

THE SABBATH ELEVATOR QUESTION

A Technical Analysis of
A Halakhic Problem

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The analytical methods employed by the Institute for Science and Halakha and the need for such methods are exemplified well by an examination of the permissibility of using an automatic elevator on the Sabbath. This subject illustrates very clearly the importance of the Institute's guiding principle, that it is impossible to establish a halakhic ruling without a complete and detailed knowledge and understanding of the device under consideration.

The question of the Sabbath elevator is especially interesting because of the conflicting decisions promulgated in the past, some permitting its use and others forbidding it. The work of the Institute indicates that both views are somewhat simplistic and that the halakhic conclusions were, unfortunately, based on incomplete technical knowledge or misconception. Comparison of even a very simplified explanation of elevator operation with the technical data on which the halakhic reasoning was based will suffice to prove this.

Most of the responsa on the subject, and this article as well, limit their discussion to an automatic elevator, one that runs according to a preset program that is not influenced by the passenger in any way. Such an elevator stops for a fixed predetermined time at each station and then proceeds to the next station. A warning buzzer sounds before the doors begin to close, thus warning the passenger not to interfere with door closing something which would affect the program.

Automation vs the Shabbos Goy

Without considering the question of the permissibility of a non-Jew operating the elevator, it should be fairly evident that an automatic program is preferable to the use of a non-Jew. As he himself does not benefit from the elevator travel, the non-Jew might be considered to be working only for the Jewish passenger. He may change the program to accommodate the passenger, advance or delay the start of the travel, or press the dispatch button for the floor he knows is desired. The automatic program is not influenced in this manner and has no intent to work for the passenger.

Note that the comparison made here is between an automatic program and manually-operated pushbuttons. The case of the old-fashioned car where an operator starts and stops the motor and varies speed and direction by moving a hand control and also opens and closes the doors by means of a lever mechanism is somewhat different and is not considered in this article.

Passenger Influence

Those who permitted the use of an automatic elevator based their view on the premise that automatic operation means that the passenger does not cause any forbidden act on the Sabbath. The car stands at the station for exactly the same period of time whether a passenger enters it or not. It then travels to the next stop whether there are passengers or not. If the same events would have occurred in his absence, the presence of the passenger, they said, has no significance. They argue, therefore, that it is permitted to enter such an elevator, travel in it and leave it.

This is certainly a logical argument. Those who forbade the use of an automatic elevator, however, had an equally convincing argument. It is obvious that the energy required to lift a full car is greater than that required to lift an empty car. The presence of a passenger and the lifting of his weight requires electrical energy from the power lines. The supply of this energy to lift the passenger is considered forbidden. The principle of the conservation of energy may be enlisted to argue further that the fulfillment of the demand by the passenger for additional electrical current causes the burning of additional fuel at the power station. The burning of such additional fuel might also be considered the halakhic responsibility of the elevator passenger.

Basics of Elevator Construction

Before examining these two views more closely, it is important that we be acquainted with the basics of elevator construction and operation. Most electrical elevators are of the traction type. As shown in the sketch, such elevators consist basically of a car and a counterweight hanging at opposite ends of a cable that passes over a pulley at the top of the shaft. An electric motor rotates the pulley to raise or lower the car. A mechanical brake prevents rotation of the pulley when the car is parked at a station. The use of a counterweight is an excellent means of saving energy as the motor need not lift the entire weight of the car but must supply energy only to move the difference between the weights at the two ends of the cable and to overcome friction.

For the sake of simplicity, let us consider a system in which there is no motor and in which the car and the counterweight are equal in weight. This is a balanced system and, if stationary, has no desire to move. If the two weights are equal and if there is no friction, it requires minimal energy to raise or lower the car. Any imbalance, such as that caused by adding weight to one side, will cause that side to descend and the other side to rise with a velocity increasing linearly with time. The force that causes the descent is obviously the weight added to the descending side.

If, as in real life, there is friction in the system, there will be movement only when the added weight is sufficiently large to overcome the opposing friction forces. Even if the weight added to the car is insufficient to cause movement, it is still true that it asserts a downward force which attempts, unsuccessfully, to cause descent. If the counterweight were initially heavier than the car, it might happen that the addition of quite heavy objects would be insufficient to cause car descent or even to prevent ascent. In all cases, however, it is evident that the added weight is trying to lower the car and is opposing the attempt of the counterweight to raise it. If a number of individual weights are added, each one may be considered as asserting a separate downward force, thus taking part in the job of lowering the car.

