Supplementary Information for the paper “Natural entropy fluctuations discriminate similar looking electric signals emitted from systems of different dynamics”

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This supplementary information provides additional arguments to support the interpretation for the distinction between SD and H discussed in the main text. It also provides the results when (i) the 15 min records are divided in segments of length 180 or 120 beats and (ii) after applying a detection algorithm which excludes the “outliers”. Furthermore, we demonstrate that the $\delta S$-value maximizes when the length of a sliding time-window becomes comparable to the period of an “oscillating” background. We also provide Tables for the complexity measures for all patients discussed in the main text as well as the results of their distinction from SD. The values of the (i) Approximate Entropy, (ii) Sample Entropy and (iii) Entropy in Natural time of all SD and H, are also presented. Finally, we discuss the quality of data as well as give some additional comments on points discussed in the main text.

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I. ADDITIONAL COMMENTS TO SUPPORT THE INTERPRETATION FOR THE DISTINCTION BETWEEN SD AND H

The plausibility of the interpretation suggested in the main text for the ECG is considerably strengthened by the following remarks. Recall that the $H_{\text{min}}$-values for $\lambda_s(RR)$ and $\lambda_L(RR)$ have been determined empirically by selecting the smallest values among the 10 H. We may overcome this empirical selection, however, as follows: We divide each ECG in (equal and non-overlapping) segments of length (l) significantly larger than the time-window of 60 beats (e.g., l=180 or 120 beats, see Tables I and II, respectively) and calculate the corresponding measures $[\lambda_s(RR)]_i$ and $[\lambda_L(RR)]_i$ for the various segments labeled by i. The mean values $\langle \lambda_k(RR) \rangle_i$ for each individual, agree more or less with the values that have been obtained in the main text (i.e., when the time-window swept through the whole record); their corresponding standard deviations (s.d.) provide, of course, a measure of the variability of each of these two ratios among the various segments studied in each record. Comparing the values of $\min\{[\lambda_s(RR)]_i\}$ and $\min\{[\lambda_L(RR)]_i\}$ (see the Tables I and II) to $\lambda_s(M)$ and $\lambda_L(M)$, respectively, we find the following: In H (with a possible exception of sel16795, which might be due to the fact that he has the smallest length, i.e., 760 beats, among the H), the values of $\min\{[\lambda_k(RR)]_i\}$ significantly exceed $\lambda_k(M)$, respectively, as they should. On the other hand, most SD (marked with ‘c’ and ‘d’ in Table I) exhibit $\min\{[\lambda_k(RR)]_i\}$ values which are smaller than (or equal to) $\lambda_k(M)$, respectively. (The values in bold, in both Tables I and II, indicate the minority of cases of SD in which the resulting $\min\{[\lambda_k(RR)]_i\}$ values exceed $\lambda_k(M)$.) Interestingly, all these (21 or 22 out of 24) SD cases coincide with those already marked with ‘a’ in Table I of the main text on the basis of the empirically determined $H$–limits of $\lambda_s(RR)$ and $\lambda_L(RR)$. Thus, the essence of our findings could be summarized as follows: When a time-window sweeps through the whole record available, the vast majority of SD exhibits $\lambda_s(RR)$- and $\lambda_L(RR)$- values which are significantly smaller than those in H (and hence SD are distinguished from H). This finding might stem from the fact that some segments of the SD records exhibit values of these measures that are comparable with those of a Markovian behaviour.

The same conclusions are drawn irrespective if we use a detection algorithm to exclude ‘outliers’ from the records. In the third column (labelled with a superscript ‘b’) of Table I we present the values obtained after applying such a detection algorithm. More precisely a moving window average filter was applied. For each set of five contiguous NN intervals, a local mean was computed, excluding the central interval. If the value of the central interval was greater than 1.5 the local average, it was considered to be an outlier and excluded from the NN interval series. This algorithm is analogous to the one used by Ivanov et al.[1].

Study of the $\delta S$-values for time-series with a “sinusoidal” background. In Fig.1, we show the $\delta S$-value calculated when a time-window of length 3-100 beats is sliding through the time series given by

$$x_k = a + b \sin(2\pi k/T),$$

or

$$y_k = \mu + \sigma \sin(2\pi k/T)\eta,$$

where $\eta$ is an exponentially distributed random variable of unit mean and standard deviation. The amplitude of

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the “oscillation” b or σ is comparable to the standard deviation of the RR-intervals in ECGs (and the “period” T of the background is 60 beats). The main result of Fig.1 could be summarized as follows: when the length of the sliding time-window becomes equal to the “period” (T=60 beats) of the “oscillating” background, the δS-value becomes maximum. (Note that the window length corresponding to the maximum amplitude is practically equal to that observed if the “oscillating” background were solely present; the latter case for the sake of comparison is also plotted in blue in Fig.1.)

II. APPROXIMATE ENTROPY (AE) SAMPLE ENTROPY (SE) AND ENTROPY IN NATURAL TIME (S)

AE and SE are based on two input parameters: the sequence length m and the tolerance level r. The smallest values of entropy correspond to perfectly regular sequences, since the output of these algorithms provides a likelihood measure that two sequences (within tolerance level r) remain close to at the next point. Note that as r decreases both AE and SE increase, because the criterion for sequence matching becomes more stringent (see Ref.19 of the main text).

In Fig. 2, we plot the values of AE calculated for r=0.2STD and m=2 (as recommended in the program apen[2]) and SE, again for m=2, and r=0.2STD (by means of the program sampen[3]) along with the S-values for all SD and H discussed in the main text. Note that no distinction of all individuals can be achieved, although the average values of the two groups actually result to be different (cf. this still holds if we calculate AE for r=0.65STD as recommended in Ref.20 of the main text). This shows the necessity of using the S-fluctuations and their ratios—mentioned in the last paragraph of Section I of the main text.

III. THE DATA ANALYZED

Table III shows the values of λ, r, ν and S_{3-4}(QT) for all patients associated with ST-change, i.e., the two groups: EST and MST. Table III presents the corresponding values for the patients associated with Arrhythmia (ARR), i.e., the two groups: MIT and MSV, while the relevant results for both SD and H can be found in Table I of the main text. The values of λ_{shuf} and r_{shuf} of all individuals are given in Tables V to VII. We now discuss the quality of ECG data. Among the 101 individuals investigated, five patients have been identified as “outliers”. The appearance of such “outliers” is not surprising (see below) when using (as we did) an automatic threshold detector [4–7] for the allocation of the intervals. More precisely, their recognition was made as

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**TABLE I:** The resulting values of the ratios $\lambda_s(\text{RR})$ and $\lambda_L(\text{RR})$ when using segments of length $l=180$ beats and then calculating their mean and minimum values.

| Signal | $\lambda_s(\text{RR})_a$ | $\lambda_s(\text{RR})_b$ | $\langle \lambda_s(\text{RR}) \rangle_{l}$ | $\text{min} (\{\lambda_s(\text{RR})_i\})$ | $\lambda_L(\text{RR})_a$ | $\lambda_L(\text{RR})_b$ | $\langle \lambda_L(\text{RR}) \rangle_{l}$ | $\text{min} (\{\lambda_L(\text{RR})_i\})$ |
|--------|----------------|----------------|----------------|-----------------|----------------|----------------|----------------|----------------|
| sel16265 | 1.72 | 1.73 | 1.69 | 1.52 | 2.85 | 2.40 | 1.78 | 0.92 |
| sel16272 | 1.69 | 1.66 | 1.67 | 1.56 | 2.69 | 2.67 | 2.50 | 1.11 |
| sel16273 | 1.61 | 1.60 | 1.60 | 1.52 | 1.74 | 1.80 | 1.80 | 1.37 |
| sel16420 | 1.51 | 1.54 | 1.50 | 1.43 | 2.37 | 2.51 | 2.19 | 1.44 |
| sel16539 | 2.00 | 2.10 | 2.02 | 1.73 | 1.94 | 2.08 | 1.92 | 1.03 |
| sel16677 | 1.92 | 1.93 | 1.90 | 1.66 | 2.61 | 2.64 | 2.26 | 1.52 |
| sel16678 | 1.71 | 1.78 | 1.76 | 1.54 | 1.57 | 1.70 | 1.51 | 0.95 |
| sel16679 | 1.77 | 1.81 | 1.77 | 1.67 | 0.99 | 1.10 | 0.82 | 0.41 |
| sel17453 | 1.87 | 1.91 | 1.90 | 1.85 | 1.67 | 1.73 | 1.68 | 0.93 |

