

related to values of the outcome variable, “heteroscedasticity” is present and the assumption is violated, which will affect the standard errors and hence the significance tests. A scatter plot of Studentized residuals against predicted values will show a random symmetrical scatter around the line at zero when there is homoscedasticity. In the case of heteroscedasticity, the scatter plot will reveal a funnel or a megaphone shape, or other non-random pattern, which may imply an omitted important predictor from the model. Formal tests for homoscedasticity exist as well (e.g. White, 1980) which can be computed from saved residuals.

*Normality:* Residuals can be saved and their distribution examined with Kolmogorov-Smirnov test or Shapiro-Wilk’s tests of normality available in most statistical software. However, a normal probability plot or Q-Q plot of the standardized residuals can reveal the skewness and the tails of the distribution guiding remedial choices, if needed. The actual data are ranked, an expected normal value is computed, and compared with an actual normal value for each case. Points lining up along the straight diagonal that goes from lower left to upper right indicate normality. Departure from the expected straight line, particularly “snaking” signals non-normality. Non-normality is not likely to have serious consequences for the significance tests unless the sample is small, and it is in small data sets, the Q-Q plot could be misleading.

In summary, residual analysis reveals the goodness of fit of the model for statistical inference. Graphical analysis methods are the most popular because they have the advantage of illustrating the complex interrelationships which may aid decisions about model modification. It is an extremely valuable exercise for building a more stable mathematical model. A stable model is more replicable.

### Cross-References

- ▶ Data Analysis
- ▶ Outliers
- ▶ Parametric Analysis
- ▶ Robust Statistical Tests

### References

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### Resilience

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### Synonyms

Adaptability; Hardiness; Management of stress; Recovery; Resourcefulness;

### Definition

The term *resilience* alludes to one’s ability to successfully adapt and endure under adverse circumstances as well as efficiently recover from subsequent harmful effects (e.g., Bonanno, 2004; Masten, 2007; Skodol, 2010). This is achieved by productively managing negative emotions and by practicing behavioral responses that improve the stressful situation (Lyubomirsky & Della Porta, 2010; Tugade, 2011). Some scholars conceptualize resilience as a *state* or *process* that considers context and the availability of resources and assets. Other scholars theorize resilience as a personality *trait* or focus on the developmental nature of the construct (Masten & Reed, 2002). Individuals high in trait resilience have demonstrated positive progressive outcomes despite high risk, sustained competence under

stress, and recovery from trauma. Past research suggests that certain protective factors within an individual may predict resilience in the face of stress. Such factors include positive emotionality, optimism, effective problem solving, faith, sense of meaning, ► self-efficacy, flexibility, impulse control, empathy, close relationships, and ► spirituality, among others (Bonanno, 2004; Masten & Reed, 2002; Tugade, 2011; Tugade & Fredrickson, 2004). In this way, resilient individuals typically demonstrate a strong, well-differentiated, cohesive sense of self and enduring, secure interpersonal relationships (Skodol, 2010).

### Description

Although an abundance of literature focuses on the demonstrative characteristics of resilient individuals, research on the mechanisms or processes by which resilience can be achieved is relatively understudied. One useful approach is to investigate the multiple pathways to resilience (Bonanno, 2004). For all intents and purposes, four unique pathways have been identified. These four pathways are differentiated by the quantity, intensity, and timing of stressors faced during childhood, adolescence, and adulthood.

One pathway characterizes individuals who appear relatively unscathed. These individuals may profit from positive self-evaluations and optimistic outlooks on life by adopting “rose-colored glasses” in the face of stress. Such positive appraisals are particularly useful for helping people overcome major stressful events or traumas, permitting them to bounce back from adversity and maintain ► homeostasis in spite of stressful experiences (Arce et al., 2009; Tugade & Fredrickson, 2004).

A second pathway characterizes individuals who, despite experiencing minor setbacks, or ► daily hassles, can function effectively. These stressors may include temporary academic difficulty, personal injury, and changing friendships (DeLongis, Coyne, Dakof, Folkman, & Lazarus, 1982). Facing mild stressors, these individuals develop personally effective strategies for coping and remain well-adjusted while enduring relative struggle.

A third category of resilience characterizes individuals who exhibit effective coping in spite of chronic stressors such as ► poverty, living with a depressed parent or spouse, or constant relocation as part of a military family. These individuals develop resilience by monitoring their emotions/resources and establishing a perception of control. As an example, the US army provides combat soldiers with resilience training (e.g., adopting optimistic perspectives), giving soldiers conceptual tools to aid them in coping with anticipated stressful circumstances (Reivich, Seligman, & McBride, 2011).

A final category of resilience characterizes individuals who have faced one or more traumatic experiences (e.g., death of a loved one, loss of a job, violent assault or natural disaster). These individuals may adapt effectively from a host of stressful experiences by adopting coping strategies with flexibility (e.g., Cheng, 2003). Previous research indicates that in the face of certain traumatic events, individuals may rely on reestablishing feelings of personal control/dignity, connectedness, and ► solidarity among family and community, as well as reaffirmation of positive, culturally shared values (e.g., religious affirmations) (Pérez-Sales, Cervellón, Vázquez, Vidales, & Gaborit, 2005). Because coping is a dynamic process, being able to employ strategies with flexibility may be one mechanism for achieving resilience in the midst of changing situational demands.

Taken together, the literature indicates that there may not be a “one size fits all” model of resilience. Future research may therefore benefit from exploring and expanding upon different types of resilience pathways and intervention methods. For instance, future research may consider whether factors such as length or quality of resilience training may influence a program’s efficacy. Are certain personality types more prone to embrace particular intervention strategies (e.g., positive emotion enhancement) over others? Also, how might gender, culture, or age moderate pathways to resilience and receptivity to varying training methods? Finally, although researchers are currently developing cross-cultural methods of resilience training, further

studies should consider the effects of cultural context on resilience conceptualization (Reivich et al., 2011).

### Cross-References

- ▶ Adaptation
- ▶ Good Neighborhood Index
- ▶ Happiness
- ▶ Health-Related Quality of Life
- ▶ Subjective Well-Being

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## Resilient Communities

- ▶ Sustainable Communities Movement
- ▶ Community Adaptation, Arctic

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## Resource Management

- ▶ Natural Resource Management (NRM)

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## Resource Utilization

- ▶ Life Satisfaction and Sustainable Consumption

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## Resource-Based Communities

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### Synonyms

Resource-dependent communities; Single-industry communities