The Passenger as a Downward Force

A real-life elevator differs from our simplified example, above, in that a motor and often a gear train are added to aid in moving the car and that the car and counterweight are not equal in weight but instead balanced when the car is approximately half loaded. When the car is empty, the motor moves the car downward against the pull of the counterweight. When the car is half full, the two sides are balanced. With a larger number of passengers, their weight alone, without the aid of the motor, is often sufficient to cause descent.

In most elevators, a single passenger does not supply enough weight to overcome the counterweight and friction. While the heavy counterweight might still be able to raise the car and passenger without the aid of the motor, the motor is needed to cause descent. The heavier the passenger, or the more passengers in the car, the less energy is required from the motor. Interestingly enough, the motor is quite "intelligent" in that it always receives from the electric supply lines just enough energy to make up the difference between the total energy required and the amount provided by the passenger weight.

To summarize for a descending car, when there are no passengers, the motor takes sufficient current from the electric power lines to supply all the energy required. With a small number of passengers, their weight supplies only part of the downward force while the motor supplies the remainder. With an almost full car, passenger weight alone is in some cases the only downward force that moves the car. When the motor is aiding the passenger weight in descent, it draws a current from the mains lower than that required to lower the empty car. This value of current is incapable of lowering the car without the participation of the passengers. In all cases, the weight of each passenger constitutes a downward force by which he contributes his part to the descent.

Responsibility for Descent

If the passenger constitutes a downward force and this force is a significant cause of the descent of the elevator car, it would appear logical to assume that the passenger is responsible for the descent and its consequences.

When the passenger load is the entire downward force, each passenger is *eino yakhol*, *incapable*, but the group of passengers as a unit is capable of performing the act. When the motor participates along with the passengers another *eino yakhol* has joined in the group action because the motor, with the low current it is receiving in its *present* operating condition, is also incapable of performing the act alone.

In his book *Ma'alot B'Shabbat*. Rabbi Halperin proves that, according to halakha, an act done by a person's weight on the Sabbath as a consequence of his physical presence is considered his responsibility and is no different from an act performed by his hands in a positive action. He also shows that the motor's capability is to be judged by existing conditions and not by its capabilities under other conditions.

As the passenger is responsible for the descent, we must examine just what actions he has caused and determine if these actions are forbidden or permitted on the Sabbath. The downward mechanical movement of the car does not involve any infraction of Sabbath law. The modern elevator stops by itself at the desired floor. Except for some modern, computer controlled elevators, an electrical switch is usually located in the shaft a short distance before each floor and another is located at the floor level. As the car descends in the shaft, it operates these switches. The switches then perform electrical operations to slow down the car and stop it at the floor level. They also connect an electric motor to open the car doors. In many cases, they turn on an electric lamp to announce the car's arrival to people awaiting it. They may also light lamps in the car and on the landing to denote the floor number and sometimes will sound a bell to alert potential passengers. All these actions and many more are performed by the car in its descent. If the passenger is responsible for the descent, he is responsible also for illuminating the various lamps, connecting the door motor, the brakes, and numerous other electrical circuits.

"It Would Have Happened Anyway"

Utilizing the reasoning of those who approved the use of the automatic elevator on the Sabbath, we can argue that all of these actions would have taken place at approximately the same time even if there had been no passenger in the car. If we are willing to ignore for the moment the slight increase in velocity caused by the passenger weight and the resulting advance in time of all subsequent events, this is quite true. If the car had been empty, the motor would have lowered the car and performed all the actions noted above. Jewish law does not control the actions and responsibilities of motors and does not forbid them to lower an elevator car on the Sabbath. If the car contains passengers, however, the motor supplies only the additional power, if required, to supplement their weight. The power supplied by the motor under such conditions is not sufficient to lower the car without the aid of the passengers, and according to halakha does not release the passengers from their share of the responsibility for the results of the descent.

