observed a distinct set of simple dance sequences. fMRI measures taken immediately before and after a week of training revealed that a subset of MNS regions showed comparable neural responses after physical and observational experience. The neural responses to physical and observational experience were more robust than responses measured while novice dancers observed comparable untrained dance sequences whilst undergoing fMRI. Moreover, participants performed physically practiced and observed dance sequences more accurately than untrained sequences. Considered together, the imaging analyses from this study suggest that among this sample of novice dancers, physical and observational learning share more commonalities than differences at a neural level. The converging evidence from the behavioral and neural measures serves to link the rich history of behavioral research on observational learning with the burgeoning field of neuroimaging inquiry into action cognition.

A tentative conclusion that can be drawn from this experiment on observational learning of dance is that we can learn to dance through observation using the same brain systems that are involved when physically practicing dance. In the (Cross et al. 2009) study, it is noteworthy that such clear evidence emerged for observational learning in light of the fact that participants were never explicitly told to try and learn the sequences they watched each training day. Evidence from other studies suggests that the amount of observational learning can be markedly increased if participants are explicitly instructed to try and learn the information they observe during the training procedures (e.g., Hodges et al. 2007). At present, a great need exists for future research to explore the different parameters that might influence observational learning at brain and behavioral levels, including motivation to learn, which part of the model provides the most information for learning a new skill, and how different kinds of instructions might influence observational learning. Such research should shed light on how educators and those involved in rehabilitating individuals recovering from neurological or physical injury might be able to capitalize upon the brain and body's inbuilt mechanisms for learning effectively from observation.

Cross-References

- ► Action Learning
- ► Imitation: Definitions, Evidence and Mechanisms
- ► Learning as a Side Effect
- ► Motor Learning
- ► Neurophysiological Correlates of Learning to Dance
- ► Robot Learning from Demonstration

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Observational Learning: The Sound of Silence

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Synonyms

Observational inference; Social learning

Definition

Observational learning refers to the process by which decision-makers learn about the quality of available choice options by observing the choices made by others who have faced the same decision. The basic premise of observational learning is that different people have different private information which is revealed by their actual choices. The observation of others' choices thus allows an *observational learner* to update her

knowledge about the choice options through rational Bayesian updating. *The Sound of Silence*, the title of a 1960s song by Paul Simon and Art Garfunkel, figuratively describes the impact on observational learners' quality inferences if previous decision-makers choose not to select a particular option, thus keeping the option "silent." This impact tends to be self-reinforcing should decision-makers share the same preferences regarding quality.

Theoretical Background

Human decisions are often made in a social environment. The mere observation of others' choices can influence a person's decision, even if these decision-makers remain total strangers. For instance, people tend to associate the sight of a long line waiting outside a restaurant with high-quality food or service, even without knowing the people in the line, or directly soliciting these people's opinions of the restaurant.

Social scientists have long recognized the power of social influence on human behavior (see Chamley 2004 for a review). This influence has traditionally been interpreted as an irrational tendency exhibited by human beings, in a manner similar to how animals swarm popular territories. It is seen as irrational partly because mass behaviors are often erroneous. However, the 1990s witnessed the rise of the view that social influence can be decomposed into a series of micro-processes by which individuals draw rational inferences from others' behaviors. The foundational theoretical analyses of Banerjee (1992) and Bikhchandani, Hirshleifer, and Welch (1992) demonstrate that individually rational observational learning might produce uniform social behaviors that are irrational – humans imitate because others' behaviors are genuinely informative; however, the act of imitation itself might subsequently result in a loss of information for people who only observe, and rationally look to learn, from these imitators (an effect called *herding externality*).

Over the past 2 decades, observational learning has attracted extensive research in a variety of social science disciplines, including economics, finance, and marketing. Theoretical models of observational learning have been extended to capture the complexity of the human decision process, the decision environment, and the incentives governing these decisions. Empirical evidence of observational learning has been widely documented through laboratory experiments with human subjects, field experiments with uninformed human participants, and natural experiments in which subjects are naturally exposed to different regimes of observational learning.

One recent empirical study explicitly examines the sound of silence effect of observational learning (Zhang 2010). The empirical setting parallels the classic environment for observational learning to occur: In the United States, renal-disease patients who need kidney transplantation enter a national waiting list. Once a kidney is procured, compatible patients sequentially decide whether to accept it for surgery. Imagine that the first patient has made her decision, yet the kidney "remains silent" without being adopted. The second patient is likely to evaluate the kidney more negatively, reasoning that the first patient (and perhaps her doctor) might have found the quality of the organ unsatisfactory. The second patient's added reservation further aggravates the silence and worsens the third patient's doubt – the collective silence could be so compelling that the third patient decides against the kidney even though her private inspection is favorable. Eventually, as the silence grows along the queue, even medically viable kidneys might be repeatedly turned down.

The sound of silence effect prevails in various aspects of life. For example, real estate properties with a long "time on market" are often hard to sell, workers with an episode of unemployment tend to experience difficulties landing a new job, and movies opening on a quiet weekend are likely to dwindle in further obscurity. Even though home buyers, employers, and moviegoers are individually doing the right thing by interpreting the silence as lower real estate value, worker capability, and movie quality, the herding externality may lead to overinterpretation of the silence, potentially causing good homes, qualified workers, and excellent movies to suffer from an initial lack of luck.

