

Internal Cardiac Coherence in therapeutic and biofeedback practice
- a practical guide to the Heart Tuner -
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Introduction

Over the past decade, **Internal Cardiac Coherence**, shortly **ICC**, has become an increasingly valued and introduced phenomenon in the practice of biometrics. Yet, its actual clinical, (alt-)therapeutical and biofeedback potential is still a developing, and indeed challenging field.

ICC gives the therapist or trainer almost instantaneous access to, and insight in the heart's comprehensive electrical response to various psychic states, which can form, at least, a very rich component in an allover psychological assessment.

ICC is related to, but very different from HRV (Heart Rate Variability), where especially its fast response makes it ideal for effect measurement and biofeedback. ICC is generally understood to reflect subtler psychic states, rather than litteral emotions. In the case of ICC we may think of terms like empathic response, emotional coherence, confirmation, open-ness, appreciation, connectedness or even euforia. No doubt all qualities worth assessing and possibly improving.

Whereas other, HRV-based (e.g. pletysmographic, beat-to-beat) techniques may focus primarily on the psycho-physical level (e.g. performance oriented), one might think of ICC as to access and entrain the "psycho-spiritual" level, in other words, subtler psychic qualities. Hence, ICC is definitely a great tool for attention / awareness training, for example in the case of ADHD indication.

The topic of HRV vs. ICC will be discussed in more detail later on.

This article is intended as a guide for the (beginning) ICC practitioner or researcher covering:

- advise for practical use
- personal experiences while testing persons
- some backgrounds
- working with the "Heart Tuner PRO-04" ICC monitor

Throughout the learning curve of getting acquainted with, and really appreciating the true inner quality of ICC, the "magic" word is: patience. Talking about "internal coherence"... ever wondered how incoherent impatience, overstressed expectations and frustration can leave *you*...? Yet, if you learn how to look at, and interpret the various data, ICC monitoring can be a "plug and play" experience.

For example, you may easily see if someone who looks very composed and calm on the outside, is in reality not so balanced at all. Or, you can actually measure how much a person is really affected by something or someone near and dear he or she hears, sees or thinks of. This will first of all teach you how sensitively ICC can respond to external or internal stimuli, and as a result, teach you how to use this newly acquired technique in practical therapy.

This paper is not intended as a technical manual - please follow the instructions of the user guide that comes with your Heart Tuner.

Getting started

In learning to work with the Heart Tuner PRO-04 ICC monitor, you will work with yourself as well as with others. The great advantage of looking at your own real time ICC display, is that it will teach you how ICC actually *feels*. This primary, inner experience is of paramount importance while working with, and training others, especially in a therapeutic setting.

Therefore our first advise is to take sufficient time, e.g. over the period of a few weeks to a month at least to get the real touch and feel of internal coherence yourself. By working with the ICC monitor regularly, you will get an "automatic", intuitive perception and a sense of lively interaction and confirmation in a direct feedback style. You will learn how the ICC monitor responds differently to different psychic states, in different situations. This natural feel, which is not merely an "intellectual" thing, teaches you truly organic interaction with the ICC display and this is extremely helpfull while working with others. During this period it may be good to keep in mind the fact that ICC reflects subtler psychic states, rather than emotions, as indicated above.

Start a measuring session by attaching the wrist electrodes and starting the software as indicated in the user manual. Especially in the beginning you may prefer a quiet, private place. Sit straight but comfortably, with relaxed arms and shoulders - this is already helping to get more coherent - and try to avoid your hands touching each other. Wait a short while until the ICC display settles down a bit. This is your baseline, which, of course can vary from person to person, and moment to moment. The ICC peak will normally keep dancing a bit. If no workable baseline is forming at all, this means that you are not yet coherent, or e.g. very emotionally aroused. This is not a good starting point to work with the Heart Tuner, although it is very instructive in teaching the individual challenge of being internally balanced, which will at the same time prepare you to qualify as an ICC trainer. A simple, regular breathing excersise can be a natural help to relax physically and emotionally.

