Cut and Strike in Irish & Celtic Banjo

This article presents the transformation of pipe articulations (cut, strike, roll) in the Irish & Celtic music to the banjo through the fretting-hand techniques. It is applicable both for the flatpicked tenor banjo and fingerpicked 5-string banjo. In a nutshell, cut is imitated by the quick pull-off, strike with quick hammer-on — the proper timing is what is crucial here, as well as the choice of the fretting-hand fingers involved. Where to use the cut or strike? Start with putting them on the second note of the pair of the same notes.

"Hats Off to the Pipes"

I have borrowed this headline from Grey Larsen's book [GL 112 – see Credits at the end] to stress the fact that the Irish ornamentation techniques were born as the articulations of the note on the instrument which provided constant airflow, that means constant sound. In order to separate the notes of the same pitch it was necessary to use fingered techniques (cut or strike). On the other hand, in order to underline the long notes with some rhythm, it was possible to divide the long note into pieces with the various combinations of the cut and/or strike – the result is generally the roll (cut + strike) or crann (several cuts).

These bagpipes articulation techniques become very symptomatic "ornamentations" for the Irish traditional music; other instruments entering the Irish universe had to develop their own ways how to imitate these ornamentations, even if they do not have the "limit" of constant-only sound. Fiddle players use special bowing and fingering techniques to play the "Irish fiddle". Banjo players use typically the picking-hand ornament called triplet or treble (the first note of the original pair of notes is divided into another [quicker] pair of notes, so the result are three picked notes: e.g. two 16th notes and 8th note). The picking-hand triplet/treble can be played loudly enough to be heard in the session, and quickly enough to be useful for high tempos. However in the quieter and slower situations the banjo player can emulate the cut and strike by the fretting-hand techniques of quick pull-off and hammer-on. [Note that I use the term "pull-off" for both pull-off where the finger moves towards the palm and for push-off where the finger moves out of the palm.]

My opinion is that the direct transformation of bagpipe articulation to Irish & Celtic banjo helps to understand the logic of ornamentation placement, and may keep the proper focus on the principal notes of the combined ornament. If one transforms rather the Irish fiddle ornamentation to banjo, something might be lost during the "Chinese whispers" transfer on longer pathway bagpipe => Irish fiddle => banjo. I am referring specifically to the long roll, discussed in the separate part near the end.

Cut = instant pull-off to the principal note

The first technique used by pipes to separate two notes of the same height is the cut – momentarily lifting of one of the fingers (which would produce some higher pitched sound) and immediate returning of that finger back (to produce again the principal note). Grey Larsen stresses that the cut is not to be played as the specific note or understood as the grace note [GL 117]. If we transform this logic to the banjo, we can conclude that the cut is special beginning of the principal note by some very short higher-pitched sound. On the banjo it can be simulated by the picking-hand stroke (by flatpick or fingerpick) on some higher note just immediately followed by the pull-off to the principal note. There are different scenarios depending on the location of the principal note on the fretboard of your banjo (whether it is on the open string or whether and how it is fretted). They will be discussed later.

It has been stressed that the timing of the pull-off is crucial. It has to be performed as immediately after the picking-hand stroke as possible, but still after the stroke in order to let the higher starting sound be just appropriately audible. If the tone of the higher note is clearly recognizable before the principal note, the pull-off is played too late. Look at the Example 1; in the first measure there are two eighth notes on the open string

(whatever string on your banjo – I have intentionally put just three lines to the tab) and we want to articulate the second one (marked in red) by the cut because this is what bagpipers would do. To execute the pull-off from the 2nd fret (tenor banjo player would typically use the index finger, 5-string banjo player may prefer the middle finger for the 2nd fret) you need to do several movements. One action with your picking hand (to pick the string) and two actions with your fretting finger: first to put it down to the 2nd fret of the string, second to perform the actual pull-off, i.e. the sidewise movement of the fretting finger which plucks the string.