From the above discussion, it can be seen that the question is not whether or not the same action would have taken place in the absence of the passenger but establishing responsibility for the action taking place in the presence of the passenger. This may be illustrated by taking the example of a non-Jew, a robot, or an automatic device, that pushes a button every ten seconds on the Sabbath to turn a lamp repetitively on and off. A Jew now pushes the non-Jew aside momentarily and presses the button in his place at the same rate. The button is still being operated every ten seconds exactly as before. When the Jew stops, the non-Jew again takes over and continues to operate the button. The lamp goes on and off at exactly the same rate during the entire time of our example.

Would the Jew be justified in arguing that he is not responsible for turning the light on and off because it would have gone on and off in the same way and at exactly the same rate even if he had been absent. Common sense tells us that, when the non-Jew pressed the button he was responsible for the result and when the Jew took over the operation he took over the responsibility as well. Of course the non-Jew could have and would have done the action by himself, but the simple fact is that he didn't.

If the argument that it would have happened anyway were valid, it would be quite simple to devise automatic devices that would enable us to take over from them and perform legally almost every act normally forbidden on the Sabbath. We can see, then, that there is no significance to the question of whether it would have happened anyway under different conditions. The question is one of responsibility for the act being performed now under the conditions *presently existing*.

The Ascending Car

We have considered thus far only the descending car. The stopping of an ascending car at the next floor is also usually carried out by its operating electrical switches while ascending. The passenger, however, cannot be considered responsible for the results of this switch operation. His weight does not aid the ascent. Just the opposite is true. The passenger weight is pushing downward and is opposed to the lifting action of the motor. His opposition to it certainly releases him from any responsibility for the results of the ascent. The question we must examine during car ascent is that raised by those who, in the past, forbade the use of the automatic elevator on the Sabbath, namely, the question of the responsibility of the passenger for the extra work done by the motor in lifting the passenger weight. It is interesting to note that, in the past, all rabbis who considered the problem of Sabbath elevator operation discussed only car ascent. Rabbi Halperin was the first person to realize that there could be a problem with descent.

As we have noted above, it is necessary to know not only to define an event but also to know how and why it happens. Only thus may we be able to determine who bears the legal responsibility for it. It is perfectly true that additional energy is taken from the electric lines to lift the passenger load or, as it is expressed above, to overcome the downward force of the passenger weight. We must now determine halakhic responsibility for the consumption of this energy.

Motor "Intelligence"

To determine responsibility for the increase in motor current, we must first examine the "intelligent" behavior of the motor. The motor demands and receives an amount of current that varies with its needs. It receives additional current from the power lines to lift additional passengers and receives lower currents if and as required to supplement the passenger weight on descent.

The connection of power to an electric motor causes it to rotate. Rotation of a motor causes the generation of an internal force within it that opposes the flow of current. These two phenomena take place at once. The faster the rotation of the motor, the greater the strength of the opposing force generated in it and the less current that will succeed in flowing into it. At low speed, therefore, the current entering the motor is larger and as speed increases the current consumption becomes lower.

In some types of motors this force takes the form of a counter-voltage that opposes the flow of current. In others, the opposing force is a result of the difference between the motor speed and the rate of reversal of the alternating current in the power line. In all motors, however, the result is the same. More speed means greater opposition and less current.

This characteristic of the motor gives it "intelligence", the ability to vary its current requirements according to load. The presence of passengers in the ascending car makes it more difficult for the motor to accomplish its task. Because of this increased difficulty, the motor is unable to reach the speed it would have been able to develop when lifting an empty car. Even a very slight decrease in speed means a lower counter-force and therefore a higher current flow. The additional current is sufficient to maintain a speed on ascent that is only very slightly lower than that of an empty car.

Preventing a Preventive Action

With a basic, if somewhat simplified, knowledge of what happens, we may now analyze the action. Rotation results in a current-opposing force. The function of this force is to *prevent* the entrance of current into the

motor. The presence of passenger weight *prevents* the development of this preventive force to the value it would have reached with an empty car. The reason that the motor current is greater when lifting passengers is that their weight has prevented the counter-force from preventing the flow of current.

