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PHIL BIALOBZYSKI
Northwest Community College , Canada

A MATHEMATICAL DECAYING WAVE ILLUSTRATION OF QUALITATIVE MENTAL STATES IN DEPRESSION AND POST TRAUMATIC STRESS DISORDER

Abstract:

In the physical sciences the mathematical wave model is used to accurately describe various phenomenon including sound and light. Can the wave model be used to help describe and illustrate the qualitative aspects of mental states?
In a visual qualitative approach a decaying wave model is used to describe and illustrate mental states associated with depression and PTSD.
Wave phenomenon is mathematically described by the following equation.
$f(t) = ACos(\omega t + \varphi)$
Where A is amplitude, ω is the angular frequency and φ is the phase shift. With an exponential decay factor and a vertical shift function the wave equation becomes the description for a vertically shifted decaying wave.
$f(t) = A \exp(-\gamma t)Cos(\omega t + \varphi) + C(t)$
where γ is the exponential decay factor and C(t) is a vertical shift function.
Model discussion
In the model, the positive vertical axis are increasing stressors and the negative vertical axis are increasing depressors, time is on the horizontal axis.
It is postulated that each person oscillates in mental stressor depressor states around an equilibrium level identified at the stressor depressor axis.
These equilibrium levels are determined by ambient environmental mental stress, peer group, physical environment and traumatic/ depressive event history.
A stressful event can be illustrated as a decaying wave with initial amplitude far above the equilibrium level. The wavelength and γ of the decaying wave may be a function of early intervention and treatment. The wave may decay back to equilibrium or the equilibrium stress level can be vertically shifted, raised or lowered, depending upon the event.
Vertical equilibrium level shifting and the application of wave properties such as constructive and destructive interference are graphically presented in the model. Stressor and depressor 'forces' are hypothesized to bring the individual back to their and their peer group's equilibrium level. These 'forces' could take the form of therapeutic regimens and environment or peer group changes.
Critical regions in stress and depression are postulated where stress or depression are beyond personal endurance.
This model can be used as a clinical aid to help patients visualize their mental states involving PTSD and depression. Future studies could attempt to quantitate the period and γ exponential decay factor parameters from published studies as a function of intervention and treatment in PTSD and depression.

Keywords:

PTSD depression wave model clinical tool