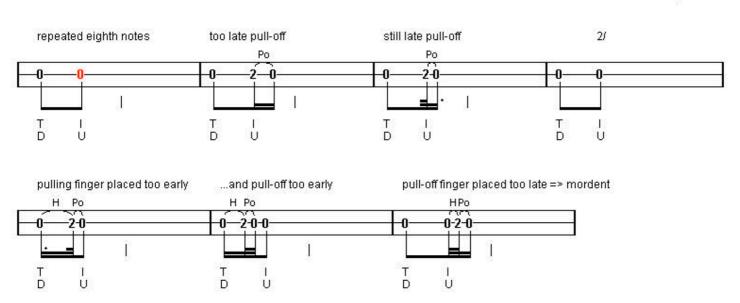
The whole Example 1 assumes that the picking-hand action is done correctly in the rhythm. Below the tab there is the picking-hand action indicated both for fingerpicking (T = thumb, I = index finger) and flatpicking players (D = downstroke, U = upstroke). Pay attention under which notes there are the picking-hand strokes – the second one (I = thumb) has to be performed when the fretting-hand finger is down on the 2nd fret of the fretboard.

The measures 2 to 4 in the first line of the Example 1 assume that the fretting finger is put down to the 2nd fret of the string in time; what differs is the timing of the actual pull-off. In the second measure the pull-off is way too late to be considered a cut. The pull-off in the third measure is still late. Finally, in the fourth measure the pull-off is so instant after the picked note that it is not perceived as separate note, thus it is not worth the separate note written in the tab. Instead here comes the symbol for cut introduced by Grey Larsen [GL 121 and his free article linked in Credits – please read it] – the slash, which I have modified by preceding it by the number indicating the fret from which the cut/pull-off is performed. Just to make the picking-hand action clear – even if the fingering (I or U) is in the 4th measure written under the number 0 indicating the open string, still the picking-hand stroke is performed when the 2nd fret is fretted.

The fifth and sixth measures of the Example 1 show the situations when the fretting finger is placed to the fretboard too early – typically in the attempt not to be late with the pull-off. In the fifth measure the fretting-hand finger is placed early, which may even produce artificial hammer-on, and the pull-off is executed in the same time when the picking hand picks the same string; the result is no audible pull-off. The sixth measure shows even bigger rush – here both the placement of the finger and the pull-off are performed before the picking-hand stroke (I or U) which is heard separately. Finally, the last measure of the Example 1 shows what happens when the cutting finger fails to arrive on time to the 2nd fret. It arrives later by the artificial hammer-on, and together with the immediate pull-off the result is the different ornament called mordent. (Mordent is legitimate ornament – actually, you may swap cuts and mordents and call it your variation.)

Example 1: Timing of pull-off in the cut to open string

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Strike = immediate hammer-on to the principal note

The strike (other names are tip, tap, pat, or slap [GL 138]) is the other technique used by pipes to separate two notes of the same height – here the additional finger for a split second covers the open hole (which would produce the lower pitched sound) and immediately bounces back (to produce again the principal note). Similarly to the cut, also the strike is not perceived as the specific note or grace note [GL 138]. Transforming this information to the banjo, we can conclude that the strike is special beginning of the principal note by some very short lower-pitched sound. On the banjo it can be simulated by the picking-hand stroke (by flatpick or fingerpick) on some lower note immediately followed by the hammer-on to the principal note.

The question is what note should be fingered during the picking-hand stroke. The easiest answer is: none. I think the best option is to stroke the open string as there is no need to bother the fretting hand with the additional fingering and it can fully focus on the timely executed hammer-on. In such case just one fretting-hand finger is involved in the execution of the strike, which might help in higher tempos. However if there is played some lower note on the same string shortly before the strike, there is the option that the original lower finger stays on its place and the strike/hammer-on starts from that fretted note.