Before discussing the halakhic status of a person who prevents a preventive action, it is worthwhile to examine the situation more closely. At the moment the passenger enters the car, the preventive force does not yet exist. It comes into being only after the independent program releases the brakes and puts the car into motion. When the passenger enters the car, therefore, he does not reduce an existing force. Only in the future, when an independent action causes the creation of the force, will the passenger presence then prevent that force from reaching its "normal" magnitude.

A Halakhic Parallel

Since classical Jewish law does not discuss elevators and electric motors, we must examine a parallel or similar example of prevention of a preventive action. Such a case exists in the *Shulhan Arukh, Orach Haim 277*, based on the Talmud in *Shabbat 120b*. The *Shulhan Arukh* states that when, on the Sabbath, a wind is liable to extinguish the candles it is permissible to close the door or window to prevent the wind from entering. At first glance, it would appear that there is no logical reason to require the *Shulhan Arukh* to make this ruling. What possible forbidden action could there be in preventing the blowing out of a candle? If a person is about to perform a forbidden act and a second person prevents him from doing it, has the second person done anything wrong? To prevent a candle from being blown out is not an action at all and is certainly permitted.

A closer examination of the action of the wind on the candle will enable us to understand the need for a ruling. The wind causes the candle flame to flicker and be blown aside. When considering the oil lamp of talmudic times, the poor contact with the wick, causes the flame to become smaller. When the wind is blocked, the flame straightens up, grasps the wick with better contact, obtains more fuel and becomes larger. For a person to enlarge the flame is certainly proscribed. It is one of the basic Sabbath prohibitions. Despite this, the *Shulhan Arukh* states specifically that it is permitted.

Here again, a second and closer examination of the events will explain the ruling. The action of the wind on the candle is to *prevent* the flame from keeping close contact with the wick and attaining its normal large size. The person who closes the window is *preventing* the wind from performing its preventive action. This allows the flame to return to its normal larger size. In other words, the prevention of a preventive action is permitted even though the result may be one that would not be permitted by direct action.

Types of Grama

In his *Shulhan Arukh Harav*, the *Baal Hatanya* adds a few explanatory words to the ruling stating that "it does not constitute even *gram hav'ara* (indirect causation of burning)". In addition to direct action, the halakha recognizes several types of indirect causation called *grama*. When an action is forbidden on the Sabbath, some types of *grama* are also forbidden. Other types may be permitted under certain extenuating circumstances, and still other types of *grama* are considered to be permitted. What the *Baal Hatanya* is saying is that prevention of a preventive action does not even fall within the legal category of *grama*. This explains why it is completely permissible.

It was explained above that, when lifting passengers, motor current increases as a result of its lower speed. Similarly, when the car is descending, passenger weight causes an increase in speed which results in lower motor current. These physical facts provide additional refutation to the argument that "it would have happened anyway". One rabbi utilizing this argument states that the descending passengers "cause nothing new, nor do they change the rate of descent, neither to advance nor to delay. Even in the absence of passengers", he states, "the events occur exactly as in their presence". His statement that there is no change in rate of descent is obviously the result of his being supplied with incorrect technical information.

In the example set forth above of the Jew who performs an act by replacing a non-Jew, we have shown that the argument "it would have happened anyway" is not relevant. We now see that, in addition to lack of relevancy, it is also factually inaccurate. Passenger presence causes a change in speed both in ascent and descent. The lowered speed in ascent causes a delay in all subsequent events and, therefore, is not considered *hillul Shabbat*. In descent, however, the passenger causes an increase in speed that advances all the subsequent electrical operations. and thus poses a halakhic question.

Advancement of Subsequent Events

There is no doubt that passenger presence in descent causes the subsequent electrical actions to take place sooner than they would have occurred if the car were empty, but no halakhic conclusion can be drawn without first examining carefully the scope and significance of *kiruv melakha*, advancing an action. Such a detailed halakhic analysis and the conclusions to be drawn from it are included in Rabbi Halperin's book, *Ma'alot b'Shabbat*. The analysis considers the definition of the *issur* and, among other things, if "advancement" of an action does not, in effect, involve a cancellation of the previously scheduled event and thus should be considered a completely new act. In the case of the elevator motor, the changes in velocity and total travel time between stops are quite small. It must be established, therefore, whether *kiruv* is prohibited even if infinitesimal or only when it is perceived by the average person's senses without the aid of instrumentation. Lastly, one must determine if there is a difference in liability when the act involves a Torah prohibition as opposed to a rabbinic prohibition.

