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### How to drive a manual transmission (stick shift) car

This tutorial starts with the assumption that you already have experience driving an automatic transmission car. In today's day and age, with the easy availability of automatic transmission cars, it is much easier to learn on an automatic. There are so many things to get used to when learning to drive, that trying to master a clutch and gearshift while trying to remember to stop in front of the stop sign or back into a parallel parking space seems a bit silly.

Read through the WHOLE tutorial first. Some things are hard to explain before others, but you need to see the whole picture before you first turn the key...

#### Preparation:

Obviously, you will need a stick-shift car. Your best bet is a car that is not new, nor one that has had the clutch recently replaced. Clutches are much "stickier" when new, and this makes learning more difficult. It's also better to learn in a smaller car, with a smaller engine. They are much easier to get going and to stop. Finally, choose a car with a floor-mount stick shift. Don't try to learn on a car that has the shifter on the steering column. Floor mounted stick shifts are more intuitive and easier to use.

You'll also want a couple good, safe places to practice. The first should be a large FLAT parking lot, preferably one with few lamp-posts so you don't have to concentrate so much on the "where you're going" while you are getting comfortable with shifting. The second should be a long straight section of low traffic roadway.

Practice on a a day where neither bad weather nor darkness are going to cause problems. If you are borrowing the car and the owner wants to come along, work out in advance that you might ask them questions, but your

intent is to learn, and that you will be learning from a few mistakes along the way. In other words, they should keep quiet unless you ask for help. (I wish my grandfather followed those rules when he was trying to teach me to bowl!)

Let your friend (you don't think they're really going to let you borrow their car to learn without coming along do you?) drive the car to the middle of the parking lot, and have them shut it off in first with the parking brake on. Trade places and climb into the driver's seat.

### **The drivers seat - Getting a feel for the pedals:**

Three pedals and a stick shift. And a parking brake. We'll get to the parking brake later - let's concentrate on the pedals and stick shift.

You already know two of the pedals - the gas and the brake. They work the same as they do in an automatic. So let's skip to the clutch. What the clutch pedal (far left) does is control the distance between two discs or "plates." One plate is connected to the engine, and has a big, flat surface. The other plate is connected to the transmission and is made of a material like fine sandpaper. The clutch pulls them apart when you press it in, and lets them touch each other when the pedal is up. So when you press in the clutch you separate the engine from the transmission. Since the pedal is not an on-off switch, you can control how quickly the two come together, letting one slip against the other for a bit, as you let the clutch pedal up. This "letting out the clutch" is the key to getting the car moving from a stop.

So, with the car still turned off, put your right foot on the brake pedal, and with your left, push the clutch to the floor. On some cars it is hard to press in, but most modern cars have a "light" clutch. A light clutch is usually what you want, because you're going to be pressing it in and slowly letting it out a lot. Practice pressing it to the floor somewhat quickly, then letting it back up slowly. It's not that hard to get used to.

### **Watch your hands - the gearshift:**

Now check out the gearshift. In general, the gears are laid out like an H, with first in the upper left, second directly below it, third is to the right of first, fourth below it, and if there is a fifth, it is up to the right of third. Reverse is usually on the left side of the H, sometimes up, sometimes down. Usually you have to push the gear lever down into the floor before it will let you go into reverse. The pattern is usually marked on the top of the knob as well.

Now, with the car still off, your foot on the brake only, and the gearshift in first, try to pull it straight down into second. It probably won't budge. This is because when the clutch pedal is up, there is usually internal pressure against the gears that keep you from taking it out of a gear, as well as putting it in a gear. While we're on the topic, why did I suggest leaving the car in first gear when it was turned off at the beginning? The answer is that manual transmission cars don't have a "Park" gear. Instead, you leave the car in first gear, and the fact that the transmission is connected to the engine means that it can't turn while the engine is off. First gear is the best gear to do this

in because higher gears could let the car move a bit if the engine turns just a tiny bit - first gear creates the greatest resistance. You may also ask why you need the parking brake as well? If you ever watched the Tom Cruise movie Risky Business, you'll know. Yes, in spite of all I've said above, it is possible to knock the lever out of first and into neutral, at which point the car can roll away. Down a hill. Out a dock. Into the lake. Very expensive.

