Chapter 7
Experimental Studies Confirming the Emotional Impact of Dynamic Movement and Looming Manipulations

The looming vulnerability model (LVM) expects that a person's perceptions and simulations of rapid gains by dynamic growing threats have powerful effects on affective responses. It isn't only the potential threat stimulus that influences affect but the dynamics of the motion of the threat and its rapid gains that also profoundly affects how the person emotionally responds. We presented a small amount of this evidence from studies using experimental designs in Chap. 5. We will now present a much more extensive body of literature that supports these expectations of the LVM. This evidence includes two broad classes of studies. These include: (1) a few studies in which the dynamism and movement of stimuli was varied in ways that did not directly menace or approach the perceiver and (2) studies that have manipulated such perceptions in ways that could directly menace or approach the perceiver.

Ambiguous Dynamic Motion Amplifies Perceived Threat

As we saw, Lewis and McBeath (2004) demonstrated that individuals have a general perceptual bias to judge directionally ambiguous motion as approaching rather than receding. Thus, any perceived dynamic change or movement can potentially increase threat because people have a self-centered bias to perceive ambiguous movement as approach movement.

Clinical Analogue Studies

In one of the earliest set of studies to compare the effects of moving versus static stimuli on danger appraisal and anxiety, Riskind and Wahl (1992) asked college students to read hypothetical vignettes about target persons (or characters) who were either psychiatrically ill strangers "on leave from the hospital" or

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nonthreatening target characters (e.g., an ordinary person in Study 1, and a professional clown in Study 2). They used a procedure in which participants were instructed to imagine encountering the target persons in public places such as standing in lines ahead of them at fast food restaurants or while waiting in line to buy tickets at the cinema. As they pointed out, it has been previously found that "active" is one of the most common descriptors applicable to mentally ill characters in prime-time television (Wahl & Roth, 1982), along with "threatening" and "dangerous" (Gerbner, 1980; Wahl & Roth, 1982). Moreover, when others are portrayed as mentally ill, they are not only widely feared as physically dangerous but often artistically depicted in active poses with muscular tension (implying high potential for movement), so that activity and movement are characteristic elements of classical depictions of madness (Gilman, 1982).

In the "Active" condition in Riskind and Wahl's (1992) studies, the target person's movement was varied in a way that did not obviously directly threaten a perceiver. For example, the person in a fast food restaurant was described as "tapping her fingers on the table and moving her legs around energetically under the table" while she ate. In the "Inactive" condition, "her hands and fingers are resting on the table and her mouth barely moves as she eats. Her legs are inactive and motionless under the table." Consistent with predictions, Riskind and Wahl's (1992) results indicated that the psychiatrically ill patients in the vignettes were rated as far more threatening and fear-provoking to the extent that they exhibited cues of dynamic activity and rapid movement. In addition, the more active characters were generally more feared than inactive ones overall, but the fear inducing effects of movement were far stronger when the target persons were psychiatrically ill patients rather than nonthreatening target characters.

A related study reported by Riskind (1997) asked college students to read hypothetical vignettes in which potential threats were described as either exhibiting dynamism and kinetic activity or movement or were described in static terms. In one dynamically described situation, for example, germs were described as moving around on a microscope slide; as another example, a wasp on the inside-and-on the back window of one's car (while one was driving) was described as wiggling its wings; in another vignette, a somewhat frightening stranger in an elevator late at night was shifting around on his feet. These dynamic scenarios were compared to matched static control situations in which the germs, wasp, and stranger in the elevator were motionless. As expected, results indicated that the participants' danger appraisals (e.g., estimated probability of harm, unpredictability, personal lack of control, behavioral urgency, and need for vigilance) and their reported anxiety were greatest after they read the dynamic as compared to the static versions of the vignettes.