*They come from Table I of the main text*

*These values, for the sake of comparison, are obtained after applying a detection algorithm which excludes the “outliers”; this algorithm is analogous to the one used by Ivanov et al., Nature (London) 399:461, 1999*

*These individuals have $\text{min} (\{\lambda_s(\text{RR})_i\})$ values which are equal to or smaller than the value $\lambda_s(M) = 1.20 \pm 0.03$ discussed in the text.*

*These individuals have $\text{min} (\{\lambda_L(\text{RR})_i\})$ values which are equal to or smaller than the value $\lambda_L(M) = 0.64 \pm 0.05$ discussed in the text.*

*This individual has the smallest length (760 beats) among the H, which might be one of the reasons why this case only deviates from the other H.*

Follows:

Four individuals, i.e., two MIT (sel230 and sel231) and two EST (sel60612 and sel60704), have been identified as “outliers”, because they exhibit $\nu_p(\text{QRS})$ values which are unusually larger than unity. This can be justified if we consider the following two facts: (i) There is a similarity of the QRS morphology from heartbeat to heartbeat (e.g., see [8]), and (ii) the so-called Long QT-syndrome,
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TABLE II: The resulting values of the ratios \( \lambda_s(RR) \) and \( \lambda_L(RR) \) when using segments of length \( l=120 \) beats and then calculating their mean and minimum values.

| signal   | \( \langle \lambda_s(RR) \rangle_l \) | \( \min(\{\lambda_s(RR)\}_l) \) | \( \langle \lambda_L(RR) \rangle_l \) | \( \min(\{\lambda_L(RR)\}_l) \) |
|----------|--------------------------------------|----------------------------------|--------------------------------------|----------------------------------|
| sel16265 | 1.70                                 | 1.46                             | 1.87                                 | 0.98                             |
| sel16272 | 1.66                                 | 1.46                             | 1.20                                 | 0.82                             |
| sel16273 | 1.59                                 | 1.47                             | 1.95                                 | 0.79                             |
| sel16420 | 1.51                                 | 1.39                             | 1.57                                 | 0.86                             |
| sel16483 | 1.42                                 | 1.23                             | 2.45                                 | 0.90                             |
| sel16539 | 2.04                                 | 1.67                             | 1.50                                 | 0.90                             |
| sel16773 | 1.91                                 | 1.67                             | 2.41                                 | 0.77                             |
| sel16786 | 1.78                                 | 1.49                             | 1.18                                 | 0.69                             |
| sel16795 | 1.77                                 | 1.68                             | 0.68                                 | 0.44                             |
| sel17353 | 1.93                                 | 1.77                             | 1.33                                 | 0.77                             |
| sel1673 | 1.09                                 | 0.93                             | 1.02                                 | 0.68                             |
| sel31   | 0.99                                 | 0.87                             | 0.31                                 | 0.19                             |
| sel32   | 1.34                                 | 0.92                             | 1.82                                 | 0.27                             |
| sel33   | 1.13                                 | 0.91                             | 0.70                                 | 0.46                             |
| sel34   | 2.01                                 | 1.39                             | 2.92                                 | 1.26                             |
| sel35   | 1.15                                 | 1.03                             | 0.45                                 | 0.35                             |
| sel36   | 1.33                                 | 1.21                             | 0.64                                 | 0.36                             |
| sel37   | 0.96                                 | 0.75                             | 0.53                                 | 0.33                             |
| sel38   | 1.11                                 | 0.78                             | 0.34                                 | 0.07                             |
| sel39   | 0.81                                 | 0.78                             | 0.10                                 | 0.06                             |
| sel40   | 1.66                                 | 1.58                             | 0.64                                 | 0.23                             |
| sel41   | 1.32                                 | 0.88                             | 0.58                                 | 0.18                             |
| sel42   | 1.43                                 | 0.81                             | 2.31                                 | 0.48                             |
| sel43   | 1.62                                 | 1.42                             | 3.39                                 | 1.11                             |
| sel44   | 1.19                                 | 1.13                             | 0.16                                 | 0.09                             |
| sel45   | 1.17                                 | 0.81                             | 0.69                                 | 0.39                             |
| sel46   | 0.94                                 | 0.85                             | 0.41                                 | 0.29                             |
| sel47   | 1.55                                 | 1.34                             | 1.83                                 | 1.28                             |
| sel48   | 0.98                                 | 0.77                             | 1.64                                 | 0.14                             |
| sel49   | 0.91                                 | 0.86                             | 0.25                                 | 0.08                             |
| sel50   | 1.32                                 | 1.09                             | 0.51                                 | 0.34                             |
| sel51   | 1.80                                 | 1.60                             | 0.63                                 | 0.57                             |
| sel52   | 1.11                                 | 0.94                             | 0.72                                 | 0.29                             |
| sel17152| 0.99                                 | 0.79                             | 1.16                                 | 0.40                             |

which is characterized by prolongation of the QT-interval (representing the total duration of both the depolarization and the repolarization phases) preceding sudden cardiac death, is almost solely caused by lengthening of the repolarization phase (i.e., lengthening of the ST-interval) and not [9] of the QRS-. Both these facts reflect that, in all cases (even including SD), the quantity \( \delta S_{shuf} \), when considering a few consecutive beats, should not greatly differ from \( \delta S \) as far as the QRS-interval is concerned. Actually, a first inspection of the Table I of the main text and the Tables III and IV shows that, in all groups of individuals, the ratio \( \delta S_{shuf}/\delta S \) in the short range -i.e., \( \nu_s(QRS) \) - scatters more or less around unity. A closer inspection of these Tables reveals, however, that in four cases (among the 101 individuals) mentioned above, \( \nu_s(QRS) \) greatly differs from unity (cf. A simple statistical test -by means of the STATIST[10]- of the 101 \( \nu_s(QRS) \) values, immediately shows that these four cases can be considered as “outliers”). The origin of this difference might be attributed to an error in the automatic QRS detection as follows: The data were sampled at 250 Hz. The true error, however, of the R-peak determination by means of the automatic threshold detector [4-7] may be much larger [8] than the nominal sampling error (=1/250) due to the fact that the morphology of the QRS is significantly distorted in severely ill patients. Then the error may be as large as 30 msec [8].

The fifth individual identified as “outlier”, i.e., sele0136, has a \( \mu_L(QRS) \) value drastically larger than the corresponding values of all other patients. Moreover, sele0136 has been found to strongly deviate from the others as far as the ratio \( \mu_L(QT)/\mu_L(QRS) \) is concerned; this ratio is unusually small (0.29), which is the smallest among the 101 individuals (cf. There are two

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We now turn to the investigation of the $\delta S(QT)$ values. In Fig. 5 of the main text, the average $\delta S(QT)$ value for each group is plotted versus the time-window length. The results of the four groups (MIT, MSV, MST, EST) of patients are located between $H$ (the lowermost curve) and $SD$ (the uppermost curve). If we plot, however, the curves for each one of the 101 individuals (in a way similar to that of Fig. 2(a) of the main text), we find, as mentioned in the main text, that there are some patients the results of which overlap with either $SD$ or $H$. To exemplify the resulting main feature, and in order to avoid the overload of the figure with the curves of 101 individuals, we present Fig. 3, which shows only the limiting cases i.e., the lowermost and the uppermost curve, called $\delta S(QT)_{min}$ and $\delta S(QT)_{max}$, respectively, obtained in the following three groups: $SD$ (the two red curves), $H$ (the two curves in black) and one group of patients only, i.e., EST (lines in blue). Two facts are apparent from the figure: First, the range between the two $SD$ curves is separated from the corresponding range of $H$, as found in Fig.6 of Ref. [11] (and can be clearly visualized in Fig.2(a) of the main text). Second, the range between the two limiting EST curves overlaps significantly (i.e., 22 out of 33 EST) with the range between the two $SD$ curves and to a lesser extent with that between the two $H$ ones. Concerning the other three groups of patients, (not shown in Fig. 3), we just note that the former overlap occurs in all of them, while the latter one occurs for a few individuals only. It is the former overlap, of course, which obscures a clear distinction between $SD$ and patients by means of a direct application of the $\delta S(QT)$ values alone.

