

A Hopf Bifurcation in an Interpersonal Relationship Model of Attachment

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1. Introduction

Attachment theory was initially proposed in the late 60's by english psychiatrist John Bowlby as an attempt to understand why close relationships between a child, at an early age, and his or her caregiver, are among the most important factors that determine the personality and mental health of such child. He also established that the sense of safety and self-worth of a person depends strongly on the quality of social interactions with close partners, starting with the caregivers in childhood [Shaver & Mikulincer, 2009]. Since then, several authors have developed this theory and it is now generally accepted that the type of relationships between children and their caregivers give rise to different behavioral patterns, called attachment styles, that are behaviors used to deal with situations that cause anxiety and shapes the way a child interacts with their environment [Miller-Karas & Burton Flier, 2023].

The purpose of the present work is to construct an interpersonal relationship mathematical model

of the attachment between two adult individuals as a dynamical system, and explore the conditions, based on the constructed model, in which a Hopf Bifurcation appears in such system. Our goal is to take the psychological theory of attachment and propose a way to model mathematically a complex human emotion like the attachment between two persons, with a system of two differential equations, each one representing the "feeling" of attachment of each person, then make interpretations of the results obtained in the qualitative analysis of this mathematical model and compare them with the already existing results given by the theory of attachment.

2. Basic attachment concepts

According to Shaver and Mikulincer [2009], Bowlby sets the concept of attachment system of a child as a "biologically evolved neural program", with the purpose of organize behavior in order to seek for proximity to the so-called attachment figures. These are individuals who potentially provide a sense of safety or security against danger, which in child-