Appendix

Several separation methods and procedures have been suggested, but not yet tested in high level competitions. We thus do not have any data to estimate the effect of the methods. It will of course be interesting to test the methods in a high level competition, but before any tests it would also be useful to check the method against the criteria for a good separating method. Those listed in Chapter 4 are:

1 It should enforce independent navigation. This is the main purpose of any method for separating runners.
1.1 Prevent following (one runner is navigating the other is more or less blindly following)
1.2 Prevent co-working (both runners are navigating, but their route choices and speed is helped by the company)
1.3 Prevent collaboration (two runners are actively sharing information and helping each other)

2 It should be fair. We want to find the best orienteer. The method we choose should not introduce differences that are large enough to influence the result. The method should not only be fair, but also be perceived as fair by runners coaches and spectators.
This means:
2.1 The same orienteering challenges
2.2 The same running time and length
2.3 The same information about map and terrain
2.4 The same tactical considerations
2. 5The same weather conditions
2.6 Minimal influence from the vegetation
2.7 Minimal influence from errors by other runners

3 It should be easy to follow for spectators at the arena and via TV.
Making our sport more spectator-friendly has been one of the main reasons for the increased awareness of the problem. This goal should not be abandoned, when we try to enforce independent navigation. However, this goal is often of less importance for many national and smaller events.
3.1 Not too large differences
3.2 Possible to compare intermediate times
3.3 The result more or less ready when the runner finishes (although mis-punching will still be a possibility)

4 It should maintain the character of the different distances.
4.1 Still have long legs for the long distance
4.2 Still have high speed for the sprint
4.3 Still be technically challenging for the middle distance

5 It should be simple for the organisers.
5.1 Have a limited number of map exchanges
5.2 Have a limited number of controls
5.3 Not require any excessive programming
5.4 Result in minimal work after the race
5.5 It should not increase the chances of organisational errors

In this appendix we will evaluate some suggested methods against the criteria above.

The suggested separating systems can be split into several groups.

A Course Planning Separating Schemes
B Anti-drafting rules
C Other procedures

A Course planning schemes

Here we group all proposed ways of placing controls to force runners apart.There has been, and probably will be more, suggested schemes for separating runners by clever placements of controls. These can be grouped into three categories. These are given below.

A.1 Butterflies and similar

(In this category we find butterflies, phi loops) The same distance is covered through each forking.

The runners enter the separating system, runs through the separating system and exit the separating system. When the runners have finished this separating system they have all run the same distance. All the separation is done during a short stretch of the course.

The system is (as shown in 6.3 and 6.4) not very efficient for H-groups. For E-groups it is even less efficient. The runners have run the same distance and it is only the difference in their running speed that separates them. As we have shown this hardly fulfils criteria 1.

A.2 Forked loops, partially forked loops and similar

(In this category we find partially forked loops, running legs). The same distance is covered through the total forking.

The runners enter the separating system twice (or more) during different parts of the course. When the runners leave the separating system they have run different distances. By adjusting the length of the different loops properly the runners that enter together will leave separated if none of them do mistakes. The separating system must be entered at least twice to ensure that the runners run the same course. The length of the loops should also be adjusted to reduce the chances of forming groups with late starters.

This system clearly fulfils criteria 1 and 2.

This system fails completely when it comes to criteria 3. Between the first and last times the separating system is encountered it is impossible to know the relative position of runners. When this system is used for relays great care is (or at least should) be taken to ensure that the different forked parts are as equal in running time as possible. To work as intended for individual forking the difference should be 30-40 seconds. It will be more or less impossible for the spectators to know positions during the race.

A.3 Unequal distance that is not corrected

(In this category we find micr-o and macr-o and similar, also score-o). Less able runner has to run a longer distance.

For systems under A.2 it is the organisers that determine the length of the forking at each station and all runners will have completed the same distance at the end. For A.3 the ability of the runners determine the distance through the forking system. This is not corrected later. These systems then clearly fulfils criteria 3. As we have shown it has problems with criteria 2.

When macr-o was used (in addition to traditional forking) for the Norwegian Championships the weaker teams got more penalty loops. This meant that the competition stretched out further in time and the difference between good and less good teams increased, which at least partially goes against 3.

B Anti-drafting rules

Here we place different suggestions for ways that require the runners to take action in the forest, or the organisers to take action after the event.

B.1 Overtaken and out

A runner that is caught up by a later starter has to quit his race.

This method does not necessarily fulfil criteria 1.

This does method also rises some grave question of fairness. If a runner is overtaken at a control that will be shown by the split times at the control and he will be required to quit. If the runner is passed due to a bad route choice he might not have seen the runner coming from behind and there has never been any possibility or intention of following. To be fair this method should disqualify any runner passed by a later starter. On the other hand it seems unfair to disqualify a runner that is more than 2 (long distance) or 1 (middle distance) minute slower than the runner starting behind. As seen in Tables 1 and 2 this could result in disqualification of silver medallists.