We return to Fig. 3. In order to distinguish $SD$ from patients, we must appropriately discriminate the overlap which refers to those of the EST individuals that lie above the uppermost $\delta S(QT)$ curve of $H$; this is called $\delta S(QT)_{max,H}$. Thus, the limits of the EST individuals we are currently interested in, do not extend from $\delta S(QT)_{min}$ to $\delta S(QT)_{max}$, since they must exceed $\delta S(QT)_{max,H}$, i.e., obey the relation (1) of the main text. To visualize it, we also plot in Fig. 3, the curve which corresponds to the one of the EST individuals, i.e., sele0606, that has $\delta S(QT)$ value lying just above the $\delta S(QT)_{max,H}$. The latter EST individual (marked solely with $min'$ in Fig. 3) corresponds to the value labeled $\delta S(QT)_{min'}$. In other words, if we apply the condition (2) of the main text to each group of patients, we are left only with those of the patients that actually overlap with $SD$. This assumes, of course, that a reasonable population for each group has been studied in advance, thus allowing a reliable determination of the corresponding limits.

We now compare the quantities $\lambda$, $\rho$, $\nu$, $\delta S(QT)$ altogether, of each $SD$, to the corresponding parameters...
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three SD (i.e., sel33, sel45, sel46), who are different from the four ones that could not be discriminated by the former combination $\lambda$, $\rho$, $\nu$. By the same token, we find that each of the remaining combinations fails to identify certain SD, which can be distinguished by another combination(s). Therefore, we conclude that each of the four quantities $\lambda$, $\rho$, $\nu$, $\delta S(QT)$ seems to complement the others in identifying all SD (cf. the same conclusion is drawn if we alternatively use the four quantities $\lambda$, $\lambda_{shuf}$, $\rho$ and $\delta S(QT)$, see Table XIII). This might be understood in the context that each of these quantities, as already mentioned, presumably captures certain “elements” of heart dynamics only. As for the necessity of using all these quantities, it might stem from the following fact. The database we used, consists of SD individuals in which different physiological processes might have led to sudden cardiac death (cf. the selection of such a heterogeneous database was intentionally made, because it was our aim to find, if possible, a general procedure to identify SD). If a study of “homogeneous” SD databases (in the sense that the same physiological processes preceded the sudden cardiac death) is made, it may happen that a smaller number of parameters are necessary to distinguish all SD. Until the completion of such studies, however, it is recommended to use all the parameters associated with the aforementioned quantities, as described in the Appendix of the main text.

VII. SES ACTIVITIES AND AN. THEIR FEATURES COMPARED TO ECG

We finally discuss whether the complexity measures in the SES activities and AN exhibit some features that allow their classification. First, we recall [13] that, in view of their (dichotomous) nature, the (relative) measure $\rho$ has no meaning here. The other measures $\lambda$, $\lambda_{shuf}$, $\nu$ are tabulated (see Table XIV) for each signal along with the $S$-values. These measures have been calculated only in the short range ($k = 8$), because the length $N$, for reasons explained in Ref. [13], does not allow a reliable calculation in the longer range. An inspection of Table XIV, reveals that the $\lambda$-values of AN (except of n1) are somewhat larger than those in the SES activities, thus allowing, only a marginal distinction between these two types of signals, as mentioned in Ref. [13]. Thus, the following interesting feature emerges: Among the four systems SES, AN, SD, H, that are all characterized by scaling (complex) dynamics, the two ones of critical dynamics (i.e., SD and SES activities) exhibit as a common behavior that their $\lambda$-values approach that of the Markovian case (i.e., their complex dynamics becomes more “simplified”), $\lambda_{M}(4) = 1.20 \pm 0.03$, while in the others (H and AN) do not. This different behavior is more distinct when comparing SD to H and becomes only marginal between SES activities and AN. When studying the $S$-values themselves, however, the following is noticed: most SES activities can be clearly distinguished[15] from the majority of AN (i.e., except of n5), because they have $S$-values smaller and larger, respectively, than the value $S_u = 0.0966$ of the “uniform” distribution (as the latter was defined in Refs. [14, 15]); on the other hand, when dealing with ECG they all have $S$-values comparable, more or less, to $S_u$ (for example, see the values for the SD and H given in Table XV), thus not allowing a clear distinction among their principal categories. Recalling that all the systems under consideration are non-Markovian ([11, 14, 15]), the following fact (the origin of which, however, has not yet been clearly understood) seems to hold in general: when two systems of different dynamics have $S$-values that distinctly differ from $S_u$, they can be distinguished on the basis of the $S$-values alone; on the other hand, if their $S$-values are close to $S_u$, their distinction requires the inspection of the complexity measures relevant to their $\delta S$-values.

VIII. ADDITIONAL COMMENTS FOR THE DISTINCTION BETWEEN SD AND H ON THE BASIS OF $\delta S(QT)$

The distinction between SD and H on the basis of $\delta S(QT)$ as depicted in Fig. 2 of the main text and discussed in Ref. 8 of the main text cannot be attributed to the large experimental error in the allocation of the QT for the following reason: Jané et al. [5] evaluated the automatic threshold based detector (which is a single-lead detector presented in Refs. [6] and [7]) of waveforms limits in Holter ECG with the QT database. They concluded that for the end of T-wave over 71% of records had a well performed automatic wave boundaries detection. For all MST and H records no detection errors were found. On the other hand, in SD and MSV, mainly due to low “signal to noise ratio” (SNR) or small T amplitude, poor detection results were found (cf. Table 7 of Ref. [5] classifies 11 out of 24 SD in the category of “well detected signals”, i.e., the correctness and the precision of the detector’s performance, quantified by a mean error and a standard deviation of this error, were smaller than 40 and 50 ms, respectively). We emphasize that the findings of Ref. 8 of the main text (and hence of Fig. 2 of the main text) result in a unified picture in all SD, and hence it could not be associated with the measurement error -which, of course, affects the computations- especially in certain SD with “poor detection results”. Jané et al. [5] recommended that, since the error probability of using this single lead detector is higher when the SNR of T wave decreases, this problem can be reduced by selecting the lead which the doctor considers more appropriate to measure QT. Thus, following this recommendation, one of the two leads (available in the QT database) was appropriately selected, for each record, in our study. To sum up, the above mentioned Holter-recordings were annotated with the values of the QT-intervals obtained from the automatic detector after taking appropriate care to reduce the error probability.

