*, c. 1400.

Note the lion-like legs of the elephants, complete with paws, which would indicate an ability to jump.

It is true that there are some people who believe that if Tosafos says that elephants jump, then elephants jump! They believe that the Tosafists, along with the other Rishonim, all possessed *ruach hakodesh*, divine inspiration, and that this necessarily means that everything that they wrote was absolutely true. But disagreeing with that premise is *not* disrespectful, according to my rabbinic mentors. And it is certainly not the approach taken by many great Torah authorities.

It should be noted, however, that the fact that elephants do not jump does *not* mean that the Tosafos was incorrect in its explanation of the Talmud. Tosafos may very well have been correct in explaining (unlike Rashi) that this is what the Talmud was referring to. But our modern knowledge about elephants does not mean that there is any less value in studying this case of the Talmud and Tosafos. Consider this: the total number of Jews who ever wanted to purchase an elephant is in any case probably somewhere in the region of zero. So why didn't the Talmud discuss the vastly more likely case of an ox, which is also usually too heavy to pick up? Presumably the Talmud wanted to give an extreme example to illustrate the difficulty of Rabbi Shimon's requirement of *hagbahah*. With this in mind, perhaps it is irrelevant if elephants do or do not jump. The point of the Talmud is just to ask how, according to Rabbi Shimon's view, one would acquire an animal that is too heavy for *hagbahah*. One of the options given is that it could be made to jump. True, the specific example given of an elephant would not work, but Tosafos' explanation of the Talmud's answer is still relevant for other animals. And there can be further ramifications. Some of the later authorities discuss the legal workings of Tosafos' answer; can jumping really suffice as a form of *hagbahah*? This point is of great legal interest and relevance even if elephants don't jump, as there are many other animals that do!

Having established that elephants do not jump, the next point to consider is how this should be presented. There is a right way and a wrong way to present such information. For example, with the highly charged topic of whether Chazal could have erred in science, one rabbi discussing the various approaches on his website that he recommended, presented the Rambam's approach concerning Chazal with the heading, "They were wrong!" I believe that this is an overly cavalier and dismissive way of dealing with such a sensitive topic. In this case, I did not, nor would I ever, say that "Tosafos doesn't know what he is talking about," as my critic claimed. Heaven forbid that I would use such a disparaging way of talking about Tosafos! All I wrote was that "I suspect that Tosafos did not know that elephants can't jump; there probably weren't very many elephants in twelfth century Europe, so I doubt that Tosafos ever saw one." Could this have been written with some more finesse? Perhaps. On the other hand, experience has taught me that one man's finesse is another man's weasel words that turn some people off altogether. And, in responding to an average of a dozen or so such questions every week, it is hard to come up with the perfect phraseology.

But isn't there a danger in teaching students that Tosafos was incorrect about elephants jumping? After all, the student may decide that if Tosafos was wrong about elephants, he was wrong about other things as well! Yet personally, I have not found it overly difficult to

demonstrate the difference between Torah rulings and empirical scientific knowledge. In my experience, students actually respect and appreciate these answers greatly.

Some may still fear a certain weakening of Tosafos' absolute authority. Teaching critical thinking may open a dangerous Pandora's box. This is indeed a legitimate concern, and one about which I spend much time worrying. But what is the alternative? To teach them that elephants do jump because Tosafos said so, and that scientists are wrong? Aside from that not being true, it carries its own dangers. For when the student discovers that elephants actually do not jump, his faith in both his rebbe and Torah will be greatly harmed.

One might suggest that it is better to simply state that we do not know the answer. That may sometimes work. But the odds are that the student will eventually discover the truth about elephants anyway – it's just a Google-search away. Is it not better for him to hear it from a rabbi who can place it in context and demonstrate that the Tosafist was not foolish for believing that elephants jump, rather than from websites that expose the "fallacious beliefs of the ignorant"?

Is there any solution for a teacher who is determined that his students never risk weakening their faith in the authority of Torah scholars? His only option is to avoid teaching this Tosafos altogether. But there will also be hundreds of other topics that he will have to censor from his class. For some communities, this may indeed be the preferred choice. Yet for others, who have access to the wider world, it is simply not possible to entirely insulate themselves from such challenges. My mentors believe that it is better to possess the tools to deal with these challenges, even if they are potentially dangerous tools.

Many people have the luxury of never having to confront these issues. But as a person who has gained a reputation for expertise in zoology, I encounter hundreds of questions about animals in the Torah and Talmud. Conflicts between Torah and zoology, such as that of the jumping elephant, inevitably arise. They are as impossible to ignore as the proverbial elephant in the room. And I can't help but notice that the elephant's feet are firmly planted on the ground.

What would *you* do?

Postscript:

More than two years on, I am amazed at how many objections I still receive on this topic. I am even more amazed at how many of them would be answered if the person would just read the essay carefully! I still have people claiming that Tosafos is referring to an elephant standing on its back legs, or to a baby elephant, or to an elephant jumping a minimal amount. One person strenuously argued that elephants have devolved from a more athletic form. This topic powerfully illuminates the different mindsets in these areas.

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