Alright, let's get a bit more productive. Ignition turned off, right foot on the brake, push in the clutch and try moving the stick shift through the pattern, one gear at a time until you get to fifth, then back down again. Now try to find reverse. It is often hard to find. If you've been quiet so far, now might be the time to finally ask the owner something like "How the \*&\$% do I get it into reverse?" They will tell you the secret, which depending on the make and model may involve a modified golf or bowling grip.

### **Stop it! - How to safely stop**

Before you get to the part about moving, you need to get just a bit of experience stopping, otherwise your friend in the passenger seat will start clawing at the dash and screaming like crazy as you try to negotiate a hard left to avoid the one other car still parked in the lot.

At least for now, we're going to go for the simple stop. It doesn't matter what gear you are in, you can always use the brake pedal the way you are used to by pushing in the clutch first. Practice. With the car turned off and the parking brake set, rest your right foot on the gas like you be in normal driving, and put your left foot wherever you normally feel comfortable. Practice the panic stop - left foot quickly pushes the clutch to the floor and the right foot moves to the brake and presses it. You don't have to slam the clutch, but do it quickly. Practice. Again. It has to become somewhat natural. Later we will talk about using the clutch as you slow down, but for starters, always push the clutch in before touching the brake.

### **Let's get going: First gear**

It's the moment of truth. Put your right foot on the brake and use your left foot to push the clutch all the way down. Put the gearshift in neutral. Make sure it's in neutral by wiggling it. It should wiggle side to side easily. Now turn the key and start the car. Turn off the radio, the fan, and anything else that makes noise. Slowly, let out the clutch. If at any point the car feels like it wants to move, push the clutch back to the floor: you are not in neutral. Shut down and start over.

With the engine warmed up a bit, and a clear path ahead of you, push the clutch back in and move the gearshift to first. With your right foot still on the brake pedal, let the clutch out slowly. You will hear the engine slow a bit and the car try to move as you let it out. You have found the point at which the clutch "catches." Push the clutch back in and take your foot off the brake, and try it again. Car still doesn't move, huh? Push the clutch back in and release the parking brake. NOW you're set.

Clutch to the floor, right foot on the gas, give the engine just a little extra gas - not much. Now slowly let the clutch come up. As you feel that catch point, the RPMs will start to drop and the car will start to move forward a bit. Slowly give it more gas to keep the RPM's constant as you let the clutch out. This is the key to the whole thing. Give it enough gas to keep the RPM's constant until the pedal is all the way out. Now push in the clutch and brake to a stop. Repeat three or four times until that "catch" point starts to feel comfortable. Never rev the engine while letting out the clutch - remember the sandpaper and the disk behind this all? If you rev the engine while letting out the clutch, you wear off the surfaces of both disks. Likewise, if you don't give it enough gas to keep the RPM's up, it will stall. Practice until it takes no more than 1.5 to 2 seconds to smoothly take the car from dead stop to clutch all the way out. The faster you can smoothly get the car going, the less wear on the clutch.

### **Quit stalling!**

In fact, since we just mentioned stalling, let's give it a try. Warn your passenger first. Try letting the clutch out WITHOUT giving it more gas. The car starts to move, then the engine dies, and the car jerks to a start. See how effective leaving the car in first with the engine off is? It just stops moving - hard. This is why you always leave the car in first gear when you park (and use the parking brake for safety's sake).

### **Getting up to speed**

It's time to drive around a bit. You're not going to go out of first gear, so you can stay in the parking lot. First gear is good up to about 15 MPH on most cars - don't exceed this or you will over-rev the engine. Start out in first just start driving slowly around the parking lot. Once the clutch is completely released, wind it up to about 10 miles and hour, then pull your foot off the gas. Whew - it almost throws you through the windshield. This is because engine speed and car speed are directly related, unlike in an automatic transmission where there is more "coast" in the transmission. Once you are down around 5 MPH, give it gas pretty firmly, about 3/4 of the gas pedal. Even on a small car, you'll jerk you head back hard. Again, the wonderful thing about a manual transmission is that it is directly coupled to the engine. Practice smoothly slowing down and speeding up a bit.

Drive around the parking lot in first a bit more, and as you come up to a curve, slowly take your foot off the gas while you push the clutch to the floor and coast around the curve. On the other side of the turn, start pressing the gas pedal to bring the RPM's back up and let out the clutch. The first few times the car will buck, because the engine will be going faster or slower than the transmission. Again, this is where letting the clutch out slowly comes in. As you let out the clutch, keep increasing power to the engine until the two "feel" the same speed. This takes a while to master. Your friend and owner of the car may turn a couple shades of pale here if you over-rev or let the clutch out too slowly so those two disks rub against each other too long. You want to get this down so that the clutch is completely engaged in about 1/2 a second or faster.