Another study conducted by Courtney, Dawson, Schell, Iyer, and Parsons (2010) collected data from self-report as well as physiological measures to compare the effects of computer-generated kinetically moving as opposed to static images of snakes and spiders. A further aspect of their study was that they examined participants who feared snakes but not spiders or vice versa. Their study found that the fear-relevant stimuli and particularly those that were moving in videos elicited greater physiological reactions (heart rate acceleration, skin conductance, and star-

tle eyeblink responses) indicative of anxiety and self-protective responding as well as self-reports of arousal. As would be expected, high fear individuals also had stronger physiological reactions than low fear individuals when presented with static images of fear-relevant stimuli, but these effects were smaller than those for moving images.

Other Studies of Affect

Simons and Detenber and colleagues have presented somewhat similar evidence on the effects of kinetic image motion on affect response to emotion-arousing pictures (Detenber, Simons, & Bennett Jr., 1998; Simons, Detenber, Reiss, & Shults, 2000; Simons, Detenber, Roedema, & Reiss, 1999). Their studies have shown that emotion-arousing pictures that move horizontally or vertically on a screen have emotionally arousing effects that are more intense than the same pictures that remain static. For example, in one study, Simons and his colleagues used images selected from the International Affective Picture System (Center for the Study of Emotion and Attention, 1997) to represent a range of categories of emotion and arousal ratings. They showed that moving pictures produce more arousal than static pictures assessed by self-report and with physiological indices such as skin conductance responses. More precisely, when the images contained motion, this was found to make the participants' responses to negative images (e.g., a crying face, a body) more negative as well as arousing, and their responses to positive images (e.g., nature scenes, a smiling baby) more positive and arousing.

Studies Manipulating Perceived Approach Movement

A considerable number of experimental studies have also examined the emotional impact of a person's perceptions that negative (or positive) stimuli are making rapid gains and approaching. These studies more directly address the impact of perceptions of rapid dynamic gains by approaching threat, since they manipulated the movement direction of threats or affective stimuli (toward or away from the perceiver). First, we examine clinical analogue studies, then examine other studies of approach movement and affect.

Spider and Social Phobia Analogue Studies

In one early study, Riskind, Kelly, Harman, Moore, and Gaines (1992) asked participants to view footage from a series of film clips of different animals with different types of motion and then rate their feelings of anxiety and perceptions of threat

when they viewed these. Each of the film clips they were shown contained an animal (either a tarantula or a rabbit) that was either approaching, motionless, or moving away. As theoretically expected, the film clips of the approaching tarantulas were rated as far more anxiety-provoking and threatening by participants than those of controlled-movement static tarantulas or those that were moving away. Consistent with the predictions, if the tarantulas showed any movement at all—even receding movement—they were more threatening than if they were still and motionless. No such differences for the movement manipulation were found for the rabbits. In support of another important prediction, it was found that all of the preceding findings were significantly stronger for individuals who had the highest levels of spider fear than for those with lower spider fear.

In a subsequent follow-up study, Riskind and Maddux (1993) presented participants with the same film clips of tarantulas, but not of rabbits. Aside from this difference, the chief new element of the study is that the film clips were presented under two different self-efficacy conditions. In both conditions, the participants were asked to imagine themselves sitting in a chair while in the room with the tarantulas they were viewing on the film clips. However, the participants were then randomly assigned to the self-efficacy conditions. In a *high self-efficacy* condition, they were asked to imagine that the door to the room was open while they were sitting in the chair with a rolled-up newspaper in their laps; in the *low self-efficacy* condition, they were asked to imagine that the door was closed while they were sitting in the chair with no newspaper. Just as predicted, the high self-efficacy and movement manipulations interacted and moderated each other's effects: the high self-efficacy instructions had a significant effect in decreasing the participants' anxiety ratings, but this only emerged when film clips showed tarantulas with approaching movement. However, the self-efficacy instructions had minimal impact on anxiety ratings when film clips showed tarantulas that were stationary or moving away. Thus, the findings indicated that self-efficacy expectations will primarily be helpful in reducing a person's anxiety when he/she perceives a threat as dynamically growing. Conversely, self-efficacy expectations are not that useful when an approaching threat is not salient to the person.