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| Individual | RR       | QRS      | QT       | RR over QRS | QT over QRS |
|-----------|----------|----------|----------|-------------|-------------|
| sele0104  | 0.99     | 0.80     | 1.23     | 0.51        | 1.27        |
| sele0105  | 1.45     | 2.67     | 1.15     | 0.42        | 1.27        |
| sele0110  | 1.84     | 2.82     | 1.23     | 0.83        | 1.23        |
| sele0111  | 1.67     | 6.66     | 1.16     | 0.56        | 1.23        |
| sele0112  | 1.42     | 2.76     | 1.22     | 0.71        | 1.31        |
| sele0114  | 1.45     | 0.83     | 1.12     | 0.56        | 1.36        |
| sele0116  | 0.94     | 0.84     | 0.99     | 0.50        | 1.19        |
| sele0121  | 1.54     | 1.92     | 1.42     | 1.63        | 1.79        |
| sele0122  | 1.11     | 4.69     | 1.31     | 0.72        | 1.10        |
| sele0124  | 1.32     | 1.84     | 1.48     | 0.56        | 1.22        |
| sele0126  | 1.12     | 1.13     | 1.25     | 0.64        | 1.14        |
| sele0129  | 1.39     | 2.59     | 1.22     | 0.98        | 1.22        |
| sele0133  | 1.26     | 1.22     | 1.02     | 0.82        | 1.41        |
| sele0136  | 1.77     | 2.25     | 1.25     | 0.57        | 1.09        |
| sele0166  | 1.86     | 5.04     | 1.30     | 0.86        | 1.14        |
| sele0170  | 1.54     | 3.07     | 1.15     | 0.71        | 1.18        |
| sele0203  | 1.16     | 0.95     | 1.29     | 0.64        | 1.24        |
| sele0232  | 1.30     | 1.09     | 1.39     | 0.74        | 1.49        |
| sele0251  | 1.20     | 3.20     | 1.29     | 0.67        | 1.23        |
| sele0303  | 0.95     | 0.73     | 1.17     | 0.54        | 0.38        |
| sele0405  | 2.08     | 5.60     | 1.24     | 0.65        | 1.19        |
| sele0409  | 1.50     | 2.61     | 1.11     | 0.72        | 1.11        |
| sele0411  | 0.99     | 0.61     | 1.26     | 0.60        | 1.25        |
| sele0509  | 0.79     | 0.48     | 1.24     | 0.85        | 1.15        |
| sele0603  | 1.66     | 2.85     | 1.14     | 0.89        | 1.58        |
| sele0604  | 1.70     | 3.37     | 1.34     | 0.88        | 1.34        |
| sele0606  | 1.17     | 1.41     | 1.98     | 0.78        | 1.14        |
| sele0607  | 1.09     | 2.41     | 1.15     | 0.69        | 1.03        |
| sele0609  | 1.00     | 1.57     | 1.38     | 0.86        | 1.23        |
| sele0704  | 0.97     | 1.95     | 1.33     | 0.98        | 1.30        |
| sele0708  | 0.79     | 0.48     | 0.99     | 0.42        | 1.03        |
| sele0709  | 2.33     | 6.66     | 1.48     | 1.71        | 2.82        |
| sele0801  | 1.01     | 1.39     | 1.20     | 0.58        | 1.38        |
| sele0802  | 1.42     | 2.68     | 1.22     | 0.63        | 1.19        |
| sele0806  | 1.72     | 3.75     | 1.29     | 0.68        | 1.28        |
| sele0807  | 1.54     | 1.90     | 1.30     | 0.71        | 1.18        |
| sele0808  | 1.01     | 0.45     | 1.28     | 0.70        | 1.18        |
| sele0901  | 1.28     | 1.17     | 1.13     | 0.71        | 1.17        |
| sele0902  | 1.01     | 0.45     | 0.82     | 0.58        | 0.17        |
| sele0905  | 2.33     | 6.66     | 1.48     | 1.71        | 2.82        |
| sele0908  | 1.01     | 1.39     | 1.20     | 0.58        | 1.38        |

**TABLE III:** The variability measures (λ), the relative ones (ρ), and the ratios ν = δS_{shuf}/δS in the short (s) range and in the longer (L) range in EST (sel0104 to sele0704) and MST (sel301 to sel 310) along with their δS_{shuf}(QT) values.

- These values are smaller than the H_{min} which corresponds to each column.
- These values are larger than the H_{max} which corresponds to each column.
- Two values are given in each column: The upper is obtained when considering all the patients, while the lower when omitting sele0138, sele0612 and sele0704 (see the text).
| Individual | RR (s) | QRS (s) | QT (s) | RR over QRS | QT over RR | RR over QT | 3-4 beats (μV) | 50-70 beats (μV) | $\Delta S_{\text{max}}(QT) \times 10^5$ |
|-----------|--------|---------|--------|-------------|------------|------------|---------------|----------------|-----------------|
| sel100    | 1.13   | 0.68    | 1.39   | 0.62        | 1.04*      | 0.33*      | 0.57          | 0.62           | 0.45*           |
| sel102    | 1.35*  | 0.49*   | 1.25   | 0.63        | 1.62*      | 0.96       | 1.10          | 0.85           | 1.71*           |
| sel164    | 1.96   | 1.74    | 1.31   | 0.63*       | 1.77*      | 0.55       | 0.21          | 0.58           | 0.86*           |
| sel104    | 1.26*  | 0.31*   | 1.63   | 0.46*       | 1.10*      | 0.44*      | 0.48          | 0.33*          | 0.67*           |
| sel114    | 0.98*  | 0.38*   | 1.26   | 0.24*       | 1.14*      | 0.26*      | 1.08          | 0.65           | 2.67            |
| sel116    | 0.95*  | 0.24*   | 1.35   | 0.71*       | 1.39*      | 0.61       | 0.88          | 0.29*          | 2.40*           |
| sel117    | 0.80*  | 0.75*   | 1.07   | 0.53        | 1.11*      | 0.52       | 0.29          | 0.42           | 1.09*           |
| sel123    | 1.40*  | 1.29    | 1.16   | 0.52        | 1.21       | 0.59       | 0.68          | 1.67           | 1.97            |
| sel121    | 1.01*  | 0.17*   | 1.17   | 0.63*       | 1.15*      | 0.46*      | 0.33          | 0.09*          | 1.69*           |
| sel221    | 1.08*  | 0.37*   | 1.47   | 0.50        | 1.19       | 0.53       | 0.82          | 0.61           | 3.40*           |
| sel223    | 0.82*  | 0.26*   | 0.99*  | 0.61        | 0.99       | 0.41*      | 1.33          | 0.56           | 2.04*           |
| sel230    | 1.86   | 3.17*   | 1.54   | 1.75*       | 3.99*      | 1.18*      | 0.22          | 0.39*          | 0.60*           |
| sel231    | 1.32*  | 3.19*   | 1.24   | 2.24*       | 1.21       | 2.80*      | 0.60          | 0.86           | 1.02*           |
| sel232    | 1.57   | 0.95*   | 1.19   | 0.56        | 1.19       | 0.51       | 2.04*         | 3.45           | 5.96*           |
| sel233    | 0.92*  | 0.18*   | 1.24   | 0.50        | 1.22       | 0.68       | 0.76          | 0.27*          | 2.67*           |
| min*      | 0.80   | 0.17    | 0.99   | 0.46        | 0.99       | 0.33       | 0.21          | 0.09           | 0.45*           |
| max*      | 1.96   | 3.19    | 1.63   | 2.24*       | 1.77       | 2.80*      | 2.04          | 3.45           | 5.96*           |
| sel803    | 0.92*  | 0.55*   | 1.36*  | 0.61        | 1.30       | 0.70       | 0.89          | 0.80           | 6.70*           |
| sel808    | 0.99*  | 0.13*   | 1.19   | 1.06*       | 1.32       | 0.64       | 0.41          | 0.72           | 1.41*           |
| sel810    | 0.99*  | 0.64*   | 1.20   | 0.47*       | 1.16       | 0.53       | 0.79          | 1.07           | 3.88*           |
| sel820    | 0.96*  | 0.17*   | 1.22   | 0.67*       | 1.14*      | 0.53       | 2.81          | 0.73           | 0.87*           |
| sel821    | 1.05*  | 0.16*   | 1.36*  | 0.63*       | 1.16       | 0.50       | 1.50          | 0.38*          | 3.38*           |
| sel840    | 1.22*  | 1.51    | 1.23   | 0.61        | 1.16       | 0.74       | 0.52          | 1.29           | 1.87*           |
| sel847    | 0.85*  | 0.32*   | 1.12   | 0.53        | 1.16       | 0.56       | 0.93          | 0.56           | 6.71*           |
| sel853    | 0.92*  | 0.18*   | 1.27   | 0.72*       | 1.24       | 0.56       | 1.56*         | 0.38*          | 2.87*           |
| sel871    | 0.95*  | 1.27    | 1.69   | 0.40        | 1.20       | 0.74       | 1.01          | 1.85           | 1.87*           |
| sel872    | 0.97*  | 0.55*   | 1.32*  | 0.58        | 1.24       | 0.53       | 0.91          | 0.86           | 4.63*           |
| sel873    | 1.02*  | 0.90*   | 1.20   | 0.54        | 1.26       | 0.53       | 0.24          | 0.40           | 1.04*           |
| sel883    | 0.98*  | 0.36*   | 1.09   | 0.47        | 1.18       | 0.60       | 0.70          | 0.54           | 2.78*           |
| sel891    | 0.92*  | 0.23*   | 1.16   | 0.56        | 1.10*      | 0.56       | 2.02*         | 0.82           | 3.74*           |
| min*      | 0.85   | 0.16    | 1.09   | 0.47        | 1.10       | 0.50       | 0.24          | 0.38           | 0.87*           |
| max*      | 1.22   | 1.87    | 1.36   | 1.06        | 0.47       | 0.74       | 2.81          | 1.85           | 6.76*           |

These values are smaller than the $H_{\text{min}}$ which corresponds to each column.

