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Quick comment on the keep-on-looking effect

Suppose in the planned run of an experiment, the expected number of background events in the search region is $b = 32$. But instead of looking at the data only at the end of the run, the nominal p-value of the background-only hypothesis is inspected at shorter intervals, and a discovery is claimed as soon as one finds $p < \alpha$. Here the number of intervals is $n_{\rm test} = 1, 2, 4, 8, 16$ and 32. The "false discovery rate", which here means the fraction of times one finds the uncorrected p-value of the background-only model less than $\alpha = 0.001$ is shown in Fig. 1(a), and the corresponding significance $Z = \Phi^{-1}(1 - p)$ is shown in Fig. 1(b).

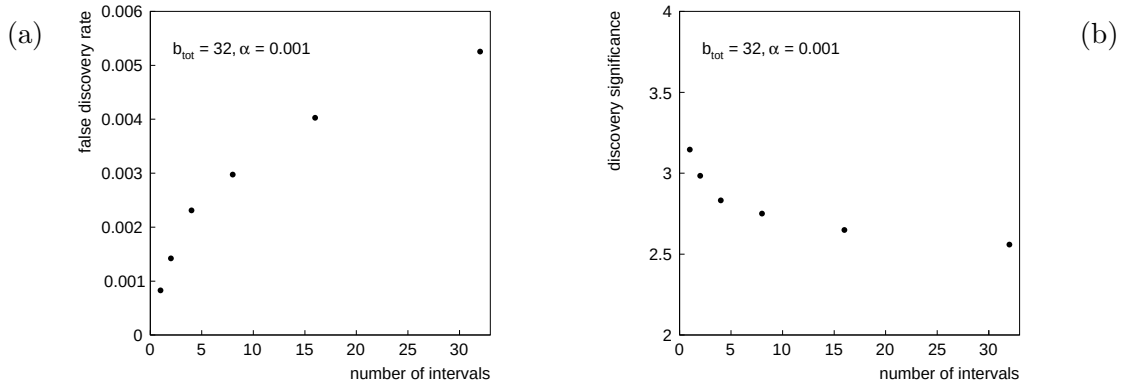

Figure 1: (a) The nominal false discovery rate and (b) the corresponding significance Z as a function of the number of intermediate tests carried out.

So in this example, the correct false discovery rate when the data are inspected at 32 sub-intervals is rougly a factor of 5 larger than the nominal p-value of 0.001.

This is just a quick look to make the point that the effect can be non-negligible. There have been other studies of this within ATLAS and there is in a large literature on the topic (google, e.g., for "Sequential Analysis").