Just like the brake pedal, any time you are NOT using the clutch, keep your foot off of it. "Riding the clutch," even if you don't think you are putting any pressure on it, ever so slightly pulls the two plates between the engine and transmission apart. You not only get less power, but you also increase the amount of slipping that wears down the clutch faster. Clutches are very expensive to replace, especially on front wheel drive cars.

### **Changing gears:**

If the parking lot is big enough that you can safely drive up to 35 MPH, you can try shifting in the lot, otherwise, let the car's owner take you to that deserted stretch of road you picked out earlier.

The next step is going from first gear to second. This is pretty much like when you practiced pushing in the clutch to coast around a corner except that you are going to move the shift lever from first straight down to second while you have the clutch on the floor. Let out the clutch while increasing pressure on the gas pedal just like you did earlier. Practice this on a straight area of course. Once you get into second gear, you can drive around the lot a bit. Remember, take your foot off the gas when you push in the clutch. If you don't, the engine RPM's will go way up without the load from the transmission.

At what speed should you shift to second? It depends on the car, but in general each gear has a good range:

First from 0 to 15 MPH tops

Second 3 to 25 MPH

Third 15 to 45 MPH

Fourth 30 to 65 MPH

Fifth 45 to ??? MPH

Usually you shift up when you are at the halfway to 3/4 point between the two extremes. First gear is really only to get you going. In fact, it is very easy to start the car in second gear - although don't try this until you get a good handle on the whole process as it is tougher on the disk plates.

When it is time to stop, just do like before, push in the clutch and use the brake pedal to stop. Later on we'll talk about using the engine to slow you down. For now, just keep working on making it second nature to press in the clutch and using the brake pedal when you want to stop. Always go back into first gear to start out again.

Practice 1st to 2nd quite a bit. As you get better at judging the way the engine applies power, you can get to smooth shifts while letting the clutch pedal out quite quickly. This is the goal. If you have trouble getting smooth fast shifts between 1st and 2nd, don't fret - it gets even easier in the higher gears.

### **While you're waiting for change:**

Imagine you are at a traffic light, waiting for the light to change to green. What gear should you be in? Where should your feet be? If you expect it to be a short light, you should have your right foot on the brake, your left foot

should be holding the clutch to the floor, and you should be in first gear. When the light changes to green, you can just let your foot off the brake and start like normal.

But, if the light looks like it will be a while, or for any other reason you don't think you will be moving, you should shift into neutral, and while still holding the brake pedal down with your right foot, let the clutch out. As long as the gear shift is in neutral, the car won't move or stall, or otherwise embarrass you. You should do this because having the clutch pushed in really stresses some of the moving parts. In fact, often times you can hear a whining sound when you have the clutch pushed in that goes away when you let it out. Normally a small sound is not a problem, but a very noticeable whine is a sign that the "throwout bearing" may be going bad. Pay a mechanic to fix it, because you don't want it to fail - the clutch can get quite flaky in its operation as the throwout bearing deteriorates.

### **Kick it in high gear:**

Now repeat the process from first, to second, to third gear. If you can master this, fourth and fifth are just the same. Drive around in third gear for a bit. Notice that letting off and punching the gas pedal doesn't have the same effect as it did in first gear. But, eventually when you let off the gas, the engine will start going so slowly that it wants to stall - around 15 MPH on a lot of cars. Give it some more gas so it doesn't stall. Notice that it doesn't have the same kind of acceleration from 15 to 25 as 2nd gear did. I won't get into it too much here, but what we're talking about is the power-band for the engine - each engine has a "sweet spot" where it accelerates best. This is why we have multiple gears. We're always trying to run the engine in the sweet spot, and depending on what speed we are going, we have to use different gears to stay within it.

### **Slow down a bit:**

What if you want to go from 35 MPH in 3rd gear down to 20 MPH, and then cruise at 20? Just let your foot off the gas and coast down to 20, or even put your foot on the brake a bit with the clutch still all the way out. OK, I never promised you that the brake / clutch thing was an unbreakable rule, just a good one to start with. So, it is OK to slow down to 20 MPH in 3rd gear and cruise - you don't have to be in second. You won't have as much power to accelerate again while in 3rd, but it will be just fine.

