In general, sensory processing as well as selective attention impairments are common amongst people with schizophrenia. It is important to note that experts have in the recent past been concerned with seeking any brain functions significant differences between individuals engaged in auditory information processing (both controlled and automatic) and individuals with schizophrenia. In this case, individuals engaged in auditory information processing (both controlled and automatic) are used as the comparison subjects. In this text, I mainly concern myself with the auditory processing of schizophrenia.

A discussion

Over time, it has been noted that people with schizophrenia have an impairment of cognitive processing (high order) as well as early sense discrimination of auditory information. It is important to note that due to the advancement of imaging studies (functional), there have been revelations of lowered activity in a number of areas including limbic areas, subcortical regions as well as dorsolateral prefrontal cortex at the time of auditory processing (controlled).

It is also important to note that during auditory processing (automatic), there are revelations of a reduced or lowered activity of the superior temporal lobe. In general terms, it may be noted that some allusions of schizophrenia include hypoactivation in a number of regions including the striato-thalamic, temporal as well as frontal brain area. According to Weinberger & Harrison (2011), there has been need to come up with a comparison between neutral systems that are related in one way or the other with the various auditory information processing aspects with the duration of illness changes in the light of schizophrenia’s controlled as well as automatic auditory information processing deficits.

It can be noted that functional magnetic resonance imaging (fMRI) has not been used for
purposes of assessing the controlled as well as automatic processing that happen to have the
duration of illness a modulator. However, electrophysiological indices have been used to bring
out the differences between the same. Cacioppo & Berntson (2007) is of the opinion that though
significant progress has been made as far as charting the brain functions differences as far as
schizophrenia is concerned during auditory processing (automatic and controlled), more needs
to be done so as to chart any existing relations between the duration of the illness and the
functional brain differences.

In a recent research by Rajendra et al. (2008), BOLD activation at the time of auditory
information processing (controlled as well as automatic) and subjects who were used for
comparison purposes were used for the assessment of functional brain differences. Some of the
findings of this research are revolutionary in a sense that they shed more light on a number of
things including but not limited to brain functions differences as far as schizophrenia is
concerned during auditory processing (automatic and controlled) and the existing relations
between the duration of the illness and the functional brain differences.

Some of the most significant discoveries of the study include the fact that there is a
significantly lower activation of superior temporal gyrus, thalamus as well as frontal gyrus at the
time of auditory processing (unattended) in patients. It is however important to note that this is in
relation to subjects who were used for comparison purposes. Further, when it comes to auditory
processing (controlled), the study came up with the findings that there is a significantly low
activation when in regard to insula, anterior cingulated gyrus, inferior frontal gyrus, middle
frontal gyrus as well as the subcortral regions.

Schizophrenia with automatic processing: functional changes

According to Weinberger & Harrison (2011), at the time of auditory processing (automatic),
there are significant decreases in activation of temporal gyrus, thalamus as well as right middle
frontal gyrus. This is a fact supported by the findings of the Rajendra et al. (2008)
research/study. Hence it follows that in accordance with previous fMRI findings, schizophrenia’s
auditory impairment goes far beyond the Heschl’s gyrus as well as superior temporal glands.
This is also the case when taking into consideration auditory mismatch negativity studies.

Thalamic function (impaired) has mostly been associated with processing (controlled) other
that automatic processing. Previous studies have demonstrated that the primary auditory cortex
is the area which informs auditory processing (auditory) when it comes to comparison subjects.
However, it is imperative to note that the prefrontal and sensory cortices interaction is what
facilitates change detection (pre-emptive) and this is what informs or motivates responses that
are largely behavioral as a result of the involvement of frontal networks.
Event related findings have gone ahead to inform sharp focus on the deterioration of schizophrenia as a result of mismatch negativity brought about by frontal contributions. However, until now, neuroimaging has not been utilized to demonstrate this. It therefore follows that auditory processing at the sensory level as well as higher cognitive functions can be associated rather closely with schizophrenia’s prefrontal dysfunction. It is also highly likely that the dysfunction of the middle frontal gyrus brought out by automatic processing may in one way or the other be the very foundation of schizophrenia’s distractibility as observed clinically.

Further, this may represent a mechanism that is significantly porous as far as the sensory stimuli filtration in environments that are taken to be noisy are concerned. Research shows that inter-modal attentional demands largely influence the response of the brain to sensor changes that are in one way or the other task-irrelevant. In the past, findings have been presented after undertaking a perceptual-motor visual tracking task at a number of complexity levels on a continuous basis while at the same time taking into consideration pitch-deviant tones that are largely infrequent and tone pips that are standard and task-irrelevant. This has been also the case with the Rajendra et al. (2008) study. According to this study, there were findings to the effect that frontal cortical as well as the superior temporal regions were activated strongly by pitch-deviant tones that were largely unattended. These findings were largely reliant on results of fMRI. In that regard, it may be noted that the primary task tracking difficulty largely modulated these activations but under conditions that are significantly high load present a greater effect. It therefore follows that the various studies that have been conducted in this direction so far are largely in agreement with the healthy subject’s literature.