It is quite apparent that those who permitted the use of the automatic elevator on the Sabbath were not aware that the passenger constitutes a downward force which makes him responsible for its results. It seems evident too, that they did not receive correct technical data concerning the effect of the passenger on elevator speed. In some instances, it may be discerned quite clearly that incorrect information was given by unscrupulous persons interested in receiving a Sabbath permit for their elevator.

The knowledge that increased motor speed causes a stronger counter-force which weakens the motor and lessens its participation in the descent provides the proof that additional passenger weight must cause a speed increase. The assumption that the passenger does not cause any advance in the electrical actions leads to a contradiction. If there is no speed increase, there is no lessening of motor current and, therefore, no weakening of the motor. If the motor is still operating with the same force, the addition of a passenger constitutes an increase in the sum of the downward forces. Such an increase in total force must bring about an increased speed which, of course, contradicts the original assumption and establishes its falsity.

Since passenger presence does cause higher motor velocity in descent, it is clear that the increased counter-force results in a weakening of motor rotational force or torque. The additional downward force of passenger weight is thus accompanied by a weakening of the downward force of the motor. Is it possible that the two changes are equal, cancel each other, and thus allow the total downward force and the elevator speed to remain unchanged? While, at first glance, this might appear feasible, a second look discloses the contradiction which proves that complete cancellation is not possible. If the speed did not increase, the motor did not weaken. The added passenger is then an additional downward force that must result in a speed increase. We see, then, that added passenger weight must cause some weakening of the motor which partially compensates for the weight increase and thus prevents an even greater speed increase that might endanger the passenger.

Misleading Information

A glaring example of false data being used to mislead may be seen in the case of a noted rabbi who considered an elevator in a Jerusalem public building and questioned the effect of passenger weight on motor current. The "technical expert" explained that the elevator car weighed some five or six thousand pounds. Certainly, a motor that lifted such a weight would not be much influenced by the addition of a 150-pound passenger. If the rabbi wanted to be extremely strict, however, he could request the use of a more powerful motor. If the motor were to be twice the usual power, he said, the effect of the average passenger would be completely undetectable. The

rabbi accepted these "facts" and evidently decided to be "strict" as he requested a motor of double power. The "expert" conveniently forgot to mention that the weight of the car is approximately balanced by that of the counterweight and that the motor need lift only the imbalance. The passenger is a dominant factor in changing the balance condition and the motor reacts accordingly. This remains equally true when the motor is oversized.

The use of this phenomenon to prevent further increase in motor speed is easily understood when one realizes that the more power that is consumed, the more difficult it becomes to rotate a generator. When there is an increase in the use of electrical power, power stations find it difficult to turn the generators and, therefore, burn additional fuel to supply the energy required to maintain generator speed. When they cannot supply the demand, the difficulty in rotating the generators causes a brownout or even a complete power failure. In the elevator motor too, when it operates as a generator, the use by neighboring consumers of the power it generates makes its rotation more difficult, thus preventing speed increase. In terms of conservation of energy, we may say that instead of using the energy generated by passenger weight pulling on the car to increase speed and kinetic energy, it is converted into electrical energy to light lamps and operate electrical equipment in the vicinity.

In many elevators, the car is slowed down and stopped by generation of energy which, when used by electric company subscribers, causes the braking action. In other words, the elevator is stopped by gradually changing its kinetic energy of movement to electrical energy. As the electrical energy is taken out of the system and used up, the car slows down and stops. Many kilowatts of power are generated during slowdown. If the power generated is not used, the car will not slow down but continue to increase its speed.

A Miniature Power Station

If a person is responsible for acts performed by his weight, we see that the passenger in the descending nearly full elevator is responsible for operating a miniature electric power station in competition with the public utility company and is supplying electric lights and power to the neighbors. It should also be evident that the passenger requires that the power generated by his weight be utilized, for otherwise the car speed increases without control and it is impossible to slow down and stop except by emergency measures.

The case where the passenger is also the owner of the building is of special interest. When the elevator generates power, the watt-hour electric meter rotates backwards and lowers the reading of the energy for which payment must be made. The passenger-owner is not only operating his private power station on the Sabbath, but is also being paid for it.

