1 **Supplemental information**
2
3 **Movie captions**
4
5 Movie S1. Stable fixed point. The two upper panels present video of the same subject
6 initially walking at two different but constant speeds. The two lower panels present the
7 real-time speed-frequency data measured during the above video trials and updated every
8 heel strike. Since the subject is free to choose her step frequency, she initially walks at
9 speed-frequency combinations determined by her preferred relationship (grey line in data
10 plots). When the red lights come on, the frequency-dependent speed control is engaged.
11 This makes the treadmill speed a function of the measured step frequency (blue line in
12 data plots).The rapid attraction of the subject towards her preferred relationship, and the
13 fact that control function has to be satisfied, results in the subject rapidly settling into the
14 upper intersection of the preferred relationship and the control function. This intersection
15 is therefore referred to as *stable fixed point*. An intersection is stable when the slope of
16 the control function is greater than the slope of the preferred relationship.
17
18 Movie S2. Unstable fixed point. The two upper panels present video of the same subject
19 initially walking at two different but constant speeds. The two lower panels present the
20 real-time speed-step frequency data measured during the above video trials and updated
21 every heel strike. Since the subject is free to choose her step frequency, she initially
22 walks at speed-frequency combinations determined by her preferred relationship (grey
23 line in data plots). When the red lights come on, the frequency-dependent speed control is
24 engaged. This makes the treadmill speed a function of the measured step frequency (blue
25 line in data plots). The rapid attraction of the subject towards her preferred relationship,
26 and the fact that control function has to be satisfied, results in the subject rapidly drifting
27 away from the intersection of the preferred relationship and the control function. This
28 intersection is therefore referred to as an *unstable fixed point.* An intersection is unstable
29 when the slope of the control function is smaller than the slope of the preferred
30 relationship.
31
32 Movie S3. Oscillation. The upper panel presents video of a subject initially walking at a
33 constant speed. The lower panel presents real-time speed-step frequency data measured
34 during the above video trial and updated every heel strike. Since the subject is free to
35 choose her step frequency, she initially walks at the speed-frequency combination
36 determined by her preferred relationship (grey line in data plot). When the red lights
37 come on, the frequency-dependent speed control is engaged. This makes the treadmill
38 speed a function of the measured step frequency (blue line in data plot). The rapid
39 attraction of the subject towards her preferred relationship, and the fact that control
40 function has to be satisfied, results in oscillation in both speed and step frequency. This
41 particular behavior is the result of the negative slope of the control function.
42