However, in a majority of studies, the primary task has been in consistence with the Rajendra et al. (2008) study, that is, when it comes to low load visual discrimination more so for superior behavioral performance of the group used for comparison purposes. With that said, it can be noted that the comparison subject’s effects as a result of the low load visual task may not have been fully brought out in a number of previous studies but nevertheless, what remains clear is that for patients who experienced a greater task difficulty, the low load visual may have been significantly apparent.

Schizophrenia with controlled processing: functional changes

According to Cacioppo & Berntson (2007), schizophrenia patients have behavioral performance that is largely impaired especially at the time of auditory processing (controlled). It is important to note that this is in most cases accompanied by decreased activation of a number of areas of focus including but not in any way limited to the insula, the subcortical structures which are made up of the thalamus and the basal ganglia, the anterior cingulated gyrus, the middle frontal gyrus
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as well as the inferior frontal gyrus.

According to Rajendra et al. (2008), there were concordant findings revealed for correct trials and all trials when it came to the interest analyses of all trials. In regard to this study, correct trials displayed anterior cingulate gyrus low activation while when it comes to both analyses, there was reduced thalamus as well as basal ganglia activation. During automatic auditory processing, schizophrenia associates impairments in areas such as the cingulated gyrus, rostral anterior, orbitofrontal cortex as well as amygdale which are essentially ventral limbic structures.

It is however important to note that the ventral structures activation is directly linked to a number three novel tone inclusion. Experts have over time identified an anterior superior temporal gyrus’ focal region which can largely be said to be relative and which demonstrates activation that is significantly lower when taking into consideration those with schizophrenia. It is also important to note that there remains some significant uncertainty in regard to the superior temporal gyrus. This uncertainty according to Rajendra et al. (2008) is as a result of some inconsistencies that have been noted in some studies where reported deficits have been a common occurrence rather than a rarity.

Controlled and automatic processing in schizophrenia: a comparison

Research findings have over time indicated that in both groupings i.e. comparison as well as patient, there is a significant activation released when it comes to controlled processing relative to automatic processing. It can however be noted that as far as controlled processing is concerned, the patient group has areas with less activation when compared to the comparison group. Ritsner (2009) noted that when it comes to attended processing, there is no detection of corresponding diminutions irregardless of unattended processing’s in regard to decreased superior temporal gyrus activity.

This difference according to Ritsner (2009) can be described in two ways. The first approach concerns itself with the responsibility as well as function of the visual task whose performance coincided with the auditory task (unattended). The assumption or position held in this case is that the primary visual task’s difficulty in the subjective form lead to a change of direction or diversion there-off from automatic processing of the frontal cortex’s attentional resources.

It is important to note that there is a huge reliance that automatic processing places on prefrontal resources. Hence with automatic processing now having the decreased prefrontal
resources, the normal sensory processing function has a bigger load placed on it. This is in reference to superior temporal gyrus's normal sensory processing function. This therefore indicates that it is only in the increment of the load level that the dysfunction in regard to superior gyrus dysfunction becomes apparent for the schizophrenia group.

The demonstration of the automatic auditory processing as far as the primary tasks complexity is apparent when it comes to the comparison subjects. When it comes to the second approach, emphasis is placed upon the heteromodal frontal cortical areas distributed processing when attention processes are taken into consideration (automatic) in relation to controlled processing. According to Weinberger & Harrison (2011), resource demands can be offloaded by frontal cortical areas. This offloading occurs at the time of controlled processing and it is most significantly from superior temporal gyrus. However, it should be noted that the manner in which the offloading is done in this case is entirely impossible at the time of automatic processing. It can also be noted that the most probable condition under which the manifestation of the superior temporal gyrus dysfunction can take place is during the low load condition as opposed to during the high load condition.

However, experimental paradigms that are highly elaborate should be utilized when it comes to the testing of these theories. When it comes to the controlled as well as automatic processing differences as far as activation is concerned and in general terms, it has been observed that the patient group tends to show low activation differences in comparison to the comparison group which tends to register more pronounced controlled processing as well as automatic processing activation differences.

This can be demonstrated by the Rajendra et al. (2008) findings which showed thalamus, dorsal anterior cingulated gyrus as well as frontal gyrus higher activation as far as controlled processing is concerned. However, this was not the case when taking into consideration the patient group in regard to schizophrenia. Ritsner (2009) is of the opinion that a number of factors may be at play as far as the brains ability to address the processing demands is concerned especially when it comes to the allocation of resources (neutral).