B.2 Strict anti-drafting

A runner that is less than 10-15-20 seconds after another runner at 2 (3) controls in a row has to stop and let the runner in front get a 20 second lead. If this is not done the runner is disqualified.
This clearly violates 2.7 as the following example shows. Runner B is overtaken by runner A. After 2 (3) short legs where they are close together at the control runner B waits and let A get the required lead. The runner A makes a bad route choice or misses the next control. To avoid disqualification runner B has to wait once more. Runner B loose from mistake by runner A. Even worse is the case where the vegetation at the control is so dense that runner B does not see runner A. B would then be disqualified due to A's mistake.
The case above could be solved by the jury afterwards, but this would be contrary to 3.2, 3.3. and 5.4

A fast runner could also follow and then sprint on the last few metres to punch the control first. The split times would then give a rather false picture of what was happening. To resolve this by the jury would again be contrary to 3.2, 3.3. and 5.4.

For middle distance and sprint this method is difficult to reconcile with requirements 4. The legs are usually so short that it is difficult to obtain the required gap between runners.

This method was tried in Sweden during the 50'ies, but the result lists then took several months to produce.

B.3 Anti-drafting with restart

A runner that is less than 10-15-20 seconds after another runner at 2 (3) controls in a row has to stop and let the runner in front get a 20 second lead. The runner punches the control when he first reaches it, and again when he resumes his race. The advantage over A.1 and A.2 is that there is no deciding who is following who in the forest and both runners get the finish the race.

There are probably problems with the fairness according to 2.3 and 2.4 as one runner will gain extra rest.
It clearly is contrary to 3 as the correct times will need to be calculated after the competition. This will also be contrary to 5.3, 5.4 and 5.5.

B.4 Enforcement of the existing rules

IOF changed the rules (§26.2) from "are expected to navigate independently" (2004) to "shall navigate independently" (2007). This seemingly small change clearly shifts the responsibilities. The old form leaves the responsibility with the organisers (particularly the course planners). The new form paragraph leaves the responsibility with the runners.

The World Cup final 2008 threatened to enforce the rules strictly. For this event the problems of groups forming was very small. To our knowledge no runner was disqualified.

Many jury meetings before the result list is ready would go against 3 and 5.
As we have seen, most groups are transient and break up again. To assume that all runners are cheaters and leave to them to prove that they are not, breaks to requirement of fairness. The mandatory carrying of a tracking device would probably be needed.

B.5 Yellow card

With tracking of the runners and manned controls the runners could be warned that they are infringing the rules and be asked to wait (or restart) at a control during the race.

With today's courses many additional hands would be needed thus violating 5. With restart we would also violate 2.3 and 2.4 as one runner will gain extra rest. If the "waiting time" is not included in the total running time the race would be difficult to follow for spectators, thus violating 3.

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B.6 Forced route choices

The last runner to the control has to make a different route choice from the runner in front. With to days small GPS tracking units it is technically easy to check whether this has happened.
This option is probably not fair and fails 2.4 and 2.7. If a runner sprints to the control and gets there first this runner has the first choice out of the control. If the weaker runner sprints best he could

spoil the race for the better runner by overtaking him just before the control. The first runner could spend a "long" time deciding upon the route choice and thus spoil the race for another runner.

An alternative is to let the runner with the highest start number chose first (as this runner would have had the best race so far). The question is then, if this runner does not punch first how close most he be to get the right to chose the route first?

This option would be very difficult to implement in middle distance races and probably fails 4 for this distance. In much Nordic terrain (and also other part of the world) there most navigation along the direct line and very little route choice.

C Other procedures

This looks into other ways of organising our events.

C. 1 Red group

The start list is not drawn or decided by the qualification races, but according to proven ability over several events (e.g. the world ranking list) or earlier performance in important races.

This only partially fulfils 1. The method should be good at preventing H-groups, but will have no effect on E-groups.

C. 2 Mass start

This is in some ways to give up. We can not prevent following and co-working so we give all runners the same possibility to do this. This is surrendering requirements 1 (which many regard as the most important). This will basically create a "new" sport.

C.3 Fewer finalists

The idea here is of course that with fewer finalists there could be a larger start interval without making the event longer.

This would also mean that the events are less interesting for media (at least for direct transmission), and thus go against requirement 3.

C.4 "Corrected" results

There are many different algorithms and programs available to calculate the time gained by being together and thus also the correct time by independent navigation. It is thus in theory possible to re-calculate the result list.

This certainly fails criteria 3 and 5. It is doubtful whether the algorithms will be good enough to fulfil criteria 2.

C.5 Hall of shame

As described in C.4 there are ways of "correcting" the results. Using these and publishing the results there will probably be a pattern of some runners "always" getting help while other hardly ever does. This could over time help the self-justice among the runners.