"the way we do it is already good enough" and certainly preferable to the very large undertaking which is the challenge of current high precision volumetric methods, one should reflect upon the following. First of all a highly skilled neuroradiologist will not recognize a change in tumor volume if this is less than about 60%.[21] Secondly, and this from the realms of basic neural science, current estimates of the cortical surface area of the normal brain have varied as much as an order of magnitude.[22] The bottom line is that our "seat of pants" estimates are a flimsy basis for the serious needs that clinical exigencies daily present to us. We need levels of precision that are at least in the 10–20% range in order to meet these exigencies.

Volumetric determinations and fundamental brain science: The central thesis here is that volume is a fundamental property of brain tissue.[18] By this we mean, on the evolutionary scale, that there is a regular stoichiometry that relates the volume of brain within species to the body plan and mean size of animals of that species.[23,24] By this we also mean that within species, the implementing and constraining oppositions of ontogenetic processes work to minimize the variation in volume of the brain or certain of its principal major structures. Yet, more elementary components of certain structures may be greatly variable from individual to individual.[25,26] By illustration, the coefficient of variation of the mean volume (CV) of neocortex of a set of normal young adults with equal male and female representation was found to be less than 10%.[27,28] By contrast the mean CV of neocortex surmounting the canonical gyral set of the normal brain was well over 20% and greatly variable across the full set of gyri.[28] We have from this analysis developed a computational model that identifies a non-linear factor, interactive between individual and specific gyrus, as the determinant of approximately 70% of this variance.[28] Uniform scaling to species (mean neocortical volume of the total population) or even individual (deviation of individual neocortical volume from the population mean) together satisfy less than 20% of the variance. Whereas there is a pervasive sexual dimorphic effect, this is of low order, estimated in this study as the source of less than 1% of gyral volume variance.

The implications of this set of findings are fully concordant with, perhaps even predictable from other types of investigations which suggest that neocortex directly serving highly overlearned motor skilled or acoustic capacities are significantly larger than the volumes of corresponding gyri in individuals without such experience or skills. Specifically, the primary motor cortex of keyboard artist[29] and the acoustic cortex of the temporal plane of musicians with pure pitch,[30] both trained from early childhood, are large relative to the corresponding areas in the general population. From the perspective of these observations we see in action a non-linear interactive individual gyrus times individual experience determination of relative enlargement of a component of the relevant neural system.[28] The larger implications of this perspective are arresting. They are that powerful evolutionarily conserved constraints act to set the total volume of neocortex to a narrow species specific value but that mechanisms operating through individual experience have substantial freedom to modulate the volumes of restricted brain regions adaptively.

The structure by structure view of the brain, and indeed, the gyrus by gyrus view of the neocortex is obviously a perspective that ignores the larger context of neural systems organization. Thus, it takes much more, structure-wise, than primary motor cortex or primary acoustic cortex to provide the neural systems support for excellence in keyboard or otherwise musical skills. These aptitudes reflect the coordinate operation of a neural system distributed to all levels of the central nervous system. More than this they require the coordinate operation of this system with other systems and the linking of associative mechanisms which so dominate the landscape of forebrain structure.[31] One reasonably inquires "what about the other processing outposts of the primary system" or "what about the intervening and linking associative processors." It is at this point that much more observation is needed in order to support and develop theory further. What is already in hand is the observation that morphometry (volumes or areas as the case may be) of the primary main line structures of the human visual system including optic tract, lateral geniculate and primary visual cortex, co-vary strongly with Pearson coefficients approaching 0.8.[32] Again the variance is minimally if at all scaled to total brain volume. Although raw volumes of larger brain structures do vary more on average than smaller structures, this size-variance dependency is removed in large part by simple re-expression of volumes of the natural logarithmic scale. Within the cerebrum itself we have found through principal component analysis and also through simple pair-wise correlations, a lower order but still significant force of co-variance (some positively, some negatively in sign) of systems and associatively linked structures at both cortical and subcortical (striatal and thalamic) levels.[33] The thesis arising from these observations, plausible yet requiring substantially more inquiry, is that the strength of volumetric covariance of linked structures will vary (perhaps either positively or negatively in sign) both as a function of the intervening "synaptic distance" and also as a function of the degree of the exclusiveness of the association (convergence-divergence considerations) of the structures.[18] To the extent that such volumetric covariance does occur, it becomes a parameter by which