These values are larger than the $H_{\text{max}}$ which corresponds to each column.

Two values are given in each column: The upper is obtained when considering all the patients, while the lower when omitting sel230 and sel231 (see the text)
TABLE V: The measures λ_{shuf} and ρ_{shuf} in the short (s) range and in the longer (L) range in EST (sel0104 to sele0704) and MST (sel0301 to sel310) along with the $\delta S_{\lambda_{s-L}}(Q{T})$-values.

| Individual | RR over QRS | RR over QT | $\delta S_{\lambda_{s-L}}(Q{T}) \times 10^3$ |
|------------|-------------|------------|----------------------------------|
| sele0104  | 1.12        | 0.57       | 1.37                             |
| sele0106  | 1.13        | 0.51       | 1.21                             |
| sele0107  | 1.13        | 0.53       | 1.27                             |
| sele0110  | 1.24        | 0.54       | 1.56                             |
| sele0111  | 1.06        | 0.47       | 1.24                             |
| sele0112  | 1.21        | 0.58       | 1.33                             |
| sele0114  | 1.13        | 0.51       | 1.22                             |
| sele0116  | 1.23        | 0.53       | 1.19                             |
| sele0121  | 1.20        | 0.52       | 1.10                             |
| sele0122  | 1.20        | 0.52       | 1.10                             |
| sele0124  | 1.24        | 0.55       | 1.43                             |
| sele0126  | 1.17        | 0.50       | 1.21                             |
| sele0129  | 1.15        | 0.56       | 1.17                             |
| sele0133  | 1.14        | 0.43       | 1.13                             |
| sele0136  | 1.49        | 0.48       | 1.15                             |
| sele0166  | 1.16        | 0.48       | 1.25                             |
| sele0170  | 1.24        | 0.53       | 1.31                             |
| sele0203  | 1.19        | 0.58       | 1.23                             |
| sele0210  | 1.24        | 0.55       | 0.74                             |
| sele0211  | 1.15        | 0.51       | 1.36                             |
| sele0303  | 1.09        | 0.48       | 1.17                             |
| sele0405  | 1.24        | 0.56       | 1.11                             |
| sele0406  | 1.26        | 0.56       | 1.15                             |
| sele0409  | 1.17        | 0.54       | 1.27                             |
| sele0411  | 1.21        | 0.56       | 1.36                             |
| sele0509  | 1.01        | 0.45       | 1.25                             |
| sele0603  | 1.07        | 0.57       | 1.27                             |
| sele0604  | 1.18        | 0.53       | 1.28                             |
| sele0606  | 1.18        | 0.54       | 1.27                             |
| sele0607  | 1.20        | 0.50       | 1.15                             |
| sele0609  | 1.26        | 0.55       | 1.19                             |
| sele0612  | 1.25        | 0.54       | 1.25                             |
| sele0704  | 1.25        | 0.54       | 1.25                             |
| sele0301  | 1.21        | 0.56       | 1.10                             |
| sele0302  | 1.20        | 0.51       | 1.31                             |
| sele0306  | 1.18        | 0.50       | 1.22                             |
| sele0307  | 1.11        | 0.52       | 1.17                             |
| sele0308  | 1.16        | 0.51       | 1.43                             |
| sele0310  | 1.17        | 0.52       | 1.31                             |
| sele0312  | 1.11        | 0.50       | 1.10                             |
| sele0314  | 1.21        | 0.56       | 1.43                             |

*These values are smaller than the $H_{\min}$ which corresponds to each column.

*These values are larger than the $H_{\max}$ which corresponds to each column.

*Two values are given in each column: The upper is obtained when considering all the patients, while the lower when omitting sele0136, sele0612 and sele0704 (see the text).
TABLE VI: The measures $\lambda_{shuf}$ and $\rho_{shuf}$ in the short (s) range and in the longer (L) range in MIT (sel100 to sel233) and MSV (sel803 to sel 891) along with the $\delta S_{\lambda_{shuf}}(QT)$-values.

| individual | RR | QRS | QT | RR over QRS | RR over QT | $\delta S_{\lambda_{shuf}}(QT) \times 10^9$
|------------|----|-----|-----|-------------|------------|----------------------------------------|
| sel100     | 1.25 | 0.51 | 1.15 | 0.55 | 1.21 | 0.47 | 0.52 | 0.48 | 0.46 | 0.56 | 3.31 | a |
| sel102     | 1.04  | 0.37 b | 1.16 | 0.51 | 1.13 | 0.49 | 1.28 | 0.94 | 2.16 | 1.19 | 1.69 | b |
| sel103     | 1.15  | 0.49 | 1.16 | 0.51 | 1.22 | 0.53 | 0.38 a | 0.36 | 1.71 | 1.19 | 0.94 | b |
| sel104     | 1.20  | 0.56 | 1.15 | 0.47 | 0.89 a | 0.37 a | 0.34 a | 0.40 | 0.65 a | 0.92 a | 3.84 b |
| sel114     | 1.08 b | 0.46 a | 1.32 | 0.71 | 1.24 | 0.55 | 1.16 | 0.76 | 2.10 | 1.89 | 1.89 b |
| sel116     | 1.07  | 0.48 | 1.46 b | 0.73 b | 1.08 a | 0.50 | 0.85 | 0.54 | 3.73 | 3.02 | 1.01 b |
| sel117     | 0.92 b | 0.44 b | 1.14 | 0.50 | 1.16 | 0.54 | 0.38 a | 0.33 | 1.34 | 1.08 a | 0.81 b |
| sel123     | 1.17  | 0.61 b | 1.26 | 0.57 | 1.06 a | 0.54 | 1.11 | 1.19 | 2.99 | 3.31 | 0.96 b |
| sel123     | 1.14  | 0.48 | 1.37 | 0.70 | 1.20 | 0.53 | 0.29 a | 0.20 a | 1.46 | 1.39 | 0.79 b |
| sel124     | 1.16  | 0.55 | 1.33 | 0.73 | 1.09 a | 0.48 a | 0.77 | 0.59 | 3.09 | 3.26 | 2.30 b |
| sel125     | 1.18  | 0.50 | 1.25 | 0.59 | 1.14 | 0.53 | 1.05 | 0.90 | 1.47 | 1.71 | 2.59 b |
| sel130     | 1.08  | 0.47 a | 1.29 | 0.59 | 1.16 | 0.54 | 0.52 | 0.42 | 2.42 | 1.46 | 1.60 b |
| sel131     | 1.23  | 0.57 | 1.14 | 0.47 | 1.25 | 0.54 | 0.85 | 1.03 | 4.02 | 1.47 | 4.83 b |
| sel132     | 1.34 b | 0.92 b | 1.13 | 0.51 | 1.16 | 0.47 a | 2.35 | 4.22 b | 7.01 | 13.04 b | 1.55 b |
| sel133     | 1.24  | 0.55 | 1.30 | 0.65 | 1.26 | 0.57 | 0.64 | 0.54 | 2.01 | 1.90 | 2.69 b |
| min c      | 0.92  | 0.37 | 1.13 | 0.47 | 0.89 a | 0.37 | 0.29 | 0.20 | 0.46 | 0.56 | 0.79 |
| max c      | 1.34  | 0.92 | 1.46 | 0.75 | 1.26 | 0.57 | 2.35 | 4.22 | 7.01 | 13.04 | 4.83 |