Viewed from a different perspective, Riskind and Maddux's (1993) data showed that participants who viewed the footage of approaching tarantulas only reported more anxiety than those who viewed the footage of the stationary or receding tarantulas when they received low self-efficacy instructions. However, the approach movement in the video clips had no effect on anxiety in the high self-efficacy condition. Thus, these findings support the idea (see Chap. 4) that when individuals have a strong sense of control, this can mitigate the impact of approach movement on their anxiety.

As we saw in Chap. 5, a person's perceptions of the dynamics of the motion and rapid dynamic gains threat (i.e., its approach movement) contribute additional incremental variance to the prediction of his or her anxiety. That is, they predict anxiety beyond the effects explained by the absolute levels of proximity or probability of encountering the threat at any given moment. In their fMRI study, Mobbs et al. (2010) instructed participants to put their feet into a covered apparatus or

"imminence box" that was said to contain a live tarantula that they could see on a monitor screen facing them. By means of this ruse, they were able to show the participants prerecorded film clips of tarantulas that appeared to be (1) moving toward or away from their own feet and (2) placed at closer or more distant relative positions to their feet. Mobbs et al.'s (2010) findings on a self-report measure of fear were consistent with the Riskind studies (Riskind et al., 1992; Riskind & Maddux, 1993) and indicated that approaching tarantulas induced greater fear than ones that were receding. Importantly, they demonstrated that manipulated tarantula movement toward the viewers elicited different fMRI responses than movement away from the viewers, even when controlling for the apparent proximity of the tarantulas to the participants' feet.

Thus, Mobbs et al.'s (2010) findings demonstrated that a person's perceptions of rapid dynamic gains and approach movement in threat make unique contributions to fear and neural defense systems that are distinct from those of mere proximity alone.

In another phobia analogue study, Haikal and Hong (2010) examined the effects of a manipulation of "temporal looming" on social anxiety. In this case, all participants were told they had a short time to prepare for a videotaped speech they would give about themselves. Meanwhile, some of the participants were assigned to a temporal looming condition (where a "count-down" clock was prominently displayed showing the time that remained before their videotape), whereas the other participants had no such clock. The temporal looming condition, in which the count-down clock was shown, was found to heighten two social anxiety-related illusions. Namely, the temporal looming condition heightened the "illusion of transparency" (that one's internal sensations are transparent to other people) and the "spotlight effect" (that others notice and remember one's behaviors when they don't).

Spread of Contamination Analogue Studies

A cluster of analogue studies that pertain to contamination fear also support the impact of perceptions of rapid gains by potential threats. Riskind, Wheeler, and Picerno (1997) examined whether mental imagery to "freeze" or slow down the rate at which threats can advance can reduce fears of contamination and avoidance behavior among individuals with subclinical obsessional symptoms. Male college student participants were shown a film clip of a men's room in a campus building which was made by the experimenters to look dirty and contaminated (e.g., dirty paper towels were on the floor). Participants who were in a "freeze" condition were asked to imagine that contaminants were "frozen" in place and unable to move, whereas those in a "loom" condition were instructed to imagine the contamination as moving and spreading. The effects of this manipulation were assessed with both verbal reports and unobtrusive measures (e.g., did the participants take cookies placed near a garbage can after the study). The findings of this study suggested that the "freeze" imagery appeared to reduce fear and avoidance for the participants who had higher scores

on the Padua fear of contamination scale, and particularly for the participants with relatively higher levels of imagination. Somewhat paradoxically, however, the freeze imagery appeared to increase the fear of participants with low scores on the Padua fear of contamination scale. The explanation offered for these findings were interpreted as suggesting that participants with low contamination fears don't tend to spontaneously imagine dynamic experiences with germs and contaminants. Thus, the "freeze" imagery may have been sensitized them to the possibility of the germs the dynamism which didn't normally even occur to them.