In all cases, both the picked "note" and the hammered-to principal note are located on the same string – this is important principle which limits the availability of strikes to fretted principal notes only and excludes open strings. This principle preserves the original approach of playing the principal note with just some particular lower-pitched starting noise, instead of playing two distinct notes. If the picked note and the hammered principal note are distributed on different strings, the sound of the starting noise (i.e. picked note) is too prominent.

As in case of cut, the timing of strike is crucial. The hammer-on has to be performed as immediately after the picking-hand stroke as possible, but still after the stroke. If the picked lower note (e.g. on the open string) is clearly recognizable before the principal note, the hammer-on is played too late. On the other hand, if the hammer-on is executed not after the picking-hand stroke but simultaneously with the picking-hand action, there is no articulation heard – which is not the goal. You have to find the optimal fraction of the second between the picking-hand and fretting-hand action.

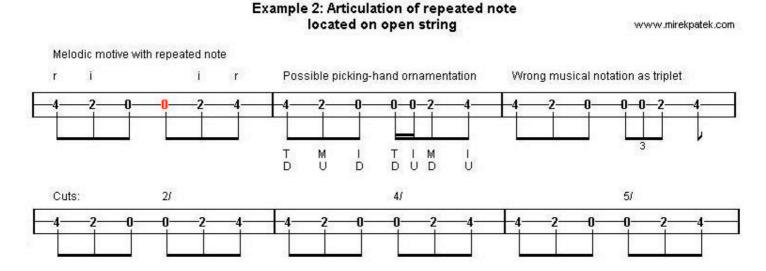
Grey Larsen uses the symbol V for the strike [GL 142 and his article linked in Credits], which is for the tenor banjo players unfortunately interchangeable with the symbol for up-stroke of the flatpick. As a fingerpicking banjo player I am using this symbol in my article (and in my other tabs) again with slight modification. The plain V means the hammer-on from open string, if the string is fretted before the hammer-on is executed, I modify the symbol for the strike by preceding it by the number of fret from which the articulation starts, e.g. 2V.

Let's now review the available cuts and strikes depending on how the principal note is fingered, starting from the notes on open string and continuing through the notes fingered by index, middle, ring, and little finger. It is the identification of the fretting finger (and not the fret number) what determines the range of available cuts or strikes.

Principal note on the open string – cuts only

As the note of the open string is the lowest available note on that particular string, there is no way how to do a hammer-on to the principal note on the open string. It is similar to the situation in bagpipes or flutes, where is no strike possible on the lowest note of that instrument. In banjo it applies not only to the lowest note of the instrument, but to the lowest note of each string. With the exception of the lowest note of the lowest string, there is the possibility of switching the note from the open string to the specific fret of the lower string (7th in tenor banjo tuned in fifths; 5th, 4th or 3rd in 5-string banjo in open G tuning). In that case the note is treated as fretted and the choice of available cuts and/or strikes depends on the fretting finger used. Otherwise, the note played on the open string cannot be articulated by the strike, but by the cut.

The Example 2 shows short motive with the repeated note on the open string – you are free to use whatever string on your tenor or 5-string banjo. Actually, you are requested to practice the cuts and strikes on every string, as the mechanics of your pull-off or hammer-on may slightly differ e.g. on the 1st string (the closest to the palm) versus the 4th string. Please note that each measure is separate unit (otherwise we would somehow deal also with the repeated note on the 4th fret – but this is not the case here).



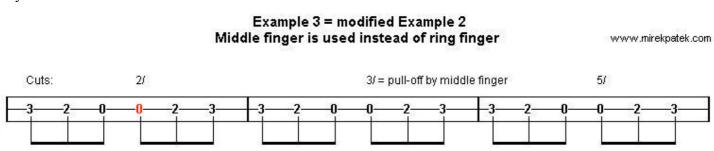
In the first measure of Example 2 there is the basic motive, with the fretting-hand fingering indicated by i for index finger and r for ring finger (middle finger would be m, and little finger uppercase L- to avoid confusion of lowercase l with uppercase I). You can see that the fretting hand uses the finger-per-fret guitar fingering, not the mandolin one. The repeated note is colored in red and bagpipe player would use some articulation on this note from the technical reason discussed above – the inability to stop the airflow.