- These values are smaller than the $H_{min}$ which corresponds to each column.
- These values are larger than the $H_{max}$ which corresponds to each column.
- Two values are given in each column: The upper is obtained when considering all the patients, while the lower when omitting sel230 and sel231 (see the text).
TABLE VII: The measures $\lambda_{\text{shuf}}$ and $\rho_{\text{shuf}}$ in the short (s) range and in the longer (L) range in H (sel16265 to sel17453) and SD (sel30 to sel17152) along with the $\Delta S_{3-d_{L},\text{shuf}}(QT)$-values. The values of $\lambda_{\text{shuf}}$ do not coincide with those given in Ref.[5] for the reasons discussed in the Appendix of the main text.

| Individual | RR over QRS | RR over QT | $\Delta S_{3-d_{L},\text{shuf}}(QT)$ | $\times 10^4$ |
|------------|-------------|-------------|------------------------------------|--------------|
| sel16265   | 1.09        | 0.54        | 1.17                               | 0.51         |
| sel16272   | 1.27        | 0.57        | 1.44                               | 0.73         |
| sel16273   | 1.19        | 0.53        | 1.16                               | 0.52         |
| sel16420   | 1.04        | 0.48        | 1.19                               | 0.54         |
| sel16482   | 1.24        | 0.55        | 1.29                               | 0.58         |
| sel16483   | 1.21        | 0.55        | 1.19                               | 0.52         |
| sel16539   | 1.17        | 0.51        | 1.10                               | 0.46         |
| sel16773   | 1.17        | 0.51        | 1.10                               | 0.46         |
| sel16786   | 1.16        | 0.55        | 1.14                               | 0.50         |
| sel16795   | 1.19        | 0.57        | 1.21                               | 0.54         |
| sel17453   | 1.18        | 0.52        | 1.14                               | 0.51         |
| H$_{\text{min}}$ | 1.04    | 0.48        | 1.10                               | 0.46         |
| H$_{\text{max}}$ | 1.27    | 0.57        | 1.44                               | 0.73         |

$^a$These values are smaller than the $H_{\text{min}}$ given in each column
$^b$These values are larger than the $H_{\text{max}}$ given in each column

These values are larger than the $H_{\text{min}}$ given in each column

These values are smaller than the $H_{\text{max}}$ given in each column
TABLE VIII: Compilation of the limits of each of the complexity measures $\lambda$, $\rho$, $\lambda_{\text{sh}}$, $\rho_3$, $\rho_4$, $\nu$ along with those of $\overline{\Delta S_{3\rightarrow 4}}(QT)$ and $\overline{\Delta S_{3\rightarrow 4}}(Q\overline{T})$ in healthy humans (H) and in four groups (MIT, MSV, EST, MST) of heart disease patients. In parenthesis we put the limits which change when considering only the patients who have $\overline{\Delta S_{3\rightarrow 4}}(QT)$ values larger than those in H. The percentage errors of the various parameters investigated are also shown. For the sake of brevity, the subscript “sh” stands for “shuffled”.

| Parameter | H | MIT | MSV | EST | MST | $r_m(\%)$
|-----------|---|-----|-----|-----|-----|-----|
| $\lambda_{\text{sh}}(RR)$ | 1.43 | 2.00 | 0.80 | 1.96 | 0.85 | 1.22 | 0.79(0.94) | 2.33 | 1.01 | 1.72(1.42) | 11.66 |
| $\lambda_{\text{sh}}(RR)$ | 0.99 | 2.69 | 0.17 | 1.74 | 0.16 | 1.87 | 0.48(0.61) | 6.66 | 0.45 | 3.75(2.68) | 14.62 |
| $\lambda_{\text{sh}}(QRS)$ | 1.16 | 1.29 | 0.99 | 1.63 | 1.09 | 1.36 | 0.99 | 1.48 | 1.20 | 1.30(1.28) | 10.53 |
| $\lambda_{\text{sh}}(QT)$ | 0.48 | 0.61 | 0.46 | 0.71 | 0.47 | 1.06 | 0.42 | 1.63(0.90) | 0.58 | 0.71(0.70) | 11.19 |
| $\rho_3(qT)$ | 1.16 | 1.41 | 0.99 | 1.77 | 1.10 | 1.32 | 1.03(1.09) | 1.71(1.36) | 1.18 | 1.38 | 32.92 |
| $\rho_3(Q\overline{T})$ | 0.50 | 1.11 | 0.33 | 0.96 | 0.50 | 0.74 | 0.43 | 2.82(1.73) | 0.67 | 1.43(1.36) | 41.37 |
| $\rho_4(Q\overline{T})$ | 0.18 | 1.85 | 0.21 | 2.04 | 0.24 | 2.81 | 0.03 | 1.54 | 0.17 | 0.99(0.96) | 18.23 |
| $\nu_3(\text{sh})^{a}$ | 0.40 | 7.10 | 0.09 | 3.45 | 0.38 | 1.85 | 0.13 | 2.86(2.61) | 0.51 | 2.62(1.25) | 18.93 |
| $\nu_3(Q\overline{T})^{a}$ | 0.67 | 5.57 | 0.45 | 5.96 | 0.87 | 6.76 | 0.15 | 10.04(4.63) | 0.53 | 4.98(1.97) | 53.56 |
| $\nu_4(Q\overline{T})^{a}$ | 1.79 | 10.04 | 0.48 | 11.03 | 0.29 | 5.35 | 0.51 | 8.93(5.12) | 1.11 | 8.70(2.07) | 50.92 |
| $\nu_4(Q\overline{T})^{a}$ | 1.16 | 1.29 | 0.99 | 1.63 | 1.09 | 1.36 | 0.99 | 1.48 | 1.20 | 1.30(1.28) | 10.53 |
| $\nu_4(Q\overline{T})^{a}$ | 0.48 | 0.61 | 0.46 | 0.71 | 0.47 | 1.06 | 0.42 | 1.63(0.90) | 0.58 | 0.71(0.70) | 11.19 |
| $\nu_4(Q\overline{T})^{a}$ | 0.50 | 1.11 | 0.33 | 0.96 | 0.50 | 0.74 | 0.43 | 2.82(1.73) | 0.67 | 1.43(1.36) | 41.37 |
| $\nu_4(Q\overline{T})^{a}$ | 0.18 | 1.85 | 0.21 | 2.04 | 0.24 | 2.81 | 0.03 | 1.54 | 0.17 | 0.99(0.96) | 18.23 |
| $\nu_4(Q\overline{T})^{a}$ | 0.40 | 7.10 | 0.09 | 3.45 | 0.38 | 1.85 | 0.13 | 2.86(2.61) | 0.51 | 2.62(1.25) | 18.93 |

*The values of these quantities do not fully coincide with those given in Ref. [11] for the reasons discussed in the Appendix.

TABLE IX: Results of the distinction of 24 SD among 101 individuals upon using the measures $\lambda$, $\rho$, $\nu$ along with $\overline{\Delta S_{3\rightarrow 4}}(QT)$ (only four $\rho$-parameters at the most, i.e., $\rho_3(Q\overline{T})$, $\rho_4(Q\overline{T})$, $\rho_3(QT)$, $\rho_4(QT)$, are used).

| Measures combined | The non-differentiated SD | Number of SD distinguished |
|-------------------|--------------------------|---------------------------|
| $\lambda$, $\rho$, $\nu$ | None | 24 (all) |
| $\lambda$, $\rho$, $\nu$ and relation(1) | One: sel35(MIT) | 23 |
| $\lambda$, $\rho$, $\nu$ and relation(2) | Four: sel30(EST), sel32(EST), sel34(EST), sel37(EST) | 20 |
| $\lambda$, $\rho$, $\nu$ and relation(2) | Four: sel30(MSV), sel41(MIT) | 20 |
| $\lambda$, $\rho$, $\nu$ and relation(2) | Three: sel33(MSV,EST), sel45(MIT,MSV), sel46(MSV,EST) | 21 |
| $\lambda$, $\rho$, $\nu$ and relation(2) | Seven: sel36(MIT,EST), sel38(MIT), sel41(MSV), sel42(EST), sel47(EST), sel51(EST), sel1752(MSV,EST) | 17 |
| $\lambda$, $\rho$, $\nu$ of RR and QRs only | Twelve: sel30(EST), sel32(EST), sel34(EST), sel35(MIT,MSV), sel37(MSV), sel38(MIT), sel40(EST), sel43(MIT), sel45(MSV), sel47(EST), sel50(MIT), sel51(MIT) | 12 |

*In all cases the data of the five patients sel230, sel231, sel0612, sel0704, sel0136 have been excluded (see the text).