Parking Violations. A Weighty Problem

The problems in the Sabbath elevator are not limited to moving violations caused by descent. There are often parking violations that take place when a passenger enters the elevator car while it is standing at a station.

Most elevators are equipped with electrical weighing mechanisms whose function is to indicate to the control system conditions such as "passenger in car", "full load", or "overload", or to supply exact data on load often needed to enable proper control of acceleration and deceleration. The weighing device is usually located under the car floor or in the suspension system on its roof. On entering the car, the passenger operates electrical circuits that weigh him and thus ensure proper operation under the existing load condition. An automatic travel program for the Sabbath is certainly not evidence that the weighing circuits are not functioning as on weekdays.

To make certain that automatic car doors will not close on a passenger standing in their path, many elevators are equipped with a photoelectric or proximity detector activated by the passenger as he passes or stands in the doorway. Additionally, all elevators have a safety device that stops the door from closing if there is resistance to its closing movement. Release of the door is then the final act that permits the car to travel. It is quite obvious

that every operation of such electrical mechanisms also causes a change in the timing of the supposedly automatic travel program and equally evident that there might be an *issur* in the operation of the mechanism itself even without reference to resultant effects.

Hand Operated Doors

In some elevators, usually in older models, the outer door is hinged and hand operated by the passenger. Since the elevator cannot be allowed to move unless this door is closed and locked, it is necessary that electrical circuits be connected to it. In a significant number of automatic and so-called Sabbath elevators examined by the Institute's technicians, it was found that releasing or closing the outer door was the final action that connected the motor and caused the immediate commencement of travel to the next stop. In the first paragraphs of this article it was mentioned that all those who considered Sabbath elevators limited themselves to the case where the passenger does not influence the "automatic" program or interfere with door operation. Unfortunately, in most "automatic" elevators, this condition does not really exist.

This short article cannot hope to survey all of the problems involved in Sabbath operation of the automatic elevator. We can only hope to make the reader aware that such problems exist and to indicate the technical knowledge and thought processes brought into play in their analysis. Rabbi Halperin's book goes into all the problems and their solutions in great detail together with the basis for his *halakhic* decisions and the reasoning involved.

Even when analysis by *halakhic* reasoning shows that an act should be permissible, this does not necessarily mean that the rabbis will permit the act. They must examine also other aspects of the act and the possible results and ramifications of its performance. Among other considerations, they must take into account what will pass through the mind of the person witnessing the act and whether the results of the act might cause revolutionary changes in the traditional characteristics of the Sabbath.

Halakhic Conclusions

In the case of the automatic elevator, the scholars of the Institute for Science and Halakha under the guidance of the eminent Rabbi Levi Yitzhak Halperin, have not felt it necessary to ban the use of the *halakhically permissible* elevator because of such secondary considerations. Rabbi Halperin has ruled that all actions resulting from car descent are the responsibility of the passengers whose weight is a factor causing the descent. On the other hand, the increase in motor current caused by passenger presence in ascent is not their halakhic responsibility in most elevators. Needless to say, it is not permitted to enter any elevator equipped with the usual weighing mechanisms or where entry may cause releveling of the car or activate door controlling devices. In the case of hinged outer doors, one must not open or close such doors unless it is certain that in doing so one does not operate any electrical circuits.

Solutions have Been Developed

From the insight gained in examination of a few of the halakhic problems, one can see that the answer to the question of operating automatic elevators on the Sabbath is neither simple nor obvious. The rabbis and engineers of the Institute have labored a number of years in examining every action that takes place in many different types of elevators and have designed elevator systems that meet all halakhic requirements for automatic Sabbath operation. Many such elevators are in operation in Israel and countries around the world.

Beware the Garden Variety of Automatic Elevator

While it is possible, in principle, to modify almost any automatic elevator to make it a Sabbath elevator, it is not often done and many still assume that the "common" automatic elevator is permissible. To correct this misconception we have attempted here to illustrate by a few examples the methods of establishing halakhic responsibility through understanding of technical devices. Such technical knowledge, properly analyzed, is a prerequisite to halakhic decisions that conform with the laws and traditions handed down to us through the generations.