As we previously saw, Dorfin and Woody (2006) also used guided mental imagery instructions in another more involved analogue study to test the LVM. College student participants had a drop of sterilized urine placed on the bodies, and then given one of three different sets of experimental imagery instructions. In the "Spread" condition, they were asked to imagine that the urine was spreading and moving on their bodies to produce increasing levels of bodily contact with the urine. In the "Static" condition, they were asked to imagine that the urine drops were dangerous but motionless. Finally, in the "Safety" condition, they were asked to imagine that the sterilized urine drops were entirely safe. In line with the LVM, the "spreading contamination" imagery was found to elicit significantly higher ratings of distress and fear as well as appraisals of danger in danger cognitions than did the other imagery conditions. Moreover, as previously noted, the spreading contamination imagery impeded habituation to the presence of the urine during a 30-min exposure period.

Other Studies of Affect: Approach Aversion Effects

In their eight studies on the approach aversion effect (see Chap. 5), Hsee, Tu, Lu, and Ruan (2014) demonstrated that there appears to be a general tendency for individuals to respond with more negative feelings to a variety of social stimuli (e.g., letters of the alphabet, emoticons, the possible visit of a distant relative) when these are approaching rather than static or moving further away. For example, in one typical study, the participants rated their feelings about emoticons (icons of faces) that were either negative, neutral or positive. The results showed that feelings about the emoticons were more negative when they were approaching, and this was irrespective of whether the emoticons expressed negative, neutral, or positive emotions. Crucially, when the social stimuli were approaching (moving closer in time, space, or probability), they elicited more negative feelings than they did if they were statically near (constant in proximity). Thus, the effects of perceiving dynamic gains in potential threats weren't limited to physical movement in space but were seen for movement in time and probabilities.

In another study, Hsee et al. (2014) asked participants to imagine that a distant cousin living a different city was going to visit their city for a week for personal business and had asked if she could stay with them and that they had consented without giving it much thought. In a "neutral" condition, participants were asked to imagine that they overall had neutral feelings about the cousin and her stay. In a

positive condition, participants were asked to imagine that they had mixed feelings, but that they overall liked the cousin and looked forward to her stay. In a negative condition, they were asked to imagine that they had mixed feelings but that overall they disliked the cousin and dreaded her visit.

Participants were then told that the cousin might visit on the next day and stay with them for a week, but that the chances she would come depended on whether she could get airline tickets. The results revealed that when the likelihood of the visit loomed closer (the probability of her finding a ticket increased), the participants felt more negatively than those in a static-near condition (in which the likelihood was always high), and those in the static-far condition (in which the likelihood was always low). Thus, the findings of the study indicated that what produced the "probabilistic approach aversion effect" was not static probability but rather the "movement in probability" that a social event would arrive.

The "approach aversion" hypothesis of Hsee et al.'s (2014) studies and their findings suggest that the approach of even positive stimuli can elicit more negative (or less positive) feelings. Nevertheless, even ambiguous or unfamiliar positive social stimuli can have potential risks. We suggest that the approach of threats (ambiguous or not) is more likely to produce negative feelings than unambiguously positive and familiar social stimuli or events.

Effects of Perceived and Imagined Approach Movement on Reactions to Affectively Charged Pictures

Other studies have demonstrated that individuals react differently to affective stimuli from the International Affect Picture System (Center for the Study of Emotion and Attention, 1997) depending on whether they are presented as moving toward or away from them. In one set of studies, Mühlberger, Neumann, Wieser, and Pauli (2008) manipulated the movement direction of pictures with different content (pleasant, neutral, or unpleasant) by changing their pixel size, creating the illusion that the pictures were approaching, receding, or resting constant size. The participants rated their emotional reactions to the stimuli after they were presented. The results of these studies generally fit with those of the other studies we have reviewed. They found that participants reacted more negatively to unpleasant pictures that were presented as moving toward them than they did to the same pictures when they were presented as moving further away or as static. In contrast, the movement direction of neutral or pleasant stimuli had no significant effects. Thus, these findings resembled those of Riskind et al. (1992) who showed that approach movement did not produce a more negative reaction to non-negative or innocuous stimuli (i.e., a rabbit, as opposed to a tarantula in the Riskind et al. study).