*In parenthesis we mark the group(s) of patients in which the corresponding SD is mislocated.

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TABLE X: The precise limits of $\lambda$, $\rho$, $\nu$ and $\Delta S_{3-4}(QT)$ which are violated by each of the 24 sudden cardiac death individuals.

| individual | $\lambda_{<}(RR)$ | $\lambda_{>}(RR)$ | $\lambda_{<}(QRS)$ | $\lambda_{>}(QT)$ | $\rho_{<}(QRS)$ | $\rho_{>}(QT)$ | $\nu_{<}(RR)$ | $\nu_{<}(QRS)$ | $\nu_{<}(QT)$ | $\nu_{<}(QT)$ | $\Delta S_{3-4}(QT)$ |
|------------|------------------|------------------|------------------|------------------|----------------|----------------|----------------|----------------|----------------|----------------|--------------------|
| sel30      | a                | a                | abce             | c                | e              | c              | c              | a              | abcede         | c              | a                 |
| sel31      | ac               | ace              | abcd             | d                | c              | d              | c              | abcede         | c              | abed             | c                 |
| sel32      | ac               | a                | abce             | c                | e              | d              | a              | c              | c              | a              | abed              |
| sel33      | a                | a                | abcde            | c                | c              | e              | c              | abe            | c              | abc              | c                 |
| sel34      | cd               | abcd             | abcde            | d                | c              | abed           | a              | abcde          | c              | abcde            | abed              |
| sel35      | a                | ac               | abcde            | c                | e              | d              | a              | abcde          | c              | abed             | c                 |
| sel36      | ad               | a                | abcde            | c                | abce           | cde             | e              | a              | abcde          | c              | abcde            | abed              |
| sel37      | ace              | a                | abcde            | c                | abe            | cbe             | a              | abcde          | c              | abed             | c                 |
| sel38      | ace              | ace              | abcde            | c                | abed           | abcde           | a              | abcde          | c              | abed             | c                 |
| sel39      | acde             | abcd             | abcde            | c                | abcde          | abcde           | a              | abcde          | c              | abed             | c                 |
| sel40      | cd               | a                | abcde            | c                | abcd           | abcde           | a              | abcde          | c              | abed             | c                 |
| sel41      | a                | ac               | abcde            | c                | abd             | abcde           | e              | abcde          | c              | abed             | c                 |
| sel42      | a                | b                | c                | e                | abcde          | abcde           | a              | abcde          | c              | abed             | c                 |
| sel43      | cd               | abcd             | abcde            | acd              | abed           | abcde           | c              | abcde          | c              | abed             | c                 |
| sel44      | ac               | ace              | abcd             | abcde            | abcde          | abcde           | ac              | abcde          | c              | abed             | ac                 |
| sel45      | ace              | ace              | abcde            | abcde            | abcde          | abcde           | ac              | abcde          | c              | abcde             |
| sel46      | ac               | ace              | abcde            | abcde            | abcde          | abcde           | ac              | abcde          | c              | abcde             |
| sel47      | cd               | bd               | c                | e                | abcde          | abcde           | a              | abcde          | c              | abcde             |
| sel48      | acde             | acde             | abcde            | abcde            | abcde          | abcde           | ac              | abcde          | c              | abcde             |
| sel49      | ace              | ace              | abcde            | abcde            | abcde          | abcde           | ac              | abcde          | c              | abcde             |
| sel50      | ad               | ae               | abcd             | abcde            | abcde          | abcde           | a              | abcde          | c              | abcde             |
| sel51      | cd               | a                | abcde            | abcde            | abcde          | abcde           | c              | abcde          | c              | abcde             |
| sel52      | ad               | a                | abcde            | abcde            | abcde          | abcde           | c              | abcde          | c              | abcde             |

Where $a, b, c, d, e$ denote the cases where the limits of $H$, MIT, MST, MSV, EST are violated, respectively.
TABLE XI: The precise limits which are violated by each one of the 24 SD, when using the complexity measures $\lambda$, $\lambda_{shuf}$, $\rho$ and $S_{3-4}(QT)$ to distinguish the SD from the other individuals. For the sake of brevity, the subscript “sh” stands for “shuf”.

| individual | $\lambda_s$ | $\lambda_L$ | $\lambda_c$ | $\lambda_L$ | $\lambda_c$ | $\lambda_{3,sh}$ | $\lambda_{4,sh}$ | $\lambda_{5,sh}$ | $\lambda_{6,sh}$ | $\rho_s$ | $\rho_L$ | $\rho_c$ | $\rho_{sh}$ | $S_{3-4}(QT)$ |
|------------|-------------|-------------|-------------|-------------|-------------|----------------|----------------|----------------|----------------|----------|----------|----------|----------|--------------|
| sel30      | a           | a           | abc        | c           | c           | cd            | d              | abc            | e              | c         | e        | c        | e         | a            |
| sel31      | ac          | ace         | abcd       | abc         | d           | abe           | d              | abe            | ace            | e         | c        | d        | abce      | ac           |
| sel32      | ac          | ace         | abce       | c           | c           | abe           | ac             | abc            | ac             | d         | acd      | ad       | ac        | a            |
| sel33      | a           | a           | abcde      | c           | c           | cd            | a              | abcde          | c              | c         | c        | c        | ab        |
| sel34      | cd          | abcd        | abcde      | ac          | d           | abe           | c              | abe            | ac             | c         | c        | c        | ab        |
| sel35      | a           | ace         | abcde      | a           | ac          | acd           | ad             | acd            | ac             | c         | ac       | c        | acde      |
| sel36      | ad          | a           | abc        | c           | c           | cd            | e              | abc            | e              | c         | abce     | ac       | ac        |
| sel37      | ace         | a           | abc        | d           | acde        | acde          | d              | acde           | ac             | c         | abcd     | acde      | ac        |
| sel38      | ace         | ace         | abcde      | a           | acde        | acde          | c              | acde           | ac             | c         | abcd     | abcd      | ac        |
| sel39      | acde        | abcd        | abc        | c           | c           | acde          | d              | acde           | ac             | c         | acde     | abcd      | ac        |
| sel40      | cd          | a           | ac          | c           | c           | acde          | d              | acde           | ac             | c         | abcd     | acd       | ac        |
| sel41      | a           | ae          | abcde      | a           | c           | abcd          | d              | acd            | ac             | c         | ac       | c        | ac        |
| sel42      | a           | b           | c           | bd          | c           | abcd          | d              | acd            | ac             | c         | ac       | c        | ac        |
| sel43      | cd          | abcd        | abc        | acde        | abcd        | e              | acde           | ac             | ac               | c         | ac       | ac       | ac        |
| sel44      | a           | ace         | acde        | abcd        | acde        | acde          | ac             | ac             | ac               | c         | ac       | ac       | ac        |
| sel45      | ace         | ace         | abcde       | abcd        | acde        | e              | acde           | ac             | ac               | c         | ac       | ac       | ac        |
| sel46      | ac          | ace         | abcd        | ac          | abcde       | acde          | abcd           | acd            | acde             | c         | ac       | ac       | ac        |
| sel47      | cd          | bd          | c           | d           | acd          | e              | d              | bcd            | acde             | c         | abcd     | acd       | ac        |
| sel48      | acde        | ace          | abcd        | ac          | bd          | d              | abc            | ac              | acde             | c         | abcd     | acd       | ac        |
| sel49      | ace          | abc          | abce        | c           | c           | bcd            | e              | abc            | ac              | c         | ac       | ac       | ac        |
| sel50      | ad          | ae          | abcd        | abde        | abcde       | e              | cd             | abcd           | acd             | c         | abcd     | acd       | ac        |
| sel51      | cd          | a           | ac          | abcd        | c           | abcd          | d              | acd            | ac              | c         | abcd     | acd       | ac        |
| sel52      | ad          | a           | abc          | bd          | abde        | acde          | bcd            | acd            | ac              | c         | abc      | abcd      | ac        |
| sel17152   | a           | a           | abc          | ac          | c           | cd            | d              | abc            | ac              | c         | abcd     | acd       | ac        |