Banjo does not have this technical reason, but in order to be stylistically in line there is used the ornamentation technique on the same note. This is important – if you understand which notes would be articulated on bagpipes, you may determine where to use the picking-hand or fretting-hand ornaments on Irish & Celtic banjo. The second measure shows the picking-hand approach of banjo players – the ornament called triplet or treble. I have indicated the proposed [finger]picking-hand fingering as well as flatpick direction in the second measure as a remark that this article is aimed to both fingerpicking 5-string banjo and flatpicking tenor banjo players. The third measure shows the widely used notation practice as the triplet – which is incorrect except in case of lilted rhythms (e.g. hornpipe) as the three notes do not have equal duration (which contradicts with the classic definition of the triplet). In the fourth to sixth measures we are finally approaching the topic of this article – the fretting-hand articulation; three cuts are shown which differ by the fretting-hand finger performing the pull-off.

If the principal note is on the open string, we have theoretically all four fretting-hand fingers available for the quick pull-off. However in the tune, the pull-off is usually NOT performed by the finger which would play non-scalar note and which therefore is not used in that key on that string – this refers to middle finger on 3rd fret in Example 2.

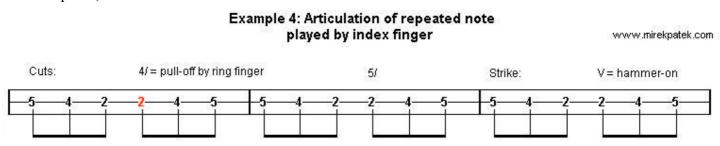
So, for cutting the repeated open string in Example 2, we have three options: quick pull-off by index finger, ring finger, or little finger. Each finger performs the pull-off from the respective fret where it is located; e.g. if the tenor banjo player uses the finger-per-fret guitar-like fingering, the index finger makes the pull-off from the 2nd fret, [the middle finger from the 3rd fret,] the ring finger from the 4th fret, and the little finger from the 5th fret. The choice of the cutting fingers depends usually on the fretting-hand fingering of surrounding notes – typically, I would use the same finger which frets the next normal note (especially if it is on the same string), as this finger is anyway prepared to do something and I can assign the additional cut to that finger rather than wake up some other one.

The following Example 3 is the modification of Example 2. The motive is in different key now and the middle finger on 3rd fret is used instead of ring finger on 4th fret. This influences the choice of fingers available for cuts, as you can see in the second measure.



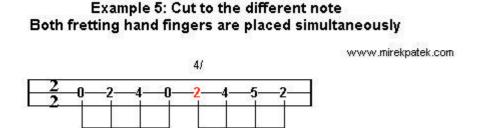
Principal note played by index finger – cuts and strike

The Example 4 shows the motive with repeated note played by the index finger on the 2nd fret. Note that the fretting hand is all the time in finger-per-fret mode, so the 5th fret is fretted by little finger and the 4th fret by ring finger. For the cut to the principal note fretted by index finger, there are only three remaining fingers available for the pull-off. And if we disregard the middle finger (as it does not play scalar note in Example 4), there is just the ring finger and little finger available – see the first and second measure. The last measure shows another option, the strike.

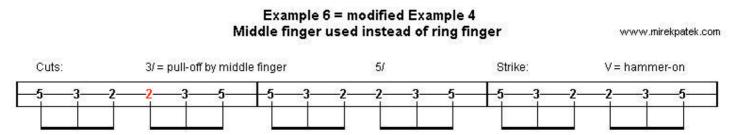


If the cut separates two principal notes of equal height (both played by index finger in this case), the index finger remains on its fret all the time – it is not lifted between the two notes. It means that there is just added ring or little finger respectively, and after the picking-hand stroke the very quick pull-off by that higher finger is performed.

