

By William Hewland.
July 2000

The following is some info regarding shifting gear and face dog wear. I am in the fortunate position where I have a good amount of knowledge on the subject, as I understand the mechanical side and the user (driver) side equally well.

N.B. For successful gear shifting, remember that it is critical to ensure that all mechanical elements between the drivers hand and the dog faces are in good order and properly set. This includes the gear linkage in the chassis!

Successful up-shifting, (defined as fast and non dog-damaging) will be achieved by fully moving the dog ring as rapidly as possible from one gear to the next, preferably with the engine's driving load removed until the shift is completed. (The opposite is true of a synchromesh gearbox as used in passenger cars, where slow movement helps). It should be remembered that it is not possible to damage the dogs when fully engaged (in gear). The damage can only take place when initiating contact during a shift, (the `danger zone`) therefore this element must be made as short as possible. If a driver moves the gear lever slowly, or if the linkage is not rigid and effective, dog wear will occur. We always recommend lightweight yet solid rod linkage, not cables ideally.

I list below the different methods of up-shifting that are used in racing most commonly. The best at the top, the worst at the bottom:

Automated (semi automated). The movement of the dog ring is powered and the engine is cut / re-instated in a co-ordinated manner. Gear-shifts take milliseconds. This system produces zero dog wear when set up well. It is not applicable to most cars, but it illustrates that speed of shift is a good thing.

Manual with engine cut. This system is almost as good as an automated one as long as the driver pulls the lever very quickly. Again it is not applicable to many cars, but it illustrates that speed of shift is a good thing. A `cheat` version of this is to shift on the engine rev limiter, which can work well. With this system it is especially important to move the lever ultra fast, otherwise the engine will be reinstated during partial dog engagement, causing damage. The damage can usually be felt by the driver.

Manual.

Best method: With no assistance from the engine management, the driver must lift off the throttle sufficiently to allow the dog ring to be pulled out of engagement. He should then stay off the throttle long enough to allow the dog ring to engage with the next gear. In practice, the driver can move the gear lever faster than he can move his foot off and back on to the throttle. Therefore the effective method is to apply load to the gear lever with your hand and then lift the throttle foot off and back on to the pedal as fast as physically possible. In lifting your foot, the loaded gear lever will almost involuntarily flick to the next gear before the foot is re-applied to the throttle.

Another method is to load the gear lever with your hand, stay flat on the throttle and dab the clutch to release the dog ring. The overall effect on the gear shift is similar to the above method, but clutch wear may become a big issue.

The worst method (most destructive and definitely slowest) is to attempt to change gear in a `passenger car / synchromesh` way, i.e. lifting off the throttle, dipping the clutch, moving the gear lever, letting the clutch up and re-instating the throttle. The method causes unnecessary clutch wear, does absolutely nothing to help come out of gear and usually causes dog wear whilst engaging the next gear. This wear is due to several reasons. Firstly, it is impossible for a driver to co-ordinate the complicated sequence of all five physical movements accurately. Consequently the engagement dogs often find themselves engaging whilst the throttle is applied. The lever is usually pulled more slowly as it was not pre-loaded, lengthening the `danger zone`.

Successful down-shifting, has similar rules applied regarding speed of shift. Unloading the dogs is done in the opposite manner obviously. Whilst braking, the dogs must be unloaded by either touching the throttle pedal or- my preferred method- by dipping the clutch. However, one sharp dab of clutch or throttle is appropriate per shift. Continued pressure on either will cause dog damage for different reasons. `Blipping the throttle` just before engagement is advisable if the rev

either touching the throttle pedal or- my preferred method- by dipping the clutch. However, one sharp dab of clutch or throttle is appropriate per shift. Continued pressure on either will cause dog damage for different reasons. `Blipping the throttle` just before engagement is advisable if the rev drops between gears are over 1300 rpm, as this will aid engagement and stabilise the car.

TOP TIP for ease of downshifting: Make the downshifts as late as possible in your braking zone (i.e. at lower road speed), because the rev drops between each gear are then lower. So many drivers make the mistake of downshifting as soon as they begin braking, causing gearbox wear, engine damage and `disruption` to the driving wheels.

This is a subject which can be much expanded on, but I feel that these are the basics, which I hope are of use.