Once you have a stable baseline, you could first try to feel and recognise different levels of psychic coherence in yourself. When after a while you are getting accustomed to it, the next excersise is to actively recall a state of internal coherence, and see what the response on the ICC display is. Again, take your time. Try to recall a dear moment in your life, or evoke a moment of great anticipation, of meeting a person you love. Enter that feeling and let it actually turn into a rush in your heart. Can you do that, or learn to do that? Then see how sensitively this is reflected in the rising of the coherence peak. *Allow yourself to feel empowered by seeing succes on the display - that's what it is for!* The next experiment is, to test yourself with the Heart Tuner while being together with another person, the best is someone you personally and emotionally relate to. Have a natural conversation, discuss topics which affect you, either positively or negatively. Use the Heart Tuner in a playfull way to see what effect interacting with this person has on you. Share the experience. Here is an example of how a personal connection can influence the ICC reading om the Heart Tuner:

One afternoon I visited a young, starting therapist in Essen, Germany to demonstrate the Heart Tuner. He was living together in his apartment, but the two of us were alone all the time. While we got to know each other a bit we had a lot of interresting conversations, about academic topics as well as rather personal issues. All the time, at least two hours, he was connected to the Heart Tuner. We were both keeping half an eye on the screen in a rather playfull way. All the time his IC index (horizontal) was on average about at the same point, as was his IC value (peak). Being a therapist, he was expected to be empathic enough, and this was well reflected in the active left-right movements of the IC peak indicating heart rate variations as a response, I assume, mostly to our conversation. Suddenly, his girlfriend popped into the room

unexpectedly. She was early from work. Right at that moment (they had not even changed a word) his coherence peak jumped up the scale higher than any time in the hours before! At that moment I knew their relationship was good and sound (which was only confirmed during our cosy dinner together). THIS is ICC monitoring at work! Of course I did not leave before having explained to the his girl what had happened (he had no chance to object). ICC, in combination with an experienced user or trainer, leaves little to hide..

Now let's first have a closer look at the Heart Tuner displays and check out a bit of technical background. In the following examples, the Heart Tuner is set up for one person ECG. The typical ECG ("raw data") input display looks like this:

[pic]

Now there are two essential pieces of information to be found here here: A) the "peak-to-peak" interval (mostly called beat-to-beat interval, or also R-R interval) which is simply a measure for the heart rate, and B) the actual shape of one single peak. One heart beat's electric peak, also called the "PQRS complex" typically looks like this in the school books:

[pic]

In theory, one single heart beat's peak can ideally be decomposed into a full internal spectrum forming a so-called arithmetic series, e.g. 1, 2, 3, etc. Hz. Practical spectrum analysis is usually done over multiple peaks. Below graph illustrates "just the way round" how a peak, similar to the heart's "PQRS" peak could be synthesized out of a coherent series of frequencies:

[pic]

A cardiologist can extract important physiological data from this one peak e.g. for diagnosing certain cardiac conditions. This is not the purpose of the Heart Tuner, *however*:

a full-scale coherent spectrum analysis of the heart's electro-magnetic emission is believed to reflect the coherent functioning of the sumtotal electro-physiological apparatus of the heart (SA + AV nodes, bundle of His and Purkinje system, Myocardium).

This is exactly what the Heart Tuner's ICC display is showing in one single graph, making the Heart Tuner a cardio-physiological health trainer as well. From the electrical viewpoint we say that all the frequencies are working together coherently, or "non-destructively". It is not a miracle that this is felt as a focussed and empowering condition, physically and psychologically. Below examples illustrate the electro-physiology of coherent intent:

During a seminar near to Mainz, Germany, I was testing a German guy, an engineer in his early thirties. I was myself quite a newby with the Heart Tuner and I wanted to test if, and how the IC index, which corresponds with the heart rate, would respond to various small mental tasks. The idea existed that higher index values, e.g. 0.9 to 1.0 would correspond to a rather "head-centered" mentality, and lower value, e.g. around 0.6 to 0.7 to a heart-centered mentality. So, I gave our engineer,

who expectedly was showing a rather higher value of around 0.8, simple tasks like doing some math, listening to music, replying to very personal questions, and so on. What in fact happened, was not a somehow expected IC peak settling down at various points while in the process of performing a specific task. Instead, at the brief instance of mentally switching to a new task, the peak would as matter of fact briefly move left, but more interestingly, rise way up for a few seconds! What I learned here was how a single moment of true, coherent intent - for whatever task - was instantaneously reflected by the height of the IC peak. Obviously, his capacity to focus on a task was well enough (although his head- vs. heart orientation would not change sustainably in the course of the experiment..).