Different situation is when the cut is used to emphasize the note, which is different from the previous one – in that case both the [index] finger which holds the principal note and the higher finger performing the pull-off have to be put to the fretboard in the same time. The index finger stays there, while the higher finger immediately does the pull-off. The Example 5 shows the cut made by ring finger to the principal note played by index finger. This cut does not separate the same notes, but adds the emphasis to the note on the beat. In the second half of the measure, the index and ring fingers are placed to the fretboard exactly in the same time. The ring finger immediately performs the cut.



The following Example 6 is just the modification of Example 4. The motive is in different key now and the middle finger on 3rd fret is used instead of ring finger on 4th fret. This influences the choice of fingers available for cuts – see the first measure.

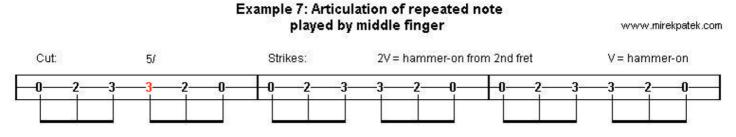


The last measures of Example 4 and Example 6 show the strike by index finger. As there is no lower finger of the fretting hand available (I do not count the thumb), the strike by index finger always starts with the picking of the open string, which is followed by the immediate hammer-on by the index finger to the principal note.

Especially in case of principal note played by index finger there is the choice between the cuts and strike. The preference of one or the other articulation depends on the surrounding notes – if they stay on the same string, there is usually place for the cut; if the melody moves from/to other string, the strike (from open string) is often preferred as it does not require two fretting-hand fingers. If the index finger plays the barre (most often the partial barre when two neighbor strings are fretted on the same fret) it is next to impossible to execute the precise hammer-on by flatted index finger. That means the strike cannot be used.

Principal note played by middle finger – cut and strikes

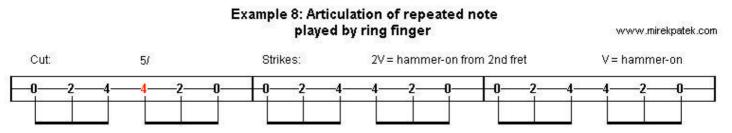
The options are shown in the Example 7 – one cut and two possible strikes.



There is the only finger available for the cut – the little finger, as the ring finger would play the non-scalar note on the 4th fret and therefore is not considered. However, there are two options for the strike – either the middle-finger hammer-on from the 2nd fret (which stays fretted by the index finger from the second to the fifth note of the 2nd measure) written as 2V or the middle-finger hammer-on from the open string, written as V only. The latter option requires lifting the index finger from the 2nd fret which seems to be ineffective motion, but it may improve the strength and rhythmical accuracy of the middle-finger hammer-on.

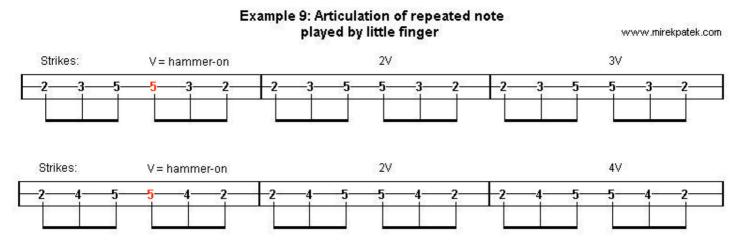
Principal note played by ring finger – cut (?) and strikes

The options are shown in the Example 8 which resembles the previous Example 7. The little-finger cut to the neighbor ring finger is quite challenging. That is why I prefer the strikes here.