In one of the studies, Mühlberger et al. (2008) examined how the movement of pictures toward the participants affected their startle responses. Negative affect states such as fear have been found to potentiate startle reactions to suddenly appearing negative stimuli (Bradley, Codispoti, Cuthbert, & Lang, 2001). In line with

expectations, when negative pictures moved toward the observers this enhanced their startle reactions as compared to when the negative pictures moved away from the observers or were static. No such enhancement of startle responses by approach movement was found for positive and neutral pictures.

Significant effects of perceived rapid gains and approach movement on emotional reactions have also emerged when participants are simply instructed to imagine affective stimuli as moving closer or moving further away. Davis, Gross, and Ochsner (2011) gave participants practice using their imagination to manipulate the movement direction (movement-toward or movement-away) of the same kinds of pictures as in Mühlberger et al. (2008) by simply using their minds rather than actually moving the pictures. Participants rated their reactions to unpleasant pictures (e.g., a dead body) as far more negative when asked to mentally visualize the negative pictures as moving closer and becoming larger as compared to when they were asked to visualize them as static (staying constant) or as moving away from them.

Auditory Looming

Consistent with the prior work we have just presented, another line of studies of auditory looming effects on affective reactions have also produced results that are in line with the LVM. In one set of studies, Tajadura-Jiménez, Väljamäe, Asutay, and Västfjäll (2010) examined the impact of auditory looming cues on reactions to unpleasant versus pleasant and neutral pictures. Participants heard tones that rose or fell in intensity level to test the prediction that the participants would automatically code approaching sound sources as potentially threatening events. In line with the LVM, the results of these experiments showed that an approaching as compared to a receding sound direction produced faster reaction times, and this effect was far stronger for unpleasant stimuli than for pleasant or neutral pictures. Tajadura-Jiménez explained the asymmetry in these effects by suggesting that the perception of approaching sound sources might be closely linked to the activation of defensive behaviors, consistent with our premise that approaching stimuli are often seen as more behaviorally urgent and even inherently threatening.

In other studies of auditory looming, Bach, Neuhoff, Perrig, and Seifritz (2009) found a variety of evidence confirming that acoustic cues that rise in intensity have strong emotional impact and apparently serve as implicit warning signals. Participants were asked to listen on headphones to approaching sounds that were rising in intensity and receding sounds that were falling in intensity. Bach and his collaborators found that approaching sounds elicited more negative reactions on both explicit self-report and implicit physiological measures. Specifically, participants rated the approaching sounds as more unpleasant, strong, intense, and arousing than the receding sounds. In addition, they rated the subjective probability that an approaching sound signaled a forthcoming threat as far higher they did for a receding sound. Additional data from the more implicit psychophysiological measures confirmed that the approaching as opposed to the receding sounds elicited

more pronounced skin conductance responses, phasic alertness, and ratings of loudness change.

Overall Summary and Conclusions

To conclude, research has provided abundant support for the hypothesis that anxiety and negative emotional reactions are higher to negative or threatening stimuli that are perceived as dynamically and rapidly gaining and approaching, as compared to those same stimuli when they are seen as static (constant) or moving further away (or receding). Indeed, under conditions of uncertainty, even ostensibly positive stimuli (e.g., smiling emoticons) can produce more aversive reactions. These findings provide ample evidence for the assumption that the state elicitations of perceptions of looming vulnerability by objective experimental manipulations dramatically affect emotional reactions.

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