Where $a$, $b$, $c$, $d$, $e$ denote the cases where the limits of $H$, MIT, MST, MSV, EST are violated, respectively.
TABLE XII: Results of the distinction of 24 SD among 101 individuals upon using $\lambda_{shuf}$, $\delta S_{3-4}(QT)$ and four $\rho$-parameters at the most, i.e., $\rho_s(QRS)$, $\rho_L(QRS)$, $\rho_s(QT)$, $\rho_L(QT)$.

| Measures combined | The non-differentiated SD$^a$ | Number of SD distinguished |
|-------------------|------------------------------|---------------------------|
| $\lambda, \rho, \lambda_{shuf}$ and relation(2) | None | 24 (all) |
| $\lambda, \rho, \lambda_{shuf}$ and relation(1) | Two: sel35(MIT), sel34(EST), | 23 |
| $\lambda, \rho, \lambda_{shuf}$ | Four: sel30(MIT), sel31(EST), sel41(EST), sel46(MIT), sel49(MIT) | 20 |
| $\lambda, \rho, \lambda_{shuf}$ and relation(2) | Four: sel30(EST), sel31(EST), sel41(EST), sel49(EST) | 20 |
| $\lambda, \lambda_{shuf}$ and relation(2) | Six: sel36(MIT), sel38(MIT), sel40(EST), sel47(EST), sel17152(MIT,EST) | 18 |
| $\lambda, \rho, \lambda_{shuf}$ of RR and QRS only | Nine: sel30(EST), sel31(EST), sel35(MIT), sel38(MIT), sel40(EST), sel46(MIT), sel47(EST), sel49(MIT), sel50(MIT) | 15 |

$^a$In all cases the data of the five patients sel230, sel231, sele0612, sele0704, sele0136 have been excluded (see the text)

TABLE XIII: Results of the distinction of 24 SD among 101 individuals upon using $\lambda, \nu, \delta S_{3-4}(QT)$ and six $\rho$-parameters at the most, i.e., including also $\rho_s(QRS)$ / $\rho_s(QT)$ and $\rho_L(QRS)$ / $\rho_L(QT)$

| Measures combined | The non-differentiated SD$^a$ | Number of SD distinguished |
|-------------------|------------------------------|---------------------------|
| $\lambda, \rho, \nu$ and relation(1)$^a$ | None | 24 (all) |
| $\lambda, \rho, \nu$ and relation(1)$^a$ | Four: sel30(MSV), sel41(MIT), sel46(MIT), sel49(MSV) | 20 |
| $\lambda, \nu$ and relation(1)$^a$ | Three: sel30(MSV,EST), sel45(MSV), sel46(MSV,EST) | 21 |
| $\lambda, \nu$ and relation(1)$^a$ | Eight: sel30(MIT,EST), sel36(MIT,EST), sel38(MIT,EST), sel41(MIT,EST), sel42(MIT,EST), sel51(EST,EST), sel17152(MSV,EST) | 16 |
| $\lambda, \rho, \nu$ and relation(1)$^a$ | Seven: sel30(MIT,EST), sel32(MIT,EST), sel34(EST), sel41(MIT), sel42(MIT), sel46(EST), sel49(MIT) | 17 |
| $\lambda, \rho, \nu$ and relation(2)$^a$ | Six: sel30(MIT,EST), sel32(MIT,EST), sel34(EST), sel41(MIT), sel42(MIT), sel46(EST), sel49(EST) | 18 |
| $\lambda, \rho, \nu$ | Eight: sel30(MIT,EST), sel32(MIT,EST), sel34(EST), sel35(MIT,EST), sel36(MIT,EST), sel41(MIT), sel42(MIT), sel46(EST), sel49(EST) | 15 |

$^a$Excluding from the data the five patients sel230, sel231, sele0612, sele0704, sele0136 (see the text)

$^b$Without excluding the patients mentioned in “$a$”.

$^c$In parenthesis, we mark the group(s) of patients in which the corresponding SD is mislocated.

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TABLE XIV: The complexity measures of SES activities and AN along with their $S$-values (as the latter were reported in Ref.[15]).

| Signal | $\lambda_s$ | $\lambda_{s_{NF}}$ | $n$ | $S$ |
|--------|-------------|-----------------|-----|------|
| K1     | 1.26        | 1.21            | 1.21| 0.006±0.003 |
| K2     | 1.26        | 1.30            | 1.30| 0.081±0.003 |
| U      | 1.06        | 1.24            | 1.17| 0.092±0.004 |
| A      | 0.97        | 0.97            | 0.97| 0.079±0.008 |
| n1     | 1.25        | 1.23            | 1.21| 0.143±0.003 |
| n2     | 1.30        | 1.31            | 1.18| 0.103±0.003 |
| n3     | 1.35        | 1.26            | 1.24| 0.117±0.010 |
| n4     | 1.36        | 1.26            | 1.20| 0.106±0.010 |
| n5     | 1.32        | 1.28            | 1.12| 0.091±0.011 |
| n6     | 1.36        | 1.01            | 1.15| 0.102±0.007 |

*Note that in these two cases the $S$-values are comparable to $S_u$, and hence their distinction can be made on the basis of the $\lambda_s$-values (see the text), which differ markedly.

TABLE XV: The entropies $S(\tau)$ in natural time for SD and H. Note that they are more or less comparable to $S_u(=0.0966)$, see the main text.

| Individual | $S(RR)$ | $S(QRS)$ | $S(QT)$ |
|------------|---------|----------|---------|
| sel16265   | 0.0972  | 0.0965   | 0.0965  |
| sel16272   | 0.0969  | 0.0961   | 0.0963  |
| sel16273   | 0.0958  | 0.0964   | 0.0961  |
| sel16420   | 0.0959  | 0.0963   | 0.0963  |
| sel16483   | 0.0971  | 0.0976   | 0.0968  |
| sel16539   | 0.0957  | 0.0966   | 0.0967  |
| sel16773   | 0.0963  | 0.0963   | 0.0961  |
| sel16786   | 0.0978  | 0.0964   | 0.0966  |
| sel16795   | 0.0953  | 0.0966   | 0.0962  |
| sel17453   | 0.0962  | 0.0966   | 0.0964  |
| sel30      | 0.0954  | 0.0959   | 0.0960  |
| sel31      | 0.0962  | 0.0966   | 0.0958  |
| sel32      | 0.0962  | 0.0985   | 0.0961  |
| sel33      | 0.0971  | 0.0967   | 0.0963  |
| sel34      | 0.0963  | 0.0952   | 0.0963  |
| sel35      | 0.0961  | 0.0964   | 0.0957  |
| sel36      | 0.0958  | 0.0966   | 0.0956  |
| sel37      | 0.0963  | 0.1002   | 0.0960  |
| sel38      | 0.0959  | 0.0964   | 0.1000  |
| sel39      | 0.0962  | 0.0950   | 0.0960  |
| sel40      | 0.0959  | 0.1005   | 0.0966  |
| sel41      | 0.0960  | 0.1003   | 0.0969  |
| sel42      | 0.0963  | 0.0970   | 0.0968  |
| sel43      | 0.0957  | 0.0955   | 0.0974  |
| sel44      | 0.0963  | 0.0964   | 0.0970  |
| sel45      | 0.0963  | 0.0976   | 0.0951  |
| sel46      | 0.0931  | 0.0966   | 0.0933  |
| sel47      | 0.0967  | 0.0966   | 0.0975  |
| sel48      | 0.0988  | 0.0965   | 0.0919  |
| sel49      | 0.0969  | 0.0965   | 0.0970  |
| sel50      | 0.0959  | 0.0961   | 0.0935  |
| sel51      | 0.0962  | 0.0967   | 0.0958  |
| sel52      | 0.0957  | 0.0928   | 0.0948  |
| sel17152   | 0.0974  | 0.0972   | 0.0957  |