Principal note played by little finger – strikes only

If the principal note is played by little finger, there is no finger available for the pull-off. It means that the note played by little finger cannot be articulated by the cut. There is the possibility of shifting the fretting hand to the higher position (up the neck – towards the bridge), so the principal note is played by different fretting-hand finger. In that case some previous paragraph applies. Otherwise, the note played by little finger can be articulated just by the strike. And there are usually three options from where the strike can start: from the open string, from the index finger, and from the ring/middle finger depending on the particular fingering in the given key. It is shown in Example 9. The last measure of the second line is not preferred – the little-finger strike with ring finger placed on the fretboard is difficult.



Possible use of cuts or strikes

- a) Whenever is repeated note, you may articulate the first one by picking hand, and the second one by picking hand plus the cut or strike. That was our focus until now.
- b) If you want to emphasize particular note (even if it is different from the previous one), you may articulate it with the cut or strike. See Example 5.
- c) Try the cut or strike instead of some treble/triplet. See Example 2. Trick for reverse engineering: just use only the second and third note of the triplet for the pair of eight notes, and cut/strike the former of these (see Credits). *Disclaimer: I have nothing against the triplet!*
- d) Some mordent (quick alternation of the principal note by hammer-on + pull-off, or by pull-off + hammer-on) was may be originally cut or strike see Example 1. Try the reverse engineering here.
- e) Divide the quarter note rhythmically into two repeated eighth notes with the second one picked plus articulated by cut or strike i.e. create the option a) intentionally.
- f) Divide the quarter note rhythmically into two eighth notes with both notes picked plus articulated by cut or strike the result might be so called short roll.
- g) Divide the dotted quarter note rhythmically into three eighth notes with the second and third one picked plus articulated by cut or strike the result might be so called long roll or kind of crann.

Roll = combination of cut and strike

The meaning of the term "roll" in Irish traditional music differs from the meaning in bluegrass banjo; however, from one perspective it may somehow serve similar purpose. The bluegrass banjo player picks the three-finger roll by adding the notes in-between the melody in order to keep the groove going. The Irish bagpipe player executes the "roll" by dissecting the long note into short ones – the result is also the continuing groove.

The so-called long roll is the dissection of dotted quarter note into three eighth notes. Typically, the first one is picked only, the second one is articulated by cut (picking-hand stroke plus fretting-hand pull-off), and the third one is articulated by the strike (picking-hand stroke plus fretting-hand hammer-on).

Looking back at the Examples 2-4 and 6-9 with the overview of available cuts and strikes for various fingerings of the principal note, we can see that the regular long roll is available only for the principal note played by index, middle, or ring finger (the latter with question mark due to very difficult cut). If the note is on the open string, we cannot articulate the strike, so the "roll" will consist of two cuts instead. Literally, it is no longer the roll – the sequence of cuts is called crann. You may use the same finger for repeated cuts, or you may use different ones, e.g. ring-finger cut followed by index-finger cut. Similarly, if the principal note is played by little finger (and maybe by ring finger), we cannot articulate the cut, so the repeated strikes are used instead. (I do not know the name for this combination).

Long roll: three notes or five notes?

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Grey Larsen stresses that the long roll contains only three notes [GL 163-164], the second and third note being articulated by the higher pitched and lower pitched sound respectively. I am convinced that this difference (three notes, two additional sounds) should be reflected also in the way how they are produced on the banjo. Therefore I play the three notes with my picking hand the same way how they would be picked without articulation; then the cut and strike is added with the help of the fretting hand. The following Example 10 shows the roll on the principal note played on the 2nd fret by the index finger.