Because of the importance of the initial luck, to "break the silence," conventional wisdom has emphasized *first impression management*. For example, it has been a recommended business strategy to accelerate product adoption by offering low introductory prices. However, recent research in observational learning advocates a seemingly opposite *demarekting* theory (Miklós-Thal and Zhang 2010). This theory draws attention to the visibility of first impression

management activities, such as product marketing efforts. If these efforts are visible to consumers who engage in observational learning, there are two countervailing effects: although intensive marketing might enhance sales, any lukewarm market response in spite of heavy marketing will signal low product quality. It is worth noting that the latter effect would have been inconsequential if consumers were irrationally herding – they would have simply chased popularity without questioning whether popularity had been driven by intrinsic quality or external marketing efforts. This distinction exemplifies the need to understand the precise mechanism by which humans make decisions.

Important Scientific Research and Open Questions

Knowing what market forces drive observed market outcomes, or *mechanism identification*, is an important topic for empirical studies of observational learning. Although observational learning often implies socially correlated choices, establishing the reverse causal relationship requires more detailed analysis. For example, a group of individuals may remain collectively silent about a product for the following reasons:

- *Correlated preferences*: The silence could simply represent a common distaste for the product. For instance, if all individuals are tradition bound, they may be uniformly reluctant to adopt new products, independent of what they know about product quality.
- *Correlated knowledge*: There may be product characteristics (e.g., defects) that all individuals are commonly aware of.
- *Correlated contexts*: There may be contextual factors that compel a set of individuals to make the same choices, such as the lack of promotional efforts within the same geographic area.
- *Correlated payoffs*: The silence could be an equilibrium market outcome if the value of the product to one individual depends on how many others have adopted the same product – one example being the adoption of telephones.
- *Preference for conformity*: Individuals may derive psychological utilities from conformist behaviors; alternatively, they may want to identify with a social group and convey this social identity by taking the same action as member of the desired social group.
- *Irrational herding*: Individuals may simply mimic others' choices as a decision heuristic, or gravitate toward popular and salient choices.
- *Observational learning*: Individuals infer from the silence of a product that others are privately aware of some product defects.

Mechanism identification is important for fundamental inquiries of human behaviors, for policy makers who wish to improve the welfare consequences of societal choices, and for businesses that aim to guide consumer decisions into a managerially desirable direction. Going back to the case of product adoption, a profit-oriented manufacturer's priorities depend on a precise understanding of the mechanism underlying buyer behaviors, as summarized in Table 1.

An area that needs further exploration is the empirical study of observational learning using historical data. A major challenge is the usual coexistence of observational learning and the aforementioned list of alternative behavioral mechanisms. One recent study

Observational Learning: The Sound of Silence. Table 1 Mechanisms underlying correlated social behaviors and potential managerial priorities

Mechanism	Potential managerial priorities
Correlated preferences	Change consumer preferences (e.g., through persuasive advertising); segment the market to target consumers who exhibit more favorable preferences
Correlated knowledge	Improve the intrinsic quality of the product
Correlated contexts	Increase demand-enhancing marketing efforts (e.g., awareness advertising)
Correlated payoffs	Incentivize early adoption
Preference for conformity	Expand market share; improve brand image
Irrational herding	Incentive early adoption; enhance product salience
Observational learning	Incentive early adoption (with the "demarketing" caveat); manage marginal consumers

has proposed that researchers can distinguish between irrational herding and observational learning from *panel data*, a data format widely available in a number of industries which include longitudinal records of choices among a set of products (Zhang and Liu 2010). The idea is that the dynamic evolution of choices helps to reveal the impact of social influences, and that the cross-sectional variations in the evolution paths help to isolate the nature of social influences – while irrational herders simply follow popularity, rational observational learners would modify the inferences they draw from popularity based on contextual factors. Empirical research in observational learning will benefit from development of other efficient, scalable methods that identify observational learning without imposing stringent data requirements.

Cross-References

- ► Bayesian Learning
- ► Imitation and Social Learning
- ► Imitative Learning in Humans and Animals
- ► Learning in the Social Context
- ► Social Interactions and Effects on Learning
- ► Social Learning
- ► Theory of Conformist Social Learning

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Observation-Based Learning Rather Than Experienced Individual Learning

► Selective Attention in Social Learning of Vervet Monkeys

Occasion Setting

A phenomenon in which stimuli come to modulate responding to conditioned stimuli without eliciting responding on their own. Typically, occasion setting occurs when a relatively long duration stimulus precedes and co-terminates with a shorter stimulus. Positive occasion setting results when a conditioned stimulus is reinforced with the occasion setter and nonreinforced alone. Negative occasion setting results when a conditioned stimulus is nonreinforced with the occasion setter and reinforced alone. Occasion setters differ from conditioned stimuli in that they do not directly elicit conditioned responding and in that their modulatory properties are not impaired by counterconditioning. It has been proposed that occasion setters act by facilitating or inhibiting CS-US associations.

Ockham's Razor

The heuristic that we should prefer the simplest hypotheses which fit the observations to date.

Oddity

► Matching to Sample Experimental Paradigm

Offending

► Delinquency and Learning Disabilities

Offline Learning

► Sequence Skill Consolidation in Normal Aging