Reviewer #1: I've really appreciated this study! I believe it provides new insight in the reversible adhesion mechanism in insects, which may be of interest also for engineering applications. It is also well written and relatively easy to follow. However I have a some questions the authors should address before the paper may be accepted for publication.

1) The author state that for the "flex" case see fig. 5 the reduction factor can go up of two order of magnitudes, provided that the quantity "ds" takes negative values. This is very counterintuitive and not easy to imagine. Maybe it is even unrealistic or unphysical. Indeed value of ds<0 would require the adhesive pad (or its backing layer) to pass through the adhering underlying surface. I believe this cannot occur in reality and must be excluded from the analysis. One, then, concludes that the reduction factor for the "flex" is very close to 1 in any configuration.

A: We believe the confusion arises here because of the definition of $\hat{d}_s$. Referring to Figure 4 ('flex' case), the description shows that $\hat{d}_s$ is the normalized form of d_s, defined as$\hat{d}_s = \frac{d_s - l_{h,0}}{w}$, which is the claw-hinge length (d_s) relative to the uncompressed hair length ($l_{h,0}$). Considering this normalized definition, $\hat{d}_s < 0$ should be physically possible. To make this clear to the reader, we have added the definition of $\hat{d}_s$ into the description of Figures 5 and 6 as well.

2) Limiting the geometry to cases with ds>0 I would conclude that the "flex" case is the one with the worse behavior. This is indeed the consequence of the fact that pillars barely can be already pre-compressed. Indeed, in the case of initial no-compression of the pillars, during the pulling process each pillar will start to be elongated and no one will be in a compression state, as instead it happens in the "free-pull" case.

A: Based on above clarification, the 'flex' case should not be the worst scenario since $\hat{d}_s < 0$ is possible. Further considering that the necessary load required to pre-compress the pillars is roughly the same order of magnitude as the the array's total adhesion force (see Figure 4), such a condition should be feasible.

3) Similar consideration applies also to the "fixed pull" case. Indeed, inducing compression on some of the pillars case can only be caused only by the weight of the insect. And maybe such forces are very very small.

A: Similar to above 'flex' case, the necessary normal load for the 'fixed pull' case to compress the pillars is also of similar magnitude as the adhesion force. We however do agree that the weight of the insect may put a limit onto how large of a load can be applied on the leg to compress the hairs, and have included this limitation in the text (see page 20 lines 12-15).

4) I believe the "free-pull" case should be the optimal configuration, as in this case during the pulling process, torque balance will require some pillars to be compressed thus leading to the so called "elastic-weakening" phenomenon.

A: Taking into account the limit induced by an insect's weight to compress the hairs, we agree the 'free pull' case could be optimal in some biological systems. However, artificial systems could be designed in ways to allow sufficient load and compress the pillars. In this case 'fixed pull' and 'flex' modes may also be preferable, depending on the the design conditions. Overall, we see that the 'flex' mode offers the highest reduction factor (see Appendix A in manuscript and point 6 below), and thus could offer the best configuration for reversible adhesion.

5) The authors assert that the optimal configuration would be obtained with the use of pillars able to support compression loads without undergo buckling. I may agree with this point, but also let us consider this ideal situation: assume the pillars undergo buckling as soon as a compressive load is applied (so they can support only tractive loads), and consider the "free-pull" case with s/L=1. In such a case the equilibrium of the backing layer would require that the applied pull-force would be totally supported by a single pillar (which would also work under very tilted conditions) thus causing an avalanche of subsequent pillar detachments (one after the other) leading to a spontaneous propagation of the detachment front. So I'm not very sure that the best condition is the one which avoids buckling.

A: This is quite an interesting scenario! Yes, for the 'free pull' case, buckling of pillars under compression would indeed result in the the backing layer experiencing a net clockwise torque, which would drive it to further tilt and detach the remaining pillars in sequence. However, this may also make it a bit tricky to have the array to show strong adhesion when we want it to, since the pillars would buckle quickly under small loads, thus limiting its reversible adhesive properties. For example, Patekar et. al. (doi.org/10.1098/rsif.2013.0171) has shown that buckling induced by sufficient vertical load can be a way to 'switch off' the adhesion of a micropillar array. When relying on our 'free pull'-based detachment case, the design conditions of the array would thus need to be optimized to take advantage of the buckling induced detachment while also showing strong adhesion when the backing layer is kept fixed and parallel to the surface. Thank you for your insight, we have now included this effect in the manuscript and have rephrased our comment on buckling (see page 20 lines 8-12).

6) It is stated that the increase of Nt augments the reduction factor! This is not very clear to me. To make an example, let us double "Nt" while halving the quantity "w" and the stiffness "kh" of each pillar! In this case I do not expect any change in the adhesive behavior of the system. So what should count really is the ratio kh/w i.e. the stiffness density and not the number Nt.

A: If we understand correctly, the situation you are describing here is a consequence of an interplay between the parameters $\hat{f}_p = \frac{f_p}{k_h w}$ *(Figure 5) and* N_t *(Figure 6), both of which we have considered separately by keeping one parameter constant while varying the other parameter. It should thus be possible to get the* *same reduction factor for multiple combinations of* $\hat{f}_p$ and N_t, *such as the case you described for example. Our rational behind choosing* $\hat{f}_p$ and N_t *as separate parameters for analysis is because,* $\hat{f}_p$ *depends mainly on the material and adhesive property of the pillars,* while N_t *relates only to the geometric design of the array itself. This was an attempt to decouple the physical properties of the adhesive and its fabrication limitations. An alternative way to look at how reduction factor changes might be to use a single parameter* $\chi = \frac{f_p N_t}{k_h w}$. *We have included this plot in the appendix section A of the manuscript, for reference (page 22 and page 16 lines 1-4).*