Example 10: Long roll - three vs five notes

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The first line shows how the dotted quarter note is divided into three eighth notes. The picking is indicated below the tab, in the version for fingerpicking players (T = thumb, I = index finger; I would use TIM instead of TIT but that is not the subject of this article) and flatpicking ones (D = downstroke, U = upstroke). The third measure shows added cut and strike in the Grey Larsen's notation, modified by me with the specification of the 5th fret from which the cut (pull-off) is performed by little finger – the result is long roll on the note on the 2nd fret consisting of three notes, the latter two being specially articulated. The fourth line begins with the rough approximation in the conventional notation just to point out that the picking pattern TIT/DUD stays the same and in the same places. Then follows the long roll as presented in Tom Hanway's book on page 35 (the five notes are marked as quintuplet there). Note that the picking-hand pattern has changed – the second stroke (by index finger or flatpick upstroke) is delayed and actually hits the lower additional note (the open string). The execution may actually morph into something shown in the last measure, where the picking pattern is regular again and there is mordent on the first note. In case the mordent is omitted, we receive the sequence 2-0-2,

which apparently differs from the original 2-2-2. One may even speculate that many three-note segments with two equal notes plus lower neighbour note in-between were originally the long roll on the first note – it may be another idea for the reverse engineering.

The following quote suggests that the source of Tom Hanway's adaptation of the long roll is the fiddle: *The long roll is more subtle than the triplet or short roll, as its notes are evenly distributed over the full beat and half.* It must be felt. This roll must be "hammered," "pulled," and picked on banjo and, thus, does not have the legato effect as played on the bowed fiddle [TH 27]. This approach apparently works for Tom Hanway. However if you would like to use the bagpipe articulation as the role model, I recommend you to play the long roll Grey Larsen's way – three notes, divided by two sounds of shortest possible duration, as shown in the third measure of Example 10.

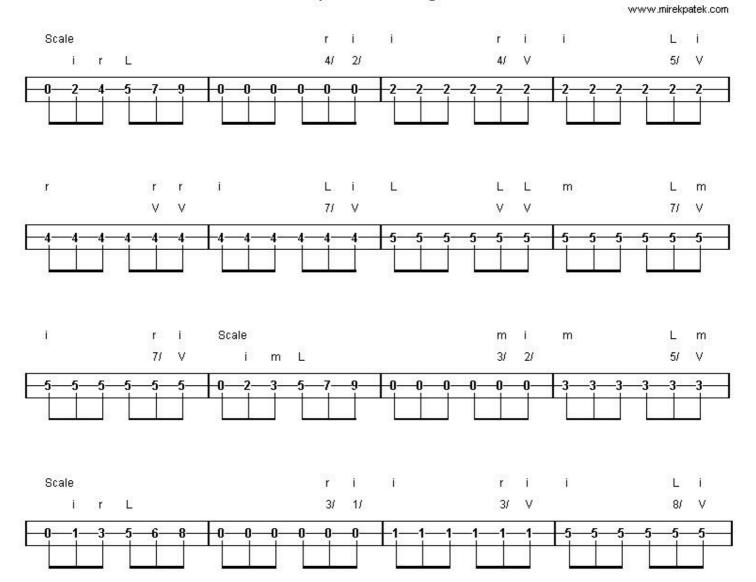
Note that this "three notes" approach will limit you – you will not be able to play the roll on the open string note, with the lower pitched sound played on another (thicker) string [as shown at TH 35]. Instead, both articulation will be the cuts so you will play sort of crann. However there will be distinct regular rhythm of three principal eighth notes.

The Example 11 shows the long rolls on different places of banjo string. Generally, I try to keep these three rules:

- a) use only notes from the scale and respective fingers for the cuts
- b) start the strike from the open string
- c) try to avoid the half-note cuts, i.e. with neighbor fingers: middle to index, ring to middle, and especially little to ring finger.

Video of Cut and Strike in Irish and Celtic Banjo

Example 11: Some long rolls



Practice the long rolls on each string of your banjo where you play the melody. As the choice of the cutting fingers depends on the scale, there is outlined the scale fingering in the first measure (imagine it is the D string, and part of D major scale – or some other scale on another string). The following measures show always the three notes without the articulation, and then with the articulation creating the roll. The purpose is to stress that the rhythm of picked notes is the same without the roll and with the roll. All the information is actually above the tablature, where are the symbols of cuts and strikes, and also for the sake of clarity the fretting-hand fingering.

