texture flows, although now the construction of a rigorous local model is slightly more challenging. Unlike curves, this model must depend on the estimate of *two* curvatures at the point $\vec{\mathbf{q}}$, $K_T = \kappa_T(\vec{\mathbf{q}})$ and $K_N = \kappa_N(\vec{\mathbf{q}})$, but more important, these estimates cannot be held constant in the neighborhood of $\vec{\mathbf{q}}$, however small; they must covary for the pattern to be feasible (Ben-Shahar & Zucker, 2003b). Nevertheless, invariances between the curvatures do exist, and formal considerations of good continuation have been shown to yield a unique approximation that, in $\mathbb{R}^2 \times S^1$, takes the form of a right helicoid (see Figures 7c and 7d) and whose orientation function has

Figure 7: *Facing page.* Differential geometry, integration models, and horizontal connections between RFs. (a) Estimate of tangent (light blue vector) and curvature at a point $\vec{\mathbf{q}}$ permits modeling a curve with the osculating circle as a good-continuation approximation in its neighborhood. Given the approximation, compatible (green) and incompatible (pink) tangents at nearby locations can be explicitly derived. (b) with height representing orientation (see the scale along the θ-axis), the osculating circle lifts to a helix in $\mathbb{R}^2 \times \mathcal{S}^1$ whose points define both the spatial location and orientation of compatible nearby tangents. Color-coded as in *a*, the green point is compatible with the blue one, while the pink points are incompatible with it. (c) The consistent structure in *a* and *b* illustrated as RFs and their spatial arrangement. As an abstraction for visual integration, the ideal geometrical model—the osculating circle—induces a discrete set of RFs, which can facilitate the responce of the central cell. Shown here is an example for one particular curvature tuning at the central cell. (d) For textures, determination of good continuation requires two curvatures at a point. Based on these curvatures, a local model of good continuation can determine the position, orientation, and curvatures of (spatially) nearby coherent points. Given these two curvatures at a point, there exists a unique model of good continuation that guarantees identical covariation of the curvature functions. Given the approximation, compatible (green) and incompatible (pink) flow patches at nearby locations can be explicitly derived. (e) In $\mathbb{R}^2 \times \mathcal{S}^1$, our model for 2D orientation good continuation lifts to a right helicoid, whose points define both the spatial location and orientation of compatible (green) nearby flow tangents. (f) As an abstraction for visual integration, the ideal geometric model—the right helicoid—induces a discrete set of RFs, which can facilitate the responce of the central cell. Shown here is an example for one particular curvature tuning at the central cell. Note that broad RF tuning means that both the helix and the helicoid must be dilated appropriately, thus resulting in compatible "volumes" in $\mathbb{R}^2 \times \mathcal{S}^1$ and possibly multiple compatible orientations at give spatial positions. This dilation should be reflected in the set of compatible RFs and the horizontal links to them, but to avoid clutter, we omit it from this figure. The effect of this dilation is illustrated in Figure 8 and consequently in all our calculations.