These factors could include but cannot be said to be limited to schizophrenia’s brain changes (functional as well as/and structural) combined with the integrity of the white matter which has been compromised. The whole scenario I recount in this case could end up more complications amongst patients with schizophrenia as a result of shifting allocation needs in relation to processing demands. This is an idea that has in one way or the other been supported by a number of findings where it has been proven that there is a significant correlation of the activation of superior temporal gyrus as well as the activation of middle frontal gyrus especially at the time of automatic processing.

It is important to note that this correlation is in regard to schizophrenia patients rather than the subjects used for comparison purposes. It hence follows that irregardless of the demands of tasks, there is a well balanced maintenance of the superior temporal gyrus and the middle
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frontal gyrus. This is especially this case when it comes to neural resources. A review of literature shows that this is indeed consistence with the disconnection syndrome in regard to schizophrenia.

Functional brain differences: Clinical correlations

It has been demonstrated that there is a correlation of sorts between the duration of illness and the dysfunction in the superior temporal gyrus. It is important to note that over time, the inferior frontal gyrus as well as the thalamus have demonstrated trends which can be said to be significantly similar. According to the study by Rajendra et al. (2008), aging is related to superior temporal gyrus dysfunction. The premise here is that if indeed the duration of the illness is in one way or the other correlated with age, then there must be a similar relationship between aging and temporal gyrus dysfunction.

However, it can be noted that most research studies do not have a comparison group corresponding age effect. It therefore follows that illness duration is the only is the only probable aspect with which the superior temporal gyrus function observes can be attributed. This is also the case when it comes to the study cited above. It is also important to note that such findings are largely consistent with the P300 prolongation findings. Further, each illness age is associated in one way or the other with brain abnormalities of a structural kind, neuropsychological deficits, enhanced severity of illness and last but not least, amplitude reduction of P300.

An identification of limitations and strengths

According to Rajendra et al. (2008), antiphychaotic medications have been utilized in the treatment of a vast majority of schizophrenia patients. Though we have a correlation of sorts between the thalamus and the basal gyngalia, there are no findings so far that established any
superior temporal gylus activation relationship as far as the above is concerned. According to recent research that has been supported by previous studies, at the time of schizophrenia’s auditory oddball detection, there are some witnessed neural activity changes which are largely seen to be independent of effects of medication, though partially.

Studies have also concerned themselves with the causes of lower activation in general terms. This is in regard to controlled processing correct responses. In addition to that, it can be noted that the relationship between behavioral performance and automatic processing activation differences have been noted to be largely independent. According to the Rajendra et al. (2008) study, it was concluded that in consideration of controlled processing in the case of correct responses, there is a significantly lower activation in general terms when taking patients into consideration.

Further, when it comes to automatic processing and behavioral performance, independent activation differences were observed. Another significant finding which has been noted over time is the prevalence of schizophrenia when taking into consideration patients who are involved in smoking. What has however been refuted according to recent studies is the cerebral blood alteration in regard to nicotine. It is also important to note that in the past, imaging studies (functional) have been carried out but there have been limitations when it comes to controlled as well as automatic processing.

However, in the modern day and age, significant progress has been made and in that regard, there is the consideration of both controlled as well as automatic design by the within-subject design. This according to Cacioppo & Berntson (2007) is one of the most significant highlights of studies carried out in the modern day and age as opposed to those that were carried out much earlier. It is also worth to note that when it comes to showing brain changes (functional) in the temporal lobe (superior), automatic processing studies have come in handy.

This is another very significant strength of the same in that it is increasingly possible to demonstrate schizophrenia’s dysfunction especially at the time of automatic processing. It is important to note that numerous results have in the past indicated that there exists a divergence in early auditory processing (parallel) as far as schizophrenia is concerned. The cause of this divergence is the right hemisphere’s signal processing that is relatively accelerated as a result of the delivery of stimuli to the ipsilateral ear.

It may be noted that the excitation of the auditory cortices (both of them) is largely simultaneous when taking into consideration patients of schizophrenia. However, when it comes to the consideration of subjects or participants who are in one way or the other healthy, the contra lateral auditory cortex seems to facilitate the processing of information. It is important to state that this remains to be the case irregardless of the stimulated ear. Another unique schizophrenia characteristic that is displayed on a patient is the signal processing that is seemingly accelerated. At the moment, this area is largely grey and in that regard, schizophrenia’s signal processing that is largely accelerated remains to be speculative.
Conclusion

In conclusion, it is important to note that the consecutive parallel auditory processing seems to be affected in a different manner as far as the various instances of schizophrenia are concerned. As it has been noted in the text above, ipsilateral auditory processing is significantly accelerated. This is believed to be brought about by inhibition that is largely altered.

It may be noted that in the past, studies concerning themselves with functional imaging have been limited to the two processing types, which is controlled processing and auditory processing. Functional brain changes have also been identified in schizophrenia patients by way of automatic processing studies. The superior temporal lobe in this case happens to be the area mostly affected by functional brain changes.
References