One good day I was able to catch David Servan Schreiber ("The Instinct to Heal", "the New Medicine of Emotions") inbetween the rush of his lecture tour in Germany, Osnabrück. David as a matter of fact wanted to know whether the Heart Tuner was able to capture negative, depressing experiences. He closed his eyes and concentrated... and up went the ICC peak, much to our surprise.. However we agreed that indeed the moment of intent, of concentration, increases the ICC level. Unfortunately, we had very little time to explore further that moment..

So, the Heart Tuner's ICC ("cepstrum") display essentially gives momentary feedback on how coherent the ECG spectrum is, and at the same time derives the heart rate. Using this heart rate detection method e.g. for HRV has the advantage that it automatically omits so-called "PVC's" (Premature Ventricular Contractions) which are known to alienate beat-to-beat measurement.

Short-term vs. long term ICC response

Above examples of Internal Cardiac Coherence were all referring to the ICC display of the Heart Tuner. The ICC display only shows the momentary internal coherence level and -index of the ECG spectrum. Hence, it is mostly used for direct effect measurement and biofeedback, as in above examples. A typical response to an internal or external stimulus is seen within about 2 to 3 seconds, and lasts about 3 seconds.

Another way to work with ICC biofeedback and entrainment is by looking at the ICC level history. This is the ICC History display in the Heart Tuner. This display essentially has 3 functions:

- it shows the continuous event-linked ICC history
- it allows easy assessment and training of a sustained ICC level
- it has an averaging (smoothing) function

The ICC History screen is included in the Heart Tuner Medium edition. The averaged ICC level is also used for the biofeedback games.

Whereas the normal ICC (peak) display is used mostly in a dynamic, interactive therapeutic or biofeedback session, the ICC History screen can be used for sustained emotional coherence training, deep relaxation and focus, and even meditation. The smoothing function, which can be

adjusted up to 10 seconds, filters out all momentary ups and downs allowing easy inspection and feedback during sustained ICC training. Below a field experience with a meditation session:

I visited an "Ananda Marga" tradition Yoga Centre in London, where I tested a very experienced meditation teacher (a monk) with the Heart Tuner. I asked him to do his regular meditation, and not mind the recording session. I was sitting next to him while he was absorbed in his practice. As I knew him and his colleagues long time, I felt naturally empathic and had a good sense of his state of mind. It was in fact a bit of a rare opportunity, while normally during deep meditation one cannot look at a computer screen at the same time. After some 10 or 15 minutes, he came in a deeper trance. I got the impression that he was experiencing regular, short bursts of bliss, which he very positively confirmed later. In the Heart Tuner spectrum and ICC displays it was clear enough. During a moment of bliss, the spectrum would not only become visually much more coherent, also many higher frequencies were showing up, in other words the spectrum would become a lot wider. Evidently, during those periods also the ICC peak would get far more distinct and rise up. The reported "bliss-events" could later be verified by himself in the ICC History screen (note: it was many times seen that during a meditation etc. session, the ICC History itself tends to become periodic - this is not a result of the breathing, clearly it is a subject of further research)

Conclusively, the ICC Averaged History provides a measurable reward for sustained ICC entrainment, like concentration and meditation, with especially in the case of individual use, the possibility of inspection afterward.

"Meeting Hearts" - ICC analysis with two persons

The common phrase "getting on the same wave length" gets a new meaning with ICC biofeedback training with two persons. As explained before, the index (horizontal) value of the ICC display is a measure for the heart rate. The numerical value actually equals $1/\text{heartrate}$, so the more to the left, the faster your heart rate. Before working with two people, please verify if the A and B signals of the input display are properly aligned (see user guide).

Now there is one important difference between measuring heart rate with a normal beat-to-beat method (e.g. pletysmography) or through ICC ("cepstrum"-) analysis as with the Heart Tuner. That is, the moment two ICC peaks are aligned, this means not only that the two heart rates are the same, but also that all frequencies in the ECG spectrum are phase-aligned. If also the actual beats are aligned (which you can see in the input screen), than this means that all the electromagnetic frequencies of two hearts are phase-locked. In other words, two hearts are beating as one, and are literally electromagnetically connected as by a radio transmitter! This altogether profound measurement of "being on the same wavelength", is believed to be the electro-physiological indicator of real empathy between two people. The experience can be very educative, as you can see in below examples:

I was with a researcher having a Heart Tuner, at her home in London. Her two kids were also present. The girl was about 12 years old, her brother 14. One could tell right away that the young girl had a naturally very empathic personality, as her mother confirmed. Her brother obviously was a bit more rigid and head-centered character. I asked them to sit next to each other on the couch (they were both connected to

the Heart Tuner) and reach out to one another, hold hands, look in the eyes, try to feel true connection, appreciation and sympathy. It's absolute fun to do this with kids. On the ICC display, the girl was at about 0.6, the boy around 0.8 index. It was quite telling that the girl was the one to grab her brothers hand. As they were sitting a while like that dwelling in a state of gently imposed sympathy.. it became clear soon enough that she was the one actually reaching out, trying to really get on her brothers "wavelength" - her ICC peak gradually moved to the right, in his direction, whereas his was not moving much. We repeated the test one more time with the same result..

The following, in my opinion, seems to be a telling story of non-meeting-hearts: During a seminar in the Netherlands with some 15 participants I was demonstrating the Heart Tuner on a big screen. Usually this is quite good entertainment as the non-compromising "lie-detector" character of ICC measurement in public provokes the necessary whoops, cheers and complaints.. There was a couple, who seemed to have very different, if not opposite personalities. Let's try not to say one of the two seemed overwhelmingly dominant, but for sake of scientific integrity, let's assume it was him. While on the Heart Tuner, it was obvious that his ICC score was very high. Not only that, in fact all his readings were so stable that I wondered if he had secretly plugged the sensors into something else (he was a programmer as a matter of fact..). The better term would be "rigid", .. that is to say, rather unflexible.. The rest of the audience tried to tease and humour him but to no avail.. One could see his wife was deeply interested in what was going on and wanted to understand all. Then, after some gentle persuasion, it was her turn (they were not connected at the same time..). As one already suspected, her ICC was very low and irregular. After some jokes and cheers she felt more self-assured and her ICC peak reluctantly showed up, and remained as good as it got. Her spouse was watching it all from a distance. Suddenly, as if his wife had been in the lime light enough, he fired a command in her direction indicating that they had to watch their time or so. At that very moment, her ICC dropped down to almost zero again.

They did not buy a Heart Tuner.

Conclusively, ICC measurement for two (or more) persons provides an additional quality of measuring hearts coming "on the same wavelength", and can be a very valuable tool e.g. for marriage counseling and conflict resolution.

Internal Cardiac Coherence (ICC) vs. Heart Rate Variability (HRV)

This is a delicate subject both from a practical, therapeutic as well as from a scientific point of view. A basic rule of thumb is that HRV resp. ICC work in very different frequency bands which normally don't interfere:

[pic]

For therapeutic practice it means that HRV and ICC could essentially be assessed and entrained separately, however there are a few catches here:

- It was demonstrated by William Tiller, that people experienced in meditation, during actual meditation would develop a very coherent ECG spectrum, with virtually zero HRV. This was later used by Rolin Mc. Craty of Heart Math Institute to suggest that ICC training would mean entraining low HRV. This is definitely not the case. High ICC plus low HRV can both be a result of deep meditation, and moreover, low HRV in this case is certainly not entrained in a permanent sense. Long time meditation practitioners certainly don't have lower HRV.
- If there is much HRV in the higher HRV range (para-sympathic influence), this may reduce ICC;
This means essentially as we all know, that if one is very emotional, the internal coherence, and hence the ability to concentrate, becomes less;
- A special application of HRV is breathing-training, that is, entraining an "ideal" sinoid HRV seen as a narrow band in the HRV spectrum. This is the training method of Heart Math Institute, where effectively the breathing is measured by means the heart rate. When these are locked, which is seen as a narrow band in the HRV spectrum, this is what they call coherence. It is not internal coherence.
- Below graph, created in collaboration with Alan Watkins, one of the Heart Math founders and now chairman of Cardiac Coherence (www.cardiac-coherence.com), could be used as a rather intuitive visualisation of ICC vs. HRV:
- [pic]
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Our "policy" for ICC / HRV training is, teaching people to be able to be internally coherent (high ICC level), while at the same time being emotionally and empathically flexible and responsive (dynamic ICC index). It is true that low HRV may be rather conducive for higher ICC, but this is certainly not a target. Below examples are illustrative for a realistic relation between ICC and HRV



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