The second measure shows the "roll" on the open string, which is literally not the roll, but crann as there is no strike – I have chosen two different cuts with different fingers here but your choice may vary. The third and fourth measures show two options for the roll on principal note fretted by index finger – actually the best location of the principal note for the execution of the roll. The fifth measure shows the "roll" on the principal note fretted by ring finger on 4th fret – instead of the cut with little finger I prefer now the strike so there are two strikes in the row. Another option is shown in the sixth measure, where the fretting hand shifts up the neck and the 4th fret is fretted by index finger. For the principal note on the 5th fret, there are three options: two strikes in the row (measure 7), the position shift with middle finger fretting the principal note (measure 8), and bigger position shift with index finger doing so (measure 9).

The tenth measure shows part of another scale as a basis for next two measures (imagine D dorian scale on D string). There are different cutting fingers for the crann on the open string (measure 11). For the principal note

on the 2nd string, there will be the same roll as in the measure 4 (cut with the little finger on 5th fret). The 12th measure shows the roll on 3rd fret with the little and middle finger; you may as well shift the fretting hand a bit and play it with ring and index finger.

The final row of Example 11 shows part of yet another scale (imagine C ionian or G mixolydian scale on B string of 5-string banjo). Again there are different cutting fingers for the crann on the open string (measure 14), there is the roll on principal note on the 1st fret, and the last measure shows the roll on principal note on the 5th fret with the cut from 8th fret (and not from neighbor 6th fret).

Short roll = long roll without the first note

Short roll is simply the long roll without the first note, which means that directly the first note of the pair is articulated by the cut (and the second note by strike) [GL 182]. So it consists of two notes, each being articulated by the sound of higher and lower pitch respectively. It is not four-note ornament – at least in the bagpipe and flute [GL 183 vs TH 27]. Similarly to the long roll discussed above, you may transfer it to your banjo from bagpipe, and not through the fiddle. Just modify the Example 11 by omitting the first note of the long roll.

Credits

The excellent book The Essential Guide to Irish Flute and Tin Whistle, written by Grey Larsen www.greylarsen.com and published by Mel Bay Publications (ISBN 978-078664942-6) apparently deserves the biggest credit. Even if I do not play the flute or whistle, the sections devoted to the theory and practice of the Ornamentation (they occupy substantial part of the book) and the two CDs included are very helpful in my effort to grasp the Irish traditional music on my banjo. The book is referenced here as GL followed by page number. I strongly recommend you to read the article A Guide to Grey Larsen's Notation system for Irish Ornamentation, which is available at http://www.greylarsen.com/services/tunebank/notationsystem.pdf.

Five-string banjo players shouldn't miss the Complete Book of Irish & Celtic 5-String Banjo, written by Tom Hanway www.tomhanway.com and published by Mel Bay Publications (ISBN 0-7866-6582-3). The book is referenced as TH followed by page number. It is hallmark book full of information, tabs, and audio CD; however in the area of combined fretting-hand ornaments, namely the long roll and short roll, the information somehow contradicts the former book.

There are many articles in the Mel Bay's Banjo Sessions, as well as Mandolin Sessions about the Irish ornamentation/articulation. Most of them are focused on flatpicked ornament – "triplet". I have found the only article focused on fretting hand – the February 2007 article More On the Left Hand by Michael Keyes, available at http://archive.banjosessions.com/feb07/Keyes.html.

The Google search of "cut strike Celtic guitar" returns the Guitar Noise lesson The Eagle's Whistle where Doug Sparling clearly explains cuts and strikes: http://www.guitarnoise.com/lesson/the-eagles-whistle/

The trick for reverse engineering of triplet to cut or strike is taken from Stephen Jones' page at http://www.rogermillington.com/siamsa/brosteve/triplets.html