And if you want to go down to 10 MPH? Simple enough, press in the clutch, use the brake pedal to slow to your preferred speed, move the shift lever to second, and let out the clutch as you match the engine speed with the gas pedal. It will be jerky the first few times as the car is often going faster than the engine, so the engine will go up in speed as you let out the clutch, even though you don't give it gas. This is called "engine braking," and is something you will want to use a little later when you have the whole normal stopping thing already mastered.

Have you ever been following a car that suddenly slowed down without its

brake lights? Chances are that the driver changed to a lower gear and let the clutch out quickly, which made the engine take some of the extra momentum from the car and slowed down without the brakes. You can't use downshifting / engine braking to bring a car to a stop, but you can use it to slow down. Downshifting as you come to a traffic light is particularly useful: as you use the engine to slow you down, you are automatically in the right gear to take off again when the light changes to green.

A word about first gear. Never downshift from second gear to first while moving. Yes, you can do it and you won't really cause any damage, but it is generally not a good practice because of the potential for over-revving the engine. When you are going that slowly, and of course when you are coming to a full stop, push the clutch in and use the brake pedal. Once you stop, shift to first. And what about the downshifting in preparation for a traffic light - wouldn't it be advantageous to be in first gear when the light switches to green? Not really; first gear is just to get the car moving from a dead stop. If you are moving at all, second gear is where you want to be.

### **Stop and Go:**

Rush hour traffic with a stick shift can be a royal pain. Clutch in, coast, clutch out. Shift up, shift down. You really get to build up those left-leg muscles. If you spend a lot of time in traffic, think seriously about whether a manual transmission car is for you. However, all that being said, always remember second gear. 2nd gear on most cars has an incredibly wide range, from near dead stop to almost 30 or 35 miles an hour. A lot of people just leave the car in 2nd and use the gas pedal to not only speed up, but also to slow down. They only use the clutch and brake pedal when the car in front of them slows down too quickly (you have to leave a little more room between yourself and the car in front of you), or when things come to a complete stop. Give it a try, it's not as hard as it sounds.

### **So what else do you need to know?**

We've already covered starting, stopping, upshifting, downshifting, engine braking, and parking (don't forget - leave it in first gear with the parking brake on!)

**Revving at stop lights.** This is why you want a manual transmission, right? Just push in the clutch and rev the engine. You can do it anywhere: stop lights, cruising down the boulevard, anywhere.

**Burning rubber.** This is simply starting in first gear like normal, except that you take the RPM's much higher and keep them constant as you let out the clutch more slowly than normal. When you do this you are multiplying the power of the engine through the clutch, giving you more power to spin the wheels - BUT - you are also burning up clutch. Even with the multiplying effect, a chipmunk engine isn't going to spin the tires much, but you can usually get at least a good chirp out of them. The key is to get the the tires to start spinning just a bit at first, then keep giving it more power as you let out the clutch and they will keep spinning until you have the clutch all the way

released and bit more.

### **Powershifting, grannyshifting, and double-clutching.**

Powershifting is effectively shifting without fully releasing the clutch. You keep the gas pedal down while you only use about half the clutch travel to shift hard and fast. This is incredibly hard on a transmission, and in fact simply will not work on most transmissions. Without fully pushing in the clutch on most cars, you can neither pull the shifter out of gear nor put it into a new one (and it will grind as you try).

Granny shifting is when you take a slight pause in neutral between gears when shifting. So instead of going smoothly from 2nd to 3rd, you pull out of 2nd, stop for a moment in neutral along the way, then go into 3rd, and let the clutch out again. Very slow.

And double-clutching? It's like granny shifting except that you actually let the clutch out when you're in neutral, bring up the engine RPMs again, then push in the clutch and go into the next gear. And you do it all VERY fast. This was especially necessary on older cars before synchro gears smoothed the processes of changing gears in the gearbox. It is also a way to avoid grinding gears on transmissions that have been damaged by powershifting too much.

**Stalling at red lights.** This one is self evident. Avoid it at all costs. Nothing is more embarrassing than calling attention to yourself with big revs and a loud exhaust, then jerking to a stop when the lights change. Of course if you want to find out who your friends really are, this will certainly make them show their true colors...

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